HHS Public Access
Author manuscript
J Emerg Nurs. Author manuscript; available in PMC 2022 January 01.

Published in final edited form as:
J Emerg Nurs. 2021 January ; 47(1): 88–100.e3. doi:10.1016/j.jen.2020.07.012.

Initial Testing of a Web-Based Intervention to Reduce Adolescent Driver Inattention: A Randomized Controlled Trial

Catherine C. McDonald, PhD, RN, FAAN,
University of Pennsylvania, School of Nursing, Claire Fagin Hall, 418 Curie Boulevard, 414 Philadelphia, PA 19104

Department of Pediatrics, Perelman School of Medicine at the University of Pennsylvania Philadelphia, PA

Center for Injury Research and Prevention, The Children's Hospital of Philadelphia Philadelphia, PA Twitter: @KateMcD_PhDRN

Jamison D. Fargo, PhD,
Utah State University, Department of Psychology Logan, UT 84322

Jennifer Swope, MS,
The Children's Hospital of Philadelphia Philadelphia, PA

Kristina B. Metzger, PhD, MPH,
Center for Injury Research and Prevention, The Children's Hospital of Philadelphia Philadelphia, PA

Marilyn S. Sommers, PhD, RN, FAAN
University of Pennsylvania, School of Nursing Philadelphia, PA 19104

Abstract

Background: Motor vehicle crashes are the leading cause of adolescent death. Inattention to the roadway contributes to crash risk.

Objective: To deploy an initial study of a web-based intervention ("*Let's Choose Ourselves*" (LCO)) designed to improve adolescent driver attention to the roadway.

Methods: We used a randomized controlled trial design in a sample of adolescent drivers to test if a web-based intervention decreased cellphone engagement in driving simulation at 3 months as compared to controls. As secondary hypotheses, we tested if the intervention increased the use of peer passengers to manage distractions and decreased eyes off the forward roadway in driving simulation, and decreased self-reported risky driving behaviors. Adolescents, ages 16–17, licensed for ≤90 days were randomized to LCO with distractions in the simulator protocol at bassline

---

Corresponding Author Tel: 215-246-8355 mcdonalc@nursing.upenn.edu.

The authors report no conflict of interest

(LCO-D), LCO with no distractions (LCO-ND), an attention control intervention on healthy eating with distractions (HE-D) or attention control with no distractions (HE-ND). We used Poisson regression modeling to test primary and secondary hypotheses.

Results: The trial included 60 adolescents (66.7% female, 78.3% non-Hispanic White, mean age 16.8 years, licensed 50.8 days). In Poisson regression, controlling for sex, we found no significant effects of *LCO* on primary or secondary outcomes. However, there was a significant effect of visit on self-report outcomes, with self-reported distracted driving behaviors increasing over time.

Conclusion: Though there were no significant effects of *LCO*, self-reported risky driving behaviors increased over time. Further investigation of the relationship between driving experience and increasing inattention to the road in adolescents is warranted.

Keywords

adolescent; distraction; driving; intervention; inattention; motor vehicle crash; teen

---

Motor vehicle crashes (MVCs) are the leading cause of adolescent death and disability. [1] Adolescent drivers are at highest MVC risk in the first six months of licensure, making it a vitally important period for interventions. [2,3] Inattention to the roadway is a major contributor to adolescent driver MVCs [4,5] and includes not looking at the roadway, hands not on the wheel and mind off the task of driving. [6] Adolescents are particularly susceptible to driver inattention, notably due to cellphone use and presence of peer passengers in the vehicle. Adolescent drivers disproportionately account for distraction-related crashes, with cellphones involved in 23% of distracted-related fatal crashes with adolescent drivers.[7] Higher number of peer passengers also increases fatal MVC risk among adolescent drivers. [8,9] Both cellphones and peer passengers can take attention away from the roadway, including eyes off the roadway. Eye glances >2 seconds off the roadway by teens is associated with an odds ratio of 5.5 increased risk of a crash.[10]

Few theoretically grounded, behavioral interventions exist to reduce teen driver inattention. We carried out an initial study of an individually targeted, theoretically grounded web-based intervention designed to reduce adolescent driver inattention to the roadway ("*Let's Choose Ourselves*" *(LCO)*). *LCO* addressed cellphone use and peer passengers as contributors to adolescent driver inattention, rooted in the theoretical constructs of attitudes, perceived behavioral control and norms related to adolescent driver inattention.[11] We used a four-group, randomized controlled trial (RCT) design (N =60) with a simulated driving assessment and self-reported risky to test if *LCO* could improve attention to the roadway.

Methods

Design

We enrolled adolescent drivers, ages 16–17 years, and licensed for ≤90 days in the Commonwealth of Pennsylvania. The protocol was approved by the Institutional Review Board at Children's Hospital of Philadelphia (CHOP) under the protocol #14–011336 "Web-based Intervention to Prevent Risky Driving Study." We obtained written consent from parents/guardians and written adolescent assent (paper or electronic through REDCap®). We also obtained a Certificate of Confidentiality, had an Independent Safety Monitor and registered the trial with Clinicaltrials.gov (NCT02319317). Data collection occurred between June 30, 2015-August 8, 2016.

We used a four-group, randomized controlled trial (RCT) design. We tested *LCO* against an attention control intervention on healthy eating. Outcomes were assessed using a simulator protocol that included simulated driving assessment at baseline and a 3-month follow-up. Also assessed were self-reported risky driving behaviors at baseline, 1-, 3-, and 6-month follow-up.

Participants

Adolescents were recruited through letters and emails to families affiliated with CHOP. We also used word of mouth, information sessions at local high schools and emails to groups expressing interest. In addition to age (16–17 years old) and licensure requirements (≤90 days in PA), inclusion criteria were access to a computer, internet and personal email; willingness to travel to CHOP for study procedures; and the ability to read and write English. Exclusion criteria were self-reported history of claustrophobia, migraine headaches, or motion sickness; self-reported current pregnancy (all related to ability to complete the assessment in the driving simulator); or participation in a teen driving study at CHOP within the past 6 months.

Intervention Description

The web-based intervention *"Let's Choose Ourselves*" was developed through a multistep process based on the Theory of Planned Behavior and previously reported[11] and delivered through a commercially available e-learning software via a secure learning management system (LMS). *LCO* consisted of six sections (Welcome; General content on adolescent driving; Ideas behind *LCO*; Cellphone use; Passengers and; Wrap-up). The content for *LCO* that was fact-based, grounded in data from focus group data collected by the study team,[12,13] interactive, and addressed attitudes, perceived behavioral control and norms about adolescent driver inattention. *LCO* provided realistic scenarios of how to deal with cellphone and passenger distractions with content and interactive activities that included free-answer questions, drag-and-drop activities, multiple choice questions, and videos from a driving simulator displaying what can happen when an adolescent takes attention away from the roadway. The goal was for participants to complete their assigned intervention in one on-line session lasting 30–45 minutes without interaction with a study team member

An attention control was used with the goal to expose control participants to an interactive web-based experience on health content with activities that were similar in format and delivery, but did not overlap on driving related content. The attention control contained fact-based information on healthy food choices and exercise, interactive questions and activities, and realistic scenarios for making food choices. The attention control modules were intended to parallel the *LCO* activities, but with content on nutritious meals and snacks, exercise, how to make healthy choices for yourself, school food options.

Here we describe the four groups to which they were randomized. In Group 1 (LCO with distractions, (*LCO-D*), participants received cellphone distractions and presence of a sex-matched research assistant (RA) peer passenger in the baseline simulator protocol prior to the online intervention LCO. Group 2 (LCO with no distractions, *LCO-ND*) received no distractions or presence of a sex-matched RA peer passenger in the baseline simulator protocol prior to the online intervention LCO. Group 3 (Healthy Eating with distractions, *HE-D*) received cellphone distractions and presence of a sex-matched RA peer passenger in the baseline simulator protocol prior to the online intervention HE. Group 4 (Healthy Eating with no distractions, *HE-ND*) received no cellphone distractions and presence of a sex-matched RA peer passenger in the baseline simulator protocol prior to the online intervention HE. In this initial study, we chose to include groups with and without exposure to cellphone distractions and a sex-matched RA peer passenger in the baseline simulator protocol to examine potential assessment reactivity of distractions at baseline.[14,15] The details of distractions and sex-matched RA passengers are described in the simulated driving protocol details and Appendix A.

Procedures

After consent, assent and eligibility was confirmed, participants completed the baseline self-report questionnaires and experimental drives in the simulator protocol. Participants then completed their assigned online intervention (*LCO* or *HE*) at a study computer at CHOP. At 3-months post-enrollment, participants returned for a follow-up assessment in the driving simulator. At 1-, 3- and 6-months, participants also completed self-report questionnaires online or in person. We chose to include 1-month self-report measures to increase retention, as well as collect data during a time period where driving behaviors change rapidly; a 1-month in-person study visit with the driving simulator was deemed undue participant burden given time intensity of the simulator protocol study visit. Retention strategies also included emails and study phone calls for reminders to complete questionnaires or attend the in-person study visit.

Randomization Procedures

A list of participant numbers was randomized by computer software by a statistician into four groups and placed in envelopes, sealed, and locked in a drawer in consecutive order by participant number.[15]

Simulated Driving Protocol

The simulated driving assessment protocol was used at baseline and 3-month follow up to assess the effects of the intervention on the later described outcome measures. A previously validated driving assessment in a simulator (Simulated Driving Assessment)[16] was delivered to participants using a Realtime Technology, Inc. (RTI) fixed-based driving simulator and an Applied Science Laboratories (ASL) Mobile Eye tracking system located at CHOP. The simulated driving assessment exposed participants to variations of the most common adolescent driver crash configurations.[17] The 21 potential crash scenarios were distributed across three experimental drives, separated by intervening straight roads, curves and turns not intended to trigger collisions.[16] Appendix A outlines the details of the Simulated Driving Protocol.

Variables

Our primary outcome was *cellphone engagement* during the simulated driving assessment measured at baseline and 3-months. The secondary outcomes also measured at baseline and 3-month during the simulated driving assessment included *use of a peer passenger* to manage distractions*; and EOFR ≥2 seconds*. The secondary outcomes included self-report driving behaviors included baseline, 1-, 3- and 6-months cellphone use while driving on the road and highest number of peer passengers. See Appendix A for details of Interrater Reliability of Coded Simulator Protocol Variables.

Cellphone engagement: Driving simulator videos of participant behaviors at baseline and 3-months were used to determine *cellphone engagement* on six cellphone-related events (see Appendix A Table A.1 for Distraction Event Description by experimental drive). *Cellphone engagement* was defined as visual or manual interaction with the phone. This included looking at the phone, picking up the phone, taking a picture, sending the picture, hand manipulation of phone (mimicking writing a text), answering a call, looking at picture on the phone (See Appendix A Table A.2 for Definitions of Variables for Cell Phone Distractions coded as Yes/No (e.g. looked at phone). Across the six distraction events, counts of Yes=1 and No=0 were summed for scores of cellphone engagement (possible range, 0–17).

***Use of a peer passenger* to manage distractions:** Driving simulator videos of participant behaviors at baseline and 3-months were used determine *use of a peer passenger* to manage distractions on three cellphone-related events (see Appendix A, Table A.1). *Use of a peer passenger* was defined as interactions with the RA peer passenger to handle the cellphone interactions during the simulated driving assessment, such as asking the passenger to read or send a text (See Appendix A, Table A.2). This outcome metric was based on the focus group research indicating that adolescent drivers perceived using a peer passenger to handle a cellphone (e.g. looking at messages, sending messages) was a safety conscious behavior.[13] Across the three distraction events in Drive C, counts of Yes=1 and No=0 on interaction metrics were summed for scores of *use of a peer passenger* (possible range, 0–3).

For those randomized to receive distractions during their baseline simulated driving assessment, videos were coded at baseline and the 3-month follow up visit; for those randomized not to receive baseline distractions, only their 3-month follow up visit videos were coded (i.e. the baseline didn't contain distraction events).

EOFR ≥2 seconds: Eye tracking videos of participant glances were used to determine the number of glances with *EOFR ≥2 seconds* during the simulated driving assessment*. EOFR ≥2 seconds* was calculated as a count of glances with duration ≥2 seconds. These were calculated across the six events described in Appendix A, Table A.1. *EOFR ≥2 seconds* in a 6second interval is associated with increased crash risk in adolescents [10]. See details in Appendix A for Coding of *EOFR ≥2 seconds*. Across the six events, the number of *EOFR ≥2 seconds* events while moving were summed for a sum score as a count.

Self-report Driving Behaviors: We collected self-report behavioral data at baseline, 1-month, 3-months and 6-months on cellphone and peer passenger related behaviors. Items included average number of days per month that they (while driving): *1) Talked on a hand-held cellphone; 2) Talked on a hands-free cellphone; 3) Read a text; 4) Sent a text*. Response options were counts of 0–31 days. Participants were also asked to report the highest number of *Teen Passengers* they had in the car while driving. Response options were counts of 0–6 or more. The response of 6 or more was transformed to a discrete value of 6 for the purposes of analysis. At baseline, participants were asked to report on behavior in the previous month; at 1-month, 3-months, and 6-months participants were asked to report on behavior since the previous assessment.

Demographic Characteristics: At baseline, self-reported characteristics on sex, date of birth to calculate age, race/ethnicity and date of licensure to calculate licensure length were collected in person or online. Age, state of licensure and licensure date were verified at baseline study visit with a copy of the participant's driver's license.

Data Analysis

We used descriptive statistics to describe the sample characteristics, as well as the simulator protocol and self-report outcome measures at baseline, 1-month, 3-months and 6months. The distributions of participant demographic characteristics and baseline measures were compared across groups at baseline using Wilcoxon rank-sum tests for continuous variables and chi-square statistics for categorical variables.

To estimate effects on the primary and secondary outcomes across the four groups, separate models were used for *cellphone engagement; use of a peer passenger*; and *EOFR ≥2* seconds at 3-months using Poisson regression. Using these models, we calculated rate ratios (RR) and 95% confidence intervals (CI) by comparing counts of each outcome variable per participant among intervention groups controlling for sex. Given that only *LOC-D* and *HE-D* received exposure to distractions and use of a RA peer passenger at baseline, we also used Poisson regression models to estimate the RR and 95% CI with only those two groups for each of the simulator outcomes at 3-months, controlling for baseline simulator outcomes and sex. Separate models for each of the self-report measures at 1-month, 3-months, and 6-months were examined using repeated measures Poisson regression, controlling for sex, and baseline measures, and accounting for correlation among visits within participant, plus the interaction of group and visit. For final models, we removed interaction terms that were not statistically significant. We accounted for overdispersion in all Poisson models by including the ratio of the deviance to degrees of freedom as dispersion parameter.

At the inception of the overall study (including prior to the steps of intervention development[11]), an a priori power analysis indicated a sample of 60 participants would yield at least 80% power to detect an effect size ≥0.30 (Cohen's d) for the interaction between group and time in a 2X2 Mixed Design ANOVA, given up to 50% attrition, a correlation of at least 0.50 between baseline and follow-up measurements, and alpha <= 0.05. As this was a Phase II trial in preparation for a later Phase III trial, the design evolved through the process of intervention development and the need to examine potential assessment reactivity of baseline exposures to distractions in the simulator emerged. This resulted in a four-group design. The study team could not increase the sample in this initial study and thus the target of 60 remained. In the resultant design, we sought to estimate key study parameters with rate ratios with 2-sided 95% CIs and test the hypotheses at the traditional 2-sided level alpha of 0.05. The limitations of the sample size and a post-hoc power analyses of the effect size of the primary outcome will be discussed. Analyses were conducted using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

We tracked our participants using guidelines from the Consolidated Standards of Reporting Trials (CONSORT) (Figure 1). Table 1 outlines the demographic characteristics of the sample overall and by intervention group; 61 participants were enrolled and randomized. We found no differences in demographic characteristics by intervention group. All adolescents completed their assigned intervention, and the mean time to complete "*Let's Choose Ourselves"* was 27 minutes, 59 seconds (range: 15 minutes, 2 seconds to 39 minutes, 51 seconds). For the attention control on healthy eating, it was 24 minutes, 52 seconds (range: 13 minutes, 0 seconds to 60 minutes, 53 seconds).

Table 2 describes the simulator outcomes of *cellphone engagement, use of a peer passenger* and *EOFR ≥2 second* at baseline and 3-month follow up. Table 3 shows the rate ratio and 95% confidence interval from the Poisson regression analyses. In Poisson regression across all four groups, controlling for sex, we did not find significant effects of *LCO* at 3-months. We observed that the direction of the effect of *LCO-D* trended towards safer behaviors: those who received *LCO-D* had less *cellphone engagement*; more *use of a peer passenger*; and fewer *EOFR ≥2 seconds*. In Poisson regression for simulator outcomes across only the two groups that received distractions in the baseline assessment, controlling for sex and baseline distraction metrics, we also did not find significant effects of *LCO* at 3-months (Table 3). Similarly, we found that again trends that compared to the control group, *LCO-D* had less *cellphone engagement*; more *use of a peer passenger*; and fewer *EOFR ≥2 seconds,* though confidence intervals did not indicate significance.

Table 4 describes the mean and standard deviation of self-reported risky driving behaviors at baseline, 1-, 3- and 6-month follow-up. Using repeated measures Poisson regression, controlling for sex and baseline measure, we found that there was no significant effect of the interaction between visit and intervention group on any of the self-reported outcomes measures. Using repeated measures Poisson regression, controlling for sex and baseline behaviors, with no interaction term of visit and group, there was a significant effect of time, where we see an increasing engagement in self-reported risky behaviors over time. Table 5 outlines the results of these Poisson regression analyses. These behaviors included highest numbers of peer passengers (3-month (rate ratio and 95% confidence interval (RR) 1.32; 1.15, 1.52) and 6-month (RR 1.58; 1.38, 1.81) compared to 1-month), sending a text message (3-month (RR 1.58; 1.03, 2.42) compared to 1-month), and reading text messages (3-month (RR 1.45; 1.08, 1.94) and 6-month (RR 1.55; 1.11, 2.17) compared to 1-month).

Discussion

We did not find significant effects of *LCO* on primary or secondary outcomes in reducing inattention as measured in our simulator protocol. We also did not find effects of exposure to baseline risks exposure in the simulator. However, the results indicate a preliminary effect size of *LCO*, with directionality indicating potential for reducing unsafe driving behavior for adolescents through an individually targeted intervention. In addition, in this small sample, we saw an increase in the report of cellphone use and carrying number of peer passengers over the 6-months of study enrollment as they gained driving experience. The results with this one-time, brief online intervention delivered during the initial months of licensure adds knowledge of when and how interventions are delivered to reduce adolescent driver MVC risk.

Although not significant, the results are encouraging in that they were in the direction of safer behaviors (i.e. less cellphone engagement in the simulator). For the primary outcome, the *HE* groups were 23–24% more likely to engage with their cellphone than the group *LCO* with distractions, though not significant. The *HE* groups were also 16–74% less likely (though not significant) to use the peer passengers to manage distractions than the group *LCO* with distractions. This can be described as the *LCO* group more often handing the cellphone to the peer passenger to check or send messages. Such behaviors can be argued as potential harm reduction behaviors for cellphone use while driving in adolescents. These effects were consistent in the *EOFR ≥2 seconds*, with the *HE* groups with 15–58% more events than the group *LCO* with distractions. This may contribute to the understanding of components that may be useful for future interventions in driver inattention for adolescents.

More research is needed on the quickly changing behaviors related to social norms among adolescents in their use of the technology relative to driving. The introduction of cellphones into the vehicle has also created a virtual peer passenger for the driver to engage with during trips. Though increasing numbers of peer passengers in the vehicle is a known risk factor for fatal risk, [8,9] we know little about the scenarios for adolescent drivers where there is a driver, peer passenger and cell phone.[13,18] Overall, a nimble approach to address these inattentive behaviors that responds to rapidly changing technology, even in the newly licensed adolescents, is needed.

A unique contribution was the periodic assessment of self-report cellphone use and peer passenger carrying for 6-months during the early phase of licensure (enrolled at ≤90 days of licensure). Adolescents were engaging in behaviors that take eyes off the road and mind off the task of driving. Although we did not see that the intervention had a significant effect on self-report distracted driving behaviors, we saw an increase in self-reported cellphone use and highest number of peer passengers over the six months. For reading a text message, at 3- and 6-months compared to 1-month, they reported 45% and 55% increases in behaviors. The highest number of peer passengers reported at baseline was above the GDL passenger restrictions in PA (total sample 1.97 compared to no more than 1 passenger under 18 years for first 6 months of licensure).[19] Our results highlight the importance of addressing risky driving behaviors either during the pre-licensure phase or at the time of licensure.

To reduce driver inattention, repeated interactions with adolescents may be needed. Event-monitoring and feedback with parent-adolescent dyads has shown to reduce adolescent kinematic risky driving events [20,21]. With the increasing pervasiveness of cellphones [22,23], further research is needed on when and how to address these types distractions in a way that is effective and sustained. Given that we also know today's adolescents are exposed to parental cellphone use while driving from childhood through their adolescent years,[24–26] multipronged efforts will be needed.

Limitations

Our study was limited by a small sample size. We chose to use a 4-group design to understand the role of in-vehicle distractions and wanted to understand multiple secondary outcomes to determine our next steps. However, the sample size, particularly when comparing the two groups who received distractions at baseline, limited our abilities to detect differences between groups. It is acknowledged that the original power analysis was for a two-group design, and during intervention development the need for the evaluation of assessment reactivity in the simulated was needed. We carried out a posthoc analyses of the Poisson models that controlled for sex and baseline assessment of distractions for our primary outcome of cellphone engagement in the simulator. We found that a sample size of n=307 would be needed to detect significant differences between the *LCO* and *HE* groups. This should inform future research relative to this intervention approach. The rigorous experimental control in the simulator is useful when trying to test interventions in potentially unsafe driving situations. However, the simulator is an artificial environment where there is no risk for an actual crash and participants are fully aware they are being monitored. Therefore, behaviors in the simulator may not be generalizable to on-road behaviors. Response bias may limit the validity of the self-report data related to cellphone use while driving and carrying of peer passengers. The sample was biased in that they were all from one state, recruited primarily through the resources through the CHOP primary care system. In addition, the sample was predominately female and white non-Hispanic.

Implications for Emergency Nursing

Key implications for emergency nursing practice rest on the foundation that adolescent MVCs are largely preventable. Knowledge about state policies on cellphone use while driving, peer passenger restrictions, and other parameters of GDL provisions can help provide evidence-based anticipatory guidance to adolescents and families. Even the newest drivers engaged in distracted driving behaviors, and thus further education and reinforcement of safety conscious behaviors are needed. In addition, consideration of efforts aimed at not just those adolescents who are in their learner permit phase or newly licensed, but rather trying to more broadly target those who are not yet drivers. Programs can capitalize on state policies that address distracted driving. For example, survey data indicate that adolescent support policy restrictions on hand-held cellphone use as well as reading/sending messages.[27] An intervention prevention program could leverage positive community norms around these policies.

Injury prevention programs by emergency nurses could address the intersection of adolescent driving, parent involvement and technology. There is a strong emphasis on the role of parents in the learning to drive or early licensure time period, [3,28] Technological interventions such as text message-blocking technology show promise,[29] but there are few studies to examine effects. There may be advantages to combining facets of technology-based interventions with behavioral interventions to increase uptake. There are a few commercially available products that can inhibit cellphone use while driving. However, families must find these technologically based intervention acceptable and feasible for use for their adolescents.[30]

Conclusions

Newly licensed adolescent drivers are at particularly high risk for MVCs. *"Let's Choose Ourselves"* is an individually targeted intervention for newly licensed teen drivers that addresses inattention to the roadway. This initial study of testing *"Let's Choose Ourselves"* did not indicate significant effects of the intervention, though trends were in the expected direction. Results point towards a need to address inattention early in the learning to drive and licensure process as we saw increasing frequency of self-reported risky driving over the 6-months of enrollment. Further work is needed to better understand effective measures that can address cellphone use while driving.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements:

This research was supported by the National Institute of Nursing Research of the National Institutes of Health under Award Number R00NR013548 (PI: McDonald). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. This research was also supported by the Dorothy Mereness Endowed Research Fund at the University of Pennsylvania School of Nursing. The authors wish to thank Flaura K. Winston and Nancy Kassam-Adams, PhD, for their contributions. We would also like to thank Chelsea Ward and the Center for Research Injury and Prevention Driving Simulator Core. For assistance in recruitment, we thank the Pediatric Research Consortium and the Recruitment Enhancement Core at the Children's Hospital of Philadelphia. Lastly, we thank the participants in this study.

References

1. Centers for Disease Control and Prevention. Ten Leading Causes of Death and Injury. Published 2019 Accessed July 15, 2020 http://www.cdc.gov/injury/wisqars/leadingcauses.html
2. Williams AF, Tefft BC. Characteristics of teens-with-teens fatal crashes in the United States, 2005–2010. J Saf Res. 2014;48:37–42.
3. Curry AE, Pfeiffer MR, Durbin DR, Elliott MR. Young driver crash rates by licensing age, driving experience, and license phase. Accid Anal Prev. 2015;80:243–250. [PubMed: 25939133]
4. Regan MA, Hallett C, Gordon CP. Driver distraction and driver inattention: Definition, relationship and taxonomy. Accid Anal Prev. 2011;43(5):1771–1781. [PubMed: 21658505]
5. Curry AE, Hafetz J, Kallan MJ, Winston FK, Durbin DR. Prevalence of teen driver errors leading to serious motor vehicle crashes. Accid Anal Prev. 2011;43(4):1285–1290. [PubMed: 21545856]
6. National Highway Traffic Safety Administration. Distracted Driving 2011, Report No. DOT HS 811 737. Published 2013 http://www-nrd.nhtsa.dot.gov/Pubs/811737.pdf
7. National Highway Traffic Safety Administration. Distracted Driving in Fatal Crashes, 2017, Report No. DOT 812 700.; 2019 https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812700

8. Ouimet MC, Pradhan AK, Brooks-Russell A, Ehsani JP, Berbiche D, Simons-Morton BG. Young drivers and their passengers: A systematic review of epidemiological studies on crash risk. J Adolesc Heal. 2015;57(1 Suppl):S24–S35.e6.

9. Tefft BC, Williams AF, Grabowski JG. Teen driver risk in relation to age and number of passengers, United States, 2007–2010. Traffic Inj Prev. 2012;14(3):283–292.

10. Simons-Morton BG, Guo F, Klauer SG, Ehsani JP, Pradhan AK. Keep your eyes on the road: young driver crash risk increases according to duration of distraction. J Adolesc Heal. 2014;54(5 Suppl):S61–7.

11. McDonald CC, Brawner BM, Fargo J, Swope J, Sommers MS. Development of a theoretically grounded, web-based intervention to reduce adolescent driver inattention. J Sch Nurs. 2018;34(4):270–280. [PubMed: 28553750]

12. McDonald CC, Sommers MS. Teen drivers' perceptions of inattention and cell phone use while driving. Traffic Inj Prev. 2015;16 Suppl 2:S52–58. [PubMed: 26436243]

13. McDonald CC, Sommers MS. "Good Passengers and not good passengers:" Adolescent drivers' perceptions about inattention and peer passengers. J Pediatr Nurs. 2016;31(6):e375–e382. [PubMed: 27496828]

14. D'Onofrio G, Fiellin DA, Pantalon M V., et al. A brief intervention reduces hazardous and harmful drinking in emergency department patients. Ann Emerg Med. 2012;60(2):181–192. [PubMed: 22459448]

15. Sommers MS, Lyons MS, Fargo JD, et al. Emergency department-based brief intervention to reduce risky driving and hazardous/harmful drinking in young adults: A randomized controlled trial. Alcohol Clin Exp Res. 2013;37(10):1753–1762. [PubMed: 23802878]

16. McDonald CC, Kandadai V, Loeb H, et al. Simulated Driving Assessment (SDA) for teen drivers: Results from a validation study. Inj Prev. 2015;21(3):145–152. [PubMed: 25740939]

17. McDonald CC, Tanenbaum JT, Lee Y-CY-CY-C, Fisher DL, Mayhew DR, Winston FK. Using crash data to develop simulator scenarios for assessing novice driver performance. Transp Res REc. 2012;2321(1):73–78 [PubMed: 23543947]

18. Gershon P, Zhu C, Klauer SG, Dingus T, Simons-Morton B. Teens' distracted driving behavior: Prevalence and predictors. J Safety Res. 2017;63:157–161. [PubMed: 29203014]

19. Insurance Institute for Highway Safety. Graduated licensing laws by state. Published 2019 Accessed July 15, 2020 https://www.iihs.org/topics/teenagers/graduated-licensing-laws-table?stateabbr=AL

20. Peek-Asa C, Cavanaugh JE, Yang J, Chande V, Young T, Ramirez M. Steering teens safe: A randomized trial of a parent-based intervention to improve safe teen driving. BMC Public Health. 2014;14:777. [PubMed: 25082132]

21. Simons-Morton BG, Bingham CR, Ouimet MCMC, et al. The effect on teenage risky driving of feedback from a safety monitoring system: A randomized controlled trial. J Adolesc Heal. 2013;53(1):21–26.

22. Anderson M, Jiang J. Teens, Social Media & Technology 2018. Published 2018 Accessed July 15, 2020 http://www.pewinternet.org/2018/05/31/teens-social-media-technology-2018/

23. Teens Lenhart A., social media and technololgy overview 2015. Published 2015. Accessed July 15, 2020 http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/

24. Carter PM, Bingham CR, Zakrajsek JS, Shope JT, Sayer TB. Social norms and risk perception: Predictors of distracted driving behavior among novice adolescent drivers. J Adolesc Heal. 2014;54(5):S32–S41.

25. Macy ML, Carter PM, Bingham CR, Cunningham RM, Freed GL. Potential distractions and unsafe driving behaviors among drivers of 1- to 12-year-old children. Acad Pediatr. 2014;14(3):279–286. [PubMed: 24767781]

26. McDonald CC, Kennedy E, Fleisher L, Zonfrillo MR. Factors associated with cell phone use while driving: A survey of parents and caregivers of children ages 4–10 years. J Pediatr. 2018;201:208–214. [PubMed: 30017337]

27. Pope CN, Mirman JH, Stavrinos D. Adolescents' perspectives on distracted driving legislation. J Safety Res. 2019;68:173–179. [PubMed: 30876508]

28. Mirman JH, Curry AE, Winston FK, et al. Effect of the teen driving plan on the driving performance of teenagers before licensure: a randomized clinical trial. JAMA Pediatr. 2014;168(8):764–771. [PubMed: 24957844]

29. Creaser JI, Edwards CJ, Morris NL, Donath M. Are cellular phone blocking applications effective for novice teen drivers? J Saf Res. 2015;54:75e29–78.

30. Delgado MK, McDonald CC, Winston FK, et al. Attitudes on technological, social, and behavioral economic strategies to reduce cellphone use among teens while driving. Traffic Inj Prev. 2018;19(6):569–576. [PubMed: 29652523]

31. Klauer SG, Dingus TA, Neale VL, Sudweeks J, Ramsey DJ. The impact of driver inattention on near-crash/crash risk: An analysis using the 100-Care Naturalistic Driving Study Data. DOT HS 810 594 2006

Contribution to Emergency Nursing Practice

- The current state of scientific knowledge on motor vehicle crash prevention indicates that adolescent driver inattention contributes to crashes, yet there is a lack of theoretically grounded interventions to reduce this type of risky driving behavior.
- The main finding of this research is that although a theoretically grounded web-based intervention did not reduce adolescent driver inattention in newly licensed drivers, self-reported cellphone use while driving was present at enrollment in these newly licensed drivers and increased over the 6-months of study enrollment.
- Key implications for emergency nursing practice from this research are that motor vehicle crash prevention efforts will take a multipronged approach, as even the newest drivers are engaging in cellphone use while driving. Injury prevention efforts related to adolescent driver inattention can start early with adolescents, well before they are independent drivers.

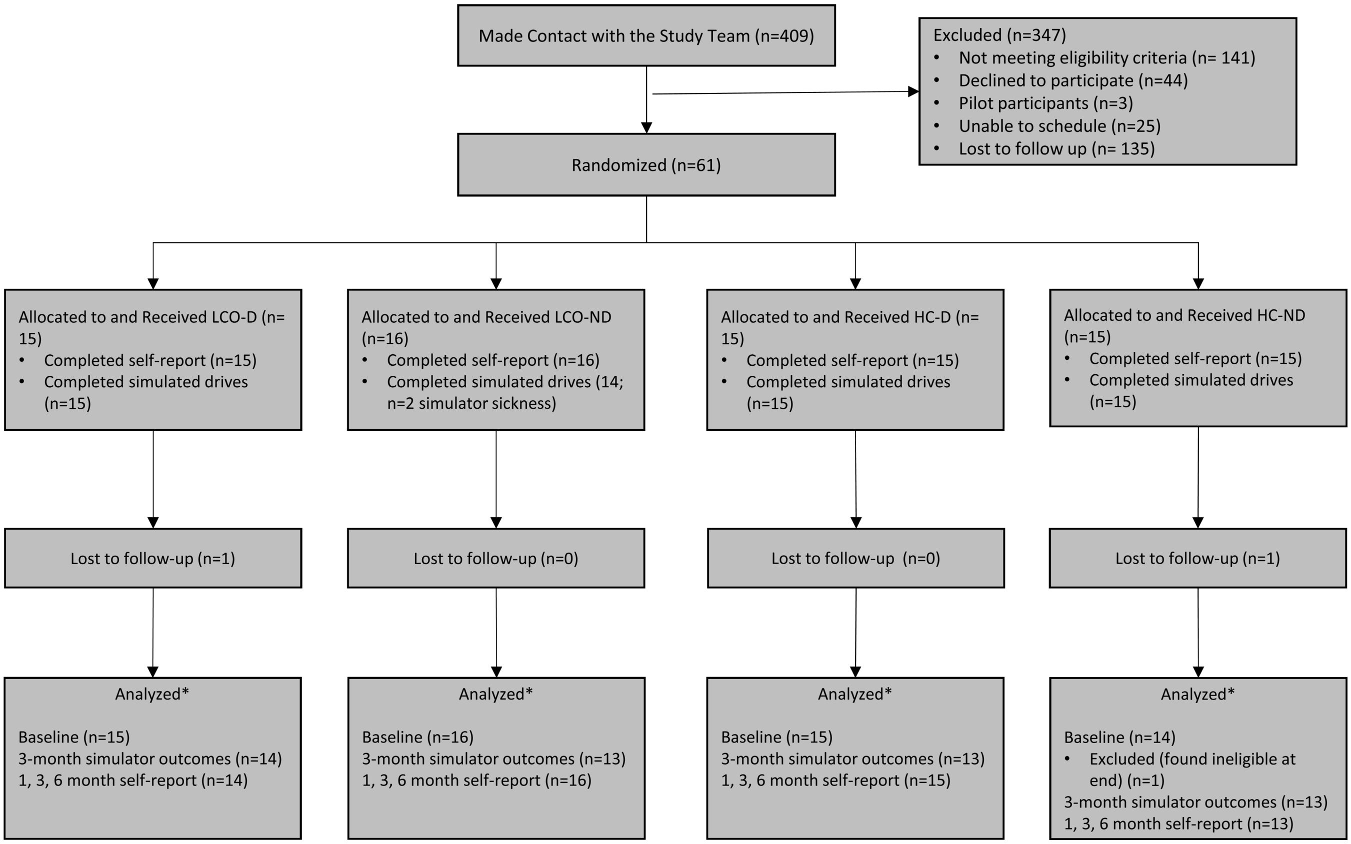

Figure 1.

Note: *any available data included in analysis

LCO-D: Let's Choose Ourselves with distractions

LCO-ND: Let's Choose Ourselves with no distractions

HC-D: Healthy Eating with distractions

HC-ND: Healthy Eating with no distractions

Table 1:

Demographic Characteristics by Intervention Group

			Total Sample		LCO-D		LCO-ND		HE-D		HE-ND	
Variable	**p**		**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Total			60	100.0	15	25.0	16	26.7	15	25.0	14	23.3
sex	0.31	Female	40	66.7	8	53.3	13	81.3	11	73.3	8	57.1
		Male	20	33.3	7	46.7	3	18.8	4	26.7	6	42.9
Race/ ethnicity	0.53	NH Black	9	15.0	4	26.7	3	18.8	1	6.7	1	7.1
		NH Other / Mixed	4	6.7	.	.	2	12.5	1	6.7	1	7.1
		NH White	47	78.3	11	73.3	11	68.8	13	86.7	12	85.7
			Mean (SD)	**Median (IQR)**	**Mean (SD)**	**Median (IQR)**	**Mean (SD)**	**Median (IQR)**	**Mean (SD)**	**Median (IQR)**	**Mean (SD)**	**Median (IQR)**
Age	0.06		17 (0.4)	16.8 (16.7, 17.2)	17.1 (0.4)	17.2 (16.8, 17.4)	17 (0.4)	16.8 (16.7, 17.1)	17 (0.3)	17 (16.8, 17.3)	16.8 (0.2)	16.8 (16.7, 16.8)
Length of licensure (months)	0.36		50.8 (23.7)	49 (32.5, 71.0)	54.3 (28.2)	47 (32.0, 86.0)	56.6 (22.5)	60 (42.0, 75.0)	49.3 (26.3)	41 (27.0, 78.0)	41.9 (14.7)	44 (36.0, 49.0)

Note: Let's Choose Ourselves with baseline distractions=LCO-D; Let's Choose Ourselves with no baseline distractions=LCO-ND; Healthy Eating (control) with baseline distractions=HE-D; Healthy Eating with no baseline distractions=HE-ND.

Table 2:

Distribution of Simulator Outcomes by Intervention Group

	Total Sample			LCO-D			LCO-ND			HE-D			HE-ND		
	N	**Mean (SD)**	**Median (IQR)**	**N**	**Mean (SD)**	**Median (IQR)**	**N**	**Mean (SD)**	**Median (IQR)**	**N**	**Mean (SD)**	**Median (IQR)**	**N**	**Mean (SD)**	**Median (IQR)**
Cell phone engagement															
Baseline	30	8.13 (5.22)	8 (4, 13)	15	7.67 (5.21)	6 (4, 14)	16	NA	NA	15	8.60 (5.37)	8 (5, 13)	14	NA	NA
3-month	53	9.43 (5.40)	10 (6, 14)	14	8.36 (6.31)	7 (2, 14)	13	9.85 (5.79)	10 (9, 12)	13	9.46 (5.43)	10 (6, 14)	13	10.15 (4.30)	10 (6, 13)
Use of a peer passenger to manage distractions															
Baseline	30	0.90 (0.96)	1 (0, 2)	15	0.80 (0.68)	1 (0, 1)	16	NA	NA	15	1 (1.2)	0 (0, 2)	14	NA	NA
3-month	53	0.64 (0.9)	0 (0, 1)	14	0.86 (0.86)	1 (0, 2)	13	0.62 (0.96)	0 (0, 2)	13	0.85 (1.07)	0 (0, 2)	13	0.23 (0.60)	0 (0, 0)
EOFR ≥2 seconds															
Baseline	30	1.50 (2.19)	0.50 (0, 3)	15	1.07 (1.53)	0 (0, 2)	16	NA	NA	15	1.93 (2.69)	1 (0, 3)	14	NA	NA
3-month	53	1.26 (1.56)	1 (0, 2)	14	1.14 (1.35)	0.50 (0, 2)	13	0.92 (1.32)	0 (0, 2)	13	1.69 (1.75)	1 (0, 2)	13	1.31 (1.84)	1 (0, 2)

Author Manuscript
Author Manuscript
Author Manuscript

Table 3:

Simulator Outcomes at 3-month Follow-up

	Rate ratio	95% CI	p-value
Controlling for sex			
Cell phone engagement			
sex (M vs F)	1.38	0.95, 2.01	0.10
HE-D vs LCO-D	1.24	0.74, 2.08	0.42
HE-ND vs LCO-D	1.23	0.75, 2.02	0.41
LCO-ND vs LCO-D	1.32	0.79, 2.23	0.29
Use of peer passenger to manage distractions			
sex (M vs F)	0.50	0.19, 1.32	0.16
HE-D vs LCO-D	0.84	0.33, 2.15	0.71
HE-ND vs LCO-D	0.26	0.06, 1.09	0.07
LCO-ND vs LCO-D	0.58	0.21, 1.65	0.31
EOFR ≥2 seconds			
sex (M vs F)	1.26	0.59, 2.66	0.55
HE-D vs LCO-D	1.58	0.60, 4.12	0.35
HE-ND vs LCO-D	1.15	0.43, 3.11	0.78
LCO-ND vs LCO-D	0.88	0.29, 2.69	0.82
Controlling for sex and Baseline Assessment of Distractions*			
Cell phone engagement			

	Rate ratio	95% CI	p-value
sex (M vs F)	1.49	1.05, 2.13	0.03
HE-D vs LCO-D	1.14	0.81, 1.60	0.45
Use of peer passenger to manage distractions			
sex (M vs F)	0.40	0.15, 1.04	0.06
HE-D vs LCO-D	0.50	0.20, 1.24	0.14
EOFR ≥2 seconds			
sex (M vs F)	0.80	0.30, 2.17	0.66
HE-D vs LCO-D	1.11	0.43, 2.84	0.83

Note:

*These models only included two groups: LCO-D and HE-D

Table 4:

Distribution of Self-Reported Driving Behaviors by Intervention Group and Time

	Intervention group														
	Total Population			LCO-D			LCO-ND			HE-D			HE-ND		
	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)
Hand held cell phone use (average days per month)															
Baseline	60	0.78 (1.70)	0 (0, 1)	15	0.67 (1.40)	0 (0, 1)	16	0.5 (0.73)	0 (0, 1)	15	1.27 (2.81)	0 (0, 1)	14	0.68 (1.23)	0 (0, 1.5)
1-month	58	2.22 (4.3)	0 (0, 2)	14	2.79 (5.59)	0 (0, 2)	16	2.56 (4.40)	0 (0, 3.5)	15	1.6 (3.07)	0 (0, 3)	13	1.92 (4.23)	0 (0, 2)
3-month	55	2.44 (5.13)	0 (0, 2)	14	1.86 (4.05)	0 (0, 2)	15	3.6 (6.62)	0 (0, 5)	13	3.08 (6.51)	0 (0, 1)	13	1.08 (1.61)	0 (0, 1)
6-month	56	3.07 (5.48)	1 (0, 4.50)	13	3.31 (7.10)	0 (0, 3)	15	3.87 (6.58)	1 (0, 5)	15	3.4 (4.52)	1 (0, 5)	13	1.54 (3.04)	0 (0, 1)
Hands free cell phone use (average days per month)															
Baseline	60	1.08 (2.17)	0 (0, 1.5)	15	0.87 (2.59)	0 (0, 0)	16	0.88 (1.36)	0 (0, 1.5)	15	0.97 (1.88)	0 (0, 2)	14	1.68 (2.77)	0.5 (0, 2)
1-month	58	2.16 (4.51)	0 (0, 2)	14	1.71 (2.89)	0 (0, 5)	16	1.69 (3.16)	0 (0, 2)	15	2.40 (4.91)	0 (0, 2)	13	2.92 (6.76)	0 (0, 0)
3-month	55	2.65 (4.84)	0 (0, 3)	14	2.79 (5.49)	0 (0, 1)	15	4.47 (5.72)	3 (0, 10)	13	1.15 (2.19)	0 (0, 0)	13	1.92 (4.73)	0 (0, 0)
6-month	55	3.16 (5.03)	1 (0, 4)	13	3.00 (4.40)	0 (0, 6)	15	5.07 (6.94)	2 (0, 9)	14	2.21 (3.53)	0.5 (0, 3)	13	2.15 (4.24)	0 (0, 3)
Read text (average days per month)															
Baseline	60	1.86 (4.61)	0 (0, 2)	15	2.53 (7.10)	0 (0, 2)	16	1.06 (1.69)	0 (0, 1.5)	15	2.2 (4.49)	0 (0, 2)	14	1.68 (3.94)	0 (0, 1)
1-month	58	2.88 (5.53)	0 (0, 2)	14	4.21 (7.62)	0.5 (0, 2)	16	2.63 (5.19)	1 (0, 2.5)	15	2.53 (4.47)	0 (0, 3)	13	2.15 (4.72)	0 (0, 1)
3-month	55	4.22 (7.00)	1 (0, 4)	14	3 (6.85)	0.5 (0, 2)	15	4.6 (6.67)	2 (0, 6)	13	5.54 (8.53)	2 (1, 4)	13	3.77 (6.41)	1 (0, 3)
6-month	56	4.48 (6.26)	2 (0, 5.50)	13	4.38 (7.53)	1 (0, 4)	15	5.93 (7.27)	3 (1, 10)	15	4.93 (6.12)	3 (0, 10)	13	2.38 (3.12)	1 (0, 4)
Send text (average days per month)															

	Intervention group														
	Total Population			LCO-D			LCO-ND			HE-D			HE-ND		
	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)	N	Mean (SD)	Median (IQR)
Baseline	60	1.61 (4.43)	0 (0, 1)	15	2.27 (7.16)	0 (0, 1)	16	0.63 (1.63)	0 (0, 0)	15	2.07 (3.58)	0 (0, 4)	14	1.54 (3.9)	0 (0, 1)
1-month	58	1.76 (4.49)	0 (0, 1)	14	3.14 (7.28)	0 (0, 1)	16	1.38 (2.70)	0 (0, 1.5)	15	1.27 (3.86)	0 (0, 0)	13	1.31 (2.95)	0 (0, 1)
3-month	55	2.82 (6.25)	0 (0, 2)	14	1.86 (5.39)	0 (0, 0)	15	3.8 (6.86)	0 (0, 5)	13	3 (8.18)	0 (0, 2)	13	2.54 (4.5)	0 (0, 2)
6-month	56	2.82 (5.22)	0 (0, 3.50)	13	1.62 (4.25)	0 (0, 0)	15	4.87 (7.41)	1 (0, 10)	15	2.47 (4.6)	0 (0, 3)	13	2.08 (3.23)	0 (0, 4)
Highest number of teen passengers															
Baseline	60	1.97 (1.44)	2 (1, 2.5)	15	1.4 (0.99)	1 (1, 2)	16	2.25 (1.34)	2 (1, 2.5)	15	2.2 (1.82)	1 (1, 3)	14	2.00 (1.47)	1.50 (1, 3)
1-month	58	1.97 (1.14)	2 (1, 2)	14	1.5 (0.94)	1.5 (1, 2)	16	2.13 (1.15)	2 (1, 2.5)	15	2.2 (1.26)	2 (1, 2)	13	2.00 (1.15)	2 (1, 3)
3-month	55	2.56 (1.41)	2 (1, 3)	14	2.71 (1.64)	2.5 (1, 3)	15	2.40 (0.91)	2 (2, 3)	13	2.62 (1.71)	2 (1, 3)	13	2.54 (1.45)	2 (1, 4)
6-month	56	3.09 (1.35)	3 (2, 4)	13	2.54 (1.13)	3 (2, 3)	15	3.20 (1.01)	3 (2, 4)	15	3.6 (1.35)	4 (2, 4)	13	2.92 (1.75)	3 (2, 4)

Table 5:

Self-reported Driving Behaviors at 3- and 6-month Follow-up

	Rate ratio	95% CI	p-value
Hand held cell phone use			
sex (M vs F)	1.23	0.59, 2.56	0.58
HE-D vs LCO-D	0.58	0.17, 2.05	0.40
HE-ND vs LCO-D	0.59	0.18, 1.92	0.38
LCO-ND vs LCO-D	1.74	0.49, 6.11	0.39
3m vs 1m	1.16	0.76, 1.78	0.49
6m vs 1m	1.44	0.98, 2.11	0.06
Hands free cell phone use			
sex (M vs F)	0.64	0.26, 1.56	0.32
HE-D vs LCO-D	0.76	0.23, 2.52	0.65
HE-ND vs LCO-D	0.73	0.21, 2.59	0.63
LCO-ND vs LCO-D	1.53	0.47, 4.99	0.48
3m vs 1m	1.25	0.81, 1.94	0.32
6m vs 1m	1.42	0.85, 2.37	0.18
Read text			
sex (M vs F)	1.42	0.79, 2.55	0.25
HE-D vs LCO-D	2.06	0.76,5.57	0.15
HE-ND vs LCO-D	1.28	0.51,3.21	0.60
LCO-ND vs LCO-D	3.11	1.20,8.09	0.02
3m vs 1m	1.45	1.08, 1.94	0.01
6m vs 1m	1.55	1.11, 2.17	0.01
Send text			
sex (M vs F)	1.61	0.73,3.58	0.24
HE-D vs LCO-D	4.03	0.57, 28.61	0.16

	Rate ratio	95% CI	p-value
HE-ND vs LCO-D	2.89	0.58, 14.29	0.19
LCO-ND vs LCO-D	10.19	1.80,57.76	0.01
3m vs 1m	1.58	1.03, 2.42	0.04
6m vs 1m	1.60	0.91,2.81	0.10
Highest number of teen passengers			
sex (M vs F)	1.03	0.87,1.21	0.75
HE-D vs LCO-D	1.04	0.83,1.31	0.74
HE-ND vs LCO-D	0.95	0.71, 1.26	0.72
LCO-ND vs LCO-D	1.00	0.78, 1.28	0.98
3m vs 1m	1.32	1.15, 1.52	<.0001
6m vs 1m	1.58	1.38, 1.81	<.0001