How compliant are technicians with universal safety measures in medical laboratories in Croatia? – A pilot study

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Abstract

Introduction: This pilot study aimed to investigate the use of personal protective equipment (PPE) and compliance to the code of conduct (rules defined in institutional, governmental and professional guidelines) among laboratory technicians in Croatian medical laboratories. In addition, we explored the differences in compliance between participants of different age groups, laboratory ownership and accreditation status.

Materials and methods: An anonymous and voluntary survey with 15 questions was conducted among Croatian medical laboratory technicians (N = 217). The questions were divided into two groups: demographic characteristics and the use of PPE. The questions of the second part were graded according to the Likert scale (1-4) and an overall score, shown as median and range (min-max), was calculated for each participant. Differences between the overall scores were tested for each group of participants.

Results: The majority of participants always wear protective clothes at work, 38.7% of them always wear gloves in daily routine, more than 30.0% consume food and almost half of them drink beverages at workplace. A significantly lower overall score was found for participants working in public compared to private laboratories (36 (16-40) *vs*. 40 (31-40), $P < 0.001$). There were no statistically significant differences in overall scores for participants of different age groups ($P = 0.456$) and laboratory accreditation status ($P = 0.081$).

Conclusion: A considerable percentage of laboratory technicians in Croatian medical laboratories do not comply with safety measures. Lack of compliance is observed in all personnel regardless laboratory accreditation and participants' age. However, those working in private laboratories adhere more to the code of conduct.

Key words: survey; compliance; laboratory technician; universal safety measures; total quality management; clinical laboratory services

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Introduction

Laboratory personnel are exposed to blood-borne infections in daily routine due to contact with human blood and other body fluids (1,2). Croatia has a low prevalence (< 2.0%) of virus hepatitis infections (3) with annual percentage of healthcare workers exposure to contaminated sharp objects of approximately 1.1% (4). Nevertheless, proper use of personal protective equipment (PPE) and compliance to the code of conduct can significantly decrease the risk of infection (5).

The code of conduct is used as a term implying rules of professional standards defined in available institutional, governmental and professional guidelines. In European Union (EU) safety and health requirements for healthcare workers are regulated by EU Directive and Clinical Laboratory Standards Institute (CLSI) guidelines (6-8). In Croatia health workers safety is also ensured with Occupational Health and Safety Act (9).

Although the compliance with the code of conduct has been reported for different countries (10,11), to the best of our knowledge this issue has not been studied in Croatia so far. Considering this and the importance of employees' safety on workplace, a pilot study was conducted to focus attention on the subject.

The survey was conducted with the aim to investigate the use of PPE and compliance to the code of conduct among laboratory technicians in Croatian medical laboratories. The term "laboratory technicians" comprise medical laboratory technicians (graduated from four-year secondary school) and bachelors of laboratory medical diagnostics (additional 3-year of education on a professional study in Laboratory Medical Diagnostics). Both have necessary skills to work on analytical procedures in medical laboratory diagnostics and analysis. Additionally, we explored the differences in compliance between participants according to i) different age groups; ii) laboratory ownership (private and public laboratories); and iii) accreditation status (standard HRN EN ISO 15189: Medical laboratories- Requirements for quality and competence (12).

Materials and methods

Study design

This cross-sectional study has been conducted from March till September 2014. The survey was created in the Google Drive application (Google, Mountain View, CA, USA) as a voluntary and anonymous questionnaire with 15 questions formed using available governmental and professional guidelines for safety measures in medical laboratory. The questionnaire was distributed to 5 university hospital centers, 12 general hospitals, 2 primary care centers and 6 private laboratories from all regions of Croatia, selected on personally available contacts. It was sent in two ways: i) as a link to electronic mail of laboratories' managers, who forwarded the link to the laboratory technicians; and ii) as a Word document (Microsoft Office, Microsoft Corporation, Redmond, USA) to managers of laboratories who distributed the printed version of the survey to the medical laboratory technicians and bachelors of laboratory medical diagnostics. These questionnaires were returned to the authors by regular mail and manually inserted into the Google Drive application.

In the electronic form all questions were required to answer. All printed versions of questionnaires that had unanswered questions were excluded from the study.

The questions, shown in Table 1, were divided into two groups: demographic characteristics of the studied population (the first three questions) and use of PPE and compliance with code of conduct (from 4^{th} to 15^{th} question). Questions 4 and 5 were general inquiry about regulation of safety measures and personal attitudes toward them. Possible answers were "yes" (graded as 2), "no" and "I do not know" (both graded as 1). Answers to questions 6 and 8-15 were 4 level statements (never, sometimes, always and often) according to Likert scale, with numeric values from 1 to 4 assigned to each category. Statements were describing the frequency of particular behavior where the correct answer was rated with 4 as the highest grade, while the most inappropriate answer was rated as 1. The question number 7 stated the reasons for not wearing PPE in a form of a free entry textbox.

The overall score was calculated for each participant by summarizing the grades for questions 4-15 (excluding question 7). The maximum possible overall score was 40, while the minimum was 11.

The participants were divided into groups according to: (i) age (18-30, 31-40, 41-50 and ≥51 years); (ii) laboratory ownership (public and private) and (iii) laboratory's accreditation status (non-accredited *vs*. accredited laboratories according to the standard HRN EN ISO 15189).

Statistical analysis

The results are presented in form of frequencies and overall scores. The frequencies are presented as numbers and percentages and overall scores as median and range (min-max).

The normality of data distribution was tested with the Kolmogorov-Smirnov test. The differences in

Table 1. Survey questions and the distribution of answers with percentages.

Questions	Answers	N (%)
General information		
1. Age (years)	18-30	44 (20.3)
	31-40	60 (27.7)
	41-50	51 (23.5)
	≥51	62 (28.6)
2. The laboratory is:	Public	182 (83.9)
	Private	35 (16.1)
3. The laboratory is accredited by the HRN EN ISO 15189.	Yes	62 (28.6)
	No	155 (71.4)
4. Personal protective equipment and code of conduct.		
5. I work in an institution with a regulated code of conduct.	Yes	191 (88.0)
	No	13 (6.0)
	I do not know	13 (6.0)
6. In my opinion, it is important to use gloves always when manipulating with human samples.	Yes	209 (96.3)
	No	5 (2.3)
	I do not know	3 (1.4)
7. I wear gloves in daily routine.	Always	84 (38.7)
	Often	59 (27.2)
	Sometimes	71 (32.7)
	Never	3 (1.4)
8. What is the reason for not wearing gloves?	I always wear gloves.	91 (41.9)
	Lack of habit.	40 (18.4)
	They interfere with my work.	70 (32.3)
	I do not think I have to use them.	0 (0.0)
	They are not available in the workplace.	11 (5.1)
	Other	5 (2.3)
9. I take off the gloves when working on computer.	Always	173 (79.7)
	Often	19 (8.8)
	Sometimes	15 (6.9)
	Never	10 (4.6)
10. I take off the gloves when using a phone.	Always	193 (88.9)
	Often	16 (7.4)
	Sometimes	5 (2.3)
	Never	3 (1.4)
11. I wash my hands before and/or after using gloves.	Always	163 (75.1)
	Often	35 (16.1)
	Sometimes	17 (7.8)
	Never	2 (0.9)

Questions	Answers	N (%)
12. I change gloves between contact with patients, when they are visibly damaged and contaminated.	Always	166 (76.5)
	Often	28 (12.9)
	Sometimes	19 (8.8)
	Never	4 (1.8)
13. I wear protective clothes at work.	Always	190 (87.6)
	Often	12 (5.5)
	Sometimes	9 (4.2)
	Never	6 (2.8)
14. I consume food at work.	Always	21 (9.7)
	Often	13 (6.0)
	Sometimes	45 (20.7)
	Never	138 (63.6)
15. I consume beverages at work.	Always	23 (10.6)
	Often	14 (6.5)
	Sometimes	63 (29.0)
	Never	117 (53.9)
16. My nails are neat and short.	Always	164 (75.6)
	Often	39 (18.0)
	Sometimes	11 (5.1)
	Never	3 (1.4)

frequencies of answers between age groups, laboratory ownership and accreditation status groups were assessed with Chi-square test and Fisher's exact test, where appropriate.

The differences in overall scores between: a) age groups were assessed with ANOVA test; b) private *vs*. public laboratories and the accredited *vs*. non-accredited laboratories with Mann-Whitney test.

Additionally, the differences between the subgroups were tested using the comparison of proportions.

P values less than 0.05 were considered statistically significant. The statistical analysis was performed using the MedCalc software, version 11.5.1.0 (MedCalc Software, Ostend, Belgium).

Results

A total of 252 participants answered the questionnaire. However, 35 surveys received by regular mail were partially filled, therefore excluded, and 217 surveys were eligible for further analysis.

The frequencies of answers are presented in Table 1. The results demonstrate that majority of the participants (87.6%) always wear protective clothes at work, while less than 40.0% always wear gloves in daily routine. More than 30.0% of laboratory technicians consume food and almost half of them drink beverages at workplace.

The maximum achieved overall score by a participant was 40, while the minimum was 16. A significantly lower overall score was found for participants working in public laboratories compared to private laboratories (36 (16-40) and 40 (31-40), respectively with $P < 0.001$). There were no statisti-

cally significant difference in overall scores in different age groups (37 (22-40) for 18-30 years; 36 (24-40) for 31-40 years; 37 (16-40) for 41-50 years; 37 (22-40) for ≥ 51 years; P = 0.456). In addition, statistically significant difference was not found when overall scores of participants from accredited and non-accredited laboratory were compared (37 (29-40) and 36 (16-40), respectively; P = 0.081). The only statistically difference between the age groups was in wearing gloves (P < 0.001). More participants aged 18-30 years always wear gloves (P < 0.001). Accredited and non-accredited laboratories differed only in nail tidiness (P = 0.048). Finally, more participants working in private laboratories always wear gloves, change gloves regularly, always take their gloves off before using phone and/or computer, have tidy nails and never consume beverages at work (P < 0.001, P = 0.013, P = 0.047, P = 0.035, P = 0.009, P = 0.005; respectively). All participants who have stated that gloves are unavailable at the workplace (N = 11) are working in public laboratory, while the main reason for not wearing gloves was "they interfere with my work".

Discussion

This pilot study shows that even though the majority of laboratory technicians are aware of the importance of wearing PPE, a considerable number do not use it during their routine work (protective clothes are not always worn by 12.5% and gloves by 61.3% of participants). The main stated reasons for not wearing gloves are that they interfere with their work and lack of habit. A small, yet concerning number of participants reported that gloves are not available in their workplace. When compared to the same personnel working in public laboratories, more laboratory technicians working in private laboratories always comply with the code of conduct. Although expected, the difference between age (except for the frequency of using gloves) and accreditation groups (except for nail tidiness) was not found.

Recently a large observational study investigated the compliance with the CLSI H3-A6 guideline among health care workers (13). The study, conducted in 12 European countries, including Croatia, showed unacceptably low level of compliance with basic guideline recommendations. Even though the most critical phlebotomy steps identified within this study were patient identification and tube labeling, the results also showed that health care personnel often do not adhere to guidelines even in simple things such as changing gloves or proper hand disinfection.

Similar studies conducted in different countries show an intriguing variability in the results. In 2008, Main and colleagues published a study on Canadian laboratory workers (N = 1,268) about the compliance of recommended personal protective behaviors. They reported a high rate of noncompliance with precautions - 62% of participants did not wear gloves consistently while handling blood and blood products and 41% of participants do not always wear gloves while handling body fluids (14). Another group of authors conducted a survey in Saudi Arabia among medical technologists of the Department of Pathology and Laboratory Medicine of their institution. The results showed that a remarkable 92% of the participants were fully compliant with wearing gloves at all times when working with blood and blood products, however only 61% wash their hands after removing gloves (15). Recently, more surveys about standard precautions were conducted among health workers in Nigeria, China, South India and Afghanistan (16-21). Although high percentage of infections with the human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV) is presented in Nigeria, only 55.5% of participants used protective gloves and face masks (16). Similar to our study, group of authors from China, showed their results of compliance with standard precautions with scores. They concluded that 64.7% participants have overall score between 28.07 and 76.36, out of maximum possible score of 80, with the highest score for hand washing (19). Author Phukan showed that in South India, although highly aware of universal safety measures for wearing gloves and washing hands (87.5% and 88.3%, respectively), laboratory technicians and nurses do not practice safety behavior. Only 14.2% laboratory technicians properly wash hands and 35.0% of them wear gloves (20). These results are

not completely acceptable since gloves must be worn for all procedures that may involve contact with blood, body fluids and other potentially infectious material. Also, personell is obligated to wash their hands after handling infectious material (22).

Despite of a strict prohibition on consuming beverages and food in workplace (8), our results show that 46.1% and 36.4% participants consume beverages and food, respectively. Similar results were found in the Turkish study, where 38.3% of participants consumed food or drinks in the laboratory (23), while in most laboratories in Pakistan there is no separate place for consuming food and beverages and one-third of laboratory technicians do not use any kind of PPE (24).

Higher overall score of laboratory technicians in private laboratories indicates a higher level of awareness and workers' safety compared to public laboratories. The participants from private laboratories almost always wear gloves and even 63.0% of participants with maximum possible overall score work in private laboratories. Also, the minimum overall score of laboratory technicians that work in private laboratory was 31, in contrast to 16 in public laboratories. Insufficient awareness among technicians in public laboratories may be due to lack of motivation, staff training or lower investments in public laboratories. Comparable results were obtained from a study in Pakistan where employees in private laboratories use more PPE than in public laboratories (25).

In contrast, there were no statistically significant differences between participants working in accredited and non-accredited laboratories. Better results were expected in accredited laboratories because they should comply with requirements from the HRN EN ISO 15189 standard.

Greater awareness about safety measures was also expected among older technicians due to their participation in more educational trainings. Observed results show no difference between age groups except for wearing gloves which was significantly better in younger technicians.

Since this is a preliminary pilot study, a possible limitation is a relatively small number of participants (217 of more than 3700 laboratory technicians in Croatia) due to limited contact availability and unbalanced proportions of participating medical laboratories (public *vs*. private and accredited *vs*. non-accredited). In addition, the questionnaire was self-reported therefore some participants could have chosen to report the desirable instead of true answers despite the fact that the survey was anonymous. Also, we were not able to control if participants filled out the questionnaire only once. Nevertheless, this is a first survey carried out in Croatia about the use of protective equipment in medical laboratories. Our results indicate the need for continuous education and training programs to improve knowledge, awareness and compliance of technicians with safety measures, as a responsibility of employers to ensure it. Also, the availability of PPE at the workplace must not be questionable.

In conclusion, a considerable percentage of laboratory technicians in Croatian medical laboratories do not comply with safety measures. Furthermore, lack of compliance with safety measures is observed in all personnel regardless laboratory accreditation and participants' age. However, those working in private laboratories adhere more to the code of conduct. Since healthcare workers are at a significant risk of bloodborne infections at daily basis, their working habits should be focused on safety in order to decrease the risk of illness and preserve their health and the health of the patients. Baseline data provided by this study could be investigated on a higher number of participants and a wider range of questions to provide a better insight into the problem.

Potential conflict of interest

None declared.

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