



Operational Research in Tropical and Other Communicable Diseases

Final Report Summaries 2003–2004

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RESULTS PORTFOLIO 3
Small Grants Scheme



**World Health
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FOREWORD

In the name of God, the Compassionate, the Merciful

It is with great pleasure that the WHO Regional Office for the Eastern Mediterranean presents the third issue of the final research report summaries of the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR) supported Small Grants Scheme (SGS). The aim of the series is to disseminate the results of the operational research projects supported by the scheme with the ultimate goal that they are translated into the policies and practices of national control programmes.

Operational research is crucial for identifying ways to increase access to timely diagnosis and effective treatment. It involves the evaluation of programme implementation, leading to improved policy-making, better design and operation of health systems, and more efficient methods of service delivery.

The scheme stimulates collaboration between national control programmes and academia. National control programmes are encouraged to identify key issues regarding programme operation and performance in order to initiate operational research in collaboration with researchers.

The challenge extends beyond programme operations to the need to introduce new tools such as drugs, vaccines and diagnostics. The evaluation of these new tools through the scheme is crucial to making a significant impact on disease burden. Operational research has therefore become an integral component of strategies to reduce the burden of communicable diseases in endemic countries.



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Regional Director for the Eastern Mediterranean

PREFACE

The WHO Regional Office for the Eastern Mediterranean supports operational research in tropical and other diseases through the TDR Small Grants Scheme. The scheme encourages collaboration between national control programmes and researchers from academia.

A two-page summary has been developed from each of the final reports of the research projects. They include the key research results and their implications for disease control. However, this is not a peer reviewed publication and the investigators are encouraged to submit their manuscripts to indexed journals. This would provide evidence for the reliability of reported results with regard to the international scientific community. This issue includes an updated list of around 90 articles resulting from Small Grant Scheme-supported research published in indexed journals.

It is hoped that the research-driven and evidence-based recommendations reported in this issue will be used to improve programme performance, increase the access of the community to timely diagnosis and effective treatment, and assist national control programmes in achieving the UN Millennium Development Goals.



Dr Zuhair Hallaj

Director, Communicable Disease Control

Brucellosis

Molecular Epidemiology

Lebanon

Molecular characterization and antibiotic resistance of *Brucella* spp. isolated from various dairy products in Lebanon

Lebanon

Bekaa valley, north east Lebanon

Study period:

October 2004–August 2005

Small Grants Scheme

(SGS) 2004 No. 189

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Abstract

A study was done to characterize and evaluate the antibiotic susceptibility of *Brucella* species isolated from dairy products in Lebanon. For the study, 238 samples were collected from the Bekaa valley, north east Lebanon, and *Brucella* colonies were isolated using *Brucella* agar and identified using standard biochemical tests. Real time polymerase chain reaction (PCR) was used for species identification. Antibiotic susceptibility testing was also carried out.

Results The study reported a prevalence of *Brucella abortus* infection of 2.94%, 4.16% and 1.64% in *baladi*, *shanklish* and *kishk* cheese, respectively. Bacteria were resistant to at least one or more of the tested antibiotics, with the highest resistance observed against streptomycin and ciprofloxacin and the highest susceptibility for ceftriaxone and doxycycline.

Conclusion These findings are alarming and call for better control of brucellosis in animals. Proper sanitation and quality control measures should be strictly followed during food preparation to minimize contamination with pathogenic organisms. The high levels of antibiotic resistance to commonly-used antibiotics could be attributed to irrational drug use and should be taken into consideration when managing brucellosis cases.

Background

Dairy products are consumed by a large proportion of the population in Lebanon on a daily basis. While some of these products are prepared in dairy plants, many are still produced in old factories or are home-

made. Dairy food production in Lebanon occurs mostly in the Bekaa valley.

Few studies have been conducted to assess the microbiological quality and level of contamination of dairy food with pathogens or the resistance of food-borne pathogens to commonly used antimicrobials. Given the marked importance of *Brucella* organisms as food-borne pathogens, a study was done to isolate and characterize, at the molecular level, different strains of *Brucella* present in dairy products that are consumed raw in Lebanon. It also aimed to evaluate the antibiotic susceptibility profile of the isolated organisms.

Materials and methods

Kishk (dried fermented cereal mixture), *shanklish* (cheese balls) and *baladi* cheese samples were randomly collected from the Bekaa valley in Lebanon. They were collected from supermarkets and mini-markets, as well as small farms. The area was divided into different communes based on the number of inhabitants residing in those communes. A total of 238 samples were aseptically collected in the same way as delivered to the consumers. Samples were then packaged in sterile bags and brought to the laboratory on ice in a cooler. All samples were refrigerated, enumerated and analysed within a maximum of 24 hours after their arrival at the laboratory.

Plate count agar media were used for the detection of aerobic bacteria present using the aerobic plate count method. The detection of total coliform was carried out using McConkey agar or violet red bile agar. *Brucella* agar was used for the detection of *Brucella* species. Colonies were identified based on morphological, cultural and biochemical criteria. Suspected *Brucella* colonies were selected and were primarily identified on the basis of gram staining oxidase and urea hydrolysis. Plates with bacterial counts ranging from 30–300

Conclusions and implications of the study

■ Dairy food production in Lebanon occurs mostly in the Bekaa valley, where the study found prevalence rates of *Brucella abortus* of up to 4.16% in dairy products. These findings are alarming and call for better control of brucellosis in animals. Proper sanitation and quality control measures should be strictly followed during food preparation to minimize contamination with pathogenic organisms.

■ The study reported high levels of antibiotic resistance to the commonly-used antibiotics. This could be attributed to irrational drug use and should be taken into consideration when managing brucellosis cases.

colonies were considered for the determination of the colony forming units (CFU) per gram.

Total DNA was extracted and standard polymerase chain reaction (PCR) was used for genus identification and real-time PCR for species identification. Characterized strains were tested for their susceptibility to eight antimicrobials, using the disk diffusion method. The tested antibiotics were: rifampicin, doxycycline, ciprofloxacin, streptomycin, tetracycline, trimethoprim-sulfamethoxazole, ceftriaxone and gentamicin.

■ Main study findings

A total of 238 cheese samples were collected from different communes in Bekaa valley: 122 were kishk, 68 baladi and 48 shanklish. The calculated CFU counts showed high contamination levels. Of 110 suspected isolates, 6 were confirmed as being *Brucella*. The prevalence of contamination was 2.94%, 4.16% and 1.64% in *baladi*, *shanklish* and *kishk* cheese samples, respectively. Real-time PCR showed that all isolates were *Brucella abortus* strain. High antibiotic resistance (66.67%) was reported against streptomycin and ciprofloxacin, while 50% resistance was reported against gentamicin. A lower resistance of 33.33% was reported against rifampicin, tetracycline and trimethoprim-sulfamethoxazole. A high susceptibility of 83.33% was observed against ceftriaxone and doxycycline.

■ Conclusions and recommendations

These findings are alarming and call for better control of brucellosis in animals. They are also indicative of the potential emergence of resistant strains of *Brucella* to antibiotics. This might be attributed to indiscriminate and irrational use of antibiotics in veterinary and human medicine. To minimize the spread of resistant strains and to minimize the disease sequelae, it is recommended that antibiotic sensitivity testing is performed for suspected brucellosis cases.

HIV/AIDS/STD

Condom needs assessment among adult male Egyptians

Egypt

Gharbia and Damietta governorates

Study period:

November 2003–October 2004

Small Grants Scheme

(SGS) 2003 No. 152

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Condom use

Egypt

Abstract

A cross-sectional study was conducted in which 1305 adult males were enrolled from Gharbia and Damietta governorates to assess their pattern of condom use. Data were collected using a structured and pretested questionnaire.

Results Confidence in condoms as a method of contraception and for the prevention of sexually transmitted infections (STIs) was 63.7% and 63.8%, respectively. Only 23.2% had ever used a condom, mainly for contraception, and 24.9% were willing to use condoms in the future. One quarter of the sample reported having enough knowledge about the proper use of condoms, while 55.2% needed more information. The main obstacles to condom use were a perceived lack of need for them (88.2%) and that they decrease sexual sensitivity (24.9%). Condom use was felt to be hazardous by 38.5%, and 64.8%

reported that it would be rejected by their partner. The easy availability of condoms was reported by 71.0%, but their purchase was felt to be stigmatized by 61.6%. The majority of the subjects had adequate knowledge about human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) (95.1%), although only a small proportion considered themselves to be at risk of STIs (16.1%) or HIV/AIDS (14.6%). In spite of the low condom use, 10.7% of those who reported ever using condoms were single and 39.5% reported having friends involved in extramarital sexual relations that were frequent (54.2%) and involved multiple partners (66.4%). Condoms were used in these relations by only 6%.

Conclusion Condom use is still infrequent among male Egyptians in these governorates. This is mainly due to a lack of information and low confidence in their efficacy. However, unsafe sexual relations are not infrequent in this population indicating the necessity to promote condom use as a method for the prevention of STIs and HIV/AIDS.

Conclusions and implications of the study

- Condoms were reported by the majority of the studied subjects to be an effective and easily available method for contraception and the prevention of STIs. However, only a limited proportion had ever used condoms. This low level of condom use should be considered in relation to the finding that only 25.3% of the studied population reported having enough information about proper condom use and 55.2% were in need of more information. This indicates that raising men's awareness about condoms would increase their use.
- The main reason given for non-condom use was the lack of the need to use them, either because the men were single or because they wanted more children. The next main reason was because of decreased sensation during sexual relations. In addition, a substantial percentage believed that harmful effects might be associated with condom use. Rejection by a sexual partner was also reported to be a reason for non-use.
- Among the studied population groups, drivers were found to be the group with the highest confidence in condom use and highest rates of condom use. However, they reported the lowest rates of knowing sources of condom purchase (52.1%). These findings should be considered in efforts to promote condom use among this group of men.
- The rate of unsafe sexual behaviour reported by this study highlights the need to improve the level of condom use in this community.

Background

Men play powerful and even dominant roles in reproductive decisions, regardless of their partner's wishes or the health consequences for themselves or their partners. For these reasons, it is important that health programmes turn their attention to male sexual health behaviour. Research, mainly from Africa, has found that a considerable percentage of men are concerned about family planning, suggesting that men's reproductive health behaviour is amenable to change [1]. A study was therefore carried out to assess the patterns of condom use among adult male Egyptians, and to identify their knowledge and attitudes towards condom use, any risk behaviours among them and any barriers to condom use.

Materials and methods

A stratified cluster sample of 1305 adult male Egyptians, aged 15–49 years, was selected from Gharbia and Damietta governorates. The study subjects were

drawn from government employees, taxi and minibus drivers, industrial workers, and university and secondary school students. Data were collected using a structured and pretested questionnaire that asked for the following information: socio-demographic characteristics; perceptions of condoms as a method for protection against sexually transmitted infections and as a contraceptive method; patterns of condom use; barriers to non-use; and risky behaviours.

■ Main study findings

Of the 1305 men, 390 were industrial workers (29.9%), 224 were drivers (17.2%), 308 were government employees (23.6%) and 383 were students (29.3%). Regarding residence, 43.1% lived in urban areas. The majority of the industrial workers and drivers were educated to primary education level (65.9% and 54.0%, respectively), while the majority of government employees were educated to higher education level (62.3%). Of the students, 7.0% were at secondary school, while 91.1% were at university. In terms of marital status 43.8% were single, with the majority of industrial workers, drivers and employees being married, while the majority of students were single.

Condoms were reported to be an effective method of contraception by 63.7% of the studied population. This was most reported among drivers (75.0%) and industrial workers (69.0%) and least among government employees (54.9%). Condoms were reported as an effective measure for prevention of sexually transmitted infections (STIs) by 63.8% of the studied population. Drivers (72.3%) and industrial workers (69.2%) reported this most.

Willingness to use condoms in the future was reported by 24.9% of study subjects, being highest among drivers (31.7%) and lowest among students (19.6%). One quarter (25.3%) claimed having enough knowledge about proper use of condoms, these being mainly industrial workers and government employees. More than half the subjects reported the need for further knowledge, especially the students. Among the studied group, 38.5% thought that condom use may be associated with harmful effects, and 64.8% felt that the other sexual partner might reject their use. More than two thirds of the studied population (71.0%) reported the availability of condoms in their neighbourhood, but 61.6% reported embarrassment about buying them.

Only 23.2% had ever used condoms, with the highest rate reported by drivers (34.8%) and the lowest by students (7.6%). Only 10.7% of single men had ever used condoms compared to 32.4% of married men. The main reasons for condom use were contraception (48.2%), prevention of STIs (38.6%) or both (10.2%). The main reasons for not using condoms were: lack of perceived need; negative

impact on sexual pleasure; feeling uncomfortable to use; ineffectiveness as method of contraception or prevention of STI; and difficult to use. Rejection of condom use for religious causes was as low as 2.1%.

The vast majority of the studied population reported having adequate knowledge about HIV/AIDS (95.1%). Less than one fifth of the studied population reported risky behaviours for STIs and HIV infection (16.1% and 14.6%, respectively). On the other hand, 39.5% reported having friends who were involved in extramarital sexual relations: drivers and students reported the highest percentages (50.4% and 43.9%, respectively) and it was reported that these unsafe sexual relations were often frequent (54.2%), and rarely only once (10.7%) with multiple partners being reported by 66.4%. Condoms were never used in these sexual relations for 62.5%, while for 6% they were always used. The majority of the studied population recognized that their friends involved in extramarital relations were at risk for HIV/AIDS (73.0%).

■ Conclusions and recommendations

Condom use is still low among adult male Egyptians. Obstacles to their use include low confidence, low perception of risk, lack of information, belief in harmful effects, decreased sensation during intercourse and the social stigma of buying condoms. The presence of unsafe sexual behaviours necessitates improving the level of condom use through: family planning, communication and social marketing campaigns that should promote the dual role of condoms in preventing pregnancy and STIs; sexual education, with more information about condoms to encourage more men to play a positive role in reproductive health; sex education for unmarried young people that should stress sexual abstinence before marriage and use of condoms for protection against STIs and HIV/AIDS; voluntary counselling and testing, which may be an effective strategy to explore the unsafe behaviours associated with STIs and HIV/AIDS, promote condom use and disseminate more information concerning their correct use; and cooperation between governmental sectors, the commercial sector and nongovernmental organizations to help meet condom needs and to disseminate sufficient information about condom use.

■ References

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HIV/AIDS

Knowledge, attitudes, practices and behaviour

Lebanon

Evaluation of the impact of HIV preventive interventions on the knowledge, attitudes, beliefs and practices of the Lebanese population

Lebanon
Nationwide

Study period:
December
2003–November 2004

Small Grants Scheme (SGS) 2003 No. 203

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Abstract

A cross-sectional study was done involving a national representative sample of 3200 Lebanese aged 15–49 years to evaluate preventive indicators for the knowledge, attitudes, beliefs and practices of the population and compare them to a previous survey conducted in 1996.

Results About two thirds of the population were sexually active and 52% had been married. Of the sexually active respondents, 13.0% reported having regular partners other than their spouse, 25% had used condoms at last sexual intercourse and 16.8% had sex with non-regular partners. The perception of risk for HIV infection was significantly lower than in 1996 (13.7% compared to 19.3%, respectively).

More than half the study subjects expressed positive attitudes towards people infected with HIV and were willing to take care of a family member with HIV/AIDS. The majority agreed that people living with HIV/AIDS should be allowed to continue their work and to receive proper medical treatment. However, 29.1%, compared to 13.6% in the 1996 study, preferred to keep an HIV positive status confidential.

The knowledge of the population about preventive practices for HIV/AIDS had regressed since 1996 and the overall rates

of misconceptions had increased. Despite the greater availability and accessibility of condoms, the rate of condom use remained almost the same. Self-reporting of symptoms suggestive of sexually transmitted diseases also increased significantly between 1996 and 2004 (5.1% and 9.1%, respectively).

Conclusion The preventive indicators for HIV/AIDS have generally regressed between 1996 and 2004. More work is needed to introduce positive changes in lifestyle and the adoption of safer sexual behaviour.

Background

The first AIDS case in Lebanon was reported in 1984. Since then, the number of cases has increased steadily, reaching 765 in July 2004. The main mode of transmission is sexual (77.25%), mainly heterosexual (52.7%), with homosexual and bisexual transmission accounting for 15.68%. However, a considerable proportion of sexually transmitted diseases (STDs) have been reported as being related to unspecified sexual behaviour or to unknown modes of transmission. This raises questions about the extent that these two latter categories may contribute to the real figures for the stigmatized homosexual mode of transmission for HIV infection.

In 1996, an assessment study of the knowledge, attitudes, beliefs and practices of the general population in Lebanon showed an overall awareness about HIV/AIDS of 95.5%. This awareness was not reflected in preventive practices. A subsequent study was then done in 2004 to evaluate HIV/AIDS preventive indicators in comparison to those measured in 1996, and to evaluate the trend in risky behaviour during 1996–2004 in this population.

Materials and methods

A cross-sectional survey was conducted on a representative sample of the Lebanese population aged 15–40

Conclusions and implications of the study

- The rise in risky behaviour and regression of preventive indicators during the last 8 years since the 1996 survey highlights the need to strengthen health education activities in the community.
- More than one third of study subjects reported inappropriate practices for prevention indicating some misconceptions. These inappropriate practices and misconceptions should be the target of future interventions and advocacy campaigns.
- The misconception that an HIV-infected person would be symptomatic influences the preventive behaviour of individuals regarding sexual partners, and is particularly alarming.
- Self-reporting of STDs significantly increased between 1996 and 2004. This finding should be investigated by an STD prevalence study.

years. The survey was adapted from the protocol for repeated surveys developed by UNAIDS and WHO. The survey instrument was a questionnaire adapted from the WHO Global Programme on AIDS methodology package. The questionnaire was divided into the following sections: identification and demographic data; background characteristics including source of information on health issues and media; marriage and regular partners; non-regular partners; non-regular commercial sex; condoms; STDs and health issues; knowledge of AIDS; risk perception; behaviour change; and attitudes towards people with HIV/AIDS.

■ Main study findings

Of the 3200 eligible and consenting respondents enrolled, 1876 were male and the rest female. The respondents, who were representative of the different ethnic groups and regions, were well educated, mostly young and about two thirds were sexually active. The rate of drinking alcohol was low, as was the rate of mobility.

Sexual activity was experienced early in life, with first sexual intercourse occurring between 15–20 years for 33.3% of males. While 70.5% of males were sexually active, only 26.8% were married, compared to 61.5% and 19.4% among females, respectively. Of the 16.8% of sexually active respondents who had had a non-regular partner in the last 12 months, most were young, living in urban areas, and were students or university educated, 31.4% agreed that they gave or received money or gifts in exchange for sex, and 26.4% had encountered the sexual partner for the first time (“casual sex”). Changes in sexual behaviour were above the country average everywhere except in Beirut and Mount Lebanon.

Media coverage on health in newspapers and magazines was read by 32.5% of respondents, and also heard on the radio, but television health programmes were the main source of information. The majority of the population were aware of HIV/AIDS (98.2%). Faithfulness to one partner, use of clean needles and syringes, and using condoms were reported as means of protection against HIV/AIDS by 87.4%, 86% and 87.3%, respectively. Compared to the 1996 survey, the preventive indicators displayed a significant decrease in three parameters: awareness, knowledge of means of protection and belief in personal protection.

Education did not seem to have had a positive effect on preventive practices in casual sex, with only 71.7% having used a condom during the last sexual intercourse with a casual partner. The rest did not use a condom because they did not like condoms, because of their inaccessibility/unavailability, because of the objection of partners, or for other reasons such

as being “sure” of their partner or because they did not think of doing so. Compared to 1996, the level of knowledge regarding condoms and their use was significantly reduced. Despite 87.3% knowing that condoms would protect from HIV/AIDS, only 14.6% had used condoms. Self-reported episodes of STDs in the last 12 months reached 9.1% among men, significantly higher than the 5.6% rate recorded in 1996, with significantly lower rates of recurrent episodes.

Although 6.8% of respondents knew a relative, friend or colleague with HIV/AIDS, only 1.1% perceived themselves to be at high risk of infection, while 67.5% perceived no risk at all, particularly women. Reported misconceptions regarding means of preventing HIV transmission were the avoidance of public toilets, mosquitoes and the sharing of food with a person with HIV/AIDS, but also that a person with HIV would be symptomatic. In general, misconceptions were associated with lower educational levels and older age groups, and were less frequent in Beirut and Mount Lebanon compared to the rest of the country. Education was significantly associated with a higher perception of risk for HIV infection, higher behavioural change, higher disclosure of HIV positive status, and a more positive attitude towards people with HIV.

Three quarters of respondents reported a high rate of willingness to take care of a family member with AIDS. Almost two thirds of respondents had a positive attitude towards people with HIV/AIDS, and agreed that they should be allowed to continue working and should not face discrimination in the workplace. Those caring for a person with AIDS were mostly in the north of the country as were those with a friend or relative living with HIV/AIDS, followed by the south and Mount Lebanon.

■ Conclusions and recommendations

Compared to the 1996 national knowledge, attitudes, beliefs and practices survey, awareness, which had been very good, has regressed over the last 8 years. Risk perception should be addressed more in future campaigns, along with misconceptions. Condoms are still not widely used in the community. The concept of safer sexual behaviour needs to be emphasized and the means of prevention need to be further promoted and made more accessible. These results call for more targeted interventions, addressing the particularities of communities and groups more specifically, for greater outreach and impact in the community.

HIV/AIDS

Behaviour study of the eunuch population regarding their sexual practices and HIV in Lahore, Pakistan

Pakistan
Lahore

Study period:
September
2004–November 2005

Small Grants Scheme
(SGS) 2004 No. 71

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Knowledge, attitudes, practices and behaviour

Pakistan

Abstract

A study was done of eunuchs' sexual practices, their knowledge about HIV/AIDS and preventive behaviour in Lahore, Pakistan. Of 5000 eunuchs in the district of Lahore, in-depth interviews were conducted with 350 using a semi-structured questionnaire.

Results Of those interviewed, 58 (16.6%) were married, 28% lived with their parents, and 66% shared their income with their parents. In terms of occupation, 9.14% were sex workers only, while 79.14% were engaged in other occupations in addition, such as singing and/or dancing and begging. While 78% had heard about HIV/AIDS, mainly from television, knowledge was significantly associated with educational level.

Overall, 93.6% are sexually active with clients and friends, 4.2% have women as

clients, 54.9% perceived themselves to be at risk of contracting HIV/AIDS and 51.3% do not use condoms during sexual activity. In addition, 34.3% reported a positive history of sexually transmitted diseases, 95.5% were substance abusers, 74.0% were smokers 79.71% reported body-piercing practices and 60.9% were willing to be tested for HIV/AIDS.

Conclusion There is a high frequency of sexual activity, low literacy and income levels. Most do not use condoms and are involved in other high risk practices such as substance abuse and body-piercing. Knowledge about HIV/AIDS is mostly inadequate.

Background

Eunuch is a term historically used to describe castrated men in charge of a harem or employed as a chamberlain in a palace or men deprived of the testes or external genitalia. A common misconception about eunuchs is that, since they are castrated, they are either unable or lack the desire to perform sexual intercourse with the women in the harem they were employed to watch over. This was not always the case, however, since if a eunuch was castrated after puberty, which was common, he would still be able to achieve an erection and engage in coitus, though no pregnancy could result.

Eunuchs castrated before puberty were also valued and trained in several cultures for their exceptional voices, which retained a childlike and other-worldly flexibility and treble pitch. These eunuchs were known as castrati.

With changing social needs, they are now no longer mainly involved in these traditional roles, but are engaged in begging and prostitution, making them vulnerable to HIV. This economically profitable role has attracted others with no biological basis to this population by adopting male prostitution and eunuchoid disguise. It is estimated that there are 5000 eunuchs living permanently in the

Conclusions and implications of the study

■ Contrary to the perception that children found with eunuchoid characters are taken away from their parents, the study reported that 28% of eunuchs were living with their parents and 57% were in contact with their parents. Another misconception is that eunuchs do not have any marital life, but the study reported that 16.57% were married, living in a spousal relational with a man, called a *giria*.

■ The study reported a high frequency of sexual activity among eunuchs combined with low socioeconomic characteristics, and inadequate knowledge and poor preventive behaviour regarding HIV infection. Safer sexual practices were significantly associated with educational level and knowledge about HIV/AIDS. Half the eunuchs perceived themselves to be at high risk of contracting HIV/AIDS due to their practices. However, this risk perception did not influence their willingness to be tested for HIV.

■ The reported high risk behaviour highlights the need to determine HIV prevalence among this population and to raise their awareness about HIV/AIDS and safer sexual practices.

■ Although the eunuch population is considered hard to reach, it was possible to enrol 350 out of 5000 living in the district of Lahore. It is recommended that voluntary HIV counselling and testing services are provided to the study population who are expected to have a greater response than non-interviewed eunuchs and who may then attract a larger population group to the services.

district of Lahore. A study was therefore carried out in order to describe the demographic profile of eunuchs living in Lahore, and to assess their knowledge, awareness and sexual practices in relation to HIV.

■ Materials and methods

The study population included those who label themselves as eunuchs, live in a close-knit community, wear feminine dress with makeup and jewellery, and engage in singing and dancing. A cross-sectional study was done whereby 350 eunuchs aged 15 to 45 years were randomly selected using cluster sampling technique in 8 towns (comprising 150 union councils) in Lahore district. They were interviewed using a standardized questionnaire regarding their sociodemographic characteristics, and knowledge and behaviour regarding HIV/AIDS.

■ Main study findings

The mean age of the eunuchs studied was 27.8, ranging from 21 to 30 years, and more than half were illiterate. In addition to engaging in sex work, they were also involved in some other occupations. Some were living alone, others with a *giria* as their head or custodian of their interests, and 28% were living with their parents. The *giria* of the eunuchs has a pivotal role in their family life. The *giria* was found to be the protector of those living with him and responsible for all relations with the external community (i.e. the non-eunuch community) including their living needs and business activities. He is responsible for planning and marketing their activities, including their dancing parties and sexual activity. Contact between eunuchs and their families ranged from no contact at all to contact on a daily basis, and 66% shared their income with their parents.

Although 78% of those interviewed had heard about HIV/AIDS, only 45% were found to have adequate knowledge. Television was the major source of information regarding HIV/AIDS, and knowledge was significantly associated with the level of education. There was no significant association between level of knowledge and willingness to be tested for HIV.

The sexual practices reported included those for both commercial and pleasure purposes; 93.6% reported having sex with friends as well as clients. The clients also included women. Frequency of sex was found to be very high, with 52% having sex daily and a further 40% on alternate days. Similarly, the number of sexual partners was also high. Although there is a perception that eunuchs are only involved in anal sex, 10% were only involved in vaginal sex and 13.7% were involved in oral and vaginal sex. Half of those involved in sexual activity took preventive measures during sex, with 46.9% using condoms, although only 20.6% were regular users. Condom use was significantly associated with educational

level, knowledge regarding HIV and income.

Body-piercing practices are a major risk factor for the transmission of HIV, having been practiced by 79.7% of respondents, with only 17.2% reporting use of new needles, 30.1% reporting use of reused needles, and more than half had not been aware of the status of the needles.

Almost all those interviewed were substance abusers (95.5%). Substances abused included hashish (20.3%) and alcohol (11.7%), while 19.7% abused more than one substance. The reported frequency of smoking was very high, with 74% smoking regularly; the majority of smokers were also substance abusers.

■ Conclusions and recommendations

The frequency of sexual activity among eunuchs is high, combined with low levels of literacy and income. Most do not use condoms, while other risk practices such as substance abuse and body piercing exist. Knowledge about HIV/AIDS and preventive behaviour is inadequate. The reported high risk behaviour highlights the need to determine HIV prevalence among this population and to raise their awareness about HIV/AIDS and safer sexual practices. It is recommended that voluntary HIV counselling and testing services are provided to the study population who are expected to have a greater response than non-interviewed eunuchs and who may then attract a larger population group to the services.

HIV/AIDS/Hepatitis

Risk reduction

Pakistan

Developing and field testing information, education and communication materials to reduce the risk of HIV/AIDS and hepatitis B and C infection from poor injection practices in Sindh province, Pakistan

Pakistan
Sindh province

Study period:
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Small Grants Scheme (SGS) 2003 No. 106

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Abstract

A study that included focus group discussions conducted in different settings was done so that the results could be used to develop information, education and communication (IEC) materials about injection safety for an HIV/AIDS prevention campaign. Focus group discussions were conducted in three urban and suburban areas of Karachi and one rural district in Sindh province. Content analysis was done to identify themes that covered injection overuse and reuse of injection equipment. A cross-sectional survey was then conducted in which 631 individuals were interviewed in order to evaluate these themes, which were rated according to their appropriateness for raising the awareness of the population about injection safety.

Results Study respondents from all localities reported that an injection is essential in any prescription. All respondents had heard about HIV/AIDS, but awareness of hepatitis B and C was low in rural areas. Awareness about disease transmission through the reuse of disposable syringes was also low. The theme 'if this is not a new syringe I will not allow this myself to be injected' recorded the highest score, followed by 'doctor, do I really need an injection for a cold, flu or fever?'

Conclusion The themes developed are recommended for use for the general population during media campaigns to increase preventive behaviour in the community.

Background

Unsafe therapeutic injection practices by health care providers in both rural and urban settings in Pakistan have been indicated as the main risk factor for the spread of hepatitis B and C viruses. To reduce the risk of transmission, there is a need to develop effective information, education and communication (IEC) materials that can be incorporated into HIV/AIDS prevention campaigns at provincial and national levels. Prior information about people's likes and dislikes can determine a campaign's success. The objective of this study was to develop IEC materials for injection safety based on the results of focus group discussions and to test their acceptability by the community. These messages can then be incorporated into HIV/AIDS prevention campaigns.

Materials and methods

Focus group discussions were conducted in three urban and suburban areas of Karachi and in one rural district in Sindh province. Content analysis was conducted to identify the themes to be targeted in order to promote injection safety in the general population. A community-based cross-sectional survey was then conducted in which 631 individuals aged 16 years and older, in two localities of Karachi, were interviewed in order to evaluate the themes identified for the IEC materials about injection safety. A cluster-sampling technique was used to select study subjects.

Study subjects were requested to rate the themes using a Likert scale of 1–5 according to their appropriateness for raising the awareness of the population about injection safety. Data analysis was performed to identify the most important concepts for use in media campaigns. Comparison of scores was used to prioritize the themes.

Conclusions and implications of the study

- The two themes 'if this is not a new syringe I will not allow myself to be injected' and 'doctor, do I really need an injection for a cold, flu or fever?' were rated highest amongst the themes, which covered injection overuse and reuse of injection equipment.
- These themes can be presented in the media in an attractive manner to improve injection safety in the community.
- These themes were rated highly by the participants and when used in a media campaign should be acceptable to the general population. Consequently, they are expected to bring about a change in community behaviour regarding injection practices

■ Main study findings

In rural Sindh province, subjects seek health care from basic health units or general practitioners in the area. Preference is for the general practitioner where patients can usually get all health services in the same place. In all localities a prescription usually contains tablets, syrups (mixtures) and an injection, which is given in almost all cases.

Study respondents from all localities reported that an injection is essential in all prescriptions. The doctor may be questioned in cases where an injection is not prescribed. All respondents had heard about HIV/AIDS, but awareness of hepatitis B and C viruses was low in rural areas. Awareness of disease transmission through reuse of disposable syringes was mostly restricted to HIV transmission. Except in the villages, all respondents had seen the health education messages of the National AIDS Control Programme. However, it was clear that there was no particular emphasis on the reuse of syringes or needles in the campaigns. Injection safety was briefly mentioned.

Respondents from urban slums, suburbs and rural areas seldom checked whether a syringe was disposable or not and were not requested to buy their own syringes from drug stores. By contrast, educated people from urban areas knew the type of syringe used and were asked to bring a disposable syringe. Economic reasons and the practice of medicine by unqualified individuals were mentioned as the main reasons for unsafe injection practices. Suggestions to improve the situation included stronger regulation over the practice of medicine by unqualified individuals, improving the basic health units so that patients do not seek care from private practitioners and the inclusion of injection safety in school health education.

In rural Sindh province, one particular local television channel (KTN) was reported as the main source of health education for the community. However, many others noted that radio is still popular and could be used effectively to transmit messages to improve injection practices. In urban and suburban areas, only television was recommended for use in educating the masses.

The following themes were obtained based on analysis of the focus group discussion results: doctor, do I really need an injection for a cold, flu or fever?; please don't inject me if it is not necessary, I will give you your fees; is this a new syringe you are using to give me an injection?; reuse of disposable syringes can cause HIV/AIDS; reuse of disposable syringes can cause hepatitis B and C; unsafe injections can cause hepatitis B and C which are life threatening; please open a new syringe in front of me for this injection; I want to get well, but do I really need an

injection?; can I get cured by oral medicines?; if this is not a new syringe, I will not allow myself to be injected.

Evaluation of themes in the cross-sectional survey The mean age of the 631 study subjects was 35.7 years (± 14.2 years), and the majority were female (81.1%). All the themes were appreciated by the respondents and were scored higher than 2.5 (the median cut-off). However some themes were rated higher than others. The theme 'if this is not a new syringe, I will not allow myself to be injected' had highest mean (4.2) and sum (2634) score, followed by 'doctor, do I really need an injection for a cold, flu or fever?' with a mean score of 3.9 and sum score of 2477.

There was no significant difference between males and females regarding the themes tested except 'is this a new syringe you are using to give me an injection?' and 'unsafe injections can cause hepatitis B and C which are life threatening', which were rated significantly higher in males. Similarly, no significant difference was found across educational levels regarding the tested items except for 'if this is not a new syringe I will not allow myself to be injected', and 'reuse of disposable syringes can cause hepatitis B and C', which rated significantly higher among those with higher educational levels, and 'please open a new syringe in front of me for this injection', which rated significantly higher among those with lower educational levels.

Other suggestions to improve injection safety proposed by the community included interviewing celebrities on television and radio to raise community awareness about the hazards of unsafe injection practices, interviewing patients who have acquired hepatitis due to unsafe injection practices and presenting case studies in the media.

■ Conclusions and recommendations

The themes identified in the focus group discussions were rated highly by the community. They are therefore recommended for use with the general population during media campaigns and in developing IEC materials to improve the preventive behaviour of the community regarding injection practices.

HIV/AIDS

Risky behaviour

Risky behaviours and needs assessment for prevention of HIV infection among drug users

Egypt

Nile Delta region

Study period:

November 2003–2004

Small Grants Scheme

(SGS) 2003 No. 187

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Abstract

A project was done to study risk behaviours for HIV infection among drug users and assess their needs for prevention, in which 188 adult drug users residing in Nile Delta governorates were recruited from specialized health facilities and interviewed using a pretested and structured questionnaire.

Results The majority of drug users studied were aged 20–40 years, male, single, literate, unemployed and living in urban areas. The duration of drug use was more than five years for 76.6% of users. The majority were smokers. Illicit drugs were the first drugs used by 71.8%, with *bango* (marijuana) ranking first followed by hashish, while licit drugs were first abused by 28.2%, with cough syrup ranking first followed by benzhexol hydrochloride (Parkinol, Nile Pharmaceutical Company, Egypt). The same pattern was found for currently abused drugs. The main motives for drug abuse were peer pressure, seeking pleasure and to improve mood and sex. Multidrugs were used, with

home being the preferred place for intake. Drug injection was reported by 44.7%, and of these, 42.9% shared needles. Previous treatment was reported by 55.9% of users, with family the main referral source, although outcomes were poor. Knowledge about HIV/AIDS was adequate among the majority of users, but deeper knowledge about modes of transmission was deficient. Only 11.2% had ever been screened for HIV compared with 43.6% for viral hepatitis. Risk of HIV infection was reported by 28.6% of injecting drug users and 22% of users with unsafe sexual relations. Nearly two thirds reported extramarital sex with multiple partners, while 66.9% reported never using condoms. Hepatitis B and C, and sexually transmitted infections, were significantly higher among users who injected drugs and practiced unsafe sexual behaviour.

Conclusion Risky behaviour for HIV infection is common among the drug users studied. However, their perceptions of risk and knowledge about HIV/AIDS were found to be deficient in many aspects. There is an urgent need to establish outreach programmes in order to increase drug users' awareness of harm reduction measures.

Conclusions and implications of the study

- The majority of drug users are young males, of single marital status, residing in urban areas. Unemployment among them is high, although the majority have secondary or higher level of education. Age of first abuse ranged from 10–37 years, with *bango* being used at a relatively younger age than other drugs.
- The majority of drug users are smokers and multidrug users. Illicit drugs are the main type of drug used, especially *bango* and hashish, while cough syrup and Parkinol are the main licit drugs used. The preferred place for drug intake is indoors with friends.
- The main motives for drug use are peer pressure, seeking pleasure and to improve mood and sex. Treatment had been received by 55.9%, mainly through family referral, but with poor outcome.
- Drug injection was practiced by 44.7%, with needle sharing engaged in by 42.9% of these. Extramarital relations were reported by 62.8%, mainly with more than one partner, and without a condom in 66.9% of cases.
- Self-reporting of hepatitis B and C, and sexually transmitted infections, was high, especially among drug users engaged in risky behaviour.

Background

The study was conducted in Gharbia governorate and other governorates in the Nile Delta region. A convenience sample of drug users aged 15–45 years admitted for treatment at governmental hospitals, private hospitals and private clinics were enrolled. In addition, a peer group was established and trained to recruit street drug users and those not receiving treatment into the study. Users were interviewed using a structured and pretested questionnaire that gathered information on: sociodemographic data; pattern of drug use; perception of risk for HIV/AIDS; risk behaviour for HIV/AIDS; attitudes and preventive behaviour; self-reported past history of any blood-borne or sexually transmitted infections.

Materials and methods

The study was conducted in Gharbia governorate and other governorates in the Nile Delta region. A convenience sample of drug users aged 15–45 years admitted for treatment at governmental hospitals, private hospitals and private clinics were enrolled. In addition, a peer group was established and trained to recruit street drug users and those not receiving treatment into the study. Users were interviewed using a structured and pretested questionnaire that gathered information on: sociodemographic data; pattern of drug use; perception of risk for HIV/AIDS; risk behaviour for HIV/AIDS; attitudes and preventive behaviour; self-reported past history of any blood-borne or sexually transmitted infections.

Main study findings

For the study, 188 users were enrolled, 81.4% aged 20–40 years. The majority were male (88.8%), single (60.6%) and with secondary or higher education (69.2%). They were mainly skilled workers (36.2%), unemployed (22.3%) or professionals (18.1%). The duration of drug use was five years or more among 76.6%. The majority were current smokers (96.8%). Illicit drugs were used first by 71.8%, with *bango* ranked first (29.8%), followed by hashish (27.7%), then alcohol (8.5%). Licit drugs were used first by 28.2%, with cough syrups ranked first (5.9%), followed by Parkinol (4.8%).

Males started drug use at a significantly younger age than females, and the mean age for starting *bango* use was significantly younger than that of hashish or Parkinol. The most common motives for initiation of drug use were peer pressure, seeking pleasure, and to improve mood and sex. Currently-used illicit drugs were mainly *bango* (64.9%), hashish (39.4%) and alcohol (24.5%). Among licit drugs, codeine-containing cough syrups were abused by 35.1%, followed by Parkinol (17%). The majority were using more than one drug (84.6%) and more than half were using three or more drugs (53.2%). The most common place for drug intake was at home (70.2%) followed by the street. Injecting drug use was practiced by 44.7%, and of these 42.9% reported sharing needles. The duration of use was significantly longer among males (mean 9.99 years \pm 6.22) than females (mean 6.57 years \pm 4.20), and among the married and those with lower educational levels.

History of previous detoxification therapy was reported by 44.1%, referred by their families in more than half the cases. The main motives for seeking detoxification therapy were domestic, financial, psychological, work or health problems. Results of treatment were poor, with only 11.4% reporting that their drug use situation was being controlled or improved, while 67.6% had relapsed or defaulted

Extramarital sexual relations were reported by

62.8% of users and found to be higher among those aged 20–40 years, those who were single, those who started drug use as a teenager, injecting drug users and multidrug users. Sexual relations were mainly heterosexual (86.5%), followed by bisexual (11%) and homosexual (2.5%). Condom use during extramarital sex was reported by only 13.6% and 66.9% reported never using a condom during sexual relations. The main reasons for non-use of condoms were because of decreased sexual pleasure and the lack of a perceived need for them. Screening for HIV and viral hepatitis was reported by 11.2% and 43.6% of drug users, respectively.

Self-reporting of hepatitis C infection was significantly higher among users who injected drugs (32.1%) than non-injecting drug users (6.7%), as well as for hepatitis B infection (9.5% and 0%, respectively). Cases of genital ulcers and urogenital discharge were significantly higher among injecting drug users, while cases of hepatitis C infection and genital ulcers were significantly higher among users engaging in extramarital sexual relations.

The majority of drug users knew about HIV/AIDS (96.8%), which was reported to be a minor public health problem by 36.7%. Heterosexual sexual transmission was the most frequently cited mode of HIV transmission (60.1%), followed by blood and blood products (47.3%), homosexual sexual relations (44.7%), injecting drugs (30.3%) and mother to child transmission (2.7%). Incorrect modes of HIV transmission were cited by 21.2% of rural residents compared to 6.9% of urban residents ($P < 0.05$).

Mass media was found to be the main source of information, followed by books and friends. The total knowledge score was significantly higher among urban residents, those with higher educational levels and injecting drug users. Manual and skilled workers had significantly lower mean knowledge scores compared to other occupations. Risk perception of HIV infection was significantly associated with higher educational levels, injecting drug use and extramarital sexual relations.

Conclusions and recommendations

Risk behaviour for HIV infection (injecting drug use and unsafe sex) is frequent among drug users. However, their knowledge about the mode of transmission of HIV is inadequate, their preventive behaviour is suboptimal and their risk perception for HIV infection is relatively low. These findings emphasize the need to establish outreach programmes to increase users' awareness of harm reduction measures.

HIV/AIDS/STD

Surveillance

Sudan

Assessment of the current surveillance system and proposal for second generation surveillance

Sudan

Khartoum state, Port Sudan, Kassala and Juba

Study period:

September 2004–December 2005

Small Grants Scheme (SGS) 2004 No. 44

Principal Investigator

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Abstract

The objective of the study was to assess the current HIV/AIDS surveillance system and develop a proposal for the introduction of second generation surveillance in Sudan. The study was conducted in two main parts: assessment of the current HIV/AIDS and sexually transmitted infection (STI) surveillance system using strengths, weaknesses, opportunities and threats (SWOT) analysis and conducting an HIV behavioural survey of military personnel.

Results The survey found that though the levels of knowledge about HIV/AIDS among military personnel were significantly higher than those reported by the 2002 national survey, gaps in knowledge about HIV/AIDS still exist. In addition, levels of stigma and discrimination against people living with HIV/AIDS were high. High risk behaviour was also reported: a considerable number had shared blades and needles with others and 19.1% had one sexual partner, while 28% had two or more. Despite this, the rate of condom use was very low: only 4.8% have ever used condoms, 0.3% had consistently used condoms during last year and 1.7%

during last sexual intercourse. Only 76 (4.2%) of respondents had had a voluntary test for HIV. Estimated prevalence of urethral discharge during the last 12 months was 5.9%. More than three quarters of respondents reported access to both radio and television, while 5.1% had no access to both. The most commonly preferred communication channels for HIV interventions were radio (62.2%), television (59.6%) and public lectures (50.6%).

Stigma/discrimination and sexual behaviour indicators scored higher in the sample with interviewers of the opposite sex to respondents i.e. respondents were more open to answering sensitive questions from interviewers of the opposite sex compared to interviewers of the same sex as themselves.

Conclusion The current HIV/AIDS/STI surveillance system needs to be strengthened by focusing more on STI surveillance, behavioural surveillance and expansion of HIV sentinel surveillance. The gaps identified in knowledge, attitudes and behaviour of military personnel should be targeted in future interventions.

Background

The first HIV/AIDS case reported in Sudan was in 1986. By December 2004, the total number of reported cases had reached 11 954. Of these, 5887 were AIDS cases and 6067 were HIV infected. Younger and middle age groups were mostly affected, with 88.5% of reported AIDS cases being 15–49 years old, and with a male to female ratio of more than 2:1 [1]. The major mode of HIV transmission is heterosexual transmission (97% of cases), while mother to child transmission accounts for 2.7%. HIV prevalence in the south is about eight times higher than in the capital, Khartoum.

To help countries focus their surveillance activities in the context of the state of their epidemic, WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS) have developed a conceptual framework to improve HIV surveillance, known as second generation

Conclusions and implications of the study

- The current HIV/AIDS/STI surveillance system needs to be strengthened by focusing more on STI surveillance, behavioural surveillance and expansion of HIV sentinel surveillance.
- The study identified gaps in knowledge about HIV/AIDS among military personnel, a high level of stigma, infrequent use of VCT services and low rates of safer sexual behaviour. These gaps should be targeted in future interventions.
- The mass media were found to have an important potential role to play in raising general awareness, while friends and peers were found to play a significant role in relation to sensitive issues such as condom use. It is recommended that peer education projects among military personnel and other vulnerable population sub-groups should be supported by mass media campaigns.
- The use of interviewers of the opposite sex as respondents yielded higher response levels to sensitive questions about sexual behaviour and stigma/discrimination related to HIV/AIDS.

HIV surveillance. Second generation surveillance aims to monitor trends in behaviour as well as HIV infection. Guidelines for second generation HIV surveillance suggest approaches to making better use of data to increase and improve responses to the HIV epidemic. A study was therefore made to assess the current HIV/AIDS surveillance system in Sudan and to develop a proposal for the introduction of second generation HIV/AIDS surveillance in the country.

■ Materials and methods

The study was conducted at the following sites: the Sudan National AIDS Control Programme (SNAP), Khartoum; the state AIDS programmes and ministries of health in Khartoum, Port Sudan, Kassala and Juba; and all military units in Khartoum.

For the assessment of the current HIV/AIDS surveillance system, the study population were key personnel at SNAP and the federal and state ministries of health, and experts involved in HIV/AIDS surveillance. The records of SNAP and the ministries of health were also reviewed. Strengths, weaknesses, opportunities and threats (SWOT) analysis was used to assess the current surveillance system, key staff from SNAP at national and state levels were interviewed and surveillance activities were reviewed using a standard check list.

For the cross-sectional knowledge, attitudes, behaviour and practices (KABP) survey, the study population were all military personnel in all military units in Khartoum state. A two stage cluster sampling technique with probability proportional to size sampling was used, and the estimated sample size of military personnel was 900. A structured pre-coded questionnaire was used for data collection. In one sample, interviewers and respondents were the same sex while in the other they were from the opposite sex to each other. The questionnaire was divided into five sections including: information about demographic data; knowledge, attitudes and behaviour in relation to HIV/AIDS; sexual behaviour; knowledge and use of condoms; STI care-seeking behaviour; and information and communication channels.

■ Main study findings

Although levels of knowledge about HIV/AIDS among military personnel were found to be significantly higher than the results obtained in the 2002 national survey, there were still gaps. For instance, only 128 (7.1%) respondents identified mother to child transmission of HIV. Knowledge about HIV prevention measures was poor, especially faithfulness 181 (10.1%) and condom use 48 (2.7%). Misconceptions about HIV transmission remain: 540 (30.0%) and 253 (14.1%) respondents mentioned mosquito bites

and eating with an infected person, respectively, as routes of HIV transmission.

Levels of stigma and discrimination against people living with HIV/AIDS were high among military personnel: 688 (38.2%) would not accept eating with an HIV-infected person, 1302 (72.3%) would not accept buying food from an HIV-infected person and 438 (24.3%) would hide the HIV infection of a family member from other people.

In terms of sexual behaviour, 19.1% of respondents reported one sexual partner while 28% reported two or more. Condom use was very low: only 87 (4.8%) had ever used condoms, only 5 (0.3%) consistently used condoms during the last year and only 30 (1.7%) had used them during last sexual intercourse. In addition, 280 (30.7%) had shared blades and 111 (6.2%) had shared needles with others.

Use of voluntary HIV counselling and testing services was very low, with only 76 (4.2%) respondents having had a voluntary test for HIV. The estimated prevalence of urethral discharge among respondents during the last 12 months was 5.9%.

The majority of respondents (75.3%) reported access to both radio and television, while 5.1% had no access to either. The most commonly preferred communication channels for HIV interventions were radio (62.2%), television (59.6%) and public lectures (50.6%).

Stigma/discrimination and sexual behaviour indicators scored higher levels in the sample that had interviewers of the opposite sex to respondents i.e. respondents were more open to answering sensitive questions in this sample than in the sample that had interviewers of the same sex as respondents.

■ Conclusions and recommendations

HIV sentinel surveillance is the main focus of the SNAP surveillance system. STI surveillance is the weakest component of surveillance activities. The decentralization strategy adopted by SNAP has not been effective in developing and sustaining HIV/AIDS/STI surveillance at state level due to poor capacity in states and lack of political support. The system is not well integrated into the existing health system and does not make full use of the available infrastructure. The current HIV/AIDS/STI surveillance system needs to be strengthened by focusing more on STI surveillance, behavioural surveillance and expansion of HIV sentinel surveillance.

■ References

[1] *HIV/AIDS/STI surveillance report*, Khartoum, Sudan National AIDS Control Programme, 2004.

Evaluation of the diagnostic techniques to detect human African trypanosomiasis in Baher El Jabel state, southern Sudan

Sudan

Baher El Jabel state

Study period:

September 2003–March 2005

Small Grants Scheme

(SGS) 2003 No. 50

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Human African Trypanosomiasis

Diagnostics

S u d a n

Abstract

A study was done to evaluate the diagnostic performance of the different tests used for the diagnosis of human African trypanosomiasis (HAT) in endemic regions. For passive case detection, 58 persons presenting themselves at Juba hospital with signs and/or symptoms suggestive of HAT were tested. For active case detection, 1381 consenting and eligible individuals were examined for enlarged cervical lymph nodes and for presence of specific antibodies. In the non-endemic region, 203 consenting healthy individuals were enrolled as a control group to study the specificity of the antibody detection tests.

Results In the non-endemic area, card

agglutination test for trypanosomiasis on filter paper (CATT/FP), CATT on diluted blood (CATT/DB) and CATT using plasma titration (CATT/PL), were 100%, 99.5% and 99.5% specific, respectively. Other tests were also highly specific. In the endemic area, active surveillance reported a seroprevalence of 0.94% using CATT/DB and all parasitologically-confirmed patients were seropositive with CATT/DB, LATEX/PL and CATT/PL. The specificity of CATT/DB carried out in the field was 99.27%, very close to the specificity recorded in the non-endemic region, while CATT/FP reported a specificity of 99.74%. There was no significant difference between CATT/DB results and those obtained with other serological tests. The costs of the two active surveillance strategies to detect and stage a patient using CATT/whole blood or CATT/DB as screening tests were calculated. CATT/DB was US\$ 50 less expensive than CATT/whole blood per detected patient in the low endemic Baher El Jabel state.

Conclusion CATT/DB is more cost-effective than the standard CATT/whole blood test, being US\$ 50 cheaper per patient. CATT/DB is therefore recommended for use as the screening test of choice in low endemic sleeping sickness regions.

Background

Recent reports from Baher El Jabel state in southern Sudan indicate that it is a low endemic region for human African trypanosomiasis (HAT). Surveillance of the disease should therefore make use of a highly specific serological screening test combined with a highly sensitive parasite detection test carried out on seropositive persons. A study was therefore made to evaluate the performance of the different diagnostic tests for HAT.

Materials and methods

The study was conducted in the endemic Baher El Jabel state in southern

Conclusions and implications of the study

■ The data collected in the non-endemic region revealed that all the serological tests used in the study have a similar specificity. This indicates that the choice between the different tests for use in an endemic region will depend on other parameters such as sensitivity, costs and applicability in the field. Regarding the latter, only CATT/DB, CATT/PL and LATEX/PL are suitable. All the other tests are laboratory bound.

■ In the endemic region, there was no significant difference in the specificity of CATT/DB and CATT/FP. Sensitivity is important when choosing the most appropriate screening test; CATT/FP was less sensitive than CATT/DB, which in turn is less sensitive than CATT/PL. The low sensitivity of CATT/FP is unexpected, given previous reports. It cannot be excluded that this low sensitivity may be related to the logistical conditions during the passive surveillance study.

■ Taking into account both the low sensitivity of CATT/DB observed in the passive surveillance study, and the high diagnostic performance of CATT/PL (sensitivity and specificity of 100% and 99.5%, respectively), CATT/PL is the more cost-effective test. If plasma is prepared from blood taken from a capillary vessel in the finger and sedimented in a micro titre plate, CATT/PL is not more complicated than CATT/DB to perform in the field.

■ CATT/DB is more cost-effective than the standard CATT/whole blood test, being US\$ 50 cheaper per patient. CATT/DB is therefore recommended for use as the screening test of choice in low endemic sleeping sickness regions

Sudan. Khartoum state was selected as a comparative non-endemic area in order to evaluate the specificity of the different tests. In the endemic region, cases of HAT were identified by passive and active case detection. For passive case detection, 58 persons presenting themselves at Juba hospital with signs and/or symptoms suggestive of HAT were tested. For active case detection, 1381 consenting and eligible individuals were examined for enlarged cervical lymph nodes and for presence of specific antibodies. Diagnosis was confirmed for seropositive individuals with enlarged lymph nodes using parasitological detection of the parasite in blood or lymph node aspirate. In the non-endemic region, 203 consenting healthy individuals were enrolled as a control group for testing the specificity of the antibody detection tests.

Blood samples were taken from all study subjects and tested for the presence of HAT antibodies using card agglutination test for trypanosomiasis (CATT) on diluted blood (CATT/DB) and CATT on filter paper (CATT/FP). The blood was examined immediately for presence of trypanosomes by haematocrit centrifugation technique (HCT) and the miniature anion-exchange centrifugation technique (mAECT). The rest of the blood was centrifuged for preparation of plasma, which was frozen for further serological testing by CATT using plasma titration (CATT/PL), LATEX/PL and enzyme-linked immunospecific assay/thyroxin binding globulin (ELISA/TBG). The clinical stage of the confirmed cases was then determined.

■ Main study findings

In Khartoum state, all subjects had negative reactions with CATT/FP, recording 100% specificity. CATT/DB at 1/4 dilution and CATT/PL were 99.5% specific. LATEX/PL was 99% specific at plasma dilution 1/8. ELISA performed on plasma samples (ELISA/PL) or on filter paper eluates (ELISA/FP) recorded a specificity of 98.5%. Of the 1381 persons enrolled in Baher El Jabel state, 13 were seropositive with CATT/DB, a seroprevalence of 0.94%. In addition, 42 persons, of whom 5 were seropositive with CATT/DB, had enlarged cervical lymph nodes. Of these, 3 patients were parasitologically-confirmed, a prevalence of 0.2%.

All parasitologically-confirmed patients were seropositive with CATT/DB, LATEX/PL and CATT/PL, while 2 were negative with CATT/FP and 1 was negative with both ELISAs. The specificity of CATT/DB 1/4 carried out in the field was 99.27%, very close to the specificity recorded in the non-endemic region. CATT/FP reported a specificity of 99.74%. There was no significant difference between CATT/DB results and those obtained with other serological

tests, except CATT/PL, which recorded a significantly lower specificity of 69%.

Of 58 persons who presented themselves at Juba teaching hospital, 3 were found to be parasitologically-positive. It was decided that the 3 seropositive cases required treatment due to their clinical signs and high numbers of cells in their cerebrospinal fluid (CSF). All patients were found in the second stage of the disease and received the appropriate treatment. Only 2 of the 6 patients were positive with CATT/DB; a low sensitivity of CATT/DB in this setting, compared to 100% sensitivity for CATT/PL.

The contradictory results obtained from different settings may indicate that the specificity of CATT/PL during passive surveillance is higher than during active surveillance, and that the specificity and sensitivity of the other tests, particularly CATT/DB and CATT/FP, are lower than those observed during active surveillance.

Taking into account the costs of the serological screening tests and the parasitological confirmation tests, the costs of two active surveillance strategies to detect and stage a patient, starting with CATT/whole blood or CATT/DB as screening tests, were calculated. The cost of detecting one parasitologically-confirmed patient using CATT/DB as the screening test in a low endemic area was US\$ 50 cheaper in comparison with using CATT/whole blood as the screening test during active surveillance.

■ Conclusions and recommendations

CATT/DB is more cost-effective than the standard CATT/whole blood test. It is therefore recommended for use as the screening test of choice in low endemic sleeping sickness regions.

Infectious diseases

Surveillance

Sudan

Improving the participation of private sector physicians in Khartoum state in the national disease reporting system

Sudan

Khartoum state

Study period:

November 2003–January 2005

Small Grants Scheme

(SGS) 2003 No. 73

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Abstract

An intervention study was carried out to improve the participation of private sector physicians from Khartoum state in the national disease reporting system. Measles, meningitis neonatal tetanus and malaria were selected to be reported on. Of 911 practitioners, 120 were randomly allocated to either the intervention or a control group. The control group received requests to report weekly on these diseases for three months, forms for case recording and instructions on weekly reporting and dispatching reports. In addition to this, the intervention group received updated information on the diseases, background documents on national surveillance system requirements, opportunities to participate in national and international seminars, offers of free periodicals and vaccines, and the means of collecting reports. Weekly reports were received or collected during a three month period. Information about the acceptability of reporting and any constraints faced by practitioners were collected using a questionnaire and a focus group discussion.

Results A significantly higher proportion of private practitioners in the intervention group made regular weekly reports during the study period compared to the control group. Hand collection, e-mails, telephone reporting and

post dispatch were the methods of report delivery. All practitioners were willing to report on the diseases, but unconditional reporting more agreeable to younger practitioners. Proper delivery means, availability of information and awareness on reporting, availability of reporting forms, requests for reporting and proper incentives were felt to be things that would improve the disease reporting system. The suggested incentives included reduction of taxes for the private practices, free vaccines and periodicals, and subsidized participation in seminars.

Conclusion Providing regular background information and facilitating the means of report delivery from private practitioners will significantly enhance their participation in the national disease reporting system, thereby strengthening disease surveillance and response.

Background

Reporting is an essential element of surveillance that provides information for action. Health services in Sudan are delivered through the Federal Ministry of Health and state Ministries of Health, as well as governmental non-Federal Ministry of Health organizations (military, health insurance etc.), the private sector and nongovernmental organizations. All Federal Ministry of Health services deliver reports on communicable diseases to the national communicable disease surveillance system.

More than two thirds of private medical practitioners in Sudan reside in Khartoum state, serving around 40% of Khartoum's population. Unlike the public sector, the private sector does not routinely report diseases to the national surveillance system. This results in incomplete records and information on notifiable diseases in Khartoum state. The surveillance of communicable diseases in Khartoum state therefore relies on public sector sentinel sites only (76 sentinel sites). Private sector contribution to the treatment of

Conclusions and implications of the study

■ The study found that availability of information on the national surveillance system and notifiable diseases, availability of case record forms, requests for and instructions on reporting, incentives and an appropriate schedule for report collection, would significantly improve private sector reporting on notifiable diseases.

■ All practitioners were aware that the Federal Ministry of Health would benefit from their records and were willing to report. Younger practitioners were more enthusiastic about reporting, possibly reflecting greater flexibility in behaviour change compared to older practitioners.

■ Difficulties in reporting to the Federal Ministry of Health resulted from the lack of a proper delivery system, lack of information and awareness, lack of reporting forms and requests from the Ministry, and lack of appropriate incentives.

communicable diseases is undocumented. A study was therefore made on ways to improve the participation of private sector physicians in Khartoum state in the national disease reporting system and on barriers to routine reporting.

Materials and methods

An intervention study was made in Khartoum state, in which 120 private practitioners were randomly selected from a total of 911 practicing in the state, and then randomly allocated to either an intervention or control group. Both groups received letters requesting reports on measles, neonatal tetanus, meningitis and malaria, as well as a set of recording forms and instructions for reporting and dispatching the reports. In addition, the intervention group received information brochures on the four diseases, background information on the national surveillance system requirements, letters offering opportunities to participate in national and international seminars, offers of free periodicals and vaccines, and instructions on weekly report collection by the Federal Ministry of Health. Weekly reports were received from the control group or collected from the intervention group to assess the regularity of reporting in each group. Data on practitioner views and the intervention were collected at the end of three months using a structured and pretested questionnaire. Three focus groups were held to discuss satisfaction with the intervention, constraints faced, feedback received and expected benefits.

Main study findings

The majority of practitioners were male, 43.3% worked full time in the private sector and almost three quarters had practiced for 5–20 years. Their clinics were mainly located in Khartoum and its suburbs, then Omdurman, followed by north Khartoum state. They reported providing care to an average of 33.5 patients a day, referring patients for laboratory diagnosis if indicated and 77.5% follow up on their patients after prescribing medicines.

A significantly higher proportion of practitioners in the intervention group made regular weekly reports during the three months of the study period compared to the control group: 22 (36.7%) and 7 (11.7%), respectively, $P < 0.05$. All practitioners kept patient records; the majority (92.3%) used cards, the rest used computers. However, a significantly higher proportion of the intervention group performed record analysis, mainly on a monthly basis or whenever possible, compared to the control group (76.6% and 33.3%, respectively, $P < 0.05$).

Many advantages to record keeping were mentioned by both groups, the most important being the ability to respond to report requests, cited by nearly half the study group compared to only 3.3% of the control

group ($P < 0.05$). All practitioners felt that the Federal Ministry of Health would benefit from their records and agreed to report, although subject to certain conditions in 58% of cases (e.g. incentives, means of collecting and dispatching data). Unconditional reporting was agreed by a higher proportion of younger practitioners compared to older ones (70% and 26%, respectively, $P < 0.0001$).

Focus group discussions All participants agreed that reporting on diseases to the Federal Ministry of Health is important. Difficulties of reporting mentioned included lack of awareness, lack of proper reporting forms, and lack of communication between health authorities and private practitioners. Lack of a convenient delivery means was felt to be the main obstacle. The postal system was considered an inefficient means to deliver reports. Delivery by hand was considered a better method but requires more staff; e-mail was noted as a good alternative. It was agreed that more than one method should be adopted to ensure proper delivery and data validation. Feedback on reports was preferred through the same delivery means.

Lack of motivation was mentioned as the main obstacle to reporting. Incentives were mentioned including free vaccines, subscription to international journals, reduction of taxes on private practices and subsidized opportunities to participate in international seminars. Expected benefits mentioned were updating practitioners on the epidemiology of communicable diseases and sharing information with the Ministry and other colleagues.

Conclusions and recommendations

Private practitioners are willing to report on notifiable diseases if information on the surveillance and reporting system together with instructions for reporting and reporting forms are made available to them. Providing information on the relevant diseases and appropriate incentives are equally important. Information technology and internet access for reporting and feedback would significantly strengthen surveillance, provided the necessary infrastructure is available.

Cutaneous leishmaniasis

Drug studies

Islamic Republic of Iran

Comparison of a combination of imiquimod and meglumine antimoniate with meglumine antimoniate alone in treatment of acute anthroponotic cutaneous leishmaniasis

Islamic Republic of Iran

Khorasan Razavi province

Study period:

March 2004–November 2005

Small Grants Scheme (SGS) 2003 No. 18

Principal Investigator

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Abstract

A randomized, single blind, placebo controlled clinical trial was done to evaluate the efficacy of intramuscular injection of meglumine antimoniate in combination with topical imiquimod 5% cream or placebo cream in the treatment of anthroponotic cutaneous leishmaniasis (ACL). ACL patients referred to clinics of the Ministry of Health and Medical Education and those of the University of Medical Sciences in Mashad were enrolled, and eligible study subjects were randomly allocated to be treated with one of the treatment regimens.

Conclusions 59 patients with 128 lesions were treated with meglumine antimoniate/imiquimod and 60 patients with 124 lesions were treated with meglumine antimoniate/placebo. Clinical evaluation of patients at the end of the 4-week treatment period and 4-week follow-up period did not show any statistically significant difference between the 2 groups. Moreover, the rate of clinical cure was far lower than expected and the addition of imiquimod did not increase the response rate to meglumine antimoniate. In the meglumine antimoniate/imiquimod group, 3 patients suffered from moderate pruritus and burning skin sensation as side effects of the topical treatment. At week 20, relapse was observed in 1 out of 32 patients treated

with imiquimod and 2 out of 37 patients treated with placebo ($P > 0.05$).

Conclusions and recommendations

Imiquimod does not improve the clinical response of ACL patients to meglumine antimoniate and the overall cure rate was generally low. These results indicate the urgent need to evaluate new drugs and/or treatment modalities for ACL.

Background

Systemic pentavalent antimonials have been used as the standard treatment of anthroponotic cutaneous leishmaniasis (ACL) since 1929. They are only parenterally available which is painful and toxic, expensive and unaffordable in most endemic areas. Furthermore, the resistance of *Leishmania* to antimonials is increasing and several courses of treatment may be necessary. Several other physical, immunological, topical and systemic agents have been used in the treatment of ACL with variable results. Imiquimod, an imidazoquinoline amine, has recently been shown to be effective in the treatment of an experimental model of leishmaniasis. Imiquimod is an immune response modifier which is unique in that it activates local immune functions.

The variations in the reports on the efficacy of treatment modalities for ACL are due to variations in the species of *Leishmania*, poor study designs and the self-healing nature of ACL, as well as differences in the criteria used to evaluate the efficacy of drugs. In this study, the efficacy of 2 weeks of treatment with intramuscular injections of 20 mg/kg/day sodium stibogluconate (Sb+5) (equivalent to 60 mg/kg/day meglumine antimoniate) in combination with 4 weeks treatment with topical imiquimod 5% cream applied 3 times/week or placebo cream in the treatment of ACL was evaluated in a randomized, single blind, placebo controlled clinical trial according to the principles of good clinical practice.

Conclusions and implications of the study

■ The study reported the low efficacy of the conventional treatment currently administered for the treatment of ACL in endemic areas, as well as the meglumine antimoniate/imiquimod combination. This might be explained by rising levels of parasite resistance to meglumine antimoniate.

■ The addition of imiquimod did not improve the clinical response of ACL patients to meglumine antimoniate. The fact that the activation of the immune response by imiquimod was not reflected in a clinical response might be due to the low susceptibility of the parasite to meglumine antimoniate. Better efficacy might be found in areas where the parasite is still sensitive to meglumine antimoniate.

■ Further research is urgently needed to evaluate new drugs or treatment modalities for ACL.

Materials and methods

A randomized, single blind, placebo controlled clinical trial was carried out in the ACL endemic city of Mashad, in Khorasan Razavi province, in the north-east part of the Islamic Republic of Iran. ACL patients referred to Ministry of Health and Medical Education and University of Medical Sciences' clinics in Mashad were enrolled. The parasitological diagnosis was based on a positive smear stained by Giemsa and/or culture in NNN medium from scrapings of the border of the active lesion.

Using a simple randomization block design, eligible study subjects were randomly allocated to be treated with 20 mg/kg/day Sb+5 (equivalent to 60 mg/kg/day meglumine antimoniate) given as intramuscular injections in 1 or 2 injections based on the dose for 14 days, and either imiquimod 5% cream (Aldara, 3M Pharmaceuticals) or a placebo of petroleum jelly (Vaseline, Paveh Pharmaceuticals, Tehran) 3 times/week for 28 days. Patients were visited at 2, 4, 8 and 20 weeks after start of treatment. A case report form was designed to record the patients' baseline data and characteristics of lesions at each visit, results of smear and/or culture, clinical response and adverse events. The largest lesion (in the case of multiple lesions) was identified as the target lesion. Any adverse events during the trial, and the severity, duration and relatedness to the treatment as well as any actions taken were recorded.

Clinical response consisted of the following:

Clinical cure The primary clinical efficacy parameter was the complete re-epithelization of all lesions with disappearance of induration (with or without scar). No parasitological evaluation was done from clinically cured target lesions.

Clinical improvement Reduction in size of erythema, induration and ulcer compared to baseline.

Treatment failure No change or increase in size of erythema, induration and ulcer compared to baseline.

Relapse Reappearance of lesions at the site or periphery of previously healed lesions or increase in the size of lesions after initial improvement.

Parasitological cure Negative smears and cultures at the end of treatment and follow-up periods.

Main study findings

Of 508 screened ACL patients, 119 eligible patients (66 female and 53 male) with a mean age of 26.95 +/- 13.15 were enrolled. Of these, 59 were treated with meglumine antimoniate/imiquimod and 60 with meglumine antimoniate/placebo. There were no statistically significant differences between the two groups regarding age and sex of patients, number, duration and location of ACL lesions, and median surface area of induration and ulceration of the lesions

before treatment.

Clinical evaluation of patients at the end of the treatment period (4 weeks) and 4-week follow-up did not show any statistically significant difference between the two groups. Although the majority of ACL patients improved after treatment, the rate of clinical cure was far lower than expected: in 2 patients (1.7%) after 4 weeks and 5 patients (5.2%) after 8 weeks. Moreover, addition of imiquimod did not increase the response rate to meglumine antimoniate. Reduction in the median surface area of induration was significantly higher in patients treated with the placebo, although the reduction in ulceration was not significantly different between the two groups.

The only side effects observed relating to topical treatment were moderate pruritus and burning sensation in 3 patients (6.7%) treated with imiquimod. At week 20, relapse was observed in 1 out of 32 patients treated with imiquimod and 2 out of 37 patients treated with the placebo ($P > 0.05$).

Conclusions and recommendations

The study found no added benefit of combining a 4-week course of treatment with imiquimod cream to a standard course of treatment with meglumine antimoniate in ACL patients. Moreover, the response rate to 2 weeks of treatment with 60 mg/kg/day meglumine antimoniate was far less than expected. Considering the various limitations of antimonials and increased resistance of *Leishmania* parasites, there is an urgent need to find alternate and/or complementary treatment for ACL.

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Cutaneous leishmaniasis

Drug studies

Islamic Republic of Iran

**Resistance of
Leishmania tropica
Iranian strain to
meglumine
antimoniate
(Glucantime): in vivo
and in vitro methods**

**Islamic Republic of
Iran**

Mashad, Khorasan
province

Study period:
September
2004–October 2005

**Small Grants
Scheme
(SGS) 2004 No. 39**

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Abstract

Recent circumstantial evidence suggests that an increasing number of Iranian patients with cutaneous leishmaniasis (CL) are unresponsive to meglumine antimoniate (Glucantime), the first line of treatment in the Islamic Republic of Iran. A study was therefore designed to determine whether clinical response (healing or non-healing) was correlated with the in vitro susceptibility of *Leishmania* parasites to Glucantime. Initially, in vitro susceptibility testing was performed on 185 isolated parasites in the intracellular mouse peritoneal macrophage model.

Results The efficacy of the different treatment regimens was comparable with around a 90% success rate (complete/partial improvement). While 54.54% and 43.0% of patients were completely healed by intralesional and systemic procedures, respectively, treatment failure was notably higher in patients receiving intralesional injections, although this difference was not statistically significant.

There was complete agreement between the clinical outcome and the in vitro EC50 values. Parasites derived from non-healing patients had EC50 at least four-fold higher than parasites derived from healed patients. A selection of these strains was typed at the molecular level by pulse field gels and by

sequencing the PTR1 gene. These techniques have indicated that 28 out of 31 selected strains were *L. tropica* and 3 were *L. major*. The *L. major* strains were part of a distinct pulse field group and the *L. tropica* isolates could be placed in 3 related additional pulse field groups. For each pulse field karyotype, sensitive and resistant parasites were selected in which the firefly luciferase marker was transfected to assess further the in vitro susceptibility of field isolates in the monocyte cell line THP1. These determinations confirmed unequivocally that patients with no healing lesions were infected with *L. tropica* parasites resistant to Glucantime.

Conclusion The study provided strong evidence about the reduced susceptibility of the parasite to the conventional treatment for CL. This is the first report of proven resistant parasites contributing to treatment failure for CL.

Background

Antimonial compounds, particularly meglumine antimoniate (Glucantime), are the first line drugs for the treatment of all forms of cutaneous leishmaniasis (CL) in the Islamic Republic of Iran [1]. Based on a few studies that have been carried out in recent years, about 10%–15% of CL cases have no desirable response to Glucantime (Mohebali, unpublished data) and these patients may need alternative treatment methods including cryotherapy, laser therapy, immunotherapy and others. A study was therefore carried out to determine the susceptibility rate of *Leishmania tropica* to Glucantime by evaluating the clinical response to treatment and comparing it to susceptibility testing by in vitro methods.

Materials and methods

All parasitologically-positive patients were allocated to treatment with either systemic meglumine antimoniate (20mg/kg/day/for 20 days) or intralesional meglumine antimoniate (almost 1–3 ml once a week for at least 6 weeks with a 1 week interval).

Conclusions and implications of the study

- The study provided evidence for the existence of Glucantime-resistant *L. tropica* isolates.
- Two models were used, mouse derived macrophages and Giemsa staining and a human monocyte cell line (THP1) and luciferase-expressing parasites, and complete agreement was reported between treatment outcome and susceptibility of the parasites. The second assay does not require animals or labour-intensive parasite staining and counting is greatly advantageous. This requires the transfection of the parasites, a technique now relatively straightforward and the parasite manipulation does not appear to modify the properties of the parasite.
- These results suggest a strategy of drug combination to minimize the emergence of drug resistance and highlight the need to find an alternative drug regimen or modality for the treatment of CL.

Leishmania spp. was isolated again from non-healed patients 30 days after treatment course completion. Promastigote cultivation was carried out before and after treatment course completion in NNN + normal saline and RPMI 1640 supplemented by 15% fetal calf serum.

Macrophage cells obtained from BALB/c mice (inbred) were cultured and incubated with promastigote solutions. For macrophage cultivation, Lab-Tek tissue culture with 8 chambers was used for macrophage adherence to the glass. The chambers were covered by 5×10^4 macro/ml and the plates incubated in 37 °C containing 5% CO₂ for 2 hours for macrophage adherence. Two hours after incubation, 200 ul of late logarithmic promastigote solutions were increasing to each chamber of the plate (2×10^5 promastigote/ml) and the plates were incubated in the above conditions for 24 hours. The promastigotes were increasing in number. Then, meglumine antimoniate solutions at concentrations of 0 (control), 7.5, 15, 30, 60, 120, 240, 480 µg/ml were added to the cultures. The first chamber was contained with RPMI only (control). The cultures were incubated for 72 hours and the slides were removed and fixed in absolute methanol for 5 minutes and stained with Giemsa 10% for 20–30 minutes. At least 100 macrophages were counted to determine the percentages of infected macrophages and the number of parasites per infected cells. The 50% effective dose (ED50) is calculated as meglumine antimoniate concentration, which decreases the survival of *Leishmania* cells by half.

In vitro susceptibility testing assay in the human monocyte cell line (THP1) was also performed for parasite isolates of some healed and all non-healed patients. After 5 days of incubation with drugs, the remaining cells were evaluated by measuring luciferase activity. The luciferase activity of the LUC-recombinant parasites was expressed as relative light units (RLU) and were transformed by the formula RLU index [2, 3]: $[100 - (\text{RLU of untreated wells} / \text{RLU of treated wells})] \times 100\%$.

■ Main study findings

One hundred and eighty five (185) patients with negative past history of leishmaniasis treatment were enrolled. Of these, 75 were treated systemically, 100 intralesionally and 10 cases treated by both. All the treatment regimens were found to be similarly effective with about a 90% success rate (complete/partial improvement) with no relapse within the first 6 months after the treatment, although 2 patients had relapses after 12 months. While 54.54% and 43.0% of the patients were completely healed by intralesional and systemic procedures, respectively, treatment failure was notably higher in patients receiving intralesional injections, although this difference was not statistically significant.

A strong correlation was found between clinical outcome and susceptibility values using the peritoneal mouse derived macrophages model. The 165 patients who responded to SbV+ treatment were infected with parasites having a mean EC50 of 17.2 µg/ml and 20 unresponsive cases were infected with parasites having a mean EC50 of 97.7 µg/ml. Similar infection rates were observed between parasites derived from responsive and unresponsive patients.

A selection of these strains was typed at the molecular level by pulse field gels and by sequencing the PTR1 gene. These techniques have indicated that 28 out of 31 selected strains were *L. tropica* and 3 were *L. major*. The *L. major* strains were part of a distinct pulse field group and the *L. tropica* isolates could be placed in 3 related additional pulse field groups.

EC50 values in the presence of Glucantime were determined by measuring luciferase activity which proved to be a rapid quantitative method for the intracellular growth of parasites. The values obtained with this rapid assay were in excellent agreement with the values obtained using the mouse macrophages assay and Giemsa staining.

■ Conclusions and recommendations

The study reported a treatment failure rate of 10% among CL patients treated with meglumine antimoniate. Treatment failure results by in vivo methods were in agreement with the in vitro susceptibility testing using mouse derived macrophages and Giemsa staining and a human monocyte cell line (THP1) and luciferase expressing parasites. The study also reported a low rate of complete improvement with systemic or intralesional injections. These results suggest a strategy of drug combination to minimize the emergence of drug resistance and highlight the need to find an alternative drug regimen or modality for the treatment of CL.

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Cutaneous leishmaniasis

Drug studies

Islamic Republic of Iran

Efficacy of local heat therapy in the treatment of anthroponotic cutaneous leishmaniasis compared to intralesional injection of meglumine antimoniate

Islamic Republic of Iran

Isfahan province

Study period:
October 2003–August 2004

Small Grants Scheme (SGS) 2004 No. 91

Principal Investigator

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Abstract

In an attempt to find a more efficacious treatment for anthroponotic cutaneous leishmaniasis (ACL) than the currently used antimonial drugs, a randomized clinical trial was carried out in Isfahan province in which ACL patients were randomly allocated to heat therapy (radiofrequency) or intralesional injection of meglumine antimoniate. Follow-up evaluation was made by clinical assessment of treated lesions. A data collection form was used to collect information on sociodemographic and clinical characteristics, and adverse effects.

Results 57 patients with 83 lesions and 60 patients with 94 lesions were allocated to the experimental and control treatment groups, respectively. Response to treatment was significantly higher in the experimental group compared to the control group. There was a significant reduction in the size of lesions after treatment in the experimental group but not in the control group, and the size of lesions and

scars were significantly smaller in the experimental compared to the control group. The number of treatment sessions was significantly lower in the experimental group, and adverse effects were much more pronounced in the control group. In both groups, there was no relapse in the lesions with complete improvement after 6 months of follow-up.

Conclusion Heat therapy with radiofrequency thermogenerator proved to be an efficacious treatment for ACL. It is more efficacious and has fewer adverse effects than the conventional treatment with intralesional injection of meglumine antimoniate.

Background

Antimonial drugs are the most common type of treatment for anthroponotic cutaneous leishmaniasis (ACL) and intralesional injection of these drugs helps to prevent most of the adverse effects associated with their systemic administration. However, studies from the Islamic Republic of Iran have reported low efficacy rates of 55.63%, 41.7% and 50% [1, 2, 3]. As the *Leishmania* parasites infecting humans are markedly thermosensitive, skin lesions can be cleared by heat therapy. Reports have shown that heating a sore to 40–42 °C for several hours each day is efficacious in ACL treatment [4]. A study was therefore carried out to evaluate the safety and efficacy of radiofrequency thermogenerator in the treatment of ACL.

Materials and methods

A randomized clinical trial was carried out in Isfahan province in which eligible ACL patients treated at the Skin Diseases and Leishmaniasis Research Centre were randomly allocated to one of two treatment groups. The first group was treated by heat therapy (radiofrequency) at 50 °C for 30 seconds once a week for 4 weeks, while the second group was treated with intralesional injection of meglumine

Conclusions and implications of the study

- The study reported a complete improvement in 80.7% of cases treated with the thermogenerator compared to only 55.33% of those treated with the intralesional injection of meglumine antimoniate. Other parameters such as lesion size, induration and remaining scar were significantly smaller and adverse effects fewer in the thermogenerator group. Fewer sessions of treatment were required for the cases in the experimental group.
- The low cure rate for intralesional injection of meglumine antimoniate reported in this study is consistent with previous reports from the Islamic Republic of Iran. This study provides additional evidence about the low efficacy of the currently applied treatment regimen in the country. This could be attributed to drug resistance and should be further investigated.
- Heat therapy with radiofrequency thermogenerator proved to be more efficacious and safer than the conventional treatment with intralesional injection of meglumine antimoniate. The latter is no longer efficacious for the treatment of ACL in this area and its substitution by heat therapy is therefore recommended. New treatment regimens or modalities for ACL should also be evaluated in order to improve ACL case management in endemic areas, reduce its morbidity burden and hence reduce transmission.

antimoniolate once a week for 4 weeks at a dose of 0.1–4 ml, depending on the size of the lesion. Follow-up evaluation was made by clinical assessment of treated lesions. Patients were visited once a week during the 4 weeks of treatment and then every month for the following 2 months. A data collection form was used to collect information on sociodemographic characteristics, characteristics of skin lesion(s) and direct skin smear results. Appearance of lesions in subsequent follow-up visits and occurrence of adverse side effects were also recorded. Data were analyzed using “intent-to-treat” analysis.

■ Main study findings

Of 120 patients, 117 completed the study. Of these, 57 patients with 83 lesions and 60 patients with 94 lesions were allocated to the first and second treatment groups, respectively. There was no significant difference between the two treatment groups regarding the following parameters: patients' age (mean age = 25.12 ± 13 vs. 22.6 ± 12 years); number of lesions (mean number of lesions = 1.4 ± 0.6 vs. 1.5 ± 0.9 , respectively); largest diameter of induration of skin lesions before treatment (mean = 1.56 ± 0.64 cm vs. 1.47 ± 0.55 cm); and disease duration (mean duration = 4.42 ± 2.1 weeks vs. 3.85 ± 2.1 weeks).

Evaluation of treatment response found that: 46 patients (80.72%) with 67 lesions (80.7%) had complete improvement in the experimental group compared to 34 patients (56.7%) with 52 lesions (55.33%) in the control treatment group ($P < 0.05$); 7 patients (12.28%) with 10 lesions (12%) had partial improvement in the experimental group compared to 15 patients (24.9%) with 20 lesions (21.27%) in the control group; and 4 patients (7%) with 6 lesions (7.3%) had poor response to treatment/ unchanged in the experimental group compared to 11 patients (18.4%) with 22 lesions (23.40%) in the control group.

There was a significant reduction in the size of lesions after treatment in the experimental but not in the control group and the size of induration and remaining scars were significantly smaller in the experimental compared to the control group. Moreover, the number of treatment sessions was significantly lower in the experimental group. The only adverse effect in the experimental group were satellite lesions, compared to allergic reactions around the lesions, sporotrichoid lesions and satellite lesions in the control group. In both groups, there was no relapse in the lesions, with complete improvement after 6 months of follow-up.

■ Conclusions and recommendations

Heat therapy with radiofrequency thermogenerator proved to be more efficacious and safer than the conventional treatment with intralesional injection of

meglumine antimoniate. The latter is no longer efficacious for the treatment of ACL in this area and its substitution by heat therapy is therefore recommended.

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Cutaneous leishmaniasis

Vector control

Syrian Arab Republic

A way forward to scale up the use of impregnated bednets for the control of anthroponotic cutaneous leishmaniasis in Aleppo

Syrian Arab Republic
Aleppo

Study period:
January–December 2005

Small Grants Scheme (SGS) 2004 No. 3

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Abstract

A study was done in the endemic area of Aleppo to provide baseline information that would assist the leishmaniasis control programme in scaling up the insecticide-treated nets (ITNs) strategy in the Syrian Arab Republic. Household, demonstration, commercial retail outlet and net placement surveys were conducted in urban and rural districts. Key informant interviews and focus group discussions were also carried out.

Results 62% and 44% of the population in the rural and urban districts used non-impregnated bednets. The commercial retail outlet survey found that only 6% sell bednets, and that people spend more money on insecticide than on buying bednets. Sewn bednets were more available in rural than in urban districts. The rectangular, white and double size bednets were the most common types sold. The majority of the population rely mainly on spraying insecticides but were willing to use ITNs if available at health centres.

Prices seen as affordable, according to community leaders, ranged from around US\$ 2–6 in poorer villages up to around US\$ 10–12 in richer ones.

Most participants believed that the best form of protection is sewage disposal and insecticide spraying on a regular basis, as ITNs are not seen as a fully effective solution. The bednet placement survey found that 81% of users of demonstrated ITNs were satisfied. Of these, 62.2% asked for more ITNs. In all surveys, the community generally preferred the rectangular, white and double size ITNs.

Conclusion The study provided an in-depth analysis of community beliefs and preferences regarding ITNs and their willingness to pay for them. This information is invaluable for the scaling up of ITNs in the Syrian Arab Republic, especially for anthroponotic cutaneous leishmaniasis prevention.

Background

Despite national efforts to control cutaneous leishmaniasis (CL), the disease remains an important public health problem in the Syrian Arab Republic. The effectiveness of insecticide-treated nets (ITNs) in reducing the burden of anthroponotic cutaneous leishmaniasis (ACL) worldwide, including in the Syrian Arab Republic, has been repeatedly demonstrated. However, current health policy is mainly dependent on selective spraying of endemic areas. A study was therefore done to collect the baseline information needed for the scaling up of ITN use in the Syrian Arab Republic.

Materials and methods

Household and demonstration surveys

A community-based cross-sectional household survey was conducted in 20 randomly selected highly endemic districts of Aleppo (10 urban and 10 rural), in which 440 households with 3654 inhabitants were surveyed. Household heads were interviewed regarding sociodemographic

Conclusions and implications of the study

- The study provided an in-depth analysis of community beliefs and preferences regarding ITNs and their willingness to pay for them in highly endemic districts in Aleppo, Syrian Arab Republic, where the prevalence of CL is around 4%.
- The study found a willingness to buy ITNs, but this was related to price. As each household already spends US\$ 2.3 and US\$ 4.7 per month in urban and rural areas, respectively, to buy insecticides, this would indicate that increasing community awareness about ITN efficacy will result in a shift in behaviour from buying insecticides to buying ITNs.
- The study reported an over-reliance on indoor residual insecticide spraying as the main vector control method in this endemic area. It is recommended to shift from this method to using ITNs. The information provided by this study and its recommendations are necessary to scale up ITN use in this community in the most efficient way.
- To implement these findings, especially those related to community misconceptions about ITNs, requires development of appropriate behavioural messages. The use of communication for behavioural impact (COMBI) methodology may be necessary.

characteristics, insect control methods used, views regarding indoor residual spraying technique, sleeping habits, knowledge regarding bednets and attitudes to ITNs. In the demonstration survey, interviewers collected information regarding ITN use, demand and price, and also about disease burden.

Commercial retail and net placement surveys Retail outlets, local tailors and the private sector involved in bednet production were interviewed regarding the number and types of bednet sold, insecticides sold and their cost, type of bednet sold and preferred kinds. For the net placement survey, 600 ITNs were demonstrated by 4 different companies (150 each). The community preference for different colours, sizes and shapes was assessed.

Interviews and focus group discussions To collect qualitative information, 17 key informants were interviewed and 7 focus group discussions were held.

■ Main study findings

The overall prevalence of CL found was 4.2%, with no significant difference between the two districts. All age groups were infected, but mainly those between 0–14 years. The entire population in both districts showed scars. The population in rural districts suffered from nuisance more than those in urban ones (100%, 95%, respectively). Almost the entire population (99%) were familiar with bednets, which were used significantly more in rural than urban districts (61% and 41%, respectively). Houses were sprayed significantly more during summer 2004 in rural compared to urban districts (67%, 33%, respectively), mainly by the government. The cost of insecticides varied from US\$ 0.5 to US\$ 20.2 per month, with each household spending US\$ 2.3 and US\$ 4.7 per month, in urban and rural areas, respectively, to buy insecticides.

Regarding the sleeping habits of the community, most sleep together in groups of 2, 3 or more than 3 persons (46%, 10% and 19%, respectively). Most adults sleep indoors in urban districts (51%), but outdoors in rural districts (71%), and 71% of adults usually go to sleep between 10 p.m. and 12 p.m. Most children usually go to sleep early in all districts (between 6 p.m. and 9 p.m.), and 62% of children sleep outdoors in summer.

Following community education about ITNs, the willingness to use ITNs was significantly higher among rural than urban inhabitants (97%, 77%, respectively). Reasons for refusing to use ITNs were because of no insects in the house or because of preference for fans or air conditioning (32%, 24%, respectively). Demonstration of the different types of ITNs found that the preferred types were double size, rectangular shape and white colour. Further ITN preferences were for sizes large enough for one baby or more and family sizes. Prices seen as affordable for ITNs

were US\$ 1.9–3.9 (31%), followed by US\$ 0.4–1.9 (19%), while 26% asked for ITNs free of charge.

For the commercial retail survey, 97 retail outlets were visited in urban and rural districts: 6% sold bednets, 69 sold insecticides and 7 were involved in bednet production, with no difference between rural/urban districts. Two shapes of bednet were available; rectangular and conical ones. The double size bednet was the type that sold most and white, pink and blue were the preferred colours. The price for each bednet ranged from US\$ 0.5 in some outlets in rural districts to US\$ 8.7 in Medina markets. Of the demonstrated ITNs, those of white colour, rectangular shape and measuring 180 x 180 x 250, 130 x 180 x 150 or 170 x 100 x 200 were preferred.

The bednet placement survey found that after 15 days of trying ITNs, 68% of the inhabitants used them daily, mainly in the rural districts (72%). About 81% of users were satisfied with the tested ITNs.

The interviews with key informants and focus group discussions found that the villagers rely mainly on spraying insecticides, such as Pif Paf, that they get from a pharmacy or the municipality, in addition to the insecticide fogging and residual insecticide spraying routinely performed by the health directorate. Economic constraints were mentioned as the main barrier to using ITNs. Though almost the entire population knew about bednets, few had heard about ITNs. The majority were willing to use ITNs, on the condition that they are provided by health centres, in order to protect against insect bites, especially for children and when sleeping outdoors. Only a few were unwilling to use ITNs, either because of having few insects in their house or due to concerns about the hazardous effects of insecticides on health.

■ Conclusions and recommendations

The study demonstrated that ITNs could play an important role in controlling ACL in the areas studied. The study found a clear acceptance of this method of prevention when the community were appropriately targeted, while some people had already used ITNs. Therefore, in order to scale up ITN usage, there is a need to increase community awareness about their efficacy and provide the community with the preferred types of ITNs at an affordable price.

Cutaneous leishmaniasis

Vector control

Islamic Republic of Iran

Impact of Olyset long lasting nets on anthroponotic cutaneous leishmaniasis in Islamic Republic of Iran

Islamic Republic of Iran

Isfahan and Fars provinces

Study period:

April 2004–August 2005

Small Grants Scheme

(SGS) 2004 No. 76

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Abstract

A large-scale intervention field trial to control anthroponotic cutaneous leishmaniasis (ACL) by using Olyset long lasting insecticide-treated bednets was carried out in two cities, Sedeh and Shiraz, in the Islamic Republic of Iran. Twelve urban sectors of two cities with ACL were selected. Six sectors were randomly selected into intervention and control areas. A total of 8620 individuals in 3000 households were enrolled in the study. During April–July 2004, a house-to-house survey was conducted to collect census, socioeconomic and baseline epidemiologic data. Olyset nets were distributed to household members of the intervention sectors. Monthly entomological surveys of the vector *Phlebotomus sergenti* were conducted using oily papers and light traps. Epidemiological and entomological surveys were repeated post-intervention.

Results There was a significant reduction in ACL incidence in the intervention areas from 1.6% to 0% in Sedeh and from 3.5% to 0.09% in Shiraz. A difference in reduction was also found between the intervention and control areas (0% and 0.88% in Sedeh, 0.09% and 5.1% in Shiraz, respectively).

Conclusions The study provided strong evidence of the effectiveness of Olyset nets

in the control of ACL in the Islamic Republic of Iran. It is therefore recommended to scale up the use of these bednets in ACL endemic areas and for the control of all other vector-borne diseases.

Background

New foci for anthroponotic cutaneous leishmaniasis (ACL) were recently detected in central Islamic Republic of Iran, such as the city of Sedeh in Isfahan province, where intensive transmission occurs so that many residents will acquire the disease before the age of nine. *Phlebotomus (Paraphlebotomus) sergenti* is the predominant sandfly vector. Insecticide-treated bednets have been successfully used for the control of *Anopheles* mosquitoes and the scaling up of their use by national control programmes has resulted in significant reduction of malaria morbidity and mortality [1]. For sandflies, deltamethrin-impregnated nets provided significant reduction in the biting rates of *Lutzomyia youngi* in Colombia [2], as well as *P. sergenti* and *P. papatasi* in the Syrian Arab Republic [3] and Turkey [4].

However, bednets with finer mesh size may be unpleasant to use in the hot weather; therefore, Olyset nets with wider mesh size (50 holes/inch²) may be preferred by the community in endemic areas. However, there have been some concerns that the wider mesh size, while preventing the passage of anopheline mosquitoes, would allow the passage of the smaller sandflies. Therefore, the effectiveness of these bednets needed to be evaluated.

Materials and methods

The study was carried out during July 2004–July 2005 in two cities, Sedeh and Shiraz, in Isfahan and Fars provinces, respectively. The population in the study area are mainly farmers or work in animal

Conclusions and implications of the study

■ The study provides strong evidence of the effectiveness of Olyset insecticide-treated nets in the control of ACL in Islamic Republic of Iran. It found that the use of Olyset nets provided a protective efficacy of 98%, thereby reducing the risk of ACL infection and subsequently its transmission. It is therefore recommended to scale up the use of these bednets in ACL endemic areas and for the control of all other vector-borne diseases.

■ In Sedeh, the Olyset net use by the population resulted in a 100% reduction in the incidence of ACL in the intervention area compared to a 58% reduction in the control area ($P < 0.05$). Similarly, in Shiraz, the reduction was 97% in the intervention areas, while there was a 6.25% increase in incidence in the control areas.

■ *P. sergenti* is the main vector and *L. tropica* proved to be the main parasite in this new ACL focus.

husbandry. In each city, six urban sectors were selected, and randomly allocated to either intervention or control groups. Overall, 12 sectors of the two cities with a combined population of 8620 inhabitants residing in 3000 houses were included in the study.

Between April and July 2004, two pre-intervention surveys were conducted in the selected sectors, whereby the inhabitants were examined for scars and ulcers. The data collection form asked about sociodemographic characteristics, past history of ACL, the sleeping patterns of families, and according to these patterns, the number of bednets that should be distributed to householders. All primary school students were examined for ulcers or scars. Medical records were reviewed to determine the incidence of ACL during the 9 months preceding the intervention.

The Olyset net is made of knitted polyethylene thread with permethrin 2% w/w incorporated during fibre extrusion. The standard Olyset net weighs ~ 750 g with surface area 14 m² (length 1.80 m, width 1.80 m, height 1.50 m) were distributed to 1500 households in the intervention areas. All the bednets ordered were white and made by Changzhou Jiusi Fibre Product Company, China. To ensure the correct use of the bednets, 59 regular training sessions for families were carried out in the intervention areas. Health education messages were disseminated to ensure the population's compliance in the proper use of bednets, and home visits were made to monitor bednet use, their coverage and community acceptability. Between August 2004 and July 2005, monthly surveys were conducted to identify new ACL cases. Entomological surveys were also conducted during the transmission season for species identification.

■ Main study findings

During the baseline survey, 15 000 persons were interviewed. In Sedeh, the estimated cumulative ACL incidence from October 2003 to July 2004 (the 9 months prior to the intervention) was 1.6% and 1.5%, in the intervention and control sectors, respectively. *Leishmania tropica* proved to be the main parasite and the vector was *P. sergenti*. Following the intervention, 16 ACL cases were diagnosed during the period July 2004–July 2005 in the control area, reporting an incidence of 0.88%, while no single case was detected in the intervention area ($P < 0.05$).

In Shiraz, the estimated cumulative ACL incidence from October 2003 to July 2004 was 3.5% and 4.8% in the intervention and control areas, respectively, with no significant difference between both sectors. Only 2 ACL cases were diagnosed in the intervention areas compared to 101 cases in the control areas during the post-intervention phase (July 2004–July 2005), reporting incidence rates of 0.09% and 5.1%

in the intervention and control areas, respectively. Therefore, the use of Olyset nets provided a significant protection against ACL to the populations at risk (relative risk and 95% confidence interval = 0.02 [0.00–0.07], $P < 0.05$) and its protective efficacy in both cities accounted for 98%.

Between July 2004 and June 2005, 2305 sandflies were collected in Sedeh and 8711 in Shiraz. The following 4 species were found in Sedeh: *P. sergenti* (53.01%), *P. papatasi* (27.8%), *P. caucasicus* (0.82%) and *Sergentomyia sintoni* (18.37%). In Shiraz, the following were collected: *P. sergenti* (51.9%), *P. papatasi* (18.03%), *P. major* (4.17%), *P. wenyoni* (0.3%), *P. alexandri* (1.6%), *P. simici* (0.1%), *S. sintoni* (17.91%), *S. dentata* (2.73%), *S. theodori* (1.63%), *S. pawlowsky* (0.93%) and *S. clydei* (0.7%). There were significant differences in monthly population sizes of *P. sergenti* between control and intervention areas in both cities ($P < 0.05$). There were two peaks, in July and September, in the intervention and control areas, but the largest population size was recorded in August. In both cities, dead sandflies were found in the morning around the Olyset nets during survey team visits to households in the intervention sectors.

■ Conclusions and recommendations

The study reported the effectiveness of permethrin-impregnated Olyset nets in the control of ACL. As bednets with finer mesh size might be unpleasant to use in hot weather, Olyset nets (50 holes/inch²) may be more acceptable to the community and would provide significant protection against the bites of sandflies and thereby reduce the risk of ACL infection in endemic areas.

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Visceral leishmaniasis

Latex agglutination test for the detection of urinary antigens for visceral leishmaniasis in Sudan

Sudan
Gedaref state

Study period:
November 2003–October 2004

Small Grants Scheme (SGS) 2003 No. 176

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Diagnostics

Sudan

Abstract

A study was conducted in Gedaref state, eastern Sudan, to evaluate the diagnostic performance of a latex agglutination test (Katex) for the diagnosis of visceral leishmaniasis (VL). A hospital-based study was carried out for the recruitment of suspected (VL) cases. Urine and serum samples were collected for visceral leishmaniasis and human immunodeficiency virus (HIV) diagnosis, respectively. All parasitologically confirmed cases with positive Katex results were assessed for clinical cure and parasitological cure.

A cross-sectional household survey was also conducted in an endemic village for the recruitment of asymptomatic healthy individuals with a negative past history of VL. Two finger prick blood spots and a urine sample were collected from each subject. The direct agglutination test (DAT) and Katex status of the subjects were determined to obtain baseline information. The subjects

were then followed up for 3-months for the appearance of symptoms and signs of VL using DAT and Katex. Non-VL patients suffering from other infections were recruited at Khartoum hospitals to study any possible cross-reactivity between VL and these infections.

Results Of 131 enrolled suspected VL cases, 41 (31.3%) were parasitologically confirmed. Katex reported a sensitivity of 90.2% and a specificity of 100%, and did not show any cross-reactivity with other endemic infections. Moreover, it was positive in the only HIV co-infected patient. Katex turned negative before the end of treatment and the mean time to Katex negatation was 11.2 days, and remained positive in the single case who was also found to be lymph node-positive when investigated for a test of cure on day 14. It was negative in all healthy subclinically infected individuals who reacted positively with DAT.

Conclusions Katex is a sensitive, specific and rapid test for the diagnosis of VL, and does not turn positive with subclinical infections or cross-react with other infections. Therefore, it is particularly useful for the diagnosis of active disease in endemic areas and for the detection of treatment failure.

Background

A study had been conducted in Gedaref state in 2002 to evaluate the diagnostic performance of latex agglutination test (Katex) for the detection of urinary antigens for visceral leishmaniasis (VL). Compared to microscopy, Katex reported a sensitivity of 95.2% and a specificity of 94.4% in smear-negative cases. Additional studies were therefore needed to investigate the ability of the test to detect asymptomatic pre-patent cases and cross-reactivity with other endemic infections. Other aspects that needed to be studied were the impact of urinary tract infections on the test and the prognostic potentials of the test.

Conclusions and implications of the study

- The study reported a higher Katex sensitivity of 90.2 % compared to earlier reports. This can be explained by the use in the study of fresh rather than stored urine samples and a gold standard of parasitological examination of lymph nodes rather than the less sensitive splenic aspirates. In agreement with previous reports, Katex specificity was 100%. Cross-reactivity with urine samples from confirmed malaria and tuberculosis patients was not observed. This adds to the diagnostic potential of the test in VL endemic areas where both diseases are prevalent.
- Katex turned negative before the end of treatment and the mean time to Katex negatation was 11.2 days. These findings suggest that Katex may be useful in the early detection of treatment failure.
- As anti-leishmanial serological response may not develop in immunocompromised patients with kala-azar, including those with HIV infection, Katex, being an antigen-based detection assay, would be expected to be a useful tool.
- The test cannot detect subclinical infections. This reinforces the diagnostic potential of the test in VL endemic areas where the inhabitants (including VL cases) develop humoral immune responses to *Leishmania donovani* infection, which remain asymptomatic in the majority of cases.

Materials and methods

Hospital-based study in an endemic area

A prospective surveillance study was carried out in the Tabarakallah Centre, Gedaref state, eastern Sudan, for the recruitment of suspected VL cases for parasitological investigation. The personal, epidemiological and clinical details of each parasitologically-confirmed patient were recorded in a standard form, and urine and blood samples were collected for visceral leishmaniasis and human immunodeficiency virus (HIV) diagnosis, respectively.

Screening for HIV was performed on stored and coded sera for the detection of specific antibodies to HIV-1 and HIV-2 using enzyme-linked immunosorbent assay (ELISA) kit and confirmation of the reactive sample was performed using a rapid test and another ELISA. For the test of cure, parasitological examination and Katex testing were performed weekly after initiation of treatment (on days 7, 14, 21 and 28).

All confirmed cases with positive Katex results were assessed for clinical cure (absence of fever, regression of spleen size) and parasitological cure (negative lymph node smear) on day 28. Intramuscular sodium stibogluconate at a dose of 20 mg/kg/day was administered for 30 days. If the test of cure was negative at the end of treatment and the patient recovered clinically then the patient was considered cured.

Studying the ability of the test to detect subclinical infections

A cross-sectional household survey was conducted in Tabarakallah village for the recruitment of asymptomatic healthy control cases (asymptomatic individuals with a negative past history of VL). For the survey, 30 households were randomly selected and their members were interviewed for past history of VL and clinically screened for the disease. Two finger prick blood spots and a urine sample were collected from each subject. The DAT and Katex status of these subjects were determined to obtain baseline information.

This phase was succeeded by a follow-up phase in which asymptomatic individuals, defined as healthy individuals with evidence of subclinical infection (positive DAT), were subjected to a follow-up period of 3 months for the appearance of symptoms and signs of VL. Katex and DAT performance were then compared at the end of the follow-up phase regarding early detection of subclinical infections.

Studying the cross-reactivity of the test in a non-endemic area

Patients with confirmed malaria, pulmonary tuberculosis, typhoid, brucellosis, urinary tract infection and proteinuria, but not suffering from VL, were recruited from hospitals in Khartoum state. Urine samples were collected and tested by Katex.

Main study findings

Of 131 enrolled suspected VL cases, 41 (31.3%) were parasitologically confirmed. Their mean age was 10.0 (+/-8) years and 56.1% were female. Two of these patients presented with relapse, and three had post kala-azar dermal leishmaniasis (PKDL). HIV infection was found in one (2.4%) of the confirmed cases. Of these 41 confirmed cases, 37 were positive by Katex indicating a sensitivity of 90.2% with a positive significant correlation between Katex score and parasite density. Kaplan-Meier analysis showed that 93.3% were Katex negative by day 21, and the mean time to Katex negativation was 11.2 days (median time: 7 days).

For the cross-sectional household survey, 238 asymptomatic healthy individuals without past history of VL were enrolled in the endemic village. Their mean age was 21.9 (19.6) years and 60.1% were female. All were Katex-negative. Therefore, the specificity of the test was 100%. DAT was positive in 6 individuals, reporting a prevalence of 2.5% of subclinical infection among the studied population. Of the 238 healthy control cases, 18 had a DAT more than or equal to 1:800 at recruitment. Of these, 14 were revisited at 3 months. None of them showed any clinical features suggestive of VL and all were Katex-negative. Comparison of DAT titre at baseline and at 3 months among these 14 subjects showed that the titre decreased over time in most of the samples, but a few showed an increasing titre and some were stable.

Katex was found to be negative in patients with confirmed pulmonary tuberculosis (35 cases), malaria (35 cases), enteric fever (25 cases) and urinary schistosomiasis (10 cases), as well as in patients with proteinuria (15 cases) and urinary tract infection (15 cases).

Conclusions and recommendations

Katex is a sensitive, specific and rapid test for the diagnosis of VL. It does not cross-react with other infections and is unable to detect subclinical infections. Consequently, it is particularly useful for the diagnosis of active disease and for the detection of treatment failure. It is therefore recommended to be included in the routine diagnosis and follow-up of the disease in endemic areas, especially in remote areas with limited laboratory facilities.

Visceral leishmaniasis

Field evaluation of Glycerol-Preserved Direct Agglutination Test for visceral leishmaniasis diagnosis, Gedarif State, eastern Sudan

Sudan

Gedarif state, eastern Sudan

Study period:

February 2004–January 2006

Small Grants Scheme

(SGS) 2004 No. 136

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Diagnostics

Sudan

Abstract

The direct agglutination test (DAT) based on glycerol-preserved (GP) *Leishmania donovani* antigen was evaluated for the serodiagnosis of visceral leishmaniasis (VL) in a rural setting in eastern Sudan. The diagnostic performance as well as the reproducibility of GP-DAT was compared with standard liquid antigen (LQ) and freeze-dried antigen (FD) by testing serum samples of 308 VL suspects.

Results In the field, GP-DAT showed a sensitivity of 86.7% and a specificity of 92.1%, compared to 88.5% and 91.1%, respectively, in the central laboratory. It showed an excellent agreement with FD-DAT and LQ-DAT in the field as well as in the central laboratory. In addition, it was highly reproducible (κ weight = 0.957).

Conclusions GP-DAT antigen proved to be a valid and stable diagnostic test for VL in remote rural conditions. Its local production will contribute to VL control.

Background

The direct agglutination test (DAT) is the main diagnostic test for visceral leishmaniasis (VL) in Sudan. It has been

reported that the control of VL in Sudan can be effectively achieved through local production of DAT [1]. Relative large-scale production of DAT antigen has been achieved locally in Sudan by Ahfad Biomedical Research Laboratory. The sensitivity and specificity of the local antigen is comparable to the reference antigen.

However, the high ambient temperatures and lack of reliable cold chain facilities in most of the VL-endemic areas have limited the application of the test to central and district laboratories. Several improvements have been introduced to DAT antigen processing in order to maintain stability under rural conditions. A freeze-dried (FD) antigen was field evaluated and found to be adequately stable for considerable periods at temperature levels up to 45°C.

A feasible preservation method different from technically-demanding freeze-drying has been recommended. By incorporating glycerol as a thermo-protectant, a simple and economical method was successfully developed by the research group at ABRL for maintenance of DAT antigen stability at extreme tropical temperatures. Performance of the locally produced glycerol-preserved antigen was assessed by comparison with the standard formaldehyde-fixed and the freeze-dried antigen in DAT. Glycerol-preserved (GP) antigen was found to retain the desired sensitivity and specificity for VL detection [2]. As the test showed adequate performance under ideal laboratory conditions, a study was carried out to evaluate its performance under field conditions.

Materials and methods

Lymph node aspirates for parasitology and a 5 ml venous blood sample for serological tests were collected from VL suspected patients presenting at Doka

Conclusions and implications of the study

■ GP-DAT antigen is a sensitive, specific and stable test for VL diagnosis under field conditions. Furthermore, its low cost (around US\$ 0.5 per test) compared with the high cost of the FD-DAT antigen (around US\$ 4.5 per test), and the ease of its performance without the need for sophisticated equipment make it ideal for diagnosis of VL under field conditions. Local production of GP-DAT is therefore recommended in order to ensure availability of the test for early diagnosis and control of VL.

■ The study showed that GP-DAT could be a better alternative to FD-DAT for VL diagnosis under field conditions. Unlike FD-DAT, it does not need sophisticated equipment, continuous electrical supply and high level of skills.

■ GP-DAT identified one parasitologically-confirmed case co-infected with HIV that was false negative with FD-DAT. This suggests an added value for diagnosis of leishmaniasis-HIV co-infected cases in endemic areas.

rural hospital. Sera were separated for duplicate testing in the field and at Ahfad Biomedical Research Laboratory in Khartoum using GP-DAT, liquid antigen (LQ) DAT and FD-DAT. For this purpose, sera were separated in a cryogenic vial and frozen until transportation to the laboratory. Transport was organized at regular intervals with an appropriate cold chain. VL patients were diagnosed based on detection of *Leishmania* parasites in their lymph node aspirates and/or clinical presentation with positive liquid DAT results.

GP and LQ-DAT antigen production Continuous maintenance of the laboratory-adapted *Leishmania* strain (1-S) proved manageable, employing liver infusion tryptose (LIT)-Haemin instead of the classical NNN-medium. Mass cultures were prepared and kept in an air-conditioned space with minor electric failure (temperature: ± 25 °C) for 6–8 days. These yielded $4\text{--}5 \times 10^7$ promastigotes per ml culture medium. Promastigotes harvested from LIT mass cultures were processed for DAT antigen. The net antigen volume obtained from 1 litre LIT was 900 ml. Antigen processing was performed according to El Harith procedure [3]. Two separate DAT antigen batches were prepared and their respective stock suspensions were preserved in glycerol. A total of 110 vials (5 ml) of FD-DAT antigen (Lot NR 1001) were imported from the Royal Tropical Institute, Amsterdam, the Netherlands. The antigen was continuously kept at ambient laboratory temperature (25–37 °C).

Antigen stock suspensions of the glycerol-preserved or the standard (liquid) were reconstituted. DAT preparation with the glycerol-preserved or freeze-dried antigen was according to the standard procedures using 2-mercaptoethanol for end-point titration. After addition of the respective antigens and incubation for 18 hours at room temperature (30–40 °C), the DAT was read by at least two observers taking 1:3200 serum dilution as a cut-off. Titres were expressed as the number of the highest dilution still showing agglutination.

■ Main study findings

Of 308 enrolled VL suspects, 105 (34.1%) were confirmed cases (with positive microscopy) and 203 (65.6%) were non-VL cases (negative microscopy). Fourteen (6%) of these were found positive by LQ-DAT. GP-DAT showed a sensitivity of 86.7% and a specificity of 92.1% under field conditions compared to 88.5% and 91.1%, respectively, under central laboratory conditions. It also showed an excellent agreement with FD-DAT and LQ-DAT in the field as well as in the central laboratory.

The receiver-operating characteristic (ROC) analysis showed that the cut-off titre that optimizes both sensitivity and specificity is $\geq 1:800$ for GP-DAT in the field, with a sensitivity of 92.4% and specificity

of 90.6%. There was no significant difference between GP-DAT and FD-DAT regarding the mean titres in the field or in the central laboratory, while there was a significant difference between GP-DAT and LQ-DAT under both conditions. GP-DAT proved to be highly reproducible where pairwise comparisons with different tests under field or central laboratory conditions showed excellent agreement (kappa weight = 0.957).

■ Conclusions and recommendations

GP-DAT antigen is a sensitive, specific and stable test with high diagnostic accuracy. The low cost of GP-DAT compared with the high cost of FD-DAT contributes to the affordability of the test. In addition, it does not require any sophisticated equipment or continuous electrical supply. Local production in relatively large batches is therefore recommended in order to ensure its availability as a diagnostic test for effective VL control.

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Lymphatic filariasis

Evaluation of the deworming effect of annual mass drug administration of a combination of albendazole and ivermectin for lymphatic filariasis in Wadi Zabid area, Yemen

Yemen
Wadi Zabid area,
Hodeidah governorate

Study period:
September
2003–October 2004

Small Grants Scheme (SGS) 2003 No. 38

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Control

Yemen

Abstract

To evaluate the deworming effect of mass drug administration (MDA) by the lymphatic filariasis (LF) elimination programme, a cross-sectional survey was conducted in 9 poor rural villages of Wadi Zabid area, Hodeidah governorate. Stool examination of samples from 1011 household members aged 5-years and older was done to determine the baseline prevalence of nematode infection. The study participants were then administered a single dose of albendazole and ivermectin within the framework of the LF elimination programme. A follow-up examination and an interview using a structured questionnaire were performed 20 days later, and another stool examination was performed 6 months after treatment.

Results *Ascaris lumbricoides* prevalence was significantly reduced from 62.5% to 2.8% and 13.2% at 20 days and 6 months, respectively. *Trichuris trichiura* and *Enterobius vermicularis* infections were significantly reduced at 20 days but not at 6 months follow-

up. There was a non-significant reduction in the prevalence of *Strongyloides stercoralis*, *Ancylostoma duodenale* and *Hymenolepis nana* at 20 days but not at 6 months follow-up. However, MDA was not efficacious against *Schistosoma mansoni* infection.

Conclusions These results suggest that a single dose combination of albendazole and ivermectin as annual mass treatment for LF could be also adopted as the main strategy for the control of intestinal nematode infection in endemic areas.

Background

The lymphatic filariasis (LF) control programme in Yemen conducts elimination activities through annual mass drug administration (MDA) of the recommended microfilaricidal regimens of single dose albendazole (400 mg) plus ivermectin (200 ug/kg). This combination is recommended for countries where *Onchocerca volvulus* is co-endemic with Bancroftian filariasis. MDA should be continued for a minimum of 4–6 years. This combination has also been found to be effective for the control of intestinal parasitic diseases. A study was therefore done to evaluate the deworming effect of MDA with a combination of albendazole and ivermectin (Mectizan).

Materials and methods

In the Wadi Zabid area, agriculture is the predominant occupation, most houses are constructed of mud, wood, stone and straw, and there is no proper sanitation. A total of 1011 household members aged 5 years and older, residing in 9 endemic villages in Wadi Zabid, were randomly selected. Stool samples were collected from eligible subjects who were also given a single oral dose of albendazole 400 mg (Glaxo Smith Kline) and ivermectin (Mectizan, Merck Sharp and Dohme). Stool samples were examined using formal-ethyl-acetate concentration methods.

Conclusions and implications of the study

■ The study reported a high prevalence of intestinal helminth infection among 66.5% of the community in Wadi Zabid area. The most prevalent helminths were *A. lumbricoides* followed by *T. trichiura*.

■ Mass drug administration for LF is also effective in the control of geohelminths and ectoparasites in the community: 70.9% of the participants noticed worm expulsion within 2 days of treatment and infested individuals experienced a reduction in symptoms. These beneficial effects would increase the community participation in the MDA rounds and hence a good coverage can be achieved.

■ Children aged between 5 and 14 years recorded the heaviest infection rates and are the most likely to benefit from treatment. Regular treatment has been found to reduce the parasitic load to a low level so that helminth-associated morbidity may disappear completely.

■ In the absence of a national control programme for geohelminth, there will be no major reduction in their burden in endemic poor communities. Therefore, MDA for LF elimination is the most promising strategy for the control of geohelminth infections applicable in these areas.

The first follow-up visit was conducted 20 days later, when stool samples were collected and examined, and subjects were interviewed according to a questionnaire that recorded the following information: sociodemographic characteristics, level of sanitation, symptoms and signs of intestinal infestation or ectoparasites, and improvement following MDA. Stool samples were further collected and examined 6 months later using the same methodology.

■ Main study findings

The mean age of the study subjects was 25.9 years and the majority were female (60.7%). The prevalence rates of intestinal helminths were: *Ascaris lumbricoides* (62.5%), *Trichuris trichiura* (16.8%), *Enterobius vermicularis* (1.2%), *Strongyloides stercoralis* (0.5%), *Hymenolepis nana* (0.9%), *Ancylostoma duodenale* (0.2%) and *Schistosoma mansoni* (0.2%). The intensity of infections was categorized as light intensity according to WHO classification (less than 5000 eggs per gram). The prevalence of ascariasis was significantly higher in children compared to adults, while trichuriasis was significantly higher among the 15–29 years age group; 66.5% of all individuals reported mixed infections. There was no significant difference between males and females regarding ascariasis infection (63.3% and 61.2%, respectively). The majority of the study population had no latrines, as was the case with all those infected with *E. vermicularis*, *S. stercoralis*, *H. nana*, *A. duodenale* and *S. mansoni*.

However, there was no significant association between the sanitary system used, whether old latrine, open pipes, septic tank or “in the wadi (valley)” and the prevalence of parasitic infection. Similarly, no significant association was reported between sociodemographic variables, such as occupation or socioeconomic status, and parasitic infection. The association of parasitic infection with the source of drinking water, being running water from the valley for 98% of households, with only 0.2% of households using soap in washing vegetables, was not studied, but is likely to be the main cause of the high prevalence of intestinal helminth infection in Wadi Zabid.

In the first follow-up, 20 days after treatment, the prevalence of ascariasis infection was significantly reduced to 2.8%, trichuriasis to 4.6% and enterobiasis to 0.2%. The prevalence of other intestinal parasites was reduced though this was not statistically significant. The majority (70.9%) of the study population recognized the benefits of expulsion of worms after treatment, and 69% had seen the *Ascaris* worms in their stool, 2–5 days after treatment. Three-quarters of the study population recognized the benefits of treatment, including improvement or

disappearance of abdominal pain, distension, anal itching, nausea and vomiting, and improvement of appetite. The diagnostic performance of the questionnaire in comparison to the gold standard formal-ethyl-acetate test was: sensitivity (79%), specificity (46%), positive predictive value (71%) and negative predictive value (56%).

In the second follow-up, 6 months later, the prevalence rate of ascariasis was still significantly reduced and that of trichuriasis was slightly lower than the baseline survey but higher than the first follow-up. However, the prevalence of the other worms, low throughout the study (< 1%), was maintained around the baseline prevalence rates.

The prevalence of pediculosis and scabies decreased significantly at first follow-up. Household members who reported ectoparasites in their houses (1.4%) noticed a remarkable decrease after treatment. Ninety (10%) patients reported symptoms of *sowda* (onchocerciasis): localized itching in the lower part of the leg. Of these, 96% had improved at first follow-up visit. The swelling was initially thought to be the adverse effect of treatment as reported by affected subjects.

■ Conclusions and recommendations

The combination of albendazole and ivermectin is efficacious in the control of geohelminths, especially *A. lumbricoides*, *S. stercoralis* and hookworms, in addition to the control of onchocerciasis and ectoparasites. These beneficial effects should enhance the participation and compliance of the community during the MDA for the elimination of LF.

Lymphatic filariasis

Epidemiology

Egypt

Xenomonitoring of the National Programme for Elimination of Lymphatic Filariasis in an endemic village in the Nile Delta of Egypt

Egypt

Menoufia governorate

Study period:

December 2003–2004

Small Grants Scheme

(SGS) 2003 No. 6

Principal Investigator

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Abstract

Egypt is among more than 34 countries that have joined WHO global efforts to eliminate lymphatic filariasis (LF). Sensitive and rapid methods are needed for monitoring the success of the intervention programmes. A study was therefore made in Egypt to determine whether assessment of vector infection rates could be a useful means for xenomonitoring elimination activities in an endemic village after three cycles of mass drug administration (MDA). The study also sought to evaluate the combination of Ssp1-PCR assay and PoolScreen2 algorithm as an epidemiological tool for xenomonitoring the success of elimination programmes. Human and vector data were collected after the first cycle of MDA as a baseline and again eight months after the third cycle of MDA for comparison.

Results The three cycles of MDA resulted in 96.2% reduction in the mosquito infection

rate, considerably higher than the observed reduction (71.6%) in human microfilaraemia. The PoolScreen2 algorithm estimated a mosquito infection rate of 8.1% after MDA-1 and 0.26% after MDA-3.

Conclusions The mosquito Ssp1-PCR approach is a reliable epidemiological tool for xenomonitoring LF elimination programmes.

Background

Egypt was one of the first countries to join WHO global efforts by initiating a national lymphatic filariasis (LF) elimination programme. In September 2000, the Ministry of Health and Population implemented the first round of mass drug administration (MDA) of a combined oral dose of diethylcarbamazine (DEC, 6 mg/kg) with albendazole (Alb, 400 mg) to eligible residents of endemic villages. The strategy followed by the Ministry comprises three to four additional annual doses. In September 2002, workers of the Ministry mass administered the third dose of DEC/Alb.

As the elimination programme progresses, the parasitic load in treated populations is expected to decrease to a level at which transmission will be interrupted, since few microfilariae would be available for ingestion by mosquitoes. Consequently, extremely sensitive and rapid methods for detection of the parasite are needed for monitoring the success of the intervention programme. The polymerase chain reaction (PCR) approach for identifying infected mosquitoes in endemic areas under MDA is non-invasive and has the particular advantage of a real time assessment of active transmission.

Combining data from the Ssp1-PCR assay based on a new simple and rapid DNA detection method (test strip) and PoolScreen2 algorithm [1] is a prospective simple and practical means to measure filaria infection rates in vector mosquitoes.

Conclusions and implications of the study

- The mosquito Ssp1-PCR approach is a reliable epidemiological tool for xenomonitoring LF elimination programmes. The study also validated the test strip DNA detection method as a sensitive, simple and rapid tool to document the Ssp1-PCR assay product and to detect *W. bancrofti* in pools of wild-caught mosquitoes.
- Collection of indoor resting mosquitoes as done in this study is labour-intensive and costly. Additional studies are needed to evaluate the efficacy of other mosquito collection methods, such as CDC-light traps or ovitraps, to capture larger numbers of potential vectors for xenomonitoring of elimination programmes.
- *Cx. pipiens* females are endophagic and endophilic but unless they find a suitable indoor site for oviposition, they often move from one house to another. Mosquitoes infected with *W. bancrofti* collected from non-infected houses could have ingested blood earlier from an infected house. Therefore, mosquito infection rates are more likely to represent the entire village rather than the sampled houses.
- The cost of the Ssp1-PCR test strip is relatively higher than the conventional Ssp1-PCR-EtBr assay (US\$ 2.15 per pool and US\$ 1.4 per sample, respectively). However, the cost of the conventional method is escalated by the required electrophoresis apparatus with photodocumentation system facilities.

A study was therefore carried out to evaluate the usefulness of this tool for xenomonitoring the success of elimination programmes. It also aimed to determine the filarial infection rate of *Culex pipiens* in an endemic village where the third cycle of MDA (MDA-3) has been implemented and compare it to baseline data after the first MDA (MDA-1).

Materials and methods

A cross-sectional survey was carried out in a LF endemic village in Menoufia governorate in which finger prick blood samples were collected eight months after the third round of MDA (MDA-3). Thick blood smears (50 μ l) were prepared from each blood sample, Giemsa stained and microscopically examined for the presence and number of microfilariae. Mosquitoes resting in bedrooms of selected houses were collected at night on a weekly basis for one month period using mechanical aspirators. Mosquitoes identified as *Cx. pipiens* were pooled by house and stored at -70°C in pools of 5–25 females until assayed for the detection of *Wuchereria bancrofti*. DNA was purified from individual mosquito pools and the Ssp1-PCR assay was carried out according to the method described by Ramzy et al. [2]. The biotinylated PCR product was hybridized with 5' digoxigenin-labelled Ssp1-specific DNA probe (5'GGTTATACCAAGCAAAC3'). The PoolScreen2 algorithm was used to estimate the maximum likelihood of *W. bancrofti* infection at a 95% confidence level in wild-caught *Cx. pipiens*

Main study findings

A total of 516 subjects (257 females and 259 males), from 69 houses, were tested for microfilaraemia by thick smears following MDA-3. Fourteen subjects residing in 13 houses were microfilaraemic, reporting a prevalence of 2.7%, which was significantly lower than the prevalence following MDA-1 (9.5%), a 71.5% reduction. A total of 2115 indoor-resting female *Cx. pipiens* were collected after MDA-3 from the same 69 houses screened for human microfilaraemia. Of these, 1563 females were fed, gravid or half gravid and pooled by house in 93 pools, then subjected to the Ssp1-PCR assay. The amplified DNA product was detected by agarose gel electrophoresis stained with ethidium bromide (EtBr), and by the test strips. Of the 69 examined houses after MDA-3, four (5.8%) houses were recognized to contain infected mosquitoes by both the EtBr and test strip DNA detection methods.

A total of 13 houses had one or more microfilaraemic subjects. Of these, 11 houses were screened for infected vectors by PCR. While three of the four "positive houses" by PCR had at least one microfilaraemic resident, eight houses with microfilaraemic residents did not harbour infected

mosquitoes. Although only four positive mosquito pools were identified by the agarose gel electrophoresis and EtBr staining method, they were also recognized by the test strip DNA detection method. The mean mosquito density per tested house was significantly higher after MDA-3 (22.6 ± 8.8) than after MDA-1 (7.6 ± 5.2) ($P < 0.001$). Mosquito density did not vary between "infected" and "uninfected" houses ($P = 0.2$).

Impact of MDA on mosquito infection with *W. bancrofti* Assuming that a PCR-positive pool contained at least one infected female, there was a 96.2% reduction in the minimum mosquito infection rate (from 6.85% to 0.26% after MDA-1 and MDA-3, respectively). The PoolScreen 2 algorithm estimated a mosquito infection rate of 8.1% after MDA-1 and 0.26% after MDA-3.

Conclusions and recommendations

The mosquito Ssp1-PCR approach is a useful epidemiological tool for xenomonitoring LF elimination programmes. It has the advantages of being non-invasive and sensitive in monitoring the reduction or interruption of disease transmission.

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Malaria

Control

Pakistan

Passive case detection strengthening as the main strategy for case detection, treatment and control of malaria in Pakistan

Pakistan

Punjab province

Study period:

October 2003–December 2004

Small Grants Scheme

(SGS) 2003 No. 112

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Abstract

A study was carried out to evaluate whether passive case detection (PCD) is suitable as the main strategy for case detection, treatment and control of malaria in accordance with the Roll Back Malaria (RBM) strategy. A quasi-experimental study was conducted in a district of Punjab province where the RBM strategy is being implemented. All health facilities in the sub-district were strengthened to become PCD posts and active case detection (ACD) was withdrawn. Results were compared before and after the intervention.

Results Implementing the revised strategy resulted in a significant increase in the slide positivity rate and the cumulative incidence of confirmed malaria. On the other hand, there was a significant reduction in the number of malaria cases that were given radical treatment. The time intervals between slide preparation and examination, and between

slide preparation and treatment, were both significantly reduced after the intervention.

Conclusions The study provided additional evidence of the effectiveness of the revised RBM strategy of strengthening PCD and withdrawing ACD in achieving malaria control.

Background

Since the start of the eradication era, the malaria control programme has relied mainly on active case detection (ACD) for finding malaria cases. Reports have shown the ineffectiveness of this approach for achieving the strategy of early detection and prompt treatment suggested by the Roll Back Malaria (RBM) initiative, and have recommended that passive case detection should be adopted as the sole means of finding malaria cases. However, no strong evidence has been provided by RBM for changing from the previous emphasis on ACD to the new approach. As a result, there has been no progress in the adoption of this new approach. This study was therefore initiated to test the effectiveness of the new approach, and to identify any problems with implementation before wider introduction.

Materials and methods

A quasi-experimental study was carried out in a district randomly selected from the five districts where the RBM strategy has been implemented in Punjab province. All health facilities of a randomly selected *tehsil* in that district were included in the study. An initial baseline survey was conducted in the *tehsil* health facilities using a structured questionnaire to assess different parameters including staff, supplies and workload for the previous nine months.

The malaria field workers (Communicable Disease Control supervisors) routinely prepared a monthly tour programme of their area to collect

Conclusions and implications of the study

■ The objective of early detection and prompt treatment can be achieved through the implementation of the revised strategy. The number of cases coming to health facilities, the number of slides prepared and the proportion of cases detected through microscopy, were all improved. The time-lag between slide preparation and examination, and between slide preparation and treatment, also substantially decreased.

■ The intervention was instrumental in achieving the rational use of drugs, cost-effective use of resources (shifting resources from drugs to diagnostics) and a reduction in drug resistance.

■ Before the intervention, radical treatment was administered to 158 patients that were recorded as cases although only 9 were confirmed cases. This reflects a lack of confidence in microscopic diagnosis possibly due to the lack of proficiency of the microscopists or to improperly equipped laboratories. The situation was completely reversed after training of laboratory staff and provision of necessary equipment, with only confirmed cases being administered radical treatment.

■ The data collection instruments developed for the project are of great importance and will act as a basis for revision of the malaria control programme's management information system.

■ The availability of equipment is essential for the successful implementation of this revised strategy.

blood samples from cases suffering from pyrexia of unknown origin (PUO) for examination and to administer presumptive treatment (ACD). Instead of collecting blood slides during their field work, the field workers were asked to follow their original tour programme to identify probable malaria cases and to refer them to the nearest passive case detection (PCD) post (all health facilities including basic health units and rural health centres) for preparation of slides and provision of treatment. They were asked to fill a new form and were requested to follow up referred cases at the PCD post and the declared positive cases in the community for completion of treatment.

Slides of referred and non-referred cases were prepared at the PCD posts, where another form was filled and the slides were then sent to the microscopy centres where part two of this second form was filled and the results were sent back to the PCD posts. A full course of anti-malarial drugs was administered to confirmed cases, and quality control was applied by re-examining all positive and 10% of the negative slides in the district reference laboratory. The impact of strengthening PCD and withdrawing ACD on malaria control parameters was then assessed in the 9 months following the intervention.

■ Main study findings

Of the 28 health facilities serving a population of 563 069, 24 basic health units act as PCD posts, while 4 facilities (1 *tehsil* hospital and 3 rural health centres) provide microscopy facilities. At baseline, several posts were found vacant and supplies and equipment were deficient in the health facilities. These posts were filled and the facilities were equipped in order to strengthen the PCD posts.

At baseline, 9860 malaria slides were prepared out of the 17 751 reported cases of PUO; only 9 of these were declared positive, reporting a slide positivity rate of 0.09%. In the post-intervention phase, 22 712 PUO cases visited the health facilities and 19 848 slides were prepared, 47 being declared positive (0.24%). These differences were statistically significant ($P < 0.01$). No significant difference was found in the positivity rate in malaria due to *Plasmodium falciparum*, but it was found to be significantly higher after the intervention malaria cases due to *P. vivax*.

Provision of malaria treatment before and after the intervention was also compared. It was noted that in the pre-intervention period, 17 537 PUO cases received presumptive treatment while 158 received radical treatment. In the post-intervention phase, presumptive and radical treatment was provided to 19 484 and 47 cases, respectively. The difference was statistically significant ($P < 0.01$).

The cumulative incidence of malaria also increased from 2.13/100 000/year, to 11.1/100 000/year, before and after intervention, respectively ($P < 0.05$). The

rise in cumulative incidence can be attributed to better diagnostic capabilities due to training and improved supplies.

In addition, the time-lag between slide preparation and examination was significantly reduced following the intervention; only 13% of slides were examined within 3 days, with a mean of 7.9 (1.2) days. After the intervention, the majority of slides (85%) were examined within 1–3 days, with a mean of 2.5 (0.5). Similarly, there was a significant reduction in the time that elapsed between slide preparation and treatment initiation. Within the revised strategy, 60% of cases received treatment within 3 days and the remaining within 4–7 days, although baseline data were not available.

■ Conclusions and recommendations

The target of early detection and prompt treatment of malaria cases can be achieved through the revised RBM strategy. The number of cases coming to health facilities, the number of slides prepared and the proportion of cases detected through microscopy were all improved. The time-lags between slide preparation and examination, and between slide examination and treatment, were also substantially decreased.

Malaria

Community participation

Sudan

Role of school teachers in detection of malaria among schoolchildren, in East Nile province

Sudan
East Nile province

Study period:
January–November 2004

Small Grants Scheme (SGS) 2003 No. 101

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Abstract

An experimental study was conducted in East Nile province to involve primary school teachers in the detection of malaria among schoolchildren. Ten schools were randomly allocated into an experimental or control group. Three focus group discussions with school teachers were held at one school and based on this a training manual was developed. Teachers in the experimental schools were trained to use the manual for detection of malaria. A clinical algorithm (headache, muscle/joint pains, feeling feverish) and an oral temperature of 37.5 °C or higher was used for the diagnosis of malaria by the teachers. A questionnaire was developed for data collection by the teachers and laboratory technicians. For the control group, data were collected on the incidence of malaria and school absenteeism from local health centres and schools, respectively.

Results Of 1242 schoolchildren referred by the school teachers in the experimental group schools to the local health centres during the transmission season, 560 (45.1%) were identified by teachers as having malaria. Of these, 369 (65.9%) had positive blood films.

Blood films done for all referred cases revealed that 424 (34.1%) were positive for the malaria parasite. The sensitivity and specificity of the teachers in detection of malaria were 87.03% and 76.65%, respectively. The positive and negative predictive values were 65.89% and 91.94%, respectively.

Conclusions With little training, school teachers can make a presumptive diagnosis of malaria if supported by health and educational authorities.

Background

Accurate diagnosis of malaria is essential to ensure that affected individuals receive appropriate treatment and that antimalarial drugs are not wasted on treatment of patients with other conditions. This is overcome by using of clinical algorithms, as used in Gambia and the United Republic of Tanzania for diagnosis of malaria in children using clinical skills alone. These studies reported sensitivities of 86% and 99%, and specificities of 61% and 52 %, respectively [1, 2].

Teachers are often key influential members of the community and can therefore promote community participation in school health programmes. They can deliver information to schoolchildren easily and are able to detect health problems early if they are taught the symptoms and signs of the disease. A study was therefore undertaken on the involvement of primary school teachers in East Nile province in the detection of malaria among the schoolchildren using clinical algorithms.

Materials and methods

An experimental study was conducted in primary schools in East Nile province. Of 55 primary schools, 10 were randomly allocated to either the experimental or control group, with 5 schools in each group. The control group schools were

Conclusions and implications of the study

■ Involvement of school teachers in early detection of malaria cases was beneficial in timely treatment of malaria cases, which reduced malaria morbidity among schoolchildren. None of the children in the schools in the experimental group progressed to severe malaria compared to 1.8% of malaria cases diagnosed in the control group schools. Implementing the findings of this study at a wider scale is therefore recommended in order to reduce malaria morbidity and mortality in the country.

■ Training school teachers on early detection of malaria cases enables them to detect 66% of confirmed malaria cases. Therefore, health authorities should provide regular training and supervision for school teachers in order to involve them in early detection of malaria and other communicable diseases.

■ Involving school teachers in ensuring treatment compliance will reduce the emergence of resistance to the antimalarial drugs currently used (artemisinin-based combination therapy) and will reduce the period that patients are infective to mosquitoes, hence achieving malaria control.

at a considerable distance from the experimental group area to allow proper assessment of the impact of the intervention. Three health centres were selected according to their proximity to the schoolchildren in the experimental group schools. Two laboratory technicians were available at each health centre during the day. Supplies and equipment were provided to the participating health centres and their laboratories, which delivered their services free of charge.

Three focus group discussions were conducted, each group consisting of 8 teachers, from different schools. The topics discussed were: the expected prevalence of malaria among schoolchildren, the cause of high prevalence of malaria, how malaria is transmitted; how to detect a case; role of the school teachers in detection and prevention of malaria and how schoolchildren are referred to the health unit. A manual for training the teachers on detection of malaria among schoolchildren was developed based on the focus group results. This included information about malaria in general, its life cycle, the signs and symptoms associated with malaria, and the diagnosis, treatment and prevention of malaria.

Based on this manual, 21 school teachers were trained on the clinical detection of malaria. Teachers were trained to look for the symptoms associated with malaria (headache, muscle/joint pain and feeling feverish), to measure oral temperature using a digital thermometer, to palpate the abdomen to detect an enlarged spleen and to fill a special referral form (questionnaire) for the sick child by checking the symptoms and signs. The case definition of malaria was the presence of one of the following: headache, muscle/joint pain and feeling feverish with an oral temperature of 37.5 °C or more. Finally the teacher would make a presumptive clinical diagnosis as to whether each was a malaria case or not, and refer the child to the nearby health centre where the rest of the questionnaire would be filled by a laboratory technician and a medical assistant. Blood films for malaria were prepared for all referred children.

To ensure compliance with treatment, the teacher would follow up the sick children, and report if they had improved or not. The children would be sent back to the health centre if they had not improved within 48 hours after receiving treatment. For the control group, data were collected for the incidence of complicated malaria and school absenteeism from the nearby health centre and school, respectively. Standard doses of chloroquine were administered for treatment.

■ Main study findings

Of the 1242 schoolchildren referred by the school teachers to the nearby health centres for any health problem, 71% were aged 10–14 years, and 61%

were male. Microscopic examination of blood revealed an incidence of malaria episodes of 34% among the referred schoolchildren. The most common symptoms were fever (71.3%), headache (78.5%), muscle pain (53.1%), joint pain (53.2%) and other complaints (cough, eye infection, ear pain, etc.). Seventy percent of schoolchildren were referred within the first two days of their illnesses. Of the 885 (71.3%) who complained of fever, 595 (47.9%) recorded a temperature of 37.5 °C or more as recorded by their teachers, while 348 (39.3%) had fever alone and positive blood films.

There were 560 (45%) suspected malaria cases reported by the teachers. Of these, 369 (65.9%) were laboratory confirmed. No severe malaria cases or deaths were reported. The sensitivity and specificity of the teachers in detection of malaria were 87.03% and 76.65%, respectively. The positive and negative predictive values were 65.89% and 91.94%, respectively. The sensitivity and specificity of feeling feverish in relation to the oral temperature of the primary schoolchildren as recorded by the teachers were 80.17% and 36.94%, respectively. The positive and negative predictive values were 53.9% and 66.95%, respectively.

In the control area, 1753 schoolchildren were referred by teachers to the health centres as routinely practiced. Of these, 454 (25.9%) had positive blood films for malaria, while 8 (1.8% of confirmed cases) had severe malaria. Loss of days from the school due to malaria was 2–4 days per child per malaria episode. There were no reported deaths due to malaria.

■ Conclusions and recommendations

Malaria is the leading health problem in schools, and it is therefore important to involve schoolchildren in the early detection and management of malaria. Teachers can play a major role in school health programmes and are willing to be involved as long as that they are supported by health and educational authorities and provided with regular training and supervision.

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Malaria

Drug studies

Yemen

Validation of molecular markers in evaluating chloroquine efficacy for uncomplicated falciparum malaria in Yemen

Yemen

Al Musaimeer district,
Lahej governorate

Study period:

September
2003–December 2004

Small Grants Scheme (SGS) 2003 No. 7

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Abstract

An in vivo 14-day sensitivity test was carried out in a sentinel site in Lahej governorate in Yemen to establish a practical system for monitoring the therapeutic efficacy of antimalarial drugs in the country. A nested polymerase chain reaction (PCR) and restriction enzyme digestion were also performed to validate the use of molecular markers of chloroquine resistance. Mutation in dhfr and dhps against sulfadoxine-pyrimethamine (SP) was then studied using the same collected samples.

Results A high rate of chloroquine treatment failure was reported (60.7%). Age less than 10 years was found to be a significant predictor of chloroquine treatment failure in the area. The prevalence of pfcr T76 mutation was very high (98.2%) and cannot be used as a reliable marker for clinical chloroquine failure. However, the genotype failure index (the ratio of resistant genotype to chloroquine therapeutic failure) is a more reliable predictor of in vivo treatment failure. Pfdhr-59, a molecular marker for SP resistance, was identified in 5% of the analyzed samples.

Conclusions Chloroquine is no longer acceptable as the first line treatment in Yemen, while SP in combination with another antimalarial drug cannot be used as first line treatment either. The country's malaria treatment policy should be urgently reviewed.

Background

Malaria is the main public health problem in Yemen. It is estimated that 60% of the population are at risk of malaria, with an estimate of three million cases per year and a mortality rate of 1% of cases annually, mainly among children and pregnant women. Early, correct diagnosis and prompt, proper treatment are essential for any malaria control programme. However, the effectiveness of treatment for falciparum malaria, and of efforts to prevent it, is hampered by the development of drug-resistant strains of *Plasmodium falciparum*. According to the national antimalarial drug policy, chloroquine is the first line drug for acute uncomplicated falciparum malaria, while sulfadoxine-pyrimethamine (SP) is the second line and mefloquine, the third line.

A study was therefore carried out to establish a practical and sustainable system for continuous monitoring of the therapeutic efficacy of antimalarial drugs in Yemen. It also sought to assess the performance of molecular markers for mutations in pfcr in identifying chloroquine resistance, and to identify the predictors of treatment failure.

Materials and methods

A sentinel site for monitoring antimalarial drug resistance was established in a rural hospital in Al Musaimeer district, Lahej governorate; 124 eligible and consenting subjects were enrolled. Their axillary temperature was recorded, and thick and thin blood films were taken for each patient. Blood was also collected by finger prick on filter paper, before treatment and during follow-up, and stored for subsequent molecular analysis.

The standard 14-day in vivo WHO protocol for the assessment of the therapeutic efficacy of antimalarial drugs

Conclusions and implications of the study

- Chloroquine is no longer acceptable as first line treatment in Yemen. SP in combination with another antimalarial drug is also inappropriate due to the dhfr triple mutation that exists in 5% of cases.
- Children less than 10 years are eight times more likely to report treatment failure than older children and adults, and are therefore at higher risk of morbidity and mortality.
- The prevalence of pfcr T76 is higher than the prevalence of in vivo chloroquine resistance, indicating low specificity of pfcr T76 as a clinical test. The genotype failure index is a better predictor of clinical in vivo treatment failure in this area.

for uncomplicated falciparum malaria was applied with some modifications [1]. Chloroquine was administered at a total dose of 25 mg/kg body weight, under direct supervision, for three days as follows: 10 mg/kg on Day 0, 10 mg/kg on Day 1 and 5 mg/kg on Day 2. Patients were followed-up on an outpatient basis on Day 0, Day 1, Day 2, Day 3, Day 7 and Day 14. Clinical condition, body temperature and parasitaemia were assessed at each visit.

The clinical and parasitological responses were classified as early treatment failure, late clinical failure, late parasitological failure, and adequate clinical and parasitological response. Patients who were classified as treatment failure were given the recommended dose of SP, the second line treatment. Those who developed signs of severe or complicated malaria, or one of the danger signs, during the follow-up period were given the first dose of parenteral quinine and taken urgently to the appropriate health facility.

DNA was extracted from dried blood spots on filter paper using methanol fixation-heat extraction method. Nested PCR amplification and restriction enzyme digestion of PCR products were performed for the detection of pfcr T76 mutation. The sensitivity of the second line treatment (SP) was studied by detecting the molecular markers for mutations in dhfr and dhps genes using the same samples collected in the study..

■ Main study findings

Of 122 (98.4%) patients who completed the follow-up, 48 (39.3%) had adequate clinical and parasitological response. The remaining 74 (60.7%) were treatment failures as follows: 28 (23%) were early treatment failures, 16 (13.1%) were late clinical failures and 30 (24.6%) were late parasitological failures. In univariate analysis, the following factors were found to be significantly associated with increased risk of chloroquine treatment failure: younger age (< 10 years), fever ≥ 37.5 °C) and higher parasite density ($\geq 25000/\mu\text{l}$ blood) at presentation. Multivariate analysis confirmed that age less than 10 years is an independent predictor of chloroquine treatment failure (OR = 8.7, 95% CI = 3.6–21.01).

Pre-treatment samples were collected from 112 patients. DNA was successfully amplified in all pre-treatment samples with the following results: 109 (97.3%) carried the mutant T76 allele alone, 1 (0.9%) showed a mixed T76/K76 pfcr genotype and 2 (1.8%) contained only the wild K76 allele. DNA was amplified from 71 post-treatment samples. Of these, 66 (93%) carried only the mutant (T76) allele, 4 (5.6%) had mixed pfcr genotype and 1 (1.4%) carried the wild K76 allele alone. The pfcr T76 allele was found in all post-treatment samples for patients who failed chloroquine treatment. Parasites carrying the wild K76 allele before treatment were not able to survive chloroquine treatment. There was no association

between the presence of either the mutant or the wild pfcr T76 allele and the treatment outcome since they were equally identified in those with adequate clinical and parasitological response and those with treatment failure.

The baseline prevalence of pfcr T76 (and T76/K76) of 110/112 (98.2%) was higher than that of the clinical chloroquine resistance of 68/112 (60.7%). In the younger group, only 12.7% of 55 pre-treatment infections by parasites carrying the T76 mutation were successfully cleared by chloroquine, whereas in the older group, 64.8% of 54 pre-treatment infections were cleared by the drug, indicating that acquired immunity contributed to clearing the parasites carrying pfcr T76 allele.

The sensitivity of the molecular marker was 100%, but the specificity was poor (4.5%). This is explained by the effect of age on the in vivo treatment outcome that depends on the state of acquired immunity. Therefore, the genotype failure index (the ratio of resistant genotype to chloroquine therapeutic failure both early and late), as a more reliable predictor of in vivo treatment failure in this area, was calculated and found to be 1.5 for all ages. After controlling for age, the genotype failure index was found to be 1.1 in children less than 10 years, whereas in older children and adults it increased to 2.4.

Analysis of the samples for the detection of molecular markers for SP resistance could not detect pfdhps-540 polymorphism while pfdhfr-59 was found in 5% of the analysed samples, indicating that a combination of SP with any other antimalarial drug is not an appropriate long-term first line treatment. Therefore, artesunate-SP would not be an inappropriate choice due to its inability to cure patients infected with the dhfr triple mutation.

■ Conclusions and recommendations

This study reported a high level of in vivo chloroquine resistance in Al Musaiameer district, Lahej governorate, Yemen, indicating the need to revise the malaria treatment policy in the country. A combination of SP with any other antimalarial drug is not an appropriate long-term first line treatment.

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Malaria

Drug studies

S u d a n

Antimalarial drug combinations for controlling the dry season subpatent parasitaemia and *Plasmodium falciparum* gametocyte reservoir in an area of seasonal transmission in Sudan

Sudan

East Nile province

Study period:

November

2003–December 2004

Small Grants Scheme (SGS) 2003 No. 64

Principal Investigator

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Abstract

A study was done to identify the appropriate drug combinations that can be used for treating *Plasmodium falciparum* subpatent parasitaemia and gametocyte reservoir during the dry season in an area of marked seasonal malaria transmission. A baseline malariometric survey was carried out in two villages in the vicinity of the city of Gadaref in eastern Sudan during the transmission season of 2003, and malaria cases were treated. This was followed by another survey during the dry season of 2004, and negative blood samples by microscopy were screened by polymerase chain reaction (PCR) for the detection of individuals with subpatent parasitaemia. These were re-examined in the pre-transmission season using PCR for confirmation of persistence of subpatent parasitaemia and reverse transcription (RT) PCR for the detection of individuals with gametocytaemia. The PCR-positive group was randomly allocated to either artesunate + sulfadoxine/pyrimethamine (SP) or artesunate + SP + primaquine. A post-intervention survey was carried out during the transmission season of 2004 to evaluate the impact of the intervention on malaria burden by comparing results to baseline data and those obtained from two other control villages.

Results A baseline prevalence of 38.9% and 54.4% were reported in the study villages during the transmission season in 2003.

During the dry season survey in 2004 no malaria cases were detected and the level of asymptomatic parasitaemia was very low using microscopy. However, using PCR has revealed a subpatent parasitaemia rate of 18.5%. Treatment of the 104 individuals during the pre-transmission season revealed that the combination of artesunate + SP alone was capable of clearing 84.2% (80/95) subpatent parasite carriers before day 3 (before administration of primaquine). The two treatment arms were sufficient to completely clear the rest of the carriers (15.8%) before day 7. Despite the safety of primaquine reported in this study, the low frequency of gametocytes prevented demonstration of its importance as a gametocytocidal drug.

The malariometric survey carried out during the transmission season of 2004 showed a significant reduction in malaria prevalence in the two intervention villages compared to the two control ones and to the pre-intervention survey. The efficacy of this intervention was 95.7% i.e. the intervention prevented 95.7% of malaria cases in the next transmission season.

Conclusions Treatment of subpatent parasitaemia in areas of seasonal malaria transmission during the pre-transmission season using artesunate + SP has a significant impact on reducing malaria burden in the following transmission season.

Conclusions and implications of the study

■ In the dry season, the prevalence of subpatent parasitaemia was 18.5% following treatment of malaria cases with chloroquine during the previous transmission season. Therefore, the new drug policy using an artemisinin-based combination is likely to reduce subpatent parasitaemia in the dry season.

■ Treatment of subpatent parasitaemia in areas of seasonal malaria transmission during the pre-transmission season using artesunate + SP prevented 95.7% of malaria cases in the next transmission season. It can therefore be considered a cost-effective method for malaria control.

■ Artesunate + SP alone was able to clear all gametocytes detected in this study.

Background

Several attempts have been made to interrupt malaria transmission by mass drug administration to control the gametocyte reservoir during the dry season before the onset of widespread transmission. However, these attempts have limitations related to the choice of the drug and reliance on microscopy for gametocyte detection. The gametocytocidal effects of antimalarial drugs have only been evaluated through the detection of gametocytes in blood smears using microscopy after treating malaria patients. No studies have ever

evaluated the efficacy of the gametocytocidal drugs in clearing gametocytes in individuals harbouring subpatent gametocytaemia detected by more sensitive techniques such as reverse transcription polymerase chain reaction (RT-PCR).

A study was therefore done to identify the appropriate drug combination for treating *Plasmodium falciparum* subpatent parasitaemia and gametocyte reservoir during the dry season in an area of marked seasonal malaria transmission in eastern Sudan. The ultimate aim was to reduce malaria morbidity and mortality during the following transmission season.

Materials and methods

A village-scale intervention study was conducted in two villages in the vicinity of the city of Gadaref in eastern Sudan. Two other villages were added as controls during the transmission season 2004. A baseline evaluation of malaria morbidity and mortality was carried out in these villages during the transmission season of 2003, in November. The malaria cases diagnosed were treated with chloroquine and resistant cases were treated with sulfadoxine/pyrimethamine (SP). This was followed by a cross-sectional clinical, parasitological and molecular survey during the dry season of 2004, in June, for detection of the malaria parasite at both patent and subpatent levels. Villagers were screened for the malaria parasite by microscopy, and negative samples were screened by nested PCR for detection of subpatent parasitaemia.

The group of PCR-positive individuals in the two villages was followed-up in August 2004 during the pre-transmission season. Blood samples were collected from these individuals for confirmation of persistence of subpatent parasitaemia by PCR and the detection of gametocytes using the RT-PCR technique. Subpatent carriers were randomly allocated to either of the following anti-malarial drug combinations: artesunate + SP; or artesunate + SP + primaquine (single dose of 0.75 mg of base/kg body weight). Blood samples were collected on days 3, 7 and 14 for follow-up. A post-intervention survey was carried out during the transmission season of 2004, in November, in the two intervention and the two control villages to evaluate the effect of treatment on malaria morbidity and mortality. Malaria cases were treated with artesunate + SP according to the new national drug policy.

Main study findings

The baseline malariometric survey conducted in November 2003 reported a prevalence of 38.9% and 54.4% in the two villages. Clinical malaria cases were not detected during the dry season survey in June 2004 and the level of asymptomatic parasitaemia was very low in the two villages (0.95% and 1.5%).

Of 615 screened individuals in both villages, 114 were detected to be positive by PCR, an 18.5% dry season prevalence of subpatent parasitaemia. Of these, 104 were followed-up during the pre-transmission season in August 2004: 52 were enrolled into the artesunate + SP group and 52 were enrolled into the artesunate + SP + primaquine group. Of the 104 individuals, only 4 had asymptomatic parasitaemia on day 0 (3.8%) and no clinical malaria cases were detected. PCR showed that nine had cleared the infection before treatment and 95 (91.3%) were still positive. Of these, only 15 cases were detected to be positive on day 3 following treatment, and all were negative on day 7. RT-PCR for day 0 samples showed that gametocyte carriage was 13.3% (11/83).

The combination artesunate + SP alone was capable of treating 84.2% (80/95) of subpatent parasitaemia before day 3 (before administration of primaquine), and all other 11 cases on its arm before day 7; it was not therefore possible to demonstrate the importance of primaquine as a gametocytocidal drug because of the low frequency of gametocytes detected in the study.

The survey carried out during the transmission season of 2004 showed a significant reduction in malaria prevalence in the two intervention villages compared to the two control villages (10.5% and 1.5% versus 24.2% and 24.3%, respectively). Moreover, there was a significant reduction in malaria prevalence in the two intervention villages in the post-intervention survey in 2004 compared to the pre-intervention survey conducted in November 2003 (10.5% and 1.5% versus 54.4% and 38.9%, respectively; relative risk and 95% confidence interval = 0.04 [0.02–0.09, $P < 0.05$]). Therefore, the efficacy of this intervention was 95.7% i.e. the intervention prevented 95.7% of malaria cases in the next transmission season.

Conclusions and recommendations

Treatment of subpatent parasitaemia in areas of seasonal malaria transmission during the pre-transmission season using artesunate + SP has a significant impact on reducing the malaria burden in the next transmission season. Despite the high cost of current first line antimalarial drugs, treatment of subpatent parasitaemia in the pre-transmission season is cost-effective because it reduces the cost of treating 95.7% of malaria cases in the next transmission season, in addition to the epidemiological impact of interrupting malaria transmission in areas of seasonal malaria transmission.

Malaria

Drug studies

Islamic Republic of Iran

Evaluation of *Plasmodium vivax* sensitivity to chloroquine in south and south-east Islamic Republic of Iran

Islamic Republic of Iran

Bandar-Abbas, Iranshahr, Nikshahr and Chabahar districts

Study period:

August 2004–October 2005

Small Grants Scheme

(SGS) 2004 No. 43

Principal Investigator

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Abstract

A study was carried out in 4 malaria endemic districts in south and south-east Islamic Republic of Iran to evaluate the sensitivity of *Plasmodium vivax* to chloroquine. Of 225 parasitologically-positive cases, 195 completed the study. The patients were given a standard 3-day regimen of chloroquine and followed-up clinically and parasitologically, according to the WHO protocol for evaluation of in vivo drug resistance, with some modifications.

Results The patients responded to the chloroquine regimen within 24–120 hours. The mean parasite clearance time of *P. vivax* in Bandar-Abbas, Iranshahr, Nikshahr and Chabahar malaria endemic districts was 63.05 ± 15.37 , 56 ± 21.7 , 70.92 ± 6.51 and 58 ± 14 hours, respectively. Although parasite clearance time for a number of cases occurred within 96–120 hours, no parasitaemia occurred after day 5 during the 28-day follow-up period.

Conclusions Chloroquine is still an efficacious drug for the treatment of vivax malaria in the area studied.

Background

Malaria is an important infectious disease in the Islamic Republic of Iran and *Plasmodium vivax* is the first most common cause of malaria in the country. According to the Centre for Disease Management, Islamic Republic of Iran, 12 007 cases of vivax malaria were recorded during March 2004–March

2005, mainly from Hormozgan and Sistan and Baluchistan provinces (1835 and 6537 cases, respectively). However, recent reports from malaria-endemic areas in the country, show a prolonged mean parasite clearance time (MPCT) [1,2,3] Therefore, a study was made to evaluate the susceptibility of *Plasmodium vivax* to chloroquine in south and south-east Islamic Republic of Iran where unofficial reports have indicated a recurrence of parasitaemia in many cases during the 28-day follow-up period.

Materials and methods

A prospective surveillance study was made during the period August 2004–August 2005, in which eligible malaria patients were enrolled from the health facilities in Bandar-Abbas district, Hormozgan province and Iranshahr, Nikshahr and Chabahar districts in Sistan and Baluchistan province.

The in vivo tests were performed according to the World Health Organization (WHO) guidelines [3] with some modifications as follows: eligible patients were treated with a standard regimen of chloroquine (25 mg/kg for 3 days) and in order to achieve a radical cure, primaquine was administered weekly (0.75 mg/kg) for 8 weeks, starting from day 7. The in vivo testing was done to determine the parasite clearance time, defined as the time from the start of chloroquine treatment until blood films become negative for at least 24 hours [4].

Parasite counts were made at day 0 and then on days 1–7, 14, 21 and 28. Blood smears were stained with Giemsa stain and then thick smears examined with an immersion oil lens. Asexual parasites were counted against at least 200 white blood cells (WBC) and then converted to the number of parasites per microlitre of blood. The results were

Conclusions and implications of the study

■ The parasite clearance time for a number of cases occurred within 96–120 hours, and no parasitaemia occurred in the studied patients after day 5 within the 28-day follow-up period. The study showed that chloroquine is still an efficacious drug for the treatment of vivax malaria in south and south-east Islamic Republic of Iran.

■ The results show that mean parasite clearance time in Nikshahr district was higher than in the other districts, but that there is still sensitivity to chloroquine. This could be an early sign for reduced susceptibility of the parasite to the drug.

addressed as MPCT. Treatment failure was defined as follows: clinical deterioration due to *P. vivax* illness requiring hospitalization in the presence of parasitaemia; presence of parasitaemia and axillary temperature ≥ 37.5 °C any time between day 3 and day 28; and presence of parasitaemia on any day between day 7 and day 28, irrespective of clinical conditions.

■ Main study findings

Of 225 parasitologically-positive cases, 195 patients completed the study. Patients responded to the chloroquine regimen, as shown by complete clearance of parasitaemia, within 24–120 hours. No reappearance of *P. vivax* parasitaemia was observed in any patients after day 5 follow-up until day 28. The MPCT was lowest in Iranshahr and Chabahar districts (56 ± 21.70 hours and 58 ± 14 hours, respectively) and highest in Bandar-Abbas and Nikshahr districts (63.05 ± 5.37 hours and 70.92 ± 6.51 hours, respectively). The MPCT for the whole study area (south and south-east Islamic Republic of Iran) was 63.50 ± 15.84 hours.

■ Conclusions and recommendations

The study showed that chloroquine is still an efficacious drug for the treatment of vivax malaria in the districts studied. Continuous monitoring of parasite sensitivity to the drug is recommended to ensure adequate malaria control in endemic areas.

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Malaria

Epidemiology

Egypt

An environmental approach to assessing the potential risk of mosquito-borne diseases in peri-urban and urban areas in greater Cairo, Egypt

Egypt

Greater Cairo (Cairo, Gizah and Qalubia governorates)

Study period:

October 2004–December 2005

Small Grants Scheme

(SGS) 2004 No. 110

Principal Investigator

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Abstract

A study was carried out to assess the risk of vector-borne diseases in greater Cairo. The medical records of malaria cases admitted to Al Abbassia fever hospital, Cairo, during the period from 2001 to 2004 were reviewed. Addresses of 139 cases were geo-referenced by global positioning system (GPS) and mosquito larval surveys were carried out within a 2km-merged buffer around the cases.

Results El Khalifa district reported the highest number of cases (n = 59). The proven malaria vectors *Anopheles pharoensis* and *An. sergentii*, as well as the suspected vector *An. multicolour*, were collected from the study area, where the latter was the most prevalent. Mosquito vectors of filariasis, Rift Valley fever and West Nile fever were also encountered. Most of the mosquito breeding habitats in urban Cairo were spatially associated with fractures/faults and vegetation, as shown by satellite and map data. Natural water sources, man-made structures and failure of infrastructure were identified as the major causes of the genesis of mosquito-genic habitats in urban environments. Most of the malaria cases and mosquito breeding habitats

were found in areas suffering from underground water rising in Cairo. The number of breeding habitats was significantly associated with the proportion of poorly managed/undeveloped land within districts, poor sanitation and slum conditions. Socioeconomic, abiotic and urban/landscape features, derived from satellite data, were capable of discriminating malarious districts. Spatial statistics proved the spatial association of cases and vectors, and indicated that mosquito breeding habitats are widely dispersed within greater Cairo.

Conclusions The study identified high risk areas for malaria that should be targeted for cost-effective disease control in greater Cairo.

Background

As the largest city of Egypt and a unique cultural, educational and tourist destination, Cairo draws a vast number of visitors from both local rural areas and abroad. The presence of *Culex pipiens* and *Cx. perexiguus* (vectors of filariasis, Rift Valley fever and West Nile virus) and *Anopheles pharoensis* and *An. sergentii* (vectors of malaria) in Cairo increases the potential risk of vector-borne diseases in the city. Thus, with efficient vectors and continuous population movement and settlement, Cairo remains at risk of introduction of several vector-borne diseases with potentially negative consequences given that much of the population lacks immunity. Therefore, a multidisciplinary vector-borne disease risk assessment was undertaken in greater Cairo.

Materials and methods

The medical records of malaria cases admitted to Al Abbassia fever hospital in Cairo during the period between 2001 and 2004 were reviewed. The total number of malaria cases recorded at the hospital between 2001 and 2004 was 211. Of the 155 malaria cases recorded in greater Cairo, 139 were identified by

Conclusions and implications of the study

■ The study represents one of the few attempts to address vectors and vector-borne diseases holistically and to clarify the linkages and interrelations between biotic, abiotic and socioeconomic variables of vector-borne disease systems.

■ The data draw attention to the potential risks associated with the development of local transmission foci if imported malaria cases are not properly managed in a timely manner. Vector control through habitat elimination should become a routine activity in order to prevent potential local transmission.

■ The results demonstrate the spatial association of malaria and mosquito breeding habitats that are widely dispersed over 36 of the 62 districts of greater Cairo. This wide distribution is cause for epidemiological alert and renders control efforts a challenge to health authorities.

■ A mosquito vector database linked to a photograph gallery of all mosquito breeding habitats in the study area was developed within a GIS environment for control, awareness building and educational purposes.

the hospital as autochthonous. These cases were geo-referenced and buffer zones of 2km were created around them that were merged into one polygon to define the focus area for sampling of potential mosquito vector breeding.

All accessible aquatic habitats were located, counted and characterized within the study area. Satellite data of the study area were also used to identify potential mosquito habitats and their geographic coordinates in order to direct the survey efforts by the field team. Aquatic habitats were identified as bodies of water harbouring at least one mosquito larva over the study period. Sources of water (natural, man-made, failed infrastructure or a mix of these) in the surveyed habitats were identified in the field. Standard dipping methods were used to collect mosquito larvae at each site. Larvae were collected and transported to the laboratory for further identification. Locations of aquatic habitats were geo-referenced and data on habitat type and environmental attributes of the area were also recorded at each aquatic habitat and documented by photography.

Socioeconomic variables were collected, including the proportion of families living in slum conditions, crowding, average household size and sanitation index. A Landsat ETM+ image dated July 2002 covering greater Cairo was processed to generate a land use/land cover map of the study area. Using this map, the study area was stratified into four land cover strata: urban, vegetation/agriculture, desert/soil and water. Very high resolution IKONOS satellite data dated May 2003 was obtained for a detailed analysis. This analysis covered 145 km² (covering 26 districts) and was focused on the central part of the study area where most epidemiological and landscape heterogeneity occurred.

A Normalized Difference Vegetation Index (NDVI) was generated using the red and near infra-red (NIR) bands of the IKONOS image. Maximum, minimum and mean NDVI values for each district were calculated. Different spatial statistical analysis tools of the ArcGIS software were used to measure geographic distribution, identify patterns and/or spatial associations and to analyse and map the risk. Discriminant analyses were used to investigate the relationships between malaria and environmental/landscape features.

■ Main study findings

During the study period, local malaria cases showed both spatial and temporal heterogeneity in Cairo. The highest number of cases was reported in 2003 while the lowest was in 2004. Spatial and temporal clustering occurred in El Khalifa district followed by Mansheyet Nasser and Nasr City districts. The mosquito surveys have corroborated previous data indicating the presence of the malaria vectors *An.*

sergentii and *An. pharoensis* in Cairo, especially in the vicinity of those areas. *An. sergentii* were collected in El Khalifa district where most malaria cases were recorded and where local people have complained of high densities of mosquitoes and related diseases. However, the number of mosquitoes collected was very low due to continuous national control efforts. Nevertheless, malaria has been reported to be still actively transmitted with very low densities of vectors. In fact, both El Khalifa and Mansheyet Nasser had high numbers of positive mosquito breeding habitats which were found to be correlated with malaria cases per district. No *Anopheles* mosquitoes were collected from Nasr City during this study.

The number of mosquito species collected from Cairo during this study reflects the diversity of habitats available in this urban setting. Among the 11 mosquitoes collected, 6 were known or suspected vectors of diseases including malaria, filariasis, Rift Valley fever, West Nile fever and Sindbis virus. *Cx. pipiens*, an efficient Rift Valley fever, filariasis and West Nile fever vector, and *Cx. prexiguus*, an efficient filariasis and West Nile fever vector, were among the most abundant. Thus, it appears that Cairo is at potential risk of these diseases, in addition to malaria, if relevant pathogen carriers are introduced to the city. Based on the vector status of the mosquito species collected from the study area, risk maps of potential mosquito-borne diseases were created to assist health authorities to locate priority areas and plan for appropriate control/surveillance measures.

■ Conclusions and recommendations

The study showed that the genesis of vector breeding in Cairo is a function of a multitude of factors, usually interconnected and sometimes synergistic. These include natural physical features (geology/hydrology/topography), man-made activities and inadequate/failed infrastructure. While such factors are generated outside of the health sector, they put a heavy burden on it. Management of mosquito breeding habitats generated through these processes requires long-term solutions, mostly resting on engineering and management interventions. Health authorities lack the capacity and the know-how for such interventions as they are beyond their scope, and therefore resort to conventional control methods that are mostly not sustainable. Accordingly, cooperation and coordination between health authorities and other stakeholders, mainly the Ministry of Public Works and Water Resources and the Ministry of Housing and Utilities and Community Settlements, whose actions may directly or indirectly affect its mandate, should be established.

Malaria

Treatment-seeking behaviour for malaria in rural areas with unstable malaria transmission in Sudan

Sudan

Kordofan region

Study period:
August 2004–February 2005

Small Grants Scheme (SGS) 2004 No. 88

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Health-seeking behaviour

S u d a n

Abstract

A facility and community-based study was conducted in rural areas of south-west Kordofan region with unstable malaria transmission in Sudan to identify the basis on which fever in children aged under-five is diagnosed and classified, and to explore the factors involved in the selection, type and sources of different treatment options. A self-administered questionnaire, in-depth interviews, focus group discussions and "a day in the life of" (DILo) analysis were used to collect information from health workers, mothers and community leaders at homes, health facilities and villages.

Results The study reported adequate knowledge of mothers regarding fever/malaria. It also found that mothers usually start care for their febrile children at home and shift to health workers if there is no response or if the condition worsens, resulting

in late consultations with an average duration of almost 3 days. The main health-seeking behaviour is to consult the nearest health facility or health personnel together with the use of traditional medicine or herbs, or to seek advice from grandmothers, grandfathers, neighbours or community volunteers. In addition, community health workers visit patients at home. The choice of treatment options available for a child with fever was restricted by low coverage of health facilities, the difficulty of reaching the facilities, especially during rainy season, the unaffordable cost of health services, dissatisfaction with services and belief in traditional medicine. Antimalarial drugs were available at health facilities, private pharmacies and at health workers' homes; 90% of mothers with febrile children reported use of antimalarial drugs before seeking care at health facilities.

Conclusions The mothers were concerned about their febrile children but went through different treatment choices, including traditional medicine and self-treatment with drugs or herbs, before seeking care at health facilities. This behaviour, together with other barriers, results in a delay in seeking treatment from health workers.

Conclusions and implications of the study

■ Four treatment choices were available to mothers with febrile children in the area. Two of these choices were chemical ("western") medicine-related (consulting health workers, at homes or at health facilities, and self-treatment with drugs). The other two (traditional medicine and using herbs) were deeply rooted in local tradition. Every village has enough herbs for initial home use. This, along with other barriers, results in delay in seeking treatment from health workers.

■ Based on the study results, the recommended methodology for implementing the home-based management for malaria (HMM) strategy should be to nominate a volunteer in each village, called a malaria control assistant (MCA), to be trained and equipped with antimalarial drugs and the necessary charts or guidelines. The MCAs should be linked to health personnel at the largest health centre in the area. Drugs for the whole area /season should be kept at the health centre pharmacy under the control of the assistant pharmacist who can distribute drugs regularly to MCAs at village level. Patients who get severe malaria should be referred by MCAs to the health centre after receiving one dose of artesunate suppositories. Private drug distributors should be part of the training programme and should be equipped with the necessary skills and charts/guidelines. There is evidence that this strategy results in a substantial reduction in malaria mortality in endemic areas.

Background

With the change in malaria treatment policy in Sudan from use of the cheap first-line drug chloroquine (CQ) to the more expensive artemisinin-based combination therapy (ACT), and given the existence of various treatment options (traditional healers, self-treatment, nongovernmental organizations, private and public health facilities), the need to determine the factors that influence health care-seeking behaviour related to malaria has emerged as one of the top priorities for the national malaria control programme. A study was therefore done to provide the necessary information required for the scaling up of the home-based management of malaria (HMM) strategy [1, 2].

Materials and methods

Focus group discussions (FGDs) with 10 groups of mothers and in-depth interviews with 10 community leaders and 15 health workers in primary health care units were carried out in 10 selected villages. A representative sample of 96 mothers who visited the health facilities with a febrile child during the study period were also interviewed. The data collection tools consisted of a FGD guide for the mothers, an in-depth interview guide for the community leaders, a precoded and pretested self-administered questionnaire for the health workers and an in-depth interview guide for mothers with febrile children attending the health facilities. The “a day in the life of” (DILo) analysis was also adopted. This required the presence of the team designated to collect the data in each village from morning to evening.

Main study findings

The mothers reported an adequate overall knowledge about malaria, its transmission and prevention. They mainly attributed any fever to malaria and correctly stated its signs and symptoms. Almost all considered fever to be a dangerous feature that leads to complications (90.4%) or to death (9.6%), and regarded malaria as a major health problem followed by chest infection and diarrhoea. All community leaders agreed that febrile illness in children presents a major public health problem and that it is mainly attributed to malaria, while a few also mentioned jaundice and typhoid. The community knew that malaria is contracted during the rainy seasons.

The main health-seeking behaviour reported was to visit the nearest health unit/centre or hospital, consulting medical assistants or any health personnel together with use of traditional medicine. Herbs were also used: drinks made from *neem*, *aradeep*, hibiscus or *galagil*, or fumigation using *habeel* tree. *Garad* and tea granules are used as antipyretics. Community health workers who visit patients at home were also reported. Average health-seeking behaviour duration was around 3 days, with deterioration of the child's condition being the main factor prompting mothers to seek health care.

The main reasons for delayed health-seeking behaviour were low health facility coverage, non-functioning health facilities, transportation difficulties due to heavy rains and unpaved roads, the unaffordable cost of health services and belief in traditional medicine. The pattern was to start with traditional medicine and then shift to other options. Health workers usually referred severely ill children to hospitals after prescribing antipyretics and educating the parents; 50% referred patients to hospitals 75 to 200 km away. Health-seeking behaviour was not significantly associated with

mother's or father's age or education, or child's age or sex, but was significantly associated with father's education.

Self-treatment was common, being reported by the majority of community leaders and health workers. The reasons for this were the ease of malaria diagnosis, the high cost of travel, consultation and laboratory investigations, and the unavailability of health facilities in the area. Patients sometimes ask the opinion of other community members, and if they agree that the sickness is malaria, they take antimalarial drugs; antimalarial use is therefore common. People obtain antimalarials from private pharmacies or drug stores in nearby villages or cities, and also use leftover drugs at home. People usually use CQ in any form; they also obtain acetylsalicylic acid (Aspirin) and paracetamol for children from nearby shops. Dosage is decided based on other people's advice. Self-treatment is particularly common in children as it is perceived as being difficult to take them to the hospital.

Private pharmacies and the revolving drug fund at the city level were the source of drugs, including antimalarial drugs for health workers. The drugs are available at health facilities, private pharmacies and health workers' homes. There is no regular drug supply system in the area. The cost for malaria cases per episode ranges from 500–1500 Sudanese dinars (US\$ 2–6). Although people are willing to pay, 50% of health workers reported that the cost is considered unaffordable for patients.

Antimalarial drugs commonly in use include CQ in the form of syrup, injection and tablets, followed by sulfadoxine-pyrimethamine (SP) and quinine. Oral treatment (especially syrup) was preferred by more than 60% of mothers for children. CQ injection was preferred by adults, with particular preference for the “French brand”.

Conclusions and recommendations

The results of the study should be the basis for the implementation of the HMM strategy using the recommended drug for uncomplicated malaria, co-blister of artesunate plus SP and/or artesunate suppositories. The implementation of the HMM strategy should take into account the ongoing treatment options in the area.

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Genetic and ecological characterization of the malaria vector in Morocco: a fundamental tool for disease control

Morocco

North, central and south regions

Study period:

September 2004–February 2006

Small Grants Scheme (SGS) 2004 No. 67

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Malaria

Vector control

M o r o c c o

Abstract

A study was carried out to identify malaria vectors and their distribution in Morocco, and to study their susceptibility to insecticides. Entomological surveys were carried out in zones representing different epidemiological categories. The collected mosquitoes were identified first based on morphological criteria, and then using molecular tools. Following this, 455 larvae were tested for insecticide susceptibility. To study vector trophism, 42 mosquitoes were tested against human, cow, sheep and chicken. Blood from engorged females was collected on filter paper and preserved at -20 °C for identification of vector trophism using modified direct ELISA technique.

Results The study identified the following 6 species: *Anopheles labranchiae* (8 provinces); *An. sergentii* (C) and *An. cinereus* (C) (4 provinces); and *An. algeriensis*, *An.*

marteri and *An. ziemanni* (2 provinces). Characterisation of 86 anopheles found that the sequences of internal transcribed spacers (ITS2) for 70 specimens corresponded with the sequence of *An. labranchiae*, while 14 were negative and 2 had sequences close to *An. messae*. Insecticide susceptibility tests reported susceptibility to temephos. The LD50 ranged between 0.0025 mg/l and 0.0047 mg/l for the different provinces. These were significantly lower than the currently recommended dose of 0.25 mg/l. Study of vector trophism suggested that *An. maculipennis*, *An. cinereus* and *An. sergentii* were zoophilic.

Conclusions *An. labranchiae* is the predominant species in Morocco and is mainly zoophilic. Insecticide susceptibility tests reported susceptibility to temephos, with lethal doses being significantly lower than the currently recommended diagnostic concentration.

Conclusions and implications of the study

- The studied areas are rich in anopheline fauna, as 6 out of the 9 reported species in Morocco were identified in these regions. These were *An. labranchiae* (*An. maculipennis* complex), *An. sergentii*, *An. cinereus*, *An. algeriensis*, *An. marteri* and *An. ziemanni*. On the other hand, absence of anophelines in Marrakech and Ouarzazate indicate the scarcity of anopheline fauna in these 2 provinces with its significance for malaria transmission.
- The genetic characterization of *An. maculipennis* complex shows that this could be composed of 2 species: *An. labranchiae* being the predominant species (80.5%) and *An. messae* (2.3%) which does not play a role in malaria transmission and usually exists in areas where malaria has been eradicated.
- Insecticide susceptibility testing showed that *An. labranchiae* is fully susceptible to temephos. These data should be communicated to the Eastern Mediterranean Region Resistance Monitoring Network and included in their database. Since temephos spraying is part of the strategy for achieving/consolidating elimination, it is important to note that the main target vector species is fully susceptible to temephos use as a larvicide.
- The study reported that *An. labranchiae* expressed zoophilic behaviour, which is favourable for reduction of malaria transmission in the country. ELISA technology is currently widely used in the country and its application for routine entomological surveillance of vector behaviour is recommended.

Background

Vector control is a fundamental element of any malaria control programme and its success depends on the extent of information available. In Morocco, autochthonous transmission of *Plasmodium vivax* has been attributed to the *Anopheles maculipennis* complex. The species of this complex are identified morphologically based on egg shape. However, these shapes vary greatly within the same species, posing a difficulty for the correct identification of a large number of specimens. The same difficulty in identification of larvae and other stages also exists due to the great variability between different species.

Recently, DNA characterisation by polymerase chain reaction (PCR) and the sequencing of the ITS2 has allowed proper identification of the members of the maculipennis complex. Therefore, a study was carried out in order to identify malaria vectors and their distribution in Morocco, and to study their susceptibility

to insecticides. An attempt was also made to study vector trophism.

Materials and methods

Based on baseline epidemiological information on malaria distribution in the country, zones representing different epidemiological categories were selected. In the north, Chefchaouen was selected as a high risk zone, Larache and Khemisset as potential risk zones and Meknes, Oujda, Rabat and Tetouan as low risk zones. In the central region, Khouribga was selected as a high risk zone, Settat as potential risk zone and Marrakech as low risk zone. In the south, Ouarzazate was selected as a potential risk zone and Tiznit as a low risk zone.

An entomological survey was carried out in which larvae were collected and resting adult mosquitoes were collected using a mouth aspirator. Initially, the collected mosquitoes were identified based on morphological criteria and then *An. maculipennis* complex were preserved for further identification using PCR. Following this, 455 larvae collected from Meknes, Tetouan and Khemisset were tested for insecticide susceptibility. To study vector trophism, 42 mosquitoes were tested against human, cow, sheep and chicken. Blood from engorged females was collected on filter paper and preserved at -20°C for identification of vector trophism using modified direct ELISA technique.

Main study findings

The study identified the following 6 species in Morocco: *An. labranchiae* in 8 provinces; *An. sergentii* (C) and *An. cinereus* (C) in 4 provinces; and *An. algeriensis*, *An. marteri* and *An. ziemanni* in 2 provinces. Characterization of 86 anopheles showed that: the sequences of ITS2 for 70 specimens corresponded with the sequence of *An. labranchiae*; 14 were negative; and 2 had sequences close to *An. messae*. *An. labranchiae* was the predominant species (80.5%). However, the presence of *An. messae*, though in a limited number (2.3%), was unexpected, especially given that the 2 specimens originated from the same region (Chefchaouen) and were separately analysed.

Insecticide susceptibility Insecticide susceptibility tests reported susceptibility to temephos. The LD50 were 0.0025 mg/l, 0.0032 mg/l and 0.0047mg/l in the north, central and south regions, respectively. These were significantly lower than the currently recommended diagnostic concentration of 0.25 mg/l.

Trophic behaviour of the vector Blood meals collected from females of *An. maculipennis*, *An. cinereus* and *An. sergentii* were all from animal origin, despite some mosquitoes being collected from human shelters. These results shed some light on vector

preference in Morocco. Based on these results and a literature review, *An. labranchiae* would be anthropophilic and zoophilic, *An. cinereus* slightly anthropophilic and *An. sergentii* anthropophilic or zoophilic according to need. The existence of zoophilic species in close contact with humans is beneficial in reducing transmission since it diverts them from human hosts.

Conclusions and recommendations

The genetic characterization of *An. maculipennis* complex shows that it could be composed of 2 species, with *An. labranchiae* being the predominant species. *An. labranchiae* expressed zoophilic behaviour which is favourable for reduction of malaria transmission in Morocco. ELISA technology is currently widely used in the country and its application for routine entomological surveillance of vector behaviour is recommended. While the main target vector species is fully susceptible to temephos use as a larvicide, gathering additional data from areas with no history of use of temephos and no intensive use of agricultural insecticides would help in assessing the validity for Morocco of the current diagnostic concentration (0.25 mg/l).

Malaria

Vector control

M o r o c c o

Replacement of DDT for malaria control in Morocco: identification of resistance mechanisms and choice of alternative insecticide

Morocco

Kénitra, Khouribga, Larache, Khémisset and Salé provinces

Study period:

October 2004–November 2005

Small Grants Scheme

(SGS) 2004 No. 108

Principal Investigator

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Abstract

A study of resistance in the malaria vector *Anopheles labranchiae* was carried out in five provinces in Morocco: Kénitra, Khouribga, Larache, Khémisset and Salé.

Results The study reported the susceptibility of *An. labranchiae* to propoxur, fenitrothion and permethrin and varying levels of resistance to DDT. The genetic study of this resistance did not reveal modification at the target site common to DDT and pyrethroids, which is the voltage-gated sodium channel. Insecticide resistance seems to be due to detoxification mechanisms specific to DDT.

Conclusions Pyrethroids are an alternative choice to DDT in Morocco. Further investigations on GST (glutathione transferase) are needed to run the biochemical assay properly with *An. labranchiae*.

Background

The control of *Anopheles labranchiae*, the major malaria vector in Morocco, is based on the use of DDT in residual spraying against adults and temephos against larvae. The resistance status of the species to this insecticide was supervised regularly by the Laboratory of Medical Entomology within the framework of its malaria control activities. The first susceptibility assays to DDT, done in 1959, before its use, had shown a normal sensitivity of the species to this organochlorine in Morocco [1]. In 1971, the first cases of resistance were reported [1]. Since then, resistance rates reaching up to 30% have been reported from different regions of Morocco, in zones regularly sprayed by DDT, as well as in zones that have not been sprayed for around 20 years. To date there is no information on the level of resistance to potential alternative insecticides such as organophosphates, carbamate and pyrethroids. The mechanisms implicated in *An. labranchiae* DDT resistance needed to be elucidated. A study was therefore done to identify the mechanisms involved in *An. labranchiae* DDT resistance and to inform the choice of alternative insecticide(s) in Morocco.

Materials and methods

Entomological surveys were conducted in Kénitra, Khémisset, Larache, Khouribga and Salé provinces where pyrethroids are massively used in agriculture. The collected mosquitoes were identified morphologically first and then by polymerase chain reaction (PCR). The susceptibility of *An. labranchiae* towards the following insecticides was studied: DDT 4% (organochlorine), fenitrothion 1% (organophosphate), propoxur 0.1% (carbamate) and permethrin 0.75% (pyrethroids).

Conclusions and implications of the study

■ The study provided evidence that pyrethroids are an alternative to DDT in Morocco that should be maintained by focal residual spraying. This will contribute to improved management of the vector population. Furthermore, to translate these findings into policy as part of the national strategy for insecticide resistance management, it is recommended that a national meeting of relevant experts and policy-makers is held.

■ The study could not conclude or rule out a reduced susceptibility to organophosphates (fenitrothion), due to difficulty in the interpretation of the diagnostic dose results while working with a small number of wild caught females of unknown physiological status and age. This could be further addressed in the framework of the national resistance monitoring network. The study contributed to the setting up of the network.

■ The molecular tests showed the absence of *kdr* gene mutation. The use of DDT in public health for more than 30 years and the use of agricultural pyrethroids for several years have apparently never selected the *kdr* mutation in *An. labranchiae* in Morocco.

■ The long term benefits of the study include technology transfer of molecular methods for the identification of insecticide resistance mechanisms specific to Morocco, as well as its contribution to the Eastern Mediterranean Network on Vector Resistance (EMNVR).

Biological assay was carried out on *An. maculipennis* wild females according to WHO recommended technique [2]. *An. maculipennis* s.l. specimens that survived the biological tests were identified by PCR. The technique used allows the amplification of the Second Internal Transcribed Spacer (ITS2) region by PCR, by using in combination a universal primer and specific primers to differentiate six of the seven species of the complex *An. maculipennis* s.l.: *An. atroparvus*, *An. labranchiae*, *An. maculipennis* s.s., *An. melanoon*, *An. messeae* and *An. sacharovi*. Kdr gene mutation in the zone coding for the voltage-gated sodium channel has never been studied for *An. labranchiae*. The IIS4–IIS6 zone of the voltage-gated sodium channel of *An. labranchiae* was amplified. The sequencing of amplification products and the determination of the genotype of every mosquito were done at the Laboratoire de Lutte Contre les Insectes Nuisibles (LIN), Institut de Recherche pour le Développement (IRD), Montpellier.

■ Main study findings

Biological assays The population of the five study provinces were susceptible to permethrin and propoxur, while varying levels of resistance were reported for DDT. Resistance levels to DDT were 22% in Larache province and 19% in Louamra and Boucharen provinces. In Ouled Moussa locality in Kénitra province, the resistance level to DDT was 19% and only 5% of the exposed sample survived exposure to fenitrothion. In Benikhlef locality, in Khouribga province, the tested population reported a resistance rate of 25% to DDT. In Chougaga locality, in Khémisset province, a resistance rate of 10% for DDT was reported and 2% of the exposed population survived exposure to fenitrothion. In Ouled Bourzin locality, in Salé province, the exposure of the population to DDT for one hour revealed the presence of low resistance; 15% of the exposed population survived the dose.

Molecular identification of species The bands obtained for the tested specimens correspond to a size of 375 bp, similar to that of the control (*An. labranchiae*). *An. labranchiae* was therefore the only species of the complex *An. maculipennis* s.l. found among the tested specimens.

Gene kdr mutation The sequencing of *An. labranchiae* amplification products did not reveal a modification in the voltage-gated sodium channel gene. There is therefore no kdr mutation in the tested specimens. These results imply that the mechanisms involved in *An. labranchiae* resistance to DDT are most probably of a biochemical nature.

■ Conclusions and recommendations

The study provided evidence for the existence of *An. labranchiae* resistance to DDT and its sensitivity to permethrin, propoxur and fenitrothion in the provinces of Kénitra, Larache, Khouribga, Khémisset and Salé. In all these provinces, pyrethroids have not been used in public health before, while DDT was first used during the 1960's and has not been used since 1980 in Salé and Kénitra, 1987 in Larache, 1994 in Khémisset and 2000 in Khouribga. Pyrethroids remain, at present, the insecticides of choice for the substitution of DDT in the malaria control programme.

The surveillance of resistance by new molecular tools is recommended. Further investigations on GST are needed to run this biochemical assay properly with *An. labranchiae*. It will be important in the future to monitor changes in GST frequencies using this assay.

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Malaria

Vector control

S u d a n

Social, behavioural and economic barriers to insecticide-impregnated bednets in Gezira state, Sudan

Sudan
Gezira state

Study period:
August 2004–June 2005

Small Grants Scheme (SGS) 2004 No. 128

Principal Investigator

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Abstract

To identify the social, behavioural and economic determinants of insecticide-treated net (ITN) use, a household survey was carried out with structured questionnaires. Using stratified random sampling, 643 households (3356 persons) were interviewed, including 380 urban and 263 rural households. The questionnaire was designed for housewives and focused on household income, perception of malaria, bednet use, sleeping habits, malaria protection and barriers against using ITNs. Another questionnaire was used to collect information on the sociodemographic characteristics and bednet usage of household members.

Results Only 23.9% of respondents had bednets at the time of the survey, but 54.5% were irregular users. The majority of respondents had adequate knowledge about malaria. Sleeping habits are subject to seasonal variation: 46.5% of respondents sleep indoors, and 33.6% outdoors. The average time at which children went to bed was 8.43 pm. The mean cost of ITNs was US\$ 41.5 ± 11.2. However, respondents reported that an affordable price should not exceed US\$ 1.54 and 47.7% cited cost as the main reason for not having bednets, but 11.4% reported having no access to bednets. As the majority of respondents had positive

perceptions regarding bednets, it can be said that more than half had an unmet need. Information collected from the 3356 household members revealed a bednet use of 30%, with a significant association between bednet use and occupation but not marital status. The significant determinants of bednet use were: female sex, income and educational level.

Conclusions Despite having adequate knowledge regarding the role of mosquitoes in malaria transmission and good perceptions about bednets, the community reported low bednet coverage, which is mainly due to high bednet cost. Therefore, the problem is a problem of unmet needs rather than community behaviour or negative perceptions. Bednet supply should be increased at a competitive price in order to raise demand.

Background

Use of an insecticide-treated net (ITN) for protection against mosquito bites during sleep is a highly effective and cost-effective intervention against malaria. Community-based randomized trials in Africa have documented average reductions of 20% in all causes of mortality in children aged under-5 within two years of increasing ITN use from 0 to 50%–70% [1, 2]. A study was therefore carried out to evaluate knowledge, attitudes and behaviour regarding bednets, and to identify sleeping patterns, bednet usage and acceptability, and the determinants of bednet use.

Materials and methods

A cross-sectional study was conducted in Gezira state, in which households were randomly selected using stratified random sampling into two urban and two rural localities. The urban communities were residents of two quarters in the town of Wad-Medani, with relatively high socioeconomic levels and easy access to health facilities. The rural communities were residents of two villages, Wad Al Naim and Wad Al Shafiy in central Gezira

Conclusions and implications of the study

- The study found that economic barriers were the main determinants of bednet use in a community having high degrees of awareness about malaria and bednet acceptability.
- A high unmet need for ITNs of around 70% was reported by the study. Therefore, the problem of low bednet use in this community is mainly economic rather than being a behavioural or negative perception problem. This finding indicates that a targeted intervention should supply bednets at competitive prices in order to raise demand and create a competitive market.
- Local production of bednets should be explored so that they can be provided at an affordable price by the community.
- The cost of treating illness using artemisinin-based combination therapy versus the cost of subsidizing bednets needs to be investigated.

state, areas with lower socioeconomic levels and limited access to health facilities.

Probability proportional to size sampling was used to select households within each locality and the wives of the heads of household (or male household heads in the absence of a female) were interviewed according to a questionnaire that included questions on the sociodemographic characteristics of the household, perceptions of malaria, current mosquito net use, insecticide use, ITN use, sleeping habits, ITN material, colour and size preference, and barriers against using ITNs. Another questionnaire was used to collect information on the sociodemographic characteristics and bednet usage of household members.

■ Main study findings

The study covered 643 households (3356 household members), of which 380 were urban and 263 were rural. Household heads had a mean age of 39.1 ± 14.6 years; the majority were married and only 14.2% were illiterate. Most of the women interviewed were housewives while the men were mainly employees. The majority of respondents perceived malaria as a priority disease and had an adequate overall knowledge of the disease, its mode of transmission and its transmission season. Different methods for preventing mosquito bites were mentioned, including insecticide spraying, smoke and electric fans.

More than half of respondents (54.5%) claimed to use bednets, but only 23.9% had bednets at the time of the survey. Of these, one third had acquired already impregnated bednets, while the rest had impregnated their nets at impregnation centres or at home, or had non-impregnated bednets. The mean distance between households and impregnation centres was 7.8 ± 2.9 km. Bednets were purchased from the market (54%), sales points (18.4%) or nongovernmental organizations (5%). The mean cost of ITNs was US\$ 41.5 ± 11.2 , which was mainly borne by the family and provided free (by nongovernmental organizations) in only 5.8% of cases. According to respondents, the suitable price for ITNs should be between US\$ 0.77–1.54. Positive and negative perceptions were reported by 90.2% and 30% of respondents, respectively.

The majority of respondents preferred to use ITNs for children aged under-5 (55.1%); the figures for the elderly and pregnant women were 18.7% and 14.0%, respectively. Overall, 46.5% of respondents slept indoors, 33.6% slept outdoors and 11.8% do both according to the weather. The average time children go to bed was $8.43 \text{ pm} \pm 1.36$. Regarding bednets, 48.1% of respondents preferred synthetic netting due to aeration and strength, 12.4% preferred cotton and 6% preferred other materials. Most bednets were white, which was the preferred colour for 74.5% of

respondents, followed by green, pink and purple. A majority (61.4%) preferred single size bednets, while 38.3% preferred double size. Overall, 47.7% of respondents cited cost as the main reason for not having bednets, while 11.4% reported no access to bednets.

The significant determinants of bednet use were female sex, income and educational level. There was no significant association between bednet use and residence. Information collected from the 3356 household members revealed bednet use of 30.0% with a significant association between bednet use and occupation but not with marital status.

■ Conclusions and recommendations

The study of the social, behavioural and economic determinants of ITN use revealed that the latter was a major barrier against bednet use, with less than one-third of the study population using ITNs. The study indicates that this community would be highly receptive to bednet use if provided at an affordable price.

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Sexually Transmitted Diseases

Syndromic management of STDs among women attending family planning and antenatal centres in Alexandria

Egypt
Alexandria governorate

Study period:
December 2004-2005

Small Grants Scheme (SGS) 2004 No. 242

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Diagnosis

Egypt

Abstract

A study was done to evaluate the validity and cost of the WHO algorithm in syndromic management of sexually transmitted diseases (STDs) in comparison with other approaches including risk score, medical examination and etiologic laboratory investigation, and to determine the prevalence of STDs among patients attending 10 randomly selected family planning and antenatal care centres in Alexandria, Egypt. A cross-sectional study was conducted, whereby women attending the centres during a four month period were interviewed and given a clinical examination. A sub-sample of 100 women underwent laboratory investigations for the detection of sexually transmitted pathogens.

Results The prevalence of STDs among patients attending the family planning centres was 25% compared to 18% at antenatal university clinics. The cure rate of the

syndromic approach exceeded 90% in the study centres. Sensitivity varied between 88.5%, 32.7% and 3.8% for the syndromic, risk and clinical approaches, respectively. Specificity varied between 14.4%, 87.5%, and 91.5%, respectively. The over-treatment rate reported for the syndromic approach was 85.4%, compared to 12.5% and 8.4% for the risk and clinical approaches, respectively. The cost varied from US\$ 5 per case in the syndromic approach to US\$ 30 if laboratory diagnosis was performed.

Conclusions The study provided evidence of the validity of the WHO approach for the management of STDs in developing countries. Its high false positive rate can be reduced by combining it with clinical and or risk approaches. The elements of the risk approach score should be adjusted in different geographical settings.

Background

Most sexually transmitted diseases (STDs) are curable and all can be prevented. STD case management aims to treat the patient and prevent complications such as infertility, adverse pregnancy outcomes, chronic pain, etc. This can only be achieved by timely and effective treatment of patients at their first visits to the health facilities.

STD case management is carried out through the following approaches: 1) an etiological approach using laboratory tests to identify the causative organism; 2) a presumptive clinical approach through the identification of clinical features; 3) a syndromic approach using standardized flow charts to identify a specific syndrome (signs and symptoms) associated with a number of well-defined etiologic agents; or 4) a risk assessment approach that uses a variety of demographic, behavioural and clinical information (other than laboratory investigations) to assess the likelihood that a person is infected with an STD or at high risk of future infection. Generally, the etiological and clinical approaches

Conclusions and implications of the study

■ The relatively low sensitivity of syndromic management in the study is in agreement with other reports. This is mainly attributed to the asymptomatic nature of cervicitis, which is not the case with urethral discharge. Similarly, the risk score reported low sensitivity because vaginal discharge usually increases during and after sexual activity, at different times in the menstrual cycle and during pregnancy or breast feeding.

■ The syndromic approach also performs poorly in detecting gonorrhoeal and chlamydial infections and the algorithm falsely identifies many women as having an STD and recommends treatment resulting in costly over-treatment. The drawbacks of over-treatment include: increased costs for drugs; the development of drug-resistant strains, requiring new and more expensive drugs; and side-effects of antibiotics. The study found that lower over-treatment rates are obtained if the syndromic approach is combined with other approaches.

■ The study reported an STD prevalence of up to 25% in family planning centres. These infections would remain untreated if the women did not seek family planning care at the centers. This would have exposed the women to the risk of complications such as infertility or chronic pelvic pain. Promoting condom use among this target population would be beneficial in preventing the spread of STDs among them and their partners.

are those most frequently adopted by health care providers. However, the syndromic approach is recommended by WHO for case management in resource limited settings.

A study was done to evaluate the validity and cost of the WHO algorithm in syndromic management of STDs in comparison with other approaches. It also aimed to determine the prevalence of STDs among patients attending family planning centres (FPC) and antenatal university clinics (ANC) in Alexandria, Egypt.

Materials and methods

Six hundred (600) women were consecutively enrolled over a period of four months from 10 randomly selected ANCs and FPCs in Alexandria, Egypt. The Institute for Training and Research on Reproductive Health, a nongovernmental organization, organized training sessions for the clinicians of the selected centres on how to apply the WHO questionnaire to collect data, clinical examination, diagnosis, drug prescription and recording of results. The items of the questionnaire included data about sociodemographic characteristics, past history of STDs and present symptoms such as vaginal discharge: odour, colour and amount, symptoms of urethritis, and dyspareunia. Married women were given a gynaecological examination including speculum examination and bimanual palpation.

A subsample of 100 randomly-selected patients (50 FPC patients and 50 ANC patients) underwent laboratory investigations to validate the syndromic management. High vaginal swabs were taken to be tested for *Trichomonas*, *Candida* and clue cells, and an endocervical swab was taken for *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. At the laboratory, the slides prepared from the swab were Gram-stained and examined under the microscope for Gram-positive yeasts and hyphae of *Candida albicans*. The fresh wet mount of the fluid was also examined under a low power microscope for motile *Trichomonas vaginalis*. The inoculated plates of modified Thayer-Martin medium from an endocervical swab were incubated and cultured colonies were identified as *N. gonorrhoeae* by morphology, Gram staining, sugar fermentation tests and oxidase production. An ELISA test was used for the detection of chlamydia antigen.

The diagnostic performances of the different approaches were compared to the laboratory results as the gold standard. The cost of the different approaches was also compared. The cost estimation consisted of direct costs such as drugs and doctors' fees and indirect costs such as travel expenses.

Main study findings

T. vaginalis was the most common STD in both study settings, with a significantly higher rate in FPCs

compared to ANCs (10% and 8%, respectively). Mixed infections of more than one STD were also found at a significantly higher rate in FPCs compared to ANCs (18% and 12%, respectively).

The cure rate of the syndromic approach exceeded 90% in the two study centres. Sensitivity varied between 88.5%, 32.7% and 3.8% for the syndromic, risk and clinical approaches, respectively. Specificity varied between 14.4%, 87.5% and 91.5%, respectively. The over-treatment rate reported for the syndromic approach was as high as 85.4% compared to 12.5% for the risk approach and 8.4% for the clinical approach. Performance parameters were reported for combined syndromic with clinical approaches (AUC = 0.82 and LR+ = 4.12) followed by the combined risk, clinical and syndromic approach (AUC = 0.80 and LR+ = 4).

In addition to the validation of the different approaches, the study investigated the 27.3% of study participants who reported being at high risk of STDs, defined as being in a new marriage, having a symptomatic partner, being under 21 years of age and partner having a risky occupation. The cost varied from US\$ 5 per case in the syndromic approach to US\$ 30 if laboratory diagnosis was performed.

Since the ANCs were only located in Alexandria University hospital, the cost was relatively low, considering travel expenses, which are not present for the FPCs that are distributed throughout Alexandria. At the ANCs, the cost of etiological diagnosis ranged from US\$ 3 for *C. albicans* and US\$ 5 for *N. gonorrhoeae* to US\$ 10 for cultures of *C. trachomatis* or *T. vaginalis* and a total of US\$ 28 if mixed infection was suspected. At the FPCs, the cost ranged from US\$ 5 to US\$ 30.

Conclusions and recommendations

While the syndromic approach has several advantages such as cost-effectiveness and rapid applicability at a large scale, it also has several disadvantages such as over-treatment and difficulty in addressing the complexity of cervical infection management. However, the advantages outweigh the disadvantages since it is sometimes difficult to carry out laboratory investigations for some risk groups such as sex workers. It is therefore a valid diagnostic approach for STD case management in resource limited settings. Its high false positive rate can be reduced by combining it with clinical and/or risk approaches. The elements of the risk approach should be adjusted in different geographical settings.

Sexually Transmitted Diseases

Epidemiology

Islamic Republic of Iran

Genital infection in Babol, Islamic Republic of Iran: prevalence and risk markers

Islamic Republic of Iran
Babol

Study period:
October 2003–January 2005

Small Grants Scheme (SGS) 2003 No. 35

Principal Investigator

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Abstract

There is little information about the prevalence and risk factors of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in the north east of the Islamic Republic of Iran. A study was therefore done to determine the prevalence of *C. trachomatis* and *N. gonorrhoeae*, and to study variables associated with these infections in sexually active women living in Babol city. A total of 550 eligible and consenting women seeking care at gynaecology clinics were enrolled, interviewed and given a pelvic examination. A vaginal swab was taken for wet smear and tested for *Trichomonas vaginalis*, a sample of endocervix was obtained for culture of *N. gonorrhoeae* in chocolate agar medium and a sample of blood obtained for detecting *C. trachomatis* by ELISA. Sociodemographic, behavioural and clinical variables were studied and their association with the wet smear, chocolate agar and ELISA results were assessed.

Results The prevalence of *C. trachomatis*, *N. gonorrhoeae* and *T. vaginalis* was 11.6%, 0.2%, and 4%, respectively. The risk markers for *C. trachomatis* infection were: income,

age (> 25 years), husband's education, husband's addiction, use of condom, and having ever heard of STD/HIV. *C. trachomatis* infection was not associated with the presence of symptoms, but with cervical friability and mucopurulent cervicitis on physical examination. Logistic regression analysis revealed that husband's addiction, use of condom, having ever heard of HIV/AIDS, protected last sexual contact and cervical friability were independent predictors/markers for *C. trachomatis*. The risk markers for *T. vaginalis* infection were age (> 25 years), husband's education, use of condom, protected last sexual contact, having ever heard of STD/HIV and smoking (including passive smoking).

Conclusions The prevalence of *C. trachomatis* is comparable to that reported worldwide and is the most common infection in this sample, but the prevalence of gonorrhoea is low. The risk markers identified should be used for early detection of cases to reduce *C. trachomatis* and *T. vaginalis* infections in the community, and their damage to women's reproductive health.

Background

Most bacterial sexually transmitted diseases (STDs) have been declining in industrialized countries, but are still of major public health concern in developing countries. Among STDs, genital *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are the most prevalent worldwide. Morbidity associated with these infections includes urethritis and cervicitis, and sequelae include pelvic inflammatory disease (PID), ectopic pregnancy, tubal factor infertility, epididymitis, proctitis and reactive arthritis. Chlamydial PID is the most important preventable cause of infertility and adverse pregnancy outcome. Approximately, 15%–20% of women with *C. trachomatis* and *N. gonorrhoeae* lower genital tract infection will develop PID, 4% chronic pelvic pain, 3% infertility and 2% an adverse pregnancy outcome.

Conclusions and implications of the study

■ Syndromic diagnosis recorded a sensitivity of 55% and 64%, and specificity of 53.5% and 56%, for *T. vaginalis* and *C. trachomatis*, respectively. This is considered acceptable for symptomatic women. On the other hand, asymptomatic infections in women could be detected using the demographic and behavioural markers identified in this study. These markers should be used for screening the target population for early detection and treatment of STDs, reducing their damage to the reproductive health of women in the community.

■ The risk markers for *C. trachomatis* infection were: income, age (> 25 years), husband's education, husband's addiction, use of condom, and having ever heard of STD/HIV.

■ The risk markers for *T. vaginalis* infection were: age (> 25 years), husband's education, use of condom, time since last protected sexual contact, having ever heard of STD/HIV and smoking (including passive smoking).

However, a considerable proportion of *C. trachomatis* and *N. gonorrhoeae* remain asymptomatic and hence untreated, leading to severe adverse effects on reproductive health. In resource poor settings, non-laboratory screening tools could play some role in identifying and treating infections in women, since most would not otherwise be reached.

A study was therefore done to determine the prevalence and risk factors of *C. trachomatis* and *N. gonorrhoeae* infections among women of reproductive age in the north east of the Islamic Republic of Iran. The risk markers could be used in a screening programme in order to achieve a reduction in *C. trachomatis* and *N. gonorrhoeae* infections and their damage to the reproductive health of women.

Materials and methods

A total of 550 eligible and consenting women attending the 6 health care centres of Babol University were prospectively enrolled and visited by expert midwives in the centres. They were interviewed according to a standardized questionnaire including information about sociodemographic and behavioural variables, and symptoms and signs of infection. They were then given a pelvic examination including inspection of the external genitalia and speculum examination for abnormal manifestations in the vulva (redness, signs of pruritus, vaginal discharge, genital ulcers), mucopurulent cervicitis (MPC) and others. A sample of cervical discharge was examined for *T. vaginalis* using a wet smear, an endocervical swab was taken for *N. gonorrhoeae* and cultured on chocolate agar, and a blood sample was tested for *C. trachomatis* using ELISA test.

Main study findings

The mean age of the women in the study was 33.6 years, and age of first sexual intercourse was 18.8 years. The majority of women and their husbands had primary-level education, 89% of women were housewives, 41.9% of husbands were self-employed, and 21.3% could save money. The most common contraceptive method used was withdrawal followed by tube ligation; 76.4% of participants have never used condom; 22% of had a history of PID; and 7.6% history of infertility. Although 85.3% had not heard of STD, 93.8% had heard of HIV. STD services are not free of charge and 86.2% mentioned stigma/social barriers to seeking STD services.

The prevalence of *C. trachomatis*, *N. gonorrhoeae* and *T. vaginalis*, was 11.6%, 0.2%, and 4%, respectively, without any coinfections. Almost two thirds of laboratory-confirmed *C. trachomatis* cases were symptomatic. The most prevalent symptoms in cases of positive *C. trachomatis* were vaginal discharge, dyspareunia and lower abdominal pain, and on physical examination, the most common signs

were cervical friability, MPC and lower abdominal tenderness. Overall, 59.1% of laboratory-confirmed *T. vaginalis* cases were symptomatic. The most prevalent symptoms were vaginal discharge, dyspareunia and genital itching, and on examination, the most common signs were redness of vulvae, MPC and discharge. Syndromic diagnosis recorded a sensitivity of 55% and 64%, and a specificity of 53.5% and 56%, for *T. vaginalis* and *C. trachomatis*, respectively. The *N. gonorrhoeae* case was asymptomatic, aged 27, a housekeeper with primary school education who had been married for nine months. Her husband was aged 32, a worker with primary school education, with a negative history of risky sexual behaviour.

The risk markers for *C. trachomatis* infection were: age (> 25 years), income, husband's education, husband's addiction, use of condoms and having ever heard of STD/HIV. Symptoms were not significant predictors of *C. trachomatis* infection, but cervical friability and MPC on physical examination were. Logistic regression analysis revealed that husband's addiction, use of condoms, having ever heard of HIV/AIDS, time since last protected sexual contact and cervical friability were independent predictors/markers for *C. trachomatis*. The risk markers for *T. vaginalis* infection were age (> 25 years), husband's education, use of condoms, protected last sexual contact in months, having ever heard of STD/HIV and smoking (including passive smoking).

Conclusions and recommendations

C. trachomatis infection seems relatively common among sexually active women in this community, and as a considerable proportion of infections are asymptomatic, infected women are exposed to reproductive health problems. The demographic and behavioural risk markers identified in this study could be introduced in an intervention programme to screen the target population for early detection and treatment infections, hence reducing their negative impact on women's reproductive health.

Tuberculosis

Case detection

S o m a l i a

Case-finding among suspected tuberculosis cases and barriers to their timely health care in south-central Somalia

Somalia

South-central zone

Study period:

January 2004–February 2005

Small Grants Scheme

(SGS) 2003 No. 15

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Abstract

Tuberculosis case-finding is exceptionally low in south-central Somalia compared to the northern part of the country. A cross-sectional survey of a representative sample of the population living in south-central Somalia investigated the prevalence of suspected tuberculosis cases and active pulmonary tuberculosis in the zone. It also studied the health-seeking behaviour of suspected tuberculosis cases and its determinants.

Results 3000 individuals were screened for a cough of more than 3 weeks duration. Of these, 111 tuberculosis suspects were identified and 2 smear-positive tuberculosis cases were diagnosed: a prevalence of 3.7% and 70/100 000, respectively.

A significantly higher proportion of tuberculosis suspects were living far from tuberculosis centres and residing in suburban areas. In addition to tuberculosis centres, the health services available for suspected tuberculosis cases living close to tuberculosis centres where mainly health posts and general hospitals, while for those living at some distance from tuberculosis centres, health

posts and private services were the main health services. The first health-seeking behaviour was to seek care at the health posts or tuberculosis centres, regardless of distance. Occupation, time to reach the health facility, residence and weight loss were significant determinants of the health-seeking behaviour of suspected tuberculosis cases.

Conclusions Inadequate health-seeking behaviour is a major impediment to tuberculosis case detection by the public health system. Increasing community awareness about tuberculosis symptoms and making adequate and accessible services available would increase case-finding in this community.

Background

Somalia had an estimated smear-positive incidence rate of 162/100 000 and a treatment success rate of 83% in 2001 that is close to the global target. However, only 32% of estimated cases are detected compared to a global target of 70% [1]. There is regional variation within the country with two-thirds of the total population in the south-central zone living in disadvantaged conditions compared to the north where the case detection rate reaches 84%.

It is clear that there are barriers to the access of suspected tuberculosis cases to tuberculosis health services in the south-central zone. A study was therefore made to assess challenges to case-finding in this zone, particularly the barriers to case-finding among suspected tuberculosis cases and to their timely health care.

Materials and methods

A cross-sectional survey was conducted in the south-central zone in which Baidoa and Waajid districts were randomly selected from the Bay and Bakool regions, respectively. The survey screened 3000 adult household members for symptoms suggestive of tuberculosis,

Conclusions and implications of the study

■ A considerable proportion of tuberculosis cases are not detected by the public health system mainly due to accessibility problems, unequal distribution of health services in the different regions and urban/suburban/rural strata of the country, and low awareness of the community about appropriate health-seeking behaviour.

■ The significant predictors of poor health-seeking behaviour in this community were: a farming occupation; living in Bay region; suburban residence; and time taken to reach the health facility. Of all tuberculosis symptoms and signs, weight loss was the only significant predictor for seeking health care among tuberculosis suspects.

■ It is recommended that: tuberculosis services are integrated into those health services available to remote households such as health centres and health posts; collaboration is established between health services in suburban areas and tuberculosis control; the awareness of the community about tuberculosis symptoms is increased; and health care providers are trained on tuberculosis control activities.

specifically a persistent cough of three weeks or more, and consenting tuberculosis suspects were interviewed according to a structured and pre-tested questionnaire about their health-seeking behaviour and barriers to seeking health care. Previously diagnosed tuberculosis patients were excluded. Sputum specimens collected from each suspected case were sent to the tuberculosis center for examination; positive cases were contacted and treatment was initiated.

■ Main study findings

The study screened 3000 individuals, 2340 in Bay and 660 in Bakool, for tuberculosis symptoms. Of these, 111 suspected tuberculosis cases were identified and 2 active smear-positive pulmonary tuberculosis patients were diagnosed, a tuberculosis suspects prevalence of 3.7% and an active tuberculosis prevalence of 70 per 100 000 population. The frequency of active smear-positive tuberculosis among tuberculosis suspects was 1.81%.

Tuberculosis suspects living more than 30 km away from tuberculosis centres were more likely to live in a suburban area compared to those living close to a tuberculosis centre (61.4% and 22.2%, respectively), indicating a significant association between the distribution of tuberculosis centres and urban, suburban and rural areas. However, there was no significant association between other socio-demographic variables and the distance of suspected tuberculosis cases' residences from tuberculosis centres.

Of 41 tuberculosis suspects who sought medical consultation prior to the interview, 44% correctly answered that tuberculosis is not hereditary, 87.8% said that tuberculosis is contagious, 92.7% believed it to be curable and 39.0% recognized that there is a vaccine for tuberculosis. These rates were lower among those who had not sought care for their illness, but this was not statistically significant.

In terms of tuberculosis stigma, of those who had sought care for their illness, 51.2% strongly agreed that they would feel ashamed of a tuberculosis diagnosis, 34.1% would have to hide it, 34.1% believed it would affect social relations, 65.9% thought it to be very costly, 34.1% thought that a tuberculosis patient should not be employed, 41.5% agreed that it would affect family responsibility, 36.6% that it would lead to complications during pregnancy, 41.5% that it would affect breast feeding and 31.7% that it would affect pregnancy outcome. Those who did not seek health care recorded slightly higher stigma scores, but this was not statistically significant.

For households closer to services, the main health services available were health posts (33.3%), general hospitals (24.1%) and tuberculosis centres (18.5%), while for more remote households they were health

posts (43.9%), private practitioners (22.8%) and general hospitals (17.5%). There was a significant difference between these two household groups regarding the type of services available in their areas, but no significant difference regarding the time taken to reach the health facility. The main means of reaching the health facility was by foot in both groups but more distant households also used public transportation.

The first health-seeking behaviour in the closer households was to seek care at health posts (42.1%), tuberculosis centres (21%) or general hospitals (21.1%), while remote households sought initial care at tuberculosis centres (43.5%), health posts (26.1%) or health centres (17.4%). The main reason for consulting a specific health facility was confidence in getting a cure for both groups, but also accessibility for 17.4% of the remote households. Reasons for not seeking health care were the distance from health services and economic constraints.

There was a higher risk of not seeking health care among females (1.72-fold), the illiterate (3.7-fold), those from lower economic levels (3.21-fold among those reporting being in debt) and those living 30 km or more from the tuberculosis centres (1.9 folds). Individuals with inadequate knowledge or incorrect beliefs about tuberculosis were at higher risk of not seeking care, but this was not statistically significant.

The significant predictors of poor health-seeking behaviour in this community were farming occupation (6-fold compared to other occupations), living in the Bay region (3.4-fold compared to those living in Bakool region), suburban residence (5.61-fold compared to urban residence), the time taken to reach the health facility (8.4-fold for more than one hour away from the health facility compared to less than one hour) and maintenance of normal body weight (3.2-fold compared to those with weight loss).

■ Conclusions and recommendations

A considerable proportion of tuberculosis cases are not detected by the public health system. This is mainly due to accessibility problems, unequal distribution of health services between the different regions and among the urban/suburban/rural strata of the country, and low community awareness about appropriate health-seeking behaviour. Integrating tuberculosis services into the health services for remote areas and increasing community awareness about tuberculosis is therefore recommended.

■ References

[1] *WHO report 2003: global tuberculosis control: surveillance, planning, financing*. World Health Organization, Geneva, 2003, (WHO/CDS/TB/2003.316).

Tuberculosis

Case detection

Jordan

Case-finding among tuberculosis suspects and barriers interfering with their timely health care in central and south Jordan

Jordan

Central and south Jordan

Study period:

December 2003–August 2005

Small Grants Scheme

(SGS) 2003 No. 202

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Abstract

A cross-sectional study was carried out in three governorates in central and south Jordan, in which adult household members were screened for tuberculosis symptoms and suspected cases were interviewed using a questionnaire that included questions on the factors that might influence the health-seeking behaviour of suspected tuberculosis cases which were referred for confirmed diagnosis. The aim was to investigate the reasons for delayed health-seeking behaviour among suspected tuberculosis cases and to determine the prevalence of tuberculosis and suspects active tuberculosis in the community.

Results A total of 61 730 individuals in 9251 households were screened, reporting a prevalence of tuberculosis suspects of 2.51% and a prevalence of “undetected” active pulmonary tuberculosis of 3.24 per 100 000 population. All of the detected cases were smear-positive.

Communities living in rural areas had a lower socioeconomic status, yet reported a

significantly longer duration of smoking and number of cigarettes smoked, and a significantly longer duration of symptoms, had a significantly lower perception of risk, a higher psychological burden from the disease and were at significantly higher risk of inadequate health-seeking behaviour.

The significant risk factors for inadequate health-seeking behaviour were female gender, living in Karak and Maan governorates, rural residence, being an expatriate, and using private means of transportation. Having fever was a protective factor prompting suspected cases to seek care.

Conclusions A considerable proportion of undetected tuberculosis cases exist in the rural community mainly due to poor accessibility to tuberculosis health services and low awareness of the disease.

Background

Delay in tuberculosis diagnosis is an important factor in the spread of the disease and poor outcome for patients. Delay can occur at the patient level due to inadequate health-seeking behaviour or at the level of the health care system. While most of reports have investigated causes of delay among diagnosed cases, few if any have investigated causes among undiagnosed individuals detected in the community. Therefore, case-finding in the community and investigating the reasons for delayed health-seeking behaviour among suspected cases of tuberculosis are crucial to the development of optimum interventions that will increase case detection in the country. Therefore a study was conducted with these objectives and also the aim of determining the prevalence of tuberculosis suspects and active tuberculosis in the communities studied.

Materials and methods

A cross-sectional study was carried out in Balqa governorate, central Jordan, and in Ma'an, and Karak governorates in south

Conclusions and implications of the study

■ The study reported a prevalence rate of undiagnosed pulmonary tuberculosis of 3.24 per 100 000 population, while the incidence of notified pulmonary tuberculosis cases accounted for 3.59 per 100 000 population in the same study area. This indicates that a considerable proportion of cases is not detected by the health care system and resides mainly in rural areas.

■ The under-detection of tuberculosis cases is mainly attributable to the poor access of rural residents to tuberculosis centres. In addition, communities living in rural areas reported significantly higher rates of risk factors for tuberculosis and were at significantly higher risk of inadequate health-seeking behaviour.

■ The risk factors for inadequate health-seeking behaviour in the communities studied were: female gender, living in Karak and Maan governorates, rural residence, being an expatriate and using private means of transportation.

■ These findings highlight the need to increase the distribution of tuberculosis health services in rural areas along with increasing awareness of rural residents about tuberculosis in order to improve their health-seeking behaviour.

Jordan. Using stratified random sampling technique, the sample was equally divided into two strata: households at a distance of less than 30 km from the tuberculosis centre and those at 30 km or more. All adult household members were screened for tuberculosis symptoms and suspected cases were interviewed using a questionnaire that asked questions on sociodemographic status, knowledge of tuberculosis, access to the tuberculosis centre, stigma and other factors that might influence the health-seeking behaviour of tuberculosis suspects. The respondents were then referred to the tuberculosis centres for confirmed diagnosis. Previously confirmed tuberculosis cases and mobile populations were excluded from the study. Tuberculosis suspects were defined as individuals with a persistent cough (either productive or not productive) for more than 3 weeks.

■ Main study findings

A total of 61 730 individuals in 9251 households were screened in the three governorates of Balga, Karak and Maan during a four month period (June to September 2004). The prevalence of tuberculosis suspects among them was 2.51% while the prevalence of active pulmonary tuberculosis was 3.24 per 100 000 population. All were smear positive.

There was a significantly higher proportion of tuberculosis suspects living in Karak governorate and residing far from tuberculosis centres (30 km or more) compared to the other two regions. Almost 90% of tuberculosis suspects living in rural areas did not live near to the tuberculosis centres, indicating that distance from tuberculosis centres is a surrogate for urban or rural residence in the study areas.

Tuberculosis suspects living far from tuberculosis centres were significantly older in age and had significantly lower socioeconomic status compared to those residing close to tuberculosis centres. Non-nationals were mainly living close to tuberculosis centres.

Smokers, whether current or ex-smokers, were more frequent among tuberculosis suspects living in areas closer to tuberculosis centres, and recorded a significantly higher rate of water-pipe smoking. However, the duration of smoking was significantly longer and the number of cigarettes higher among those smokers living far from tuberculosis centres.

The duration of symptoms was significantly longer for cough, loss of weight, chest pain and haemoptysis, but not fever, among suspects living far from tuberculosis centres. Moreover, there was a significant association between the knowledge of tuberculosis suspects about the disease and the distance between their residence and the tuberculosis centres. The main source of information for almost two thirds of tuberculosis suspects was the mass media, followed by medical personnel, and was significantly associated

with distance from residence to tuberculosis centre.

Tuberculosis suspects had a high risk perception of contracting tuberculosis and this was significantly higher among those living closer to tuberculosis centres.

Although there was no significant difference between the two groups regarding mean percentage score for stigma, a significantly higher mean percentage score for psychological burden of the disease was recorded among those living far from tuberculosis centres.

Health centres were the main services available for 95.3% and 92% of tuberculosis suspects living close to and far from tuberculosis centres, respectively. Private practitioners and tuberculosis centres rarely existed in distant/rural areas.

The first action with the onset of symptoms was to visit the health centre, together with self-medication. A significantly higher proportion of tuberculosis suspects visited private practitioners or tuberculosis centres among those living close to these centres, while a significantly higher proportion of those living far from tuberculosis centres visited traditional healers.

The main reasons for all tuberculosis suspects for consulting the above-mentioned facilities for the current illness was their accessibility and confidence in obtaining a cure. In addition, those living far from tuberculosis centres mentioned following someone's advice or because it was the only service available.

The main reasons for not consulting the various facilities for the current illness were the beliefs that the symptoms were not serious or being busy. In addition, those living far from tuberculosis centres mentioned economic constraints and having to wait for a long time before being diagnosed, and the far distance and poor quality of services.

The significant risk factors for inadequate health-seeking behaviour (not seeking health care with the onset of symptoms) were: female sex (1.82-fold increased risk); living in Karak and Maan (1.8 and 1.6-fold, respectively); rural residence (1.83-fold); being an expatriate (15.84-fold); and using private means of transportation (1.9-fold). Having fever was a protective factor prompting tuberculosis suspects to seek care.

■ Conclusions and recommendations

The prevalence of active smear-positive tuberculosis undetected by the health care system was 3.24 per 100 000 population in the studied communities. These cases were detected in rural areas with poor access to tuberculosis health services. These findings call for increasing the distribution of tuberculosis health services in rural areas along with increasing awareness of rural residents about tuberculosis in order to improve their health-seeking behaviour.

Tuberculosis

Case detection

Pakistan

Involvement of religious leaders in raising awareness of the community about tuberculosis and its impact on case detection in Baluchistan

Pakistan

Balochistan province

Study period:

April 2005–July 2006

Small Grants Scheme

(STB) 2004 No. 3

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Abstract

A study was done to involve religious leaders (RL) in raising community awareness about tuberculosis in order to encourage tuberculosis suspects to seek medical advice earlier. The knowledge of the RL was assessed through a questionnaire, which was followed by training to enable them to educate the community about tuberculosis in the weekly sermon and through personal contacts.

A total of 87 RL were included in the study, 42 in the intervention and 45 in the control districts. To evaluate the impact of the intervention, tuberculosis patients and RL were interviewed after the intervention, and case notification rates in the intervention and control districts were compared.

Results At baseline, 74% of the RL considered a cough to be the main symptom of suspected tuberculosis disease, followed by fever and weight loss. However, the majority (86%) wrongly reported that a more than one month duration of cough was required in order to suspect the disease. The

majority of RL (78%) believed that tuberculosis was curable, around 40% could not identify a person they knew as having tuberculosis, and only 38% knew about the availability of anti-tuberculosis drugs at tuberculosis facilities.

After the intervention, knowledge of cough as the main tuberculosis symptom and the definition of a tuberculosis suspect increased significantly (100% and 93%, respectively). Also, 92% of RL were able to identify a person they knew as having tuberculosis. Further, all RL knew about the availability of free anti-tuberculosis drugs in facilities.

There was also a significant difference between the intervention and control districts regarding the number of patients who sought health care due to religious leaders. The intervention districts reported significantly higher case notification and detection rates compared to the control districts following the intervention during the last two quarters of 2005 and the first quarter of 2006.

Conclusions The study found that involving RL in raising the awareness of the community proved to have a beneficial impact on the health-seeking behaviour of tuberculosis suspects and on increasing case detection in the community.

Conclusions and implications of the study

■ The study reported the inadequate knowledge of religious leaders (RL) about tuberculosis. Their sources of knowledge were mainly derived from non-medical books and beliefs, while some were advising non-medical forms (spiritual, *hikmat* etc.) of treatment. This improved significantly after training and distribution of IEC materials.

■ The RL became aware of the tuberculosis clinics in their area and gained confidence in their services. They cooperated, conveyed educational messages on the symptoms and early diagnosis of tuberculosis, and advised people to seek timely and appropriate care.

■ As a result of the awareness campaign, the case notification and detection rates significantly increased in the intervention compared to control districts. Involving RL in raising community awareness about tuberculosis is therefore recommended.

■ Only those RL of mosques where weekly prayers (*juma*) were offered were included in the awareness programme. However, hundreds of mosques exist where weekly prayers are not offered, and raising the awareness of these Imams (religious leaders) will result in a more effective awareness programme.

Background

The targets of the national tuberculosis control programme (NTP) are to reach an 85% treatment success rate (TSR) and a 70% case detection rate (CDR) by 2005. However, the CDR in Baluchistan province was 28% and the TSR 80% in 2004, indicating the need to develop interventions to increase case detection in the community. Religious leaders (RL) could play a significant role in influencing the behaviour of the community. A study was therefore conducted in order to involve RL in raising community awareness about the disease, thereby influencing their health-seeking behaviour with the ultimate goal of increased case detection.

Materials and methods

An intervention study was conducted whereby three intervention and three control districts were randomly selected from the province. All eligible RL were included in the study. Using a questionnaire, baseline information was collected on the knowledge of RL about tuberculosis and health services delivering tuberculosis care, and on their willingness to raise community awareness about the disease and adequate health-seeking behaviour. RL in the intervention districts were given a one day training programme on tuberculosis and ways to guide the community to seek timely and appropriate care.

The following educational messages were delivered to male householders during the weekly service: an individual suffering from cough for more than three weeks is considered a tuberculosis suspect and should seek immediate care at the tuberculosis centre for diagnosis and treatment, if confirmed to be an active tuberculosis case; tuberculosis is a curable disease; the treatment is free of charge at the designated NTP centres.

The acceptability of having RL deliver educational messages and being involved in raising community awareness was evaluated. The impact of the intervention was assessed by interviewing tuberculosis suspects at health facilities and comparing the case notification and case detection rates before and after the intervention in both the intervention and control districts.

Main study findings

A total of 87 RL were included in the study, 42 in the intervention and 45 in the control districts. Of these, 76 were Muslim, 7 were Hindu and 4 were Christian. Ethnically, 47 were Baloch, 27 Pashtun and 13 were "other".

Religious leaders At baseline, 74% and 84% of the RL in the intervention and control districts, respectively, considered a cough to be the main symptom for suspecting tuberculosis disease, followed by fever and weight loss. However, the majority (86%) wrongly reported that a more than one month duration of the cough was required in order to suspect the disease. Knowledge about tuberculosis suspects increased significantly following the intervention (93%). At baseline, 78% believed that tuberculosis was curable compared to 97.4% after the intervention. The source of information for 45% of RL was physicians followed by non-medical books (*unani*) (36.4%). Following the intervention, physicians became the main source of information (76.5%).

Before the intervention, more than 40% of RL could not identify a person they knew as having tuberculosis due to lack of knowledge about the diagnostic symptoms, but after the intervention 92% were able to. At baseline, 50% of RL had relatives and friends who consulted doctors and 12.5% other health care

providers, compared to 92% after the intervention, while 82% had advised suspects to seek care at tuberculosis centres for early diagnosis of tuberculosis.

Around one third of RL at baseline were giving advice about non-prescribed medications, but this behaviour declined after the training, with advice being given to suspects to seek care at local tuberculosis clinics instead. While only 38% had known about the availability of anti-tuberculosis drugs at these facilities, all became aware of them after the intervention and that they are free of charge, and they expressed a high level of satisfaction with the available services.

The majority of RL felt that informing people about tuberculosis is religiously good and were in favour of telling people about tuberculosis during the weekly religious ceremony.

Patients A total of 428 patients were interviewed: 226 in the intervention districts and 202 in the control districts. Most patients recognized tuberculosis symptoms including cough (70.8%), sputum (47.7%), fever (51.8%) and weight loss (15.7%). A significantly higher proportion of patients correctly mentioned the duration of tuberculosis treatment in the intervention districts than in the control districts (32% compared to 16.3%). Also, a significantly higher proportion of patients in the intervention districts than in the control districts mentioned RL as the source of information for correct and timely health-seeking behaviour (22% compared to 13%, respectively) ($P = 0.01$). The second source of information was relatives, which was significantly higher in intervention compared to control districts (23% and 19%, respectively). A significantly higher proportion of patients sought care at tuberculosis clinics based on somebody's advice in the intervention compared to control districts (66.37% as and 59.41%, respectively). Fewer patients in the intervention districts self-reported to tuberculosis facilities compared to control districts (34% and 40%, respectively). There was significant district difference between intervention and control districts regarding the number patients who sought health care due to RL.

Case detection The intervention districts reported a significantly higher case notification rate compared to the control districts following the intervention during the two quarters of 2005 and first quarter of 2006.

Conclusions and recommendations

The RL were motivated to increase community awareness about tuberculosis and significantly contributed to informing the community about adequate health-seeking behaviour with the onset of illness. Their contribution had a significant impact on the CDR in the study area. It is therefore recommended to sustain the training sessions, involve RL of all levels (not only Imams) and integrate RL into the NTP at the country level.

Tuberculosis

Case detection

Egypt

Quality of health care for tuberculosis suspects and patients, and its association with the case-detection rate in Egypt

Egypt

Cairo and Alexandria governorates

Study period:

July 2004–July 2005

Small Grants Scheme

(SGS) 2004 No. 49

Principal Investigator

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Abstract

A health system research study was carried out in all chest centres and 54 primary health care (PHC) clinics in Cairo and Alexandria, two governorates with low and high tuberculosis cases detection rates, respectively, in order to test the association between quality of care and tuberculosis case detection by the health system. The study also aimed to evaluate the impact of introducing a suspect register for tuberculosis case detection. Data were collected about the quality of care delivered in the health facilities to patients with tuberculosis and suspected tuberculosis and on consumer and provider satisfaction with care, using questionnaires and/or observation checklists. Physicians in the PHC clinics were trained to register suspected cases of tuberculosis using a register form and to refer them to chest clinics for diagnosis and registration using another form. Forms collected from PHC and chest clinics were then compared and analysed.

Results Cairo recorded significantly lower quality indicators regarding: employee health programme; quality of pharmacies in tuberculosis health services; quality of laboratory request forms, registers and reports; quality of slide storage; quality of sputum

sample collections; and quality of care delivered to patients with tuberculosis and suspected tuberculosis.

Adequate satisfaction with care was recorded among patients, with no significant difference between the two governorates, while health care providers recorded a significantly lower mean percentage score of satisfaction with care in Alexandria compared to Cairo. Introducing the suspect register resulted in a significant increase in the case detection rate in both governorates.

Conclusions These results provided evidence about the strong association between the quality of health services and tuberculosis case detection in the community.

Background

Egypt reported a new smear-positive tuberculosis case detection rate (CDR) of 55% in 2002, compared to the WHO target of 70%. Therefore, a study was carried out to test whether there is an association between quality of care (QOC) and case detection by the health system by comparing QOC parameters in two governorates with low case and high case detection, namely Cairo and Alexandria, respectively, (CDR of 59% and 84%, respectively, in 2003). The study also aimed to evaluate the impact of introducing a suspect register on tuberculosis case detection.

Materials and methods

Out of 27 governorates, Cairo and Alexandria governorates were selected as surrogates of health systems with low and high tuberculosis case detection, respectively, and for the comparable sociodemographic characteristics of their populations. All chest facilities in both governorates (11 and 7 in Cairo and Alexandria, respectively) were included in the study. Out of all primary health care (PHC) clinics in these governorates, 3 were randomly selected from the same chest facility district, totalling 54 PHC clinics in the 2 governorates.

Conclusions and implications of the study

■ The study illustrated why a strong health care system is a prerequisite for the framework of case detection and treatment. The necessity of improving the quality and accessibility of general health services to ensure early detection and subsequent cure was demonstrated. The study is the first report to confirm the association between quality of health services and tuberculosis case detection by these services.

■ The quality parameters/indicators that were deficient in Cairo are directly linked to case detection in the community, providing an explanation for the significantly lower CDR in Cairo compared to Alexandria.

■ The study validated the quality parameters in monitoring the improvement in quality of health services over time. These parameters should be targeted in future interventions in order to improve tuberculosis case detection in this community.

The quality of services delivered to outpatient attendees and patients was evaluated using a modified form of the standard quality control sheet of the quality department of the Ministry of Health and Population (an observation checklist). The quality parameters were evaluated on a 4-point Likert scale and the mean percentage scores for the studied parameters were calculated. Outpatient attendees (tuberculosis suspects) and patients in chest clinics were also interviewed regarding their satisfaction with the care delivered in these facilities using a questionnaire.

Evaluation of the impact of the suspect register A register form was designed for recording tuberculosis suspects in the PHC clinics studied. Suspected cases of tuberculosis were referred to the chest clinics to be diagnosed and registered on another form. Forms collected from the PHC clinics and chest clinics were compared, and the data analysed.

■ Main study findings

In Cairo, the quality indicators (QI) for patients' rights and environmental safety recorded a mean score ranging from 65%–79%, while the infection control QI recorded an excellent score (almost 100%). By contrast, employee health programmes were found to be deficient in Cairo health facilities. The QI for pharmacies were inadequate, recording a suboptimal mean score of 47.5%. The recording system was adequate where most of the indicators were fully met, except the QI related to recording the results of 3 sputum smear examinations. Laboratories were following acceptable good laboratory practice (GLP), recording a mean score of 83%.

The QOC delivered to patients with suspected tuberculosis was unsatisfactory: an adequate history and clinical examination, proper communication of the educational message and request for a sputum smear examination were properly performed in less than 50% of cases of suspected tuberculosis. A better QOC was delivered to newly diagnosed tuberculosis patients (mean score of 82.1%). However, deficiencies existed in communicating the educational message to patients, especially regarding the importance of adherence to directly observed treatment, short course (DOTS), and in asking for contact investigations, or assignment to a treatment supporter. Observation also found that patients are not always contacted when they interrupt their treatment (only 19% of cases).

Reviewing of records found that personal data were adequately recorded, as well as treatment regimen and date of initiating treatment, and necessary diagnostic tests are performed on time. Deficiencies existed in linking treatment plans to diagnostic test results, contact investigation and assigning patients to PHC clinics to receive DOTS.

In Alexandria, the QI for patient rights, environmental safety, infection control and the employee health programme recorded mean scores of 62%–75%. Similarly, the mean score of the QI for pharmacies was 69%. The recording system was adequate, with most of the indicators being fully met, except the QI related to record design. Laboratories were following GLP in an acceptable way, recording a QI mean score of 92%.

An adequate history and clinical examination, proper communication of the educational message and request for a sputum smear examination were properly performed in more than 90% of cases of suspected tuberculosis, recording an overall QI mean score of 81%. A better QOC was delivered to newly diagnosed tuberculosis patients (a mean score of 86.5%).

Reviewing of records found that personal data were adequately recorded, as well as the treatment regimen and date of initiating treatment, and necessary diagnostic tests are performed on time. Deficiencies existed in linking treatment plans to diagnostic test results, contact investigation and assigning patients to PHC clinics to receive DOTS.

Cairo recorded significantly lower QI scores regarding: employee health programme; quality of pharmacies in tuberculosis health services; quality of laboratory request forms, registers and reports; quality of slide storage; quality of sputum sample collections; QOC delivered to patients with suspected tuberculosis, especially regarding requests for 3 successive sputum smear examinations; QOC delivered to tuberculosis patients, especially regarding contact investigation, instructions on adherence to DOTS and contacting patients on interruption of treatment.

Adequate satisfaction with care was recorded among patients, with mean scores of 88.1% and 86.5% in Cairo and Alexandria, respectively, with no significant difference between the two governorates. On the other hand, health care providers recorded a significantly lower mean score of satisfaction with care in Alexandria compared to Cairo.

Introducing the suspect register resulted in the detection of 13 new cases in Cairo compared to 6 cases in Alexandria. These were diagnosed by the screening of 146 and 153 suspected cases in Cairo and Alexandria, respectively. Therefore, the rate of increase in the CDR attributed to the introduction of the suspect register was 4.1% and 9.9%, respectively, per quarter; an annual increase of 16.3% and 39.4% in the CDR in Cairo and Alexandria, respectively.

■ Conclusions and recommendations

These results provided evidence for a strong association between the quality of health services and tuberculosis case detection in the community. The deficiencies identified in the study should be subject to an intervention to improve the CDR in Cairo.

Tuberculosis

Community participation

Pakistan

Community involvement in enhancing case-detection and treatment success rates of tuberculosis patients under the DOTS strategy in Pakistan

Pakistan
Sindh province

Study period:
November 2003–March 2005

Small Grants Scheme (SGS) 2003 No. 178

Principal Investigator
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Abstract

A community-based intervention study was carried out in Dadu district, Sindh province, to evaluate the role of community involvement in enhancing case-detection and treatment success rates of tuberculosis patients under the directly observed treatment, short course (DOTS) strategy. The basic development needs (BDN) programme team already involved in community mobilization, as well as teachers, local councillors, community-based organization activists and the community representatives of the BDN programme were trained in DOTS implementation. The cases detected and sputum conversion rates after the intervention were compared to the baseline rates, and between BDN programme and non-BDN programme areas.

Results In the intervention areas, 81, 88, and 129 new cases were detected in the first three quarters, respectively, compared to 61, 79 and 87 in the control areas ($P < 0.01$). The incidence of new cases increased from a baseline of 39 to 40 per 100 000 to 71.2 and 52 per 100 000, in the intervention and control

areas, respectively ($P < 0.05$). Moreover, the proportion of sputum-positive cases was significantly higher in the intervention areas compared to the control areas.

Conclusions BDN programme areas reported significantly higher case-detection and sputum smear conversion rates compared to non-BDN programme areas and to the baseline rates. Involvement of the BDN programme in DOTS implementation could be replicated in other parts of the country in order to achieve better tuberculosis control.

Background

Recent governmental efforts to intensify tuberculosis control activity have achieved directly observed treatment, short course (DOTS) coverage countrywide in 2005. However, there is need to improve case-detection mechanisms and treatment success rates in order to achieve national targets. The Government of Pakistan and provincial government in collaboration with WHO and local communities have started a community-based basic development needs (BDN) programme in selected sites of all four provinces of the country since 1996. The BDN programme aims to achieve a better quality of life, with the ultimate goal of attaining good health. It is an integrated approach for socioeconomic development based on full community involvement, community organization and self-reliance through self-management and self-financing by the people. A study was therefore undertaken to evaluate the role of community involvement in enhancing the case-detection and treatment success rates of DOTS patients in the BDN programme area of Dadu district in Sindh province.

Materials and methods

A community-based intervention study was carried out in Dadu district, Sindh province, in which the case-detection and sputum conversion rates were compared

Conclusions and implications of the study

- Community health workers play an effective role as treatment supporters and help mitigate the stigma of tuberculosis. Community support is essential in new case identification and in providing support to tuberculosis patients by helping them to enrol in DOTS diagnostic and treatment centres, and in ensuring patient compliance.
- Two important lessons that tuberculosis control can learn from the experience of community participation in other aspects of primary health care are that: community health workers can play an important role, provided that they receive adequate support, motivation and incentives; and that it is better to work through existing community organizations than to create new ones.
- DOTS implementation should become a formal component of the BDN programme. BDN programme workers should receive formal training in DOTS. This should include community volunteers such as teachers, councillors, *nazims* and community activists.
- Intensive monitoring and supervision, preferably by federal and provincial officers with sufficient technical expertise, is highly recommended.

between BDN programme areas and non-BDN programme areas with similar facilities. The community representatives of the BDN areas were encouraged to take responsibility for referring suspected tuberculosis cases to the nearest diagnostic centre, carrying out direct observation of treatment in diagnosed cases, assisting in defaulter tracing and educating family members of patients on preventive measures in association with women health volunteers and lady health workers.

All tuberculosis patients detected in the BDN areas during the first two quarters of the study were included. Representatives from village development committees, women health volunteers, women's and youth group members, and other community members, were given a 1-day orientation session on tuberculosis control using the DOTS strategy. Case detections and sputum conversions were then observed during the next three quarters and the results evaluated by analysing the quarterly reports of case detections and sputum conversions. Female members of the families of the studied tuberculosis patients were also encouraged to attend vocational training and literacy centres, and to educate family members on the prevention of tuberculosis and other health-related activities. The home health care package already developed by the BDN programme was employed for these activities. This included immunization of women of child bearing age and children, and the provision of regular and continuous family planning, growth monitoring and antenatal services to the family. The families were also supported to upgrade their environmental health and sanitation status, and were provided with income-generating loans to fight the disease through an increase in their financial status.

■ Main study findings

Most of the tuberculosis patients were aged 15–40 years of age with an almost equal male to female ratio (1.1). In the intervention area, 81, 88, and 129 new cases were detected in the first three quarters of the study, respectively, compared to 61, 79 and 87 in the control group ($P < 0.01$). The proportion of sputum smear-positive cases was significantly higher in the intervention group compared to the control group (Chi square test (1) = 8.21, $P = 0.004$). The incidence of new cases increased from a baseline of 39 to 40 per 100 000 to 71.2 and 52 per 100 000, in the intervention and control groups, respectively ($p < 0.05$).

An increase in the proportion of sputum smear-positive cases was also noticed over time (Chi square for trend = 3.84, $P = 0.0499$), whereby there was a 2.33-fold increase in the proportion of sputum smear-positive cases in the intervention area compared to the control area. In the intervention group, 19.7%

cases were sputum smear-positive in the first quarter, increasing to 27.2% in the second quarter and finally to 35.2% in the third quarter. While in the control area, smear-positive cases constituted 21.3% of cases in the first quarter declining to 17.2% of cases in the third quarter.

The proportion of sputum smear-positive cases was 23.5% and 20.7%, in the intervention and control areas, respectively, and was significantly lower than the proportion of sputum smear-negative cases in both groups. The proportion of extrapulmonary cases ranged 22%–25% in the intervention area compared to 7% in the control area. Using regression analysis, the predicted number of detected tuberculosis cases was $56 + 20.5$ (per quarter) in the intervention area compared to $49.7 + 13$ (per quarter) in the control area. Similarly, the predicted case-detection rate was $11.55\% + 8.6\%$ (per quarter) and $16.8\% + 3.6\%$ (per quarter), respectively.

■ Conclusions and recommendations

BDN programme areas reported significantly higher case-detection and sputum conversion rates compared to non-BDN programme areas. It is therefore recommended to involve the BDN programme in DOTS implementation and to expand it to the rest of the country.

Tuberculosis

Community participation

S u d a n

Community based tuberculosis-control programme in Yei county: experience in a war situation in south Sudan

Sudan

Yei county, Equatoria region, south Sudan

Study period:

September 2004–August 2006

Small Grants Scheme

(SGS) 2004 No. 59

Principal Investigator

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Abstract

A study was carried out to evaluate the effectiveness of community-based directly observed treatment, short course (CB-DOTS) in a post-conflict area with disrupted health infrastructure. An intervention study was done at the Malteser tuberculosis and sleeping sickness hospital, in which all newly diagnosed sputum smear-positive cases starting DOTS treatment during 2005 were enrolled. The hospital was used as a diagnostic centre as well as a treatment centre for the initial phase of tuberculosis treatment. Primary health care units served as treatment and supervision centres for community-based tuberculosis management. After discussions with chiefs, community leaders, community volunteers and community health workers were educated and trained in all aspects of tuberculosis control. The 2005 cohort was compared with the cohort of new sputum smear-positive cases registered during 2004. These patients

had been treated at the hospital for the whole six month period until they had completed treatment.

Results 160 sputum smear-positive cases were enrolled in 2005. Of these, 132 (82.5%) patients were cured of the disease after 6 months of treatment, 139 successfully completed treatment reporting a treatment success rate of 87%, 11 (7%) defaulted, 6 (4%) died, 2 (1%) reported treatment failure while 2 (1%) non-nationals were transferred to continue treatment in Uganda.

The 2004 cohort consisted of 148 patients. Of these, 112 (76.4%) patients were cured at the end of treatment, 25 (16.9%) defaulted, 8 (5.4%) died and 2 (1.4%) patients reported treatment failure.

The treatment success rate was significantly higher in the CB-DOTS group compared to the control group. In addition, a significantly lower default rate was reported among the CB-DOTS group.

Conclusions The study reported the effectiveness of CB-DOTS in improving the treatment success rate and reducing defaulting in post-conflict areas with disrupted health infrastructure.

Background

The recently concluded war in southern Sudan destroyed the tuberculosis infrastructure that had been in place before the war. The tuberculosis programme in southern Sudan was started in the late 1990s by international nongovernmental organizations.

Although the nongovernmental organizations implemented the WHO recommended directly observed treatment, short course (DOTS) strategy, the treatment interruption (default) rate in southern Sudan was noted to be high. In 2002, the default rate was 11.6% of all patients treated during that year. This was probably because almost the entire population of southern Sudan lives in rural areas where distances to the nearest health facility are high and transport means are almost non-existent.

Conclusions and implications of the study

■ The study reported the effectiveness of CB-DOTS in post-conflict areas with disrupted health infrastructure. CB-DOTS could be the ideal approach for tuberculosis control in areas with poor accessibility to health services.

■ These results have enabled the Ministry of Health to approve the Malteser proposal to expand CB-DOTS to neighbouring counties, namely Mundri and Meridi and to initiate it in Rumbek in Lakes state. Rapid expansion of CB-DOTS in southern Sudan and remote areas throughout the country is highly recommended.

■ Tuberculosis in Yei county is more common among males, accounting for more than 60% of cases, than females and affects the most productive age group. This observation could have several explanations in the context of southern Sudan. It is probably due to the effects of the recently concluded war in Sudan. Nearly all males in southern Sudan were recruited into the army and were based in confined and overcrowded military camps where health facilities were not available. This provided a conducive environment for the transmission of tuberculosis.

■ Both men and women face gender-related barriers to health services, but tuberculosis stigma is more pronounced in women than in men. While men worry about loss of wages and capacity to work, women fear rejection by family and community; marriage becomes difficult and divorce sometimes results.

In order to reduce this high treatment interruption rate, appropriate methods to ensure DOTS were devised. Among the many methods used to ensure patient compliance, community-based DOTS (CB-DOTS) has shown a high level of success and its implementation in southern Sudan could improve the access to health care of the mainly rural communities and reduce the cost of treatment in an area where there is low economic activity. It could also increase treatment success and significantly reduce treatment interruption. A study was therefore done to evaluate the effectiveness of CB-DOTS in a post-conflict area with a destroyed health infrastructure.

Materials and methods

Yei county is one of the 13 counties in Equatoria region in southern Sudan with an estimated population of about 250 000 people. It has 2 hospitals, 7 health centres and 41 primary health care units. The study was done at the Malteser tuberculosis and sleeping sickness hospital, which was used as a diagnostic and sputum smear follow-up centre as well as a treatment centre for the initial phase of tuberculosis treatment. The primary health care units in the counties served as the treatment and supervision centres forming the community-based tuberculosis management component of the study.

The study was an intervention study that involved all newly-diagnosed sputum smear-positive cases starting DOTS treatment at the Malteser tuberculosis and sleeping sickness hospital in the 1st, 2nd, 3rd and 4th quarters of 2005. Discussions with chiefs, community leaders, community volunteers and community health workers were initially conducted to familiarize them with the purpose and objectives of the study. Then, community health workers and community volunteers were trained. The training included basic knowledge of tuberculosis, treatment of tuberculosis, side effects of drugs and how to mark tuberculosis treatment cards.

Patients initiated treatment at the hospital where they were admitted for two months. After they had converted to being sputum smear-negative, they were discharged into the community to be followed up by either community volunteers or community health workers for the rest of the four month continuation phase. The role of the community health workers or community supervisors was to administer daily directly observed treatment to patients, mark out patient cards, mobilize the community and refer suspected new cases for tuberculosis investigation. These health workers were in turn supervised every two weeks by tuberculosis nurses from the Malteser hospital who ensured that there was a continuous supply of drugs, that patients' cards were marked properly and that community mobilization was continuously done. Follow-up of sputum smear

examinations were done in the 2nd, 5th and 6th months of treatment. The cohort was compared with a similar cohort of sputum smear-positive cases treated in the 1st, 2nd, 3rd and 4th quarters of 2004. These patients had been treated at the hospital for the whole six month period until they had completed treatment.

Main study findings

Of 160 sputum smear-positive cases enrolled in 2005, 110 (68.8%) were male and 50 (32.1%) were female with an average age of 31 years (12–70 years). In 2004, there were 148 new sputum smear-positive tuberculosis cases eligible to be included in the study. There was no significant difference between the intervention and control groups regarding age and sex of participants.

The intervention group reported a sputum smear conversion rate of 80.6% at the 2nd month of treatment. Of the 160 study subjects, 132 (82.5%) were cured after 6 months of treatment, while 139 successfully completed treatment reporting a treatment success rate of 87%, 11 (7%) defaulted, 6 (4%) died, 2 (1%) reported treatment failure and 2 (1%) non-nationals were transferred to continue treatment in Uganda.

The control group reported a sputum smear conversion rate of 80.4% at the 2nd month of treatment. Of the 148 patients, 112 (76.4%) were cured, 25 (16.9%) defaulted from treatment, 8 (5.4%) died and 2 (1.4%) reported treatment failure.

Therefore, the CB-DOTS group reported a significantly higher treatment success rate and lower defaulter rate compared to the control group. The cure, death and failure rates were higher in the CB-DOTS group compared to the control group but this was not statistically significant. The efficacy of the intervention was 49% i.e. CB-DOTS prevented 49% of unfavourable treatment outcomes (deaths, defaulting and failure).

Conclusions and recommendations

CB-DOTS can be effective even in war ravaged areas like southern Sudan. It could be the ideal approach for adequate tuberculosis control in areas with poor accessibility to health services. Rapid expansion of CB-DOTS in southern Sudan and remote areas throughout the country is therefore recommended.

Tuberculosis

Control

Pakistan

Assessment of factors affecting case-finding of tuberculosis patients and compliance with treatment: development of a health education model

Pakistan

Gujranwala district,
Punjab province

Study period:

November 2003–March
2005

Small Grants Scheme

(SGS) 2003 No. 130

Principal Investigator

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Abstract

A prospective cohort study was conducted at urban and rural health facilities in Gujranwala District, Punjab Province, in which 100 patients with pulmonary tuberculosis were enrolled. Two focus group discussions, one each for urban and rural areas, were organized. An additional focus group session was organized for the directly observed treatment, short course (DOTS) treatment supervisors. Data were collected at the time of recruitment and at the end of the intensive and continuation phases of treatment. The quantitative analysis of the cohort was integrated with the qualitative findings of the focus groups in order to develop a health education model.

Results The model describes those elements that should be targeted for health education in order to reinforce supporting factors and minimize impeding factors in seeking care and continuation with treatment.

Conclusions The study developed a culturally sensitive health education model for better tuberculosis control in Pakistan.

Background

Delay in seeking medical treatment and the abandonment of treatment before it becomes effective have become the main barriers to controlling tuberculosis. A study was therefore carried out to explore and describe the motives and reasoning of individuals with respiratory symptoms

seeking medical care and their subsequent adherence to the prescribed chemotherapy. The ultimate goal of the study was to use the generated knowledge to design a culturally sensitive health education model to improve compliance and treatment outcomes of tuberculosis patients.

Materials and methods

A mixture of quantitative and qualitative methods was used in the study. A prospective cohort study design was employed involving a cohort of 100 patients, equally divided between urban and rural areas, who were enrolled during the first quarter at two urban chest clinics and rural health centres in Gujranwala District.

The first interview was conducted at the health facility during recruitment, while the second and third interviews were conducted at the patient's residence, at the end of the intensive and continuation phases, respectively, regardless of the patient's compliance.

Four focus groups, involving the patients and their relatives, were also conducted to discuss the factors that facilitate or impede access and compliance to tuberculosis treatment. One additional focus group session was organized in each area for the directly observed treatment, short course (DOTS) treatment supervisors.

Based on the findings of the cohort study and focus groups, a health education model was developed by a technical working group made up of health care providers, health managers, donors, nongovernmental organizations and anthropologists. The model covered the different elements of tuberculosis treatment access and compliance that can be modified through a health education approach by targeting the patient, family, community and health care providers.

Conclusions and implications of the study

■ The proposed health education model for tuberculosis-DOTS focuses on the important elements that contribute to improving health care seeking behaviour and compliance with tuberculosis treatment.

■ The study identified three key factors that influence the behaviour change of patients pertinent to health education: patient perceptions and experiences of the disease and treatment options for the disease; support from the family, the community and community health workers; and negative influences of the family, the community and community health workers.

■ Main study findings

About half the patients were younger than 30 years of age, 56% were female, while 40% were illiterate, and most belonged to the lower socioeconomic levels.

Patients mentioned fever (82%), cough (75%) and cough with sputum (40%) as the main tuberculosis symptoms. About half said that living with untreated tuberculosis patients, malnutrition and sharing of utensils were causes of tuberculosis. Most believed that tuberculosis is a communicable, life threatening, curable and stigmatizing disease, and agreed that people should avoid the company of a tuberculosis patient.

There was no significant difference between defaulters and those who completed treatment in terms of socio-demographic characteristics and knowledge about the disease. However, a significantly higher proportion of those who completed treatment knew that tuberculosis is a communicable disease.

Of the 70% of patients who knew that they were suffering from tuberculosis, 70% had received information from doctors, 15.6% from traditional healers, 3.9% from health workers and 2.6% from other patients. Fever was the most common symptom (40%) that made patients seek medical care, followed by loss of weight, loss of appetite and cough.

First health-seeking behaviour at a health facility was delayed for more than 4 weeks in about half the patients, and only 20% sought health care within 2–3 weeks from the onset of symptoms. The reasons for delayed health-seeking behaviour were: use of other treatment or measures, poverty, lack of awareness and negligence. The main reasons for not seeking initial care at health facilities were: long distance, unavailability of drugs, lack of awareness of services, high cost and unsuitable opening hours of the health facility. Forty percent of patients sought care at services outside the National Tuberculosis Programme such as private practitioners, paramedics and traditional healers due to confidence in obtaining a cure, low cost of services and the popularity of these health care providers. The majority of patients were satisfied with the care delivered at health facilities.

There was a significant difference between urban and rural centres regarding the treatment outcome of patients. Patients treated in urban centres recorded a significantly higher treatment completion rate compared to those treated in rural centres, a higher death rate and a lower default rate. Patients felt that health workers were the best treatment supporters, followed by friends and neighbours. The factors that hindered patients from completing treatment were not feeling any improvement with treatment and the appearance of side-effects.

Focus Group Discussions A total of 70 respondents participated in the focus groups. Factors impeding the health-seeking behaviour of the patients

were initially, with the onset of symptoms, inadequate knowledge regarding the symptoms and causes of the disease. Knowledge was gained later, at the health facility during diagnosis. Other factors were the stigma of tuberculosis and financial problems, mainly concern of job loss when the need to take treatment at the health facility entailed missing work.

Factors impeding patient compliance to treatment were negative behaviours by some doctors, insufficient assistance from treatment supporters, an irregular supply of medicines, lack of proper testing facilities, travel costs and the poor effects of medicines, especially during the intensive phase. Factors impeding the efficiency of treatment supporters were the need to pay the travel fares of poor patients and for female treatment supporters (lady health workers) to accompany male patients to health facilities. In terms of family factors, most wives took adequate care of their husbands. The latter, by contrast, avoided their wives if they became sick. Mothers, sisters and literate family members were very supportive of patients.

Key factors that strongly determine patient behaviour pertinent to health education include: patient perceptions and experiences of the disease and treatment options; support from family, the community, community health workers and health workers at the health facility; and the negative influence of the family and the community. These were identified as target areas for health education messages and as components of the model.

Health education model For the patient there should be information about the disease (aetiology, prevention and treatment) and educational messages to minimize negative beliefs, including on the consequences of discontinuing treatment and addressing beliefs about the harmful effects of the drugs. For the family there should be educational messages on encouraging the patient to adhere to treatment, helping the patient to attend the health facility on the appearance of side-effects and helping the patient with social rehabilitation. For the community and community health workers messages should address the need to support the patient with the regular intake of drugs, reassure the patient on the appearance of side-effects, help the patient attend the health facility and correct any false beliefs that may influence patient behaviour. For health workers there should be training in communication skills.

■ Conclusions and recommendations

The health education model developed identifies target areas that need reinforcement and impeding factors in the patient, the family, the community and health workers that negatively affect patient behaviour. It is recommended that the model is implemented by the national control programme.

Tuberculosis

Defaulter tracing

Pakistan

Adherence of the national tuberculosis control programme to the DOTS-recommended defaulter tracing mechanism in North West Frontier Province, Pakistan

Pakistan

North West Frontier Province

Study period:

December 2004–November 2005

Small Grants Scheme (SGS) 2004 No. 6

Principal Investigator

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Abstract

A study was undertaken to evaluate the extent of adherence of directly observed treatment, short course (DOTS) facilitators and treatment supporters to DOTS defaulter tracing mechanisms in DOTS-implementing districts of North West Frontier Province (NWFP) and to provide suggestions on how to improve the existing DOTS defaulter tracing mechanism.

The study was carried out in five districts of NWFP. A total of 200 eligible study subjects were interviewed using a structured questionnaire. These included 50 DOTS facilitators and 150 treatment supporters, enrolled from 50 randomly selected health facilities, 10 from each of the five districts. Two focus group discussions were also held in which the reasons for interrupting treatment were discussed with some of the retrieved defaulters who provided recommendations for increasing adherence to treatment.

Results The majority of DOTS facilitators (76%) were paramedics (medical technicians,

lady health volunteers, drug dispensers), while majority of the treatment supporters (83%) were lady health workers. A great majority (90%) of the health facilities did not have a desk guide. Furthermore, 82% of treatment supporters had not received training in the DOTS strategy, and while 69% stated that they filled in the treatment support card themselves, it was observed that 79% did not do so correctly. The main reasons for defaulting mentioned in the focus groups were lack of a defaulter tracing mechanism and the lack of health education regarding hazards of treatment interruption.

Conclusions The main recommendations of the study are to give training to treatment supporters in the DOTS strategy, and to revise and make more comprehensive the guidelines on tracing DOTS defaulters.

Background

The use of a standardized short course drug regimen including direct observation of treatment is one of the five operational components of the directly observed treatment, short course (DOTS) strategy for tuberculosis. The direct observation of treatment component is intended to address patient non-compliance. Although the national tuberculosis control programme (NTP) in Pakistan has made noticeable progress during the last few years, the treatment success and case detection rates are far below the global targets of 85% treatment success and 70% case detection rates. A very high defaulter rate of approximately 30% is a challenge for the NTP interventions. A study was therefore undertaken to evaluate the defaulter tracing mechanism in North West Frontier Province (NWFP).

Materials and methods

A cross-sectional study was conducted between March and November 2005 in five randomly selected districts of NWFP (Peshawar, Mardan, Nowshera, Bannu and Mansehra), in which 10 health

Conclusions and implications of the study

■ The study reported sub-optimal adherence of health staff in various health facilities of NWFP to the DOTS defaulter tracing mechanism developed by NTP. The majority of treatment supporters had not received training in the DOTS strategy. Training should not be limited to those working in the public sector but should include those working in the private sector who treat tuberculosis patients.

■ One of the issues that emerged from the focus group discussion was that no health facility staff approach defaulters. This emphasized the lack of coordination in the DOTS defaulter tracing mechanism. It was also observed that during commencement of anti-tuberculosis treatment, patients were not told about side-effects, resulting in DOTS defaulting. Health education was also not provided. There is no proper monitoring of DOTS patients by treatment supporters.

■ The main study recommendations were to: develop comprehensive guidelines for the tracing of defaulting patients; train LHWs in the DOTS strategy and give them incentives for retrieving defaulted patients; provide desk guides to health facilities; educate patients about tuberculosis and DOTS; and ensure coordination between LHWs and other health facility staff.

centres were randomly selected from each of the five districts. From each centre, one DOTS facilitator and three treatment supporters were enrolled, giving a total sample size of 200 (50 DOTS facilitators and 150 treatment supporters). These were interviewed using a semi-structured and pretested questionnaire regarding their sociodemographic characteristics and the extent of their adherence to the defaulter tracing mechanism.

In addition, two focus group discussions were held for the defaulters that could be retrieved to explore the reasons for defaulting.

■ Main study findings

While 84% of the DOTS facilitators were male and one third were university graduates, 88% of treatment supporters were female and only 5% were university graduates, and more than half had completed their matriculation ($P < 0.05$). The majority (83%) of the treatment supporters were lady health workers (LHWs) followed by community volunteers (9%) ($P < 0.05$), while 44% of the DOTS facilitators were medical technicians, followed by medical officers (24%).

Around two thirds of DOTS facilitators had worked in the health facility for 1–10 years compared to 94% of treatment supporters ($P < 0.05$), but the majority of the treatment supporters (82%) had not received training on the DOTS strategy. On whether treatment supporters provide DOTS facilitators with information about defaulted patients, 99% of treatment supporters agreed compared to 50% of DOTS facilitators. Similarly, 48% of DOTS facilitators said that treatment supporters inform/meet them after four weeks of treatment interruption by a patient, while 75% of treatment supporters responded that they meet DOTS facilitators within less than a week (Cohen's Kappa = 0.3); 84% of DOTS facilitators compared to 97% of treatment supporters said they would try to retrieve the absent patient who was in the initial phase of anti-tuberculosis treatment within seven days of his/her absence.

There was agreement between the two groups regarding the difficulty in obtaining anti-tuberculosis medicines: 76% of DOTS facilitators and 87% of treatment supporters agreed that they had no difficulty (Cohen's Kappa = 0.6). The main difficulty cited by DOTS facilitators were transport problems (33%), while for treatment supporters it was absence of staff (35%).

Ninety per cent (90%) of health centres did not have a desk guide present. While 96% of DOTS facilitators responded that they filled in the TB-01 cards themselves and the same percentage of cards were properly filled, only 42% of TB-03 registers were properly filled. Although 64% of DOTS facilitators would declare a patient a defaulter after the treatment had been interrupted for one month, 26% would do

so after two months and 8% after more than two months.

A total of 88% of treatment supporters said that they visited the patient's home to provide anti-tuberculosis medicine, and 53% responded that the treatment support card was with the patient, while 38% kept it themselves. Although 69% of treatment supporters filled the treatment support card themselves, it was observed that 79% were not filled correctly.

Overall, 98% of DOTS facilitators and 99% of treatment supporters responded that they were not given any incentive to trace DOTS defaulters. Regarding measures that would be adopted to trace DOTS defaulters, 56% of DOTS facilitators and 98% of treatment supporters said they would visit the patient's home, while 8% of DOTS facilitators and less than 1% of treatment supporters would involve LHWs. The majority of defaulting patients in the five districts were in Peshawar (43%), followed by Mardan (26%) then Mansehra (24%).

The most important recommendation by DOTS facilitators and treatment supporters was to visit the defaulter patient's home followed by health education, having a copy of the patient's national identity card in order to be able to trace defaulters, having staff dedicated to tracing defaulters, involving locality elders, modifying the behaviour of the health facility staff, and having transport to enable defaulter tracing.

Some of the issues raised in the focus group discussions were: anti-tuberculosis medicines are stopped because of their side-effects; frequent changes of physician lead to no improvement in signs and symptoms, and treatment is abandoned; nobody from the health facility approaches patients after they default on treatment; health education is not given and the dangers of stopping anti-tuberculosis medication are not highlighted; treatment supporters are not trained to monitor the intake of medicines; and the role of the treatment supporters is not significant during treatment. The recommendations from the focus groups were that the quality of anti-tuberculosis medicines should be improved, guidance and health education regarding tuberculosis treatment should be provided and treatment supporters should be involved in DOTS defaulter tracing.

■ Conclusions and recommendations

The study found that the DOTS defaulter tracing mechanism is not fully implemented. Further technical support is needed in this area. Treatment supporters, especially LHWs, need training in the DOTS strategy.

Tuberculosis

Monitoring and evaluation

Pakistan

Strengthening the tuberculosis surveillance system under the DOTS strategy in Punjab

Pakistan

Punjab province

Study period:

December 2004–March 2006

Small Grants Scheme (SGS) 2004 No. 7

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Abstract

A study was carried out to evaluate the feasibility and impact of introducing an electronic recording and reporting system in Punjab with the ultimate goal of strengthening tuberculosis surveillance in the country. An experimental study was conducted in six districts in Punjab whereby an electronic recording and reporting system was introduced, with six other districts used as an external control. Data were collected using a structured questionnaire and by reviewing available reports at district headquarters. The impact of the intervention on the quality and timeliness of reporting was evaluated by comparing the intervention and control districts, as well as the pre- and post-intervention data.

Results All districts had established district project implementation units (DPIUs) and had functioning computers with the required software and telephone facilities. All districts had support staff but only five out of the six experimental districts had essential staff for

surveillance. At baseline, half the districts could provide correct answers about programme performance indicators (case detection rate and sputum conversion rate) and one third could provide correct answers about the early default rate, but none were able to provide information about the latest treatment success and default rates or other diagnostic centre indicators within their districts. Analysis of the available reports from experimental and control districts found that 93% of the reports due were available at the DPIUs in the experimental districts. Of these, 13% had some sorts of deficiency. Similarly, in the external control districts, 89% of the reports due were available and of these, 12% had deficiencies.

After the intervention, all districts provided correct figures about the case detection, sputum conversion, early default, treatment success and default rates in their districts. All districts were able to provide correct answers about the essential indicators of their diagnostic centres within the relevant district. Analysis of reports found that all reports due were available in the experimental districts, had been submitted on time, and no deficiencies were recorded. However, in the external control districts, 90% of the reports due were available at the DPIUs. Of these, 10% had some sort of deficiency.

District tuberculosis coordinators expressed a high level of satisfaction with the electronic surveillance system.

Conclusions The introduction of the electronic recording and reporting system at district level in Punjab resulted in strengthening of the surveillance system in terms of the availability of reports, quality of reports, freedom from error and timely submission. It was user friendly and easily accepted at district level. It is therefore recommended to introduce it in all districts nationally.

Background

Electronic recording and reporting systems in the health care sector have played a vital role in monitoring and evaluating programme performance and disease impact. Many countries have developed electronic recording and

Conclusions and implications of the study

■ The electronic recording and reporting system provides accurate information, reduces deficiencies and ensures timely submission of reports from districts to provincial level. It is therefore recommended to introduce it to all districts provided training and necessary equipment (computer and internet connectivity) is delivered. This will strengthen the existing reporting system at district level and will strengthen the surveillance system at provincial and national levels.

■ All DTCs found that the system was easy to use, time saving and provided accurate information about district and diagnostic centre performance indicators. They all agreed that the system helped in consolidating reports at district level, but did not allow report generation from tuberculosis registers at diagnostic centre level. They have therefore proposed to develop an electronic tuberculosis register at diagnostic centre level with the necessary training and equipment.

■ Introduction of the electronic recording and reporting system entails capacity building in data management and analysis for health care workers. This strengthens the health system through human resources development. The system also enhances the knowledge of health care providers regarding programme indicators.

reporting systems to strengthen their surveillance systems. In Pakistan, the tuberculosis surveillance system faces several challenges and needs to be strengthened. Different indicators for tuberculosis programme performance, such as directly observed treatment, short course (DOTS) coverage, case detection rate, sputum conversion rate and treatment success rate are calculated manually. The process is time consuming and many district supervisors forget the formulae for the different indicators. The reports are sometimes inconsistent or contain many errors, and are not submitted on time.

Given these difficulties, the provincial tuberculosis control programme in Punjab province developed an electronic reporting system for use at provincial level and found it user friendly, time saving and accurate. Most of the indicators are automatically calculated, consolidation of the reports received from different districts is automatically done and a common report for the province is automatically generated.

A study was therefore done of a district level pilot project to test the feasibility and impact of introducing the electronic recording and reporting system before its wider implementation in all districts nationwide.

Materials and methods

An intervention study was carried out in six randomly selected districts of the 22 DOTS-implementing districts of Punjab province. An electronic DOTS surveillance system was introduced in these districts and all six district tuberculosis coordinators (DTCs), their DOTS facilitators and computer operators attended training sessions. Another six districts were randomly selected as an external control.

Data were collected using a structured questionnaire and by reviewing available reports at district headquarters before and after the intervention. The following variables were used to compare between intervention and control districts, as well as pre- and post-intervention results: degree of error in reports; time of report submission to the Punjab tuberculosis control programme; and type of information provided. The acceptability of the electronic surveillance system with tuberculosis surveillance staff was assessed at the end of the study using a self-administered questionnaire.

Main study findings

Pre-intervention baseline situation All districts had established district project implementation units (DPIUs) and had functioning computers with the necessary software (Microsoft Office and Windows XP) and telephone facilities. All had support staff but only five had essential staff for surveillance. Half the districts could provide correct answers about programme performance indicators (case detection rate and sputum conversion rate) and one third about

the early default rate. However, all districts were unable to provide information about the latest treatment success and default rates or other diagnostic centre indicators within their districts.

Analysis of the available reports from experimental and control districts found that in experimental districts, of 1238 reports due, 1142 (93%) were available at the DPIUs. Of these, 149 (13%) had some sort of deficiency: 8% had calculation errors, 66% had inconsistencies, 17% had missing information and 3% had inaccuracies; 9 (6%) reports had more than one type of deficiency. Similarly, in the external control districts, of 2125 reports due, 1901 (89%) were available at DPIUs. Of these, 231 (12%) had deficiencies: 14% had calculation errors, 67% had inconsistencies and 13% had missing information; 16 (7%) reports had more than one type of deficiency.

Post-intervention results All DTCs, DOTS facilitators and computer operators participated in the post-test evaluation. Results showed that all districts had established DPIUs, had enough computers with the necessary software and had telephone facilities and staff. They all provided correct figures about the case detection, sputum conversion, early default, treatment success and default rates in their districts. All districts were able to provide correct answers about the essential indicators for the diagnostic centres within the district.

All available reports from experimental and control districts were collected and analysed. Reports from experimental districts were collected through the electronic reporting system. The results showed that in experimental districts, of 666 reports due, all were available at the DPIUs, were submitted on time and no deficiencies were identified. On the other hand, in the external control districts, of 603 reports due, only 545 (90%) were available at DPIUs. Of these, 52 (10%) had some sort of deficiency: 6% had calculation errors, 79% had inconsistencies, 12% had insufficiencies and 4% had more than one type of error.

All DTCs found the electronic surveillance system easy to use and time saving, and that it provided accurate information about the district and diagnostic centre performance indicators.

Conclusions and recommendations

The electronic recording and reporting system provides accurate information, significantly reduces deficiencies and ensures timely submission of reports from districts to provincial level. It is therefore recommended to introduce it to all districts provided that training and equipment are available. This will strengthen the existing reporting system at district level and will strengthen the surveillance system at provincial and national levels.

Tuberculosis

Quality of care

Syrian Arab Republic

Survey of physicians' usage of radiography and smear microscopy for pulmonary tuberculosis diagnosis and follow-up in Syrian Arab Republic

Syrian Arab Republic
Nationwide

Study period:
August 2004–August 2005

Small Grants Scheme (SGS) 2004 No. 6

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Abstract

A survey of registered physicians in the Syrian Medical Association was carried out during August 2004 and March 2005. These included general practitioners and chest, internal medicine and infectious diseases specialists. The aim was to evaluate their knowledge, practice and adherence to national guidelines regarding tuberculosis control. They were requested to fill self-administered questionnaires that were collected by field workers.

Results A total of 2000 registered doctors filled the questionnaire. Of these, 715 were in the private sector, 421 in the public sector and 864 in both. During the previous 12 months, 45.3% had treated tuberculosis patients. Almost all (99.6%) reported sputum smear microscopy as the main diagnostic test for tuberculosis, 92.7% had notified tuberculosis cases to the national tuberculosis control programme, 69.5% stated the correct drug regimen and 79.4% stated the correct treatment duration..

Conclusions Tuberculosis patients are mainly managed in the public sector and their health care providers are generally adherent to national tuberculosis control guidelines.

Background

Tuberculosis services are integrated into primary health care in the Syrian Arab Republic where the majority of health facilities belong to the public sector. Sputum smear microscopy and radiography are available in tuberculosis centres and general hospitals, and treatment is available free of charge in the public sector and is banned in the private sector [1]. Accordingly, tuberculosis cases diagnosed in other sectors such as nongovernmental health care institutions and the private sector are referred to the national tuberculosis programme (NTP) for treatment. A survey was therefore done to evaluate physicians' knowledge, practice and adherence to national guidelines regarding tuberculosis control in order to identify gaps that could be targeted in future interventions.

Materials and methods

A survey of the registered physicians in the Syrian Medical Association was carried out during August 2004 and March 2005. These included general practitioners and chest, internal medicine and infectious diseases specialists. They were requested to fill self-administered questionnaires that were collected by treatment observers working in the NTP.

The questionnaires included questions on age, years of experience, specialty, number of tuberculosis patients treated in the previous year, adherence to tuberculosis practices, availability and use of the NTP manual, contact with local tuberculosis programme personnel, and access to continuing education on tuberculosis. The questionnaire also

Conclusions and implications of the study

- The adherence of physicians to national guidelines in diagnosis and treatment of tuberculosis can be explained by the fact that almost two-thirds (64.3%) work in the public sector, and that anti-tuberculosis treatment is only available in the public sector. Accordingly, patients diagnosed in the private sector should be referred to the NTP for treatment.
- As only one third of physicians work in the private sector, their linking to the NTP will be much more feasible than in settings where the private sector is the main health care provider.
- Deficiencies reported in a small proportion of physicians included over-reliance on chest radiography for tuberculosis diagnosis, inadequate knowledge about treatment regimens and non-reliance on sputum microscopy for monitoring treatment response and assessment of cure. These deficiencies should be the target of future interventions. In addition, the NTP manual should be accessible to physicians in all sectors.
- Regular training of health care providers on national tuberculosis control guidelines is recommended in order to ensure their adherence to the guidelines and the provision of quality services to tuberculosis patients.

included questions about diagnostic tests used for initial diagnosis and subsequent follow-up and treatment regimens.

■ Main study findings

A total of 2000 registered physicians were enrolled in the study. Their mean age was 40+/-8.8 years, and the majority were male. They were mainly general practitioners (60.9%) or specialists in internal medicine (33.4%), chest (5.4 %) or infectious diseases (0.4%). The mean duration since graduation was 14.4+/-9 years. Overall, 715 (35.8%) physicians were in the private sector, 421 (21.1%) in the public sector and 864 (43.2 %) in both.

Of the 2000, 903 (45.2%) had managed tuberculosis cases during the previous year, and the number of cases was significantly higher for physicians working in both sectors. A total of 1475 (73.8%) stated that they would recommend a sputum smear examination to almost every patient with suspected tuberculosis, and 1814 (90.7%) would recommend three specimens when requesting a sputum smear examination. This was significantly higher in physicians working in the public or both sectors compared to those working in the private sector. The mean duration for collecting sputum was 2.8+/-0.5, 2.6+/-0.9 and 2.8+/-0.4 days in the private, public and both sectors, respectively ($P > 0.05$).

Though guidelines do not recommend reliance on chest radiography for diagnosis, 62.2% of respondents reported asking for chest radiography in cases of suspected tuberculosis, and this was significantly higher in physicians working in the public or both sectors in comparison to the private sector. The reasons for recommending chest X-ray were confirmation of diagnosis (63%), easier diagnosis of tuberculosis (4%) and differential diagnosis (1.6%).

Only 697 (34.9%) of the physicians knew that the NTP manual for tuberculosis control existed, and this was significantly higher in physicians working in the public or both sectors in comparison to the private sector.

A total of 1389 (69.5%) stated the correct drug regimen for CAT1, while 182 (9.1%) stated the incorrect regimen for CAT3, and this was significantly higher in the private sector. 1587 (79.4%) stated the correct treatment duration (6 months) with no significant difference between sectors.

The NTP manual recommends that sputum be collected during the course of treatment for tuberculosis as an indication of the patient's response to therapy as well as at the end of treatment to assess disease cure. While only a minority of physicians (9.2%) reported sputum smear examination alone as a measure to monitor treatment response and to assess the cure at the end of treatment, the majority

used sputum and X-ray or clinical examination and/or X-ray. Overall, 1853 (92.7%) notified tuberculosis patients to the tuberculosis centre with no significant difference between sectors. The majority (85.3%) reported that they maintain effective collaboration with the NTP.

■ Conclusions and recommendations

The study found overall adherence by physicians to NTP guidelines in diagnosis, treatment and follow-up of patients. Deficiencies reported in a small proportion of physicians included over-reliance on chest radiography for tuberculosis diagnosis, incorrect treatment regimens and non-reliance on sputum microscopy for monitoring treatment response and assessment of cure. These deficiencies should be targeted in future interventions. In addition, the NTP manual should be accessible to physicians in all sectors. Regular training of health care providers on NTP guidelines is also recommended in order to ensure adherence to the guidelines and the provision of quality services to tuberculosis patients.

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“Transferred out” as treatment outcome: the contribution to treatment success and testing of a better strategy for surveillance in Punjab

Pakistan
Punjab province

Study period:
December
2004–February 2006

Small Grants Scheme
(SGS) 2004 No. 8

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Tuberculosis

Treatment success

Pakistan

Abstract

An intervention study was carried out in three districts of Punjab for a period of six months to identify the final treatment outcome of patients who were initially reported as transferred out. A modified tuberculosis register was kept in all diagnostic centres of the three districts and DOTS facilitators were trained to make the required entries for patients who were reported as either transferred “out” or “in”.

Results 4442 patients were registered in the three districts during the two study quarters. Of these, 104 (2.3%) were reported as transferred out, and correct matching of “in” and “out” patients was possible for 74 (71.15 %). In 30 patients (28.8%) initially reported as transferred out this matching was not successful, and these patients could not be located in the modified register. Of the 104 transferred out cases, 17 were cured and 43

completed treatment. This resulted in adjusting the treatment success rate in the three study districts from 89.6% to 90.9% (1.3% increase).

Conclusions Adequate matching of patients transferred out and in was possible for two thirds of cases initially reported as transferred out. This resulted in increasing the treatment success rate by 1.3% in the three districts. If extrapolated at the country level, cumulative figures from all the districts are expected to yield a significantly higher treatment success rate for the country than the rate currently reported by the national control programme.

Background

The directly observed treatment, short course (DOTS) programme achieved 100% coverage throughout Pakistan in 2005. However, certain problems remain a challenge including non-compliance to treatment leading to multi-drug resistant tuberculosis, low case detection, a suboptimal treatment success rate and deficient recording and reporting of patients who are transferred out. To know the treatment outcome of patients who are transferred out, there is a need to establish strong linkages between diagnostic centres. A study was therefore done to identify the final treatment outcome of patients initially reported as transferred out.

Materials and methods

An intervention study was conducted in three districts of Punjab, namely Bahawalnagar, Gujranwala and Toba Tek Singh during April–September, 2005. The TB03 register was modified by adding three columns, one of which was labeled ‘concerned diagnostic centre’ and contained initial information about patients including place of initial diagnosis and start of treatment, as well as district tuberculosis number. The other two columns were labelled “transferred out” and “transferred in” and contained information about the treatment centres

Conclusions and implications of the study

■ With this intervention, 74 cases were correctly matched. This resulted in adjusting the treatment success rate from 89.6% to 90.9%. This indicates that adequate matching of transferred out and in cases can result in raising the treatment success rate by 1.3%.

■ The treatment success rate among matched patients was 57.7%, significantly lower than the original cohort. This is mainly because a considerable proportion of patients were not retrieved. This could be explained by missing information about the centres where they were transferred to or due to defaulting. However, it was not possible to determine the proportion of defaulters among this group. This indicates that in addition to the 13% default rate reported by the country an unknown proportion of defaulters could exist among transferred out patients.

■ Training DOTS facilitators on adequate recording of information and the electronic surveillance system should rectify the gaps related to the treatment outcome of transferred out cases.

■ In the first phase, there is a need to introduce an electronic system of data entry for all tuberculosis patients at district level to provide more accurate information about these patients. In the second phase, all diagnostic centres could be linked through the electronic surveillance system in order to retrieve patients in the different centres.

patients were transferred “out” from or “in” to for the continuation of treatment until its completion. These additional columns enabled the programme to trace the patient until completion of treatment to know the final treatment outcome. All patients who reported as ‘transferred out’ and ‘transferred in’ from the 40 diagnostic centres in the three districts were entered in modified TBO3 registers. DOTS facilitators were trained on how to make correct entries in the modified TBO3 registers. District tuberculosis coordinators were also trained to guide and supervise the project.

gaps related to the treatment outcome of transferred out cases.

■ Main study findings

During the study period, 4442 patients were registered in the three districts. Of these, 104 (2.3%) were entered as being “transferred out” in the modified TB03 register. Correct matching of those transferred “out” and “in” within the diagnostic centres of the districts was performed in 74 cases, while 30 cases were not retrieved and their treatment outcome results therefore remained missing to the health system.

There were significant differences between the three districts regarding the proportions that were correctly matched or lost from the health system. In Bahawalnagar, correct matching was performed for 34 out of 42 patients (81%), while 8 (19%) were lost, compared to 31 out of 47 (66%) matched and 16 (34%) lost in Toba Tek, and 9 out of 15 (60%) matched and 6 (40%) lost in Gujranwala. The treatment outcome of the 104 transferred out cases was: 16.3% cured ($n = 17$), 41.3% treatment completed ($n = 43$), 13.4% failure ($n = 14$), 28.84% defaulted/ transferred out ($n = 30$). The treatment success rate (cure rate + treatment completion rate) among the patients was 57.7%.

Correct matching of cases resulted in adjusting the treatment success rate from 89.6% to 90.9% ($P < 0.05$). This indicates that adequate matching of transferred “out” and “in” cases resulted in increasing the treatment success rate by 1.3%. The main reasons for failure in tracing patients were incorrect entries in registers, incorrect addresses given by patients or difficulty in locating patients who were transferred out to other districts.

■ Conclusions and recommendations

The study showed that adequate matching of patients transferred “out” and “in” for two thirds of cases initially reported as “transferred out” resulted in increasing the treatment success rate by 1.3% in three districts. If extrapolated at the country level, cumulative figures from all the districts are expected to yield a significantly higher treatment success rate for the country than the rate currently reported by the national tuberculosis control programme. Training DOTS facilitators on adequate recording of information and the electronic surveillance system should fill the

**Who makes the best
treatment supporter
for tuberculosis?
Evidence from DOTS
implementation in
Pakistan**

Pakistan
Balochistan and Punjab
provinces

Study period:
August 2004–June 2006

**Small Grants
Scheme
(SGS) 2004 No. 96**

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Tuberculosis

Treatment success

Pakistan

Abstract

A prospective cohort study was carried out in Jaferabad and Jhang districts in Balochistan and Punjab provinces, respectively, in Pakistan. The objective was to compare the treatment outcome of tuberculosis patients assigned to different types of treatment supporter. Four types of treatment supporter (health care workers, lady health workers, councillors and nongovernmental organization members) received training in the National Tuberculosis Control Programme module for lady health workers (LHWs), modified according to the needs of the other treatment supporter types. All 442 adult smear-positive patients registered in the first two quarters of 2005 in the two districts were assigned to one

of the four types of treatment supporter according to their preference. Records of the cohort were analysed to assess sputum conversion rates and treatment outcome according to the type of treatment supporter.

Results The majority of patients (225) selected LHWs as their treatment supporters.

In Jaferabad district, all patients supported by LHWs became sputum smear-negative after two months treatment, while in Jhang district, 14 patients remained sputum smear-positive. Sputum smear results were missing for about one quarter of cases in the two districts.

The treatment success rate (cure rate and treatment completion rate) was highest for health care workers, followed by LHWs, with no significant difference between these two types of treatment supporter (79.4% and 70.7%, respectively). However, the treatment success rate for councillors was 66.7% and for nongovernmental organization members was 55.2%, significantly lower than that obtained with the other types of treatment supporter.

Conclusions Based on these results, it is concluded that health care workers and LHWs are the recommended types of treatment supporter associated with high treatment success rates, while nongovernmental organization members are not recommended as treatment supporters unless adequately trained and supervised.

Background

WHO has promoted the implementation of directly observed treatment, short course (DOTS) by a treatment supporter as part of the wider DOTS strategy [1]. The direct observation of treatment by a treatment supporter aims to improve patient adherence to treatment, at least during the intensive phase (when rifampicin is given). The treatment supporters may then continue to supervise patients until the end of treatment by regularly monitoring patients, providing positive encouragement and, if necessary, tracing late attendees. A study was therefore made to evaluate

Conclusions and implications of the study

- Health care workers and LHWs are the recommended types of treatment supporter associated with high treatment success rates, while nongovernmental organization members are not recommended as treatment supporters unless adequately trained and supervised.
- The unavailability of sputum smear results of patients at different stages is an indicator of inadequate laboratory performance. The National Tuberculosis Control Programme needs to ensure an efficient laboratory quality assurance system.
- The National Tuberculosis Control Programme in Pakistan is piloting a project on the integration of tuberculosis control into primary health care centres with an enhanced role for LHWs. The study provided evidence that LHWs are the treatment supporters most accepted by patients, therefore their wide-scale involvement as treatment supporters is strongly recommended. This should be coupled with adequate training and supervision, targeting the gaps identified in the study.
- LHWs cover a population of 1000 each and have no means to trace defaulted cases out of their catchment area. An efficient coordination mechanism is required at facility level to report default cases and to obtain help from other LHWs or lady health supervisors in default tracing.
- Councillors as community leaders are a new addition to the health system in Pakistan. Their involvement in DOTS implementation needs to be further analysed. It is suggested that their use in advocacy and default tracing would be more useful than in treatment support.

patient preferences for the different types of treatment supporter and to identify the most effective types of treatment supporter.

■ Materials and methods

A prospective cohort study was conducted in Jaferabad and Jhang districts in Balochistan and Punjab provinces, respectively. All smear-positive adult tuberculosis cases registered during the first two quarters of 2005 were assigned to one of four types of treatment supporter according to their preference. A total of 1570 individuals were identified and trained for the treatment supporter role (30 health care workers, 720 lady health workers (LHWs), 600 councillors and 220 nongovernmental organization members. The National Tuberculosis Control Programme standard training module for treatment supporters was used, with minor modifications. All treatment supporters were requested to supervise daily intake of treatment, according to National Tuberculosis Control Programme protocols. The cohort of patients was followed up for the treatment results. Regular patient records were used to collect data on case-finding, sputum conversion and outcome. Data on the type of treatment supporter for each patient were recorded.

■ Main study findings

Of the 442 patients included in the study, 80% were between 15 to 55 years of age and there was a slightly higher proportion of males than females. The preferred type of treatment supporter for the majority of patients were LHWs, with some variation between districts. In Jaferabad district, health care workers followed by LHWs were the preferred types, whereas in Jhang district, LHWs were the most preferred type.

In Jaferabad district, all patients supported by LHWs seroconverted at two months treatment while in Jhang district, 14 patients remained sputum smear-positive. However, sputum smear results were not available for a considerable proportion of patients (22.6%). The cure rate of patients supported by LHWs was significantly higher than those supported by nongovernmental organization members, councillors or health care workers. However, the treatment completion rate of patients supported by health care workers was significantly higher than those supported by LHWs, nongovernmental organization members or councillors.

The death and default rates were significantly higher for LHWs and nongovernmental organization members compared to councillors and health care workers (death rates: 4% and 5.9% versus 0% and 0%, respectively; default rates: 11.1% and 16.9%, versus 0.7% and 3.2%, respectively). Transferred out rates were significantly higher among patients supported by nongovernmental organization members

and health care workers compared to those supported by LHWs and councillors (22.1% and 17.5% versus 13.3% and 5.6%, respectively). Treatment failure was only recorded in two cases supported by LHWs.

Patients supported by health care workers reported the highest treatment success rate (cure rate and treatment completion rate), followed by those supported by LHWs, with no significant difference between type. However, patients supported by nongovernmental organization members reported a significantly lower treatment success rate compared to those supported by health care workers or LHWs.

■ Conclusions and recommendations

Based on these results, health care workers and LHWs are recommended as treatment supporters and are associated with high treatment success rates, while nongovernmental organizations are not recommended as treatment supporters unless adequately trained and supervised.

The study also found that LHWs were the type of treatment supporter most preferred by patients. The weaknesses identified in each type of treatment supporter should be strengthened in order to improve the treatment outcome of tuberculosis patients.

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Tuberculosis

Public-Private Mix

Pakistan

Developing a viable model for public-private mix in urban Rawalpindi, Pakistan
Urban Rawalpindi

Study period:
January 2004–July 2005

Small Grants Scheme (SGS) 2003 No. 109

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Abstract

An intervention study in Rawalpindi was designed based on the findings of a previous baseline study conducted in 2003 about the knowledge, attitudes and practices of private practitioners regarding tuberculosis. The aim was to develop a viable model of public-private mix to involve private practitioners in directly observed treatment, short course (DOTS) implementation. From the 100 private practitioners involved in the previous study, 60 were selected. A consultative workshop was arranged to orient the practitioners on national tuberculosis control programme (NTP) guidelines for tuberculosis control. Practitioners were trained in the doctor's module on NTP guidelines for diagnosis and treatment of tuberculosis, and were provided with anti-tuberculosis drugs, sputum cups and the necessary recording and reporting tools. Practitioners had access to diagnostic facilities for their patients at the tuberculosis

centre in Rawalpindi.

Results Regular monitoring and supervision carried out by the NTP during the implementation of the study showed a significant improvement in the knowledge and practices of private practitioners after the intervention: all used sputum smear microscopy for diagnosis compared to a baseline of 1% in 2003; 57% correctly categorized patients compared to 4% in the baseline study; and 34% inquired about previous treatment history and 54% administered anti-tuberculosis drugs according to NTP guidelines compared to none in the baseline study. A significantly higher proportion managed their patients according to NTP guidelines or referred them to the NTP for diagnosis and treatment (31% compared to 19% in the baseline study).

Regarding treatment under supervision, more than half chose a treatment supporter for their patients, compared to none in the baseline study, and 40% maintained records for their patients compared to 3% in the baseline study. More than one third traced patients who interrupted their treatment or defaulted in comparison to 2% in the baseline study. Similarly, about half investigated patients' close contacts, while almost all in the baseline study had limited their contact tracing to a simple inquiry about symptoms.

Conclusions The study reported the successful implementation of the public-private model developed, which proved to have a beneficial impact on the practices of private practitioners. The implementation of the model at country level is therefore recommended.

Background

A descriptive cross-sectional study was carried out by the national tuberculosis control programme (NTP) in Pakistan in 2003 to evaluate the knowledge, attitudes and practices of private practitioners and the extent of their adherence to NTP guidelines. The results showed that private practitioners were not following NTP guidelines in diagnosing, treating and conducting follow-up of pulmonary tuberculosis patients. A follow-up study

Conclusions and implications of the study

■ The study developed and evaluated a public-private mix model that was successful in increasing referral and notification of patients from private practitioners to the NTP. It also found significant improvement in knowledge and practices of practitioners following training on NTP guidelines. The results highlight the need for regular training sessions for the private sector as part of routine NTP activity in order to strengthen collaboration and ensure their involvement in NTP activities and tuberculosis control.

■ Many important issues need to be taken into account in the development of public-private partnerships such as the commercial interests of private practitioners, their capacity and patient confidence. Most of the practitioners were satisfied and recognized the need for public-private partnership in the delivery of tuberculosis services. They emphasized the need for an effective feedback mechanism on referred patients.

■ The reasons mentioned by patients for seeking care in the private sector were the difficulty in finding service points and a lack of interest and care by public sector service providers during their visit for sputum smear microscopy. When the model was implemented, patients were pleased to receive medicine free of charge from their private practitioner, close to their home and without waiting in long queues. They suggested there should be separate counters for patients coming from the private sector.

was done to develop a viable model of public-private mix in tuberculosis control.

■ Materials and methods

Of the 100 private practitioners in the previous study in Rawalpindi, 60 were randomly selected. These were invited to a consultative workshop to agree on a mechanism for introducing the standardized directly observed treatment, short course, (DOTS) case management protocol in private practice, and devise a suitable strategy for collaboration between the sectors. In accordance with the agreed modalities, private practitioners were trained in the doctor's module on NTP guidelines for diagnosis and treatment of tuberculosis, and were provided with anti-tuberculosis drugs (to be prescribed free of charge), sputum cups and the necessary recording and reporting tools. The practitioners had access to diagnostic facilities for their patients at the tuberculosis centre in Rawalpindi.

Regular monitoring and supervision was carried out by the NTP during the implementation of the public-private mix strategy. The questionnaire that had been used in the initial baseline study to evaluate the knowledge, attitudes and practices of practitioners was used again to evaluate the impact of the intervention on case management. All practitioners involved in the study and 10 patients receiving treatment under the public-private partnership were interviewed at the end of the study. Their experience and views regarding the model of public-private partnership were reviewed.

■ Main study findings

The results showed a significant improvement in the knowledge of private practitioners regarding tuberculosis including knowledge of the causative organism, mode of infection, DOTS components and tuberculosis control activities. More than one third of practitioners correctly identified the duration of cough for a tuberculosis suspect compared to only 1% in the baseline study. More than half (57%) referred tuberculosis suspects to the tuberculosis centre for microscopy and 31% referred them for tuberculosis diagnosis and treatment, compared to 19% who referred tuberculosis suspects to the NTP in the baseline study. The study also found that 74% relied on sputum smear microscopy for diagnosis compared to a baseline of 1%, and 26% used X-ray, with or without erythrocyte sedimentation rate (ESR), in addition to sputum smear microscopy.

Similarly, there was a significant improvement in the following practices: categorizing patients before initiating treatment (57% correctly categorized patients compared to 4% in the baseline study); inquiring about previous treatment history (34% versus none, respectively); and administering anti-tuberculosis drugs according to NTP guidelines as fixed-dose

combinations provided by NTP (54% compared to none in the baseline study, where 97% had prescribed wrong regimens to patients). However, 3% prescribed anti-tuberculosis drugs to be purchased from the market and the rest did not prescribe drugs but referred patients to the NTP for diagnosis and treatment.

Regarding treatment under supervision, more than half choose a treatment supporter for their patients, compared to none in the baseline study. Family members, followed by health workers, were the preferred type of treatment supporter. While 40% of practitioners ensured the intake of the anti-tuberculosis drugs they administered to patients under observation, 31% did not ensure treatment under observation for patients managed by the NTP. Additionally, 40% maintained records for their patients compared to 3% in the baseline study.

More than one third of practitioners traced patients who interrupted their treatment or defaulted in comparison to 2% in the baseline study. Similarly, about half the practitioners investigated their patients' close contacts, while almost all those in the baseline study limited their contact tracing to a simple inquiry about symptoms.

The enrolled practitioners managed 82 patients during the study period who were followed up for their treatment outcome. The treatment outcome results were: 70% treatment success rate, 1.2% death rate, 22% default rate, 6% transferred out and 0% failure. The majority of practitioners were satisfied with the support provided by the NTP, mainly in relation to the provision of diagnostic services and an adequate supply of anti-tuberculosis drugs, and recognized the need for public-private partnership in the delivery of tuberculosis services. They emphasized the need for an effective feedback mechanism for referred patients.

Most practitioners recommended a separate reception counter to deal exclusively with patients referred by private practitioners. They had received complaints from patients attending the tuberculosis centre for sputum smear microscopy. Patients had faced difficulty in locating service points and complained of a lack of interest and care from service providers during their visits.

Most respondents expressed full satisfaction with the diagnostic services provided by the tuberculosis centre in Rawalpindi and appreciated the special arrangements such as facilitation at the reception and direct access to laboratory services for sputum smear microscopy and receiving test results.

■ Conclusions and recommendations

A workable model of public-private partnership was developed in consultation with private practitioners and tested in the study.

Tuberculosis

Public-Private Mix

Pakistan

Impact of training on the National Tuberculosis Control Programme guidelines on the notification of tuberculosis patients by private medical practitioners in Lahore, Pakistan

Pakistan
Lahore

Study period:
October 2003–February 2005

Small Grants Scheme (SGS) 2003 No. 161

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Abstract

A study was carried out to identify any association between the type of training of private medical practitioners on National Tuberculosis Control Programme (NTP) guidelines and increased notification of tuberculosis patients. For the study, 249 private medical practitioners were randomly allocated into either a 3-day training group (87) or a 1-day orientation group (162). After their training or orientation on NTP guidelines, they were asked to notify their tuberculosis patients on the revised TB03 form. Notifications by both groups were then analyzed for a 6 month period.

Results At baseline, private medical practitioners were not notifying their patients to the NTP. After training, the number of notifying private medical practitioners significantly increased during the following 6 months, with no significant difference between the two groups. However, the number of notifying private medical practitioners declined steadily after the first notification. The mean age of notifying private medical practitioners was significantly higher than non-notifying private medical practitioners (47.15 years and 42.80 years, respectively). In fact, the notification steadily increased from 12.5% in the age group of less than 30 years to 57.1% in the age group of more than 60 years. Similarly, notification was significantly better

by private medical practitioners who worked in the private sector only than by those who were also working in the public sector. Notification was not influenced by the gender or postgraduate qualification of the private medical practitioners.

Conclusions One-day orientation to private medical practitioners is sufficient to improve their notification practice. This orientation should be followed by the active follow-up of private medical practitioners to avoid a decline in notification.

Background

Several studies have revealed that private medical practitioners are not following the national tuberculosis control programme (NTP) guidelines regarding case notification, proper diagnosis, follow-up of tuberculosis patients, and prompt treatment. Other reports from Pakistan have shown that tuberculosis patients are not adequately treated in the private sector, and therefore remain an important source of infection in the community.

These results emphasize the need for regular training of private physicians on diagnosis and case management of tuberculosis. More importantly, functional collaboration needs to be established between private medical practitioners and the NTP to provide quality tuberculosis care services, thereby decreasing the burden of tuberculosis in the community. A study was therefore done to test a model of public-private mix, assess its impact on case notification, and compare the impact of two types of training delivered to private medical practitioners on case notification to the NTP.

Materials and methods

A quasi-experimental study was conducted in Lahore, in which 249 private medical practitioners providing care for tuberculosis patients were randomly allocated to two types of training group,

Conclusions and implications of the study

- A 1-day orientation of private medical practitioners on NTP guidelines is sufficient in terms of their role in notification. Involvement of private medical practitioners in other NTP/ DOTS activities is also crucial for achieving the target of a 70% case detection rate in Pakistan.
- Private medical practitioners of an older age group were more responsible in notifying tuberculosis patients than younger ones.
- Private medical practitioners working in the private sector only were more responsible in notifying tuberculosis patients than those who were also working in the public sector.
- From a programme point of view, a 1-day orientation of private medical practitioners on NTP guidelines with active follow-up may be the best option for increasing case notification.

162 for a 1-day orientation and 87 for a 3-day training course on NTP guidelines. During the training, the practitioners were interviewed using a structured and pretested questionnaire about their demographic characteristics, years since graduation, working status (part time/full time in private sector), willingness to participate in the training sessions and reasons, and their practice of notification of tuberculosis patients to the NTP.

The notification form was developed as a modification of the TB03 form and was distributed to the practitioners during the training sessions. The notification of tuberculosis patients by both groups was followed up for 6 months after the intervention.

■ Main study findings

The majority of the doctors in both training groups were in the age group 40–49 years, and female doctors constituted 8% and 9.6% of practitioners in the 1-day orientation and the 3-day training groups, respectively. As regards the employment status of the practitioners, 44.0% and 30.8% in the 1-day orientation and the 3-day training groups, respectively, were working in some governmental or semi-governmental organizations.

Of the 202 private medical practitioners (out of 249) who actually attended the training groups, 66 had done post-graduate study in any specialty. Of the 162 practitioners initially enrolled in the orientation group, 150 (92.6%) were willing to attend the session, and 52 out of the 62 (83.9%) initially enrolled were willing to attend the 3-day training.

Reasons for attending the training groups were to obtain a certificate for training, establish collaboration with the NTP and explore incentives for the patient and the doctor. Reasons for non-participation in the training groups were: shortage of time because of commitment to patient care in the clinic, lack of incentives and not feeling the need because of confidence in the treatment they already deliver to tuberculosis patients.

During the period May–October 2004, the largest number of private medical practitioners who notified tuberculosis patients was in the first month after the intervention, when 36 (24%) and 10 (19.2%) practitioners notified the NTP of their tuberculosis cases in the 1-day orientation and 3 day training, respectively.

The number of private medical practitioners notifying the NTP of their tuberculosis patients decreased slowly in both groups, until the last month when only 5 (3.3%) and 3 (5.8%) practitioners of the 1-day orientation and 3-day training, respectively, did.

The highest rate of notification was done by private medical practitioners of the age groups 50–59 years and 60 years old and older, who constituted 57.1 % and 39.3% of notifying practitioners, respectively.

The mean age of notifying private medical practitioners was significantly higher than those who did not notify patients to the NTP (mean = 47.15 and 42.80 years, respectively, $P < 0.05$). In fact, the notification rate steadily increased from 12.5% in the age group of less than 30 years to 57.1% in the age group of more than 60 years. In addition, there was a significant association between notification and working status, whereby a significantly higher notification rate was reported among practitioners working in the private sector only compared to those also working in governmental jobs (27.5% and 15.9%, respectively, $P = 0.03$).

On the other hand, there was no significant association between notification practice and gender or postgraduate qualification. Regarding the cost of the intervention, the cost of training per physician in the training group was US\$ 30 compared to US\$ 10 in the orientation group.

■ Conclusions and recommendations

A 1-day orientation of private medical practitioners on NTP guidelines with active follow-up is an efficacious intervention to increase their notification of tuberculosis cases. It is therefore recommended to be implemented and expanded countrywide and in other tuberculosis endemic countries. There is also a need for further studies on the impact of different mechanisms of notification and incentives on the notification rate of private medical practitioners.

Tuberculosis

Public-Private Mix

Yemen

The impact of orientation and training of private practitioners on the notification of tuberculosis patients to the National Tuberculosis Control Programme in Sana'a, Yemen

Yemen
Sana'a

Study period:
November 2003–April
2005

**Small Grants
Scheme
(SGS) 2003 No. 169**

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Abstract

A study was made to test a model of public-private mix in Sana'a, assess its impact on case notification and the case detection rate, and to compare the impact of two types of training delivered to private medical practitioners on their case notification to the National Tuberculosis Control Programme (NTP). A total of 246 registered private medical practitioners working full/part time in the private sector and providing care for tuberculosis patients in Sana'a were randomly allocated to two types of training group: 186 for a 1-day orientation and 60 for 3-day training on NTP guidelines. At baseline, a register was established in the NTP during the last two quarters of 2003 in order to register the referred and notified patients from each private medical practitioner. During the training, the practitioners were interviewed and were given referral forms. All patients referred from these practitioners during the last two quarters of 2004 were registered.

Results The intervention produced a significant increase in the number of notified cases from 62 to 286 before and after the

intervention, respectively. The total number of private medical practitioners who notified tuberculosis patients also increased significantly from 16 to 115 after the intervention. There was no significant difference between the two groups regarding the number of patients notified or the number of notifying private medical practitioners after the intervention. The case detection rate in Sana'a has significantly increased from a baseline of 66.5% in 2003 to 74.9% in 2004.

Conclusions The study reported the successful impact of the two types of training on case notification by private medical practitioners and the impact of the intervention on the case detection rate. Therefore, a 1-day orientation, being less costly than the 3-day training, is the recommended type of training to be implemented by the NTP.

Background

Recent reports from Yemen and other countries in the Eastern Mediterranean Region show that at least one third of new tuberculosis patients visit one or more private medical practitioners before reaching the national tuberculosis control programme (NTP). Research has also found that the private sector is not adherent to NTP guidelines in the diagnosis and management of tuberculosis patients, which contributes to the delayed treatment of patients.

In view of this situation, it is clear that tuberculosis control cannot be achieved without establishing effective collaboration and coordination between the NTP and private medical practitioners. A study was therefore made to test a model of public-private mix in Sana'a, assess its impact on case notification and the case detection rate, and compare the impact of two types of training delivered to private medical practitioners on case notification to the NTP.

Materials and methods

A quasi-experimental study was conducted in Sana'a, in which 246

Conclusions and implications of the study

■ The study reported the successful impact of training private medical practitioner on notification of tuberculosis patients to the NTP and the impact of the intervention on the case detection rate. The intervention increased the case detection rate from a baseline of 66% in Sana'a to exceed the global target of 70%. This is a successful model that could be replicated in other Yemeni cities and other endemic countries.

■ There was no significant difference between the impact of the two types of training on case notification and referral. Therefore, a 1-day orientation, being less costly than the 3-days training, is the recommended type of training to be implemented by the NTP.

■ Private medical practitioners are willing to collaborate with the NTP in management of tuberculosis patients in Sana'a. In order to ensure their active collaboration in tuberculosis control, their needs should be taken into consideration. These include: increasing communication between the NTP and private medical practitioners, establishing coordination strategies for diagnosis and follow-up of patients, increasing the number of diagnostic centres and integrating tuberculosis services into all health services

registered private medical practitioners working full/part time in the private sector and providing care for tuberculosis patients in Sana'a were enrolled. At baseline, a register was established in the NTP in order to register the referred and notified patients from each private medical practitioner during the last two quarters of 2003 before the intervention. The register provided the baseline data needed to perform a comparison of rates before and after the intervention to evaluate the impact of the intervention. Eligible and consenting private medical practitioners were then randomly allocated to two types of training group: 186 for a 1-day orientation and 60 for 3-day training on NTP guidelines.

During the training, the practitioners were interviewed using a structured and pretested questionnaire. Referral forms were also distributed to the practitioners for use when referring patients to the NTP. Health personnel in the NTP were trained to register cases referred from private medical practitioners and to collect the referral forms. All patients referred from private medical practitioners in the post-intervention period during the last two quarters of 2004 (July–December 2004) were registered.

■ Main study findings

The mean age of the private medical practitioners was 36.97 years, ranging 25–74 years, with half aged 31–40 years, and the majority were male (83.7%). Of the 246 practitioners, 118 (49.4%) had a postgraduate degree, and 204 (82.9%) worked part time for the public sector. More than half were general practitioners, and the rest were mainly internists, with only three chest specialists.

A total of 245 private medical practitioners had diagnosed tuberculosis patients during the previous 6 months, with 185 and 60 attending the orientation and training groups, respectively. Within the orientation group, 174 (94%) of practitioners had diagnosed 1–10 cases during the previous 6 months and 11 (6%) had diagnosed more than 11 cases. Within the training group, 51 (85%) had diagnosed 1–10 cases during the previous 6 months and 9 (15%) had diagnosed more than 11 cases. Only 16 private medical practitioners had notified tuberculosis patients in the 6 months prior to the intervention: 9 in the orientation group and 7 in the training group.

There was no significant difference between the two groups regarding age, gender, qualifications, affiliation to the public sector, or number of tuberculosis cases diagnosed or notified during the 6 months prior to the study. However, the number of tuberculosis cases treated during this period was significantly higher in the orientation group.

The intervention produced a significant increase in the number of notified cases from 62 to 286 before and after the intervention, respectively. In the

orientation group, the number of notified cases increased from 23 to 209, compared to an increase from 39 to 78 in the 3-day training group, but this was not statistically significant. In the orientation group, 9 out of 186 practitioners (4.8%) had notified tuberculosis patients to the NTP; this number increased to 85 (45.6%) after the intervention. Similarly, in the 3-day training group, the number of practitioners who notified tuberculosis patients increased from 7 (11.7%) to 30 (50%) after the intervention. Regardless of type of training, the total number of practitioners who notified tuberculosis patients increased significantly from 16 (6.5%) to 115 (46.7%), with no significant difference in notification between the two groups.

The case detection rate also increased significantly from a baseline of 66.5% in 2003 to 74.9% in 2004. The cost of the training per practitioner was US\$ 27 for the 3-day training and US\$ 9 for the 1-day orientation. Although 216 (87.8%) practitioners were willing to participate in NTP activities, many felt that more communication is needed to sustain future collaboration. Other suggestions were for: regular provision of the new referral sheets; feedback about referred patients; coordination strategies for diagnosis and follow-up of patients; health education; meetings and seminars; a free telephone line for communication between the NTP and private medical practitioners; increasing the number of diagnostic centres; and integrating tuberculosis services into all health services.

■ Conclusions and recommendations

This successful public-private mix model was effective in achieving the global target of a 70% case detection rate. As there was no significant difference between the impact of the two types of training on case notification and referral, the less costly 1-day orientation is the recommended type of training to be implemented and expanded countrywide and in other tuberculosis endemic countries.

Tuberculosis

Public-Private Mix

Egypt

The impact of orientation and training of private medical practitioners on the notification of tuberculosis patients to the National Tuberculosis Control Programme in Sharkia governorate, Egypt

Egypt

Sharkia governorate

Study period:

September

2003–November 2004

Small Grants Scheme

(SGS) 2003 No. 171

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Abstract

A study was carried out to test a model of public-private mix in Sharkia governorate, assess its impact on case notification and the case detection rate, and compare the impact of two types of training delivered to private medical practitioners on case notification to the national tuberculosis control programme (NTP).

A total of 225 registered private medical practitioners working full/part time in the private sector and providing care for tuberculosis patients in Sharkia governorate were randomly allocated to two types of training group: 167 for a 1-day orientation and 58 for 3-day training on NTP guidelines. The practitioners were interviewed about the number of patients diagnosed, treated and referred to the NTP during the 6 months preceding the intervention (training). During the training, they were given referral forms, and then all patients referred/notified by them during the 6 months following the intervention were registered by the NTP.

Results There was a significant increase in the number of referring/notifying private medical practitioners from 11 (4.9%) at baseline in the pre-intervention phase to 36 (16%) in the post-intervention phase, with no significant difference between the two training groups regarding the number of notifying private medical practitioners following the intervention. Moreover, the intervention produced a significant increase in the number

of notified cases from 19 before the intervention to 234 afterwards. As a result, the smear-positive case detection rate increased significantly from 44% in 2003 to 54% in 2004. Between the two types of training, there was no significant difference regarding the number of notifying private medical practitioners, but the 1-day orientation resulted in a significantly higher number of tuberculosis patients notified.

Conclusions The study reported the successful impact of the two types of training on case notification by private medical practitioners and the impact of the intervention on the case detection rate. Therefore, the 1-day orientation, being less costly than the 3-day training, is the recommended type of training to be implemented by the NTP.

Background

Research has found that most of tuberculosis patients initially consult local private medical practitioners because they are readily accessible and often affordable. It has also been shown that the private sector does not adhere to National Tuberculosis Control Programme (NTP) guidelines in the diagnosis and management of tuberculosis patients, which contributes to the delayed treatment of the patients.

In Egypt, including Sharkia governorate, there is almost no notification of tuberculosis patients by private medical practitioners. A study was therefore made to test a model of public-private mix, assess its impact on case notification and the case detection rate, and compare the impact of two types of training delivered to private medical practitioners on case notification to the NTP.

Materials and methods

Sharkia governorate was selected because of its low reported case detection rate of 46% in 2003, and the availability of a complete database of private medical practitioners in both urban and rural areas.

Conclusions and implications of the study

- The study reported the beneficial impact of raising the awareness of private practitioners about early detection of suspected tuberculosis cases on their case notification to the NTP.
- The 1-day orientation resulted in a significantly higher number of notified/referred patients compared to the 3-day training. Therefore, a 1-day orientation, being less costly than the 3-day training, is the recommended type of training to be implemented by the NTP.
- The collaboration strategy between the private sector and NTP tested in this study should be implemented countrywide in order to achieve a 70% case detection rate.

A quasi-experimental study was then conducted in the governorate, in which 225 respondents working full/part time in the private sector and providing care for tuberculosis patients were enrolled. The private medical practitioners were then randomly allocated to two types of training group; 167 for a 1-day orientation and 58 for 3-day training on NTP guidelines.

During the training, the practitioners were interviewed using a structured and pretested questionnaire about the number of patients diagnosed, treated and referred to the NTP during the 6 months preceding the intervention (training). Referral forms were also distributed to the practitioners for use in referring patients to the NTP. Health personnel in the NTP were trained to register cases referred from private medical practitioners and to collect the referral forms. All patients referred from private medical practitioners in the 6 months following the intervention (February–July 2004) were registered. Surveillance data were compiled on total tuberculosis notification in the governorate during the period February–July in both 2003 and 2004.

■ Main study findings

The private medical practitioners included in the study represented 97% of all chest physicians, 51% of all general practitioners and 53% of all internists in Sharkia. Of the 225 private medical practitioners, 86 (38%) had diagnosed tuberculosis patients in the 6 months before the intervention, with a maximum number of diagnosed patients of 15 per private medical practitioner. A total of 43 (19%) private medical practitioners had treated tuberculosis patients before the intervention, with a maximum of 12 per practitioner. Only 11 (4.9%) had notified tuberculosis patients before the intervention.

The two training groups were comparable with respect to specialty, gender, managerial authority, cases diagnosed, treated and notified in the 6 months before the intervention, and cases notified to the NTP during the 6 months following intervention. However, those who had never diagnosed or referred a patient before were more likely to be in the orientation group.

The number of referred patients increased significantly from 19 to 234 in the 6 months following the intervention. In the orientation group, the number of notified cases increased from 10 to 188, compared to an increase from 9 to 46 in the 3-day training group. Therefore, between the two training groups, a significant difference was only reported from the orientation group, with no significant difference in the number of notified/referred cases from the 3-day training group. This is despite the number of notified patients being significantly higher in the training group compared to the orientation group before the intervention.

In addition, the number of private medical practitioners referring at least 1 patient in the 6 months following the intervention increased significantly following the intervention from 11(5%) to 36 (16%), before and after the intervention, respectively, ($P = 0.0001$). In the orientation group, 29 (17.4%) private medical practitioners referred at least 1 patient afterwards, compared to 7 (12%) in the 3-day training group, which was not statistically significant ($P = 0.34$).

During February–July 2003, 289 tuberculosis patients (all types) were notified to the NTP, while during February–July 2004, 314 patients were notified, of whom 301 were smear-positive. With a total population of 4.3 million in Sharkia, the smear-positive notification rate was 3.07/100 000 and 3.79/100 000, before and after the intervention, respectively. With an estimated smear-positive incidence rate of 7/100 000 per 6 months, the case detection rate was 43.9% and 54.2%, before and after the intervention, respectively ($P < 0.05$). Therefore, the intervention had a significant impact on the case detection rate in Sharkia governorate. Regarding the cost of the intervention, the cost of training per physician in the training group was US\$ 21 compared to US\$ 7 in the orientation group.

■ Conclusions and recommendations

This successful public-private mix model was effective in increasing case notification and the case detection rate in Sharkia. As the 1-day orientation resulted in a significantly higher number of patients being notified while being less costly than the 3-day training, it should be implemented and expanded countrywide and in other tuberculosis endemic countries.

Tuberculosis

Public-Private Mix

A f g h a n i s t a n

Tuberculosis and the private sector in Afghanistan: a quantitative and qualitative assessment

Afghanistan
Kabul

Study period:
March 2004–February
2005

**Small Grants
Scheme
(SGS) 2003 No. 215**

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Abstract

A study was carried out to examine involvement of the private sector in tuberculosis control. Baseline information regarding the number of private practitioners in Kabul was obtained from the Ministry of Public Health and the department of census and population at the Ministry of Internal Affairs. A total of 193 private practitioners, representing 10% of private practitioners, were enrolled from the 16 districts of Kabul. They were requested to fill in self-administered questionnaires including information about the extent of adherence to the guidelines. Qualitative information was collected during 5 focus group discussions held during a workshop that was organized for the training of the private practitioners, and 400 referral sheets were distributed. In addition, 560 patients filled in questionnaires including information regarding their sociodemographic characteristics, knowledge, attitudes, health seeking behaviour and satisfaction with care. Following the workshop, a 6-week pilot project was carried out in the 16 districts to assess the impact of the intervention (the training workshop) on the adherence of private practitioners to the National Tuberculosis Programme (NTP) guidelines, including their case referral to the NTP.

Results The study found inadequate adherence of private practitioners to NTP guidelines. However, the majority of private practitioners expressed interest in learning about the directly-observed treatment, short

course (DOTS) strategy. Patients treated at NTP clinics were however satisfied with the quality of care and drugs delivered, and had adequate knowledge regarding the disease, its treatment and duration, receiving a complete description of the site of disease, and sputum examination results, during treatment. Post-intervention evaluation showed a significant improvement in adherence of private practitioners to NTP guidelines and a 20% increase in the number of notified cases attributed to private sector referral of tuberculosis cases in the quarter following the intervention.

Conclusion and recommendations

Training of private practitioners led to a significant increase in the number of cases referred to the NTP and in the extent of their adherence to NTP guidelines regarding the DOTS strategy. It is therefore recommended to repeat these workshops at regular intervals and expand them countrywide in order to achieve tuberculosis control.

Background

It is widely assumed that a substantial portion of tuberculosis patients in Afghanistan seek treatment from the private for-profit sector. That tuberculosis cases seen in the private sector are not reported to the Ministry of Health may at least partially explain the large gap between the numbers of estimated and notified cases of the disease. A study was therefore made to identify possible interventions to ensure that tuberculosis patients seeking care in the private sector are adequately managed according to the directly-observed treatment, short course (DOTS) strategy.

Materials and methods

A quasi-experimental study was conducted in the 16 districts of Kabul. The sampling of private physicians was proportional to the number of physicians in each district, which was considered the study cluster. Details of the private practitioner and clinic distribution in the

Conclusions and implications of the study

- Private practitioners are not aware of NTP guidelines under the DOTS strategy. Unless intensively trained on these guidelines, they pose a significant threat to effective tuberculosis control in the country.
- The trained private practitioners were motivated to adopt the DOTS strategy and to be involved with the public sector in tuberculosis control, and encouraged untrained private practitioners to do so. This finding indicates the potential that exists for their successful involvement in tuberculosis control.
- Based on the successful outcome of this study, the NTP has decided to expand the model throughout the country.

city were obtained from the Ministry of Health and department of census and population at the Ministry of Internal Affairs.

A cross-sectional phase was then conducted to collect baseline information regarding the number of private practitioners in the city: 193 self-administered questionnaires evaluating knowledge and practice regarding tuberculosis and its control were distributed to private practitioners. In addition, 600 questionnaires were distributed equally for patients presenting in both the public and private sectors. The questionnaires requested the information on sociodemographic characteristics, accessibility to the health facility, clinical features and satisfaction with care.

A two-day workshop was conducted for private practitioners. Sixty private sector practitioners participated in the workshop, along with National Tuberculosis Programme (NTP) doctors and representatives of WHO, Japanese International Cooperation Agency (JICA) and MEDIAR (a nongovernmental organization); 400 referral sheets were distributed to the private practitioners for use in referral of their suspected and confirmed tuberculosis cases to the NTP.

Focus group discussions focused on the following topics: how to encourage tuberculosis patients to adopt the DOTS strategy; the reasons for patients' preference for the private sector in diagnosis and treatment; measures to improve the situation; means to implement NTP guidelines; means of collaboration between private and public sectors; and the role of NTP in raising awareness of the private sector about NTP guidelines under the DOTS strategy. Following the workshop, a six-week pilot project was initiated in the study districts to evaluate the impact of the training workshop on the practice of the private practitioners and their case referral to the NTP.

■ Main study findings

Of the 193 questionnaires distributed to private sector practitioners, 175 were collected, while 560 patient questionnaires were completed. Case management and treatment in the private sector was generally poor and inadequate: anti-tuberculosis drugs were prescribed without reliable diagnostic techniques; and practitioners were not aware of the DOTS strategy, case definition, patient categorization, treatment duration, treatment regimens or doses. Sputum smear examination was not performed by 95% of private facilities due to lack of trained staff and/or equipment, hence patient follow-up by sputum smear microscopy was also not performed. There was no established system for recording and reporting of cases and monitoring treatment outcome, and no contact investigation existed. In addition, expensive anti-tuberculosis drugs of doubtful quality are

prescribed by private sector practitioners and purchased on the market.

Patients managed in the private sector complained of the shortage of tuberculosis diagnostic and treatment centres, this being their main reason for seeking care in the private sector. They were unaware of the nature of their disease, the importance of being treated under the DOTS strategy and the availability of free services in the public sector. The majority stopped treatment within 2–3 months due to the high cost of drugs or after initial improvement. Others were administered drugs for more than the recommended duration. However, many sought care in the public sector when they were informed about the availability of free services. On the other hand, patients were treated in the public sector according to the DOTS strategy and were satisfied from the care delivered in the public health services. Moreover, the patients received monthly incentives, which plays a major role in motivating them to adhere to treatment, and ensures proper DOTS implementation.

The results of the post-training six-week pilot project showed a significant increase in the private practitioners' adherence to NTP guidelines under the DOTS strategy and in their case referral during the post-intervention quarter. Of 1040 patients registered at NTP centres in that quarter, 194 were referred by private practitioners; a 20% increase in case-finding due to private sector involvement

■ Conclusions and recommendations

Private practitioners' practices are not in line with NTP guidelines under the DOTS strategy, which poses a significant threat to effective tuberculosis control in the country. Great efforts should be made to expand their involvement in tuberculosis control by implementing training for the private sector as a routine activity of the NTP.

Tuberculosis

Public-Public Mix

Pakistan

Involving medical colleges and tertiary care hospitals in DOTS implementation in Pakistan

Pakistan
Peshawar and
Abbotabad

Study period:
October 2004–March
2006

Small Grants Scheme (SGS) 2004 No. 9

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Abstract

An intervention study was undertaken to involve medical colleges and their tertiary care hospitals in directly observed treatment, short course (DOTS) implementation. Three teaching hospitals in Peshawar were selected for intervention and the chest specialists and medical officers were invited to a consultative meeting to agree on a public-public mix strategy. It was agreed that both hospitals would provide DOTS services according to national tuberculosis control programme (NTP)-approved protocols to a well defined catchment area.

Patients from outside the catchment area were referred after diagnosis with a note to a primary health care centre. The provincial tuberculosis control programme provided microscopes, reagents, drugs and reporting tools. Training was delivered to the doctors, laboratory technicians and DOTS facilitators. Two teaching hospitals, with an almost equal

number of health care providers to the intervention hospitals and located in a distant geographical area (Abbotabad), were included as control hospitals where no intervention was applied. The knowledge and practices of the health care workers, and the number of patients managed in the intervention and control hospitals, before and after the intervention, were compared.

Results There was a significant difference between the knowledge and practices of doctors working in the intervention hospitals compared to those working in the control ones, and compared to the baseline situation. During last quarter of 2005 in the intervention hospitals, 656 patients presented with a cough of more than three weeks and 1350 smear examinations were performed. Of the cases were registered, 40, including 13 sputum smear-positive, were from the catchment population, while 42 sputum smear-positive patients were from outside the catchment area and were referred to a primary health care centre with a reference note; 18 feedback reports were received from primary health care and 10 referred patients came for follow-up.

Conclusions Chest specialists and staff of tertiary care hospitals can be sensitized, trained and involved in the DOTS strategy through training and support from the NTP.

Background

Several reports highlight the need to engage private practitioners in general, and university specialists, in particular, in directly observed treatment, short course (DOTS) implementation. This will be reflected in their practices and teaching activities, benefiting future health care providers.

Materials and methods

An intervention study was carried out in three teaching/tertiary care hospitals in Peshawar. Two teaching hospitals, with an almost equal number of health care providers to the intervention hospital and located in a distant geographic area

Conclusions and implications of the study

■ The implementation of DOTS in tertiary care hospitals should be properly planned with the involvement of all stakeholders including hospital management, pulmonology and pathology departments, national and provincial tuberculosis control programmes and district health departments responsible for primary health care.

■ The most significant change that occurred as a result of the tested public-public mix strategy was assigning dedicated staff for maintaining records and communicating with the primary health care network through reference notes and the two-way mechanism that was established between the tertiary care hospitals and primary health care, a link that was absent for the control hospitals.

■ Though the impact of the intervention was not evaluated in terms of case detection rate and treatment success due to the duration of the study, it is expected that the intervention will improve these indicators due to the large number of patients recorded and treated according to NTP guidelines. These two key elements of the DOTS strategy did not exist before the intervention or in the control hospitals.

■ Training of undergraduate and postgraduate doctors will have an effect in the long run as a majority of these doctors will work as chest specialists or will manage tuberculosis suspects in the private sector.

(Abbotabad) were included as control hospitals.

A consultative meeting was held with university physicians working in the chest units to agree on a strategy of collaboration in DOTS implementation with the NTP. The main barriers to collaboration were the adoption of different regimens in the university, lack of a proper referral mechanism between tertiary care hospitals and primary health care, reliance on chest X-ray rather than sputum smear microscopy for diagnosis, lack of a recording and reporting system in the university context and the need for capacity building in DOTS implementation.

These concerns were addressed by developing the following the public-public mix strategy:

1. The tertiary care hospitals developed a DOTS committee for supervision.
2. The provincial tuberculosis control program provided microscopes and anti-tuberculosis drugs.
3. Training on the recommended training modules.
4. Patients from the catchment area were diagnosed
 - in the outpatient department of the hospital
 - according to the NTP recommended protocol
 - including the provision of free drugs under direct observation.
5. The chest unit of the hospital maintained adequate records and sent quarterly reports to the district tuberculosis coordinator.
6. Tuberculosis patients not from the designated catchment area were diagnosed and referred with a note to the primary health care centre nearest to their place of residence based on a list of centres with available DOTS facilities provided by the district tuberculosis coordinator.

Patients diagnosed at the intervention hospitals were sent to a primary health care centre facility with a note from the physician for supervised treatment at the primary health care centre. However, the clinical assessment of the patient at the end of the intensive phase and follow-up during the continuation phase was performed by hospital chest specialists. Hospital records were checked for the number of patients diagnosed as tuberculosis cases and those referred to primary health care centres by chest/medical physicians.

Feedback on patients referred to primary health care centres was collected for a period of three months after the intervention. All patients registered as pulmonary tuberculosis and those referred to primary health care centres were followed until completion of their intensive phase of treatment. The knowledge and practices of the trainees were evaluated before and after the intervention, as well as between the intervention and control hospitals. Hospital records were reviewed to see how many tuberculosis patients were registered and how they

were being diagnosed and treated. The number of cases referred from the enrolled chest specialists in the catchment area before and after the intervention, and between the two groups, was compared.

■ Main study findings

There was a significant difference between the knowledge and practices of doctors working in the intervention hospitals compared to those working in the control ones, and compared to the baseline situation. The results of the study show that sputum smear microscopy was the main tool for diagnosis of tuberculosis and patients were categorized and prescriptions were made according to NTP recommended protocols.

The chest units maintained patient records and developed close coordination with the provincial tuberculosis control programme, district health department and primary health care network. During the last quarter of 2005, 656 patients presented at the chest outpatient departments with symptoms of a cough of more than three weeks: 40 patients were registered in the tertiary care hospitals as tuberculosis patients; 13 (32%) were sputum smear-positive and 22 (55%) were extrapulmonary tuberculosis mostly referred from other departments of the hospital. These patients were registered and treated at the tertiary care hospital, while 42 sputum smear-positive patients were referred to primary health care in different areas of the province; only 10 (23%) reported back for follow-up after completion of the intensive phase. The department of pulmonology of the control hospital, although providing outpatient care to almost 100 patients with respiratory symptoms daily, had no records available for comparison. Interviews with the head of department and other staff revealed that on average, 10 tuberculosis patients are seen per week and diagnosis is based on clinical assessment, chest X-ray and sputum microscopy but no laboratory register was available for confirmation. No anti-tuberculosis drugs were available in the hospital store and patients buy medicine from the market. There was no recording and reporting system and no referral mechanism existed for referral to primary health care.

■ Conclusions and recommendations

The study found that a practical model can be established in tertiary care hospitals and that case management practices were improved after establishing linkages between tertiary care and primary health care. Due to the duration of the study, the impact of the intervention was not evaluated in terms of case detection rate and treatment success. However, it is expected that the intervention will improve these indicators given the number of patients treated in tertiary care hospitals that were not reported previously.

Vaccine preventable diseases

Disease burden

Pakistan

**Burden of
*Haemophilus
influenzae* type b
disease in Pakistani
children**

Pakistan
southern Sindh

Study period:
September 2003–July
2005

**Small Grants Scheme
(SGS) 2003 No. 111**

Principal Investigator

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Abstract

A study was carried out to estimate the burden of meningitis due to *Haemophilus influenzae* type b (Hib) in children under 5 years of age in two urban centres of southern Sindh in Pakistan. This information was critical for decision-making about the introduction of Hib vaccine as a routine vaccine in the country's Expanded Programme on Immunization (EPI). Prospective surveillance was set up in 8 sentinel sites in Karachi and Hyderabad. Participating hospitals/paediatricians were requested to send cerebrospinal fluid (CSF) specimens collected from any child younger than 5 years of age clinically suspected to have acute bacterial meningitis to their respective laboratory collection points for investigations. Patients

with confirmed Hib meningitis were followed for 3 months to assess complications.

Results During the 12 month surveillance period, the surveillance system detected a total of 1481 eligible children with suspected acute bacterial meningitis. Of these, specimens from 237 (16%) children met criteria for possible bacterial meningitis. Of them, Hib was detected in the CSF of 45 children (18.9%), and pneumococci in 34 (14.3%). More than 90% of Hib meningitis cases were in children less than 1 year of age, and all cases from Hyderabad were younger than 1 year of age. The minimum detected incidence rate of Hib meningitis in metropolitan Hyderabad and the surrounding area was 7.6 per 100 000 children under 5 years of age per year.

Conclusions Hib is most common cause of bacterial meningitis in children in Pakistan. Hib vaccination should be routinely included as part of the EPI.

Conclusions and implications of the study

■ Hib was detected in 19% of children with possible bacterial meningitis in Karachi and Hyderabad, making it the most common cause of acute bacterial meningitis in children in these cities. The minimum detected rate of 7.6 per 100 000 population under the age of 5 for Hyderabad is likely to be a significant underestimate because it was not possible to detect cases managed in the private sector. In addition, many children with suspected meningitis do not undergo lumbar puncture for a variety of reasons.

■ On the assumption that the surveillance system captured 10%–20% of Hib meningitis in Hyderabad, an adjusted annual incidence of 38–76 per 100 000 children under the age of 5 years per year could be derived, which is substantial, and comparable to rates observed in many African and Latin American countries.

■ A striking finding is that most Hib meningitis is concentrated in the very young age group, with more than 90% of disease observed in the under 1 year old population, and almost half in children less than 6 months of age. Hib meningitis adjusted incidence rate in the infant age group in Hyderabad is thus around 190–380 per 100 000 children under the age of 1 year per year.

■ Hib meningitis represents only a fraction of the burden of invasive Hib disease, although it is the most severe form of invasive disease with a high rate of permanent disability. The clinical syndrome of pneumonia is much more common, and results in many more deaths, but is under-recognized because of the difficulty in obtaining appropriate specimens. These results support the decision to introduce Hib vaccine in order to reduce childhood mortality in Pakistan.

Background

Haemophilus influenzae type b (Hib) is an important childhood pathogen, causing pneumonia, meningitis and sepsis, primarily in children less than 5 years of age. Use of the Hib vaccine has been shown to decrease the incidence of radiologically-confirmed pneumonia by 21% in the Gambia and 22% in Chile in controlled trial settings [1, 2]. For over a decade, the Hib conjugate vaccine has been part of routine childhood immunizations in industrialized countries where Hib invasive disease has virtually disappeared [3]. However, despite the availability of the vaccine for over 15 years and its proven efficacy, many obstacles have prevented most developing countries from introducing Hib vaccination in their Expanded Programme on Immunization (EPI) due to the fact that health policy decision-makers need to understand the magnitude of the disease burden and cost of disease to society, which has not

been easy to demonstrate because of inadequate surveillance capacities.

A review of the experience in four developing countries that had recently introduced Hib immunization showed that local surveillance and severity data were critical in the decision to adopt Hib vaccine [4]. Another deterring factor has been the high cost of the vaccine compared to other routine vaccines in the EPI. However, many developing countries have undertaken cost-effectiveness exercises and found the vaccine to be cost-effective. Thus, there is an urgent need for local data on the Hib disease burden to enable decision-making on vaccine introduction in resource-poor countries such as Pakistan. A study was therefore done to estimate the burden of meningitis due to *Haemophilus influenzae* type b in children under 5 years of age in two urban centres (Karachi and Hyderabad) of southern Sindh in Pakistan.

Materials and methods

Prospective surveillance was set up in 8 sentinel sites in Karachi and Hyderabad fulfilling the following criteria: easy accessibility for patients; greater than 50 paediatric beds; large catchment population of > 250 000 people; 24-hour availability of skilled personnel to perform lumbar punctures for cerebrospinal fluid (CSF) analysis; and close proximity to an Aga Khan University Hospital (AKUH) laboratory collection point for quality-assured laboratory facilities. In addition, all paediatric consultants were informed about the study and the availability of free CSF analysis at AKUH for any patient they suspected to have possible bacterial meningitis.

Participating hospitals/paediatricians were requested to send CSF specimens obtained from any child younger than 5 years of age and clinically suspected to have acute bacterial meningitis to their respective AKUH laboratory collection point. CSF received in the AKUH laboratory underwent immediate analysis for cell count. If the cell count was greater than or equal to 30 cells per mm³, then latex antigen testing for Hib, pneumococci and *Neisseria meningitidis* was performed using Wellcogen antigen detection kits. CSF culture was only performed for CSF specimens with abnormal cell count or biochemical profile that had negative latex antigen tests. Patients with proven Hib meningitis diagnosed at the National Institute of Child Health were followed up for 3 months to assess complications of illness.

Main study findings

During the 12 month surveillance period, the surveillance system detected a total of 1481 children aged less than 5 years who underwent lumbar puncture for suspected acute bacterial meningitis. Of these, specimens from 237 (16%) children met

criteria for possible bacterial meningitis (cell count > 100 per mm³, with polymorphonuclear predominance, glucose < 40 mg/dl). Of these, Hib was detected in the CSF of 45 children (18.9%) and pneumococci in 34 (14.3%). Of the 45 children with Hib meningitis, 28 were from Karachi and 17 were from Hyderabad. More than 90% of Hib meningitis cases were in children less than 1 year of age, and all Hyderabad cases were younger than 1 year of age. The youngest child with Hib meningitis was 11 days old.

The minimum detected incidence rate of Hib meningitis in children under 5 years of age in metropolitan Hyderabad and the surrounding area (a catchment population of approximately 222 855 children aged under 5 years) was 7.6 per 100 000 children under 5 years per year. Follow-up information was available for 15 children with confirmed Hib meningitis. Of these, 5 suffered mild to moderate neurological sequelae, and 3 (20%) severe sequelae. There were no deaths.

Conclusions and recommendations

These results indicate that Hib is the most common cause of bacterial meningitis in children in Pakistan and there is a substantial burden of invasive Hib disease. Hib vaccination should be routinely included as part of the country's EPI.

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Vaccine preventable diseases

Immunization coverage

Pakistan

Causes of low tetanus toxoid immunization coverage of pregnant women in Lahore district, Pakistan

Pakistan
Lahore

Study period:
November 2003–October 2004

Small Grants Scheme (SGS) 2003 No. 90

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Abstract

A study was conducted in Lahore district, Pakistan, to assess the causes of low tetanus toxoid (TT) immunization coverage at community, health care delivery and management level. A multistage stratified random sampling technique was used to select 362 married women who delivered full term babies during a one year period. They were interviewed using a pretested questionnaire. Interviews with directors of primary health care facilities and health managers, as well as focus group discussions were also done.

Results Of the 362 women, 87% had received two doses of TT immunization, but only 17% had received five doses of TT. Antenatal care had been received by 85% of women during the last pregnancy; this was significantly associated with educational level. About 88% of women heard had about TT vaccine, but of these, 44% were not aware of its advantages. The main causes for not

having two doses of vaccine were not knowing about the importance of vaccination (33%) and not knowing the place and time to get vaccinated (19%). According to the health managers and primary health care facility directors, the main reasons for low coverage are lack of community awareness regarding the disease and false beliefs about TT vaccination.

Conclusions The coverage of TT vaccination is satisfactory with regards to the two doses. Further improvement can be obtained by raising awareness among women through the media.

Background

The WHO/UNICEF/UNFPA recommended strategies for achieving MNT elimination are: providing at least two doses of tetanus toxoid (TT) to all pregnant women in high risk areas, and three TT doses to all women of childbearing age; promoting clean delivery services to all pregnant women; and ensuring effective surveillance for MNT.

Pakistan is one of eight countries that account for 73% of all neonatal tetanus deaths in the world. Maternal tetanus immunization is implemented as part of the routine immunization programme. In 2002, the expanded programme on immunization (EPI) reported 80% coverage of children and about 38% TT2 coverage of pregnant mothers in Pakistan. A study was therefore made to assess the different causes of the low immunization coverage of TT2 in pregnant women.

Materials and methods

A household survey was conducted in Lahore district, in which 362 married women were interviewed using a pretested questionnaire that gathered information on sociodemographic characteristics, last pregnancy, knowledge about TT vaccination, TT vaccination status and causes of non-vaccination. Six focus group discussions

Conclusions and implications of the study

- TT2 coverage among the mothers was relatively high (87%) but only 17.1% of had received five injections. Although this coverage is higher than the provincial coverage (62%), it is still below the target of 100% for pregnant women. Attempts should continue to increase coverage with special focus on causes of low coverage.
- More than three quarters of TT vaccinations took place at government health facilities. The outreach teams were responsible for less than one quarter of all TT vaccinations. This indicates the need to revisit the present strategy of immunization which gives emphasis to outreach activities.
- Antenatal care had a strong impact on TT2 coverage. TT vaccination is an important component of antenatal care and increase antenatal visits by pregnant women will increase coverage.
- Low community awareness about the disease and the importance of vaccination was identified as the most important reason for low TT coverage; other reasons were related to management and service delivery.
- If a proper awareness campaign using all available channels is launched, and supported by strengthening of the immunization delivery system, it is possible to achieve 100% TT2 coverage of pregnant mothers.

were conducted, each group consisting of married women and their husbands, lady health workers, traditional birth attendants and the vaccinators of the area. Directors of primary health care centres situated in the union councils were selected and five key people responsible for EPI activities in the district were interviewed.

■ Main study findings

The majority (96%) of respondents were aged 16–35 years old, and one quarter were illiterate; 85% had made one or more antenatal visits during the last pregnancy, with a significant association between frequency of antenatal care visits and educational level. Antenatal care was mainly delivered by a physician (68%) followed by dai (midwives) (17%) and other health care providers. The reasons for not receiving antenatal care were long distance between residence and health centre, and being busy. The last delivery occurred at home for 38% of respondents, followed by public hospitals (35%) and private health facilities (26%), with only 1.9% taking place at health centres.

The majority of the respondents (88%) had heard about TT vaccination, and this was significantly associated with educational level. Of these, 44% were unaware of the benefits of TT and only 13% knew that TT vaccination protected mother and child. The main source of knowledge was physicians, with the media playing a minor role (4%).

In the interviews, 87% reported having received two doses of TT, mainly in the first pregnancy, and this rate decreased with TT3 onwards. However, most of those who claimed to have been vaccinated did not have vaccination cards. The public governmental health facilities were the main providers of vaccination, with the outreach team playing a minor role (less than 15% for the different doses), and vaccination during supplementary immunization activities being almost negligible ($\leq 1\%$). There was a significant association between vaccination status and both educational level and antenatal care delivery.

The most common reasons for low coverage identified by health managers were lack of awareness regarding TT coverage and false beliefs regarding TT injections. They all agreed that TT coverage can be improved by enhancing public awareness and community participation, and by strengthening supervision of health workers.

According to the primary health care directors, the main reasons for low coverage were lack of awareness regarding TT immunization among the public, misconceptions and false beliefs regarding TT coverage, and negative attitudes and behaviour of mothers-in-law and husbands. Their main suggestions for improving coverage were creating awareness among the public through health education using all types of media, effective implementation of the national

programme for family planning and primary health care, and through strengthening supervision of vaccinators.

Focus group discussion revealed the inadequate knowledge held by the women, their husbands and traditional birth attendants regarding the disease, its mode of transmission and severity, and the consequences of not being vaccinated. By contrast, almost all lady health workers and vaccinators involved in the focus groups were well aware of all aspects of the disease and its vaccination.

Almost 80% of traditional birth attendants thought that the TT vaccination is good for the growth of baby and the mother, and only 20% recognised unhygienic measures during delivery as the main cause of infection. However all lady health workers, and traditional birth attendants, and a few women, knew the significance of cleanliness during delivery in the home or other places.

Most participants, except for the vaccinators and lady health workers, thought the vaccine would act as a contraceptive rather than for the prevention of tetanus, because it was provided by the government. They also thought it would cause abortion. They were against vaccination because of the pain and swelling it causes in the arm, which hinders them from performing their duties. Old women considered it useless because they had given birth to children without TT vaccination and had not faced any problems. Some women considered the TT injection to be *garrm* (hot) in nature, which could harm the baby. Other misperceptions were that the disease was caused by evil looks from devils, *djinn* and other evil creatures. The most common reason for not being vaccinated was that the respondent did not know the importance of TT vaccination (33%), followed by knowing the place and time of vaccination (19%).

More than 90% women reported they had not been visited by vaccinators or other health workers, and had not been educated about the importance of vaccination. However, they reported that lady health workers emphasized the importance of vaccination for their children's but not for themselves. Few women mentioned that nearby health facilities lacked vaccination services.

■ Conclusions and recommendations

Eighty-seven percent of women are protected against tetanus in Lahore district, the capital of the province and the focus of all health activities. Still, 13% of women were unprotected against tetanus. TT2 coverage in other parts of the province will not be better than in the provincial capital. The main reasons for not achieving 100% coverage are lack of awareness among communities, de-motivated health workers and unfilled vaccination staff positions. To achieve the target of 100% TT coverage, both short term and long term interventions are needed.

Vaccine preventable diseases

Immunization coverage

Pakistan

Age-appropriate immunization coverage of the under one year old children and married women in Gadap Town, Karachi, Pakistan

Pakistan
Gadap Town, Karachi

Study period:
November
2003–November 2004

Small Grants Scheme
(SGS) 2003 No. 119

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Abstract

A study was carried out to determine the age-appropriate Expanded Programme of Immunization (EPI) coverage of under-one year old children and tetanus toxoid (TT) coverage of their mothers (15–49) in periurban Karachi, to identify geographical areas with poor coverage (less than 80%) and to identify the factors associated with low EPI coverage. Utilizing a 30-cluster sampling technique, 7 households with infants were randomly selected per cluster. Children's mothers were interviewed regarding the EPI coverage of their children, their own TT vaccination status, and other demographic and potential risk factors for low vaccination.

Results Forty-five percent of the infants were appropriately covered. The mothers' TT coverage in the index pregnancy was 57.3% for both TT doses. Using the multivariate model, four factors were found to be significantly associated with children's immunization status: type of house construction (a proxy indicator of socioeconomic status), mother's TT vaccination status, years since marriage and

parents' educational status.

Conclusions The EPI coverage in Gadap Town, Karachi is low. Educating the community about the health hazards of non-adherence to the vaccination schedule of the EPI and increasing the accessibility of the community to public vaccination services are highly recommended.

Background

The infant mortality rate (IMR) in Pakistan is 83/1000 live births and the maternal mortality ratio (MMR) is 500/100 000 live births. The immunization coverage is also inadequate, with 67% of children vaccinated with BCG, 63% with DPT 3 (diphtheria, pertussis and tetanus, three doses) and OPV 3 (oral polio vaccine, three doses) and 57% with measles. The tetanus toxoid (TT) coverage of pregnant women is reported at between 56%–57%. By enhancing the expanded programme on immunization (EPI) coverage, the IMR and MMR can be reduced.

A study was therefore carried out to determine the EPI coverage of children under one-year of age and the TT coverage of married women of childbearing age in Gadap Town, Karachi, Pakistan. It also sought to identify geographical areas with poor coverage (less than 80%) and the risk factors for inappropriate vaccination coverage.

Materials and methods

A cross-sectional study was conducted in Gadap Town, Karachi, in which seven children under one-year of age and their mothers were randomly selected per cluster using the 30-cluster sampling technique. In each selected village, the mothers of the selected children were interviewed regarding the immunization status of their children and their own TT vaccination status. EPI cards were checked whenever available and children were examined for BCG scars. The

Conclusions and implications of the study

- The age-appropriate vaccination coverage for under one-year old children in Gadap Town, Karachi, was 44.8%. For the index pregnancy, the TT coverage for women was 57.3%, whereas for previous pregnancies the coverage was 66.7%.
- None of the union councils was adequately covered. Union Council 6 recorded the highest coverage rate of 78.57%.
- Unlike private services, public dispensaries provide free-of-charge services, but are fewer and people have to travel longer distances to reach them, incurring travel expenses and lost working days.
- The determinants of having no or incomplete vaccination coverage were: the type of house construction as surrogate indicator for the socioeconomic status, mother's TT vaccination status, years since marriage and parental educational levels.
- Mothers' TT coverage status was significantly related to the children's EPI coverage status, which reflects the health seeking behaviour of the more aware mothers who are making good health choices for both themselves and their children.

mothers were also interviewed regarding their sociodemographic characteristics, reproductive history, health services utilization pattern, reasons for non-compliance with the EPI schedule, knowledge of immunization and satisfaction with available vaccination services. The immunization coverage of the children was recorded on the form and a decision regarding its age-appropriateness was made based on the recommended EPI schedule.

■ Main study findings

Overall, 210 women and their under one-year old children were enrolled in Gadap Town. The EPI coverage of the children was 44.8% and the mothers' coverage for the two doses of TT was 57.3%; 51 mothers had never received TT vaccination in their lifetimes, and 12 had received one dose only. The rest of the women had received either between 2–5 doses of TT (64.8%) or, in the case of 11 women, more than 5 doses of TT vaccine (5.2%).

Physicians were the most common providers of TT vaccination for mothers (50.7%), followed by primary health care centres (27%) and lady health workers (13.9%). A small proportion was vaccinated by mobile vaccination teams (4.9%) and traditional birth attendants (1.4%). Most of the women had to travel a distance of more than 5 km to get vaccinated (45.8%). A small proportion of women (15.3%) had received vaccination services at home, either by a mobile team, lady health workers or traditional birth attendants.

More than 40% of women received TT free of charge, while the rest reported having spent either less than 20 rupees (17.7%), between 20–40 rupees (24.7%) or more than 40 rupees (17.1%) on the vaccination and travel to the facility.

When asked about the reasons for not being vaccinated, 37.5% women said that it was not beneficial for them, or mentioned the long distance between the vaccination centre and their residence (32.2%). Other reasons given were fear of pain, domestic constraints or the misconception that it could harm their foetuses.

EPI coverage of all union councils was determined taking into account the proportion of children vaccinated out of all children studied. None of the union councils in Gadap Town had a coverage of 80% or above. Union Council 6 had a coverage of 78.57%, while Union Council 1 and Union Council 3 had coverages of 60.7 and 57.1%, respectively. The rest of the union councils had coverages of less than 40%.

Most of the infants were vaccinated with BCG vaccine and OPV 0 (76.2%). DPT 1 and OPV 1 were received by about 61%, DPT 2 and OPV 2 by 49%, and DPT 3 and OPV 3 by 45%. Only 26.7% had received measles vaccination. Hepatitis B vaccine

coverage was 23.75%. The age-appropriate immunization coverage for children under one-year old was therefore 44.8%. There were 25 (11.9%) children in the study sample that had not been vaccinated at all. Children received vaccination mainly at government hospitals (49.1%), followed by primary health care centres (29.2%) and general practitioners (14.3%). Health workers (3.8%) and mobile health teams (1.9%) were other sources of vaccination.

The distance travelled to get a child vaccinated was more than 5 km in many cases (43.7%). About 40% of the families reported walking to the centre to get their children vaccinated, 33.5% used public transport and 26% used private transport. About 40% reported that their children's vaccinations were free of charge, 18% reported a cost of less than 20 rupees, 24.7% a cost of 20–40 rupees and 17% a cost of more than 40 rupees.

Reasons for not getting a child appropriately vaccinated were the distance between the health facility and residence (37%), inadequate knowledge (13.7%), lack of vaccine in the facility (10%) and absence of a mobile team (6%), while 33.3% refused vaccination because they thought it was unnecessary, it would make their children sick or because their children were sick or too weak to receive vaccination.

Only 20% of mothers knew the name of the tetanus vaccine and 88.5% believed it was important. Around one-third of mothers identified the different EPI target diseases. The main source of their knowledge was primary health care centre staff (49%), followed by the media, such as television (19%), radio (3.8%) and newspapers (2.4%). Friends and neighbours were another source (11.5%), as were traditional birth attendants (6.7%).

Most of the women were satisfied with the vaccination services available in their vicinity, but 19.1% were dissatisfied. The causes of dissatisfaction were distant vaccination centres, the absence of mobile teams, staff attitudes, the unavailability of vaccines, and the cost of vaccines and travel. The significant determinants of no or incomplete vaccination coverage were: type of house construction, mother's TT vaccination status, years since marriage and parents' educational levels.

■ Conclusions and recommendations

The EPI coverage of Gadap Town is unsatisfactory. Efforts should therefore be made to improve this coverage through raising community awareness about the importance of vaccination and the hazards of vaccine preventable diseases. Particular emphasis should be given to increasing public vaccination service coverage to increase the access of the community to free vaccination services.

Vaccine preventable diseases

Molecular Epidemiology

Islamic Republic of Iran

Genotyping of the measles virus strain in the Islamic Republic of Iran

Islamic Republic of Iran
Nationwide

Study period:
November
2004–November 2005

Small Grants Scheme (SGS) 2004 No. 70

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Abstract

A study was carried out to characterize the genetic properties of measles virus circulating in the Islamic Republic of Iran a year before and after a measles and rubella mass vaccination campaign. Of 303 serum samples, 300 samples were related to the period before the mass vaccination campaign in December 2003, and 3 to the period after the campaign. Genotyping was carried out using reverse transcription polymerase chain reaction (RT-PCR) and phylogenetic analysis was performed to identify the source of transmission, information needed to control the disease.

Results All measles strains circulating before the campaign belonged to genotype D4 strain. The mean per cent of inter- and intra-distance of Iranian strains was 2.2% and 1.3%, respectively, compared with standard genotype D4. The 3 samples obtained after the campaign were positive in terms of measles IgM but were negative by RT-PCR,

probably due to inadequate sampling or low number of viral copies. The main transmission chains were identified.

Conclusions The study set up a database of the genetic characteristics of measles virus in the country. This information will allow the monitoring of changes in viral genotypes over time to provide evidence about the interruption of the endemic transmission of measles.

Background

Molecular characterization of measles viruses is an important component of measles surveillance because it enhances the ability of surveillance and epidemiological investigation to identify the source and trace the transmission pathway of a virus. Documentation of changes in viral genotypes over time in a particular country or region can provide evidence about the interruption of the endemic transmission of measles and can serve as a valuable tool for measuring the effectiveness of measles control and elimination programmes. A study was therefore done to characterize the genetic properties of circulating measles viruses in the Islamic Republic of Iran a year before and after a measles and rubella mass vaccination campaign.

Materials and methods

Of 658 IgM-positive serum samples collected before the vaccination campaign in 2003, 300 were randomly selected from the northern, southern, central, western and eastern parts of the Islamic Republic of Iran. Three (3) confirmed positive serum samples collected after the mass campaign were also included in the study. The sera were mostly stored in a refrigerator at -20 °C before and after the test, although a small number of sera were stored at -70 °C. A 456 bp of carboxyl terminus of N-gene was amplified and then sequenced. Phylogenetic analysis was performed with the software of Bioedit (version

Conclusions and implications of the study

■ Molecular characterization of measles viruses is an important component of measles surveillance because it enhances the ability of surveillance and epidemiological investigation to identify the source and trace the transmission pathway of a virus. Documentation of changes in viral genotypes over time in a particular country or region can provide evidence about the interruption of the endemic transmission of measles and can serve as a valuable tool for measuring the effectiveness of measles control and elimination programmes.

■ Identifying measles virus strains circulating prior to a mass vaccination campaign, allows the differentiation of subsequent outbreaks to determine whether they originate overseas or are part of continuing transmission of indigenous measles virus lineages, the latter suggesting a failure of control measures to interrupt transmission.

■ Given that the number of IgM-positive measles cases is low during the elimination phase, it is recommended that the virus is isolated from throat and urine samples in addition to serum samples during this phase. Epidemiological data should also be collected for every suspected case. These data should include: age, sex, residence, clinical signs, vaccination history and history of travel to endemic areas 3 weeks prior to illness.

7.0.4.1) and Treecon (version 1.3-b) using the nucleotide Kimura-2 parameter for the distance estimation and neighbour-joining method for tree construction.

■ Main study findings

Measles virus identified from the south (Fars), central (Esfahan province), north (Golestan and Tabris) and west (Kurdistan) parts of the country belonged to genotype D4. The mean per cent of intra-distance and inter-distance for Iranian strains compared with D4 genotypes of other countries were 1.3% and 3.6%, respectively. The percentage of nucleotide difference between the 450 nucleotides coding for the C-terminus of the N protein in D4 genotype was between 2.9 to 5.9 per cent N-gene.

On the basis of phylogenetic analysis, the main transmission chains were identified. The 3 samples obtained after the mass campaign were positive in terms of measles IgM, but negative by reverse transcription polymerase chain reaction, probably due to inadequate sampling or low number of viral copies. The fact that it was not possible to identify the genotype of the measles virus after the mass campaign suggests that it was not clear whether all strains circulating after the mass campaign were still indigenous, as was the situation before the campaign. However, of the 3 diagnosed cases after the campaign, 2 were Afghan nationals and the third was an Iranian lady with a positive travel history to Thailand. This strongly suggests that the cases diagnosed after the campaign could have been imported, though it is not decisive as genotyping was not performed.

■ Conclusions and recommendations

The study set up a database of the genetic characteristics of measles virus in the Islamic Republic of Iran. This information will allow the monitoring of changes in viral genotypes over time to provide evidence about the interruption of the endemic transmission of measles. Identifying the measles virus strains circulating prior to a mass vaccination campaign allows the differentiation of subsequent outbreaks to determine whether they originate abroad or are part of continuing transmission of indigenous measles virus lineages, the latter suggesting the failure of control measures to interrupt transmission.

Vector control

Insecticide resistance

Islamic Republic of Iran

An evaluation of a molecular kit in comparison to routine susceptibility test for early detection and monitoring insecticide resistance in Iranian malaria vectors

Islamic Republic of Iran

South, south-east and northern regions

Study period:

October 2003–March 2005

Small Grants Scheme

(SGS) 2003 No. 180

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Abstract

A polymerase chain reaction (PCR)-based diagnostic tool was developed for the detection and monitoring of susceptibility/resistance related to a voltage-gated sodium channel (VGSC) gene in *Anopheles stephensi*, *An. culicifacies* and *An. fluviatilis*. This was evaluated by amplification of further specimens of the three main anopheline malaria vectors studied. These data have provided information on the mechanism of insecticide resistance, which has been applied to detect and characterize the VGSC gene in seven other malaria vectors in Islamic Republic of Iran. Cloning and sequencing of the partial sequence of exon I and II and the whole sequence of intron II in the other seven anophelines were then performed.

Results The presence of TTG mutation related to knock down resistance (*kdr*) in *An. maculipennis* complex was reported from northern Islamic Republic of Iran. TTT mutation assigned as indication of *kdr* resistance in *An. gambiae* was also found in *An. stephensi* on the Islamic Republic of Iran–Pakistan border. Leu-His polymorphism

in exon I of *An. culicifacies* specimens and a TTA sequence similar to that reported in susceptible specimens of *An. gambiae*, have been detected in the other seven studied malaria vectors. Molecular data were in concordance with the results of the WHO susceptibility test and other reports.

A comparison of the intron II sequence of the VGSC gene in the 10 species has shown that it is species-specific and could be used as a molecular marker for detection of different species. A phylogenetic tree that was constructed based on the target sequence could easily differentiate these species.

Conclusions Detection of VGSC gene in anopheline vectors, which are most common in the Eastern Mediterranean Region and Indian subcontinent, is essential for any evaluation of the insecticides applied by the malaria control programmes.

Background

Molecular characterization of pyrethroid resistance in *Anopheles gambiae* and pyrethroid insecticide pressure in the last 10 years in malaria endemic areas of the Islamic Republic of Iran justify the introduction and application of molecular techniques for characterization, early detection and monitoring of pyrethroid resistance in the other main malaria vectors.

A study was therefore done to evaluate a molecular kit developed by the research team for the detection of knock down resistance (*kdr*)-related mutations in the voltage-gated sodium channel (VGSC) gene of three main malaria vectors (*An. stephensi*, *An. culicifacies*, *An. fluviatilis*). These data have provided some information on the mechanism of insecticide resistance which has been applied to detect and characterize the VGSC gene in the other seven malaria vectors in the Islamic Republic of Iran.

Materials and methods

Field collected specimens of all *Anopheles* species from different

Conclusions and implications of the study

Most insecticides currently used in public health belong to the pyrethroids group. As all pyrethroids act on the same target site, development of resistance resulting from a mutation in this target site (such as *kdr* mutation) induces cross-resistance to all pyrethroids. Therefore, monitoring and management of insecticide resistance should be an integral part of malaria and other vector-borne diseases control programmes.

Molecular data obtained by the evaluated PCR-diagnostic tool were in concordance with the results of the WHO susceptibility/resistance test and other reports. Moreover, sequence analysis showed that intron II region could be used as a diagnostic tool for detection of different species. Therefore, the evaluated PCR-diagnostic tool is a reliable diagnostic tool for the detection and monitoring of insecticide resistance and for species characterization.

Detection of VGSC gene in anopheline vectors, which are most common in the Eastern Mediterranean Region and Indian subcontinent, is essential for evaluating the insecticides used by the malaria control programmes.

provinces in south, south-east and northern Islamic Republic of Iran were collected before, during and after transmission seasons. Specimens underwent the WHO susceptibility test followed by morphological identification using the pictorial key to Iranian anophelines. The selected insecticides for the susceptibility test were; DDT 4%, dieldrin 0.4%, malathion 5%, permethrin 0.25%, Icon 0.1% and deltamethrin 0.025%.

Genomic DNA was extracted from individual mosquitoes followed by molecular identification of the internal transcribed spacer 2 (ITS2) region adapted by Djadid et al, 2003 [1]. VGSC gene has been amplified by *An. gambiae*-specific primers and later by Kolazinski primer and reverse primer (Foru-R), which has been designed based on VGSC gene in *An. culicifacies* and also by specific primers designed for Iranian anophelines. Fragments of polymerase chain reaction (PCR)-amplified products were purified and then cloned and sequenced.

■ Main study findings

PCR amplification of ITS2 region in collected anophelines and their sequencing produced the first reports in the study area of *An. sergentii*, *An. dthali*, *An. superpictus*, *An. subpictus*, *An. multicolour*, and *An. apoci*, which have been submitted to GenBank (and are available at <http://www.ncbi.nlm.nih.gov>).

The field susceptibility test on selected species revealed that in the south eastern malaria-endemic area only *An. stephensi* is resistant to DDT and dieldrin, and is to some extent tolerant to permethrin. Surprisingly, *An. culicifacies* showed a minor tolerance to DDT and dieldrin, while being totally susceptible to malathion, permethrin, Icon and deltamethrin. On the other hand, *An. fluviatilis* from Kerman Province and *An. dthali* from Sistan va Baluchistan Province were susceptible to all tested insecticides. In northern Islamic Republic of Iran, *An. maculipennis* and *An. sacharovi* showed resistance to DDT and dieldrin, and partial tolerance to permethrin and deltamethrin.

VGSC was amplified, cloned and sequenced in further specimens of *An. culicifacies*, *An. stephensi* and *An. fluviatilis*, and in *An. maculipennis*, *An. sacharovi*, *An. sergentii*, *An. dthali*, *An. subpictus*, *An. superpictus* and *An. pulcherrimus*, followed by submission to GenBank as first world reports. Alignment of 211bp of kdr-related VGSC gene in 10 different studied species has shown that despite 19 nucleotide differences, the first 104bp of this sequence (almost half) is similar among these species, while the variation in the second half is extensive. A phylogenetic tree was constructed based on a partial sequence of exon I and II and the whole sequence of intron II in the 10 species. It revealed that there are four main branches including: 1. *An. culicifacies*, *An. fluviatilis*, and *An. stephensi*; 2. *An. pulcherrimus*,

An. subpictus, *An. superpictus* and *An. dthali*; 3. *An. maculipennis* and *An. sacharovi*; and 4. *An. sergentii*.

Fragments suspected to be in the size of the amplified region in *An. gambiae* VGSC gene were cloned in *An. culicifacies*, *An. stephensi* and *An. fluviatilis*. Of the cloned fragments, two bands related to *An. stephensi* and one band to *An. fluviatilis* showed similarity with VGSC gene in priming sites. These results are consistent with the sequences of primers designed and applied in previous reports.

■ Conclusions and recommendations

Bioassays, molecular and biochemical assays are complementary in an integrated vector control programme, but should be enriched with an acceptable knowledge of the ecology of target vector species. This could be achieved through intercountry and regional cooperation in designing, implementing and evaluating malaria control programmes.

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