Surveillance of childhood vaccine-preventable diseases at health facilities in Jeddah, Saudi Arabia

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ترصُّد الأمراض الممكن توقِّيها باللقاح لدى الأطفال في المرافق الصحية في جدة، المملكة العربية السعودية

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الخلاصة: أجرى الباحثان دراسة مستعرضة شملت 33 من المرافق الصحية في جدة، المملكة العربية السعودية، لتقييم أداء هذه المراكز الصحية، وما لدى العاملين الصحيِّين فيها من معارف حول أنشطة ترصُّد أمراض الطفولة التي يمكن توقِّيها باللقاحات. واستخدَم الباحثان استبياناً لتقييم الترصُّد أعدَّته منظمة الصحة العالمية واستبياناً صُمِّم خصيصاً للمعارف. واتَّضح أن هنالك جوانب قصور في بعض البنود المتعلقة بالترصُّد. وبلغت النسبة المئوية للمرافق الصحية التي لديها دليل تدريبي حول الترصُّد (57.6٪) والتي تستكمل السجلات السريرية بشكل صحيح 60.6٪. وخلال الأشهر الستة المنصرمة كان 36.4٪ من المرافق تفتقد النماذج الملائمة للترصُّد، بينما لم يخضع للمراجعة الإشرافية سوى 18.2٪ من هذه المرافق. ولم تزد نسبة العاملين الصحيِّين الذين لديهم درجة تبعث على الرضى من المعرفة عن الربع.

ABSTRACT A cross-sectional study was conducted at 33 randomly selected health facilities in Jeddah, Saudi Arabia, to assess health facilities' performance and health workers' knowledge of surveillance activities for childhood vaccine-preventable diseases. The WHO surveillance assessment questionnaire and a specially designed knowledge questionnaire were used. There were deficiencies in some surveillance items. The percentages of health facilities that had the surveillance manual and correctly filled clinical registers were 57.6% and 60.6% respectively. In the 6 months preceding the study, 36.4% of facilities lacked the appropriate surveillance forms while only 18.2% had received supervision reviews. Only one-quarter of health workers had a satisfactory knowledge score.

Surveillance des maladies de l'enfant à prévention vaccinale dans des établissements de santé de Djeddah (Arabie saoudite)

RÉSUMÉ Une étude transversale a été menée dans 33 établissements de santé de Djeddah (Arabie saoudite) choisis au hasard, afin d'évaluer l'efficacité de ces établissements et les connaissances des professionnels de santé en matière d'activités de surveillance des maladies de l'enfant pouvant être évitées par la vaccination. On a utilisé le questionnaire d'évaluation de la surveillance mis au point par l'OMS et un questionnaire spécial sur les connaissances. Certains items ont révélé des points faibles. Les pourcentages d'établissements de santé qui disposaient du manuel relatif à la surveillance et qui remplissaient correctement les registres cliniques étaient respectivement de 57,6 % et 60,6 %. Six mois avant l'étude, 36,4 % des établissements ne possédaient pas les formulaires de surveillance adéquats et seuls 18,2 % avaient reçu des rapports de supervision. Seuls un quart des professionnels de santé obtenaient un score de connaissances satisfaisant.

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Introduction

The threat of communicable diseases is re-emerging in developed countries [*1*], while in the Eastern Mediterranean Region these diseases are still the most common causes of death, disability and illness [*2*]. Developing effective and efficient national surveillance and response/control systems is important for national, regional and global health security [*2,3*].

Public health surveillance is "the ongoing systematic collection, analysis, interpretation and dissemination of data regarding a health-related event" [*4*]. Data dissemination by public health surveillance systems can be used for immediate public health action, programme planning and evaluation, and formulating research hypotheses [*4,5*]. Successful communicable disease surveillance depends on effective bidirectional flow of information between the local level of health care and communicable disease control units at regional, national and global levels [*6*].

Childhood immunization programmes are incomplete without proper surveillance of vaccine-preventable diseases (VPD) [*7*]. Such surveillance makes it possible to estimate the burden of diseases, decide about the appropriate policies to reduce these diseases, identify pockets of susceptibility and control potential outbreaks [*8*]. In Saudi Arabia, the Expanded Programme on Immunization (EPI) provides vaccination against the major childhood diseases [*9*]. However, evaluations of the surveillance system at the health facility level have been limited in scope and content. The aim of this study, therefore, was to assess the surveillance system for childhood VPD at the health facility level in Jeddah governorate, and to determine the knowledge of health care workers about VPD surveillance.

Methods

Study design

A cross-sectional study was conducted at 33 randomly selected health facilities in Jeddah governorate during the period December 2005 to February 2006. The focus of this assessment was on childhood VPD, namely tuberculosis, hepatitis B, poliomyelitis, diphtheria, pertussis, tetanus, measles, mumps, rubella and meningitis (as *Haemophilus influenza* type b is the commonest cause of bacterial meningitis in children aged 2 months to 5 years in this area).

Sample

The sample included 27 primary health care (PHC) units, randomly selected from a total of 38 PHC facilities from all 6 Ministry of Health supervision districts by the proportional allocation technique. Also, 3 private and 3 government hospitals were randomly selected from a list of all hospitals in Jeddah.

Data collection

The data were collected using 2 questionnaires.

Assessment of national communicable disease surveillance and response system

The WHO generic questionnaire for assessment of national communicable disease surveillance and response systems at health facility level was used [*10*], with some modifications to be specific for assessment of childhood VPD. It was completed by the person in charge of surveillance at each health facility, usually a health inspector but sometimes a nurse or doctor. The questionnaire included both interview and observation items. Questions were asked about the efficacy and quality of the surveillance system in addition to observing and checking the presence of important materials needed for the surveillance system.

The following items were assessed:

- Information sources (presence of national surveillance manual; presence of standard case definitions for childhood VPD).
- Clinical registry (presence of clinical registers; whether registers filled correctly).
- Case detection (presence of materials for collecting, storing and transporting specimens for suspected cases of VPD).
- Case reporting (lack of appropriate surveillance forms in the preceding 6 months; whether last monthly report agrees with the clinical register for diseases targeted for eradication, diseases targeted for elimination, epidemic-prone diseases and any country-priority disease; presence in the preceding 3 months of 12 weekly reports and 3 monthly reports; whether weekly reports submitted on time).
- Data analysis (presence of data analysis of VPD cases by place, time and line graphs; presence of action threshold for 1 country-priority disease; presence of demographic data used as denominators).
- Epidemic preparedness (presence of a written case management protocol for 1 epidemic-prone disease).
- Epidemic response (whether prevention and control measures are implemented based on local data).
- Assessment of feedback (presence of at least 1 feedback bulletin or report on surveillance from a higher level in the preceding 1 year).
- Assessment of supervision (presence of at least 1 written supervision report from a higher level in the preceding 6 months).
- Training (whether respondent ever received training on surveillance).
- Adequacy of resources (presence of stationery, computers, statistical packages, e.g *SPSS* or *Epi-Info*, faxes and motor vehicles).

Knowledge about surveillance for childhood VPDs

The second questionnaire was a predesigned interview questionnaire for assessing the knowledge of health care workers about surveillance for childhood VPDs and related topics. All health care workers involved in preventive care who were available on the day of the study and agreed to participate were included in the study. The questionnaire consisted of 2 sections; the 1st section enquired about personal data: sex, educational level and job and whether any training on surveillance had been received. In the 2nd section, the knowledge of health workers about different items of surveillance was assessed. The knowledge items consisted of 26 open-ended questions about:

- Definition of surveillance.
- Definition of international notification weeks and the number.
- Diseases under EPI, their definitions, with examples (suspected and confirmed cases of poliomyelitis, measles, tetanus and tuberculosis).
- Classes of reporting of communicable diseases, with examples of 1st, 2nd and 3rd classes for VPD.
- When and how to report different classes of VPD.
- Types of data to be reported on immediate, weekly and monthly reports for childhood VPD.
- Name of report submitted in case of absence of poliomyelitis (zero report).
- Different preventive and control measures of some cases of VPD.

Statistical analysis

Statistical analysis was conducted using *SPSS*, version 13. For the surveillance questionnaire, the performance indicators were calculated using WHO methods [*10*]. For the knowledge questionnaire, a knowledge score was calculated. Responses to each question were scored from 0–2 (0 for incorrect answer or don't know, 1 for incomplete answer and 2 for correct complete answer). The total knowledge score ranged from 0–52 and was graded as follows: poor score: < 26, fair score: 26–34.5, good score: > 34.5. The chi-squared test was calculated, or the Fisher exact test when the cells had a frequency of ≤ 5. Results were considered statistically significant with a *P*-value < 0.05.

Results

Table 1 shows that the national surveillance manual was present in 57.6% of the selected health facilities. It was observed that the percentage of facilities that correctly filled the clinical register of childhood VPD was 60.6%. Regarding the ability to confirm cases of VPD, observation revealed that 60.6%, 51.5%, 48.5% and 24.2% of health facilities had the ability to collect sputum, stool, blood and cerebrospinal fluid samples respectively. Regarding the capacity to handle specimens, 60.6% of facilities had a functional cold-chain supply, 42.4% had transport media and 48.5% had packing materials.

Table 1 also shows that 36.4% of health facilities lacked the appropriate surveillance forms for reporting of childhood VPD in the preceding 6 months. In only one-third of health facilities did the last monthly summary report agree with the clinical register for diseases targeted for eradication (poliomyelitis) and for elimination (measles).

The table also shows that the percentage of health facilities that had the correct number of weekly reports in the 3 months preceding the study (12 reports) was only 27.3%, while the percentage was slightly better (39.3%) regarding the correct number of monthly reports (3 reports). As regards the timeliness of reports, only 27.3% of health facilities submitted the weekly reports on time in the 3 months preceding the study.

Regarding data analysis, the results of the study revealed that no computerized database system was available at the health facility level, analysis of data was limited and generally data were analysed at the district level. One-third of the facilities conducted analysis of data by place, 39.3% by time, while prepared line graphs were found in only 12.1% of the health facilities. In 27.3% of health facilities, health care workers reported that they had an action threshold for at least 1 of the country-priority diseases; however, observation showed that the action threshold for poliomyelitis was found in 18.2% of the facilities and for measles in 15.2%.

Regarding epidemic preparedness and response, Table 1 shows that 57.6% of the facilities had a case management protocol for 1 epidemic-prone disease, and 60.6% implemented prevention and control measures based on local data.

The presence of at least 1 feedback report from a higher level during the preceding 1 year was found in 24.2% of the facilities, while a surveillance performance supervision review in the preceding 6 months was present in only 18.2%. Training on surveillance was reported by 66.7% of health workers.

Assessment of the availability of surveillance resources showed that 63.6%, 54.5%, 84.8%, 48.5% and 6.1% of the health fa-

Table 1 **Performance indicators of childhood vaccine-preventable diseases surveillance system at health facilities in Jeddah**

Item	No. of facilities (n = 33)	%
Presence of surveillance manual		
Reported (yes)	19	57.6
Observed (yes)	19	57.6
Case detection and registration		
Clinical registry		
Reported (present)	25	75.8
Observed (correct filling of registers)	20	60.6
Presence of vaccine-preventable diseases standard case definition		
Reported (yes)	18	54.5
Observed (yes)	19	57.6
Ability to confirm cases		
Ability to collect sputum sample:		
Reported (yes)	25	75.8
Observed (presence of collection materials)	20	60.6
Ability to collect stool sample:		
Reported (yes)	23	69.7
Observed (presence of collection materials)	17	51.5
Ability to collect blood or serum sample:		
Reported (yes)	25	75.8
Observed (presence of collection materials)	16	48.5
Ability to collect CSF sample:		
Reported (yes)	8	24.2
Observed (presence of collection materials)	8	24.2
Capacity to handle all samples:		
Reported (yes)	15	45.5
Observed (presence of working cold-chain)	20	60.6
Observed (presence of transport media for specimens)	14	42.4
Observed (presence of packing material for shipment of specimens)	16	48.5
Data reporting		
Lack of appropriate surveillance forms in last 6 months	12	36.4
Last monthly report agreed with the register for:		
Disease targeted for eradication (poliomyelitis)	11	33.3
Disease targeted for elimination (measles)	11	33.2
Epidemic-borne disease (meningitis)	12	36.4
Disease of major public health importance (meningitis)	12	36.4
Correct number of weekly reports in last 3 months	9	27.3
Correct number of monthly reports in last 3 months	13	39.3
All weekly reports submitted on time in last 3 months	9	27.3

Table 1 **Performance indicators of childhood vaccine-preventable diseases surveillance system at health facilities in Jeddah *(concluded)***

Item	No. of facilities (n = 33)	%
Analysis of data		
Description by place	11	33.3
Description by time	13	39.3
Description by line graph	4	12.1
Presence of action threshold for a country-priority disease (reporting)	9	27.3
Presence of action threshold for a country-priority disease (poliomyelitis)	6	18.2
Presence of action threshold for a country-priority disease (measles)	5	15.2
Presence of demographic data	5	15.2
Epidemic preparedness		
Presence of case management protocol for 1 epidemic-prone disease	19	57.6
Epidemic response		
Implementation of prevention and control measure based on local data	20	60.6
Feedback		
Presence of at least 1 feedback report from higher level during the last year	8	24.2
Supervision		
Presence of surveillance supervision report in the last 6 months	6	18.2
Training		
Staff received training on disease surveillance and epidemic management	22	66.7
Resources available		
Stationery	21	63.6
Computer	18	54.5
Fax	28	84.8
Vehicle	16	48.5
Statistical package[a]	2	6.1

[a]Epi-Info/SPSS.
CSF = cerebrospinal fluid.

cilities had stationery, computers, faxes, vehicles and statistical packages (*Epi-Info*/*SPSS*) respectively.

Regarding the knowledge of health workers about surveillance activities, it was found that only about one-quarter (24.1%) of health care providers had a satisfactory knowledge score, 29.3% had a fair score while about a half (46.6%) obtained a poor score. After combining the fair and satisfactory knowledge scores, no statistically significant difference was found between

the health workers' level of knowledge and the type of facility or sex ($P > 0.05$) (Table 2). No statistically significant difference was found between the level of knowledge of those who had attended a training course on surveillance and those who had not ($P > 0.05$). On the other hand, respondents with a higher level of education (university or postgraduate degree), physicians and those with shorter work experience (< 10 years) had statistically significant better knowledge scores compared to others ($P < 0.05$).

Discussion

Public health surveillance systems provide information for action against infectious disease threats [*11*] and evaluating these systems is necessary to ensure that problems of public health importance are being monitored efficiently and effectively [*12,13*].

Standardized case definitions for diseases under surveillance are important for providing uniform criteria for reporting cases [*12*]. The results of the present study revealed that the percentage of health facilities with access to the official standard case definition of childhood VPD was 57.6%. This low rate may be attributed to a lack of available case definitions at health facilities or a lack of knowledge of health workers about them. However, the rate reported from the present study is better than that

Table 2 **Relationship between the knowledge scores of health workers about surveillance of vaccine-preventable diseases and studied variables**

Variable	Poor knowledge		Fair/satisfactory knowledge		χ^2	*P*-value
	No. of staff	%	No. of staff	%		
Type of health facility						
Primary health care	21	52.5	19	47.5	1.80	0.17
Hospital	6	33.3	12	66.7		
Sex						
Male	10	34.5	19	65.5	3.39	0.06
Female	17	58.6	12	41.1		
Educational level						
University/postgraduate	7	29.2	17	70.8	4.97	0.02
Less than university	20	58.8	14	41.2		
Job						
Physician	5	26.3	14	73.7	4.65	0.02[a]
Other specialty	22	56.4	17	42.6		
Period of working (years)						
< 10	12	34.3	23	65.7	5.33	0.02
10+	15	65.2	8	34.8		
Received training on surveillance						
Yes	13	48.1	14	51.9	0.05	1.00
No	14	45.2	17	54.8		
Total	27	46.4	31	53.4		

[a]***Fisher exact test.***

from a study from Uganda in 2000, where only 35% of facilities had the official standard case definition of EPI diseases [*14*].

In our study 60.6% of facilities correctly and completely filled the clinical register for VPD. An earlier study in 2000 in Jeddah to evaluate communicable diseases reporting found that the usefulness of reporting diminished because of incomplete, absent or incorrect filling of personal and disease data [*15*]. The problem of incorrect and incomplete form-filling may be due to a lack of knowledge of the people in charge of surveillance about how to fill registers and reports. Our results agree with the study in Uganda where the corresponding rate was 56% [*14*]. In the United States of America (USA), despite state and local laws requiring medical providers to report notifiable infectious diseases to the public health authorities, a literature review of 33 published studies between 1970 and 1999 revealed that the percentage of complete reports varied from 9% to 99% and was most strongly associated with the disease being reported [*16*].

Many health facilities in our study did not have the capacity to properly collect, store and transport specimens of suspected cases of VPD. This may be because cases that need laboratory investigations are referred to more advanced laboratories. This result concurs with the results of a study of VPD surveillance in Georgia (a former republic of the Soviet Union) in 2002 [*8*].

Results from Uganda showed that 65% of facilities lacked an adequate supply of reporting forms during the 6 months preceding the study [*14*]. The corresponding figure from our study was better, with only 36.4% of facilities lacking the appropriate forms. This is perhaps due to differences in the resources available for health care between the countries. However, our rate still requires improvement. A study to assess the structure and performance of infectious disease surveillance using the health management information system (HMIS) in Tanzania reported a slightly better rate (27% of facilities lacked theses forms) [*3*]. This better rate may be because the WHO Regional Office for Africa approved the integrated disease surveillance and response strategy for strengthening infectious disease surveillance and response capacity in Tanzania, where it has been applied since 1998.

In about one-third of the health facilities in the present study the monthly report agreed with the clinical register (for diseases targeted for eradication, elimination, epidemic-prone diseases and those with major public health importance). This low rate may be attributed to a lack of health workers' knowledge about these diseases, their classification, and when and how to report them. However, the current rate is slightly better than that obtained from Uganda (29%) [*14*].

Under-reporting of infectious diseases remains a major problem in communicable diseases surveillance [*17*]. A study from the USA in 1999 found that only 33% of the diseases on the list for national surveillance were actually reportable in each of the responding States [*12*]. In our study the percentage of health facilities that had submitted the correct number of weekly reports in the 3 months preceding the study was only 27.3%. This rate is low and requires much improvement. In Germany in 2003, the first evaluation of the surveillance systems of notifiable diseases using an electronic database system revealed that their programme was very successful, with 90% of facilities transmitting data weekly [*18*]. This may be due to the benefits gained from application of an electronic database system, which is a much easier and less costly way of transmitting data.

Timeliness of reporting is a key performance measure of public health surveillance systems [*19*]. In the present study only 27.3% of health facilities submitted the correct number of weekly reports on time during the 3 months preceding the study. This low rate may be attributed to health workers' lack of understanding of the importance of timeliness of reporting. A slightly higher rate (35%) was obtained from Tanzania [*3*]. Analysis of the National Notifiable Diseases Surveillance System in the USA showed that long lag times in reporting and variability in reporting across states limited the usefulness of the data [*19*]. For these reasons, a computer database, the Public Health Surveillance Knowledgebase was established in 2003 in order to facilitate the integration of information sources [*20*]. Even so, when database systems for notifiable diseases are in place, such as in New South Wales, Australia, there may be factors limiting their ability to provide timely and accurate data [*21*].

We found that the analysis of data about VPD in children at the health facility level was limited; only about one-third of facilities conducted analysis of cases by place and time, while only 12.1% prepared line graphs. This low figure may be attributed to analysis of data at the higher (district) level and lack of statistical packages (such as *SPSS* or *Epi-info*) or people trained to use them at the health facility level. Our result agrees with a critical review of infectious diseases surveillance in Gaza, Palestine, where prepared line graphs were reported from 10% of health facilities [*17*]. These results also agree with that from an assessment of infectious disease surveillance systems in Armenia where very few surveillance data were computerized, analysed or used to develop or evaluate public health policy [*22*].

It was reported from the Tanzanian study that 29% of medical offices had population denominators to use for data analyses [*3*]. On the other hand, a lower rate (15.2%) was obtained in our study. This can be attributed to a lack of availability of census data at the health facilities, and to the analysis of these data at district level.

While 27.3% of health facilities reported having a threshold action for one of the country-priority diseases, on observation it was found that an action threshold for poliomyelitis was found in only 18.2% of facilities and for measles in 15.2%. Results from Uganda showed that 27% of health facilities had a threshold action for epidemic-prone diseases [*14*].

Regarding epidemic preparedness and response, 57.6% of facilities had a case management protocol for 1 epidemic-prone disease and 60.6% had implemented prevention and control measures based on local data. The rate obtained in our study requires much improvement by increasing the availability of management protocols and training health workers on these. A lower rate was reported from Uganda, where 50% of facilities conducted community prevention and control measures [*14*]. On the other hand, better results were obtained from Tanzania, where 79% of facilities using HMIS implemented prevention and control measures based on local data [*3*].

Lack of feedback from the reporting centres to the health centres hampers improvements in clinical practice [*22*]. In our study the presence of at least 1 feedback report (during the preceding 6 months) was found in only 24.2% of facilities, and a performance supervision review was found in 18.2%. Better results were obtained from the Tanzanian study, where 42% of facilities using HMIS received supervision or feedback during the same time period [*3*].

On the other hand, in Uganda, feedback was found in 15% of facilities and supervision in 32% [*14*].

In the present study two-thirds of health workers in charge of surveillance reported receiving training. This agrees with results from Uganda where 62% of health providers received training on surveillance [*14*]. On the other hand, a higher rate (81%) was reported from Tanzania [*3*].

Our study found a deficiency of resources needed for surveillance at the health facility level, such as computers and statistical software. This may also be due to the analysis of data at district level. Similar results were obtained from Brazil, where there was a lack of equipment and a deficiency in staff qualifications [*23*]. The Ugandan study reported a greater deficiency in resources than our study; stationery was found only in 25% of facilities [*4*].

Regarding knowledge of health providers about different items of surveillance, about a half (46.6%) of them in our study had a poor knowledge score; only about a quarter of health providers had a satisfactory knowledge score. The low standard of knowledge is of concern and needs improvement. The results of a study in 1997 for assessment of surveillance and control of poliomyelitis in Egypt showed that the knowledge of some health workers was incomplete [*24*]. The results of a focus group discussion to assess knowledge about VPD surveillance in Georgia in 2003 showed that health providers had poor knowledge about surveillance and the regulations and accordingly the level of these activities was minimal [*25*]. In our study, no statistical significant difference was found between the knowledge of health workers who received training about surveillance and those who did not. This indicates that the training courses need to be revised. The results also showed that physicians who had university degrees and above, and those who with shorter work experience, had better knowledge scores. The reason for this may be that graduate health care providers, especially those who are recently graduated, usually study the topic of reporting and surveillance of infectious diseases during their course at university.

It is concluded from the present study that there are deficiencies in some areas of the surveillance systems for childhood VPD in the health facilities of Jeddah governorate. Given the importance of surveillance in monitoring and controlling VPD, there is an urgent need to address the deficiencies in resources, reporting and knowledge within the health facilities in order to correct them and improve the surveillance system for childhood VPD in Jeddah. The development of continuing education, staff motivators and electronic database systems are among the strategies recommended in this regard.

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