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**Presenter Information**

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## **THE POTENTIAL OF IVDR FEEDBACK AND PARENTAL GUIDANCE TO IMPROVE NOVICE MALE YOUNG DRIVERS' BEHAVIOR**

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**Summary:** Young male drivers are well known for their increased involvement in road crashes when moving to the independent driving phase. This study examines the potential of IVDR (In-Vehicle Data Recorder) systems, which provide feedback on driving performances, and parental monitoring to restrain young male drivers' aggressive driving behavior.

The IVDR system was installed in the family car of young drivers for a period of 12 months, starting in the accompanied driving phase and continuing to the first nine months of independent driving. The system documents events based on measurements of extreme G-forces in the vehicles. 242 families of young male drivers participated in the study. They were randomly allocated into 4 groups: (1) FFNG- Family Feedback No Guidance- all members of the family were exposed to feedback on their own driving behavior and that of the other family members; (2) FFPG- Family Feedback Parental Guidance - similar to the previous group with the addition of personal guidance given to parents on ways to enhance their involvement and monitoring of their sons' driving; (3) IFNG- Individual Feedback No Guidance- each driver received feedback only on his own driving behavior; (4) CNTL- a control group that received no feedback or parental guidance.

The collected data from the IVDR was analyzed and the results indicate substantial benefits to drivers in the FFPG group in which parents received personal guidance to enhance their parental involvement and feedback on their son's driving behavior, compared to the CNTL group which did not receive any feedback.

### **INTRODUCTION**

The high involvement of young drivers in road crashes all over the world, especially in severe and fatal crashes (Israel Central Bureau of Statistics, 2011), attracted a lot of attention from the public and the media and urged both policy-makers and private organizations to put substantial efforts in this direction. One of the most noticeable actions was the modifications made to the Israeli driver licensing process. Novice young drivers are required to drive only when accompanied by an experienced driver for the first three month after licensure. An experienced driver is defined as a driver over the age of 24 that has a driving license for at least 5 years, or over the age of 30 with at least 3 years of driving experience. During the first two years of driving, the new driver is limited to drive with no more than two passengers, unless when

accompanied by an experienced driver. Another limitation that was introduced in 2011 is lower tolerance to blood alcohol content (BAC), which is 0.01% for novice drivers and those that are under 24 years old, compared to 0.05% for other drivers. The law does not mandate a minimal amount of driving within the accompanied driving period (ADP) nor does it include any limitations on night driving, although it was proved to be effective in other countries, mainly the US (McCartt et al., 2010).

In several studies it was found that that the problem of novice drivers' crash involvement is most acute during the transition from supervised driving during the accompanied driving period (ADP) to independent driving after it ends (Williams, 2003; Lotan and Toledo, 2007). During the ADP period the involvement in crashes is low, while immediately after it ends their crash involvement rises drastically. Afterwards, the crash rate declines gradually as the drivers gain experience. Several studies reported higher involvement of young male drivers in road crashes when compared to the involvement of young female drivers (Williams, 2003; OECD, 2006). Differences were also found in the level of aggressive driving (Prato et al., 2010; Farah, 2011). Therefore, this study seeks to focus on the more risky and problematic group - young male drivers during the start of their independent driving.

Recent technology development in sensing and communication provided traffic safety and human factors researchers with a valuable tool, in-vehicle data recording devices (IVDR), that can be used to monitor, study and influence drivers' behavior, not only to analyze post crash data, but rather as a mechanism to prevent crashes (Ogle, 2005). IVDR systems were proven to have positive impact on driving behavior and safety when used as a monitoring tool (Musicant et al. 2007). This positive effect was found to hold also when applied to specific groups, such as young drivers (Prato et al., 2010; McGehee et al., 2007 & Carney et al., 2010). Results of these studies showed that risk indices were substantially lower after feedback from the IVDR was provided. McGehee et al. (2007) found that combining technology with parental feedback resulted in a significant decrease in the young drivers' number of unsafe driving events.

There is a great amount of research which focused on investigating the impact of different aspects of parental monitoring on the prevention of various risk behaviors among children and adolescents (e.g., Fletcher et al., 2004). The New Authority (NA) (Omer, 2004; Omer, 2011) is a promising approach which aims to help parents to increase their involvement and monitoring ability, enable them to better resist the child's risk activities and prevent escalation. These parental activities are subsumed under the term "vigilant care", which is to better be able to connote the attitude of parental watchfulness and positive involvement, than the more current but rather mechanical term "monitoring". Parental counseling in NA has been shown effective in reducing aggressive and risk behaviors, as well as in reducing parental helplessness, preventing parental outbursts and increasing positive interactions (Ollefs et al., 2009; Weinblatt and Omer, 2008). These findings suggest that this approach might allow for the development of a brief counseling intervention, geared to enhancing parental involvement in the child's driving and increasing their ability to make use of IVDR feedback, while also enabling them to cope better with the conflicts that might arise.

## METHODOLOGY & DATA COLLECTION

This study investigates the potential contribution of providing feedback via an IVDR system and providing parental guidance to improve and maintain a good safety level of young drivers' behavior throughout the first year of driving.

### Participants & Recruitment Process

A rolling recruitment procedure was used where recruitment continued for several months after starting data collection. Candidates who expressed an interest to take part in the study had to meet the following screening criteria: (1) males only; (2) driving experience of up to 1.5 months from the day they were licensed (meaning that they were still at the accompanied driving phase); (3) their parents have access to the internet; (4) live in the geographical area between Haifa in the north and Ashdod in the south; (5) drive the family car (and do not own their own car); (6) do not have ADHD which is not medically treated. The final sample included 217 families. The young drivers' age ranged between 17 and 22 years old (average= 17.5, std. = 0.8). Participants received about \$250 as an incentive for their participation.

### Experiment Design

In order to examine the impact of providing feedback, type of feedback (individual vs. family) drivers received from the IVDR system, and the impact of providing parental guidance, four different study groups were designed. The four groups were defined as follows:

**IFNG – Individual Feedback No Guidance group.** The feedback, in this group, is given only to the driver, thus parents have no access to the driving records of their teens and vice versa.

**FFNG – Family Feedback No Guidance group.** The driving records of each driver using the equipped vehicle were exposed to all members of the family using the same vehicle (typically – the young driver and his parents).

**FFPG – Family Feedback Parental Guidance group.** Similar to the FFNG group, but in addition, individual family based brief program of parental guidance was provided. The guidance intervention, which is based on the NA approach, was developed specifically for this study.

**CNTL – Control group.** None of the drivers (neither parents nor teens) received any feedback or guidance throughout the duration of the study (the full 12 months).

The feedback is provided to all the groups except for the control group starting from the end of the accompanied driving phase. Participants were randomly assigned to the four groups.

### Data Collection

The IVDR is a G-force based system which tracks all trips made by the vehicle. The following information was recorded and collected by the IVDR system: (a) trip start and end time; (b) driver identification; (c) extreme G-force based maneuvers performed by the vehicle, termed as "events"; (d) evaluation of the severity of each event; and (e) vehicle location.

Drivers were requested to identify themselves at the beginning of each trip using a personal Dallas keys (iButton device). Overall, about one third of the trips were not identified. Models for identification of the driver were developed in order to probabilistically allocate the unidentified trips among the family members. These models were developed for each family separately.

In the IVDR real-time feedback unit the driver continuously receives feedback on triggered events which is determined based on the extreme G-forces recorded and it is color coded with green, yellow and red lights for moderate, intermediate and high severity of the triggered event.

Drivers are classified as moderate, intermediate or aggressive drivers. The level of aggressiveness is set according to the amount and rate of events. Moderate drivers perform less than 2 aggressive maneuvers per one driving hour, intermediate drivers perform between 2 to 5 aggressive maneuvers per one driving hour, and aggressive drivers perform more than 5 aggressive maneuvers per one driving hour. The web-based application provides drivers with reports that summarize the information for the driver. For a more detailed description of the system and previous studies that have used it see Lotan et al., (2010).

### **Parental Guidance**

In the NA approach, the parents are guided to link their level of parental involvement to the three levels of driving aggressiveness that were introduced above – moderate (green), intermediate (yellow) and aggressive (red). Thus, when the young driver drives moderately parental involvement is kept to a minimum. This level of involvement is termed open attention in the NA. When the young driver is classified as intermediate the parents' level of vigilance should be intensified. This level is termed focused alertness. Finally, if the young driver drives aggressively parental involvement is highest. This level is termed protective action.

For each of the levels of vigilant care, specific parental tools were developed. A general guideline that is valid for all levels is for the parents to routinely check the driving record on the experiment IVDR website. Specific guidelines are then provided to help parents react appropriately to information indicating the young driver's risk level. The guidance program was administered in a ninety-minute meeting at the family's home. Both parents and the young driver were invited to attend. The parents were also given written material with instructions on how to implement the guidelines in ways that will increase effectiveness and minimize escalation. Later on, three to four bi-weekly phone conversations were conducted. These were initiated by the counselors. These contacts were bolster sessions, devised to help the parents to better cope with the difficulties they face in implementing the program.

### **RESULTS**

The number of drivers in the four groups was balanced and the four groups had similar total number of trips in the before and after period. Random allocation of the participating drivers to the four groups was examined also with respect to their age and driving behavior during the accompanied period (when groups were still undifferentiated by feedback). It was found that there were no significant differences among the groups, and thus, any further differences in the solo period can be attributed to the intervention and the feedback type provided to the drivers.

In order to compare the driving behavior among the groups, we defined an index which expresses the driving behavior measured by events rate. Events are determined by the IVDR system and are related to G-force events performed by the vehicle, such as: strong brakes, extreme accelerations, sharp turns, extreme speed etc. Figure 1 presents the average events rates and standard deviations of the four groups for each of the 11 months corresponding to the first driving period by the young drivers participating in the study. In the figure, month 0 corresponds to the first month of solo driving. ADP month are indicated with negative values. Note that the figure does not include the first month of ADP as the data for this month was limited.

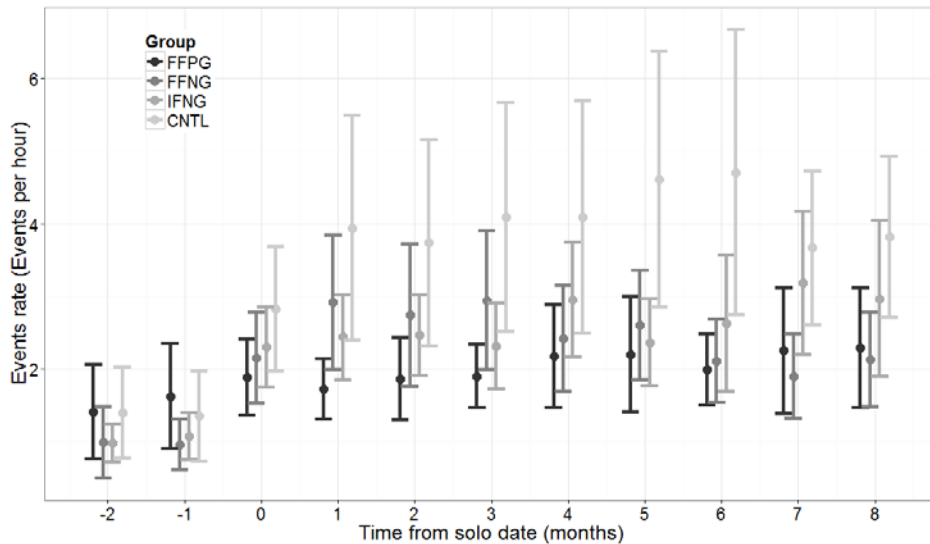


Figure 1. Average events rate and standard deviation per group and month

Figure 1 demonstrates the differences among the groups. From the figure it is apparent that the CNTL group is consistently the worst group in terms of their event rates from the start of the solo phase. The FFPG seems to be the best in terms of their event rates, and indeed from feedback point of view – this is the group that received the most elaborate forms of feedback – both family feedback and guidance to parents. Also, this group (the FFPG group) performs better than its control group, in this case the FFNG group. One-Way ANOVA tests for the event rates among the four groups did not find statistically significant differences in the accompanied driving period ( $p$ -value=0.451), however in the solo period, the differences were found to be statistically significant ( $p$ -value=0.026). Further examination of the differences among the four groups using post-hoc Bonferoni analysis revealed that the mean difference between the CNTL group and the FFPG group is significant ( $p$ -value=0.025) while all other groups were not found to differ significantly.

In order to assess the unique contribution of parental guidance, additional comparison was made between the FFPG group and its control group (FFNG group). Quantiles of events rate during the first six months of the solo period are presented in Figure 2. The figure presents one standard deviation around the quantiles. Using quantile regression, no significant differences were found between the FFNG and FFPG groups. However, a clear pattern can be seen of the increasing differences of events rate between the two groups. These results suggest that while looking on the mean (or lower quantiles), differences between the two groups are minor; however at higher quantiles (0.7 and above) these differences increase and drivers in the FFNG group exhibit higher levels of events rate.

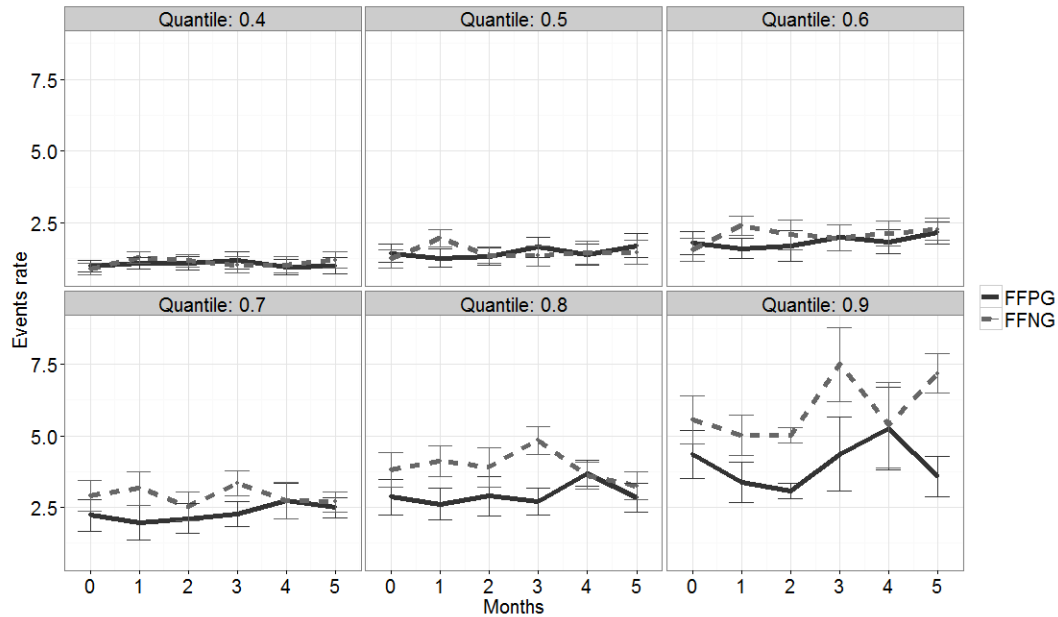


Figure 2. Events rate by quantiles in the first 6 months in the solo period

## SUMMARY & CONCLUSIONS

This study investigated the potential contribution of feedback provision, parental guidance, and the combination of the two interventions on the improvement of young male drivers' driving performances during the first year of driving. For that purpose, four groups were designed which differ by the type and level of intervention they were exposed to (CNTL = no feedback, no parental guidance; IFNG = individual feedback; FFNG = family feedback; FFPG = family feedback and parental guidance). The participating young male drivers were randomly distributed to one of these groups. A comparison of the driving behavior, defined by events rate, among the four groups was performed. Events rate was calculated as the count of undesirable driving events per driving hour.

The results show interesting differences in the events' rate among the four groups. These differences are more notable during the 9 months of the solo driving phase. In this study the highest intervention level was experienced by the FFPG group, and included both family feedback and guidance to parents on how to effectively use this feedback. It was found that the FFPG group seems to be the best in terms of their event rates. Thus, as the level of intervention increases, events' rate decreases.

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