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Research Article

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Road Traffic Safety for International Workforce: Can Employer's Policy Make a Difference?

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Abstract

Background: Road traffic crashes pose a great threat to global health. In 2010, 1.3 million people died in road crashes and up to 50 million were injured. The burden is heavily skewed with low- and middle-income countries being affected the most. Road safety is an occupational health problem for many international organizations and it is of paramount interest to prevent deaths and injuries due to road traffic crashes. The aim of this study was to investigate possible effects of a road safety policy implementation within the organization by analyzing event rates (crashes and near-crashes), risk behavior among the staff, and possible gender differences.

Methods: The study was conducted at the Health Services Department of an international organization in Washington D.C. United States. An electronic road safety survey was delivered to staff in 2008 (S1) and consequently a road safety policy was developed and implemented globally. A second survey (S2) was distributed 9 years later (2017). Questions on events and health behavior included in these surveys were analyzed and compared in order to investigate possible effects of the road safety policy implementation.

Results: The number of crashes per 1000 mission-days was reduced from 0.9 to 0.7 and the number of near-crashes per 1000 mission-days from 13 to 10.6. The travel adjusted event rates were highest in low-income countries followed by middle-income countries. High-income countries had a considerably lower risk. Seatbelt use among staff has greatly improved (from 70% to 86% stating they always use seatbelts when available and functional). While traffic deaths have increased in developing countries over the past 9 years, the risk for staff at this international organization has decreased significantly with no gender difference.

Conclusion: The findings show significant improvement of road safety for the staff at the international organization compatible with policy impact.

Introduction

The global problem of road traffic safety

Fatality burden: The Global Burden of Disease Study estimates 1.3 million deaths in traffic globally in 2010, an increase of 45% since 1990 [1,2]. Most of the deaths involve car occupants but pedestrians also represent a sizeable part accounting for 22% of road deaths globally and 40% in Africa [3]. Although increase worldwide of people and vehicles, thanks to preventive efforts the number of road traffic deaths, has plateaued out, but more can be done [3]. In adults of Low-Income Countries (LIC) and Middle-Income Countries (MIC), road traffic injuries cause more fatalities than malaria, typhoid and diarrhea combined [4].

Economic effects: Road traffic crashes also have a negative impact on the economy of the families afflicted, as well as on the countries concerned [3]. In 2012, the estimated lifetime medical cost for road crash injuries was $25.2 billion, and the cost for lost lifetime productivity even higher, around $32.9 billion in the US alone [5].

Skewed distribution of burden in the world: Most affected are LIC and MIC where 90% of global fatalities occur [3]. With 1% of world registered vehicles, LIC account for 16% of road deaths. MIC with 53% of vehicles holds almost three quarters of road deaths. [3].

The paradigm shift: Injuries sustained in road crashes can be predicted and prevented, with Sweden as a leading example [3]. Road safety is a major public health issue, and the human behavior and body's vulnerability should be taken into account when designing cars, the roads, and road traffic legislation [6].

Road safety at an international organization (IO): For this IO business traveling is an occupational characteristic. Seventy per cent of all staff yearly travels regularly as part of their work, mostly to LIC and MIC [7]. Employees reported many incidents and crashes in road traffic and 1-3 staff fatalities occurred annually during the decade prior to 2008 [8].

In 2008, a staff survey on road safety was conducted and covered travel in the years 2005-2007 [7]. The purpose of the survey was to analyze road safety problems faced by travelers, identify high-risk countries, and suggest strategies for prevention [7].

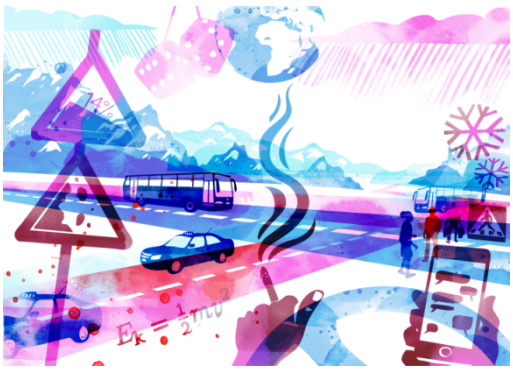

Figure 1: Common risk factors for crashes.

Based on data from this survey a Road Safety Directive was issued. (Table 1)[8].

Road Safety Policy	
Measures to address road environment factors	Restricted travel at dawn and night in high-risk countries, restricted travel during certain weather conditions
Standards and rules for vehicles	Vehicles equipped with safety features such as functional seat-belts, air-bags, annual vehicle inspections
Standards and rules for drivers	Qualifications, certifications, training, driver's checklist for basic road safety, distraction and schedule for management of fatigue
Standards and rules for passengers	Staff members should not be expected to drive while on mission travel
Measures to address emergency medical resources	Vehicles equipped with medical kits, drivers trained in first aid/CPR, drivers and staff shall have information on emergency services numbers

Table 1: Sections and headlines of the Road Safety Policy.

Aim and specific objectives: The aim of this study was to evaluate possible impact of the road safety policy implementation. Specific objectives were to analyze changes in road safety risk between countries, investigate gender differences in risk perception and safe behaviors, and identify areas for further improvements.

Ethics

The surveys were approved by the Occupational Health and Safety Committee (OHSC) at meetings in 2008 and 2016.

Materials and Methods

This research was conducted by the Health Services Department (HSD) at an IO in Washington D.C. United States. The first survey (S1) was conducted in 2008 and covered the years 2005-2007 [7]. After the first survey, the Road Safety Policy was developed and launched (Table 1) [8]. In 2017, a second staff survey (S2) was conducted covering 2014-2016.

The surveys were developed by a multi-departmental task force and included questions about demographics, travel, experienced crashes and near-crashes, and other road traffic safety concerns. S1 comprised 58 and S2 150 questions.

The question on crashes was worded: In the past 3 years, how many times have you been in a "road traffic crash" (collision) while traveling on mission or at your work location?

The question on near-crashes was worded: In the past 3 years, how many times have you been in a "near-crash" situation while traveling on mission or at your work location (Duty station)?

near-crash is defined as almost having a collision with another vehicle, pedestrian or obstacle on the road. This situation would require a sudden action to avoid a collision, such as sudden breaking, turning or alike

Population and data collection

In this study, only responses from staff at headquarter (HQ) were analyzed. Respondents who had reported no mission-days were excluded in both surveys.

Variables

Analyzed questions: Only questions included in both surveys were analyzed. The results from S1 showed a strong correlation (r=0.89) between crashes and near-crashes [7]. Therefore, due to a relatively small number of reported crashes, near-crashes and crashes were combined for total number of events. The number of near-crashes and crashes was calculated per 1000 mission-days.

Risk: To standardize for variations of HQ staff travel, a risk was calculated as the sum of crashes and near-crashes per 1,000 mission-days over 3 years.

Near-crash and crashes by country: The three most recent near-crashes and crashes were described in detail. Since the number of mission-days by country was unavailable, templated on a UN analysis, the number of staff at each country office was used as a proxy for the travel exposure (number of trips to the country office). The logic is that the number of staff at each country office typically is proportional to the volume business in that country. Human Resources of the IO provided the necessary staff lists, for the S1 from 01/31/2008 and the S2 from 02/14/2017.

To prevent low sample size from biasing the results, countries with no reported crashes and with less than 4 near-crashes were excluded, as well as countries with less staff than 10.

Another method for calculating incidence rate was based on missions per country. The question used was "Please check all the countries in which you have traveled by road during your missions in the past 3 years:"

The rate was calculated as crashes and near-crashes per 1000 missions by country.

Risk for countries in relation to income: Population data came from United Nations Population Division database and the information about gross national income (GNI) per capita was calculated by the World Bank using The World Bank Atlas method [3]:

Low=$1045 or less

Middle=$1046-12745

High=$12746 or more

Seatbelt use: The question used for this analysis was "When seatbelts are available and functional, how often do you use them while driving or riding a car?" The alternatives were always, sometimes, and never.

Comments from respondents: The open question "Do you have any suggestions how to improve road safety?" was compared using qualitative methods [9]. The comments were divided into defined categories and subgroups for both surveys. These were discussed and agreed upon based on their content related to the road safety policy. Some comments could belong to several groups and hence, sometimes mentioned in more than one category, and divided by sex.

Statistical methods: SPSS statistics v.25 was used for statistical analysis of data. Poisson regression was performed for analysis of

crashes and near-crashes. Chi-square test used for analysis of seatbelt use, with a two-tail test with $p<0.05$ for significance.

Results

S1 was delivered to 15,962 e-mail addresses belonging to staff at both headquarters (IO's) and country offices with 3760 respondents giving a response rate of 24%. S2 reached 27,615 e-mail addresses belonging to staff at both headquarters (IO's) and country offices with 6,364 respondents and a response rate of 23%. The age and gender distribution is similar between the surveys. Staff as opposed to consultants constituted the largest part of the responders (85% in S1 and 77% in S2). There were less travelers in S2 (57% of total respondents compared to 82% in S1).

Questions	Survey 1 (S1), 2008 Number of respondents (% of respondents)	Survey 2 (S2), 2017 Number of respondents (% of respondents)
Age		
29 or younger	98 (4.7)	149 (5.7)
30-39	558 (27)	642 (25)
40-49	702 (34)	802 (31)
50-59	570 (28)	725 (28)
60 or older	142 (6.9)	304 (12)
Total	2070	2622
Gender		
Female	1085 (53)	1471 (56)
Male	976 (47)	1155 (44)
Total	2061	2626
Contract type		
Staff	1758 (85)	1917 (77)
Consultant	305 (15)	559 (23)
Vendor/Contractor	4 (0.2)	12 (0.5)
Total	2067	2488
Number of missions in a typical year		
0	332 (16)	772 (31)
1-3	650 (32)	768 (31)
4-6	668 (33)	601 (24)
7-9	169 (8.3)	170 (6.8)
10-20	212 (10)	184 (7.4)
>20	5 (0.2)	6 (0.2)
Total	2036	2501
Number of mission-days in a typical year (all travelers)	Survey 1Number of respondents (% of respondents)	Survey 2 Number of respondents (% of respondents)
1-9	265 (16)	308 (24)
10-20	450 (27)	379 (29
21-50	400 (24)	335 (26)

51-100	408 (24)	240 (18)
101-150	142 (8.4)	43 (3.3)
>150	22 (1.3)	7 (0.5)
Total	1687	1312

Table 2: Demographic and travel characteristics of responders based at Headquarters (Washington D.C.).

As shown in Table 2 the mean age and gender distribution of the responders was similar between the surveys, although a higher proportion of men were traveling on longer trips.

Non-respondents

Information about the non-respondents was unavailable but total staff lists were. From this comparison it can be implied that the non-responders had a higher proportion of men compared to women, and a larger share of consultants compared to regular staff.

Staff Road Safety Policy awareness

25% (n=482) of 1,917 responders at headquarters answered that they were aware of the Staff Road Safety Policy in the second survey. 50% (n=956) of responders were not familiar with the policy, and 25% (n=478) were not sure.

Number of near-crashes and crashes

Staff was asked to describe the three most recent crashes and near-crashes in the past three years.

S1: Reported crashes on mission during years 2005-2007, were n=163 and of near-crashes n=2,396. Of these, 142 crashes (87%), and of the near-crashes 1,627 (68%) were described.

S2: Reported crashes on mission during years 2014-2016 was n= 56 and reported near-crashes were n=1,168. Of these 27 crashes (48%), and of the near-crashes 298 (26%) were narrated.

The number of reported near-crashes on mission was reduced by more than half since the first survey and reported crashes to about a third compared to S1 with similar gender distribution.

Risk Ratio (RR) for the international organization: S1 reported per 1000 mission-days 0.9 crashes, 13 near-crashes, and 13.9 total eventsSimilarly, S2 reported 0.7 crashes and 10.6 near-crashes, and 11.3 total events.The results indicate that the risk for crashes as well as near-crashes have significantly decreased, RR=0.58 (95% CI 0.05-1.12), P=0.032, respectively RR=0.18 (95% CI 0.03-0.33), P=0.019.

Gender differences

The risk for female travelers had significantly decreased for near-crashes RR=0.22 (95% CI 0.01-0.43), P=0.036. The risk for male travelers had significantly decreased for crashes RR=0.46 (95% CI 0.28-1.36), P=0.003.

No statistically significant difference was found for female staff concerning crashes RR=0.35 (95% CI -0.5-1.20), P=0.42, or for male staff concerning near-crashes RR=0.14 (95% CI -0.07-0.36), P=0.19.

Near-crashes and crashes by country

The countries with highest incidence rates for events (near-crashes + crashes) are presented in Table 3

Rank S2 (S1)	Countries	Number of events	Travel adjusted event rate
1 (10)	Nigeria	20	11
2 (11)	Uganda	10	10
3 (not included in S1)	Congo, Democratic Republic of	5	6.4
4 (41)	Peru	8	5.7
5 (15)	Sri Lanka	7	5.4
6 (32)	Bangladesh	13	4.3
7 (38)	Mexico	7	4.1
8 (13)	Kenya	15	3.0
9 (34)	China	12	2.9
10 (18)	Egypt	6	2.7
11 (29)	Senegal	5	2.4
12 (23)	India	36	2.3

Table 3: Risk table of top 12 high risk countries based on travel adjusted event rate during years 2014-2016 for S2 (2017)*. Ranking in S1 shown in parenthesis.

Six of the countries with the highest number of events by country office size in S1. (Guyana, Iran, Yemen, Sudan, Guinea, Nigeria) are also in top 12 with per 1000 missions as denominator.

All 12 of the countries with the highest number of events in S2 are also in top 12 with per 1000 missions as denominator. Nigeria is at the top with both methods.

Risk for countries in relation to income

The crash risk varies by country income group based on gross national income per capita. Low- and middle-income countries carry the highest risk as can be seen in Table 4. The number of events per 100 staff at CO is considerably higher for low- and middle-income countries in contrast to high-income countries. The same pattern is seen with 1000 missions as a denominator.

Travel adjusted event rate				
Income group	Number of countries	Number of events	Number of staff at CO (country office)	Travel adjusted event rate
Low	30	105 (368)	2609 (1297)	4.0 (28.4)
Middle	96	203 (962)	8206 (4541)	2.5 (21.2)
High	52	11 (248)	18932* (14557)	0.06 (1.7)

Table 4: Travel adjusted event rate for high-/middle- and low-income countries for S2 (S1 in parenthesis).

Seatbelt use

The proportion of respondents who claim that they always use seatbelt on mission has increased from 70 per cent in 2008 (S1) to 86 percent in 2017 (S2); R=1.20 (95% CI 1.15-1.25), p<0.0001, for women RR=1.17 (95% CI 1.09-1.25), p<0.0001, and for men RR=1.24 (95% CI 1.16-1.31), p<0.0001.

Summary of comments from respondents

The percentage of respondents requesting more information and awareness about road safety policy together with the proportion of comments suggesting no need for further improvement has increased from S1 to S2 (Figure 2).

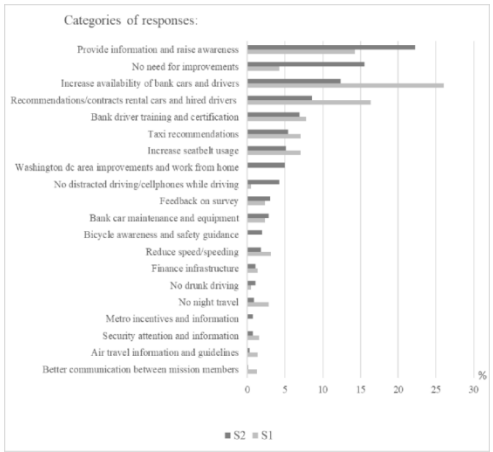

Figure 2: Summary of 644 comments from respondents from S1 and 664 from S2, shown as percentages of total number of comments from each survey.

The share of comments expressing concerns about risks in terms of seat belts, night traveling and speeding has decreased. An emerging issue for the staff based on comments in survey 2 is the risk with distracted driving, for example using cellphones during driving.

DIFFERENCES IN SUGGESTIONS BETWEEN MEN AND WOMEN. A large proportion of both men and women want increased availability of IO's cars and drivers. In both surveys, a larger share of comments from men can be sorted in the category "No need for improvements". The fraction of women commenting on distracted driving as an issue is greater than the percentage of comments from men in that category.

Discussion

Main findings

The numbers of crashes as well as near-crashes on mission have decreased in S2 for both reported and described events and for both genders. After adjustment for number of mission-days there were no significant gender differences in reported near-crashes and crashes in any of the surveys. It should be pointed out that staff on mission rarely is the driver which may affect gender as a risk factor.

The risk ratio is compatible with an overall effect of the road safety policy with a statistically significant decrease rate in reported crashes, near-crashes, and total events.

Some countries are in the top both in actual numbers and for two different incident rates, a strong indicator that traveling in this country is associated with high risk. Compared with the baseline study, S1, [7], 7 of the 12 countries are also featured in the list of high-risk countries calculated by number of events by 1000 person-days.

Our results indicate that low-income countries bear the highest risks for events, followed by middle-income countries, consistent with previous research. According to WHO, 90% of fatalities in road traffic occur in LIC and MIC, a trend likely to continue [2,10]. The number of IO staff's deaths per year in motor vehicle accidents has decreased from 1-2 per year to only 2 deaths during a 7-year period consistent with an increased staff safety due to the policy implementation, although random variations from year to year could be an alternate explanation.

Results of S2 show that a significantly higher proportion of travelers reported using seatbelts always, when available and functional. The fraction of comments on the importance of seatbelts has decreased between the surveys, consistent with the increase of seatbelt use. However, our results implicate that men are slightly better at using seatbelts than women, which opposes previously published research that claims the opposite [11-14]. IO's staff is highly educated and therefore perhaps more likely to put their seatbelt on.

Comments

For the qualitative research part, there are many interesting transitions in opinions. Those inquiring more information and increased awareness have increased from about 14% in S1 to about 22% in S2.

Comments concerning distracted driving have increased from 0.5% in S1 about 4% in S2. It seems that women consider distracted driving a bigger issue than men. Some research implies males are more likely to engage in certain activities causing distractions than women [15].

However, other studies show no statistical significance between the sexes and distracted driving [16-18].

More respondents have answered that they do not have any suggestions for improvement in survey 2, which could indicate that much has been done to improve staff's road safety between two surveys in terms of the policy development and implementation.

Methodological considerations

A major strength is the large study population and the high proportion of travelers within this group, adding more events and more information to analyze. The longitudinal design with two cross-sectional surveys with a policy implemented after the first one is strength. Furthermore, many different aspects have been investigated to evaluate the effect of the policy.

However, there are also some limitations. The study does for ethical reasons not have a randomized, controlled design. Some questions used varied somewhat between the surveys. Another weakness is using staff at each country office as a proxy for risk estimation in lieu of mission-days. On the other hand, our results are in line with those of WHO [2]. The same countries are in the top 12 for high risk in S2 regardless of use of denominator. This promotes using staff per CO as a denominator for calculating risks, as well as the proxy of events per 1000 missions as a way of standardization. Another weakness is that the missions are self-reported.

Furthermore, the response rate from HQ in S2 was only 16%. The possible reasons could be that the survey was distributed to all staff, including non-travelers who may be less interested in road safety. Another reason could be the survey length and the high number of questions included. The respondents with traffic events are likely more inclined to respond. On the other hand, the low response rate might result in loss of events from non- respondents.

Another important issue is the definition of near-crashes and the quality of this indicator for crash-risk estimation. A near crash can be interpreted differently between responders. However, there is a positive correlation between near-crashes and crashes in S1 which strengthens using near-crashes as a risk indicator for crashes.

When analyzing the comments, this was performed in a way according to qualitative research by Kirsti Malterud [9]. It must be remembered, however, that it is unreliable to use quantitative methods for a qualitative research question, and our interpretation should be regarded with caution.

Possible additional improvements of road safety

The policy should be better promoted so that all staff can be aware of it.

Furthermore, judging by the comments, increasing the number of and more effective use of the organization's own vehicles and drivers would improve the perceived road safety.

Distributing road safety surveys to the staff must be continued at regular intervals for further enhancement. However, measures could be taken to improve the response rate. This could include reducing the number of questions and simplifying the existing ones.

Conclusion

While traffic fatalities have increased in developing countries since 2008, crashes and near-crashes experienced and reported by staff have decreased and seat belt use has increased, likely as effects of the Road Safety Policy implementation.

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