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Evaluating the Use of a Mobile App in High School Seniors to Monitor Cellphone Use While Driving: A Quality Improvement Project

Kristen Mankus
mankusk@mail.sacredheart.edu

Evaluating the Use of a Mobile App in High School Seniors to Monitor Cellphone Use While Driving: A Quality Improvement Project

Kristen Mankus, BSN, RN

A DNP project submitted in partial fulfillment of the requirements for

the degree of Doctor of Nursing Practice

Rosemary Johnson, DNP, RN; DNP Project Faculty Advisor

Tyler Webb Vice Principal "W" High School; Practice Mentor

Katie Stanley; Co-Investigator

Sacred Heart University Davis & Henley College of Nursing

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This is to certify that the DNP Project Final Report by

Kristen Mankus

has been approved by the DNP Project Team on

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for the Doctor of Nursing Practice degree

DNP Project Faculty Advisor: Dr. Rosemary Johnson, DNP APRN

Practice Mentor: Mr. Tyler Webb MS, M.Ed

Abstract

Background: Motor vehicle accidents are the leading cause of death in teenagers in the United States. Driver distraction is responsible for more than 58% of teen crashes. Evidence from 9 critically appraised articles including two systematic reviews support the need to reduce distracted driving among teenagers; mobile applications along with education can impact behavioral change to encourage teens to refrain from this unsafe practice.

Purpose: The use of the mobile application “Safe2Save” that financially rewards users for not unlocking their cellphone while driving may motivate teenagers to reduce this high-risk behavior. The global aim for this project is to incorporate education on distracted driving and the use of mobile apps into High School curriculum. The specific aim of this project is to decrease the amount students unlock their cellphone while driving over a 4-week period measured by the app “Safe2Save” and improve their perception related to distracted driving after education measured by the Distracted Driving Survey (DDS).

Methods: Seniors at a high school volunteered to participate in this QI project. Baseline DDS results were collected, then students downloaded the app, received education, and submitted post-surveys. Data was collected from 11/2021 to 1/2022. Evaluation and adjustments were discussed allowing for recommendations for sustainability using IHI’s model of the Plan-Do-Study-Act.

Results: Comparing students driving statistics showed an inconsistent correlation between using the app and decreasing cellphone use while driving. Comparison between pre-and post-DDS scores were not done. There was significant drop in post-DDS responses (n=6) compared to pre-DDS responses (n=15). Additionally, the responses to the survey were anonymous. However, both survey responses demonstrated viewing maps as the most prevalent reason to use a

cellphone while driving. This calls for more concrete findings whether a mobile app and education reduces the amount teenagers use their cellphone while driving.

Discussion: The outcome information suggests that it is uncertain if the use of a mobile app that financially rewards users will influence the amount individuals use their cellphone while driving. This project calls for additional studies to support the incorporation of education including mobile apps into High School curriculum.

Keywords: driving, motor vehicle accidents, distraction, cellphone, mobile application, smartphone, apps, teens, adolescents, teenagers, high-school students.

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Table of Contents

Appendices

List of Tables

List of Figures

Chapter 1: Problem Identification, Development of Clinical Question, and Evidence Review

Background and Significance of Problem

Motor vehicle crashes are the leading cause of death and disability in the United States (Centers for Disease Control and Prevention [CDC], 2017). These traffic crash deaths resulted in $55 billion in medical and work loss costs in 2018 (CDC, 2020). Teenagers ages 16-19 disproportionately account for this statistic; they are three times more likely to be involved in a fatal crash compared to any other age group (Monroe et al., 2020). In fact, in 2015, there were 221,313 teenage drivers admitted to hospital emergency rooms, which resulted in 2,333 fatalities (Freidlin et al., 2018). Many of these accidents can be attributed to distracted driving which is a growing epidemic and public health priority. An average of 8 people are killed and 1,161 are injured due to a distracted driver in the United States every day (Adeola, 2016). Again, teenagers outweigh the rest of the population accounting for 22% of distracted-related fatal crashes (McDonald et al., 2019). Cell phone use is a major, if not the most prevalent, distraction. Previous studies on cellphone use while driving among teens have shown that 71% make or answer phone calls, 64% read or send text messages, 20% read or send emails, 29% check websites or social media, and 71% search for music. Unfortunately, cellphone use continues even though 97% of teens acknowledge this is a dangerous behavior (Delgado et al., 2018). As a result, this is a public health issue that requires an intervention that is evidence-based.

Nurses are at the forefront of public health. Nurses, particularly Doctor of Nursing Practice (DNP) prepared, are uniquely skilled to implement and evaluate public health interventions that can make an impact on distracted driving in the teenage population. In the paragraphs to follow, a discussion of how a nurse-lead quality improvement (QI) project will be

discussed. This QI project will describe how the use of a mobile application called, "Safe2Save", and a driving educational program will positively influence driving behaviors in teenagers. The goal of this QI project is to reduce distracted driving in high school seniors. In conclusion, the information gained from this project could be useful for driving education courses, parents of new drivers, and high school organizations to incorporate smartphone applications to reduce distracted driving into their curriculum.

Description of Local Problem

Despite the increases in driving-safety laws, traffic cameras, and national educational campaigns, there continues to be a rise in the number of teens using their cellphones while driving (Delgado et al., 2018). This calls for a new approach or intervention to resolve this issue. The "Safe2Save" smartphone or mobile application (app) is a promising innovation that can reduce this high-risk behavior. This smartphone or mobile app gives users a score on their driving performance by recording the number of minutes driven and how many times their phone was unlocked while going over 10mph. This score is converted into points that can be redeemed at retail on-line stores such as Amazon, Best Buy, Columbia, and more. The use of smartphone or mobile apps to promote behavioral change has been well-studied in areas such as Diabetes, Heart Failure, and smoking cessation (Lunde et al., 2018). In the treatment of non-communicable diseases, mobile health apps have been beneficial for continuous communication, increasing motivation, and improving lifestyle factors (Kiyarosta et al., 2020). Furthermore, mobile apps are emerging as a useful and cost-effective intervention for high-risk behaviors such as drunk driving (Wilson et al., 2017). Therefore, it is imperative to foster safe driving in teenagers using a smartphone or mobile app to reduce distracted driving. This intervention will not only reduce motor vehicle accidents but save lives.

Organizational Priority

This project has the support of the faculty at Wethersfield High School, including project mentor and Vice Principal, Tyler Webb. This project has also received approval from the Town of Wethersfield Super Intendant of the public schools, Mr. Michael Emmet. Lastly, this project worked in coordination with and support from the "Safe2Save" company and its Director of Community Engagement, Meagan Kamra.

Focused Search Question

The PICO format (Melnyk & Fineout-Overholt, 2019) was used to guide the evidence search to reduce cell phone usage in teenagers while driving. Therefore, the PICO for this QI project is: In teenage drivers (P) does using a mobile driving app and safe driving education (I) compared to none (C) have an impact on cellphone use while driving (O)?

Evidence Search

External Evidence. A description of the evidence search including search terms, criteria, and results (refer to Tables 1, 2, & 3) can be found in Appendix A, Description of the Evidence Search. A summary of relevant information was collected from each article and summarized in Appendix B, Evidence Summary (refer to Table 4). Melnyk & Fineout-Overholt Nursing Evidence-Based Practice Research Appraisal tools (Melnyk, & Fineout-Overholt, 2015) were used to critically appraise the evidence which has been converted into synthesis tables (refer to Tables 5 & 6) displayed in Appendix C, Levels of Evidence and Outcomes Synthesis Table. Ten studies met the search criteria and will be discussed in Literature Review section. The strength of evidence varied among each study. There were two Level I studies, two Level II studies, two Level V studies, three Level VI study, and one Level VII study included in the review.

Evidence Appraisal, Summary, and Recommendations

There were limited studies specifically related to smartphone or mobile apps use to influence distracted driving in teenagers. However, 3 studies found smartphone apps can be used to track distracted driving. Additionally, there were two systematic reviews (SR) and one randomized control trial (RCT) studies that provides significant support that smartphone or mobile apps can positively influence behavior change and improve health outcomes. One observational study, using surveys, also showed providing education can have an impact on distracted driving in teenagers. Lastly, an unpublished observational study showed the “Safe2Save” driving smartphone app reduced teenager cellphone use while driving.

There were 3 studies that showed cellphone use while driving is a prevalent high-risk behavior among teens (Friedlin et al., 2018; McDonald et al., 2019; Monroe et al., 2020). These studies also showed that smartphone apps can be used to track distracted driving. These smartphone apps access use of phone while driving by measuring car movement via elevated g-force. This enables researchers to collect continuous data on teenage driving behavior.

There were two SRs by Yang et al. (2020) and Lunde et al. (2018), which included a total of 38 and 9 studies respectively. These SRs evaluated smartphone apps in the management of diabetes and noncommunicable diseases. The SR by Yang and colleagues (2020) evaluated the use of the mobile app called, WeChat. The WeChat app was used to monitor diet, exercise, blood glucose levels, and foot-care for the self-management of diabetes. The app gave patients the opportunity to send pictures, videos, and texts to nurses and receive timely feedback. The WeChat app provides follow-up and sends patient education content in real time, thus promoting patients to develop good self-management habits. The SR by Lund and colleagues (2018) examined apps where participants could manually record exercise, diet, and glucose data each

day into the app. This information was monitored by participants and health personal who could give feedback based on what the app had registered. Both reviews found a statistically significant improvement in hemoglobin A1C levels in 32 out of 38 and 7 out of 9 studies respectively (Lunde et al., 2018; Yang et al., 2020). Another study adds additional evidence that smartphone or mobile apps can be used as a means to influence behavioral change and improve health outcomes. For example, Kiyarosta and colleagues (2020) conducted a randomized control trial that used a mobile app intervention to improve self-care in a group of heart failure patients (n=120). They found features of the app such as daily reminders, educational content, and medication guide in the intervention group had resulted in improved self-care scores that was statistically significant ($p<.01$) as compared to the control group.

The literature review also revealed that education can be an effective method in improving the attitudes related to distracted driving among teenagers. A survey of students' self-reported perceptions regarding being unlikely to answer a phone call while driving increased from 41% to 74% after education was provided (Adeola, 2016). Education from this survey included a presentation regarding the frequency, severity, and mechanism of teenage injuries from distracted driving. The presentation relied on the use of the Health Belief Model to promote healthy driving behaviors and prevent consequences associated with distracted driving. The education was a 3-hour long program that took place over 6 weeks to reach a sample of 1,238 students across the country (Adeola, 2016).

While it is not a published study, the Texas A&M Transportation Institute (TTI) conducted an observational study of cellphone use while driving in Fort Bend County, Texas. The study observed 100 high school students at 16 major-intersections who used the "Safe2Save" smartphone app over a 4-month period to improve distracted driving. They found

teenage cellphone use while driving reduced from 6.2% to 4.9% ("Safe2Save Evaluation Survey," 2019).

In conclusion, a smartphone app can have a positive effect on teenage driving behaviors. They are a cost-effective and user-friendly (Wilson et al., 2017). Additionally, the principles of behavioral economics and the potential financial rewards from using a smartphone app will motivate teenagers to drive safely. As a result, utilizing a smartphone app such as the "Safe2Save" to reduce distracted driving in a group of high school seniors will be effective. The monetary incentive from using the app should motivate these teenagers to complete this driving quality improvement study and, most importantly, drive safely (Brower et al., 2020). According to Delgado and colleagues (2018), a survey of high school students (n=153) showed 75% of students reported that a financial incentive is the most likely strategy to reduce texting while driving.

Chapter 2: Project Plan

Project Goals

1) Reduce the number of times Seniors at "W" High School use their cellphone while driving over 4-week period (measured and evaluated by objective 1).
2) Positively change student's perception of cellphones use while driving over a 4-week period (measured and evaluated by objective 2).
3) Incorporate distracted driving education and smartphone app ("Safe2Save") in future "W" High School's advisory class.

Project Objectives (Specific, Measurable, Achievable, Relevant, Time-based):

1) Collect and compare driving scores (total time driving and total number of distractions measured by number of times cellphone was unlocked while driving over 10mph) weekly:
    a) The goal of this project would be to achieve an increase in driving scores on the "Safe2Save" app by an average of 1 point each week. The higher the score, the safer the driving performance with a score of 100 indicating driving with 0 distractions.
2) Administer and compare pre-test (week 1) and post-test (week 4) Distracted Driving Survey (DDS) scores
    a) Achieve a decrease in DDS mean score by 1 unit on post-test. For every 1-unit decrease on the DDS, the odds of having a car crash decreases by 7% (Bergmark et al., 2016).

Context

This QI project took place at a high school that will be referred to as "W" High School to maintain confidentiality. It is a public high school serving 1,152 students grades 9-12. There are approximately 87 teachers with a student to teacher ratio of 13:1 over the last five years. "W" High School has a graduation rate of 96% and a minority enrollment of 28%. There are 665 staff members employed at "W" High School consisting of teachers, counselors, administrators, custodians, maintenance, nursing, coaches, paraprofessionals, lunch aides, and librarian assistants ("Public School Review," 2021). All senior students are required to take an Advisory class supporting students with academics, social and emotional issues, and plans for students' post-graduate plans. Advisory class occurs at the same time every Monday and the students are divided into small groups of 10-15 for this class. Students will be informed of the opportunity to

participate in this quality improvement project through a pre-recorded video their teachers will present during this class. Thus, all senior students will be informed of the opportunity to participate in the project. Eligibility for participation requires a valid driver's license, owning a smartphone, and parental/guardian consent. There are approximately 286 seniors' students at "W" High School.

Project Team Members and Roles

Tyler Webb, MS, M.Ed, the Vice Principal of "W" High School role is to coordinate key events for completion of the project which include displaying the video that creates awareness of the quality improvement project and scheduling a lecture in the auditorium for students regarding distracted driving. He will direct communication between faculty members at "W" High School regarding these events and the students who are participating. Katie Stanley, MS, M.Ed, is a Math teacher at "W" High School and co-investigator. Her role is to aid with students in how to download the "Safe2Save" app, distribute and collect surveys, and create awareness of the project through emails to students. Meagan Kamra, Director of Community Engagement for "Safe2Save" role is to collect students driving statistics on the "Safe2Save" app and provide the results to the PI, Kristen Mankus, at the completion of the project. She will also provide amazon gift cards to 1st, 2nd, and 3rd safest drivers who participated and completed the quality improvement project. Rosemary Johnson, DNP APRN is the academic partner, DNP project faculty advisor, and evidence-based practice expert.

Key Stakeholders, and Buy-in

The senior students at "W" High School are key stakeholders in this project. To get their buy in and increase participation in the study, the potential benefits of "Safe2Save" mobile app including increased driving safety and financial reward are emphasized through a pre-recorded

video prior to the start of the project. To get their buy in, guardians will need to sign parental consent that provides a summary of the project, the risks of distracted driving, and the benefits this smartphone application can provide. The support of staff from "W" High School was obtained through connections with practice mentor and Vice Principal of "W" High School, Tyler Webb, as well as co-investigator and math teacher, Katie Stanley. Buy in from the company "Safe2Save" which is based in Dallas, TX, was obtained through PI connections with Meagan Karma, Director of Community Engagement, who saw an opportunity for expanding their company to Connecticut through support of this project.

Chapter 3: Project Design and Methodology (EBP Process Steps 3-4)

Framework

This QI project will follow the Institute for Healthcare Improvement (IHI) Model for Improvement. The IHI's model uses rapid cycles of the Plan-Do-Study-Act. This model is a tool for accelerating improvement by setting specific aims, establishing measures, selecting changes, and testing those changes (Langley et al., 2009). The process mapping of this study using IHI's model can be found in Appendix D, PDSA Framework.

Plan phase. The PI met with practice mentor via zoom to coordinate how to best implement this project with students. Due to COVID-19, no visitors are allowed on school grounds and limited live communication with students. As a result, the PI used a pre-recorded video detailing the distracted driving project, sent emails, and had one live distracted driving class/lecture via Zoom.

Do phase. In this phase, students will download the Safe2Save mobile application and receive education on the risks of distracted driving. Students were informed of the details of this project through a pre-recorded video made by the PI. The video was displayed during the

students' Advisory class on October 25, 2021. The pre-recorded video was made to create awareness and promote participation in the project. This method was chosen so all senior students would be able to view the video on the same day and give all available students the chance to participate. The pre-recorded video emphasized and explained that participation was voluntary and would not affect students' grades, coursework, or academic outcomes at "W" High School. The pre-recorded video also addressed the benefits and risks associated with the project. Lastly, the pre-recorded video also explained that students and their parents must read and sign an informed consent to participate in the project. Informed consent was distributed by faculty at "W" High School after the video was presented in their Advisory class, see Appendix F.

Pre-DDS surveys were sent via an email in Google Format on November 1, 2021, by co-investigator. Due to low response rate the co-investigator distributed hard paper copies of the pre-DDS survey, instructing students who had not responded to the email to complete and return the hard copy to the co-investigator. Post-DDS surveys were sent via email in Google Format on January 4th, 2022, by co-investigator. Due to low response rate the co-investigator distributed hard paper copies of the post-DDS survey, instructing students who had not responded to the email to complete and return the hard copy to the co-investigator. Both Google Format emails and hard copies did not require students name, keeping all responses anonymous. An attachment of the pre- and post DDS collected demographic information on the sample population. This included participant's age, ethnicity, gender, number of months owning a driver's license, and prior motor vehicle accident involvement, see Appendix H.

The educational component, consisting of a lecture given by the PI occurred on December 20, 2021. This meeting was held during the students' Advisory class. Students who

submitted informed consent were granted permission by the practice mentor and Vice Principle, Tyler Webb, to attend a lecture on distracted driving. Students who attended this lecture met in the auditorium, and the lecture was given via Zoom. The placement of this educational class in the second week of the study allowed the PI to obtain baseline driving scores before the educational lecture. The goal of the class was to inform students of the potential consequences of distracted driving and improve their safe driving behaviors. The distracted/safe driving lecture consisted of a PowerPoint presentation that included statistics on teenagers and motor vehicle accidents, what distracted driving is, and ways to promote safe driving behaviors ("National Safety Council," 2021).

Study phase. Process measures included measuring students' perception of the risks of distracted driving before and after receiving the educational class through the distracted driving survey (DDS) (see Appendix E for DDS). The PI will gather and analyze driving behaviors through the Safe2Save application at the end of the project. Data will be sent directly from the app to the PI from Meagan Kamra. The goal of this project would be to achieve an increase in distracted driving scores on the "Safe2Save" app by an average of 1 point each week. The higher the score, the safer the driving performance with a score of 100 indicating driving with 0 distractions.

Act phase. The DNP student will revise process as needed based upon what is learned in the first PDSA cycle.

Possible Barriers

Potential barriers to implementation of this quality improvement project include receiving approval from key stakeholders such as "W" High School faculty and Superintendent, communication with students, and obtaining parental consent. Potential barriers to sustainability

may include lack of organizational support to incorporate distracted driving education and smartphone app ("Safe2Save") into "W" High School's curriculum. Plans to address barriers include outlining the risks and benefits of participation in the project in every email, video, and consent agreement, as well as having "W" High School teacher Katie Stanley as a team member to promote communication, collect consent forms, administer DDS, and assist PI with students.

Sustainment

To promote and maintain interest in using a safe driving app and student participation in the distracted/safe driving project, faculty at "W" High School were instructed to remind students to check their progress on the app "Safe2Save" every Monday during students' Advisory class. In addition, an email was sent by the co-investigator informing students that if they were able to confirm they had successfully downloaded the app and submitted the survey, donuts would be available for them in her classroom. Lastly, the company "Safe2Save" provided a financial incentive to 3 students with the best driving scores. Students were notified by email of driving score rankings by co-investigator at the end of the competition who would also distribute gift cards during school hours.

Dissemination

This quality improvement project and its outcomes will be summarized in an electronic poster presented to students and faculty at Sacred Heart University EBP-conference. An executive summary will be provided with the poster. A posterboard display at the entrance of "W" High School during the month of June 2022 will show students in the results of the distracted driving project from weeks 1 through 4. This would encourage and hopefully motivate students to continue using the app and invite their friends to use the app who were not part of the study. The executive summary will be sent as an email to the students who participated in the

project as well as project mentor. The goal is to have a smartphone application, like "Safe2Save" be incorporated into the advisory curriculum at Wethersfield High School. Lastly, the PI will email the executive summary to three local driving schools near the high school in the hopes that they will incorporate this information into their driving education program.

Timeline

Table 1

Project Timeline

Phase	**Key Actions**	**Activity**	**Person(s) Responsible**	**Completion Date**
Phase I: Assess Need	Determining senior students at "W" High School are a high-risk population for distracted driving and how this can lead to motor vehicle accidents.	Research of adolescent's driving behaviors. Research of adolescent's perception of distracted driving. Develop PICO Question.	Mankus, K.	February, 2021
Phase II: Planning Microsystem Level	Discuss distracted driving education and "Safe2Save" application with Sarah Harris, Instructional Supervisor of Technology at "W" High School, to gain approval for study	Approval from administration to pursue "Safe2Save" smartphone application to reduce distracted driving among high school students.	Mankus, K.	February, 2021
Phase III: Appraisal of evidence education	Discussions held with EBP instructor Dr. Johnson to appraise and discuss articles from the review of literature	Appraisal of evidence	Mankus, K.	February, 2021

Phase IV: Appraisal of evidence	Articles reviewed and critically appraised	Appraisal of evidence	Mankus, K.	February, 2021
Phase V: IRB process and project planning	Discussion Administration of "W" High School, Vice Principle, Thomas Moore and Super Intendent Michael Emmet. Discussion with Project advisor Dr. Rosemary to outline project information.	Rough draft of project outline.	Mankus, K.	March, 2021
Phase VI: Presentation Proposal and IRB deliverables	Create project proposal and IRB deliverables.	Create project proposal power point presentation, Distracted Driving education power point, Distracted Driving Survey, deliver to IRB and project advisor	Mankus, K.	April, 2021
Phase VII: Implementation	Obtain guardian/student consent, obtain baseline data, have students download "Safe2Save, and deliver education.	Obtain students baseline perception regarding distracted driving through DDS survey and complete distracted driving educational PowerPoint	Mankus, K.	November-December 2021
Phase VIII: Implementation	Obtain students driving scores from "safe2Save"	Students will be given second DDS survey to fill out and	Mankus, K.	January, 2022

	application weekly for 4-week period.	complete 1 month after start of study.		
Phase IX: Evaluation	Analysis of collected data	Principal Investigator and Project Advisor will synthesize the results from the DDS survey and driving scores to characterize statistics determining the results of distracted driving education and "Safe2Save" application.	Mankus, K.	February, 2022
Phase X: Dissemination	Deliver study results to "W" administration and through email and newsletter.	A newsletter will be drafted with the results of the analyzed data and details of the study given to the Administration of "W" High School. The goal is to have this study incorporated into the High School Curriculums advisory class for future students if results are successful.	Mankus, K.	April, 2022

Resources

Table 2 describes the anticipated costs for project implementation and evaluation. The Principal Investigator will be putting together the educational power point unpaid. Education will

be done by the Principal Investigator during scheduled classroom hours. Materials created or utilized by the Principal Investigator will be electronic which will add no additional costs. Surveys will be sent and submitted anonymously through Google Format as well as hard paper copies. The “Safe2Save” smartphone application is free to download for students which will add no further costs. Total cost for this project will be approximately $5 for paper surveys.

Table 2

Cost analysis

Expenses	
“Safe2Save” Smartphone Application	$0
Education PowerPoint Material	$0
Distracted Driving Scores Survey (combination of Google Format email and hard paper copies)	$5.13
Total Estimated Cost	$0

Review for Ethical Considerations

This project involves education and use of smartphone application for students at “W” High School. This project does not require Sacred Heart University Institutional Review Board approval because it is a quality improvement project, see Appendix G, Differentiating Quality Improvement and Research Tool. It does require approval from Principal of “W” High School, Thomas Moore and Superintendent Mr. Michael Emmett which has been acquired. Since this study involves participants under the age of 18 years, students will need guardian or parental consent to participate.

Chapter 4: Project Implementation, Evaluation, Outcome, Results

Project Implementation

There are two interventions for this project. One intervention is to have students download and use the “Safe2Save" driving app daily throughout the study period December 6, 2021-Janruary 1,2022 (total of 4 weeks). Students will be entered into a “driving competition” automatically through the Safe2Save app when they download the app and enter the access code “W”. This allowed the “Safe2Save” app to collect driving data on participants. This allowed students to view their progress and compare their scores to other students. All information was de-identified through the username students choose to use when they download the app so students will not be able to discern which driving scores belong to whom. The second intervention included an educational PowerPoint lecture that reviews the risks of distracted driving while using cellphones two weeks after the competition has started on December 20, 2021. There was one survey instrument, the DDS, which was administered at baseline and end of the safe-driving program.

There were two outcomes for this QI study. The first outcome was to track and compare distracted driving scores on a weekly basis. The last outcome was to measure and compare distracted driving perception at pretest and post-test using the DDS.

Lastly, there was a monetary incentive given to the top 3 students with the best driving scores. This monetary reward will be in the form of a gift card provided by the developers of the "Safe2Save" smartphone app. The developers of the "Safe2Save" are based in Dallas, Texas and partner with local businesses in the area to provide all drivers with financial incentive not to use cellphones while driving. The company's goal is to expand their partnership with businesses throughout the country. Currently, however, this company has limited partnership with local businesses in Connecticut. Therefore, they have offered to provide three gift cards to best three teen drivers as a financial incentive to drive safe.

Barriers to Implementation

Student interest

The most significant barrier was gaining students' interest to participate in the distracted/safe driving project. To improve participation and interest, it was emphasized in the pre-recorded video, all announcements, and emails prior to the study that goal of this project was not to get students in trouble or affect their academic outcome, but to enable them to become safe drivers. Additionally, there was potential financial benefit for all participants which was the three safest drivers would receive gift cards from "Safe2Save". However, only 44 out of the 286 eligible seniors expressed interest in the project by submitting informed/parental consent.

Student attrition rate

Student attrition was another barrier faced during this project. The investigators of the project had a difficult time getting students to complete the task required, which was to submit

pretest DDS and download the "Safe2Save" app. To reduce this barrier, co-investigator, Katie Stanley sent emails to students to let them know they could stop by her classroom, and she would assist them in downloading the app. The email also stated she would bring in donuts for students who were able to show Ms. Stanley they had downloaded the app and submitted the DDS pretest. Despite all these attempts, 15 out of the 44 students, who initially showed interest in the project submitted the DDS pretest and 14 students downloaded the "Safe2Save" app on their phones.

Maintaining students' interest and participation during the study is another factor that contributed to dropout rates. To reduce attrition, every Monday, during the students' advisory class, an announcement was made to remind students to monitor their driving scores on the "Safe2Save" app, to use the app, and to continue to drive safely. Yet, students did drop out of the project. One participant had a driving score of 0, meaning the participant either never drove or had left their setting on the mobile app to "passenger settings" so the app would not gather this participant's data. Four participants deleted the app by week 1 and two participants had deleted the app by week 2, leaving a total of 7 participants to complete the 4-week project.

Parental Consent

An additional barrier to consider was guardians' approval and informed consent. To reduce this barrier, the informed consent emphasized the goal of this project: to enhance their children's driving safety and that the "Safe2Save" app posed no potential harm to the students.

Poor Communication between Students and Project Leader

Due to COVID-19, on-site visitation with students was not allowed. As a result, the project leader was unable to communicate with students in-person. Unfortunately, live video stream communication with students was not possible. This led to pre-recorded video about the project and limited students' ability to ask questions or have the PI receive feedback about the

project. The first time the PI received live feedback from students was during week 2 of the project on December 20, 2021. On this day, the PI taught live distracted/safe driving educational class. Students who showed initial interest, by submitting parental consent, had never downloaded the app by this point or had deleted the app before the safe driving project ended.

Survey responses

Pre and post DDS survey responses were anonymous to maintain confidentiality of each student participating. However, student response to the survey was poor. Out of the 44 students who consented to participation, only 15 responded to or completed the pre-test survey. The response rate for the post-test survey was lower. Only 6 students completed the post-test survey.

Data Collection

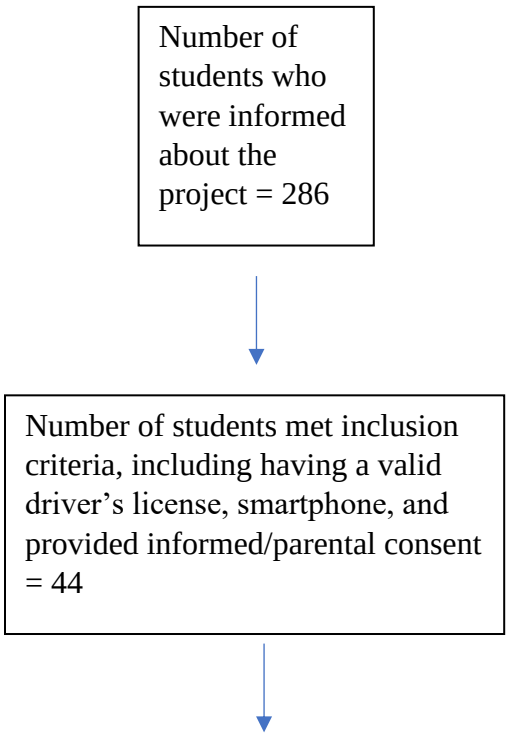
On October 25, 2021, all eligible students were given consent forms to have parents review and sign. They were instructed to return signed consent forms after one week (by November 1, 2021) to Mrs. Stanley, co-investigator. A total of 44 students consented to participate in the distracted/safe driving study. As a result, an email was sent to each student by the co-investigator giving them step by step instructions on how to download the "Safe2Save"app and instructions on how to complete the initial DDS.

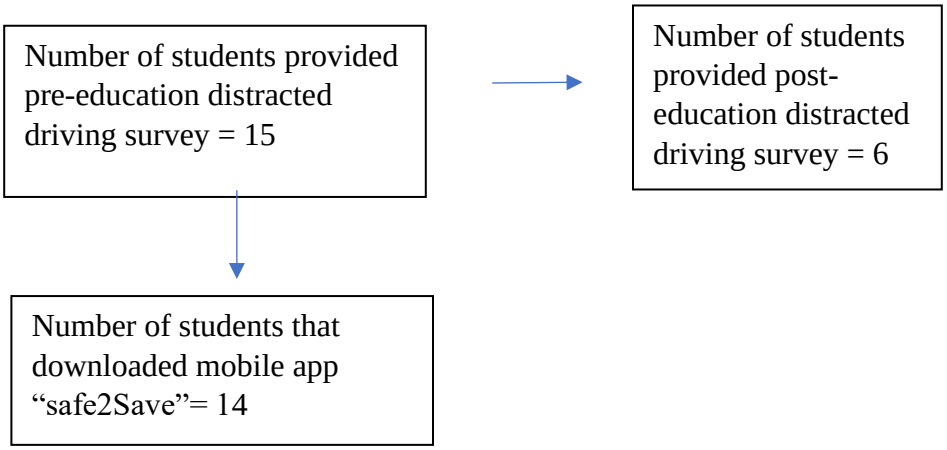
A follow-up email was sent to the 44 students who consent to participate on November 9, 2021, because few students had downloaded the app or completed the DDS pretest and demographics form. The second email reiterated how to download the "Safe2Save" and reminded students to complete the DDS pretest and demographics form. At this time, the co-investigator had also distributed hard paper copies of the pre-DDS survey, instructing students who had not responded to the email to complete and return the hard copy to the co-investigator. As a result, students had 5 weeks to download the "Safe2Save" app and hand in the DDS pretest.

A total of 15 students completed the DDS pretest and demographics questionnaire, and 14 students downloaded the “Safe2Save” app when the data collection for driving scores began on December 6, 2021.

Recruitment for the study was by convenience sampling of seniors who attended the Advisory Class at “W” High School. Data collection transpired from November 2021 to through January 2022. Figure 1 outlines the number of eligible students for the study and the total number of students enrolled at the beginning of the study. Two hundred and eight-six students was eligible for enrollment. Forty-four agreed to participate with parental consent, fifteen followed through with submitting the distracted driving survey, and 14 downloaded the “Safe2Save” mobile app at the start of the study.

Figure 1 *Students enrolled in study*





The study ended two weeks after the second meeting on January 1, 2022, and data collection on driving scores stopped. All scores were taken directly from the app by Meagan Karma, and sent to the PI, at the end of the competition in the form of an excel spreadsheet. The DDS post-test was sent out via Google format and copies were also distributed by the co-investigator on January 4, 2022. An attachment of the DDS post-test collected demographic information on the sample population. This included participant’s age, ethnicity, gender, number of months owning a driver’s license, and prior motor vehicle accident involvement. Students had three weeks to submit survey responses by January 21, 2022.

Evaluation

Outcome Measurements

The pre- and post-education survey was utilized to measure distracted driving behavior perception. The DDS is an 11-item scale that measures perceptions of cell phone use related to distracted driving risk, see Appendix E, Distracted Driving Survey. The DDS demonstrated strong validity and reliability. Excellent internal consistency was shown with Cronbach’s alpha at 0.93 and test-retest reliability at 0.82. Results are obtained through a Likert scale with students receiving 0 points for never participating in high-risk behavior and 4 points for always

participating in high-risk behavior in each item of the survey. Therefore, the higher the DDS score the riskier the driving behavior. According to Bergmark et al. (2016), for every 1-point on the survey there is a 7% chance of having an accident. The highest potential score an individual can receive on the survey is 68, leading to a 476% chance of having an accident (68x7). The lowest score an individual can receive is 0, leading to a 0% chance of having an accident. The students driving scores from the "Save2Save" app were sent to the PI at the end of the competition from Meagan Karma, Director of Community Engagement, for the "Safe2Save" company.

Descriptive statistics such as mean and standard deviation, along with frequency and percentage, and flow charts and graphs were utilized to analyze and report demographics (refer to Table 3 and 4), driving scores (refer to Table 5), and scores from the DDS. The potential for missing data was also collected. Missing data is addressed in Table 11. Analysis of data will be performed by PI with supervision of the Project Advisor, Dr. Johnson.

Table 9 depicts patient demographics and baseline characteristics from the DDS pre-test. Table 10 depicts patient demographics and baseline characteristics from the DDS post-test. Most of the students were white and female. There was no real difference in age or baseline driving experience.

Table 3. *DDS Pretest Demographics (total n= 15)*

	f	**%**
Age:		
Less than 18	*11*	*73.3*
greater than or equal to 18	*4*	*26.7*
Ethnicity:		
African American	*1*	6.7
Caucasian	*13*	*86.7*
Hispanic	*1*	*6.7*
Asian	*0*	*0*

Other	*0*	0
Gender:		
Female	*10*	*66.7*
Male	*5*	*33.3*
Nonbinary	*0*	*0*
Number of month's student has driver's license:		
0 to 3 months	*0*	*0*
4 to 7 months	*11*	*73.3*
8 to 12 months	*4*	*26.7*
Number of prior motor vehicle accidents (as the driver, not a passenger):		
0	*14*	*93.3*
1 to 2	*1*	*6.7*
>2	*0*	*0*

Table 4. *DDS Post-test Demographics (total n= 6)*

	f	**%**
Age:		
Less than 18	*4*	*66.7*
greater than or equal to 18	*2*	*33.3*
Ethnicity:		
African American	*0*	0
Caucasian	*6*	*100*
Hispanic	*0*	*0*
Asian	*0*	*0*
Other	*0*	0
Gender:		
Female	*5*	*83.3*
Male	*1*	*16.7*
Nonbinary	*0*	*0*
Number of month's student has driver's license:		
0 to 3 months	*0*	*0*
4 to 7 months	*0*	*0*
8 to 12 months	*6*	*100*
Number of prior motor vehicle accidents (as the driver, not a passenger):		

0	*6*	*100*
1 to 2	*0*	*0*
>2	*0*	*0*

Results

QI Study Question 1

1. What was the effect of using a mobile app that provides financial incentive had on using a cellphone while driving?

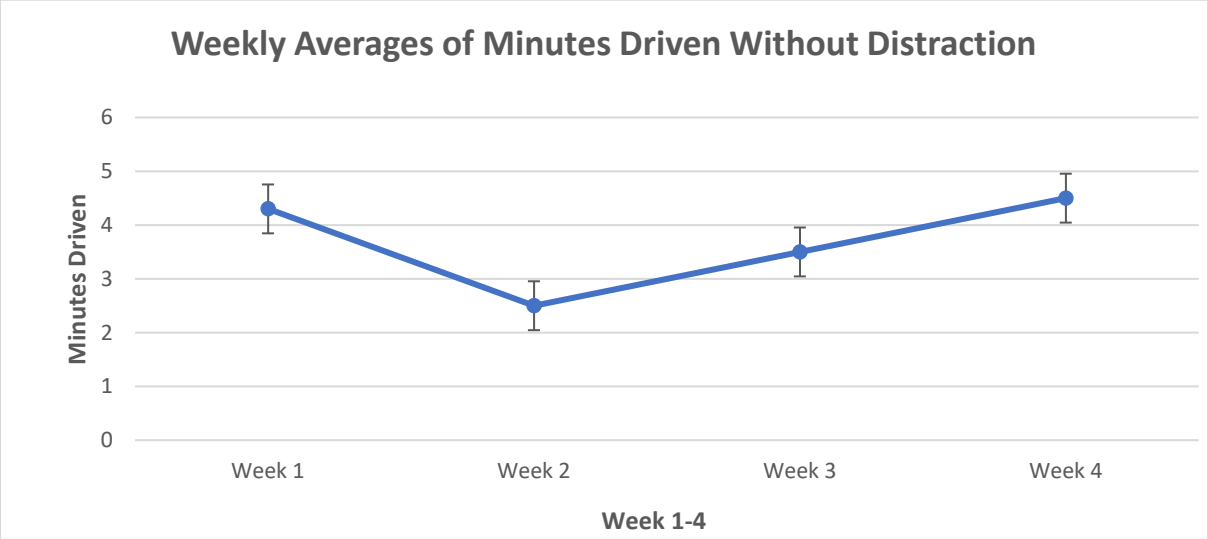
Table 5 displays the student's usage of a cellphone while driving over 10pmh. The 'Safe2Save" app gives users a driving score that is determined by calculating the number of minutes a participant has driven, the number of times they unlocked their cellphone during those minutes driven and gives them points for every minute driven without using their cellphone. Descriptive data is presented for this information, giving the average of the data collected from all students over a 4-week period time frame, December 6, 2021 – January 1, 2022. Missing data is represented in this table for students who dropped out early from the program. One participant had a driving score of 0 throughout the entire project, meaning the participant either never drove or had left mobile app setting on "passenger" so the app would not gather this participant's data, essentially disqualifying them from data collection. Four participants had deleted the app by week 1 and two participants had deleted the app by week 2, leaving 7 participants to complete the 4-week project. Information from Table 5 depicted as a line graph in Figure 2 representing the weekly average students would drive without unlocking their cellphone. This was calculated by taking the cumulative minutes driven and dividing by number of distractions that occurred per given week. For example, week 1 students drove for 301 minutes which was then divided by the

number of distractions 74, resulting in students driving on average for 4 minutes and 6 seconds without unlocking their cellphone.

Table 5. *Weekly averages and missing data for driving scores, distractions and minutes driven (n=14)*

Week	**Scores** M (SD)	**Distractions** M (SD)	**Minutes** M(SD)	**Missing** f (%)
1	86 (9.7)	74 (85.1)	301 (175.2)	1 (7%)
2	84 (9.9)	112 (183.1)	319 (186.7)	5 (36%)
3	85 (7.9)	148 (202.5)	533 (261.9)	8 (57%)
4	88 (6.9)	59 (58.6)	273 (151.2)	7 (50%)

Figure 2. *Weekly averages of minutes driven without a distraction (unlocking their cellphone) (n=7)*

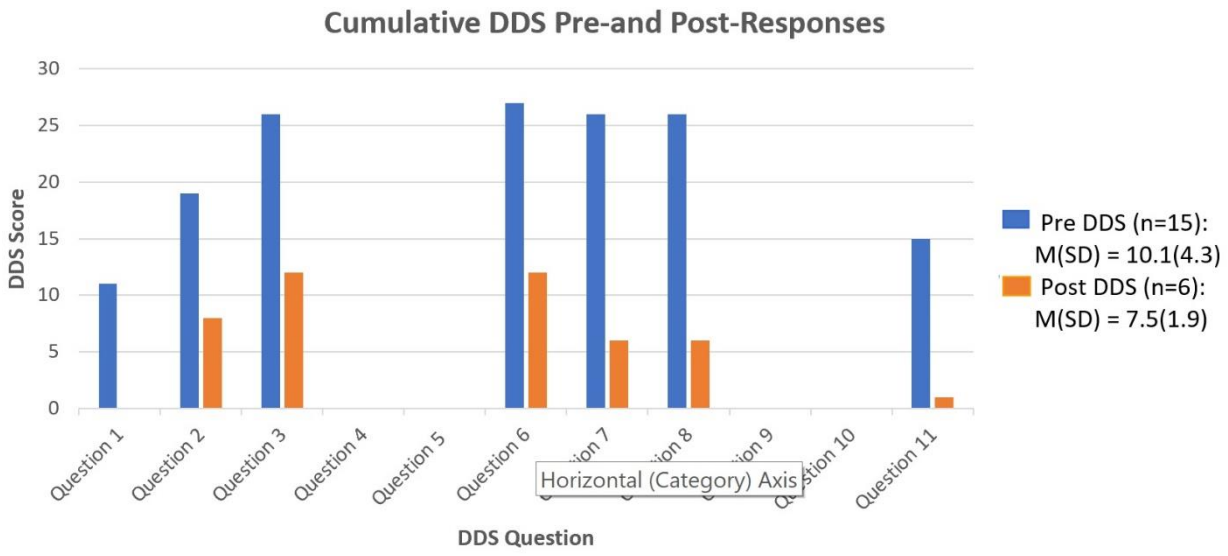


QI Study Question 2

1) What is the effect of education on the perception regarding distracted driving behaviors?

Figure 3 represents the students' perception regarding how often they use their cellphone while driving before (n=15) and after (n=6) the educational program with downloading the driving app. I was unable to compare the students who had completed both pre and post survey due to the survey responses being anonymous. Figure 3 bar graph demonstrates the cumulative score for each DDS question of every student's response before and after implementation. The x-axis represents the 11 questions on the DDS survey. The y-axis represents the sum of scores for each student that had submitted a response.

Figure 3. *Cumulative Distracted Driving Survey (DDS) pre- and post- responses*



Discussion

The participants of this project were asked to download the "Safe2Save" mobile app on their cellphones for a 4-week period and complete a pre-and post-survey regarding their perceptions on distracted driving. COVID-19 zero policy restriction on school grounds affected the communication between investigator and the students. Communication was carried out with a

pre-recorded video shown to students with verbal instructions on how to download the app, a follow-up email with written step by step instructions on how to download the app, a Zoom meeting with students in the second week of the project providing education, and a final email at the end of the program.

Data from Safe2Save mobile app: Figure 2 shows students increased the amount they looked at their cellphone during week 2 (every 2.8 minutes) compared to week 1 (every 4 minutes). After the education lecture, during the second week, students had a steady decline in distracted driving. The amount students unlocked their cellphones while driving decreased from every 3.6 minutes to every 4.6 minutes in week 3 and 4 respectively. Therefore, the app with financial incentive alone did not improve outcomes, but the education provided had a positive impact. Contributing factors to these results include the dropout rate going from 14 students actively using the app in week 1 to 7 students in week 4. Clarification on attrition was not obtained due to the data being deidentified. Also, miscommunication and confusion of how the app works was not fully clarified until week 2 when students had a Zoom conference with the PI.

Data from pre- and post-Distracted Driving Survey (DDS): Figure 3 represents the pre and post DDS scores measuring student's perceptions of cell phone use related to distracted driving risk. The pre-survey had 15 participants. Based student responses to the DDS, most common distracted driving behavior was viewing cellphone for maps or directions (score 27) followed by reading or writing a text message (score 26). On the DDS post-intervention, the most common distracted driving behaviors remained the same. The 6 students who completed the DDS post-test continued to view maps or read text messages both receiving a score of 12. The cumulative pre-test score was 153 and the post-test score was 44 with an average score of 10.1 and 7.5 respectively. Unfortunately, the investigators were not able to compare pre and post surveys due

to the reduced post-test response and survey results being anonymous. However, it is interesting to take note of the responses from question 1 pre-and post-DDS, asking students if they believe they could safely text and drive. Pre-DDS cumulative score was 11 and the post-DDS score was 0, meaning all students from the post-DDS thought it was unsafe to text and drive.

Chapter 5: Dissemination

Implications of Project Results to Organization and Practice Community

Distracted driving has become a major public safety issue with the proliferation of mobile technology and the in-dash features of modern vehicles with ¼ of all motor vehicle accidents involving the use of mobile devices (Fluker, 2019). Interestingly, the use of mobile applications has shown impacts on behavioral change that contribute for positive results in the state of health (Rodrigue et al., 2020). This connection could give insight to an innovative method to reduce the use of cellphones while driving by downloading a mobile app that encourages users to refrain from this behavior.

This quality improvement project which had high school students download the mobile app Safe2Save showed a positive effect in weeks 2-4 with a reduction in the use of cellphones while driving. However, there was an increase in the amount students used their cellphones in weeks 1-2, making results inconclusive if the app truly had an effect on their behavior. Pre and post surveys regarding the students' perceptions about distracted driving were not compared due to the attrition rate and anonymity of survey responses. High attrition rate in this sample population is common. A systematic review by Farris et al. (2020), explains how one third of adolescents enrolled in randomized control trials will not complete participation (Farris et al., 2020).

Pre and post survey responses of this QI project reported the most prevalent use of a cellphone while driving was for reading maps followed by reading text messages which did not change post-education. Similar to the study by Delgado et. al (2017), that showed most teens are willing to refrain from behaviors such as viewing social media while driving (99%) but unwilling to give up navigation (59%) even with technological and behavioral economic strategies to reduce cellphone use while driving. The strategy reported as most likely to reduce cellphone use while driving was through financial incentives (75%) (Delgado et al., 2017). The findings from this QI study shows evidence that incorporating the "Safe2Save" app and safe driving education into the driving curriculum is beneficial.

Key Lessons Learned

One of the key lessons learned is the importance of good communication between team members for all phases of the project. Strong communication was necessary for creating awareness of the project to have students participate. Open communication throughout the project can increase or decrease the student's enthusiasm to carry out all interventions of the project. The communication barrier that existed during this project created immense obstacles such as students not knowing how to download the app or fully understand the details of how the app worked once downloaded.

Second key lesson learned is the flexibility required to implement a quality improvement project. Challenges such as the project not being a priority for the school and not being a faculty member meant that dates of interventions were subject to change depending on the needs of the school. The PI also had to coordinate with faculty on how these interventions would work for them as the QI project was taking up their class time and interrupting their school schedule. These factors helped build interprofessional and collaboration skills.

Dissemination and Sustainability Plan

Students' usage of cellphones both increased and decreased throughout the 4-week program indicating the app did not have a significant impact on their use of cellphones while driving. Analyzing the pre and post DDS surveys was inconclusive due to student attrition rate and anonymity of responses. QI projects require multiple attempts and modifications to create change. The PDSA cycle can be used in future projects to adjust for more successful implementation. Reducing barriers include increasing communication between project leader(s) and students as well as requiring usernames for surveys to allow comparison of pre and post data. Behavioral change such as reducing the amount a person uses a cellphone while driving is an accomplishment that takes time and continued effort. According to the transtheoretical model, people go through different stages of motivation to modify a behavior considered a problem. Going through these changes takes work, occurs in phases, and individuals may have setbacks (Santiago et al., 2021). In conclusion, the dissemination of this quality improvement project includes creating and presenting an EBP poster to Sacred Heart University, a poster displayed at the entrance of "W" High School to encourage sustained behavioral change among students for 1 month in June 2022. An executive summary of the project will be sent as an email to the students who participated in the project as well as project mentor and Vice Principal of "W" High School. The PI would encourage education on distracted driving with the use of mobile apps be incorporated into the Advisory curriculum at "W" High School. Lastly, the executive summary will be emailed to three local driving schools near the high school in the hopes that they will incorporate this information into their driving education program.

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Appendix A

Description of Evidence Search

The PICO question for this QI project is: In teenage drivers (P) does using a mobile driving app (I) compared to not using a mobile driving app (C) have an impact on cellphone use while driving (O)?

A search of the following databases was conducted; CINAHL, MEDLINE, Cochrane Database of Systemic Reviews. The key words searched were: driving, motor vehicle accidents, distraction, cellphone, mobile application, smartphone, apps, teens, adolescents, teenagers, high-school students. Distracted driving and adolescents narrowed initial searches. Limits/Filters for all searches pertaining to distracted driving included, English language, peer reviewed, Boolean phrase, full text, published between 2015-2021. Tables 1-3 below display database, search terms and results of search.

Table 6

Search Terms and Search Results by Database [CINAHL]

Search Terms	Number of hits	Number of title & abstract reviewed	Number of full-text articles reviewed	Number of articles selected for this review without duplicates
Driving and distracted	101	n/a	5	1
Driving and cellphone	36	n/a	8	3
Driving and applications	308	n/a	4	0
Driving and health app	2	n/a	1	1
Driving and e-health	3	n/a	1	1
Driving and smartphone	39	n/a	4	2
Smartphone app	905	n/a	0	0
Smartphone app and health	409	n/a	7	3
Mobile app and behavioral change	142	n/a	4	2

Driving and teens	66	n/a	3	2
Driving distracted and teen	8	n/a	2	2
Driving and adolescents	22	n/a	3	1

Table 7

Search Terms and Search Results by Database [MEDLINE]

Search Terms	Number of hits	Number of title & abstract reviewed	Number of full-text articles reviewed	Number of articles selected for this review without duplicates
Driving and distracted	347	n/a	3	0
Driving and cellphone	26	n/a	4	1
Driving and applications	2585	n/a	2	0
Driving and health app	11	n/a	2	1
Driving and e-health	8	n/a	1	1
Driving and smartphone	143	n/a	4	2
Smartphone app	2050	n/a	0	0
Smartphone app and health	1520	n/a	3	0
Mobile app and behavioral change	87	n/a	3	1
Driving and teens	131	n/a	1	0
Driving distracted and teen	26	n/a	4	2
Driving and adolescents	110	n/a	0	0

Table 8

Search Terms and Search Results by Database [Cochrane Database of Systemic Reviews]

Search Terms	Number of hits	Number of title & abstract reviewed	Number of full-text articles reviewed	Number of articles selected for this review without duplicates
Driving and applications	2	n/a	0	0
Driving and health app	1	n/a	0	0
Smartphone app	6	n/a	1	0

Smartphone app and health	6	n/a	1	0
Mobile app and behavioral change	1	n/a	1	0
Driving and teens	1	n/a	1	0
Driving and adolescents	6	n/a	1	0

To conclude, CINAHL yielded the most useful results while MEDLINE produced useful results with several duplicates. The Cochrane Database no results.

Appendix B

Evidence Summary

Search Question in PICOT format: In teenage drivers (P) does using a mobile driving app (I) compared to not using a mobile driving app (C) have an impact on cellphone use while driving (O)?

Table 9

Evidence Summary Table

Article number	First author year	Purpose	Evidence type level of evidence	Sample/setting	Major variables study and their definitions	How major variables were measured	Findings that help answer the question	Worth to practice/ project, quality of evidence
1	Monroe et al.(2020)	The purpose of this study was to evaluate if teen driving educations events (speech from state trooper, mother whose child died in accident, young adult paralyzed from	Prospective Observational Study level 5	397 students across 4 schools in Alabama in 2018. 1304 students across 9 schools in Alabama in 2009.	Wearing a seatbelt Texting while driving Drinking while driving Going over 10 mph over the	Teen driver questionnaire adapted from CDC National Youth Risk Behavioral Survey	Results from 2018 compared to 2009: 69% vs 36% reported always wearing a seatbelt 78% vs 33% reported texting	Teen driving educational events are an effective strategy to increase adolescent drivers’ awareness of safe driving practices. An alarming number of teens still report risky

		crash) effected the prevalence of high-risk driving behaviors (including non-use of seat belts, texting and drinking while driving) among teens over a nine-year period in a single state.			speed limit .		while driving. 97% vs 88% never drink while driving 59% vs 55% reported going over 10mph of the speed limit	driving behaviors in this study. Persistent efforts to increase public awareness of teen driving safety issues is indicated.
2	Adeola (2016).	“Get the Message: A Teenage Distracted Driving Program” was established to identify, define, and measure the factors that	Qualitative single study level 6.	A convenience sample of 1,238 teenagers was obtained through a partnership between the CIPP, the National Youth Leadersh	Participants who engaged in forms of distracted driving defined by: Making or	Pre and post education survey responses were entered into an electronic database.	Pre-survey 47% reported making or answering phone calls 34% reported reading	The distracted driving program demonstrated the effectiveness of a distracted driving program in promoting healthy driving

		contribute to teen distracted driving by surveying teens who attend an educational program. The purpose of this research is to examine the protective factors and program measures that may influence teenagers’ perspectives about safe driving habits.		ip Forum, and the Georgetown University Summer Program which prepare students for the transition to college. This study represented all 50 states in the United States, the District of Columbia, Puerto Rico, Canada, and 21 other countries.	answering phone calls Reading a text message Sending a text message		text messages 21% reported sending a text while driving. Pre-education 66% unlikely to use their phone while driving Post education 92% reported being unlikely to use phone while driving.	behaviors in teens.
3	Yang et al (2021)	This study aims to evaluate the application of	Systematic Review Level 1	Thirty-eight articles involved 2,709 controls and	Diabetes Management defined by HgA1c and	Measurement of fasting glucose	WeChat group had a lower level in fasting plasma	Patients' understanding of the disease and satisfacti

		WeChat mobile app based on clinical research data, provide clinical evidence for medical staff and promote the self-management of patients with diabetes.		2,709 patients who used WeChat	fasting glucose levels. Self-efficacy of diabetes management defined by diet, exercise, medication taking, monitoring of glucose, and foot care	and HgA1c Summary of diabetes self-care activities (SDSCA) scale The Short Form-36 (SF-36) Health Survey measure Diabetes Management Self-Efficacy Scale (DMSES	glucose (FPG in mmol/L; MD: 1.36, 95% CI 1.10-1.62, P <.00001) and HbA1C (MD: 1.07, 95% CI 0.86-1.27, P <.00001). Self-efficacy scale improved significantly, including diet score (MD: −1.31, 95% CI −1.77 to −0.86, P <.00001), exercise score (MD: −1.92, 95% CI −2.44 to −1.40, P <.00001), medicati	on with follow-up increased significantly, whereas the incidence of adverse reactions and complications decreased. What is new and conclusion: WeChat follow-up appears to be helpful to improve the level of blood glucose and self-management, reduce the incidence of adverse reactions and complications, and

							on taking score (MD: −1.45, 95% CI: −1.94 to −0.97, P <.00001), monitoring of blood glucose score (MD: −1.17, 95% CI −1.83- −0.51, P =.0005) and foot care score (MD: −1.71, 95% CI −2.08 to −1.34, P <.00001)	improve the satisfaction rate of patients with type 2 diabetes.
4	Kiyarosta et al.(2020)	This study was conducted to determine the effective	Randomized control trial. Level 2	120 patients with HF in the intensive care unit of Firoozgar	Self-care behavior as defined by exercise, low-salt	Self-report and case reviews of their medical records.	There was a statistically significant difference between	According to the results, the self-care behavior among patients

		ness of using the smartphone app "My Smart Heart" on self-care of patients with HF.		Educational-Medical Center	diet, taking medications, monitoring weight, and reporting symptoms to provider.	The data were collected using a Demographic Information form and the European Heart Failure Self-Care Behavior (EHFSC) Questionnaire	groups in terms of the mean score of self-care after the intervention where the mean score in the intervention group was lower ($p<0.001$) which indicates better self-care. Based on the results, the intervention effect was reported at 0.787	with HF improved after the intervention compared to the control group. The results of this study suggest that the smartphone application was able to improve the self-care behaviors of people with HF
5	Lunde et al. (2018)	The aim of this study was to review and assess the effectiveness of app-based	Systematic review Level 1	9 studies including randomized and nonrandomized controlled trials that included patients aged 18	Lifestyle outcomes defined as physical activity, physical fitness, modification of dietary	All studies included in the meta-analyses were evaluated using the Grading of	Five of 8 studies evaluating HbA1c reported statistically significant differences between	Our review demonstrated limited research of the use of smartphone apps for NCDs

		interventions, lasting at least 3 months, to promote lifestyle changes in patients with Non-Communicable Diseases.		years and older diagnosed with any of the four main NCDs of cardiovascular diseases, cancers, chronic pulmonary diseases, and diabetes mellitus.	habits, and quality of life. Meta-analyses were conducted for one of the outcomes (glycated hemoglobin, HbA1c)	Recommendations Assessment, Development, and Evaluation (GRADE)	groups in favor of the intervention groups One of 3 studies evaluating waist circumference reported a statistically significant effect between groups in favor of the intervention group. Additionally, 1 study reported a statistically significant within group change for the intervention group One of 5 studies evaluatin	other than diabetes with a follow-up of at least 3 months. For diabetes, the use of apps seems to improve lifestyle factors, especially to decrease HbA1c. More research with long-term follow-up should be performed to assess the effect of smartphone apps for NCDs other than diabetes.

							g body weight reported statistically significant differences between groups in favor of the intervention group, and 2 studies reported a statistically significant change in body weight within the intervention groups.	
6	McDonald et al. (2019)	The purpose of this study was to describe novel smartphone-based measures of cell	Randomized control trial. Level 2	16 adolescents aged 16-17 in Pennsylvania.	Cell phone usage defined by cell phone screen off/on, cell phone screen	A commercially available cell phone monitoring device (Cellcontrol	5,624 miles in 705 trips, 964 cell phone unlocks, and 146.22 minutes	Smartphone-based applications are an innovative means by which to collect continuous data

		phone use while driving in a sample of newly licensed adolescent drivers.			locked/unlocked, phone call dialing activity, phone call answering, call time length,	DriveID) paired with a smartphone application was used to collect data on cell phone use while driving and driving exposure	of call time.	on cell phone use while driving that can be used to better understand and intervene on this frequent behavior in newly licensed adolescent drivers.
7	Delgado et al. (2018)	The goal of this study was to determine attitudes of teen drivers who admit to texting while driving about strategies aimed at reducing cellphone use while driving	Qualitative single study level 6.	153 adolescents aged 16–17 living in Pennsylvania who owned smartphones and admitted to texting while driving completed an online survey	willingness to give up cellphone use while driving (e.g., texting, e-mail, music, and navigation applications); (2) perceptions of effectiveness of various behavioral intervent	Survey instruments measured willingness to give up cellphone use and perceptions of technological and behavioral economic strategies to reduce cellpho	Most teens were willing or somewhat willing to give up reading texts (90%), sending texts (95%), and social media (99%) while driving. However, they were not	Promising strategies for increasing acceptance of cellphone blocking technology among teen drivers include automated screen locking and permitting hands-free navigatio

					ions to discourage phone use while driving, including financial incentives and social incentives, particularly novel approaches designed using insights from behavioral economics; and (3) perceptions of benefits of cellphone blocking technology, features they would be intereste	ne use while driving. We used chi-square tests to test the hypothesis that willingness to give up certain types of cellphone use while driving and the perceptions of strategies to reduce cellphone use while driving would differ by self-reported frequency of texting while driving in the past 30 days	willing to give up navigation (59%) and music applications (43%). Those who engaged in high-frequency texting while driving were more likely to say that they were not willing to give up navigation applications (73 vs. 44%, P < .001), music applications (54 vs. 32%, P < .001), and reading texts (15	n and music combined with behavioral economic incentives to sustain engagement.

					d in adopting, and reasons for not using cellphone blocking technology.		vs. 4%, P = .029). Overall, the following strategies were rated as likely to be very effective for reducing texting while driving: gain-framed financial incentives (75%), loss-framed financial incentives (63%), group-based financial incentives (58%), insurance discounts (53%), automatic phone locking while driving (54%), e-mail	

							notifications to parents (47%), automated responses to incoming texts (42%), peer concern (18%), and parental concern (15%).	
8	Friedlin et al. (2018)	The purpose of this work was to evaluate the utility of a simple, nonproprietary iPhone app to assess teenage Kinetic Risky Driving behavior.	Case study, expert opinion. Level 7	The iPhone and Android devices were dashboard-mounted in a vehicle equipped with the DAS instrumentation.	The experimental protocol consisted of driving maneuvers on a test track, such as cornering, braking, and turning that were performed at different acceleration levels	The iPhone gForce app recorded linear acceleration (gravity-corrected). The Android app recorded gravity-corrected and uncorrected acceleration measurements,	Averaging the correlation coefficients for all maneuvers, the longitudinal and lateral acceleration measurements between iPhone and DAS were rlng=0.71 and rlat=0.83,	The gForce iPhone app reliably assessed elevated g-force events compared to the DAS. Collectively, the gForce app and iPhone platform have the potential to serve as feature-rich, inexpensi

					(mild, moderate, or hard).	and the DAS device recorded gravity-uncorrected acceleration measurements. Lateral and longitudinal acceleration measures were compared.	respectively, while the corresponding acceleration measurements between Android and DAS were rlng=0.95 and rlat=0.97. The correlation coefficients between lateral accelerations on all three devices were higher than with the corresponding longitudinal accelerations for most maneuvers.	ve, scalable, and open-source tool for assessment of kinematic risky driving events, with potential for research and feedback forms of intervention.
9	Brower et al.	This study examine	Longitudinal observa	54,917 users from	Factors that influenc	we explored the	The key drivers of the	This study demonstr

	(2020)	s the impact of reducing reward size over time and explored the influence of other program features such as quiz timing, health intervention content, and type of reward program on user engagement with a mobile health (mHealth) app.	tional study Level 5	British Colombia who downloaded the app between March and July 2016.	e mobile app engangment defined by type of rewards earned by users, air travel, and grocery, time delay between early offers, the content of the health intervention, and changes in the number of points offered.	extent to which the 2 sources of program-level variance influenced the likelihood that a participant chose to engage with a given quiz. Thus, our outcome measure was a binary measure of whether a participant chose to complete each of the 8 quizzes during the initial 5	likelihood of continued user engagement, in order of greatest to least impact, were (1) type of rewards earned by users (eg, movies [+355%; P <.001], air travel [+210%; P <.001], and grocery [+140%; P <.001] relative to gas), (2) time delay between early offers (−64%; P <.001), (3) the content of the health intervention (eg, healthy eating [−10%; P <.001] vs	ate that this program, built around the principles of behavioral economics in the form of the ongoing awarding of a small number of reward points instantly following the completion of health interventions, was able to drive significantly higher engagement levels

						weeks post registration.	exercise [+20%, P <.001] relative to health risk assessments), and (4) changes in the number of points offered	
10	Wilson et al. (2017)	This study aims to reduce repeat first-time convicted drunk driving offenders by exploring whether an online program is an effective method for reducing this high risk behavior.	Qualitative single study. Level 6	15 first time offenders recruited from the Cairns and Brisbane Magistrates court	Acceptability of program defined by navigation, online delivery, engagement, straight-forwardness, and usability.	Questionnaire survey	93.3% found navigation easy, 93.3% preferred online delivery than face to face, 93.3% found the program to be engaging. 86.7% found the program to be straightforward. 90.8% found it to be useful.	Online interventions for reducing risky behavior such as drink driving may be useful and cost effective from a public health perspective.

Appendix C

Evidence Synthesis

Table 10

Level of Evidence Synthesis Table

Article Number	1	2	3	4	5	6	7	8	9	10
Level I: Systematic review or meta-analysis			X		X					
Level II: Randomized controlled trial				X		X				
Level III: Controlled trial without randomization					X					
Level IV: Case-control or cohort study										
Level V: Systematic review of qualitative or descriptive studies	X								X	
Level VI: Qualitative or descriptive study, CPG, Lit Review, QI or EBP project		X					X			X
Level VII: Expert opinion								X		

Table 11

Outcomes Synthesis Table

Article Number	1	2	3	4	5	6	7	8	9	10
Mobile App influenced behavioral change	NE	NE	↑	↑	↑	SN	↑	SN	↑	↑
Distracted driving habits	↓	↓	NE	NE	NE	↑	↓	NE	NE	SN
Perception to safer driving	↑	↑	SN	SN	NE	NE	↑	NE	NE	↑

NE, not evaluated; SN, shows a need

Table suggests that mobile applications have the ability to influence behavioral change. While limited studies evaluated the effect of mobile applications on driving behaviors, several studies showed that when participants perceptions related to safer driving improved their distracted driving habits decreased. Mobile applications are a promising innovation to improve perceptions related to safe driving and decrease distracted driving habits.

Appendix D

PDSA Framework (Langley et al., 2009)

ACT

Evaluate Findings

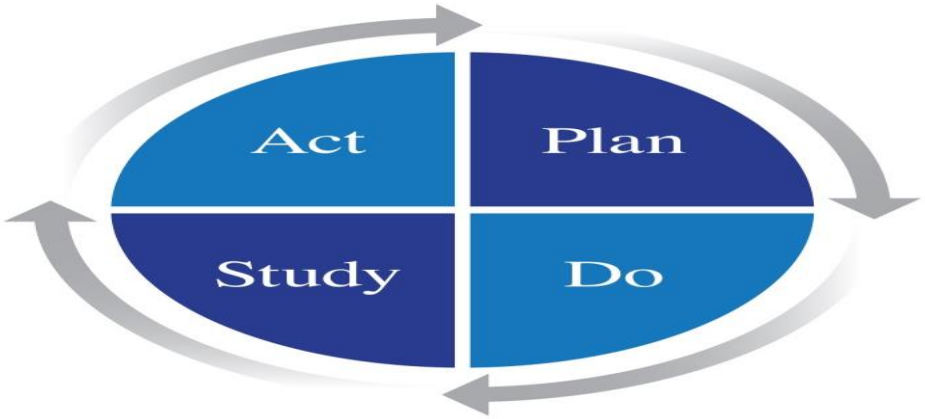
What changes need to be made?

Disseminate information.

PLAN

Reduce distracted driving among teens

Improve perceptions related to distracted driving among teens



STUDY

Analyze data

Compare data

DO

Collect pre and post-test DDS scores

Students download "Safe2Save"

Provide Education

Collect driving scores

Appendix E

Distracted Driving Survey (Bergmark et al., 2016)

1. Do you think that you can safely text and drive?
☐Always ☐Most of the time ☐Some of the time ☐Rarely ☐Never

2. In the last 30 days, have you READ text messages while driving?
☐Every time I drive ☐Most of the times I drive ☐Some of the times I drive ☐Rarely ☐Never

3. In the last 30 days, WHEN have you READ text messages? (select all that apply)
☐While driving at any speed ☐While driving at low speeds (under 25 mph)
☐While in stop-and-go traffic ☐While stopped at a red light ☐None of the above

4. In the last 30 days, have you READ email while driving?
☐Every time I drive ☐Most of the times I drive ☐Some of the times I drive ☐Rarely ☐Never

5. In the last 30 days, WHEN have you READ email? (select all that apply)
☐While driving at any speed ☐While driving at low speeds (under 25 mph)
☐While in stop-and-go traffic ☐While stopped at a red light ☐None of the above

6. In the last 30 days, have you viewed maps or directions on your phone while driving?
☐Every time I drive ☐Most of the times I drive ☐Some of the times I drive ☐Rarely ☐Never

7. In the last 30 days, have you WRITTEN text messages while driving?
☐Every time I drive ☐Most of the times I drive ☐Some of the times I drive ☐Rarely ☐Never

8. In the last 30 days, WHEN have you WRITTEN text messages while driving? (select all that apply)
☐While driving at any speed ☐While driving at low speeds (under 25 mph)
☐While in stop-and-go traffic ☐While stopped at a red light ☐None of the above

9. In the last 30 days, have you WRITTEN email while driving?
☐Every time I drive ☐Most of the times I drive ☐Some of the times I drive ☐Rarely ☐Never

10. In the last 30 days, WHEN have you WRITTEN email while driving? (select all that apply)
☐While driving at any speed ☐While driving at low speeds (under 25 mph)
☐While in stop-and-go traffic ☐While stopped at a red light ☐None of the above

11. In the last 30 days, have you read messages or viewed information on social media apps or sites while driving? (e.g. Facebook, Twitter, Snapchat, etc.)
☐Every time I drive ☐Most of the times I drive ☐Some of the times I drive ☐Rarely ☐Never

Item score: never = 0, rarely = 1, some of the time = 2, most of the time = 3, always= 4

Appendix F

Informed Consent

Informed Consent

Protocol Title: “Safe2Save” Mobile App Decreases Cell Phone Use while Driving Among High School Juniors: A Quasi-Experimental One Group Study

Protocol Number: [This number will be assigned by Department of Research staff once you are ready to submit. It can be left blank during protocol drafting]

Version Date: 02/16/2021

Sponsor: Investigator Initiated

Principal Investigator(s): Kristen Mankus BSN RN

Co-Investigator(s): Katie Stanley

Faculty DNP Project Advisor:

Rosemary Johnson, DNP, APRN-BC, Adjunct Faculty Professor Sacred Heart University

Institutional Contact: Wethersfield High School

Address: 411 Wolcott Road, Wethersfield CT 06109

1. Introduction and Purpose of the Study:

The purpose of this study is to reduce the number of times students unlock and use their cellphone while driving over 10mph.

2. Description of the Research:

With a parental permission and the student's voluntarily consent to participate in this study, each student will complete the Distracted Driving Survey (DDS) at the beginning and the end of the study. This survey will access the student's belief and knowledge about distracted driving. Each student will receive brief educational class on safe driving practices through a PowerPoint presentation on Zoom during their scheduled Advisory Class. Each student will receive instruction on how to download and use the "Safe2Save" smartphone application (app). This smartphone app is free and rewards users for driving every 2 miles over 10mph (miles per hour) without unlocking their phones. Users earn points which can be redeemed at organizations such as Amazon, Best Buy, GrubHub, and many other retail stores.

The "Safe2Save" app will ask students to share their location while using the app. This location is not shared with the Principal or Co-Investigator of this project. Allowing the app to know the student's location allows the app to detect when the phone is in a car moving over 10mph. This is how the app determines if the student uses the phone while driving.

Students driving scores will be sent to the PI directly from the app. After the 4-week period, students will be asked to repeat the Distracted driving Survey. All information obtained during the study will be confidential and anonymous. Each student has the option to drop out of the study at any time without consequences. The student's participation in this study will not affect or alter the student's academic outcome at "W" High School.

3.. Potential Risks and Discomforts:

No known risks.

4.. Potential Benefits:

Students who participate in this study may have a better understanding of the risks of distracted driving. This study will offer a safe driving program that motivates students not to use their cellphone while driving. By doing this, students can earn points that can be redeemed on the "Safe2Save" app as a financial reward for driving safely.

5. Confidentiality:

No names or other identifying information will be used when discussing or reporting data. The investigator(s) will safely keep all files and data collected in a secured password encrypted

laptop kept with Principal Investigator, Kristen Mankus, BSN RN. The results of the survey and driving scores will be shared between the Faculty DNP Project Advisor and the Investigators.

Authorization

By signing this form, you authorize the use and disclosure of the following information for this research: Example: I authorize the use of my records, any observations, and findings found during the course of this study for education, publication and/or presentation.

6. Compensation:

No compensation will be given for participation.

7. Voluntary Participation and Authorization:

Your decision to participate in this study is completely voluntary. If you decide to not participate in this study, it will not affect the your grades, coursework, or academic setting that you are enrolled. Please note that this opportunity is completely optional and not sponsored by "W" High School. The developer of the Safe2Save application has not signed the "W" Public Schools student data privacy compliance agreement, and students are not compelled to install or use this application on a personal device.

8. Withdrawal from the Study and/or Withdrawal of Authorization:

If you decide to participate in this study, you may withdraw from participation at any time without penalty. Note any data collected prior to withdrawal may be included in the study.

9. Cost:

There is no cost to participate in this study.

I (the student)_____voluntarily agree (give assent) to participate in this safe driving program.

□ Yes

□ No

I (guardian/parent)_____give guardian permission (consent) for this student_____to participate in this safe driving program.

□ Yes

□ No

I understand that I will be given a copy of this signed Consent Form.

Name of Participant (print):

Signature:

Date:

Name of Guardian/Parent over 18years of ag

Instructions for submission:

Once printed and signed, the informed consent can either be submitted electronically to mankuskristen@gmail.com or can be dropped off at Vice Principal Tyler Webbs' office or Katie Stanleys' classroom by November 8th, 2021.

Appendix G

Differentiating Quality Improvement and Research Tool (Foster, 2013)

Differentiating Quality Improvement and Research Tool

Question		Yes	No
1.	Is the project designed to bring about immediate improvement in patient care?	X	
2.	Is the purpose of the project to bring new knowledge to daily practice?	X	
3.	Is the project designed to sustain the improvement?	X	
4.	Is the purpose to measure the effect of a process change on delivery of care?	X	
5.	Are findings specific to this hospital/community?	X	
6.	Are all patients who participate in the project expected to benefit?	X	
7.	Is the intervention at least as safe as routine care?	X	
8.	Will all participants receive at least usual care?	X	
9.	Do you intend to gather just enough data to learn and complete the cycle?	X	
10.	Do you intend to limit the time for data collection in order to accelerate the rate of improvement?	X	
11.	Is the project intended to test a novel hypothesis or replicate one?		X
12.	Does the project involve withholding any usual care?		X
13.	Does the project involve testing interventions/practices that are not usual or standard of care?		X
14.	Will any of the 18 identifiers according to the HIPAA Privacy Rule be included?		X

Adapted from Foster, J. (2013). Differentiating quality improvement and research activities. Clinical Nurse Specialist, 27(1), 10–3. https://doi.org/10.1097/NUR.0b013e3182776db5

An answer of yes to all of the items in l-l0 and no to all of the items in 11-I4 indicates that this project meets criteria for a Quality Improvement Project. It also indicates that the project does not qualify as human subjects' research, and does not have to go through the Institutional Review Board at Sacred Heart University.

Appendix H

Demographic Information Survey

Please choose one of the following for each question

1. Age

Less than 18 years old
Greater than 18 years old

2. Ethnicity

African American
Caucasian
Hispanic
Asian
Other

3. Gender

Female
Male
Nonbinary

4. Number of months owning a driver’s license

0-3
4-7
8-12

5. Number of prior motor vehicle accidents (as the driver not the passenger)

0
1-2
>2