Describing nurses' awareness of biological risk in delivering care for renal-dialysis patients: an italian pilot survey

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Abstract. *Background and aim of work.* Despite national descriptions of awareness, knowledge, and perceptions about the exposure to the biological risk among nurses employed in renal-dialysis care are pivotal to increase work safety, there is a paucity of data on these descriptions in the Italian context. This study aimed at describing Italian nurses' awareness and knowledge about biological risk in delivering care for renal-dialysis patients, and their experiences of biological accidents. *Methods.* A pilot survey using cross-sectional data collection and convenience sampling procedure. 124 nurses were enrolled receiving a 7-item questionnaire: Questions 1, 2, and 7 were referred to the awareness about educational learning needs, questions 3 and 4 explored nurses' knowledge about biological risk, questions 5 and 6 collected accident-related information. *Results.* Overall, nurses' awareness and knowledge about biological risk appeared almost limited. Surprisingly, 52% of the enrolled nurses experienced a biological accident, and 29.5% reported to know colleagues who developed work-related disease after a biological accident. We found positive significant associations between awareness and knowledge. *Conclusions.* This pilot study highlighted the need to further describe Italian nurses' awareness and knowledge about biological risk in delivering care for renal-dialysis patients, as well as the need of up-to-date epidemiological description about biological accidents. Accordingly, future studies are highly recommended to provide robust evidence aimed at supporting policy makers, educators, clinicians, regulators, and managers.

Keywords: biological risk; renal-dialysis care; nursing; survey

Introduction

Biological risk is a serious issue for healthcare workers involved in delivering care for renal-dialysis patients, acknowledging they have high risk of exposure to blood and body fluids during their daily working activities (1). According to previous research, the incidence of biological risk accidents among nurses, technicians, and students is higher than the one reported among physicians (2). Particularly, nurses involved in delivering renal-dialysis care are particularly exposed to biological risk accidents (3). In this context, scientific

societies have a pivotal role in defining strategies to decrease the biological risk, developing recommendations, and in improving the awareness about biological hazards (4). For this reason, mapping the awareness about biological risk in specific national contexts is strategic to develop strategies to face with some possible cultural weakness among healthcare workers. For this reason, the Italian Nursing Society of Renal Care (SIAN) has conducted a pan-national description of the nurses' awareness about biological risk in delivering care for renal-dialysis patients through a survey.

Background

Healthcare workers are exposed to many factors that can cause occupational diseases. These factors can be categorized as follow (5): a) Factors that cause infectious and parasitic diseases (e.g., prions, viruses, bacteria, fungi, protista, and worms); b) biological allergens (e.g., bacterial, fungal, plant, and animal); c) biological toxins, including immunotoxic factors, stimulating or inhibiting the components of the immune system, such as, bacterial endotoxins, mycotoxins, β-glucans, volatile organic compounds, toxins, plant, animal venoms; d) carcinogens, such as the aflatoxins—which are toxins produced by certain *Aspergillus* species—or wood dust; e) biological vectors (e.g., ticks, mosquitoes) carrying bacteria, viruses, parasites, and others pathogens; f) submicron and nanomolecules coming from bacteria and fungi.

Nurses are the healthcare workers with biological higher risk (6) and nurses and physician are the categories that most deal with injuries of this kind (55,4%) (7). For instance, an observational study found higher rates of needlestick and sharps injuries (NSSIs) among nurses than among physicians, even if the accidents were underreported for both the professional categories (6). The most represented type of injury is accidental needle puncture during blood sampling (77,6%) (7), and nurses are the category of health professionals who use needles more than other categories. In a study (8) the prevalence of reported needle bite injuries among nurses working in public hospitals has been 34.5% in the last year and 48.8% and in all injured nurses, 53.7% occurred during the night shift, due to tiredness.

Knowledge about biological risk becomes essential to change behavior and develop effective prevention measures for self-protection to avoid biohazard injury (9), and healthcare workers requires an educational/training course with the specific objective of acquiring complex skills starting from university education. In fact, competence, knowledge and training represent the best strategies to make healthcare professionals prepared and accountable and to minimize biological risk injuries (10). As reported, the lack of experience increases the risk of exposure to bloodborne pathogens (BBP) (11). For this reason, nursing and medical students are highly exposed to the biological risk (12-13). Overall, biological risk is under-estimated and the awareness about this topic is still limited (14).

Accordingly, the lack of awareness about biological risk has been reported as a major cause of accidents (15-16). Healthcare workers with low level of awareness about biological risk are more inclined to perform risky behaviors, such as recapping used needles (16–17). A survey performed in 181 hospitals in the United States of America (USA) highlighted that accidents among nurses were the most frequent, and healthcare workers with highest level of awareness reported lower rates of accidents (18). Some performed in Europe (19) and in Indonesia (20) reported similar results The lack of awareness is also associated with inadequate/risky behaviors when a biological risk accident happens among healthcare workers, undermining the correct management of the same accident, such as considering the adequate reporting (21-22). Furthermore, the associations between inadequate behavior and biohazard accidents were clearly highlighted by a recent literature review through a search in seven databases, from 2005 to 2014 found that the reasons for the poor adherence to precautionary standards are related to learning deficiencies. permanent, risky behavior, inadequate supply of protective equipment and devices and inadequate working conditions (23). In addition, inadequate occupational health and safety measures were factors associated with needle stick injury (8).

Some essentials considerations are reported by Kebede & Gerensea (2018). The authors explain that nurses with work experience greater than 10 years were more than six times at higher risk to sustain needle stick injury (NSI) than those who work experience

were less than or equals to 5 years with. In addition, nurses who worked greater than 40 h per week nearly three times at higher risk to sustain NSI than those who worked hours less than or equals to 40 h per week with. Who do not use personal protective equipment (PPE) during procedure were five times at more risk to sustain NSI. The risk of NSI was nearly five times higher in nurses who did not follow infection prevention guidelines than those followed it. Finally, nurses who did not receive infection prevention training were nearly six times at more risk than nurses who received training.

Considering that the renal-dialysis care was described as a high danger setting for biological risk (24), the Italian Nursing Society of Renal Care (SIAN) wanted to investigate the awareness of nurses about biological risk.

Needle stic injury is common among dialysis unit staff, with Twenty-five (24.5%) respondents had experienced NSI in the last one year while 41 (40.2%) respondents had had at least one NSI in their entire working career (25). This kind of blood-borne risk is reported also by Kabbash et al. (26) while the authors showed study from 32 hemodialysis units in Egypt, where 48.6% of the HCWs reported NSI in the previous year. The risks in hemodialysis had been well reported in literature and they are due to the invasive procedures, such as insertion of dialysis catheters for access assisted by the nurses; the senior nurses do needle artero-venous fistulae, while the technicians are concerned with machine maintenance (25). The risks in hemodialysis are well known as reported by Petrosillo et al. as early as 1995 (27), where they reported that nurses had the highest rate of sharps injury and skin or mucous membrane contamination because they do most of the invasive procedures in the dialysis units studied. Physicians were only involved in clinical management of the patients.

In this context, the role of the scientific societies aimed at improving awareness is particularly strategic for achieving adequate disseminations of best practice (28). Thus far, the description of nurses' awareness about biological risk in delivering care for renal-dialysis patients is generally under-investigated with data collected mainly as a secondary outcome (15). With regards for Italy, there are no available pan-national description of perceptions about the exposure to the biological risk among nurses employed in renal-dialysis care. For this reason, this study aimed at describing Italian nurses' awareness and knowledge about biological risk in delivering care for renal-dialysis patients, and their experiences of biological accidents. Having this information seems to be pivotal to understand the main weakness of nurses involved in this clinical field.

Materials and methods

Design

This pilot investigation has an observational design, collecting cross-sectional data through a pan-national survey in Italy. The pilot nature of the study was necessary to frame a solid framework for developing more in-depth investigations, as no previous recent data were available on nurses' awareness about biological risk in Italy.

Sample and sampling procedure

This study adopted a convenience sample of nurses involved in delivering care for renal-dialysis patients. Nurses belonging to the Italian nursing society of renal care (SIAN) were considered eligible. The survey was distributed to the participants of the society's National Congress in May 2019. All eligible nurses were invited to participate voluntarily into the study. SIAN is a scientific society recognized by the Italian Ministry of Health and it has more than 300 members. Its mission is to support the fieldwork and ethical reflections with the aim of structuring a specific core of awareness, competence and professional exchanges between colleagues operating in the various sectors of the chronic kidney disease: hemodialysis, peritoneal dialysis, kidney transplantation, hospitalization, pre-dialysis and post-transplant nephrological surgeries, palliation and research. SIAN promotes conferences or days of study and distance learning. In addition to spreading specific skills in the nephrology sector, the company collaborates with other societies to produce procedures and protocols.

Survey

The survey was developed by the board of SIAN. It comprised of a socio-demographic form for describing respondents' characteristics and seven questions aimed at describing the nurses' awareness about biological risk in delivering care for renal-dialysis patients. More precisely, question 1 investigated whether the respondent has attended specific continuing education on biological risk. Question 2 explored whether the respondent performed general continuing education in the last three years Questions 3 and 4 had multiple choice answers and were intended to investigate the opinion of the respondents by choosing from those that had been selected and reported in the literature as health care professionals and body parts of health professionals to have a higher biological risk and increased exposure to biological agents. Questions 5 and 6 collected accident-related information. Question 7 investigates whether the operator would like to attend continuous training courses on biohazard.

Data analysis

The characteristics of the sample and the answers to the survey were synthetized using descriptive statistics, where mean and standards deviation (SD) were used for normally distributed continues variables, while frequency and percentage were used for nominal/ordinal variables. Data were assessed for missing information, errors or outliers using the analysis of frequency distribution. The associations between each answer ['yes' or 'no' referred to questions 1, 2, 5, 6, and 7; 'completely correct' or 'almost correct or incorrect' referred to questions 3, and 4], the other answers, and dichotomous socio-demographic data (e.g., sex) were assessed through odds ratios (ORs) with their 95% confidence interval (95% CI). The associations between each answer and quantitative socio-demographic data (e.g., age) were assessed using point-biserial correlation coefficient (r_{pb}). Statistics were performed using IBM SPSS 22 (SPSS, Inc., Chicago, IL, USA), setting the significance level at p≤ 0.05 (two-tailed test).

Ethical Consideration

The study was proposed and approved by the institutional board of the Italian Nursing Society of Renal Care (SIAN) on 28 March 2018. The approval of the ethics committee was not required for this investigation. Participation took place anonymously and on a voluntary basis. All respondents were informed that the compilation of the questionnaire replies would be considered as explicit consent to participate and that the data would be used in aggregate form to guarantee greater privacy.

Results

Sample characteristics

266 eligible nurses were invited, and a total of 124 nurses (response rate = 46%) answered to the survey. Table 1 shows the socio-demographic and professional characteristics of the enrolled nurses. The majority of the nurses were female (76.6%), from the north of Italy (62.6%), employed in public facilities (96.8%), and working in outpatient settings (94.3%). The mean age of the included nurses was 46.66 years (SD = 8.84), their mean working experience was equal to 23.52 years (SD=9.49), while their mean working experience in delivering care to renal-dialysis patients was equal to 15.93 years (SD=10.3).

Survey

The major of nurses (86.3%) performed specific education on biological risk (question 1); however, 38.2% of responders answered that they did not attend any continuing education courses in the last three years (question 2). Furthermore, 64.2% of the enrolled nurses answered correctly in identifying healthcare providers at higher biological risk (question 3); conversely, only 39.7% answered correctly in identifying which part of the body is most exposed to the biological risk (question 4). Surprisingly, 52% of the nurses experienced a biological accident (question 5), and 29.5% reported to know colleagues who developed work-related disease after a biological accident (question 6). Finally, 8.1% of responders reported that they would not like to attend continuing education courses on biological risk (question 7).

There were not differences in answering to the questions in relation to socio-demographic and

Table 1. Characteristics of the sample (N=124)

		N	%
Sex			
	Males	95	76.6
	Females	29	23.4
Age			
	Years (mean; SD)	46.66	8.84
Region			
	North	77	62.6
	Center	28	22.76
	South	18	14.63
Working experience			
	Years (mean; SD)	23.52	9.49
Working experience with renal-dialysis patients			
	Years (mean; SD)	15.93	10.3
Facility			
	Public	119	96.8
	Private	4	3.3
Setting			
	Outpatients	116	94.3
	Ward	7	5.7

Legend: SD = Standard Deviation

Table 2. Survey responses (N=124)

		N	%
Q1: Have you ever attended courses on biological risk?			
	Yes	107	86.3
	No	17	13.7
Q2: Have you attended continuing education courses in the last three years?			
	Yes	103	83.1
	No	17	13.7
	Missing	4	3.2
Q3: Who are at higher biological risk among these healthcare providers?			
	Completely correct	79	64.7
	Almost correct or incorrect	44	35.5
	Missing	1	0.8
Q4: Which part of the body is most exposed to the biological risk?			
	Full correct answer	48	38.7
	Almost correct or incorrect	73	58.8
	Missing	3	2.5
Q5: Have you ever experienced a biological accident?			
	Yes	64	51.6
	No	59	47.6
	Missing	1	0.8
Q6: Do you know any colleagues who developed work-related disease after a biological accident?			
	Yes	36	29.0
	No	86	69.4
	Missing	2	1.6
Q7: Would you like to attend continuing education courses on biological risk?			
	Yes	113	91.1
	No	10	8.1
	Missing	1	0.8

professional data (all p > 0.05). However, nurses that did not attended specific education courses on biological risk showed an increased likelihood (odds) by 17 times of answering that they also did not attend any kind of continuing education courses in the last three years (question 2) (OR=17.3; 95%CI=3.7–23.3; p<0.001). Furthermore, nurses that did not attended specific education courses on biological risk exhibited a decreased likelihood (odds) by 72% of answering correctly to question 4 (identifying which part of the body is most exposed to the biological risk (OR=0.28; 95%CI=0.07–0.92; p=0.048). The nurses who answered correctly to question 4 showed an increased likelihood (odds) by 6.6 times of answering that they would like to attend continuing education courses on biological risk (question 7) (OR=6.6; 95%CI=1.1–23.9; p=0.046).

Discussion

Given the unavailability of pan-national descriptions about perceptions referred to biological risks among Italian nurses employed in renal-dialysis care,

this pilot study provides the initial basis to frame the understanding about this topic. More precisely, the study investigated through seven questions the awareness about the need of education (questions 1, 2, and 7), nurses' knowledge (questions 3 and 4), and accident-related information (questions 5 and 6).

The awareness about the need of education seems to be still limited in our study. Despite 86.3% of the responders performed specific education on biological risk, more than one third of them (38.2%) did not attended any kind of continuing education course in the last three years. This means that one third of responders did not fulfil the normative requirements about continuing professional education, as every healthcare worker has to attend continuing medical education (CME) to achieve a fixed among of CME credits (150 CME) within a three-year cycle (29).

Nursing profession requires lifelong learning to address the fast-changing challenges of clinical practice (30). For this reason, the in-depth understanding of the barriers underpinning the reported low rates of CME within each three-year cycle should be further addressed by future investigations. Some authors argued that the mismatch between contents and learning approaches of the majority of CME courses and learning needs perceived by clinicians could be the paramount barrier for sustaining lifelong learning (31). However, some cultural and work-related barriers should to be considered (30). For instance, low job satisfaction, employee engagement, and work overload could negatively affect the organizational culture, and therefore negatively influencing the individual's lifelong learning-attitudes as well as organizational safety (32).

Items exploring nurses' ability in identifying healthcare providers at higher biological risk and in identifying which part of the body is most exposed to the biological risk showed that education on this topic is still fundamental to achieve adequate standards of knowledge. Accordingly, only 39.7% of the responders answered correctly to question 4, and 64.2% to question 3. These results highlight the need of strategies to support the mastering of biological risk management in delivering care for renal-dialysis patients. Future research should clarify whether nurses with

higher positive attitudes towards education actually reflect over time stable safe behaviors (e.g., reporting behaviors) and up-to-date knowledge (33).

The rates of the reported experiences of biological accidents require high attention, even if it is not possible to generalize these rates acknowledging the pilot nature of the study. However, these results corroborated that biological accidents among nurses involved in renal-dialysis care are highly frequent (34). Furthermore, a high level of under-reporting in this field, ranging from 30% to 80%, was described by previous research, especially for sharps injuries (35). Accordingly, the prevention and management of biological accidents should be considered as a top priority by the multi-stakeholders community of managers, educators, researchers and clinical experts.

Overall, there is an urgency for innovative educational and regulatory approaches to address the criticalities derived from this study, and for supporting sound changes in the workplace. To achieve successful outcomes, it is pivotal a strong and widespread leadership culture that has to pay high attention to safety. Moreover, future research is needed as well to support policy with evidence. For instance, despite in this pilot study nurses' answers did not differ at the comparisons by sex, age, facility, setting, working experience, and regions, it is possible that specific sub-groups could be highly exposed to the risk of unsafe behaviors. Accordingly, tailored strategies could be effective in supporting the weakest sub-groups.

This study has several limitations. Firstly, the pilot nature of the investigation undermined the possibility of generalization. However, this study gave interesting hints and data for designing future in-depth investigations, such as the need to further assess with valid and reliable tool the areas of awareness and knowledge, as well as the need to perform an epidemiological description about biological accidents among Italian nurses employed in renal-dialysis care.

Secondly, the geographical distribution was not uniform, as the major of the responders were from the north of Italy. This means that future research should overcome this limit to allow the collection of responses that reflect a uniform geographical distribution.

Thirdly, the limited sample did not allow significant sub-groups analysis.

Implications for Clinical Practice

Recent times have led to greater awareness about the importance of hospital-acquired infections and the need to control them. Hospitals today provide increasingly complex treatments and treat increasingly serious patients, for this reason it is important that all health personnel have balanced and fair information, develop full awareness of the problem, and acquire familiarity in the prevention of risks in the workplace. It is also important to improve workers' knowledge in order to help them acquire a less distorted perception of risk, this can be achieved through training, awareness and orientation towards mandatory procedures for the containment of biological risk.

Through the investigation carried out, SIAN lays the foundations for being able to intervene through subsequent distance or field training courses that provide the necessary tools to be able to carry out actions in complete safety for the health workers and patients.

Conclusions

This study highlighted the need to further investigate Italian nurses' awareness and knowledge about biological risk in delivering care for renal-dialysis patients, and the up-to-date epidemiological description of biological accidents. Future research is highly recommended to support with evidence the policy makers, educators, clinicians, regulators, and managers. The results derived from this study suggested that innovative educational and regulatory approaches are required to address the still limited awareness about biological risks in delivering care for renal-dialysis patients. It is important the engagement of a multi-stakeholders community to address these weaknesses with plans, research, policy, and education.

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