EVALUATION OF PHYSICIAN ADHERENCE TO STANDARD PRECAUTIONS IN GYNECOLOGY AND OBSTETRICS RESIDENCY: A PRACTICE, CHALLENGE AND TRAINING NEED STUDY

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Abstract

Background: Standard Precautions (SP) are the crucial measures of avoiding healthcare-associated infection and their implementation is important in safeguarding healthcare professionals and patients alike. Doctors, especially the ones working in gynecology and obstetrics, are more likely to be exposed to blood stains and bodily fluid of a patient because their work is invasive. Nevertheless, the compliance of the SP of resident physicians in these specialties has not been sufficiently investigated. Purpose: The aim of the study was to evaluate the compliance of the resident physicians in the gynecology and obstetrics department with SP protocols and to find out what factors impact on adherence. Methods: A quantitative descriptive study was done on 121 gynecology and obstetrics resident physicians in three years of residency (R1, R2, R3) in a teaching hospital. The data were gathered on the basis of a structured questionnaire and Standard Precautions Compliance Scale which had 13 items in the form of a Likert-type instrument. The data was analysed using descriptive statistics and Kruskal-Wallis test. Ethical permission was granted and informed consent was gathered to all the participants. Findings: The researchers discovered that there were very big differences in adherence to SP depending on practices. Compliance was high in regards to proper sharps disposal (96.6) and the use of gloves in case they got exposed to blood and secretions (79.3). Nevertheless, the rates of compliance were lower with such practices as treating patients as they were infected with HIV (8.3%), and wearing safety glasses (17.4%). There were also great variations in compliance between the years of residency as R1 residents were more likely to comply to hand hygiene and standard precautions than the R2 and R3 residents. Conclusions: This paper identifies moderate adherence to SP in gynecological and obstetric resident physicians. Most of the major practices were highly adhered to but there is a need to improve hand hygiene, use of PPE, and handling of needles. The findings highlight the importance of regular and mandatory training on SP, especially high-risk practices, to increase compliance and minimize the risk of occupational health. Increasing the rates of SP adherence will help in provision of safer healthcare environments between the healthcare workers and the patients.

Keywords: Standard Precautions, physician compliance, gynecology, obstetrics, residency, infection control, personal protective equipment, hand hygiene, healthcare worker safety.

Introduction

Standard precautions (SP) represent measures that medical workers need to adhere to when attending to every patient regardless of their illness. These measures are ensuring good hand hygiene, using personal protective gear (PPE) gloves, masks, safety goggles, and aprons, managing and processing sharp objects correctly, and following several measures to reduce the risks in the workplace [1,2]. Healthcare professionals should use SP universally. Adherence to such guidelines especially by the doctors is paramount. Gynecologists and obstetrics physicians have increased chances of exposure to patient blood and body fluids because of invasive operations they carry out. That is why, they should be complete and consistent in terms of following SP protocols. Although the need to implement these measures is already well-established, studies also show that SP compliance of medical professionals is still not optimal [3,4]. Besides, only a selection of research assesses the adherence of gynecology and obstetrics physicians to SP.

It is possible that non-adherence to SP in healthcare facilities leads to work-related injuries, and one of the crucial pathways to this fact is the lack of risk perception, especially when it comes to working with sharp objects [5]. Little data exist concerning the extent of SP compliance in the gynecology and obstetrics setting among physicians. Thus, this paper sought to fill this knowledge gap by exploring how resident physicians in these departments adhere to SP protocols.

Methods

The study was quantitative descriptive research in one of the cities in the south east. The participants of the study were physicians who were resident gynecologists and obstetrics, in year one (R1), year two (R2), and year three (R3) of their residency at a teaching hospital. Every resident of these years was invited to take part in the study. A group-based application that was conducted in the classroom was used to collect data. The Standard Precautions Compliance Scale was conducted with the help of a structured questionnaire that included demographic and professional data sheets. It is a 13-item Likert scale which is meant to measure physician compliance with Standard Precautions (SP). All the items will be rated on a scale between 1 and 5 and the average score of each item will be divided into three categories; high ([?] 4.5), intermediate (3.5 to 4.49), and low (< 3.5) [6]. The scale was created [7,8] and tested [9] and psychometric properties such as internal consistency, content validity and construct validity assessed and were all found to be satisfactory [9].

The analysis of the study sample was characterized using descriptive statistics (frequency, mean, median, maximum and minimum) as measures of central tendency. Kolmogorov-Smirnov test was used to determine the normality of the data. On these findings, suitable parametric and non-parametric tests were picked. Kruskal-Wallis was the test that was applied to compare the mean scores of the three groups, with the significance level of p [?] 0.05. The test of Equality of variances was done using Levene test. IBM(r) SPSS version 20 was used to carry out the statistical analyses. The Research Ethics Committee in the medical school of the ABC Foundation gave ethical approval to the study. The participants were assured that all the information gathered would be kept confidential and would not have any impact on their performance at school. All the participants were informed about the study and signed a consent form prior to participation. The total sample size was n = 121.

Results

The total number of participants was 121, 94 females (77.6) and 27 males (22.4). Most of the respondents were between 25-30 years (78.5%), 13.2% were 30 years and above, and 8.3% were between 20-25 years. On the weekly work hours, 52.9 percent of the respondents had to work 51-70 hours both weeks, and 35.5 percent had to work more than 71 hours in both weeks and 11.6 percent had to work 30-50 hours in both weeks. The information regarding Standard Precautions (SP) was obtained in the school or university (74.4%), with fewer counts of participants learning about the previous two (14.0% each),

and other (3.3%). On the training on SP, 30.6 percent of the participants had formal training and the remaining (69.4) had never had any SP training. The statistical method of the data analysis such as the Chi-square tests demonstrated that there were significant differences in the ages and time spent at work weekly and knowledge and training in SP varied among the study population (Table 1).

Table 1: Demographic and Professional Characteristics of the Study participants (n=121).

Variables	N (%)	Mean	SD
Gender			
Female	94 (77.6)	-	-
Male	27 (22.4)		
Age			
20–25 years	10 (8.3)	$\chi 2 = 27.7$	2.12
25–30 years	95 (78.5)		
≥30 years	16 (13.2)		
Weekly hours worked			
30–50 hours	14 (11.6)	$\chi 2 = 67.2$	15.7
51–70 hours	64 (52.9)		
≥71 hours	43 (35.5)		
Knowledge about SP			
School or university	90 (74.4)	-	-
Lecture in the hospital	10 (8.3)		
Through the previous two options	17 (14.0)		
Other	4 (3.3)		
Received training in SP			
Yes	37 (30.6)	-	-
No	84 (69.4)		

The adherence of physicians to standard precaution (SP) on various items in the study was different. Most physicians (96.6) noted that they always disposed sharps in the right containers and only a minor percentage (3.4) cited that they rarely did so (Table 2). Regarding the practice of treating every patient as an HIV carriers, 8.3% of all physicians said they always did it but a more significant number (26.4) never resorted to it. A considerable proportion (48.0%) of physicians indicated that they were always consistent with the standard precautions no matter the diagnosis of a patient, but others were not. About hand hygiene, physicians with 51.2% always washed their hands after taking off the disposable gloves and 38.0% frequently did. Conversely, 43.0% persistently wore a protective apron in case of chances of direct contact with blood or any other secretions on clothes whereas 28.9% frequently put on a protective apron. Disposable gloves were a common practice with 79.3% of the physicians wearing gloves at all times when there was a risk of being in contact with blood or other secretions. The use of safety glasses and masks was also lower and only 17.4% and 37.9% of the physicians reported that they always wore masks and safety glasses, respectively.

As to the cleaning of spills of blood or other secretions, 27.3 percent were always cleaning them up, and 43.0 always cleaning them often. Eighty-two six percent of physicians reported having handled scalpels and sharps properly. Nevertheless, a high rate (45.5) of physicians claimed that they never recapped used needles, which means that the rates of non-observance of this practice are high.

To use gloves with puncture of veins, 82.6% of physicians stated that they always put on gloves, and 9.9% did it frequently. Most (51.2) physicians said that materials contaminated by patient saliva were contaminated, and 22.3% said they were frequently contaminated.

Table 2: Physician Adherence to Standard precautions (n = 121)

Items	Always n (%)	Often n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
1. Dispose of sharps in proper containers	116 (96.6)	4 (3.4)	-	-	-
2. Treat all patients as though they were contaminated with HIV	10 (8.3)	29 (24.0)	33 (27.3)	17 (14.1)	32 (26.4)
3. Follow standard precautions with all patients regardless of their diagnosis	23 (19.0)	58 (48.0)	31 (25.6)	9 (7.4)	-
4. Wash hands after removing disposable gloves	62 (51.2)	46 (38.0)	10 (8.3)	3 (2.5)	-
5. Use a protective apron when there is a possibility of getting blood or other secretions on clothes	52 (43.0)	35 (28.9)	21 (17.4)	13 (10.7)	-
6. Use disposable gloves when there is a possibility of contact with blood or other secretions	96 (79.3)	21 (17.3)	4 (3.3)	-	-
7. Use safety glasses when there is a possibility of the eyes being splashed with blood or other secretions	21 (17.4)	19 (15.7)	29 (24.0)	42 (34.7)	10 (8.3)
8. Use a disposable mask when there is a possibility of the mouth being splashed with blood or other secretions	46 (37.9)	54 (44.8)	17 (14.0)	-	-
9. Immediately clean any spills of blood or other secretions with disinfectant	33 (27.3)	52 (43.0)	18 (14.9)	12 (10.0)	6 (5.0)
10. Carefully handle scalpels or other sharps	100 (82.6)	21 (17.3)	-	-	-
11. Recap used needles	6 (5.0)	21 (17.3)	10 (8.3)	29 (24.0)	55 (45.5)
12. Use gloves when puncturing the veins of patients	100 (82.6)	12 (9.9)	2 (1.7)	-	-
13. Consider as contaminated all materials that have been in contact with the saliva of patients	62 (51.2)	27 (22.3)	15 (12.4)	10 (8.3)	7 (5.8)

The researchers evaluated the adherence of physicians to standard precautions (SP) in three years of residency (R1, R2, and R3). The compliance was quite different among various items and certain practices exhibited high levels of compliance whilst others were characterized by low levels of compliance. In the case of Item 1 (disposing sharps in proper containers), physicians across all years of residency were very compliant as the mean scores were 4.94-5.00 and displayed no significant difference with the groups ($p = 0.737$). By comparison, the compliance level in the Item 2 (treating all patients as those who were contaminated with HIV) rating was smaller, with a mean of between 2.66 and 2.88. The group differences were not significant ($p = 0.808$). The difference between residing years ($H = 11.30$, $p = 0.004$) was significant in item 3 (following the standard precautions with all patients irrespective of diagnosis) where the R1 residents have the highest mean score (4.18) compared to R2 (3.41) and R3 (3.47). Likewise, in the case of Item 4 (washing hands following the removal of disposable gloves), there was a significant difference ($H = 10.14$, $p = 0.006$), and R1 residents as more compliant (mean = 4.55) than R2 (3.75) and R3 (4.57). No significant variations have been found in Item 5 (wearing a protective apron in case of exposure to blood or secretions), with the average scores of R1, R2, and R3 being 3.75 to 4.18 ($p = 0.246$). The item 6 (putting on disposable gloves when in contact with blood or secretions) had a high level of compliance throughout all years of residence with no significant differences ($p = 0.542$). In the case of Item 7 (wearing safety glasses in case of exposing eyes to dangers), compliance was poor in general with the mean scores between 2.77 and 3.31 although there were no significant differences in compliance between groups ($p = 0.408$). In the same way, the non-significant trend of Item 8 (wearing a disposable mask in those cases when there is a risk of exposure to the mouth) had a mean score of 3.90 to 4.42. The item 9 (immediately cleaning spills of blood or other secretions) did not have any significant differences between the groups ($p = 0.464$). A high compliance was reported in item 10 (carefully handling scalpels or other sharps) with mean scores of 4.80 to 4.91 and none of the groups indicated significant differences ($p = 0.645$). The compliance in item 11 (recapping used needles) was poor in all years of residency, with many physicians indicating that they have never recapped needles ($p = 0.293$). In the case of the Item 12 (wearing gloves when puncturing veins) there was no significant difference in compliance ($p = 0.531$) as the mean score of R1 was 4.81, R2 was 4.91, and R3 was 4.78. Also, the compliance of item 13 (when materials were contaminated with patient saliva were considered as contaminated) was high, and there were no significant group differences ($p = 0.767$).

Table 3: Physician Compliance Standard Deviations and means by Residency (n = 121).

Items	Residents	N	Mean Score	SD	H	p
Item 1	R1	58	4.96	0.26	0.61	0.737
	R2	24	5.00	0.00		
	R3	39	4.94	0.30		
Item 2	R1	58	2.88	1.08	0.42	0.808
	R2	24	2.66	1.17		
	R3	39	2.79	1.20		
Item 3	R1	58	4.18	0.61	11.30	0.004b
	R2	24	3.41	0.70		
	R3	39	3.47	1.03		
Item 4	R1	58	4.55	0.64	10.14	0.006b
	R2	24	3.75	0.94		
	R3	39	4.57	0.50		
Item 5	R1	58	4.18	0.99	2.80	0.246
	R2	24	3.75	0.84		
	R3	39	4.16	0.84		
Item 6	R1	58	4.85	0.36	1.22	0.542
	R2	24	4.66	0.67		
	R3	39	4.68	0.64		
Item 7	R1	58	2.77	1.29	1.79	0.408
	R2	24	2.91	0.87		
	R3	39	3.31	1.29		
Item 8	R1	58	4.22	0.63	3.76	0.152
	R2	23	3.90	0.66		
	R3	39	4.42	0.80		
Item 9	R1	58	3.77	1.28	1.53	0.464
	R2	24	3.50	1.42		
	R3	39	4.05	1.07		
Item 10	R1	58	4.81	0.39	0.87	0.645
	R2	24	4.91	0.28		
	R3	39	4.80	0.41		
Item 11	R1	58	3.81	1.36	2.45	0.293
	R2	24	4.33	1.15		
	R3	39	3.63	1.30		
Item 12	R1	57	4.81	0.39	0.97	0.531
	R2	24	4.91	0.28		
	R3	39	4.78	0.41		
Item 13	R1	58	4.07	4.07	0.53	0.767
	R2	24	4.16	4.16		
	R3	39	4.22	4.22		

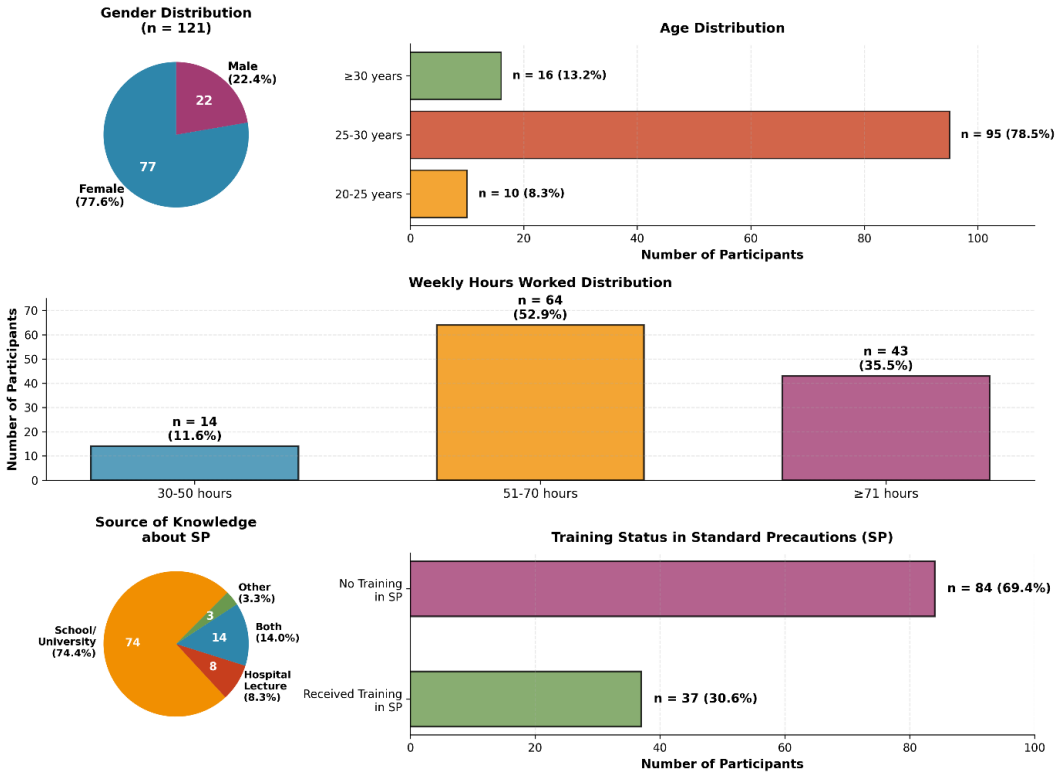

Figure 1: Demographic and Professional Characteristics of Study

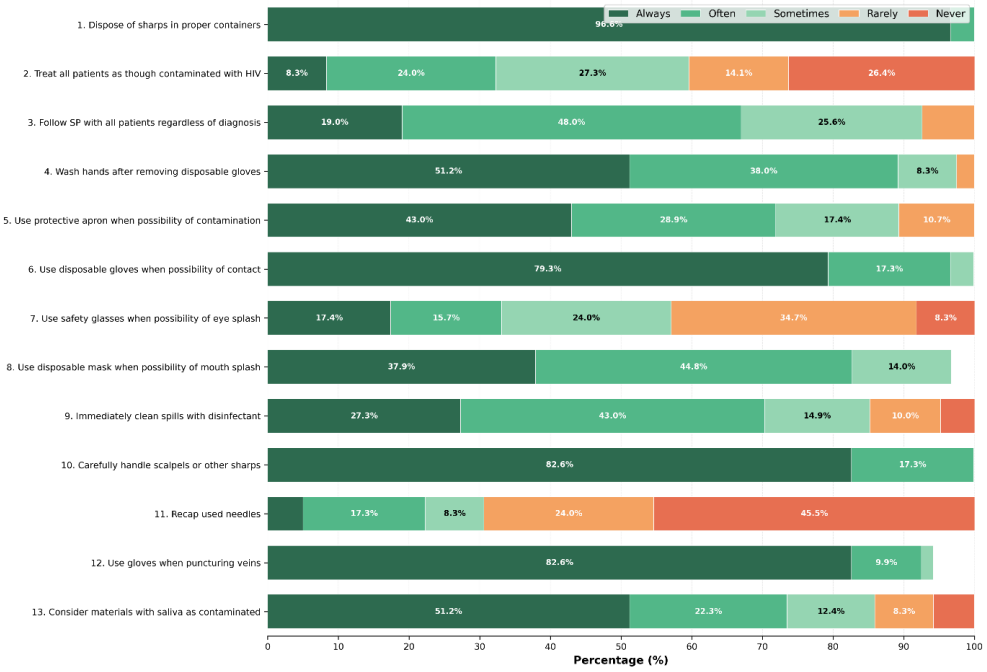

Figure 2: Physician Compliance with Standard Precautions

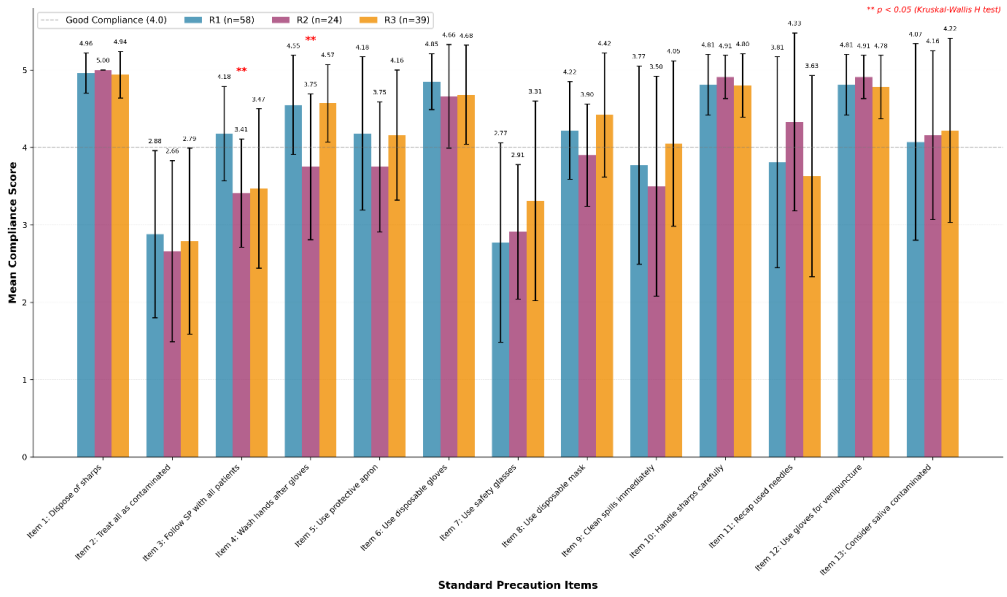

Figure 3: Mean Compliance Scores by Residency Year with Standard Deviations

The trial evaluated the physician compliance to Standard Precautions (SP) in three years of residency (R1, R2, and R3) in 121 participants. Most of them were aged between 25-30 years and most of them were females (77.6%). The acquisition of SP was predominantly school or university based with 30.6 percent having some formal training in SP. There was a wide difference in compliance among various practices of SP. The most compliance was registered in such practices as sharps disposal (96.6) and glove use when in contact with blood or secretions (79.3). Noncompliance was, however, observed to be low in such aspects as treating all patients as they were infected with HIV, only 8.3 percent always used this practice, and in the use of safety glasses (17.4 percent), and masks (37.9 percent). Differences in compliance between some practices were significant between the years of residency. R1 residents were the most compliant residents with regards to adherence behavior especially when it came to adherence to standard precautions and hand hygiene. Lack of compliance was highest in recapping discarded needles where 45.5 percent of respondents indicated that they had never followed the procedure.

Discussion

Standard Precautions (SP) are required in the treatment of any patient whether infected or not [2]. In this research, however, resident physicians in gynecology and obstetrics had moderate compliance with SP. Although SP is important, most of the past studies have always indicated that the adherence of physicians to such practices is usually suboptimal [9-11]. Further, not many studies have measured SP compliance directly in resident physicians working in different medical specialties.

The people in this study complained of long working hours, and a significant percentage of them were over 50 working hours a week. This observation is in line with the earlier studies that discovered the physicians working an average of 56 hours per week [9], but another study reported an average of 41 hours per week among resident physicians of a state university hospital [11]. The current regulations regulate the maximum working hours of a physician as 60 hours, most of which should be used in service activities [12]. Even with these regulations, residents tend to overtime their hours especially in cases of critical care or when a procedure is taking more time than expected [13]. This puts a clash between their educational ambitions and the massive labour force they offer to healthcare facilities.

Regarding SP training, the majority of the participants in this study said that they have not been provided with formal SP training. This is in line with other literature including one conducted on 56 physicians in a university hospital where 94 percent had not attended SP training [10]. Based on the existing laws, it is stated that healthcare facilities must offer training on infection control during employment and throughout the service period [14]. Nonetheless, a local study has discovered that only thirty-three percent of physicians knew about these regulations despite the fact that training was observed to enhance the level of SP knowledge [11]. This indicates that SP training should be conducted on a regular and compulsory basis to every healthcare provider including doctors in order to improve compliance [15].

In the study, much inconsistency in adherence to particular SP measures was also noted. An example is hand hygiene when gloves were doffed, taking a significant difference according to the years of residency, prior research also demonstrated a poor adherence to hand hygiene protocol among healthcare workers [16,17,18], especially among physicians [10,11]. Hand hygiene is a basic element of SP but it is not paid much attention to, as evidenced by a study in which compliance was higher in nurses than in physicians [21]. In the present study, observance of hand hygiene was inconsistent, some residents did not wash their hands after removing gloves. The same pattern has been noted in other healthcare environments whereby compliance with hand hygiene is not at the desired standards [10] [22].

There was also a significant difference in the application of personal protective equipment (PPE). Although the level of compliance with the use of gloves was good (79.3%), the level of adherence to the use of aprons, masks, and safety glasses was lower. The most commonly used PPE is a glove, which probably fits well because it is easy to use. Other types of PPEs like aprons and safety glasses were not as consistent in compliance though. This is also similar to other studies, whose physicians have indicated a reduced compliance with PPE measures especially those that cover safety glasses [11] [4]. PPE was observed to be used sparingly in certain environments, particularly in places of high-risk such as the intensive care units [23].

The safe work with sharp objects is another important point that should be discussed. A lot of doctors stated that they would recap needles that were used, and this is a major cause of occupational accidents such as blood-borne infections. Needle recapping has been cited as one of the most common causes of needle-stick injuries in the health care facility [25]. The same had happened with medical students where 73.2% of them said that they could recap needles at least occasionally [26].

Comprehensively, this paper points out at the average degree of SP compliance among resident physicians in gynecology and obstetrics. The use of PPE and proper needle handling were not consistently used and most of the participants said that not all of them received SP training at the workplace. The results highlight the necessity of the hospital management to take into consideration the occupational health risks and focus on frequent SP training. Specifically, infection control should focus on enhancing the risk of adherence to PPE and hand hygiene and minimize unsafe procedures like recapping needles. These findings would be useful in designing and executing more efficient SP training interventions on medical personnel and eventually lead to safer healthcare delivery.

Conclusion

The article has investigated the adherence of physicians to Standard Precautions (SP) in gynecology and obstetrics training programs and found that there was moderate compliance with the SP guidelines. Some

of these practices, including disposal of sharps in a proper manner and use of gloves, had high levels of compliance, whereas other practices, including wearing safety glasses and recapping needles, had high levels of non-compliance. The results provide insight into the fact that despite the necessity of SP to keep the patient and the healthcare worker safe, their regular use among resident physicians remains insufficient.

The main reasons behind poor compliance are the lack of SP training and high workload of resident physicians who usually work beyond recommended hours. In addition, although residents showed different degrees of compliance with particular SP practices (especially hand hygiene and PPE practices), the absence of regular training worsens the compliance gaps.

These findings underline the necessity of the introduction of SP training on a broad scale and the necessity of the strict compliance with the policy of infection control. The management of the hospital should focus on enhancing SP training and adherence by updating it on a regular basis and providing specific educational interventions, specifically in the high-risk areas of working with needles and wearing personal protective equipment. Better SP compliance not only prevents harm to healthcare workers but also prevents harm to patients, therefore, leading to improved healthcare outcomes.

References

[1] Brazil, Ministry of Labour and Employment. (2005). Directive N 485 from November 11, 2005. Ruling Norm N. 32 (Safety and Health in Healthcare Establishments). Available at: http://portal.mte.gov.br/data/files/8A7C812D36A280000138812EAFCE19E1/NR-32%20(atualizada%202011).pdf. *Daily Official Gazette*, Nov 16, 2005. Section 1 N219:80-94.

[2] Brazil. (1981). Law No. 6932 of 1981. Regulates the activities of residents and other measures. *Daily Official Gazette*, July 07, 1981. Available at: http://presrepublica.jusbrasil.com.br/legislacao/109606/lei-6932-81. Accessed March 14, 2016.

[3] Brevidelli, M. M., & Cianciarullo, T. I. (2006). Compliance with standard-precautions among medical and nursing staff at a university hospital. *OBJN*, 5, 1–5.

[4] Brevidelli, M. M., & Cianciarullo, T. I. (2009). Psychosocial and organizational factors relating to adherence to standard precautions. *Rev Saúde Públ*, 43, 907–916.

[5] Dejoy, D. M., Murphy, L. R., & Gershon, R. R. M. (1995). The influence of employee, job task, and organizational factors on adherence to universal precautions among nurses. *Int J Ind Ergon*, 16, 43–55.

[6] Garner, J. S. (1996). Hospital infection control practices advisory committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol*, 17, 53–80.

[7] Garus-Pakowska, A., Sobala, W., & Szatko, F. (2013). The use of protective gloves by medical personnel. *Int J Occup Med Environ Health*, 26, 423–429.

[8] Gershon, R. R. M., Vlahov, D., Felknor, S. A., Vesley, D., Johnson, P. C., Delclos, G. L., et al. (1995). Compliance with universal precautions among health care workers at three regional hospitals. *Am J Infect Control*, 23, 225–236.

[9] Lam, S. C. (2011). Universal to standard precautions in disease prevention: Preliminary development of compliance scale for clinical nursing. *Int J Nurs Stud*, 48, 1533–1539.

[10] Lam, S. C. (2014). Validation and cross-cultural pilot testing of compliance with standard precautions scale: self-administered instrument for clinical nurses. *Infect Control Hosp Epidemiol*, 35, 547–555.

[11] Lam, S. C., Tsang, C. M. S., Cheung, R. L. S., Chiu, T. H. K., Ho, C. K. S., Cheung, A. C. P., et al. (2012). Investigation on the compliance with standard precautions among nurses in Hong Kong hospitals. *Int J Infect Dis*, 16S, e386.

[12] La-Rotta, E. I. G., Garcia, C. S., Barbosa, F., dos Santos, A. F., Vieira, G. M., Carneiro, M. (2013). Evaluation of the level of knowledge and compliance with standard precautions and the safety standard (NR-32) amongst physicians from a public university hospital, Brazil. *Rev Bras Epidemiol*, 16, 786–797.

[13] Maheshwari, V., Kaore, N. C., Ramnani, V. K., Gupta, S. K., Borle, A., & Kaushal, R. (2014). Study to Assess Knowledge and Attitudes Regarding Hand Hygiene amongst Residents and Nursing Staff in a Tertiary Health Care Setting of Bhopal City. *J Clin Diagn Res*, 8, DC04–DC07.

[14] Massuda, A., Cunha, F. M., & Petta, H. (2007). Residência médica: contribuições dos médicos residentes ao debate. *Rev. Assoc. Med. Bras.*, 53, 96–97.

[15] Mota, E. C., Barbosa, D. A., Silveira, B. R. M., Rabelo, T. A., Silva, N. M., Silva, P. L. N., et al. (2014). Hand hygiene: a review of adherence and practice of health professionals in hospital infection control. *Rev Epidemiol Control Infect*, 4, 12–17.

[16] Naderi, H. R., Sheybani, F., Mostafavi, I., & Khosravi, N. (2012). Compliance with hand hygiene and glove change in a general hospital, Mashhad, Iran: an observational study. *Am J Infect Control*, 40, e221–e223.

[17] Nugmanova, Z., Patel, N., Nurbakhyt, A., Akhmetova, G. M., Kovtunenko, N., Trumova, Z., et al. (2015). Universal precautions in Central Asia: the need for multiple strategies in this window of opportunity. *J Hosp Infect*, 89, 197–201.

[18] Oliveira, A. C., & Gonçalves, J. A. (2010). Occupational accident with sharp edge material among workers of an operating center. *Rev Esc Enferm USP*, 44, 482–487.

[19] Oliveira, A. C., & Gonçalves, J. A. (2010). Occupational accident with sharp edge material among workers of an operating center. *Rev Esc Enferm USP*, 44, 482–487.

[20] Oliveira, A. C., Paiva, M. H. R. S., Paula, A. O., & Gama, C. S. (2011). Accidents with biological material among undergraduate students in medicine. *Ciênc Cuid Saúde*, 10, 89–95.

[21] Pereira, F. M. V., Lam, S. C., Chan, J. H. M., Malaguti-Toffano, S. E., & Gir, E. (2015). Difference in compliance with Standard Precautions by nursing staff in Brazil versus Hong Kong. *Am J Infect Control*, 43, 769–772.

[22] Pereira, F. M. V., Malaguti-Toffano, S. E., Silva, A. M., Canini, S. R. M. S., & Gir, E. (2013). Adherence to standard precautions of nurses working in intensive care at a university hospital. *Rev Esc Enferm USP*, 47, 686–693.

[23] Primo, M. G. B., Ribeiro, L. C. M., Figueiredo, L. F. S., Sirico, S. C. A., & Souza, M. A. (2010). Adhesion to the practice of hand hygiene by professionals in the health area in a University Hospital. *Rev Eletr Enf*, 12, 266–271.

[24] Santos, T. C. R., Roseira, C. E., Piai-Morais, T. H., & Figueiredo, R. M. (2014). Hand hygiene in hospital environments: use of conformity indicators. *Rev Gaúcha Enferm*, 35, 70–77.

[25] Siegel, J. D., Rhinehart, E., Jackson, M., & Chiarello, L. (2007). Guideline for Isolation precautions: preventing transmission of infectious agents in healthcare settings. Available at: http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf. Accessed July 2015.

[26] Souza, R. T., Bica, C. G., Mondadori, C. S., & Ranzi, A. D. (2012). Evaluation of Occupational Accidents with Biological Materials in Medical Residents, Academics and Interns of School Hospital of Porto Alegre. *Rev Bras Educ Med*, 36, 118–124.