Knowledge and practices of health care workers and medical students towards universal precautions in hospitals in Mazandaran Province

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المعارف والممارسات لدى العاملين على إيتاء الرعاية الصحية وطلاب الطب حول الاحتياطات الشاملة في المستشفيات في ولاية مازانداران

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الخلاصة: تستقصي هذه الدراسة المعارف والممارسات حول الاحتياطات الشاملة لدى 540 من العاملين في إيتاء الرعاية الصحية وطلاب الطب في مستشفيين جامعيين في ولاية مازانداران في جمهورية إيران الإسلامية. وقد اقتصرت النسبة المئوية لمن سمع عن الاحتياطات الشاملة على 65.8٪ من العاملين في أحد المستشفيين و90٪ من العاملين في المستشفى الآخر و53٪ من الطلاب. وبشكل إجمالي كان هناك فهم متواضع للاحتياطات، باستثناء ما يخص التخلُّص من الأدوات الحادة والتماس مع السوائل المهبلية، واستخدام القناع والمئزر وتنظيف رَشَاش الدم. ويعاني العاملون الصحيون من صعوبة في التمييز بين سوائل البدن العميقة وبين إفرازات البدن التي لا تعتبر مصدراً للعدوى. وقد سُجِّلَتْ كذلك الممارسات الجيدة المتمثِّلة بغسل اليدين والتخلص من الإبر واستخدام القفازات والأقنعة والمآزر.

ABSTRACT This study investigated knowledge of and practices towards universal precautions among 540 health care workers and medical students in 2 university hospitals in Mazandaran Province, Islamic Republic of Iran. Only 65.8% and 90.0% staff in the 2 hospitals and 53.5% of medical students had heard about universal precautions. Overall, there was a low understanding of precautions, except concerning disposal of sharps, contact with vaginal fluid, use of mask and gown or cleaning spilled blood. Health workers had difficulty distinguishing between deep body fluids and body secretions that are not considered infectious. Good practices were reported regarding hand-washing, disposal of needles, and glove, mask and gown usage.

Connaissances et pratiques des agents de soins de santé et des étudiants en médecine concernant les précautions universelles dans des hôpitaux de la Province de Mazandaran

RÉSUMÉ La présente étude a examiné les connaissances et les pratiques concernant les précautions universelles chez 540 agents de soins de santé et étudiants en médecine dans deux hôpitaux universitaires de la Province de Mazandaran (République islamique d'Iran). Seulement 65,8 % et 90,0 % du personnel des deux hôpitaux et 53,5 % des étudiants en médecine avaient entendu parler des précautions universelles. De manière générale, il y avait une faible compréhension des précautions, sauf pour ce qui concerne l'élimination des objets piquants et tranchants, le contact avec les sécrétions vaginales, le port du masque et de la blouse ou le nettoyage des souillures de sang. Les agents de santé avaient du mal à faire la distinction entre les liquides internes de l'organisme et les secrétions corporelles qui ne sont pas considérées comme infectieuses. Des bonnes pratiques étaient signalées en ce qui concerne le lavage des mains, l'élimination des aiguilles et l'utilisation des gants, du masque et de la blouse.

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Introduction

Since medical history and examination cannot reliably identify all patients infected with human immunodeficiency virus (HIV) and other bloodborne pathogens, the United States Centers for Disease Control (CDC) has proposed a series of procedures that health care workers' (HCWs) should use with all patients [*1*]. "Universal precautions" are designed to prevent health care staff being exposed to blood and body fluids by applying the basic principle of infection control through hand-washing, utilization of appropriate protective barriers, such as gloves, mask, gown and eyewear, and safe handling of needles.

Universal precautions practices are important, as any health care organization has a responsibility to protect its staff from potential danger and itself from loss of manpower if staff suffer occupational injuries or illnesses [*2*]. Patients too may be harmed if staff are uniformed about safe handling of blood or body fluids or they may be deprived of appropriate care due to inappropriate fears or misunderstandings [*3,4*].

HCWs working in hospitals frequently provide care to patients whose hepatitis B virus (HBV) or HIV status is unknown. The Islamic Republic of Iran is a medium endemic area for hepatitis B infection, with about 3.1% of the population being carriers of HBV and 30%–50% of the population having evidence of previous infection with the virus [*5*]. The risk of HBV infection after a known occupational exposure is about 25%. Furthermore, there is a 0.3%–0.5% occupational risk of infection with HIV after percutaneous exposure to HIV-contaminated blood [*6*], although the cumulative career risk may be as high as 1%–2% among emergency service staff or surgeons [*7*]. Occupational exposure to HIV is common in the developing world. A survey assessing exposure to HIV among HCWs in South Africa showed that 13% of the staff reported accidental exposure when caring for HIV-positive patients [*8*].

Data from a study in Sweden [*9*] showed that the majority of reported cases of occupational blood exposure were among nurses and a minority were among physicians. Other data [*10*] showed that nurses are the staff most frequently involved in occupationally acquired HIV infection. A study assessing the frequency of body fluid exposure among midwives showed that 65.1% of them had experienced exposure to amniotic fluids or blood at least once in the past 6 months and 25% reported 5 or more such exposures [*11*]. Lymer et al. showed that of 1180 incidents, only 9% had been reported [*9*].

Surveys have shown that the use of universal precautions significantly decreases the number of incidents of occupation exposure to blood [*12,13*]. Nevertheless, the level of compliance with universal precautions is generally low [*14-16*]. The weakest aspects reported are not practising hand decontamination, [*17*], not using barrier protection and recapping needles [*18,19*].

The objectives of the present study were to measure knowledge about universal precautions among HCWs and medical students, to investigate their practice towards universal precautions and to look for any relationship between knowledge and practice. Such information would be useful in identifying specific areas that may need further attention in the continuing education of nursing and medical students and in providing feedback to these groups about improving safe practices.

Methods

This was a cross-sectional survey. The sample was all medical staff (ancillary staff,

nurses, operating room staff and laboratory technicians) and medical students at the 2 university hospitals in Sari, Mazandaran Province, Islamic Republic of Iran (hospital A and hospital B).

Scale

A self-administered questionnaire was constructed, consisting of 3 parts. Part I collected demographic data, including age, sex, years of experience in job, level of education and type of occupation (laboratory, operating room, nursing, health service, medical student). Part II asked respondents if they had heard about "universal precautions", and then measured knowledge of universal precautions, with 10 statements (scored "true" or "false"; maximum score 10). Part III investigated their practice towards universal precautions in 8 questions about use of protective devices, disposal of sharps, and decontamination of spills and used articles (scored "agree" or "disagree"; maximum score 8). The statements measuring knowledge of and practice towards universal precautions were based on the universal precautions guidelines recommended by the CDC in 1996 (12 items) [*1*] and a questionnaire devised by Chan et al. in Hong Kong [*2*].

The content validity of the questionnaire was assessed using the ideas of experts from the infection control committee of the 2 hospitals. A pilot study with 20 subjects was used to test the feasibility and internal consistency of the questionnaire. The reliability coefficient for the questionnaire (using Cronbach's α coefficient) was 0.71.

Data analysis

Frequencies, means and standard deviations were used to summarize the data. Knowledge was scored with 1 for a correct answer and 0 for a wrong answer, then the total score was calculated. The relationship between the knowledge scores and practice rates toward universal precautions was calculated using the Pearson correlation coefficient. The Kruskal–Wallis 1-way analysis of variance or Mann–Whitney U tests were used to examine knowledge and practice in relation to demographic data, depending on the data level of measurement.

Ethical considerations

The research proposal was sent to the 2 hospital managers for approval in order to gain access to the staff. Distributors provided information about the study to the participants and the anonymity and confidentiality of the responses, voluntary participation and the right to refuse participation were emphasized.

Results

Demographic data

Of the 650 questionnaires distributed, 540 (83.1%) were completed and returned (283 from staff at hospital A, 173 from staff at hospital B, and 84 from medical students). Only 65.8% of hospital A staff had heard about universal precautions compared with 90.0% of hospital B staff. Among the staff respondents, 40.6% had 0–5 years of experience in their job, 10.3% had 6–10 years, 15.1% had 11–15 years and 34.0% had more than 15 years of experience (Table 1). The majority (64.3%) had a bachelor degree in nursing. The demographic profile of medical students was similar except that 67.7% were female and 33.3% male.

Staff knowledge of universal precautions

The mean knowledge score of hospital A staff was 7.34, of hospital B staff was 8.63 and of medical students was 7.81. Most of the staff in both hospitals answered cor-

Table 1 Demographic data of the sample of hospital health care workers in Mazandaran Province (excludes medical students)

Variables	No.	% (n = 456)
Age (years)		
20–29	177	38.8
30–39	152	33.3
40–49	109	23.9
50+	18	3.9
Sex		
Male	159	34.9
Female	297	65.1
Years of experience		
0–5	185	40.6
6–10	47	10.3
11–15	69	15.1
> 15	155	34.0
Level of education		
Below diploma	34	7.5
Diploma	57	12.5
University diploma	72	15.8
Bachelor degree or above	293	64.3
Occupation		
Ancillary staff	70	15.4
Laboratory worker	46	10.1
Operating room	59	12.9
Midwife	18	3.9
Nurse specialist or officer	263	57.7

n = total number of respondents.

rectly the items related to disposal of sharps (94.9% and 99.3% correct respectively), clearing up blood spills (70.8% and 93.9%), use of mask and gown (96.3% and 99.3%), application of universal precautions with all patients irrespective of their underlying illness (92.6% and 94.3%), and application of universal precautions when in contact with vaginal fluids (97.5% and 95.6%) and not with saliva (79.0% and 76.8%) (Tables 2 and 3).

Nevertheless, many of them had the misconception that the universal precautions should be applied when in contact with sweat (80.8% and 39.6% respectively) (Table 2). In addition, many of the hospital A staff had the misconception that washing with ordinary detergents is insufficient for decontamination of devices that are only in contact with skin (51.6%).

Practice of universal precautions

Concerning the use of protective devices, almost all respondents agreed on the practice of wearing gloves, gown and eye wear when they were exposed to deep body fluids or blood products (Table 3). Concerning the use of gloves when exposed to sweat, practices were poor, as only 19.2% of hospital A staff, 60.3% of hospital B and 33.9% of medical students answered this question correctly. For the care of patients by a health care worker with non-intact skin, only 16.1%, 50.4% and 25.2% of hospital A and B and medical students answered correctly. Also the respondents' practices toward disposal of sharps into a sharp box was good (94.8%, 99.3%, 100% respectively).

Regarding wearing gloves as the first step in cleaning surfaces, the practices of hospital B staff was slightly better than the 2 other groups. Also only 74.5% of medical students agreed that washing with soap and water for 5 minutes is the first step after contact with infective materials.

Relationships between knowledge and practices

A significant relationship between the respondents' knowledge of and practices toward universal precautions was shown in hospital B ($r = 0.58$, $P < 0.001$). Also knowledge and practices of hospital B staff was better than in hospital A.

In Hospital A, using the Kruskall–Wallis analysis of variance, it was found that knowledge was highest in the 30–40 years old age group and lowest in the > 50

Table 2 Knowledge of universal precautions (UP) among health care workers (HCWs) and medical students in Mazandaran Province

Item	% answering correctly		
	HCWs hospital A (n = 283)	HCWs hospital B (n = 173)	Students (n = 84)
Have you ever heard of UP?[a]	65.8	90.0	53.5
UP are applied to patients with HIV and HBV only (F)	87.9	86.3	96.3
UP should be applied to all persons regardless of their infection status (T)	92.6	94.3	90.9
Isolation is necessary for patients with blood-borne infections (F)	53.7	77.4	81.8
Used needles can be recapped after giving an injection (F)	89.9	90.7	58.1
For decontamination of devices such as manometer (with only contact with skin) washing with usual detergent is enough (T)	48.4	85.6	87.2
Subcutaneous injuries during intravenous injections are the most common cause of occupational infections (T)	78.4	92.8	72.7
Universal precautions are not necessary in situations that might lead to contact with saliva (T)	79.0	76.8	81.8
There is effective anti-HCV vaccine (F)	77.9	88.5	100.0
HCWs with non-intact skin should not be involved in direct patient care until the condition resolves (T)	55.8	77.4	32.7
Blood spills should be cleaned up promptly with sodium hypochlorite (T)	70.8	93.9	80.0

[a]% who heard of UP.
n = total number of respondents.
T = true, F = false (researchers' views).
HCV = hepatitis C virus; HIV = human immunodeficiency virus.

years group. Also the group with a university diploma had the highest knowledge of universal precautions, followed by the group with a bachelor degree. There was no significant relationship between knowledge and practice score and years of experience. The analysis also revealed that laboratory workers had the highest knowledge, followed by midwives, nurses and operating room staff.

In Hospital B, a significant relationship was shown between knowledge and practice and occupation, as nurses obtained the highest score. The group with the fewest years of experience (0–5 years) had the highest knowledge score and the group with a bachelor degree or more had the highest knowledge of and practice toward universal precautions. The 20–30 year old age group had the highest knowledge and practice score. There was a significant relationship between age and knowledge of and practice toward universal precautions, as the 20–30 year old age group had the highest and the > 50 year group the lowest.

Using the Mann–Whitney U test, it was found that women had a significant higher level of knowledge of and practice toward

Table 3 Practice of universal precautions among health care workers (HCWs) and medical students in Mazandaran Province

Item	% answering correctly		
	HCWs hospital A (n = 283)	HCWs hospital B (n = 173)	Students (n = 84)
I assume that blood and all body fluids of patients are infectious (T)	98.7	98.6	100.0
I wear mask, gown and eye wear if procedures and patient care activities are likely to cause splashing of blood and deep body fluids (T)	96.3	99.3	100.0
I dispose of used needles into a sharp box after injection (T)	94.9	99.3	100.0
I wear gloves as the first step in cleaning surfaces contaminated with blood or other bloody body fluids (T)	90.6	95.2	89.0
Washing with soap and water for 5 minutes is my first step after contact with infective material (T)	89.9	89.2	74.5
I apply universal precautions in situations that might lead to contact with sweat (F)	19.2	60.3	33.9
If I have a wound, I wear gloves before caring for patients (T)	16.1	50.4	25.2
I apply universal precautions in situations that might lead to contact with vaginal discharge (T)	97.5	95.6	98.1

n = total number of respondents.
T = true, F = false (researchers' views).

universal precautions than men (z = 2.86, $P = 0.006$; z = 3.78, $P < 0.0001$ in hospital A and B respectively).

Discussion

The study showed an overall low understanding of universal precautions among health staff and medical students, except concerning disposal of sharps, contact with vaginal fluid, use of mask and gown or clearing up spilled blood. Universal precautions were not only insufficiently but also selectively understood. Chan et al. likewise showed that nurses' knowledge of universal precautions was inadequate [*2*], despite the fact that the majority of occupational blood exposures involved nurses [*9*]. Furthermore, the knowledge score in our study was less than optimal, especially in hospital A, where only 65.8% of staff had even heard about universal precautions. This may be related to the lack of regular post-employment education on issues of universal precautions, especially in that hospital.

Although the efficacy of universal precautions is controversial [*20*], they remain a valuable way to minimize or prevent accidental exposure of staff to pathogens. It is necessary to reinforce and clarify the concept of universal precautions and infection control guidelines among hospital staff, especially the staff of the operating room. Universal precautions are usually incorporated in the current student training curriculum of HCWs; however, there is a lack of regular integration of universal precautions guidelines as part of on-the-job

training in our hospitals. Although infection control committees in both hospitals have programmes of regular training and examination, it seems that this curriculum has not been implemented effectively. In general, hospital B staff performed better than hospital A staff, presumably because the current activity of the hospital B infection control committee is more regular and comprehensive. Ryan et al. [*21*] also recommend that there should be a systematic evaluation of nursing students' knowledge pertaining to universal precautions. A more comprehensive ongoing educational programme on universal precautions should be organized and this should be considered as a mandatory refresher course for all HCWs in the hospitals. As suggested by Van Wissen [*22*], one way to achieve this is to select target groups on the basis of prior knowledge. The content of the programme should be tailor-made according to the recommendations of the target group, and there could be a sympathetic forum in which more personal issues can be confidentially discussed. Support sessions should be provided for nurses in which feelings and fears can be openly discussed [*23*]. Although we did not test their actual practices in universal precautions, most respondents in all the groups agreed that universal precautions should be used for all patients irrespective of their bloodborne infection status. However, Young et al. showed that nurses did not always use adequate protection if they thought a patient was HIV negative or if they did not know the patient's HIV status [*24*].

Meunier et al. showed that 30% of third and forth year students who already have experience in clinical practice described blood exposure accidents during their hospital training and only 45% of these accidents were reported [*25*]. In our study, medical students were less knowledgeable than staff in some aspects: only 53.5% had heard about universal precautions and only 58.1% knew that used needles cannot be recapped. It seems that medical students have no systematic programme of education about universal precautions during clinical practice.

Occupational safety and health regulations require both employers and employees to reduce or eliminate occupational risks. Protective barrier use is a major element of universal precautions. To encourage their use, protective barriers must be readily available, easy to use, effective and comfortable. Therefore, staff managers and infection committee members should take a leadership role to ensure safe practices and resolve related practical issues. Also the education of medical students during the years of clinical practice is very important. Post-educational surveys or observational studies about universal precautions as practiced in clinical settings need further attention. Further studies should include physicians as well as support staff in order to gain a more comprehensive picture of the practice of universal precautions in hospitals.

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Community-based initiatives

Investing in health, particularly the health of the poor, is central to the achievement of the Millennium Development Goals. In support of this strategy, WHO Regional Office for the Eastern Mediterranean is actively promoting in the countries of the Region community-based initiatives (CBI) such as Basic Development Needs, Healthy Cities, Healthy Villages and Women in Health and Development. These approaches are based on the principle that good health status is central to creating and sustaining the capabilities of poor people to meet their basic needs and to escape from poverty.

Currently, all the countries in the Region have implemented at least one of the CBI initiatives. Under varying sociopolitical conditions, these initiatives have proved their effectiveness and sustainability through flexible and locally-sensitive mechanisms. The CBI approach has resulted in improved nutritional status, lowered mortality during epidemics, effective malaria and tuberculosis control measures, increased use of safe drinking water, higher school enrolment and promotional activities leading to healthy lifestyles in the communities where projects have been implemented. Further information can be found on the CBI homepage at http://www.emro.who.int/cbi/index.htm.