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Needlestick injuries among obstetrics and gynecology trainees: a study design to investigate an underestimated priority

Giovanni Scambia[1], Ricciarda Raffaelli[2], Silvia Baggio[2], Simone Garzon[2], Antonio Simone Laganà[3], Enrico Sartori[4], Francesca Vanzo[2], Enrico Vizza[5], Roberto Angioli[6], Chiara Benedetto[7], Angelo Cagnacci[8], Massimo Candiani[9], Gaspare Carta[10], Donatella Caserta[11], Pier Luigi Cherchi[12], Andrea Ciavattini[13], Ettore Cicinelli[14], Luigi Cobellis[15], Erich Cosmi[16], Rosario D'Anna[17], Vincenzo De Leo[18], Rossana Di Paola[2], Anna Di Pinto[11], Alfredo Ercoli[19], Fabio Facchinetti[20], Enrico Ferrazzi[21], Tiziana Frusca[22], Fabio Ghezzi[3], Pantaleo Greco[23], Marco Liberati[24], Giuseppe Loverro[14], Luigi Nappi[25], Marco Palumbo[26], Manuela Neri[27], Antonio Perino[28], Sara Clemenza[29], Emilio Piccione[30], Isabel Peterlunger[31], Nicola Rizzo[32], Beatrice Negri[4], Tommaso Simoncini[33], Arsenio Spinillo[34], Pier Luigi Venturini[35], Patrizia Vergani[36], Fulvio Zullo[37], Antonio Chiantera[38], Nicola Colacurci[39], Elsa Viora[40], Massimo Franchi[2].

On behalf of the Italian Society of Gynecology and Obstetrics (SIGO).

[1] SIGO President. Catholic University of the Sacred Heart, Rome, Italy
[2] University of Verona, Verona, Italy
[3] University of Insubria, Varese, Italy
[4] University of Brescia, Brescia, Italy
[5] IRCCS – Regina Elena National Cancer Institute, Rome, Italy
[6] University Campus Bio-Medico of Rome, Rome, Italy
[7] University of Turin, Turin, Italy
[8] University of Udine, Udine, Italy
[9] Vita-Salute San Raffaele University, Milan, Italy
[10] University of L'Aquila, L'Aquila, Italy
[11] Sapienza University of Rome, Rome, Italy
[12] University of Sassari, Sassari, Italy
[13] Polytechnic University of Marche, Ancona, Italy
[14] "Aldo Moro" University of Bari, Bari, Italy
[15] University of Campania "Luigi Vanvitelli", Naples, Italy
[16] University of Padua, Padua, Italy
[17] University of Messina, Messina, Italy
[18] University of Siena, Siena, Italy
[19] University of Eastern Piedmont, Novara, Italy
[20] University of Modena and Reggio Emilia, Italy
[21] University of Milan, Milan, Italy
[22] University of Parma, Parma, Italy
[23] University of Ferrara, Ferrara, Italy
[24] "G. d'Annunzio" University of Chieti-Pescara, Chieti, Italy
[25] University of Foggia, Foggia, Italy
[26] University of Catania, Catania, Italy
[27] University of Cagliari, Cagliari, Italy
[28] University of Palermo, Palermo, Italy
[29] University of Florence, Florence, Italy
[30] University of Rome "Tor Vergata", Rome, Italy
[31] University of Trieste, Trieste, Italy
[32] University of Bologna, Bologna, Italy
[33] University of Pisa, Pisa, Italy
[34] University of Pavia, Pavia, Italy
[35] University of Genoa, Genoa, Italy
[36] University of Milano-Bicocca, Monza, Italy
[37] University of Naples "Federico II", Naples, Italy
[38] SIGO General Secretary
[39] "Italian Association of University Gynecologists" (Associazione Italiana Ginecologi Universitari - AGUI) President
[40] "Italian Association of Hospital Gynecologists and Obstetrics" (Associazione Ostetrici Ginecologi Ospedalieri Italiani - AOGOI) President

Corresponding Author: Massimo Franchi
massimo.franchi@univr.it

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ABSTRACT

Risk of needlestick injuries (NSIs) is high in surgical staff. Medical students and trainees have reported the highest rate of NSIs, and Obstetrics and Gynecology is considered a high-risk specialty. The risk associated to NSIs is further increased by the high prevalence of blood borne pathogens in the population. Nevertheless, the degree of concern about contraction of these serious infections has been reported significantly lower over time, showing diminishing attitudes toward prevention of exposure and lack of consideration as a major problem, in fact most of NSIs resulted unreported. Therefore, education is fundamental to change individual attitudes and behaviors, to improve awareness and increase the use of standard protections, in order to reduce the injury rate and implement reporting to hospital surveillance systems. The proposed study aims to assess NSIs in trainees currently attending residency programs in Obstetrics and Gynecology in all academic hospitals of Italy, with a standardized, pre-piloted, national-based survey. At this purpose, we developed the Obstetrics Needlestick Injury Questionnaire (ONSI-Q), a 40-items survey that will be completed via a web-based platform. The ONSI-Q investigates real incidence of NSIs, adopted protection practices, presence of associated risk factors, and attitudes and rate of the reported accidents among trainees during obstetric procedures (suture of perineal tear/episiotomy and cesarean section). These results will provide the opportunity to investigate an underestimated priority, in order to encourage educational practices with the aim to improve prevention and reporting strategies, and therefore increase occupational safety in this high-risk surgical specialty.

Key words: Needlestick Injuries; Risk assessment; Occupational exposure; Obstetrics and Gynecology; Postgraduate training; Study design.

SOMMARIO

Il personale di sala operatoria, gli studenti di medicina e i medici in formazione specialistica sono le categorie che riportano il più alto tasso di punture d'ago e l'ostetricia e ginecologia è considerata una delle specialità con la più alta probabilità di riportare lesioni. Ad aumentare ulteriormente il rischio, vi è l'elevata prevalenza di patogeni a trasmissione ematica nella popolazione generale, anche se il grado di consapevolezza di tale rischio è risultato ridursi nel tempo. Con il ridursi della consapevolezza si è osservata progressivamente meno attenzione nella prevenzione dell'esposizione e nella segnalazione degli eventi. Pertanto, l'educazione finalizzata ad aumentare la consapevolezza del rischio mira a cambiare l'atteggiamento e i comportamenti individuali, con l'obiettivo di ridurre il tasso di punture d'ago e implementare il tasso di segnalazione degli eventi ai sistemi di sorveglianza ospedaliera. Data l'importanza del tema, lo studio proposto mira, mediante l'utilizzo di un questionario, a valutare le punture d'ago negli specializzandi che attualmente frequentano le Scuole di specialità in Ginecologia e Ostetricia Italiane. A questo scopo, abbiamo sviluppato l'Obstetrics Needlestick Injury Questionnaire (ONSI-Q), un questionario di 40 domande che sarà somministrato mediante una piattaforma web. L'ONSI-Q mira a valutare l'incidenza reale delle punture d'ago, le pratiche di protezione usualmente adottate, la presenza di fattori di rischio, e le caratteristiche degli incidenti durante le procedure ostetriche (sutura di lacerazione perineale, episiotomia e taglio cesareo). Questi risultati daranno l'opportunità di indagare un tema genericamente sottovalutato, al fine di implementare le pratiche educative, con l'obiettivo di migliorare la prevenzione e le strategie di segnalazione e quindi aumentare la sicurezza sul lavoro in questa specialità chirurgica ad alto rischio.

INTRODUCTION

All healthcare providers who perform invasive procedures with sharp instruments are at increased risk of needlestick injury (NSI)[1]. NSIs may result in important health consequences and psychological stress for healthcare providers and, indirectly, for their relatives[2]. Although readily preventable, the high incidence of NSIs persists, with elevated risk both in the operating room (OR) and inpatient room settings[3]. According to recent data reported by the Centers for Disease Control and Prevention, about 385,000 sharps injuries among healthcare workers occur annually in the United States, with an estimated overall cost for managing a single NSI ranging from $650 to $750[4,5]. With regard to the European Countries, it is estimated that more than 1 million of such injuries occur each year in the healthcare services. The incidence of NSIs differ greatly within Europe, depending also on the reporting rate and the availability of data. For example, in UK studies show one of the lowest reporting rates of 9%, although NSIs are estimated around 100,000 per year, representing one of the most frequent accident among healthcare providers. In France, it has been reported an incidence of about 32,000 of such injuries per year, with an estimated reporting rate of 50%. In Sweden, the extremely high rate of unreporting is explained by the low attitude to report NSIs, which in turn is related to the low prevalence of harmful pathogens such as HCV, HBV and HIV. In Italy, where a national reporting system exists, surveys conducted on a

regular basis since 1986 documented an incidence of 27,000 claims of such occupational events per year[6], with a reporting rate ranging from 0% to 65%[7,8].

The Italian Occupational Risk Study on HIV (SIROH), which is the main public surveillance program for occupational infections in Italy, indicated that training personnel accounted for 13% of occupational exposures to NSIs[7].

The European economic burden of NSIs, especially those resulting in infection, is substantial. In Italy, the annual costs for NSIs are estimated around euro 7 million, not including long term treatment, lost productivity, legal or compensation costs[6,7]. The injury risk for healthcare personnel is further increased by the high prevalence of hepatitis B (hepB), hepatitis C (hepC), and human immunodeficiency virus (HIV) in hospitalized surgical patients, with a reported exposure to these blood-borne pathogens as high as 38% considering all surgical procedures[9–11].

However, the degree of concern about contraction of blood-borne pathogens was reported significantly lower over time, showing diminishing attitudes toward prevention of exposure[3,12,13]. Additionally, the majority of healthcare providers exposed to infective risk either undervalued or did not know seroconversion rates after exposure to common blood-borne pathogens[1,3]. After a hepB-positive needlestick injury, the transmission has been documented to range from 6% to 30%, although it has declined steadily since the mandatory vaccination of healthcare providers[14]. The average risks of hepC and HIV transmission, for which a vaccination is not currently available, following a contaminated NSI are 1.8%[15] and 0.3%, respectively[16]. Because of the increased risk of exposure, understanding incidence, causes, and methods to prevent blood-borne pathogens transmission is of paramount importance to reduce NSI incidence.

Underreporting is one of the major causes of the biased low priority that NSIs have received so far. The extent of this phenomenon has simply been underestimated. Previous reports found that 28% to 60% of NSIs were in fact unreported, and one-third of people with any injury had at least one unreported accident[3,15,17]. Underestimating of NSI rate and its related morbidity represents an important issue and healthcare workers should be educated on the importance of reporting all NSIs, on the true seroconversion rates in high-risk injury, and on the effectiveness of preventive measures and post exposure prophylaxis[1,3].

Concerning this last element, an European Union (EU) directive was published in June 2010 and made national law in all EU countries by May 2013[18]. The central elements were risk assessment, assignment of risk-dependent protection for each activity, as well as clear definition of a variety of protective measures. In order to protect employees from injury while they are working with medical sharps, the law requires that sharps should be replaced by suitable safety-engineered devices (SEDs) or by methods that reduce the risk of NSIs[19]. Although a protocol that changes the environmental risk is a good way to prevent injuries, it is important to remind that the most important factors of NSI risk are individual attitude and behavior[20]. The most commonly cited reason for NSI reported by different studies are ''careless/accidental'' or "rushed", with a demonstrated general lack of concern. Most NSIs occur during night and early morning hours, and most healthcare providers reported that they were injured by another individual[3,21]. In a previously published report, double gloving and eye protection in the operative room were reported as standard protocol by 25% and 79% of the healthcare providers, respectively[3].

This can explain why the reports of sharp injuries in an Irish teaching hospital in 2000 versus 2010 found no difference in NSI rate, despite the implementation of the European Sharps Directive[20].

The risk of NSIs is higher in surgical staff compared to the other healthcare providers, in particular, medical students and trainees have reported the highest rate of injuries[3,17,21,22], often unreported because of perceived low risk[20]. This finding is well explained in a study published in 2007, investigating only trainees from surgical specialties, which found that 99% of them reported at least one NSI[21]. Another study conducted among medical students and senior faculties reported a 28% rate of injuries in medical students and 100% in faculty[17], data confirmed also in a more recent report[3]. Surgeons in training of all specialties have the greatest risk of exposure due to the big amount of procedures performed during their training and the increased propensity for injury while learning new technical skills and working long hours[23].

Although different studies investigated NSIs prevalence in surgical specialties, data about NSIs in gynecology and obstetrics are limited, in particular among trainees. However, on the basis of available data, gynecology and obstetrics should be considered a high-risk specialty for NSIs. In fact, NSIs have been reported to occur more in gynecology than in any other surgical specialties,

with rates of 10% during abdominal hysterectomy, 21% during vaginal hysterectomy, and 6–10% of gynecologic procedures overall[24,25]. The reported rates of NSIs-related glove perforations during obstetric and gynecologic surgeries ranged from 7 to 24%[26–30]. With regards to the specific context of a labor and delivery unit, Arena et al.[31] in 1991 reported that in nearly one quarter of cesarean sections and half of perineal laceration repairs, glove perforations were identified at the end of the procedure. In another study, the rate of surgical glove perforation in obstetrics was 21.7% at the time of cesarean and 10.4% at the time of vaginal delivery, with higher rates among repeated compared to primary cesarean deliveries, and in women with episiotomy extensions than in those without[32].

These high rates could be explained by the increased rate of surgical procedures performed by obstetricians such as perineal tears, episiotomies and cesarean sections. Furthermore, these procedures are performed during day and night and sometimes in emergency situations that require short time. Moreover, perineal tears and episiotomy repairs are performed on the awake patient, often in movement, and in limited space, increasing the risk of auto-injuries.

The purpose of this study is to investigate the impact of needle incidents among current trainees in gynecology and obstetrics with a standardized, pre-piloted, national-based survey involving all academic hospitals in Italy. In details, the purpose is to assess the real incidence of NSIs among trainees in obstetrics and gynecology during obstetric procedures, their standard protection practices, their attitudes, the associated risk factors occurring during an incent, the perception of the real risk concerning blood-borne pathogens and the official reported rate of events. These results will provide a more complete vision of the real problem giving the opportunity to develop new educational protocol in order to improve standard practice safety.

MATERIALS AND METHODS

Obstetrics Needlestick Injury questionnaire (ONSI-Q)

We developed the Obstetrics Needlestick Injury questionnaire (ONSI-Q), a 40-items survey to investigate incidence of NSIs, protection practices, attitudes, associated risk factors, and the reported rate of events among trainees in obstetrics and gynecology during obstetrics procedures (**Table 1**). The survey was designed by an expert group of two teaching medical doctors in obstetrics and gynecology (MF and RR), and two specialty tutors (SB and SG). The survey instrument was based on the surveys used by Makary et al. to study surgical trainees NSIs in 2007[21] and by Ouyang et al. to study medical trainees NSIs in 2017[33]. The surveys were changed and implemented with items consistent with obstetrics practice and procedures, with particular attention in episiotomy and cesarean section (**Table 2**). Thereafter, four trainees, two specialty tutors, and three medical educationalists checked the items for validity and suggested potential amendments or rewording. Duplicate or unclear items were changed or removed. The survey was finally revised, reviewed, written in a web-based platform and electronic survey logic was added. The questionnaire was pilot tested by a group of 56 trainees in Obstetrics and Gynecology from the proposer University Hospital of Verona, and feedback was incorporated before the survey tool was finalized. Questions included: demographics data, postgraduate year of clinical training, gender; the number of past NSIs; factors surrounding NSIs, factors and technique characteristics surrounding NSIs during perineal tears/episiotomy repair, factors and technique characteristics surrounding NSIs during cesarean section, reporting of injury, blunt needles use, exposure to and management of patients affected by hepB, hepC, and HIV; attitudes and concerns regarding exposure to bloodborne pathogens. All these data were investigated both for perineal tear/episiotomy and cesarean section.

Data collection

All the Italian Obstetrics and Gynecology trainees will be invited to complete the ONSI-Q. The questionnaires will be submitted in Italian. ONSI-Q evaluations will be completed via a web-based platform, and participants will be reminded up to three times by e-mail to participate in the online ONSI-Q evaluations.

Data analysis

Descriptive statistics and frequencies will be used to describe the main characteristics of the study population and for the ONSI-Q outcomes. For the ONSI-Q analysis no exclusion criteria will be used. Descriptive statistics will be used for variables with normal distribution expressed as mean and standard deviation (SD); for non-normal distribution variables and ordinal variables as median and interquartile range (IQR); for the nominal variables as number of cases

(n) and percent (%). For continuous variables, the normal distribution will be tested with Kolmogorov-Smirnov test. Wilcoxon test and Mann-Whitney test will be used to compare non-parametric and ordinal variables. Friedman test and Kruskal-Wallis test will be used to compare non-parametric and ordinal variables in case of tree or more groups. T-test and ANOVA will be used to compare normal distributed variables. Categorical data will be analyzed with Chi-square test. Univariate logistic regression will be performed to assess the relationship between reporting behavior and possible predictive variables. Univariate logistic regression will be used to assess the relationship between number of needlestick injuries and possible predictive variables. All reported p values will be two-sided and significant will be considered at $p<0.05$. All analyses will be performed in IBM SPSS Statistics 23.0, Armonk, NY.

Ethics and methodological standards

The study does not require approval by an independent Institutional Review Board (IRB) because no patients will be included. Informed consent will be required to each enrolled trainee using the web-based platform for ONSI-Q data collection and analysis for research purpose. Participation will be anonymous and voluntary for all trainees.

DISCUSSION

Gynecology and obstetrics could be acknowledged as a high-risk specialty for NSIs among all surgical specialties[25]. Considering all healthcare providers, trainees have the highest risk for NSIs and a higher probability to underreport these accidents[3,21]. In this context, the future study will aim to assess the real incidence of NSIs in the specific field of obstetrical surgery.

Moreover, we want to investigate if trainees are aware of risks related to surgical procedures they perform in clinical practice and of the wrong attitudes that can increase NSIs rates, including the non-use of protection devices. The final purpose is to understand how to develop and improve educational programs in order to implement the safety of procedures and reduce the incidence of NISs. Means of prevention of such injuries include using surgical staplers for the skin rather than subcuticular closure, handling the needle with forceps rather than fingers, positioning tissue with surgical retractors, double gloving for surgical procedures, and using blunt tip rather than the traditional taper tip and cutting tip surgical needles[25].

Finally, trainees and all staff should be made aware of the higher than expected seroconversion rates and frequency of NSIs, as well as the importance of reporting NSIs to occupational health responsible, in order to assure an early intervention and a correct surveillance for the injured person, preventing the spread of blood-borne pathogens.

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DISCLOSURE OF INTERESTS

The authors have no proprietary, financial, professional or other personal interest of any nature in any product, service or company. The authors alone are responsible for the content and writing of the paper.

All the authors conform the International Committee of Medical Journal Editors (ICMJE) criteria for authorship, contributed to the intellectual content of the study and gave approval for the final version of the article.

Table 1.
Obstetrics Needlestick Injury Questionnaire (ONSI-Q).

1)	☐ Male ☐ Female	
2)	Which Obstetrics and Gynecology Residency Program are you attending?	
3)	Have you sustained any needlestick injury as a resident?	☐ Yes ☐ No
4)	Which blood-born pathogen do you fear the most?	☐ HIV ☐ HBV ☐ HCV
5)	Have you ever had a needle stick involving a "high risk" patient ("high risk" defined as history of HIV, hepatitis B or C, or IV drug use)?	☐ Yes ☐ No ☐ I do not know
6)	At your Institution, are blunt suture needles used for obstetrical surgical procedures on patients with a history of HIV, hepatitis B or C, or IV drug use?	☐ Yes, a specific protocol exists in the Department ☐ No ☐ Yes, at the surgeon's discretion
7)	How many needlestick injuries have you sustained on labor and delivery unit (cesarean section/ suture of perineal laceration/episiotomy)?	☐ 0 ☐ 1 ☐ > 1 (please specify the number ____)
8)	If you have never had needle sticks in obstetrics, the most recent needle stick you have sustained occurred:	☐ During gynecological surgical procedures (operating room or inpatient room setting) ☐ During your 1st year rotation in "Tronco Comune" (please specify in: General Surgery/Plastic Surgery/Anesthesiology)
9)	At which year of the Residency Program did you experience your most recent needle stick injury in obstetrics?	☐ First ☐ Second ☐ Third ☐ Fourth ☐ Fifth
10)	Did your most recent needle stick injury in obstetrics involve a high-risk patient (HBV, HCV, HIV)?	☐ Yes ☐ No ☐ I do not know
11)	In your opinion, what was the cause of your most recent needle stick injury in obstetrics? (tick one relevant box)	☐ Rushed ☐ Nervousness ☐ Fatigue ☐ Lack of skill set required ☐ Lack of appropriate assistance ☐ Out of my control
12)	Which year of the Obstetrics and Gynecology Residency Program are you attending?	☐ First ☐ Second ☐ Third ☐ Fourth ☐ Fifth
13)	Was your most recent needle stick injury in obstetrics? (tick appropriate box)	☐ Self-induced ☐ By someone else
14)	Which type of needle have you been injured by during your most recent needle stick in obstetrics?	☐ Solid needle ☐ Hollow-bore needle ☐ I do not known / remember
15)	Which task were you doing during your recent needle stick?	☐ Cleaning-up the operating field ☐ Retracting tissue with appropriate device ☐ Using my hand instead of appropriate device ☐ Moving my hand in the operating field, injured by needle used by the lead surgeon
16)	Where did your most recent needle stick injury in obstetrics occur?	☐ Operating room ☐ Delivery room
17)	When did your most recent needle stick injury in obstetrics occur?	☐ Day shift ☐ Night shift
18)	Which procedure were you performing during your most recent needle stick injury in obstetrics?	☐ Cesarean Section ☐ Episiorrhaphy ☐ Suture of vaginal laceration ☐ Trachelorrhaphy ☐ Other (please specify ____)
19)	Which kind of laceration were you repairing, if your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy?	☐ 1st grade laceration ☐ 2nd grade laceration ☐ 3rd grade laceration ☐ 4th grade laceration ☐ Episiotomy ☐ Ninforrhaphy
20)	Which tissue were you repairing, if your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy?	☐ Cutis ☐ Vaginal mucosa ☐ Perineal Muscle ☐ Rectal mucosa ☐ Anal sphincter ☐I do not know/remember
21)	If your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy, how many of these procedures had you performed as first operator before?	☐ < 10 ☐ 10 - 50 ☐ > 50
22)	If your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy, which suture technique were you using?	☐ Continuous suture (see Royal College) ☐ Interrupted stiches ☐ Additional hemostasis stitches ☐ I do not know / remember
23)	If your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy, which anesthesiologic technique were you using?	☐ None ☐ Local anesthesia with anesthetic infiltration ☐ Epidural/spinal anesthesia (the patient had analgesia during labor) ☐ General anesthesia (in case of complicated lacerations that require suture in the operating room)
24)	If your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy, were you supervised by a tutor?	☐ No, I was completely autonomous ☐ I was supervised by a senior trainee ☐ I was supervised by a consultant

25) If your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy, were you assisted by a midwife?	☐ Yes ☐ No
26) If your recent needle stick injury occurred during suture of vaginal laceration/episiorrhaphy, was it particularly difficult?	☐ Yes ☐ No
27) If your recent needle stick injury occurred during cesarean section, you were:	☐ First operator ☐ Second Operator ☐ Third Operator
28) If your recent needle stick injury occurred during cesarean section, the surgical procedure was:	☐ Emergency cesarean section (red code) ☐ Urgent cesarean section (yellow code) ☐ Scheduled cesarean section (green code) ☐ Elective cesarean section (withe code)
29) If your recent needle stick injury occurred during cesarean section, in your opinion the surgical procedure was particularly difficult because of:	☐ High number of previous hysterotomies (cesarean section and/or myomectomy) ☐ Difficult hemostasis ☐ Emergency procedure ☐ It was not complicated
30) If your recent needle stick injury occurred during cesarean section, the surgical procedure was assisted by:	☐ Instrumentalist nurse ☐ Midwife
31) Which tissue were you repairing, if your recent needle stick injury occurred during cesarean section?	☐ Cutis ☐ Subcutaneous tissue ☐ Fascia ☐ Peritoneum ☐ Uterus: hysterorrhaphy ☐ Uterus: hemostatic suture ☐ Other (please specify ____) ☐ I do not remember
32) If your recent needle stick injury occurred during cesarean section, the surgical procedure was complicated by:	☐ Uterine hemorrhage ☐ Extrauterine hemorrhage ☐ Vesical lesion ☐ There were not complications ☐ Other (please specify ____)
33) What did you do after your recent needle stick injury? (tick all appropriate boxes)	☐ "I continued to work as it had not happened" ☐ "I reported the accident to someone" ☐ "I washed the wound with disinfectant solution" ☐ "A witness encouraged me to report the injury and ask for help" ☐ "I requested the serological screening for infectious disease of the patient" ☐ "I underwent serological evaluation for bloodborne pathogens"
34) Which is the level of needle handling safety training you have received?	☐ I did not receive any training ☐ Not adequate training ☐ Adequate training
35) If you got training, was it offered in the form of (tick all appropriate boxes):	☐ Lectures ☐ Practical advice provided during procedures (for example by the first operator or instrumentalist) ☐ Suggested readings ☐ Practical training ☐ I did not receive any training
36) When do you think would be the best opportunity to introduce needle handling safety training?	☐ During Medical school ☐ At the first year of training ☐ After the first year of training
37) After your recent needle stick injury, who was aware of the accident? (tick all appropriate boxes)	☐ Consultant ☐ Senior trainee ☐ Younger trainee or same year of training ☐ Instrumentalist ☐ Nurse ☐ Midwife ☐ Anesthesiologist ☐ Partner ☐ Husband/Wife
38) Did you report your recent needle stick injury?	☐ Yes ☐ No
39) If you did not report your recent needle stick injury, which was the most important reason? (tick one relevant box)	☐ "The procedure takes too much time" ☐ "Reporting is not useful" ☐ "I did not want to know the results of my serological screening" ☐ "I did not want to know the results of the patient's serological screening" ☐ "I did not want people to know about my needlestick injury" ☐ "I was aware of patient serological screening (HIV-HBV- HCV) and drug use history" ☐ "I did not know where to report the injury" ☐ "My colleagues usually do not report needlestick injuries"
40) If you reported the injury, did you complete the follow-up and undergo the recommended serological exams?	☐ Yes ☐ No ☐ The follow-up is ongoing

Table 2.
Comparison of Obstetrics Needlestick Injury Questionnaire (ONSI-Q) with the reference surveys.

Survey Items	Makary et al. (2007)	Ouyang et al. (2016)	Present Study
Instrument			
Survey distribution	Survey form to be completed	Web-based platform	Web-based platform
Number of questions	6	16	40
Type of questions	Qualitative and quantitative	Qualitative and quantitative	Qualitative and quantitative
Pilot test	yes	yes	yes
Surveyed trainees' demographics			
Number invited to participate	741 (699 respondents)	840 (350 respondents)	1180 will be contacted
Level of training	General Surgery trainees (also, trainees in 4 subspecialties regularly rotating in GS)	Medical students/residents/postgraduate fellows	Ob-Gyn trainees
Institution	19 Residency programs in USA	Toronto University Hospital	38 Residency programs in Italy
Previous NSIs	yes	yes	yes
Most recent NSIs	yes (expanded set of questions)	yes	yes (expanded set of questions)
NSI circumstances			
Specific field of work	yes (Surgery)	no	Yes (Obstetrics)
Specific surgical setting	no	no	yes (Delivery Room/CS-OR)
Relation to specific surgical procedure	no	no	yes (expanded set of questions for Vaginal Suture and CS)
Source of NSI	yes	yes	yes
Task performed during injury	yes	yes	yes
Perceived cause of NSI	yes	no	yes
Involvement of High-Risk Patients (HRP)			
Fear of blood-borne pathogens	yes	no	yes
NSIs in this circumstance	yes	no	yes
Institutional protocol for prevention of NSIs in case of HRP	no	no	yes
Post exposure immediate actions	no	yes	yes
Report after NSI			
Occupational Health	yes	yes	yes
Another person	yes	yes	yes
Reason for not reporting	yes	yes	yes
Completion of the reporting/surveillance practice	no	no	yes
Needle handling training	no	yes	yes

NSI= needlestick injury; CS=Cesarean Section; OR= Operating Room; GS= General Surgery

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