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Effectiveness of a TPB-based educational intervention to reduce mobile phone use while driving in Rasht city, Iran

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ABSTRACT

Introduction: Traffic accidents are a critical global public health problem, and cell phone use while driving has been identified as a major contributing factor. Despite legislative measures, distracted driving persists, requiring additional educational interventions. **Objective:** To evaluate the effectiveness of a Theory of Planned Behavior (TPB)-based educational program in reducing mobile phone use while driving among agency drivers in Rasht, Iran. **Methods:** A quasi-experimental study was conducted with 151 agency drivers, divided into intervention (n=76) and control (n=75) groups. The intervention consisted of three TPB-based educational sessions targeting awareness, attitudes, subjective norms, and perceived behavioral control. Data was collected pre- and two months post-intervention using a validated questionnaire. Statistical analyses included chi-square, Mann-Whitney U, and Wilcoxon signed-rank tests. **Results:** Post-intervention, significant improvements were observed in the intervention group across TPB constructs. Knowledge scores increased from 0.92±0.11 to 0.99±0.3 (p=0.001), attitude scores rose from 23.48±2.75 to 24.66±1.78 (p=0.001), and perceived behavioral control improved from 21.42±4.88 to 24.72±2.92 (p=0.001). Similarly, behavioral intention increased from 22.59±3.81 to 25.12±1.21 (p=0.001), and subjective norm scores rose from 22.43±3.56 to 25.19±1.51 (p=0.001). In contrast, the control group showed no significant changes in these constructs. However, no significant reduction in actual mobile phone use behavior was observed in the intervention group (15.55±3.72 to 15.58±3.77; p=0.31). **Conclusion:** The TPB-based educational intervention improved psychological determinants of mobile phone use while driving but did not significantly change behavior. These findings highlight the need to combine educational programs with stricter regulations and technological measures to achieve meaningful reductions in distracted driving.

Keywords: Cell phone use; Distracted driving; Theory of Planned Behavior; Traffic education; Road traffic safety; Transit-oriented development.

INTRODUCTION

Road traffic accidents (RTAs) are a pressing global public health issue, resulting in approximately 1.2 million fatalities and over 50 million injuries annually. The burden is disproportionately borne by low- and middle-income countries, where these incidents contribute significantly to mortality, morbidity, and economic loss[1,2]. In Iran, RTAs account for 1–2% of the gross national product, representing an annual economic toll of approximately $500 billion[3]. These accidents are not merely the product of poor infrastructure or vehicle defects; human factors, particularly driver behavior, play a pivotal role[4,5].

Among these, mobile phone use while driving has emerged as one of the most critical and preventable causes of distracted driving. Despite mounting evidence of the dangers, mobile phone use while driving remains alarmingly prevalent. Drivers frequently engage in calling, texting, and other phone-based activities, often underestimating the risks involved[6]. Studies reveal that using mobile phones while driving increases the risk of a crash by up to four times, irrespective of whether the device is handheld or hands-free[7]. Cognitive impairments, such as reduced spatial processing, occur even during hands-free conversations, highlighting the profound impact on driving performance[8].

Gender differences in mobile phone use while driving have also been observed, suggesting a complex interplay of behavioral and societal factors[8]. Despite the increasing prevalence of mobile phone use in Iran, research specific to its impact on driving behaviors remains limited[6]. Cognitive studies reveal that even conversations without a physical phone in hand can significantly impair spatial processing in the brain, affecting driving performance[6].

Addressing this issue through legislative measures has yielded mixed results. While laws prohibiting mobile phone use while driving exist in many countries, enforcement is often inconsistent, and their deterrent effect is limited[6]. This has led to a growing recognition of the need for complementary approaches, particularly those targeting driver behavior through

education and awareness. Educational interventions, when grounded in robust behavioral frameworks, can be instrumental in modifying risky behaviors. The Theory of Planned Behavior (TPB) offers a compelling model for understanding and influencing health-related behaviors[9,10]. According to TPB, behavioral intention—the primary predictor of actual behavior—is shaped by attitudes, subjective norms, and perceived behavioral control[11-13].

Educational programs informed by TPB have shown promise in addressing other traffic safety concerns, such as seatbelt use and speeding[9,10]. However, few studies have explored its application in reducing mobile phone use while driving, particularly in the context of Iran, where the prevalence of mobile phone use and the associated risks are rising[6]. Furthermore, existing interventions targeting this behavior are often rudimentary and inadequately documented, highlighting an urgent need for rigorously designed, theory-driven educational strategies.

This study is justified from personal, social, and academic perspectives. On a personal level, mobile phone use while driving has become a routine behavior that exposes both drivers and passengers to avoidable risk. From a social perspective, distracted driving imposes high costs on families, communities, and the healthcare system through injuries, disabilities, and fatalities. Academically, the application of behavioral theories such as the Theory of Planned Behavior (TPB) provides an evidence-based framework to understand and modify these risky behaviors[6-9]. Therefore, investigating this issue contributes not only to public health improvement but also to the theoretical development of behavior change models in traffic safety. By focusing on psychological determinants of behavior, this intervention complements legislative efforts and provides a holistic framework for mitigating this important public health concern.

Given these considerations, this study aims to address this gap by evaluating the effectiveness of a TPB-based educational intervention in reducing mobile phone use while driving among agency drivers in Rasht, Iran.

METHODS

Study Design and Setting

This quasi-experimental study aimed to evaluate the effectiveness of an educational intervention based on the Theory of Planned Behavior (TPB) in reducing mobile phone use while driving among agency drivers in Rasht, Iran. The study received ethical approval from the Gilan University of Medical Sciences Ethical Review Board (IR.GUMS.REC.1395.317).

Population and Sampling

The study population consisted of agency drivers from Rasht city, specifically from 60 passenger transport agencies located in the eastern and western regions of the city. Given the quasi-experimental design, participants were not randomly assigned to the intervention and control groups; rather, they were allocated based on geographic regions. The eastern region of Rasht served as the intervention group, while the western region served as the control group. A multi-stage sampling method was used to select drivers from each region.

The total sample size was 151 drivers, with 76 participants in the intervention group and 75 in the control group. Inclusion criteria specified that drivers had to be employed by agencies within the Union of Tourist Institutions and actively engaged in driving duties. Exclusion criteria included drivers who were unwilling to participate or had repeated absences from intervention sessions.

Sample Size Determination

A sample size calculation was performed based on a pilot study involving 18 drivers, which provided preliminary data on mobile phone use behavior. Using a significance level of 0.05, a power of 0.80, and an effect size derived from the pilot data, the required sample size for each group was calculated to be 68 participants. To account for potential dropout, the final sample size was adjusted to 75 participants per group.

Data Collection Instrument

Data were collected using a researcher-developed questionnaire (Supplementary File 1) consisting of four sections: Demographic characteristics (7 questions), Awareness of mobile phone risks while driving (6 questions), TPB constructs: Attitude, subjective norms, perceived behavioral control, and behavioral intention (measured on a 5-point Likert scale), Self-reported mobile phone use frequency (measured on a 5-point Likert scale).

The questionnaire was developed based on the TPB framework and relevant literature. It was validated by experts and pilot-tested with 18 drivers to ensure clarity and appropriateness for the target population.

Validity and Reliability

The content validity of the questionnaire was assessed by a panel of experts in nursing, epidemiology, statistics, and health education. The Content Validity Ratio (CVR) and Content Validity Index (CVI) were calculated to be 0.98 and 1.0, respectively, indicating excellent content validity. Reliability was assessed using Cronbach's alpha coefficient for each construct: Attitude (α=0.80), Subjective Norms (α=0.85), Perceived Behavioral Control (α=0.89), Behavioral Intention (α=0.86), and Behavior (α=0.80) .These values indicate satisfactory internal consistency for the constructs measured.

Intervention Development

The educational intervention was based on the TPB and aimed to modify two key constructs: subjective norms and perceived behavioral control. A thorough needs assessment and literature review informed the development of the intervention. The intervention consisted of three 45–60-minute group sessions delivered over three weeks, and each session targeted specific components of the TPB:

Awareness Raising: Educating participants about the risks associated with mobile phone use while driving.

Attitude Change: Engaging drivers in discussions about the social and personal consequences of unsafe driving behaviors. Skill Building: Providing practical strategies to help drivers avoid using mobile phones while driving.

The intervention was delivered by trained health educators with expertise in health education and behavior change. Educational materials included visual aids, pamphlets, and interactive group discussions.

Study Groups and Allocation

Due to the quasi-experimental design, participants were allocated to the intervention and control groups based on geographic location (east and west Rasht, respectively). While randomization at the individual level was not possible, demographic comparability between groups was ensured through stratification and statistical adjustments in the analysis.

Data Collection Procedure

Data collection occurred at two time points: pre-intervention and two months post-intervention. The pre-intervention data was collected via self-administered questionnaires

distributed over two weeks. Post-intervention data were similarly collected two months following the intervention to assess changes in knowledge, attitudes, and behaviors related to mobile phone use while driving.

Ethical Considerations

The study received ethical approval from the Gilan University of Medical Sciences Institutional Review Board (IR.GUMS.REC.1395.317), and written informed consent was obtained from all participants. All participants were informed of their right to withdraw from the study at any time without penalty.

Statistical Analysis

Data analysis was conducted using SPSS version 20. Descriptive statistics (frequencies, means, and standard deviations) were used to summarize demographic characteristics and study variables. For inferential analysis, chi-square tests, Mann-Whitney U tests, and Wilcoxon signed-rank tests were used to assess differences between groups and evaluate changes in outcomes pre- and post-intervention. Statistical significance was set at $p<0.05$.

RESULTS

During the study and after gathering basic information and analyzing demographic data, the mean age and standard deviation of participants were found to be 44.91±11.62 years in the intervention group and 39.17±10.83 years in the control group. Statistical analysis revealed a significant difference in the age distribution between the intervention and control groups among the drivers. Regarding educational attainment, statistical tests indicated that the highest proportion of drivers in both the control group (50.7%) and intervention group (63.2%) held diplomas (Table 1).

The intervention and control groups differed significantly in age and education variables. The mean age was 44.91 in the intervention group and 39.17 in the control group. In terms of education, 63.2% of the intervention group and 50.7% of the control group completed high school diplomas, showing a statistically significant difference (Table 1).

Table 2 presents the comparative analysis of mean scores for Theory of Planned Behavior (TPB) constructs (TPB) among drivers in the intervention and control groups before and after the implementation of the training program. Before the intervention, there was no significant difference between the groups in these constructs. However, following the theory-based training program, significant improvements were observed in the intervention group across awareness, attitude, subjective norms, perceived behavioral control, and behavioral intention related to mobile phone use while driving.

Scores for subjective norms, which represent perceived social pressures, improved significantly in the intervention group, rising from 22.43±3.56 to 25.19±1.51 ($p=0.001$). This suggests that the intervention effectively addressed social influences, such as the expectations of peers and family members.

The intervention group saw a marked improvement in perceived behavioral control scores, increasing from 21.42±4.88 to 24.72±2.92 ($p=0.001$). This indicates that participants felt more capable of resisting mobile phone use while driving.

Behavioral intention, the direct precursor to behavior according to the TPB, significantly increased in the intervention group from 22.59±3.81 to 25.12±1.21 ($p=0.001$). This improvement highlights the program's effectiveness in fostering participants' willingness to avoid mobile phone use while driving.

Despite these psychological improvements, no significant reduction in self-reported mobile phone use behavior was observed in the intervention group (15.55±3.72 to 15.58±3.77, $p=0.31$). Similarly, the control group exhibited no change (14.37±2.38 to 14.33±2.38, $p=0.31$).

This finding indicates that while the intervention enhanced drivers' knowledge, attitudes, and intentions, these changes did not translate into actual behavior modification within the study period.

DISCUSSION

The findings of this study underscore the potential and limitations of using educational interventions based on the Theory of Planned Behavior (TPB) to address mobile phone use while driving among agency drivers in Rasht, Iran. While the intervention successfully improved psychological determinants such as knowledge, attitudes, subjective norms, perceived behavioral control, and behavioral intention, it did not translate into a significant reduction in actual mobile phone use while driving. This highlights the complexity of modifying behaviors deeply embedded in daily routines and influenced by external factors.

The significant improvements observed in the intervention group across all TPB constructs—knowledge, attitudes, subjective norms, perceived behavioral control, and behavioral intention—are consistent with prior studies on the efficacy of theory-based educational programs in promoting safer driving behaviors. This finding aligns with previous studies on behavioral change through educational interventions, including those by Moeini et al.[6], Rezaian et al.[14], and Tagdisi et al.[15].

The increase in knowledge scores demonstrates the effectiveness of targeted educational strategies in raising awareness about the risks of mobile phone use while driving. Enhanced attitudes and subjective norms reflect the ability of the intervention to shift perceptions and influence social pressures related to driving behavior[16,17]. Furthermore, the observed improvement in perceived behavioral control suggests that participants gained confidence in their ability to resist mobile phone use while driving, an outcome aligned with findings in other TPB-based interventions targeting health behaviors[18,19].

The intervention led to significant improvements in TPB constructs, aligning with studies by Moeini et al.[6] and Rezaian et al.[14], which demonstrated similar outcomes in health education settings. However, the lack of significant change in behavior reflects findings from studies where external factors, such as enforcement and technological solutions, play a critical role.

Regarding attitude, the intervention group showed a significant increase in average score from 23.48 to 24.66 post-intervention, whereas no meaningful change was observed in the control group. This improvement can be attributed to increased awareness and information conveyed through lectures, educational slides, pamphlets, and group discussions, which are pivotal in shaping attitudes as a precursor to behavior change. This finding is consistent with studies by Zhang et al.[17] and Jadgal et al.[16], as well as Pakpour et al.[19] on attitude change following educational interventions.

Subjective norm scores in the intervention group significantly increased from 22.43 to 25.19 post-intervention, reflecting the influence of significant others such as family, friends, and peers. This increase was not observed in the control group and aligns with findings by Jalambadani et al.[18]. However, it contrasts with findings by Tavousi et al.[20] and Ahmadi Tabatabai et al.[21], suggesting variations due to different study methodologies and constructs used.

Perceived behavioral control scores significantly rose from 21.42 to 24.72 post-intervention in the intervention group, indicating the training's positive impact. Perceived behavioral control is akin to self-efficacy, emphasizing individuals' beliefs in their ability to perform desired behaviors. This finding is consistent with studies by Parrot et al.[22] on physical activity promotion and Reger et al.[23] on encouraging walking among elderly populations.

However, the lack of meaningful change in actual mobile phone use highlights a critical gap between intention and behavior. While the TPB provides a robust framework for

understanding and predicting behavioral intention, external factors such as environmental cues, habit strength, and enforcement mechanisms can impede the translation of intention into action[20,21]. For instance, the ubiquity of mobile phones and their role in daily life may create habitual patterns that are difficult to break without additional reinforcement strategies[22].

This finding aligns with studies suggesting that educational interventions alone may be insufficient to elicit sustained behavior change in the absence of systemic support[23,24]. Stricter enforcement of traffic laws, combined with technological solutions such as mobile phone blocking applications, may be necessary to complement educational efforts. The integration of these measures could provide a multi-faceted approach to reducing distracted driving and its associated risks[25,26].

Behavioral intention scores in the intervention group increased significantly from 22.59 to 25.12 post-intervention, whereas no meaningful change was observed in the control group. This finding mirrors studies on behavioral intention change across different health behaviors Caron et al.[24], Parrot et al.[22], Jadgal et al.[16].

However, there was no significant increase in actual mobile phone use scores among intervention group drivers (15.55 to 15.58), indicating the need for additional health promotion strategies beyond education, such as stricter regulations and safety engineering within vehicles.

This finding contrasts with studies on behavior change following TPB-based interventions in different contexts Fowler et al.[26], Mehri et al.[25], Jalmabadani et al.[27]. This finding aligns with studies suggesting that educational interventions alone may be insufficient to elicit sustained behavior change in the absence of systemic support[23,24]. Stricter enforcement of traffic laws, combined with technological solutions such as mobile phone blocking applications, may be necessary to complement educational efforts. The integration of these measures could provide a multi-faceted approach to reducing distracted driving and its associated risks[25,26].

This study contributes valuable insights into the application of behavioral theories to traffic safety. It underscores the importance of targeting psychological determinants as a foundational step in behavior change interventions. However, it also highlights the necessity of integrating educational initiatives with broader systemic approaches to address complex and habitual behaviors like mobile phone use while driving.

Although the intervention improved participants' knowledge, attitudes, subjective norms, and perceived behavioral control, these psychological improvements did not result in significant behavioral change. This finding can be explained by the gap between intention and behavior described in Ajzen's Theory of Planned Behavior, where habitual patterns, environmental factors, and enforcement limitations function as barriers to action. The persistence of mobile phone use while driving, despite positive intentions, suggests that educational interventions should be complemented by environmental and regulatory support to achieve sustainable behavior change.

Study Limitations

This study had several limitations. First, the quasi-experimental design limited control over confounding variables, and participants were allocated based on geographic regions rather than randomization. Second, reliance on self-reported data may have introduced response bias, as participants could underreport their actual mobile phone use while driving. Third, the short follow-up period (two months) may have been insufficient to detect long-term behavioral changes. Future research should consider using objective monitoring tools (such as in-vehicle tracking or mobile apps) and longer follow-up durations to better assess the sustainability of behavioral change. Additionally, including qualitative evaluations may provide deeper insights into the barriers preventing intention from translating into behavior.

Conclusion

The TPB-based educational intervention effectively improved psychological determinants related to mobile phone use while driving but did not significantly reduce the actual behavior. This indicates that while educational approaches can enhance awareness, attitudes, and perceived control, they may be insufficient to overcome entrenched habits without broader support. These findings underscore the need to integrate educational programs with stricter enforcement policies, workplace safety regulations, and technological measures such as mobile phone blocking applications. Such multifaceted approaches are likely to produce more meaningful and sustained reductions in distracted driving behavior.

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Table 1: Frequency distribution of educational levels among agency drivers in the intervention and control groups.

Group Education	**Intervention**		**Control**		**Chi-Square p-value**
	n	**percent**	**n**	**percent**	
Elementary School	**1**	**1.3**	**0**	**0.0**	0.002
Middle School	10	13.2	17	22.6	
Diploma	48	63.2	38	50.7	
University	17	22.4	20	26.7	
Total	76	100.0	75	100.0	

Table 2: Comparison of mean and standard deviation of TPB constructs among agency drivers in Rasht before and after educational intervention.

Theoretical constructs	Group	Control		Intervention		Significance level
		Means	Standard deviation	Means	Standard deviation	
Knowledge	Before intervention After the intervention Significance level	0.92 0.94 0.014	0.12 0.08	0.92 0.99 0.001	0.11 0.3	0.74 0.001
Attitude	Before intervention After the intervention Significance level	22.56 22.48 0.47	3.60 3.50	23.48 24.66 0.001	2.75 1.78	0.10 0.001
Perceived Behavioral control	Before intervention After the intervention Significance level	20.84 20.87 0.51	4.57 4.27	21.42 24.72 0.001	4.88 2.92	0.39 0.001
Behavioral intention	Before intervention After the intervention Significance level	22.64 22.55 0.12	3.59 3.43	22.59 25.12 0.001	3.81 1.21	0.90 0.001
Subjective norm	Before intervention After the intervention Significance level	21.28 21.37 0.51	3.96 3.58	22.43 25.19 0.001	3.56 1.51	0.07 0.001
Behavior	Before intervention After the intervention Significance level	14.37 14.33 0.31	2.38 2.38	15.55 15.58 0.31	3.72 3.77	0.05 - 0.04