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Who risky driving behavior in a flood of deals? a case analysis

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Abstract
Driving in flood is one of the leading causes of death in floods. This study aimed to determine the risk factors associated with risky driving behavior in flood and provide the relevant behavior model. This is a descriptive analytical study. Data were collected by a questionnaire. Chi-square test and logistic regression analysis were used to analyze the data and estimate the model. The results of chi-square test revealed a significant relationship between three variables of education level, response to flood warning and knowledge of the main causes of death in flood and the variable of driving in flood. In the estimated logistic regression model, two variables of education level and response to flood warning had predictive value for driving behavior in flood. Accordingly, the possibility that people without academic education show risky driving behavior in flood is 2.6 times more than people with academic education. In addition, the possibility of showing risky driving behavior in flood in people who do not take flood risk warning seriously is 2.5 times more than others. Identifying risky groups in flood prone areas and also providing interventions and training programs can help reduce risky driving behavior in flood.

Keywords: Floods, Automobile Driving, Behavior, Regression Analysis

Introduction
Among a variety of natural hazards, flood was the most common cause of the greatest number of deaths [1,2]. Drowning (inside the vehicle) was the leading cause of death during flood [2]. Many parts of Iran are also prone to flood risks and in recent decades there has been an increasing trend of flood leading to a total of 8000 deaths and many injured people [3,4]. Although there were not any data on causes of death in flood in Iran and no study has been conducted in this regard, Jonkman and Kelman reported that 70% of all flood-related deaths were caused by drowning while 33% were inside the vehicle and 25% were related to the pedestrian [5]. As the results of this study and other reports in this regard shows, the main cause of death during flood is risky driving behavior that should be avoided [6-8]. Accordingly, by studying the behavior in the population at the risk of flood and exploring its relationship with some possible associated

factors, occurrence or non-occurrence of the behavior could be predicted in individuals at the time of flood and high-risk groups and individuals could be identified and as a result training measures could be provided to reduce the occurrence of this behavior.

To date, studies conducted on flood as a natural disaster are mainly concerned with the extent and causes of deaths or diseases arising from flood [9-12]. Other major studies conducted in this regard are about the amount of preparedness and evaluation of individuals' behavior and responses to all types of natural disasters in general such as earthquakes and flood [13, 14]. Furthermore, studies have been conducted on risk assessment, perceived flood risk and the role of communication in this regard [15]. In a study conducted by Sorenson, demographic profile, environmental information and some social factors were investigated as possible risk factors influencing people's behavior during disasters [16]. However, very few studies have been conducted on risky driving behavior in flood. This study aimed to determine risk factors associated with risky driving behavior in flood. A model was estimated by risk factors determined to predict the possibility of this risky behavior during flood.

Method

This analytical study was conducted in 2013 in Quchan, located in the northeast of Iran and a flood prone area [17]. The study population included all people over 18 years old living in Quchan covered by Quchan health network (n=71,361) [18]. Inclusion criteria included being literate, no obvious mental and cognitive diseases, not participating in training courses related to flood, living in Quchan at least for three years and having a driver's license. People who did not meet inclusion criteria were excluded from the study.

A researcher-made questionnaire was used to collect data. The questionnaire validity was assessed and confirmed by experts in the field of health in disasters and emergencies from Iran and Tehran universities of medical sciences and experts from the Red Crescent Organization who had experience in disaster relief and rescue, especially flood. The reliability of the questionnaire was evaluated by the test-retest method. The questionnaire was completed twice, with an interval of two weeks, by 60 people and the reliability was confirmed by the correlation coefficient of 0.81. The questionnaire had two main parts. The first part of the questionnaire pertained to the dependent variable assessment i.e. driving in flood. In this part a scenario was proposed for the respondents to determine whether they would drive in flood or not. In this scenario, the individual was asked to imagine a flood. Then based on the mentioned scenario, three multiple-choice questions (including "totally agree", "agree", "disagree" and "totally disagree") were presented. If the respondents selected "totally agree" or "agree", they were considered as having risky driving behavior in flood and otherwise, they were considered as not having risky driving behavior in flood. Given that logistic regression was used in this study, in which the dependent variable must be binary, the data were coded as 0 and 1 to perform statistical analysis in SPSS software. Code 1 was given to the group with risky driving behavior in flood and the other group was coded 0. The internal reliability of these three questions was measured by Cronbach's alpha test, obtained as 0.87, and confirmed.

The second part of the questionnaire contained 9 questions to evaluate 9 independent variables in this study (possible risk factors associated with risky driving behavior in flood). Given that the best mode for logistic regression is when binary independent variables are included in the analysis, despite their different nature, these variables were considered binary in the statistical analyses performed and were coded as 0 and 1. These variables included age (age group 18 to 35 years and above 35 years), gender, marital status, education level (people without and with academic education); response to the flood warning (people who leave the place immediately after receiving the warning and people who do not leave the place), experience

of exposure to flood, experience of losses due to flood, perceived flood threat (people who believe flood may occur in their living place and those who do not think so) and knowledge about the causes of deaths in flood.

Given that the main statistical test used in this study was logistic regression and there is no specific formula in logistic regression to determine the sample size and in the statistical references, it is recommended to consider 15 to 20 participznts for each independent variable, the sample size was calculated as follows for the 9 independent variables [19].

135 = 9 × 15 with respect to the potential loss of 10%, the final sample was:

135 + 15 = 150

Thus, the final sample size included 150 participznts who were selected from the study population by multistage sampling. In the first stage, seven clusters were selected based on seven urban health centers. In the second stage, stratified sampling was performed, i.e. subjects were selected in proportion to the population covered by each center. In the third step, a number of family files were selected systematically and based on the last two digits of households files in each health center (according to the number of participznts determined for each center) and in the final step one person was selected from those over 18 years of each household as the final participznts.

To collect data, the researcher went directly to the homes of subjects based on existing addresses in the households' health files. To respect the ethical principles, after explaining the research objectives for participants and reassuring them about the confidentiality of their personal information and obtaining their informed consent to participate in the study, the researcher delivered coded and anonymous questionnaires to the subjects. After the questionnaires were completed, they were returned to the researcher. Data collection lasted almost two months.

In this study, chi-square test was used to assess the significant relationship between all independent variables (possible risk factors) and the dependent variable. The significance level in this test was considered less than 0.05 ($p<0.05$). Independent variables that showed a significant relationship with the dependent variable were identified as the risk factors associated with risky driving behavior in flood and using binary logistic regression they were used to determine the predictive equation of the risky behavior. Forward logistic regression was performed and independent variables were entered into the equation step by step according to the intensity of their relationship with the dependent variable.

Results

Most participants in this study were in the age group 18-35 years (73%). The number of men participating in the study was more than women (63% vs. 27%). Eighty percent of the subjects were single and the rest were married. Forty percent of respondents had an academic degree.

Table 1 shows the results of chi-square test performed to assess the relationship between the independent variables (possible risk factors) and the dependent variable (driving in flood).

The findings show that there is a significant relationship between three independent variables of education level, attitudes toward the flood warning and knowledge about the risks of flood and the dependent variable of driving in flood ($p\leq0.05$) (Table 1).

Table 1 *Chi-square test results*

Dependent variable	Driving in flood	
Independent variable	p-value	Chi-square
Age	0.775	0.081
Gender	0.895	0.017
Marital status	0.175	1.839
Education level	0.000	12.386
Response to the flood warning	0.007	7.278
Experience of exposure to flood	0.748	0.103
Experience of losses due to flood	0.095	2.781
Perceived flood threat	0.182	1.778
Knowledge about the causes of deaths in flood	0.036	4.416

As mentioned, the independent variables which had a significant relationship with the dependent variable (education level, attitudes toward the flood warning and knowledge about the risks of flood) were entered into the logistic regression analysis as potential predictors to estimate the predictive model of risky driving behavior in flood. Table 2 shows the coefficients of these variables estimated in the model. The results of Hosmer-Lemeshow test for the dependent variable of driving in flood showed that the predicted values based on the model are fitted with the observed values (p=0.5)

As shown in Table 2, the independent variable of knowledge about the main causes of death in flood that was entered into the logistic regression equation as one of the possible risk factors (independent variables) did not have a predictive value for risky driving behavior in flood in the model as its related regression coefficients were not significant in the final equation.

Based on the estimated odds ratios shown in Table 2, the possibility that people without academic education show risky driving behavior in flood was 2.5 times more than people with academic education. In addition, the findings of this table show that people who do not take the flood risk warning seriously are 2.5 times more prone to say they will probably drive in flood (risky behavior) than others (those who take warning seriously).

Table 2 *Coefficients of the predictive model of risky driving behavior in flood*

Coefficient Independent variable	β	S.E	Wald	Sig	Exp(B)
Education level	0.982	0.387	6.447	0.011	2.669
Response to the flood warning	0.949	0.435	4.761	0.029	2.583
Knowledge about the causes of deaths in flood	0.614	0.409	2.257	0.133	1.849

Discussion

The study findings shows that there was no statistically significant difference between participants' gender and their agreement to drive during flood and both genders had the same desire to drive during flood. The results of a study conducted by Booth and Nolen also revealed that gender differences between girls and boys in taking risk in uncertain situations are not due to the inherent differences between genders and can be a reflection of social learning [20].

The results of this study also indicated that there are no significant differences between the answers to questions of driving in flood and marital status and this study showed that single and married people's risk-taking is the same when facing flood. Given that studies generally suggest that there is a high level of variety of problems in single people such as cardiovascular and respiratory diseases and other external causes of death etc. [21,22], The results of this study cannot be attributed to physiological, physical and psychological problems, but it seems that the main cause is deficient knowledge in a large part of the population.

Also people with good knowledge about the main causes of death in flood, compared to those without this knowledge, less stated that they would drive in flood. The relationship between these two variables was statistically significant. The reason may be that having knowledge about the risks of a specific phenomenon will lead to more cautious and more accurate decision-making when facing with it. The results of this study are consistent with the findings of Luwak. and Ostad Taghizadeh. Levak. in a study aimed to identify and understand the requirements for active participation of families in emergency preparedness plans concluded that for people's active participation in the activities of emergency preparedness plans and taking measures in this area, it is necessary that sufficient knowledge be provided about emergency conditions and the risky consequences and then motivation

and facilities be given to participate in such activities [23]. As can be seen in this study, as in the present study, having knowledge about a particular phenomenon (emergency conditions) and the consequences is associated with the correct reaction to it (avoiding risky behavior, lack of preparedness for emergencies). Ostad Taghizadeh, in a study titled "Knowledge, Attitude and Practice of Tehran's Inhabitants for an Earthquake and Related Determinants" detected low level of knowledge about earthquake and its risks as one of the risk factors for lack of taking safety measures against earthquake [24]. As can be seen in this study, similar to the present study, low knowledge about a particular phenomenon (earthquake) and its consequences result in a high-risk behavior (lack of taking preventive and safety measures against earthquakes).

The results of the present study indicate a significant relationship between educational level and risky driving behavior in flood, i.e. lower level of education led to higher risky driving behavior in flood in that the possibility of driving in flood in people with low educational level was 2 times more than that in educated people. Geckova. also demonstrated that there is an inverse relationship between people's education level and the occurrence of risky behaviors; so that people with lower levels of education conduct more risky behaviors [25]. It seems that one of the main causes of this finding is the power of thinking, reasoning, problem-solving and better decision-making in educated people than those with lower education. That is why these people make the right decision not to drive in flood when faced with flood.

No relationship was observed between the question "Can I experience flood in my living place?" i.e. a question which evaluates the variable of perceived flood risk in people, and risky driving behavior in flood. In interpreting this finding, the study of Solis. should be mentioned [26]. Their findings indicated that the residents of some areas have the ability to properly understand the risk, but it is not so in some areas. In areas where there is a proper understanding of the risk, there is a significant direct relationship between proper understanding of the risk as an influencing factor and their appropriate decision-making when facing the risk. Their study clearly showed regional differences in the willingness of families to leave their living place in the face of hurricane risk, so that families living in Southeast Florida who did not have a proper understanding of hurricane occurrence (perceived low risk) less tended to leave their homes and no relationship was observed between their perceived risk and their decision to evacuate their homes, while residents of Northwest Florida, who had proper (and high) risk perception were more willing to leave their living place and in this area there was a significant relationship between perceived risk and decision to evacuate, although the real risk of hurricane occurrence was the same and high in both regions. In this study, lack of understanding the relationship between the flood risk and risky driving behavior in flood can be attributed to the same geographical differences in the ability to properly understand the risk in people living in different areas.

Also as expected, the percentage of people who took flood warning seriously i.e. they stated that they leave the site immediately after receiving the flood warning news, and also stated that they would not drive in flood, was more than the percentage of people who did not take the warning seriously and the relationship was significant between these variables and the variable of response to flood warning. Drobot. in a study to investigate the relationship between some variables and risky driving behavior in flood in two state/city of Denver/Austin in the US shows that there was a significant relationship between response to flood warning and risky driving behavior in flood; so that the possibility of driving in flood was higher in those who did not take warnings seriously [27].

The findings of this study also showed that the relationship between two independent variables of academic education and response to flood warning and the dependent variable

of the research (risky driving behavior in flood) was statistically significant and considering the significance of their coefficients in the estimated regression model, they can be considered as two predictor variables for risky driving behavior in flood. These two variables are both dependent on awareness, knowledge and physical or virtual experience indicating that natural disasters training should be considered by health managers and policy makers in different parts of Iran depending on the type, severity and the potential risk.

Conclusion

Overall, based on the findings, people without academic education and those who do not take flood warning seriously are considered as people with risky driving behavior in flood. Accordingly, these groups can be identified in flood prone areas and group or individual training programs can be implemented for them to reduce the occurrence of this risky behavior. Also some interventions can be performed to increase the effectiveness of flood warning messages so that these warnings are taken more seriously. In this regard, it is suggested that qualitative studies be conducted to explore the visible and invisible reasons of not taking flood warnings seriously by some people.

This study had some limitations in terms of the identification and separation of the participants who had the real experience of being trapped in flood from those who did not. No limitation was faced in the implementation and application of statistical methods.

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Contributions

Study design: HAG, HS
Data collection and analysis: HH
Manuscript preparation: HAG, HS, AE

Conflict of interest

"The authors declare that they have no competing interests."

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