

# Investigating Compliance with Standard Precautions During Residency Physicians in Gynecology and Obstetrics

Milton Jorge de Carvalho,<sup>I</sup> Fernanda Maria Vieira Pereira,<sup>II,\*</sup> Elucir Gir,<sup>III</sup> Simon Ching Lam,<sup>IV</sup> Caio Parente Barbosa<sup>V</sup>

<sup>I</sup>Faculdade de Medicina do ABC, Departamento de Ginecologia e Obstetrícia, Santo André/SP, Brazil. <sup>II</sup>Universidade Federal Fluminense – Enfermagem, Rio das Ostras/RJ, Brazil. <sup>III</sup>Universidade de São Paulo, Enfermagem Geral e Especializada, Ribeirão Preto/SP, Brazil. <sup>IV</sup>The Open University of Hong Kong, Division of Nursing and Health Studies, Hong Kong, China. <sup>V</sup>Faculdade de Medicina do ABC, Departamento de Saúde da Coletividade, Santo André/SP, Brazil.

**OBJECTIVES:** Physician compliance with standard precautions is important in the specialty of gynecology and obstetrics because of the high frequency of invasive procedures. The current study investigated compliance with standard precautions among resident physicians working in gynecology and obstetrics.

**METHOD:** A cross-sectional study was conducted among resident physicians in gynecology and obstetrics in their first (R1), second (R2) and third (R3) years of residency at a teaching hospital in a city in São Paulo. A structured questionnaire that included demographic and professional aspects and the Standard Precautions Adherence Scale were used to collect data. Statistical analysis was performed using IBM<sup>®</sup> SPSS version 20. Ethical aspects were considered.

**RESULTS:** Fifty-eight resident physicians participated in the study. Of the enrolled participants, 27 (46.6%) were in R1, 12 (20.7%) were in R2 and 19 (32.8%) were in R3. The standard precautions compliance score was 4.1, which was classified as intermediate. There were no significant differences in the compliance scores of the resident physicians across the three years of residency ( $H=2.34$ ,  $p=0.310$ ).

**CONCLUSION:** Compliance with standard precautions among resident physicians was intermediate. Preventive measures in clinical practice are not fully adopted in the specialty of gynecology and obstetrics. More important, many professionals claimed lack of sufficient training in standard precautions in the workplace. Such circumstances should draw the attention of hospital management with regard to occupational health risks.

**KEYWORDS:** Resident physicians; Gynecology; Obstetrics; Standard Precautions; Compliance.

Carvalho MJ, Pereira FM, Gir E, Lam SC, Barbosa CP. Investigating Compliance with Standard Precautions During Residency Physicians in Gynecology and Obstetrics. *Clinics*. 2016;71(7):387-391

Received for publication on November 17, 2015; First review completed on January 13, 2016; Accepted for publication on April 14, 2016

\*Corresponding author. E-mail: clinica@clinicadamulher.com.br/fernanddamaria@hotmail.com

## INTRODUCTION

Standard precautions (SP) are measures that should be applied by health care workers when treating all patients, regardless of their infection status. SP include the use of hand hygiene, the use of personal protective equipment (PPE) (e.g., gloves, masks, safety glasses and aprons), the application of caution in handling and disposal of sharps, and engagement in actions to minimize risk in the workplace (1,2). SP are supposed to be adopted by all health care workers. Physician compliance with SP is extremely important. Because

physicians working in gynecology and obstetrics units perform many invasive procedures and therefore have a chance of coming into contact with patient blood and bodily fluids, their SP compliance must be fully satisfactory. However, despite the evidence confirming the importance of applying SP, the literature reveals that the SP compliance of medical professionals is still insufficient in general (3,4). Furthermore, the SP compliance of physicians in gynecology and obstetrics units has not yet been investigated.

Failure to comply with SP in health care can render professionals liable to occupational accidents. One causal factor of such accidents is reduced risk perception, especially in the context of the handling of sharp objects (5). Information is lacking on SP compliance among physicians in gynecology and obstetrics. Thus, the current study aimed to contribute relevant information on the topic. The objective of this study was to investigate SP compliance among resident physicians working in gynecology and obstetrics.

**Copyright** © 2016 CLINICS – This is an Open Access article distributed under the terms of the Creative Commons License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and reproduction in any medium or format, provided the original work is properly cited.

No potential conflict of interest was reported.

**DOI:** 10.6061/clinics/2016(07)06



**METHODS**

A quantitative descriptive study was conducted in a city in the southeast region of Brazil. The study participants were resident physicians in gynecology and obstetrics in their first (R1), second (R2), and third (R3) years of residency at a teaching hospital. All such residents were invited to participate in the study. Data were collected through a collective application given in the classroom. The data collection period spanned from February 2013 through July 2015. A structured questionnaire that included a demographic and professional data sheet was used for data collection in addition to the Standard Precautions Compliance Scale. The Standard Precautions Compliance Scale is a 13-item Likert-type instrument used to investigate physician compliance with SP. Item score ranges from 1 to 5 and the mean score of each item can be classified into three

categories: high, which is equal to or greater than 4.5; intermediate, which ranges from 3.5 to 4.49; and low, which is less than 3.5 (6). This instrument has been developed (7,8) and validated for use in Portuguese in Brazil (9). Psychometric properties, namely internal consistency, content validity and construct validity, were examined with satisfactory results (9).

Descriptive statistics and measures of central tendency (single frequency, mean, median, maximum and minimum) were used to characterize the study population. The Kolmogorov-Smirnov test was used to verify the normality of the variables. Through such analysis, parametric and non-parametric tests were appropriately applied. The Kruskal-Wallis test was used to compare the means of the three groups, with  $p \leq 0.05$  being considered significant. Levene's test was used to verify the hypothesis of equality of variances. Statistical analysis was performed using IBM® SPSS version 20. The study complied with ethical aspects that were approved by the Research Ethics Committee of the ABC Foundation Medical School. The participants were assured that all information would remain confidential and would not affect their academic results. They expressed their agreement and signed a free and informed consent form.

**Table 1** - Demographic and professional characteristics of the resident physicians in the gynecology and obstetrics (n=58). São Paulo, Brazil, 2013-2015.

Variables	N (%)	Mean	SD
<i>Gender</i>			
Female	45 (77.6)	-	-
Male	13 (24.4)	-	-
<i>Age</i>			
20-25 years	5 (8.6)	$\chi^2 = 27.7$	2.12
25-30 years	46 (79.3)		
≥30 years	7 (12.1)		
<i>Weekly hours worked</i>			
30-50 hours	7 (12.1)	$\chi^2 = 67.2$	15.7
51-70 hours	31 (53.4)		
≥71 hours	20 (34.5)		
<i>Knowledge about SP</i>			
School or university	43 (74.1)	-	-
Lecture in the hospital	5 (8.6)	-	-
Through the previous two options	9 (15.5)	-	-
Other	1 (1.7)	-	-
<i>Received training in SP</i>			
Yes	18 (31.0)	-	-
No	40 (69.0)	-	-

<sup>b</sup> SP = standard precautions

**RESULTS**

Fifty-eight resident physicians in gynecology and obstetrics participated in the study. In total, 27 (46.6%) of the participants were R1, 12 (20.7%) were R2, and 19 (32.8%) were R3. Forty-five (77.6%) were female. The mean age was 27.7 years (SD=2.12; range, 24-33). Most of the residents worked in more than one hospital, and the mean working hours per week was 67.2 (SD=15.7). The majority of the physicians (n=40, 69.0%) indicated that they had received no SP training. Table 1 presents the demographic and professional characteristics of the participants.

Table 2 presents the response frequencies for each item according to the SP compliance scale. For item 2, which stated "treat all patients as though they were contaminated with HIV," five (8.6%) of the physicians indicated the alternative "always." For item 3, which stated "follow standard

**Table 2** - Distribution of the frequencies of responses to items from the Standard Precautions Adherence Scale among the resident physicians in the gynecology and obstetrics unit (n=58). São Paulo, Brazil, 2013-2015.

Items	Always n (%)	Often n (%)	Sometimes n (%)	Rarely n (%)	Never n (%)
1. Dispose of sharps in proper containers	56(96.6)	2(3.4)	-	-	-
2. Treat all patients as though they were contaminated with HIV	5(8.6)	14(24.4)	16(27.6)	10(17.2)	13(22.4)
3. Follow standard precautions with all patients regardless of their diagnosis	11(19.0)	28(48.3)	15(25.9)	4(6.9)	-
4. Wash hands after removing disposable gloves	30(51.7)	22(37.9)	5(8.6)	1(1.7)	-
5. Use a protective apron when there is a possibility of getting blood or other secretions on clothes <sup>a</sup>	25(43.1)	17(29.3)	10(17.2)	5(8.6)	-
6. Use disposable gloves when there is a possibility of contact with blood or other secretions	46(79.3)	10(17.2)	2(3.4)	-	-
7. Use safety glasses when there is a possibility of the eyes being splashed with blood or other secretions	10(17.2)	9(15.5)	14(24.1)	20(34.5)	5(8.6)
8. Use a disposable mask when there is a possibility of the mouth being splashed with blood or other secretions <sup>a</sup>	22(37.9)	26(44.8)	9(15.5)	-	-
9. Immediately clean any spills of blood or other secretions with disinfectant	16(27.6)	25(43.1)	9(15.5)	6(10.3)	2(3.4)
10. Carefully handle scalpels or other sharps	48(82.8)	10(17.2)	-	-	-
11. Recap used needles	3(5.2)	10(17.2)	5(8.6)	14(24.1)	26(44.8)
12. Use gloves when puncturing the veins of patients <sup>a</sup>	48(82.4)	8(13.8)	1(1.7)	-	-
13. Consider as contaminated all materials that have been in contact with the saliva of patients <sup>a</sup>	30(51.7)	13(22.4)	7(12.1)	6(10.3)	1(1.7)

<sup>a</sup> Item with 1.7% missing (n=57)



precautions with all patients regardless of their diagnosis," only eleven (19.0%) of the resident physicians noted "always."

The participants indicated better SP compliance on four items (items 1, 6, 10 & 12). These items reflected that the participants were more cautious regarding compliance with the handling and disposal of sharp articles (items 1 & 10) and with the use of gloves (items 6 & 12). Most items (53.8%; items 3, 4, 5, 8, 9, 11, & 13) were associated with intermediate compliance. These items covered various SP concepts, including hand washing, use of PPE, and decontamination of the environment. The endorsement frequencies for items 2 and 7 were the most widely dispersed, which indicated uncertainties on when safety glasses should be worn and on when patients should be treated using SP.

The Kolmogorov-Smirnov normality test results indicated that the data were not normally distributed ( $p=0.007$ ), necessitating the use of non-parametric tests for inferential statistics. The Kruskal-Wallis test was used to compare the means of the SP compliance scores. As shown in Table 3, regarding the compliance score for item 3, which states "follows standard precautions with all patients regardless of their diagnosis," a statistically significant difference ( $H=11.30$ ,  $p=0.004$ ) was found among the participants. Regarding the compliance score for item 4, which states "washes hands after removing disposable gloves," a statistically significant difference ( $H=10.14$ ,  $p=0.006$ ) was also found.

The overall SP compliance score among the participants was 4.1 (SD=0.33), which was classified as intermediate. The means of the total compliance scores across the three years of the study were 4.0 (SD=0.34) for R1, 3.9 (SD=0.33) for R2, and 4.1 (SD=0.31) for R3. Levene's test showed a homogeneity of variances ( $F=0.26$ ,  $p=0.769$ ) among the participants. No statistically significant difference was found in the means of the total compliance scores among the participants ( $H=2.34$ ,  $p=0.310$ ); however, the participants in R3 obtained the highest observed mean score.

## DISCUSSION

SP compliance is an indispensable practice in the care of all patients, regardless of their infection status (2). However, in the present study, SP compliance among resident physicians in gynecology and obstetrics was intermediate. Although this compliance is an important and widely discussed issue in the literature, several studies have indicated the poor SP compliance of physicians (9–11). Furthermore, few studies have evaluated SP compliance among resident physicians in different specialties.

The number of hours that the residents in this study worked per week was high. This result was similar to the findings of a study conducted in São Paulo, Brazil in which physicians were found to work an average of 56 hours per week (9). In contrast, in a study that evaluated 93 resident physicians from a public university hospital, the average number of work hours per week was 41 (11).

According to the current legislation in Brazil, a physician's workload should not exceed 60 hours per week, with 80% to 90% of the load dedicated to service and the rest to theoretical and complementary activities (12). It is noteworthy that medical residents frequently extend their workload out of self-interest, especially when attending to an individual in critical care who experiences a complication or when a surgical procedure requires longer than expected. In this sense, residents often represent an important workforce

**Table 3** - Comparison of the mean scores for the items from the Standard Precautions Adherence Scale among the resident physicians in the gynecology and obstetrics unit. São Paulo, Brazil, 2013-2015.

Items	Residents	N	Mean Score	SD	H	p
Item 1	R1	27	4.96	0.26	0.61	0.737
	R2	12	5.00	0.00		
	R3	19	4.94	0.30		
Item 2	R1	27	2.88	1.08	0.42	0.808
	R2	12	2.66	1.17		
	R3	19	2.79	1.20		
Item 3	R1	27	4.18	0.61	11.30	0.004 <sup>b</sup>
	R2	12	3.41	0.70		
	R3	19	3.47	1.03		
Item 4	R1	27	4.55	0.64	10.14	0.006 <sup>b</sup>
	R2	12	3.75	0.94		
	R3	19	4.57	0.50		
Item 5 <sup>a</sup>	R1	27	4.18	0.99	2.80	0.246
	R2	12	3.75	0.84		
	R3	18	4.16	0.84		
Item 6	R1	27	4.85	0.36	1.22	0.542
	R2	12	4.66	0.67		
	R3	19	4.68	0.64		
Item 7	R1	27	2.77	1.29	1.79	0.408
	R2	12	2.91	0.87		
	R3	19	3.31	1.29		
Item 8 <sup>a</sup>	R1	27	4.22	0.63	3.76	0.152
	R2	11	3.90	0.66		
	R3	19	4.42	0.80		
Item 9	R1	27	3.77	1.28	1.53	0.464
	R2	12	3.50	1.42		
	R3	19	4.05	1.07		
Item 10	R1	27	4.81	0.39	0.87	0.645
	R2	12	4.91	0.28		
	R3	19	4.8	0.41		
Item 11	R1	27	3.81	1.36	2.45	0.293
	R2	12	4.33	1.15		
	R3	19	3.63	1.30		
Item 12 <sup>a</sup>	R1	26	4.81	0.39	0.97	0.531
	R2	12	4.91	0.28		
	R3	19	4.78	0.41		
Item 13 <sup>a</sup>	R1	27	4.07	4.07	0.53	0.767
	R2	12	4.16	4.16		
	R3	18	4.22	4.22		

R1, First year resident physicians; R2, second year resident physicians; R3, third year resident physicians

<sup>a</sup> Item with missing (n=57)

<sup>b</sup>  $p \leq 0.01$

for maintaining institutions, clashing with their main goal of learning (13).

Most of the resident physicians in gynecology and obstetrics who were evaluated in the current study reported that they had not received any training in SP. Corroborating this result, a study evaluating 56 physicians from a university hospital in Brazil found that 94% did not receive any SP training (10). According to Regulatory Standard 32 (NR 32), a law currently in effect in Brazil, institutions must provide healthcare workers with training in infection control when they join and throughout the length of their service (14). However, a local study investigating physician knowledge of and compliance with this occupational regulation indicated that 30.3% of physicians are not familiar with NR32, despite that in-hospital SP training was demonstrated to enhance knowledge surrounding SP (11). This evidence indicates that regular SP training is essential not only for nurses and allied healthcare professionals (15) but also for medical staff.



The present study showed significant differences in hand hygiene after glove removal among the evaluated resident physicians. Other studies on SP measures have shown unsatisfactory rates of compliance in hand hygiene among health care workers (16,17,18), especially physicians (10,11). Although SP are recommended procedures for all health care workers when caring for patients, many of these workers selectively follow only some of the guidelines (15,19,20). Another study found that hand hygiene compliance was better among nurses (62.5%) than doctors (21.3%) (21). A study conducted in a tertiary hospital in India with 80 resident physicians showed that 70% of the physicians considered hand hygiene necessary after glove removal (21). In another study conducted on hand hygiene among health care workers, compliance with SP was found to be unsatisfactory among physicians, especially residents; out of 213 records of hand hygiene opportunities, only 50 indicated compliance, and 37 indicated that hand hygiene was incorrectly performed (10). Similar results were found in a study conducted in a municipal hospital in southeastern Brazil. Of 54 hand hygiene opportunities, hand hygiene measures were not performed in 33% of these opportunities, and the right technique was used in only 14.3% of the opportunities (22). Based on these findings, compliance with hand hygiene is inconsistent and greatly varies among different regions, settings and health care disciplines.

Another study area warranting discussion is the use of PPE. A higher percentage of compliance was found for the use of gloves compared to the use of aprons, masks and safety glasses. This is not surprising because gloves are the easiest of these items to use (23). The compliance rate for the use of gloves by physicians in an Iranian hospital was found to be 82.2%; however, gloves were changed by health professionals with each new patient in only 15.8% of the total number of opportunities (24). In another study conducted among doctors and nurses in three hospitals, the compliance was 50% for glove use, and doctors were more likely to use gloves than nurses (3). A similar rate of compliance has been documented among medical students (4). Compliance with the use of aprons was not consistent in this study. Health care workers in an intensive care unit noted that PPE was infrequently used in daily practice, especially among physicians (23). For safety glasses, compliance was even lower among the residents. Corroborating the literature, safety glasses have been indicated as the PPE with the lowest level of compliance among physicians (11) and medical students (4).

Apart from the above, the safe handling of sharp objects is considered essential for minimizing occupational risks related to blood-borne infections. Most of the current participants reported that they recapped used needles with a certain frequency. Indeed, resident physicians have been ranked as second in terms of incidence of occupational accidents in teaching hospitals, with recapping of needles being a main cause of such accidents (25). In an analysis of the behavior of medical students from a public university in southeastern Brazil, it was found that 73.2% of the students recapped needles with some frequency (26).

SP compliance among resident physicians was intermediate. Preventive measures in clinical practice are not fully adopted in the specialty of gynecology and obstetrics. Furthermore, many professionals claimed a lack of sufficient SP training in the workplace. Such circumstances should garner the attention of hospital management with regard to

occupational health risks. They also offer one possible explanation for the suboptimal SP compliance. In relation to PPE, a higher percentage of compliance was found for the use of gloves compared to the use of aprons, masks and safety glasses. However, the compliance rates were still not satisfactory. These results can contribute to planning and implementation of infection control measures and should support evaluations of SP training strategies among medical teams.

## ■ AUTHOR CONTRIBUTIONS

Carvalho MJ and Barbosa CP designed the study. Carvalho MJ, Gir E and Pereira FM collected and analyzed the data. Carvalho MJ, Gir E, Pereira FM, Lam SC and Barbosa CP prepared the manuscript.

## ■ REFERENCES

- Garner JS. Hospital infection control practices advisory committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol.* 1996;17(5):53-80, <http://dx.doi.org/10.2307/30142367>.
- Siegel JD, Rhinehart E, Jackson M, Chiarello L. Guideline for Isolation precautions: preventing transmission of infectious agents in healthcare settings. Published 2007. Available at: <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>. Accessed July 2015.
- Garus-Pakowska A, Sobala W, Szatko F. The use of protective gloves by medical personnel. *Int J Occup Med Environ Health.* 2013;26(3):423-9, <http://dx.doi.org/10.2478/s13382-013-0095-1>.
- Nugmanova Z, Patel N, Nurbakhyt A, Akhmetova GM, Kovtunenkov N, Trumova Z, et al. Universal precautions in Central Asia: the need for multiple strategies in this window of opportunity. *J Hosp Infect.* 2015; 89(3):197-201, <http://dx.doi.org/10.1016/j.jhin.2014.11.011>.
- Oliveira AC, Gonçalves JA. Occupational accident with sharp edge material among workers of an operating center. *Rev Esc Enferm USP.* 2010; 44(2):482-7, <http://dx.doi.org/10.1590/S0080-62342010000200034>.
- Brevidelli MM, Cianciarullo TI. Compliance with standard-precautions among medical and nursing staff at a university hospital. *OBJN.* 2006; 5(1):1-5.
- Dejoy DM, Murphy LR, Gershon RRM. The influence of employee, job task, and organizational factors on adherence to universal precautions among nurses. *Int J Ind Ergon.* 1995;16(1):43-55, [http://dx.doi.org/10.1016/0169-8141\(94\)00075-E](http://dx.doi.org/10.1016/0169-8141(94)00075-E).
- Gershon RRM, Vlahov D, Felknor SA, Vesley D, Johnson PC, Delclos GL, et al. Compliance with universal precautions among health care workers at three regional hospitals. *Am J Infect Control.* 1995;23(4):225-36, [http://dx.doi.org/10.1016/0196-6553\(95\)90067-5](http://dx.doi.org/10.1016/0196-6553(95)90067-5).
- Brevidelli MM, Cianciarullo TI. Psychosocial and organizational factors relating to adherence to standard precautions. *Rev Saúde Públ.* 2009; 43(6):907-16.
- Primo MGB, Ribeiro LCM, Figueiredo LFS, Sirico SCA, Souza MA. Adhesion to the practice of hand hygiene by professionals in the health area in a University Hospital. *Rev Eletr Enf.* 2010;12(2):266-71.
- La-Rotta EIG, Garcia CS, Barbosa F, dos Santos AF, Vieira GM, Carneiro M. 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.* 2013;16(3):786-97, <http://dx.doi.org/10.1590/S1415-790X2013000300021>.
- Brazil. Law No. 6932 of 1981. Regulates the activities of residents and other measures. *Daily Official Gazette*, Jul 07 1981. [in Portuguese]. Available from: <http://prespublica.jusbrasil.com.br/legislacao/109606/lei-6932-81>. Accessed Mar 14, 2016.
- Massuda A, Cunha FM, Petta H. Residência médica: contribuições dos médicos residentes ao debate. *Rev. Assoc. Med. Bras.* [Internet]. 2007 Apr [cited 2016 Mar 16];53(2):96-97. Available from: <http://dx.doi.org/10.1590/S0104-42302007000200002>.
- Brazil, Ministry of Labour and Employment. Directive N 485 from November 11, 2005. Ruling Norm N. 32 (Safety and Health in Healthcare Establishments). *Daily Official Gazette*, Nov 16 2005. Section 1 N219:80-94 [in Portuguese]. Available from: [http://portal.mte.gov.br/data/files/8A7C812D36A280000138812EAFCE19E1/NR-32%20\(atualizada%202011\).pdf](http://portal.mte.gov.br/data/files/8A7C812D36A280000138812EAFCE19E1/NR-32%20(atualizada%202011).pdf)
- Pereira FMV, Lam SC, Chan JHM, Malaguti-Toffano SE, Gir E. Difference in compliance with Standard Precautions by nursing staff in Brazil versus Hong Kong. *Am J Infect Control.* 2015;43(7):769-72, <http://dx.doi.org/10.1016/j.ajic.2015.03.021>.
- Pereira FMV, Malaguti-Toffano SE, Silva AM, Canini SRMS, Gir E. Adherence to standard precautions of nurses working in intensive care at a university hospital. *Rev Esc Enferm USP.* 2013;47(3):686-93, <http://dx.doi.org/10.1590/S0080-62342013000300023>.





17. Santos TCR, Roseira CE, Piai-Morais TH, Figueiredo RM. Hand hygiene in hospital environments: use of conformity indicators. *Rev Gaúcha Enferm.* 2014;35(1):70-7, <http://dx.doi.org/10.1590/1983-1447.2014.01.40930>.
18. Lam SC. Validation and cross-cultural pilot testing of compliance with standard precautions scale: self-administered instrument for clinical nurses. *Infect Control Hosp Epidemiol.* 2014;35(5):547-55, <http://dx.doi.org/10.1086/675835>.
19. Lam SC. Universal to standard precautions in disease prevention: Preliminary development of compliance scale for clinical nursing. *Int J Nurs Stud.* 2011; 48(12):1533-9, <http://dx.doi.org/10.1016/j.ijnurstu.2011.06.009>.
20. Lam SC, Tsang CMS, Cheung RLS, Chiu THK, Ho CKS, Cheung ACP, et al. Investigation on the compliance with standard precautions among nurses in Hong Kong hospitals. *Int J Infect Dis.* 2012;16S:e386, <http://dx.doi.org/10.1016/j.ijid.2012.05.507>.
21. Maheshwari V, Kaore NC, Ramnani VK, Gupta SK, Borle A, Kaushal R. 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.* 2014;8(8):DC04-7.
22. Mota EC, Barbosa DA, Silveira BRM, Rabelo TA, Silva NM, Silva PLN, et al. Hand hygiene: a review of adherence and practice of health professionals in hospital infection control. *Rev Epidemiol Control Infect.* 2014;4(1):12-7, <http://dx.doi.org/10.17058/reci.v4i1.4052>.
23. Oliveira AC, Gonçalves JA. Occupational accident with sharp edge material among workers of an operating center. *Rev Esc Enferm USP.* 2010;44(2): 482-7, <http://dx.doi.org/10.1590/S0080-62342010000200034>.
24. Naderi HR, Sheybani F, Mostafavi I, Khosravi N. Compliance with hand hygiene and glove change in a general hospital, Mashhad, Iran: an observational study. *Am J Infect Control.* 2012;40(6):e221-3, <http://dx.doi.org/10.1016/j.ajic.2011.12.012>.
25. Souza RT, Bica CG, Mondadori CS, Ranzi AD. Evaluation of Occupational Accidents with Biological Materials in Medical Residents, Academics and Interns of School Hospital of Porto Alegre. *Rev Bras Educ Med.* 2012;36(1):118-24, <http://dx.doi.org/10.1590/S0100-55022012000100016>.
26. Oliveira AC, Paiva MHRS, Paula AO, Gama CS. Accidents with biological material among undergraduate students in medicine. *Ciênc Cuid Saúde.* 2011;10(1):89-95.