



Attitude of Medical Students towards Occupational Safety and Health: A Multi-National Study

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Abstract

Background: Work-related diseases contribute immensely to the global burden of diseases. Better understanding of attitudes of health care workers towards occupational safety and health (OSH) is important for planning.

Objective: To assess the attitude of medical students towards OSH around the globe.

Methods: A questionnaire assessing the attitude towards OSH was administered to medical and paramedical students of 21 Medical Universities across the globe. In the current study 1895 students, aged 18–36 years, from 17 countries were included. After having performed a principal components analysis, the associations of interest between the identified components and other socio demographic characteristics were assessed by multivariate linear regression.

Results: Principal component analysis revealed 3 components. Students from lower and lower-middle-income countries had a more positive attitude towards OSH, but the importance of OSH was still rated higher by students from upper-income countries. Although students from Asian and African continents showed high interest for OSH, European and South-Central American students comparatively rated importance of OSH to be higher. Paramedical students had more positive attitude towards OSH than medical students.

Conclusion: The attitude of students from lower-income and lower-middle-income towards importance of OSH is negative. This attitude could be changed by recommending modifications to OSH courses that reflect the importance of OSH. Since paramedical students showed more interest in OSH than medical students, modifications in existing health care system with major role of paramedics in OSH service delivery is recommended.

Keywords: Health knowledge, attitudes, practice; Students, medical; Allied health personnel; Occupational health; Safety

Introduction

Work-related injuries and illnesses contribute immensely to the global burden of diseases.

As per International Labour Organization (ILO) estimates, approximately two million workers worldwide die from work-related injuries and illnesses.¹ Men suffer two-thirds of those deaths with groups of

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cancers, circulatory diseases and communicable diseases being the most common,² however poor recording and differences in the recording criteria should not be overlooked. Not only the physical and psychosocial effects but also the economic aspect of work-related diseases cannot be disregarded. The total costs including medical costs, wage loss, household production loss, and loss due to pain and suffering, was estimated to be US\$ 77 billion.³

The exposure of workers to different harmful substances has been prolonged due to increment in the age of retirement. Additionally, on account of industrialization, workers in developing countries are facing new conditions with lack of relevant knowledge and skills.⁴ For understanding and realizing the importance of occupational safety and health (OSH) at country, regional and company level, information on OSH is needed by health care professionals and workers at each level.⁵ Moreover, with help of pronounced and ingenious information on OSH, nations can direct resources and skills for appropriate purposes such as regulatory measures on health and safety at work.⁴ This information can certainly be best provided by the OSH experts with their comprehensive knowledge.

As both technical and medical branch of science, OSH is one of the essential components of medical education. Most work-related health problems are likely to be managed by non-occupational physicians.⁶ Non-recognition and mismanagement of work-related diseases is often linked to inadequate medical training.⁷ Therefore, not only for furnishing information on OSH, but also for diagnosing, combating and preventing occupational diseases, the knowledge of physicians and paramedical specialists in particular, should be up-to-date regarding the potential causal relationship between work and the diseases.⁸ Moreover, they should also be familiar with

the basic legal aspects of OSH in the industrialized as well as in transition nations.⁹ Getting the medical students interested in OSH is certainly challenging for varied attributable causes.¹⁰ Over the years, various national, international bodies and medical authorities have recapitulated the importance of medical contribution in OSH and desirability of training in the discipline at the medical undergraduate level.^{6,10-13} However, as revealed by existing literature, there exist substantial differences at national as well as international level on the duration for which OSH is taught, the course content of OSH and the examination procedures, suggesting that OSH is not only neglected but even downsized across the globe.¹⁴

The low interest of health care workers in OSH could be attributed to low interest of medical and paramedical students for OSH. This possibility of low interest awakens the need to assess the attitude of medical and paramedical students for OSH. A previous study on assessing the attitude of German and Brazilian medical students confirmed that the overall attitude of students towards OSH was low with negligible students considering occupational health (OH) as career option.⁸ The current study was conducted to analyze and compare the attitude of students towards OSH globally and to identify factors associated with poor OSH attitude. Besides being an initiative in assessing the attitude of students for OSH globally, this study might also apprehend the need of structuring and implementing a standardized OSH course in medical universities worldwide, using modern teaching tools. This in turn shall help in making work a better and safer place for workers.

Materials and Methods

Study Design

Having obtained the ethics approval of the

Ethics Commission of the University Hospital Munich (LMU), this cross-sectional study was carried out in 21 universities across four continents in 17 different countries. A questionnaire containing 23 questions was distributed amongst medical and paramedical students. Having explained the voluntary character of the study to the students, they were asked to fill in the questionnaires and return them to the study co-ordinators. Due care was taken by the study co-ordinators in ensuring students had no prior exposure to OSH before entering the study. In universities where OSH is taught as obligatory module (Table 1) the questionnaires were distributed from the 1st to 6th year students (depending upon the curriculum of the participating university) at the beginning of the teaching term, before the first lecture of OSH. In rest of the universities (Table 1), where OSH was not included in the curriculum, the questionnaires were distributed to the students in any random lecture.

Study Population

The medical and paramedical students of 31 universities were targeted for this cross-sectional study. The expected number of students was supposed to be 3800 with 90% response rate. On account of some technical difficulties, 21 universities responded and the remaining 10 universities dropped out (Fig. 1). The response also varied (Table 1) from as high as 98.5% to as low as 22.8% (an average response rate of 50%). A total of 2218 (1421 female) students participated in the study; 1725 of participants were medical students. As in most universities OSH is taught only in or after 3rd academic year, in this study, participants from only 3rd to 6th academic year were selected while the rest were excluded. For ethical reasons, only students above 18 years were included in the study. Subsequently, 1895 students, *ie*, 85.44% of the study participants were included in the

current study.

Questionnaire and Special Items

We used a one-page questionnaire consisted of 23 questions. Three questions were taken from the questionnaire used in Munich in 1998,¹⁵ asking directly about the interest in, knowledge of and students' vision about the importance of OH. These items were assessed on a 6-point Likert scale from "very high" to "very low."

Additionally, 12 questions taken from a questionnaire developed at the Coronel Institute of the Academic Medical Centre (AMC) in Amsterdam to assess the effect of case-based e-learning on the attitude towards OSH, were used. As in the Dutch study, these items were scored on a 5-point Likert scale from "totally agree" to "totally disagree."¹⁶ These 12 questions assessed individual thoughts on occupational physicians as career option, work-related aspect of diseases, interest in occupational diseases, diagnosis of occupational diseases, role of occupational physicians, resuming work after rehabilitation and preventive aspect

TAKE-HOME MESSAGE

- Work-related diseases have a significant contribution to the global burden of diseases.
- About two million workers worldwide die from work-related injuries and illnesses. Most of them are men.
- Occupational safety and health (OSH) is one of the essential components of medical education.
- Non-recognition and mismanagement of work-related diseases is often linked to inadequate medical training.
- Students from lower- and lower-middle-income countries had a more positive attitude towards OSH but students from upper-income countries have low interest for OSH.
- Paramedical students had more positive attitude towards OSH than medical students.

Table 1: Coordinating universities with the details of study participants

Country	Name of the coordinating university	OSH course	Academic year	No. of students receiving	No. of students responding	% Response	Student faculty
Brazil	Federal University of Parana	Yes	5 th	345	79	22.9%	Medicine
	University de Los Andes	No	3 rd -4 th	158	120	75.9%	Medicine
Chile	Universidad Catolica del Norte	No	4 th	49	41	84.0%	Medicine
	Universidad Austral	No	2 nd	160	142	88.8%	Biochemistry
China	Hainan Medical University	No	4 th -5 th	326	99	30.4%	Medicine
Colombia	Universidad del Rosario	Yes	2 nd -3 rd	186	80	43.0%	Physiotherapy
			4 th -5 th	112	61	54.5%	Medicine
Croatia	University of Zagreb	Yes	6	292	82	28.1%	Medicine
Germany	Ludwig Maximilians University, Technical University	Yes	5 th	345	266	77.1%	Medicine
Guatemala	Universidad Rafael Landivar	No	3 rd	50	36	72.2%	Medicine
India	Maulana Azad Medical College	No	3 rd	50	37	74%	Medicine
Malaysia	University of Malaya	Yes	3 rd	201	162	80.6%	Medicine
Mongolia	Health Sciences University of Mongolia	Yes	5 th	110	56	50.9%	Medicine
Nepal	Kathmandu Medical College	No	3 rd -4 th	120	70	58.3%	Medicine
Nigeria	Usmanu Dan Fodio University	No	5 th	20	19	95.4%	Medicine
	Ebonyi State University	No	5 th	205	202	98.5%	Medicine
Pakistan	Northern Institute of Medical sciences	No	3 rd -4 th	200	85	42.5%	Medicine
Peru	Universidad Alas Peruanas	No	1 st -6 th	910	264	34.5%	Medicine & others [†]
Poland	Medical University of Lodz	No	6 th	219	50	22.8%	Medicine
Turkey	Istanbul University, Cerrahpasa Medical Faculty	Yes	5 th	80	64	80%	Medicine
Venezuela	Universidad Central de Venezuela	Yes	4 th	100	64	64%	Medicine
		Yes	5 th	235	139	59.2%	Medicine
Overall						49.6%*	

*Response rate was calculated by dividing the total number of students responding by the total number of students receiving questionnaires.

[†]Others were medical technology, obstetrics and nursing students.

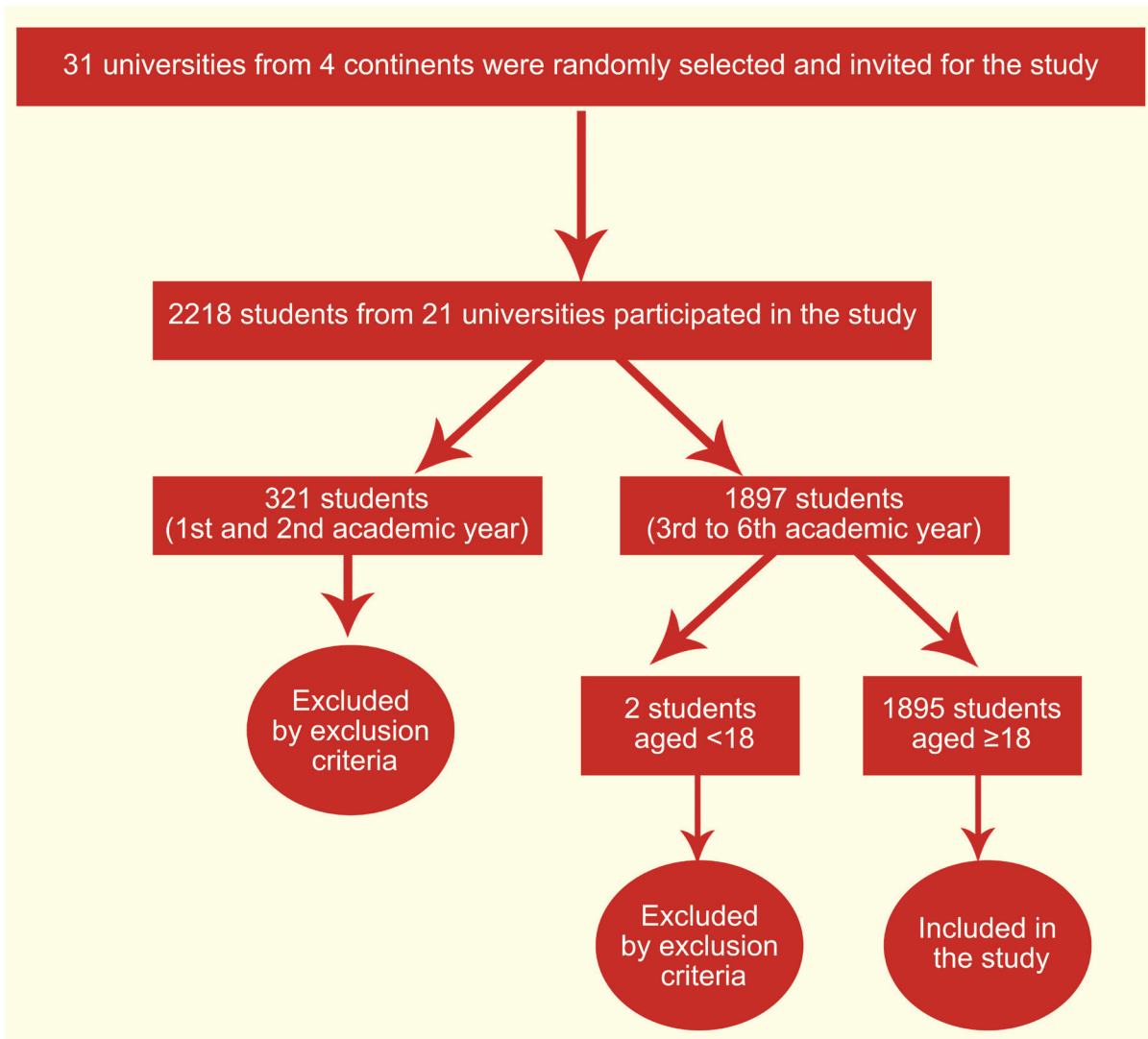


Figure 1: Study flowchart showing the sampling of the participants and the number of students enrolled in the current analysis, 2011–2012

of occupational diseases. In addition, sex and age of participants were assessed. The questionnaire was translated to Spanish, Mongolian, Chinese, Portuguese, German, Polish and Turkish and were back translated to English to check its validity.

Data Management and Statistical Analysis

The questionnaire data were sent by scans/posts to the center in Munich. Data double entry was done to overcome any manual typing errors. To identify regional/cultural

differences in the attitude, the 21 universities, based on their cities, were categorized into four different continents namely South and Central America, Asia, Africa, and Europe.¹⁷ We further assessed the association between country income level and attitude towards OSH. We therefore used the income categorization of the participating countries by World Bank and divided the universities into four categories—upper-income countries, upper-middle-income countries, lower-middle-income coun-

For more information on the World Bank Classification of countries see <http://data.worldbank.org/about/country-and-lending-groups>



Table 2: Countries by their income level as per World Bank

Lower	Lower-Middle	Upper-Middle	Upper
Nepal	Guatemala India Mongolia Nigeria Pakistan	Brazil Chile China Colombia Malaysia Peru Turkey Venezuela	Croatia Germany Poland
70	435	1315	398

tries, and lower-income countries (Tables 2 and 3).¹⁸ Due to less number of students in the category of lower-income countries, the lower-income and lower-middle-income countries were grouped together. The type of student was also considered to be independently associated with attitude towards OSH. We therefore, classified students into medical students and paramedical students. Paramedical branches were students of physiotherapy, public health, nursing, medical technology, obstetrics, and biochemistry.

To find correlated variables and to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components, primarily a principal component analysis was performed on

Table 3: Countries by the continents they belong to geographically

Central and South America	Asia	Africa	Europe
Brazil Chile Colombia Guatemala Peru Venezuela	China India Malaysia Mongolia Nepal Pakistan Turkey	Nigeria	Croatia Germany Poland
1089	510	221	398

the data. As a result of the analysis, the 17 variables, *ie*, question number 1 to 17 from the questionnaire, were reduced to three principal components. The loading value of only >0.30 was considered for classification under each component.¹⁹ For further analysis, the scores of variable with the highest component loading were used. Descriptive analysis was carried out on the refined dataset obtained after the principal component analysis to describe the main features of the dataset. For determining the association and the strength of association between the three principal components and other independent variables of the dataset, bivariate analysis by Kruskal Wallis sum rank test was performed on the study participants by sex, by income level of the countries, countries by continents, and the type of student. Furthermore, to find empirical relationships between the three dependent principal components and other independent features of the dataset, multivariate analysis was performed in which the three principal components were analysed by income level, type of continent, and type of student. We adjusted our models firstly for only sex and age, and secondly for sex, age and academic year of the students. All statistical analyses were conducted with R 2.14.1 and Microsoft Excel[®] 2007.

Results

The mean age of participants was 22.6 (SD 2.3, range 18 to 36) years (Table 4). Of 1895 students included in the current analyses 62% were females and 91% were medical students. More than a third (38%) of participants studied in South and Central America followed by Asia (30%) and Europe (21%). More than half (53%) the students came from upper-middle-income countries. Most students (42%) were in their 5th academic year.

From principal component analysis a

set of three linearly uncorrelated principal components were obtained (Table 5). We named these three components “Component Interest for OSH,” “Component Importance of OSH,” and “Component in Conflict of Importance of OSH” based on the label of the variables loaded into each component.

In the bivariate analysis, students from lower- and lower-middle-income countries showed the highest interest and knowledge for OSH while those from upper-income countries reportedly were least interested or had least knowledge of OSH (Table 6). The interest in OSH diminished with the increase in income level of the country, so there was a gradient for income observed. However, importance was rated highest by the students of upper-middle-income countries.

With respect to regional differences, South and Central American students showed the highest importance for OSH. Even though European students showed that they were least interested in OSH, still they did realize the importance of OSH. Paramedical students were more interested, had more knowledge and ranked the importance of OSH higher than medical students. With respect to the third component, also there was a gradient observed by income level of the countries.

After mutually adjusting the results for other variables in the model, lower- and lower-middle-income countries had a significant interest for OSH as compared to upper-income countries (Table 7). Confirming the results of bivariate analysis, there was an income gradient observed here as well and the interest declined with increase in income level of the country. Upper-income country students despite of displaying low interest in OSH still rated the importance of OSH to be high. According to the results of model that compared different countries geographically by the continent they belonged to with African

Table 4: Socio-demographic characteristics of the participating students, 2011–2012 (n=1895)

Characteristic	Number of missing	Total n (%)
Sex		
Female	23	1164 (62.18)
School type		
Medical	0	1719 (90.71)
Academic year		
3 rd yr		597 (31.50)
4 th yr	20	332 (17.52)
5 th yr		794 (41.90)
6 th yr		152 (8.02)
Countries by income level		
Lower + Lower-Middle		504 (26.60)
Upper-Middle	0	994 (52.45)
Upper		397 (20.95)
Continent type		
Africa		220 (11.61)
South and Central America	0	710 (37.47)
Asia		568 (29.97)
Europe		397 (20.95)

continent taken as reference, African and Asian students had high interest for OSH, followed by South and Central American and European students who shared almost same interest. Interestingly though South and Central Americans and European students displayed lack of interest for OSH, they still rated importance of OSH to be high. Paramedical students rated interest and importance of OSH higher than medical students. Sex was not included as an independent variable to be assessed in the multivariate analysis because as observed from the bivariate analysis the associations between the components and the gender remained similar, irrespective of the gender of the study participant. However, all models used were adjusted for sex.

Table 5: Three components with their component loading derived from the principal component analysis, 2011–2012, (n=1985).

Questions	Component “In-terest for OSH”	Component “Importance of OSH”	Component “In Conflict of Importance of OSH”
5. Becoming an occupational physician is an option for me.	0.80	-0.07	0.13
1. My interest in the subject of occupational medicine is: (Likert)	0.74	0.08	0.01
14. I am extremely interested in the preventive aspect of occupational medicine.	0.74	0.16	0.05
9. I find occupational diseases interesting to study.	0.69	0.34	-0.14
2. My knowledge in the field of occupational medicine is: (Likert)	0.68	-0.12	0.21
3. I rate the relevance of occupational medicine for students as: (Likert)	0.60	0.22	0.03
12. I find work disability an interesting problem to study.	0.48	0.34	-0.11
7. It is important to diagnose a disease as an occupational disease.	0.07	0.68	-0.13
10. Occupational diseases will continue to be an interesting medical problem in the future.	0.22	0.62	-0.06
6. With every patient there might be work-related aspects of their disease.	0.17	0.61	-0.09
8. Resuming work after illness is an important part of rehabilitation.	-0.12	0.61	0.09
16. Every physician should report occupational diseases.	0.10	0.57	0.21
13. If you have a certain disease you must take it into consideration when choosing an occupation.	0.05	0.51	0.07
11. Occupational physicians play an important role in preventing diseases.	0.42	0.48	-0.07
17. Your medical file always indicates your patient's occupation.	0.13	0.39	0.26
15. Occupational medicine is not an option for me because it is too involved with healthy people.	0.05	-0.16	0.75
4. I feel that the work of the occupational physician entails an awful lot of administrative work.	0.04	0.23	0.59

Table 6: Bivariate analysis of three components obtained from principal component analysis by sex, countries by income level from low- to high-income, countries by continents they belong to and type of student, 2011–2012 (n=1895)*

Characteristic	Component “Interest for OSH”		Component “Importance of OSH”		Component “In Conflict of Importance of OSH”	
	Mean (SD)	p value	Mean (SD)	p value	Mean (SD)	p value
Sex						
Female	3.51 (1.35)	0.410	1.77 (0.95)	0.117	3.66 (1.18)	<0.001
Male	3.55 (1.37)		1.86 (1.02)		3.41 (1.26)	
Countries by income level						
Lower + Lower-Middle	2.97 (1.39)	<0.001	2.02 (1.12)	<0.001	3.37 (1.36)	0.001
Upper-Middle	3.48 (1.34)		1.67 (0.85)		3.58 (1.20)	
Upper	4.30 (0.96)		1.85 (1.02)		3.74 (1.03)	
Countries by continents						
Africa	2.95 (1.49)	<0.001	2.49 (1.21)	<0.001	3.50 (1.37)	<0.001
South and Central America	3.57 (1.36)		1.49 (0.76)		3.77 (1.18)	
Asia	3.11 (1.30)		2.00 (0.98)		3.18 (1.24)	
Europe	4.30 (0.96)		1.85 (1.02)		3.74 (1.03)	
Student type						
Medical	3.64 (1.32)	<0.001	1.83 (0.99)	<0.001	3.57 (1.20)	0.475
Paramedical	2.27 (1.14)		1.52 (0.75)		3.45 (1.35)	

*The response for each component was ranked on a Likert scale of 5 from “totally agree” to “totally disagree.”

Discussion

Our results showed that there is low interest for OSH among medical students, especially from upper-income countries which mainly comprised of European nations in our study. As seen from the results, the interest for OSH declined with the increase in income level of countries suggesting an income gradient. Surprisingly, though

the interest of students from lower- and lower-middle-income countries was high, still they ranked importance of OSH to be really low. This difference in attitude of students could possibly be due to differences in the socio-economic status and the environment students are exposed to. In many developed countries exposure to work and harmful substances starts as early as infancy because of the type of work

Table 7: Multivariate analysis of the three components derived from principal component analysis by sex, countries by income level, countries by continents they belong to and type of student, 2011–2012 (n=1895)*

Characteristic	Component “Interest for OSH”		Component “Importance of OSH”		Component “In Conflict of Importance of OSH”	
	Adjusted Estimates 1 β (95% CI)	Adjusted Estimates 2 β (95% CI)	Adjusted Estimates 1 β (95% CI)	Adjusted Estimates 2 β (95% CI)	Adjusted Estimates 1 β (95% CI)	Adjusted Estimates 2 β (95% CI)
Income level (Ref: Lower + Lower-Middle)						
Upper-Middle	0.41 (0.22 to 0.59)	0.41 (0.21 to 0.60)	0.10 (-0.4 to 0.24)	0.12 (-0.02 to 0.26)	0.04 (-0.14 to 0.22)	0.02 (-0.16 to 0.20)
Upper	1.37 (1.16 to 1.59)	1.43 (1.21 to 1.66)	0.27 (-0.44 to -0.10)	0.43 (-0.61 to -0.25)	0.12 (-0.97 to 0.33)	0.21 (-0.02 to 0.43)
Continent (Ref: Africa)						
South and Central America	0.63 (0.35 to 0.92)	0.64 (0.35 to 0.92)	0.77 (-0.99 to -0.54)	0.72 (-0.95 to -0.50)	0.19 (-0.09 to 0.47)	0.17 (-0.11 to 0.46)
Asia	0.06 (-0.31 to 0.20)	0.05 (-0.21 to 0.32)	0.21 (-0.41 to -0.01)	0.21 (-0.42 to -0.01)	0.46 (-0.71 to -0.21)	0.43 (-0.70 to -0.17)
Europe	0.55 (0.13 to 0.98)	0.48 (0.05 to 0.91)	0.47 (-0.80 to -0.13)	0.51 (-0.85 to -0.17)	0.04 (-0.38 to 0.46)	0.05 (-0.37 to 0.49)
School type (Ref: Paramedical students)						
Medical students	1.68 (1.47 to 1.89)	1.53 (1.31 to 1.76)	0.01 (-0.17 to 0.16)	0.06 (-0.12 to 0.23)	0.45 (0.24 to 0.65)	0.34 (0.12 to 0.57)

Adjusted estimates 1: Models adjusted for sex and age; Adjusted estimates 2: Models adjusted for sex, age and academic year.
 β: Estimated regression coefficients; CI: Confidence interval.
 *p values for all the six models were <0.001

mothers are forced to take up for living,⁴ which might raise the awareness and need of having a safe working environment for oneself, family and acquaintances.

Our study has served to be an initiative to measure the attitude of students towards OSH globally. Such a study has never been carried out in the past at a global level. Additionally, the average response of the study participants from our study was also acceptable from statistical point of view.

Some limitations of our study were that students either left few questions unanswered or left the whole survey blank. This non-response could possibly be either due to lack of interest in OSH or because of confidentiality concerns. This non-response serves as a ground for selection bias. Another problem was attendance of study participants. Due to the non-obligatory nature of the lectures, in several centres, very few students attended the lectures on the day the survey was conducted. Also, the average response of the study participants calculated based on the number of students attending the lectures dropped with increase in the income level of the countries, which in turn could result in differential bias (Table 8). Therefore, the high interest in OSH observed in lower-income countries could possibly be an output of only interested students attending the lectures and participating in the study.

Our study showed that though the attitude of students from lower- and lower-middle-income countries for importance of OSH was low, the interest was still rated high by these students. Therefore, to enhance the perception of these students, a course focusing on the importance of OSH is better to be introduced into their academic curriculum. Since the students already have high interest in OSH, the nature of this course should be voluntary. However, the lectures of this course could be held more frequently to meet the ob-

Table 8: Percentage response of study participants from respective countries by income level*

Lower and Lower-Middle	Upper-Middle	Upper
Gautemala 72%	Brazil 23%	Croatia 28%
India 74%	China 30%	Germany 77.1%
Mongolia 50%	Chile 75%, 84%, 89%	Poland 22.8%
Nepal 58%	Colombia 43%, 55%	
Nigeria 99%, 95%	Malaysia 81%	
Pakistan 43%	Peru 34%	
	Turkey 80%	
	Venezuela 59%	
	Venezuela 64%	
71%	60.2%	42.6%

*The percentage is calculated as the number of students answered the questionnaire divided by the number of students presented in the class.

jective. Furthermore, while structuring a course for students of lower- and lower-middle-income countries, modifying the sessions in the light of student-based evaluation, as shown by Grime, *et al*, can enhance the perception of students for the value of OSH teaching sessions.²⁰

Additionally, it could be seen from our results that paramedical students showed more positive attitude than medical students. Therefore, besides structuring and implementing the course that improves the attitude of medical students towards the importance of OSH, it is necessary to modify the role play of students in delivering the OSH health care. As paramedical students showed more interest in and realized the importance of OSH compared to medical students, reforms in health care practice should be recommended. For example, nurses and physical therapists may be specifically trained to deliver OSH services to the workers. This could prove helpful in aiding timely assistance to occupational injury patients and ultimately be helpful in reducing the number of workers suffering from work-related injuries.

Since the interest of students from up-

per-income countries was low, some reforms in their academic curriculum could be made to change the negative attitude of these students. Alternatively, instead of the occupational health experts, student participation is strongly recommended in structuring the course. This shall not only improve the attitude of students towards OSH, but as shown by Shanahan, *et al*, improve the satisfaction rate of students.⁹ Since workplace visits have contributed to the overall aim of knowledge and attitude change on occupational health issues, workplace visits can also be included in the OSH courses for these students.⁶ Besides, case-based e-learning should also be incorporated into the curriculum. As suggested by Kolb, *et al*, case-based e-learning has proven to be a unique tool in the international platform, which supports the quality of education and training in OSH throughout Europe.²¹

In conclusion, our study showed that the attitude of students from lower- and lower-middle-income countries towards importance of OSH needs to be changed and an OSH course realizing importance of OSH could play a vital role in doing so. Additionally, since paramedical students are more interested in OSH than medical students, they could play a major role in delivering OSH health care.

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