Original article

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Validation of a questionnaire about knowledge and perception of biological risk among biomedical students of Sapienza University of Rome

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Abstract

Background and aim. Healthcare workers and Biomedical students are continuously exposed to biological risk in their clinical practice. The objective of this study was to evaluate the validity and reliability of an Italian questionnaire on the knowledge and perception of biological risk in Biomedical students at the beginning of their professional training.

*Material and methods.*An electronic questionnaire was administered to students attending the second semester of the first year of Biomedical Courses at Sapienza University of Rome. The questionnaire consists of 40 questions divided into five sections collecting sociodemographic data, health status and level of knowledge and perception of biological risk. The statistical analysis was performed with Statistical Package for Social Sciences (SPSS) version 25.

Results. A total of 309 individuals answered the online questionnaire, with a response rate of 83.5%. The analysis of internal consistency was performed by two dichotomous variables that measured the knowledge level on hygiene behaviour and gloves use. The analysis showed a standardized *Cronbach*'s alpha equal to 0.765, corresponding to a good reliability. A better reliability was found out among physiotherapy and medical students, with a *Cronbach*'s alpha equal to 0.944 and 0.881, respectively. Regarding vaccines, 97.7% of the sample was given a Hepatitis B vaccination and 98.7% of students consider vaccinations essential for healthcare workers.

Conclusion. Results of *Cronbach*'s alpha showed a good reliability of the questionnaire. First-year Biomedical students may be exposed to occupational biological risk mainly because of their inexperience. A training educational path should be implemented in order to acquire competences, knowledge, attitudes and practical skills, correct behaviors and a personal and professional responsibility. ***Clin Ter 2019; 170(6):e430-434. doi:10.7417/CT.2019.2172***

Key words: *knowledge, perception, biological risk, occupational exposure, university, students*

Introduction

Biological risk represents one of the main risks for healthcare workers as it constitutes an intrinsic risk to healthcare activities. Healthcare professionals are constantly in direct contact with biological materials (blood, saliva, other body fluids, respiratory aerosols, etc.) as well as with materials or instruments contaminated with blood or other potentially infected biological material substrate.

Exposure to biological risk is often caused by accidental needle or sharp injuries (72%), followed by those from mucocutaneous contact (25%) and contact with non-intact skin (3%) (1).

World Health Organization (WHO) estimates that about three million people among the 35 million health workers worldwide are exposed percutaneously to bloodborne pathogens every year, two million to Hepatitis B Virus (HBV), about 900.000 to Hepatitis C Virus (HCV) and 170.000 to Human Immunodeficiency Virus (HIV) (2).

It is estimated that there are 1 million needle-stick injuries every year in Europe (3). National data confirm the international epidemiological landscape. The report published by the Italian Study on HIV Occupational Risk (SIROH) estimated the frequency of percutaneous exposures by professional profile from 1994 to 2013: nurses represent the mainly involved professional category (54.8%), followed by trainees and surgeons (10.4%). Furthermore, it is worth remembering the high number of cases of occupational exposure involving nursing students (46.2% of the total of cases of occupational exposure relating to personnel in training) (4).

Actually, many health profession degree courses provide clinical internship activities in operating units and hospital facilities during the training course, aiming at acquiring skills that are indispensable for the exercise of students' future profession (5).

Several studies conducted in recent years in Italian universities confirmed the involvement in biological risk accidents of students in training, in particular nursing students, (6-8) but also medical trainee students (9-10). A recent study carried out at Sapienza University of Rome highlighted that 791 students presented a biological risk injury from 2010 to 2015, mainly women (71.8%), nursing students (92.8%) and medical students (5.7%); moreover, puncture wounds were the most frequent kind of injury (58.4%) followed by contact with biological fluid (20.1%) (8).

**equally contributed*

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Particularly, students represent a category at risk, due to inexperience and lack of technical skills (11). For this reason, investigating the level knowledge and perception of biological risk in students seems to be necessary. Analyzing the relationship between the perception of risk and the probability of suffering an accident at work, *Cordeiro* (2002) found that people with the lowest levels of risk perception had a higher risk to be victim of injuries (12).

The objective of this study was to evaluate the validity and reliability of an Italian questionnaire on the knowledge and perception of biological risk in Biomedical students at the beginning of their professional training. This tool aims to identify the perception of biological risk, level of knowledge of the correct application of: a) Standard Procedures; b) use of Personal Protective Equipment (PPE); c) use of Needle-stick Prevention Devices (NPDs) and procedures to be adopted following a biohazard injury.

Methods

The teamwork was composed by physicians specialized in hygiene and preventive medicine and occupational medicine, biologists specialized in microbiology and a HSE technician of Sapienza University of Rome. The team structured the questionnaire about knowledge and risk perception of occupational biological risk for Biomedical students.

This study was conducted at the Sapienza University of Rome through the administration of an electronic questionnaire to students attending the second semester of the first year of Biomedical Courses from March to April, 2019. The objectives of the study, the modalities of achievement of the informed consent and the description of the different sections of the questionnaire were actively presented during a day of classes by a member of the team. Student were given the link to access the online questionnaire by email and they were invited to fill in it. Participation in filling in the questionnaire was on a voluntary basis, students could fill in the questionnaire at the same time using their mobile dispositive or once back home. The questionnaire was available on the Google Docs online platform from March 1st to April 30th 2019. Students could complete the questionnaire even at a delayed time from the date of the presentation of the project.

The degree courses included in this survey were: Medicine, Nursing, Physiotherapy, Health, Safety and Environment (HSE) Techniques and Healthcare Assistance. Students who had already attended the first year of course in the past were excluded.

Questionnaire

The questionnaire used for this survey is a modified version of an existing tool, developed by *Cardoni et al*. (2012) (13).

The questionnaire consists of 42 questions divided into five sections. The first section contains socio-demographic information on age, sex, degree course and parents' work. The following sections contain, respectively, information on health status (twelve questions), level of knowledge and perception of biological risk (fourteen questions), level of knowledge of standard precautions and use of PPE (seven questions) and prophylaxis and post-exposure procedures (nine questions). The questionnaire was available on the Google Docs online platform.

To complete the survey, students had to click on an informed consent form and then they could answer the questionnaire in each section. Most of the questions had only one correct answer, others could have more than one answer.

Statistical analysis

The statistical analysis was carried out using SPSS 25.0. Descriptive statistics for quantitative variables were performed using mean, standard deviation (SD), median and minimum and maximum. Differences between groups for qualitative variables were assessed using the Chi-square test. A statistically significant difference was accepted at a p value of less than 5%.

In order to evaluate internal consistency and reliability of each domain of the questionnaire, the *Cronbach*'s alpha coefficient was used (14). Satisfactory values have been considered those above 0.70.

Results

Out of 370 students attending the first years of course, 309 respondents completed the survey, with a response rate of 83.5%. The mean age was 21.6 (SD 0.58), with 95.0% being 27 years old or younger. The majority of participants were female (68%). Regarding the typology of course attended, 60.2% of the students were Nursing students and 25.2% were Medical students, while the remaining percentage was represented by student attending courses of Physiotherapy (6.5%), Health, Safety and Environment Techniques (6.5%) and Healthcare Assistance (1.6%) (Table 1). Out of 309 students, 27.8% attended another university

Table 1. Biomedical student demographics and attended degree courses at Sapienza University of Rome.

	N = 309	
	n	**%**
Gender		
Female	210	68.0
Male	99	32.0
Age (years)		
<19	109	35.3
19-21	137	44.3
>21	63	20.4
Degree Course		
Healthcare Assistant	5	1,6
Physiotherapy	20	6,5
Nursing	186	60,2
Medicine	78	25,2
HSE Techniques	20	6,5

course and 67.0% of the responders answered that they heard about biological risk during their university courses. Regarding the perceived level of knowledge about biological risk, only 5.1% of students affirmed to have a high level of knowledge. Significant differences about level of knowledge were found stratifying results by typology of course: 93.8% of people who answered to have a high level of knowledge were nurses (Chi-Square=58.2; p<0.001). The level of awareness about the presence of biological risk inside healthcare settings is very high: 96.8% of students stated that healthcare environment has a medium-high level of risk and 93.5% of them think that it is possible to be exposed to any biohazard during future practice activities. About the risk of infection, 96.4% of the students believe that the respect of the procedures could reduce the risk of infection in clinical settings. Moreover, 58.2% of the students have never heard about NPDs and over 86.0% of them would use gloves in several risk activities. Surprisingly, 47.3% of the students would recap needles before collocating them in dedicated rigid containers, exposing themselves to a high risk of injury. In particular, 80.0% of physiotherapy students, 60.0% of HSE technicians and healthcare assistants, 59.0% of medical students and only 37.1% of nursing students showed this possible risk behavior (Chi-Square=58.2; p<0.001). Regarding vaccines, 97.7% of the sample was given a Hepatitis B vaccination. Moreover, 98.7% of students consider vaccinations essential for healthcare personals and 97.0% of them think that vaccinations should be compulsory for this category of workers. Furthermore, only 43.0% of the students know the main procedures to adopt in case of accidental exposure to biological agents and 41.0% of the students are not aware to have an insurance against biological risk accidents during their traineeship activities.

The teamwork opted to perform the analysis of internal consistency of the 13 ordinal variables for the knowledge level about standard precautions and use of individual protection devices (question 1 section 4; and question 5 section 4) showed an overall standardized Cronbach's alpha equal to 0.765, corresponding to a good reliability. In the analysis by item the value of the alpha remained stable: in Table 2 it is possible to see the alpha for each eliminated item, and it can be observed that refining the questionnaire removing the item about recapping the needles after use brings the Cronbach's alpha to a maximum reliable value of 0.793 (Table 2). Performing the analysis separately on different areas of study, the questionnaire showed a better reliability among physiotherapy and medical students, with a Cronbach's alpha equal to 0.944 and 0.881, respectively. Lower values of Cronbach's alpha were obtained for nurses (α=0.680), healthcare assistants (α=0.680) and health, safety and environment techniques (α=0.510) (Table 2).

Discussion

Results of *Cronbach*'s alpha showed a good reliability of the questionnaire. However, performing the analysis for each individual degree course, the level of reliability appears variable. In particular, the low value of *Cronbach*'s alpha of HSE technicians could be related to occasional direct contacts with healthcare settings that these professionals actually have. Furthermore, the questionnaire administration method could have reduced the ability to verify the reliability of the results. The non-compulsory, relaxed atmosphere and the use of the participants' mobile phones may have led the students of some degree courses to compile the questionnaire with inattention, without seriousness or using the help of colleagues, influencing and thus modifying the obtained results.

Moreover, the sequence of questions 1 and 5 of section 4, concerning knowledge of standard precautions and use of personal protective equipment, may have influenced the internal consistency of the questionnaire, lowering the value of the alpha. This may explain why the value of the alpha increases when the question on re-needling is eliminated from the analysis.

Only 37.5% of the students would insert the used needle directly into the cutting container and this requires careful consideration as several studies have shown that most injuries occur during the first year of study (7,15,16) and that the operations that expose students to a greater biological risk are precisely the recapping (prohibited by universal precautions) and the disposal of the needle, with an accident rate ranging from a minimum of 6.9% (17) to a maximum by 39.7% (15).

La Torre et al. (2019) showed that the puncture wounds are the most frequent (n=462) representing 58.4% of the total and occurring mainly at the level of the wrist and hand (n=380); the second most common type of injury was represented by contact with biological fluids (n = 159) (8).

However, a positive result that emerges from this study is that 97.7% of the sample has been subjected to vaccination against hepatitis B. This high percentage is largely due to the application of L.165 of 27/05/1991, which imposed the obligation of hepatitis B vaccination to all those born since 1979 (18).

It seems interesting to underline that most of the first year students of Biomedical courses (98.6%) considered healthcare settings as medium-high risk environments and, among these, 93.5% think to be able to incur in a biohazard accident during their training activities. This may be related to the decision to administer the questionnaire to students who have just started the vocational training, which could have supported the awareness of being unprepared and the tendency to overestimate the probability that a negative event could happen (11).

The lack of knowledge of NPDs application and of the main procedures to be adopted in the event of accidental exposure to biological agents could be explained by the lack of specific educational content in all Biomedical students, who address these issues in subsequent semesters of degree course.

The limitations of this study include a small sample size and the recruitment of participants. The sample size was 309 students, which makes it difficult to generalize the results for the entire Italian population. More important, the survey is restricted to some degree courses of Biomedical of Sapienza University of Rome. Future research should recruit more participants and more Biomedical courses, even extending the study to other Universities. Nevertheless, this study provides a reliable tool which could help to better investigate the level of knowledge and perception of biological

Table 2. Statistical analysis of internal consistency of the questionnaire.

		Overall	Physiotherapy	Medicine	Nurse	Healthcare Assistence	HSE Techniques
Hygiene behaviour	Hand hygiene before working	0,751	0,940	0,882	0,630	0,727	0,510
	Hand hygiene before gloves	0,747	0,937	0,870	0,630	0,694	0,461
	Hand hygiene After gloves	0,750	0,945	0,875	0,613	0,755	0,511
	Hand hygiene Before/after biological material	0,747	0,939	0,867	0,594	0,551	0,494
	Gloves before contact with patient	0,749	0,935	0,871	0,602	0,647	0,504
	Recapping needles	0,793	0,936	0,871	0,626	0,694	0,490
	Surgical Mask before contact with patient	0,731	0,933	0,868	0,622	0,540	0,513
	Safety glasses before contact with patient	0,741	0,936	0,873	0,622	0,662	0,463
Use of gloves	Intramuscular injection	0,760	0,934	0,867	0,631	0,694	0,514
	Blood sampling	0,751	0,937	0,870	0,630	0,694	0,481
	Wash surgical instrument	0,751	0,939	0,866	0,690	0,647	0,595
	Blood samples test tube manipulation	0,739	0,946	0,873	0,549	0,656	0,448
	Other biological fluids manipulation	0,741	0,951	0,881	0,553	0,662	0,310

risk among students and to plan corrective measures, such as specific biological risk courses, workshops or training practical activities, in order to increase students' awareness and judgement about this topic.

Conclusions

The present study showed that first-year Biomedical students may be exposed to occupational biological risk mainly because of their inexperience. Considering Biomedical students as future healthcare professionals, knowledge about biological risk becomes essential so that they could change their behavior and develop effective prevention measures for self-protection (19). This requires an increase in students' awareness of this topic, as well as on injuries, healthcare associated infections, aggression, stress and burnout, manual handling of loads, cancer, alcohol related problems (20-32). Students with greater knowledge regarding causes and consequences will be more likely to adopt behaviors aimed at reducing the possibility of experiencing a biohazard injury.

This requires a didactic/training educational path with the specific objective of acquiring complex competences to which knowledge (knowing what to do), attitudes and practical/applicative skills (knowing how to do), taking correct behaviors (knowing how to act) contribute, and a personal and professional responsibility, as a moment of personal and human growth (knowing how to be).

The collection of information about the level of knowledge and perception of occupational biological risk can therefore be a fundamental tool for planning / optimizing the training programs of students in the Biomedical area, especially in relation to the knowledge and the correct use of the standard precautions (hand washing, use of PPE and NPDs, attention during the handling and disposal of needles and other sharp instruments), which must be adopted by trainees and health workers for all patients, regardless of their diagnosis, and of post-management procedures exposure.

Therefore, knowledge, training and proficiency represent the main strategies for making future healthcare professionals prepared, skilled and responsible and for minimizing biohazard injuries in trainee students.

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