

June 20, 2021

Project TraumaHawk

Improving Patient Outcomes through Photographic Trauma Site Documentation

Phase IV: Regional Expansion



Final Report

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The University of Iowa
Emergency Medicine

Sponsored by the Iowa Department of Transportation and the Federal Highway Administration

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16. Abstract TraumaHawk, a smartphone app for law enforcement and first responders, was designed by the University of Iowa (UI) to connect pre-hospital emergency care to hospital trauma teams. At the scene of a crash, first responders use TraumaHawk to generate and send a report with vital collision information, as well as photographs showing extent of intrusion and damage in a vehicle's occupant compartment, to the receiving trauma center. Utilizing TraumaHawk to identify serious crashes remotely provides trauma teams with significantly more time to prepare for incoming patients than the conventional ambulance crew notification. TraumaHawk results to date have been positive, with a significant increase in emergency department (ED) prep time. To date, the TraumaHawk project has completed three successful phases of development. Phase four was to include the regional expansion westward in Iowa. During this phase, updates to the app and alerting system were required. Expansion proved to be challenge because of a variety of HIPPA and other privacy and infrastructure challenges.			
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INTRODUCTION

TraumaHawk, a smartphone app for and first responders, was designed by the University of Iowa (UI) to connect first responders to level-1 hospital trauma teams. At the scene of a crash, first responders use TraumaHawk to generate and send a report with vital collision information, as well as photographs showing extent of intrusion and damage in a vehicle's occupant compartment, to the receiving trauma center.

Utilizing TraumaHawk to identify serious crashes that likely have complex injuries remotely provides trauma teams with significantly more time to prepare for incoming patients than the conventional ambulance crew notification. This critical additional time allows trauma staff to assemble a more complete and appropriate level of treatment by specialists, as well as to arrange other vital aspects of care, such as scheduling operating rooms. TraumaHawk results to date have been positive, with a significant increase in emergency department (ED) prep time. When the TraumaHawk alert occurred first, the cases provided an earlier notification to the ED, on average, of about 12 minutes, but ranged up over 30 minutes prior to trauma page. Maximum time prior to trauma page was 90 minutes.

Since its inception, TraumaHawk has received international attention. Drs. McGehee & Buresh presented on the project at the Enhanced Safety of Vehicles (ESV) conference in Sweden in 2015 and made an additional presentation in Bosnia the same year. In June 2016, US DOT National Highway Traffic Safety Administration (NHTSA) Administrator Dr. Mark Rosekind traveled to the UI to receive a TraumaHawk presentation and, following this visit, Dr. Rosekind invited TraumaHawk team members to make a presentation to his chiefs of staff at NHTSA. In spring 2017, the Director of NHTSA's Office of Emergency Medical Services, Dr. Jon Krohmer, visited the UI to discuss TraumaHawk in more detail.

Building on this success, the TraumaHawk team's intention is to make Iowa a trauma analysis hub not only for statewide crash analyses, but also nationally and internationally. Much like a radiologist can view an image anywhere in the world, specially trained UI traumatologists and ED physicians could view TraumaHawk images from distant trauma centers to provide assistance to other physicians and ED staff around the country and possibly the world.

To date, the TraumaHawk project has completed three successful phases: the first was the original development of the app, the second was the evaluation of time savings and other outcomes for the overall program, and the third scaled the app to be deployed to more law enforcement personnel within eastern Iowa. With the TraumaHawk app only being used in 70 cases out of a possible 900 sent to the UIHC during the project's first three phases, there is a need to expand the coverage of TraumaHawk throughout Iowa to further evaluate the program as well as help additional crash victims.

Basic training provides first responders with information on how to photograph vehicles at a crash scene using the TraumaHawk app. Similarly, trauma staff receive training regarding crash injury biomechanics and traumatology. To maintain the project's momentum, the TraumaHawk team expanded its communication, training, and presence within the law enforcement community in the

past year by developing training videos and through holding regular meetings at each of the three Iowa State Patrol district offices.

Although the number of TraumaHawk users has increased, smartphone penetration among law enforcement has been a challenge. Lately, some law enforcement agencies have been acquiring smartphones for staff, including the Iowa State Patrol which is currently in the process of obtaining iPhones for all supervising troopers. But to dramatically increase the number of TraumaHawk units in the field, it would be extremely helpful for the TraumaHawk project if the rank-and-file troopers were also able to integrate iPhones into their cruisers. Increasing the penetration of TraumaHawk would also increase the number of crashes/crash victims that could benefit from this technology.

Phase IV concentrated on the expansion of the TraumaHawk service area into central and western Iowa. As part of this expansion to the state's only other Level I Trauma Center outside of the UI Hospital and Clinics, the Iowa Methodist Medical Center, an additional server and secure computer infrastructure will be required. Additionally, training for trauma and law enforcement in the new areas will be necessary.

Task 1. Upgrade to TraumaHawk Server

With the expansion of TraumaHawk to other regions and hospitals throughout the state of Iowa, the development of a server/client was finalized in phase IV. The server allows data to be sent directly to a database while still allowing for the communication with the first responders and ED staff through SMS messages and notification. This improved and simplified access of report data by ED staff through a web interface and makes the expansion to other hospitals outside the UIHC more feasible.

The web portal is only assessable to those with appropriate login credentials. With the completion of the portal, usability testing was done in several phases with the UIHC. This testing identified bugs with the app and portal and allowed for changes to be made. The final web portal screens can be seen in the Web Portal Training in Appendix A.

Testing Documentation

Each phase required periodic updates to the TraumaHawk App since it was being utilized in beta testing mode through Apple. Since the focus of phase four was to expand regionally, we focused on migrating the app development environment to a cross-platform environment (creating one app and building it for Android and iOS) which meant the re-development of the entire app, while the current iOS version of the app was available continued use. The final version was developed and evaluated on both iPhone and Android devices and worked successfully after several debugging iterations. Since we were also interested in making the app more accessible, communication between our developer and the University of Iowa began on how to release the app. In order to release it, it would require our team to work with the UI IT department to create a UI developer account thus requiring us to make arrangements for updates to be pushed to the app store. Any updates in the future would have varying levels of complexity and take substantially longer as it would need to be done through this account instead of by our developer.

Task 2. Increase Geographical Area with Iowa Methodist Medical Center in Des Moines

As the TraumaHawk project has continued to improve, the next step was the expansion of the program area to enable this program in a larger area. Given that TraumaHawk is intended for use with the most severe crashes, it is applicable only to Level I Trauma Centers that can receive these types of patients. The only other Level 1 Trauma Center in Iowa outside of the UI Hospitals and Clinics is Methodist Medical Center in Des Moines. The UI team has had preliminary meetings with both the head of the Methodist Medical Center's emergency department (ED), as well as the Trauma Outreach & Injury Prevention Coordinator; both were receptive to the opportunity to be part of the TraumaHawk program.



Figure 1: Image of Iowa Methodist Medical Center in Des Moines, Iowa

To incorporate the TraumaHawk program into Methodist Medical Center, three main tasks would be required. After the photos are received in the trauma bay, they are then entered into the patient's permanent medical record as photo attachments by hospital staff. Discussions with Methodist Medical Center legal counsel were required as there are privacy concerns and compliance with the Health Insurance Portability and Accountability Act (HIPAA). Additionally, a TraumaHawk workstation would work to incorporate TraumaHawk into the Methodist Medical Center's ED and its computing infrastructure. Training of nurses, doctors, and other staff regarding the app and how to diagnose the photographs received will be necessary. Rob Kaufman, a senior research scientist engineer and traumatologist at the University of Washington along with UI staff developed the training.

Legal Approval at Methodist Hospital

While there were willing parties to execute an expansion of TraumaHawk to Methodist Hospital (MH) in Des Moines, there were a number of bureaucratic elements that had to take place. Legal approval was first on the list. The UI had done this previously and we felt that because we had approval at one organization, it would be a similar process. One advantage we had at the UI was that as a research hospital, legal council would frequently consider unusual circumstances. We felt at the time that because a public hospital had gone through the process it would be easier to put through an application at another. MH, however, is not a teaching hospital and is less inclined to take new

projects that may have some perceived risk. For instance, TraumaHawk utilized still images from crash scenes that involve patient care—which is protected under The Health Insurance Portability and Accountability Act (HIPAA). HIPAA protections are absolute and because TraumaHawk utilized a UI server in Iowa City, there was concern that there was some uncertainty about data protection—even though the UI has a high level of computer security.

In numerous phone calls and in-person meetings that occurred over the course of about 18 months, we were unable to get MH to agree to have TraumaHawk. One issue that came up a number of times related to funding. The UI had hundreds of hours in-kind that were not covered by the modest grants we received over the life of the project. MH was not willing to provide internal support for not only the legal issues associated with the project, but training of physicians, nurses, paramedics and other trauma staff. Our initial discussions were very enthusiastic. Unfortunately, that enthusiasm hit a bureaucratic and financial wall.

Demonstration of integration into the Methodist Medical Center IT infrastructure

Numerous communications with MH occurred over phase IV of this project. As the details emerged on what commitments MH would need to put forward in legal, IT, and training, the costs to MH became unmanageable and their interest cooled. Even the cost of one meeting with a surgeon was scrutinized.

During this time, we also sought and were approved for expansion by the UI Institutional Review Board (IRB) for ethical use of study and data. This approval document can be found in Appendix B.

A timeline of the communication consisted of the following:

- Methodist nurses visited UIHC (2017)
- Numerous communications to get a meeting at Methodists (See Quarterly reports)
- Communication with Iowa State Patrol Colonel Nathan Fulk (June 2018)
- Meeting in Des Moines (June 2018)
- IRB approval (2019)
- Communications with State registry (2019)
- Unable to resolve the IT, Legal, and Privacy issues

Documentation of training of Methodist Medical Center trauma staff

Training of the Methodist Center Trauma staff did not take place due to the inability to integrate TraumaHawk into the hospital. However, training was developed before we experienced issues with MH. They would have received the web portal training in Appendix A along with the TraumaHawk Training found in Appendix C.

Task 3. Integration of Central Iowa Law Enforcement

To expand to a new hospital, additional law enforcement personnel were to be trained to facilitate the hospital receiving TraumaHawk reports. Unfortunately, since we were unable to expand into the hospital, this training was unable to take place. It was also determined that the Des Moines Metro would not be a good fit for the app as more severe crashes occur in rural communities. These of which they rarely respond to.

Training of any new app users did not take place due to the inability to integrate TraumaHawk into the hospital. However, training was developed before we experienced issues with MH. They would have received the TraumaHawk Training found in Appendix C and Appendix D.

During this phase, we were interested in understanding how to better facilitate receiving more TraumaHawk reports. Since the Iowa State Patrol was the major user, we conducted two studies how to get the TraumaHawk app into more users' hands.

ISP smart phone use

We examined how many ISP personnel were issued state-issued iPhones and how they are assigned. This information could provide insight into the capabilities of the app being used across the state. Unfortunately, the phones are generally issued to personnel that may not be responding to crashes that could use TraumaHawk. Personnel that receive phones are crisis negotiators, supervisors, and specialists (crash reconstructionist). If more phones were available to the rank-and-file troopers on the road, it could allow for a higher rate of use.

Examination of Iowa DOT Crash Reports

The second study examined Iowa DOT Crash Reports to determine which agencies (state patrol, sheriff's office, etc.) were completing the crash reports in the areas in our three current ISP districts (11, 12, 13) and in the new expansion area (1, 2). This analysis reviewed crashes marked with crash severity of Level 1 (Fatal) or Level 2 (Major Injury) during the timeframe of 2014-2017.

Table 1 shows that breakdown of which agency completed the crash report for of Level 1 and Level 2 crashes. The majority of severe (1 & 2) cases were responded to by non-ISP (71.27%) vs ISP (28.73%).

Table 1 Agency Response to Level 1 and Level 2 Severity Crashes

	N	%
Non-ISP	4049	71.27
ISP	1632	28.73
Total	5681	100.00

Table 2 shows which agency completed the crash report along with where crash victims were initially transported. The hospitals were selected based on current or potential future use. UIHC was chosen because it currently uses TraumaHawk. Methodist was selected because they are part of the expansion. The other two were chosen based on their proximity to UIHC (St. Luke's) and Methodist (Mercy) and their likelihood for future expansion. 'Other' included hospitals other than these four as well as mortuary, Iowa State Examiner, etc.

This table shows that regardless of which agency responds, crash victims are taken to 'other' over half the time. When ISP completes the report, there is a much higher probability that they will be taken to UIHC over the nearby St Luke's. Mercy is used more often than Methodist by all responders in the expansion area.

Table 2 Agency Response/Transfers for Level 1 and 2 Crashes

Transferred to:	Non-ISP	ISP	Total
Mercy	886	212	1098
Methodist	424	103	527
St. Luke's	189	59	248
UIHC	370	406	776
Other	2180	852	3032
Total	4049	1632	5681

Since level 1 crashes involve a fatality, we examined level 2 crashes alone. When examine level two crashes alone, non-ISP response increases (78.10%) and ISP response decreases (21.90%). Table 3 shows that more than half (52.3%) of the crashes from non-ISP were transported to 'other', whereas ISP responded crashes only sent about 44 percent to 'other'. For level 2 crashes alone, most UIHC-responded transfers had ISP responders.

Table 3 Agency Response/ Transfer for Level 2 Crashes

Transferred to:	Non-ISP	ISP	Total
Mercy	804	152	956
Methodist	378	76	454
St. Luke's	154	44	198
UIHC	338	280	618
Other	1839	433	2272
Total	3513	985	4498

Study Conclusions

The data from these two studies indicate that the success of the TraumaHawk program depends on the app becoming more accessible to a broader group of agencies other than ISP. The ISP does not have enough phones in the hands of everyday trooper. It would be interesting to see if every trooper was equipped with a phone, how much the numbers would increase.

The data indicates that patients in more severe crashes are often taken to hospitals not designed to handle Level 1 Trauma like UIHC and Methodist. There are several unknowns with this examination. It is unknown if crash victims were eventually transported to either UIHC or Methodist or another hospital. It is unknown how many victims passed away during initial transport, at the initial hospital, or during a second transport. A further examination is needed to better understand why so many level 1 and 2 crashes aren't transported to higher level trauma centers initially. This examination would need to remove fatal victims at the scene. An analysis of detailed victim timeline from the crash scene through their final hospital transport could prove beneficial into understanding whether victims can benefit from bypassing lower-level trauma hospitals for a higher- level trauma center.

It may prove beneficial to develop a program to educate responders across the state about the TraumaHawk program even if the app is not available to them. Understanding the three critical cues (intrusion, restraint status, direction of force) of a crash may help responders make different choices about victims' injury severity and the best transport method/location.

Task 4. Monitor Outcomes

A key aspect of this project involves continuously monitoring outcomes to see how TraumaHawk is working and how it can be improved. The goal for Phase IV is to substantially increase the number of TraumaHawk alerts with the increased coverage across the state.

TraumaHawk alerts from Project

Throughout the project, the team monitored the number of TraumaHawk alerts across the east central Iowa State Patrol network. Since there are still a limited number of TraumaHawk phones, the number of reported crashes has remained somewhat low relative to the total number of severe crash possibilities. Our analysis focused on two main questions:

From the TraumaHawk program, there were 905 cases of motor vehicle crashes (MVC) presented to the UI Hospitals and Clinics ED that met Trauma Alert/Activation criteria and were not transferred from another hospital. Among those, 69 crashes or 7.6% were TraumaHawk cases. Interestingly, TraumaHawk cases were significantly younger than non-TraumaHawk MVC. We did not find any differences in patient sex, time of injury, injury severity, the proportion of hospital admissions, hospital length of stay, or mortality by TraumaHawk status. This is primarily due to the small numbers. The proportion of MVCs that had an ED MD or trauma surgeon present on arrival did not differ by TraumaHawk status. As a Level I trauma center, the UI ED has such specialists onsite for all cases.

Forty of the 69 TraumaHawk alerts had corresponding ED trauma pages available. About 63% of the TraumaHawk alerts occurred before the trauma page. When the TraumaHawk alert occurred first, the median time was 12 minutes prior to the trauma page. In 75% of cases, the TraumaHawk alert came in nine to 29 minutes prior to the trauma page. The maximum amount of time of a TraumaHawk page came in was 90 minutes prior to the trauma page. These results continue to show that there is a significant time advantage for the ED when a TraumaHawk alert is issued.

Data Summary

The data shows that about 63% of the TraumaHawk cases had alerts that occurred before the trauma page. These TraumaHawk cases provided an earlier notification to the ED, on average, of about 12 minutes, but ranged to more than 30 minutes prior to trauma page. This increase in the notification time for personnel in the ED is beneficial on a number of levels. First and foremost, trauma teams and specialists are alerted earlier to incoming severe trauma. This allows the ED charge nurse to make sure that the appropriate facility and human resources are prepared and standing by, providing more time to organize the necessary care plans for the incoming trauma patients. The trauma team also has additional time to alert appropriate specialists prior to patient arrival.

Although TraumaHawk has facilitated an increase in communication between those in the field and the ED, there is still a need to scale the program more broadly. As there were 905 potential TraumaHawk cases since inception, only 7.6% came into the UI Hospitals and Clinics as TraumaHawk cases. This issue could be related to the minimal number of iPhones and limited number of TraumaHawk users in the state of Iowa. There is a definite need to expand the app to

additional phones and users to see how much impact the program can have in benefiting trauma patients' care. The next phase of the project will expand the coverage of TraumaHawk into central and western Iowa.

Conclusions

The TraumaHawk program has shown to improve prehospital alert times and enhance communication from the field to the emergency department at the UI. It has been shown to be popular in its concept among the first responders and law enforcement that have used it. The enhanced communication between the Iowa State Patrol with the UI trauma center alone has been beneficial. As is true with many areas in the state of Iowa, TraumaHawk is a visionary project—one that in many ways is ahead of its time. One challenge that the program faced was the integration into more hospitals. While the privacy issues were integrated into its design, individual hospitals have to make independent determinations of how such systems will be integrated into their operations. As in many areas, additional funding will be required to pay for such integration as well as training of trauma center staff. The project has accomplished a lot relative to the original development on the iPhone. The system migrated to the Android platform as well as a new server system.

Recommendations for future implementation of TraumaHawk should consider that all first responders and law enforcement should each have their own smartphone. This will increase the use of the system.

Because the expansion of TraumaHawk is constrained by the legal issues at each hospital system, one possibility of growth is to integrate the TraumaHawk capabilities into other pre-hospital communication systems. One such pre-hospital system is a company in Bozeman, MT that has a rapidly increasing market share of communication integration. The Pulsara platform is a HIPAA-compliant, secure, easy-to-use app that unites the entire care team — even if they are in different departments or organizations (rural or urban). By replacing multiple phone calls, radio reports, faxes, and pagers with one unified patient channel, care providers see reduced treatment times, reduced costs, and improve the overall communication (Pulsara.com).

ACKNOWLEDGMENTS

The authors would like to thank and acknowledge those entities that have made this lifesaving work possible, including the Iowa Department of Transportation and the Federal Highway Administration. Additional thanks go to Steve Gent and Sandra Larson from the Iowa Department of Transportation, as well as the many dedicated Iowa State Patrol deputies and staff who have helped make the project a success. Special thanks goes to Colonel Nathan Fulk. Finally, we'd like to thank Robert Kaufman, senior research scientist engineer and traumatologist at the University of Washington, a pioneer of automotive traumatology who we have relied on greatly.

Appendix A: TraumaHawk Web Portal Training



National Advanced Driving Simulator

TraumaHawk Web Portal Training

May 24, 2019



The University of Iowa
Emergency Medicine

TraumaHawk Web Portal Screens



ED staff goes to portal login

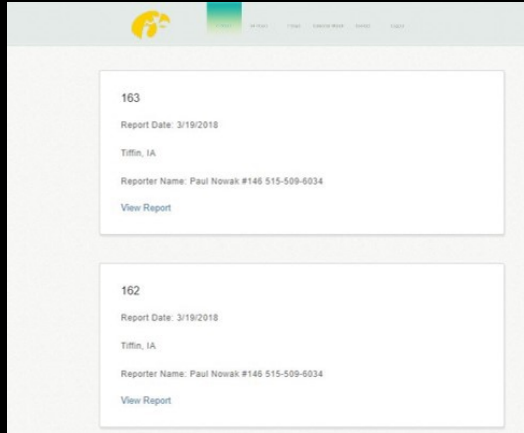


Enter email and Password provided to you by UI (each hospital will be assigned one)

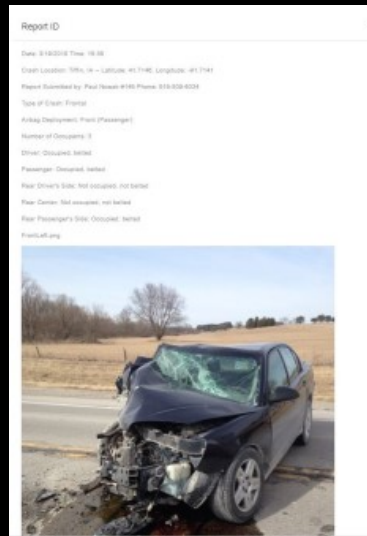


National Advanced Driving Simulator

TraumaHawk Web Portal Screens



Calendar Page appears, select View Report for the most recent crash



Crash Report

View Crash Report. Scroll down to see additional pictures

IOWA

National Advanced Driving Simulator

TraumaHawk Web Portal Training

For questions or comments related to the TraumaHawk Program, feel free to reach out to one of our research staff.

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IOWA

National Advanced Driving Simulator

Appendix B: IRB Approval



**Human Subjects Office/
Institutional Review Board (IRB)**

105 Hardin Library for the Health Sciences
600 Newton Road
Iowa City, Iowa 52242-1098
319-335-6564 Fax 319-335-7310
irb@uiowa.edu
<http://research.uiowa.edu/hso>

IRB ID #: 201904735

To: Daniel McGehee

From: IRB-01 DHHS Registration # IRB00000099,
Univ of Iowa, DHHS Federalwide Assurance # FWA00003007

Re: TraumaHawk: Examination of Motor Vehicle Crashes

Protocol Number:
Protocol Version:
Protocol Date:
Amendment Number/Date(s):

Approval Date: 05/16/19

**Next IRB Approval
Due Before:** 05/15/21

<p>Type of Application:</p> <p><input checked="" type="checkbox"/> New Project <input type="checkbox"/> Continuing Review <input type="checkbox"/> Biennial Review <input type="checkbox"/> Modification</p>	<p>Type of Application Review:</p> <p><input type="checkbox"/> Full Board: Meeting Date: <input checked="" type="checkbox"/> Expedited <input type="checkbox"/> Exempt</p>	<p>Approved for Populations:</p> <p><input type="checkbox"/> Children <input type="checkbox"/> Prisoners <input type="checkbox"/> Pregnant Women, Fetuses, Neonates</p>
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Source of Support: Iowa Department of Transportation

Investigational New Drug/Biologic Name:
Investigational New Drug/Biologic Number:
Name of Sponsor who holds IND:

Investigational Device Name:
Investigational Device Number:
Sponsor who holds IDE:

The following documents have been submitted for the above review and approval:

Miscellaneous	[External] Re_State Trauma Registry use.pdf
Assurance Document	Assurance Doc.pdf
Funding Source Grant	TraumaHawk Phase IV proposal.docx
Waiver: Other Non-UI Letter of Agree	RERC Policy 4-17 FINAL.pdf

OFFICE OF THE VICE PRESIDENT
FOR RESEARCH

This approval has been electronically signed by IRB Chair:
Catherine Woodman, MD
05/16/19 0952

As Principal Investigator, you are responsible for ensuring this project is conducted in compliance with all applicable federal, state, and local laws and regulations, institutional policies, and requirements of the IRB, which include, but are not limited to, the following:

IRB Approval: IRB approval indicates that this project meets the regulatory requirements for the protection of human subjects. The research is approved to be conducted as described in the HawkIRB application. The addition or omission of study activities is not permitted without prior IRB review and approval. IRB approval does not absolve the principal investigator from complying with other institutional, collegiate, or departmental policies or procedures.

Agency Notification: If this is a New Project or Continuing Review application and the project is funded by an external government or non-profit agency, the original HHS 310 form, "Protection of Human Subjects Assurance Identification/IRB Certification/Declaration of Exemption," has been forwarded to the UI Division of Sponsored Programs, 100 Gilmore Hall, for appropriate action. You will receive a signed copy from Sponsored Programs.

Recruitment: Your IRB application has been approved for recruitment of subjects not to exceed the number indicated on your application form. The IRB has approved all recruitment strategies described in the application. It is not necessary to use all of these strategies, but no additional recruitment strategies may be used without IRB approval.

Biennial Review: Eligible, non-exempt, studies that do not require an annual continuing review will require a Biennial check in until the project is closed in HawkIRB by the Principal Investigator. The required Biennial check in will include a very brief, seven question check every other year. You are responsible for submitting a Biennial Review in sufficient time for review.

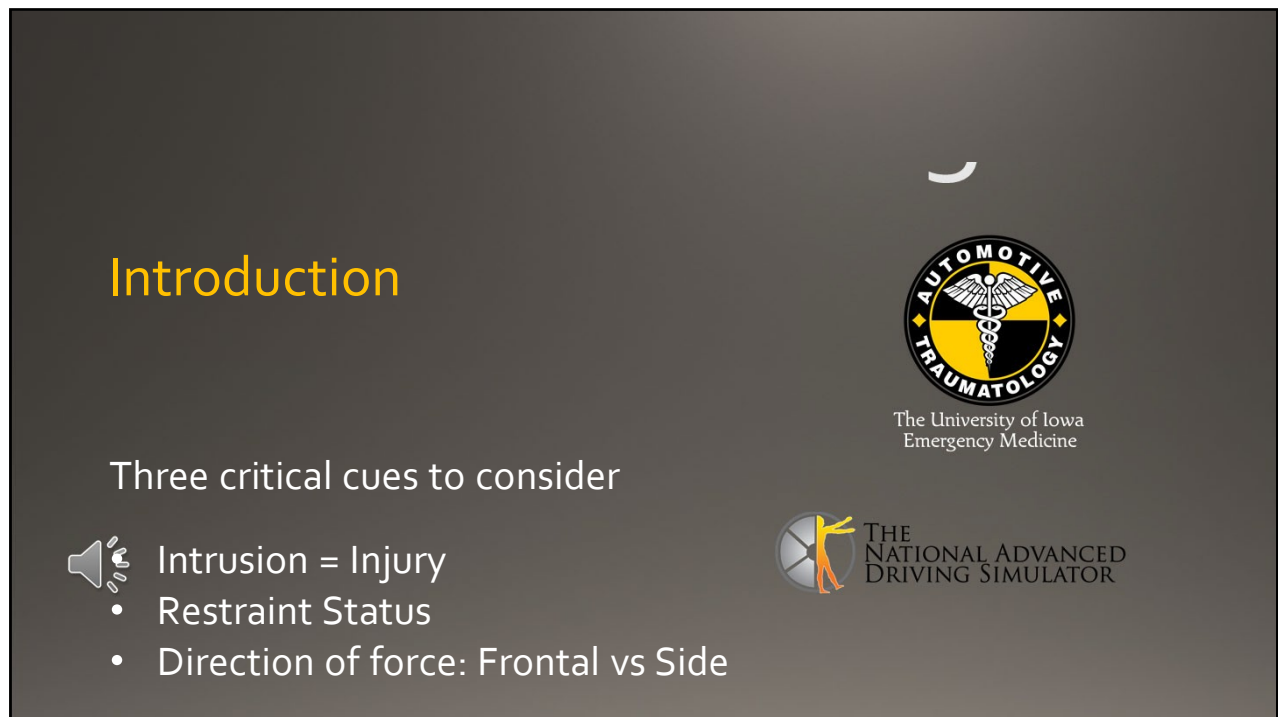
Modifications: Any change in this research project or materials must be submitted on a Modification application to the IRB for prior review and approval, except when a change is necessary to eliminate apparent immediate hazards to subjects. The investigator is required to promptly notify the IRB of any changes made without IRB approval to eliminate apparent immediate hazards to subjects using the Modification/Update Form. Modifications requiring the prior review and approval of the IRB include but are not limited to: changing the protocol or study procedures, changing investigators or funding sources, changing the Informed Consent Document, increasing the anticipated total number of subjects from what was originally approved, or adding any new materials (e.g., letters to subjects, ads, questionnaires).

Unanticipated Problems Involving Risks: You must promptly report to the IRB any serious and/or unexpected adverse experience, as defined in the UI Investigator's Guide, and any other unanticipated problems involving risks to subjects or others. The Reportable Events Form (REF) should be used for reporting to the IRB. Reports from the investigator to the IRB must be submitted via HawkIRB within ten working days of the event or within 10 working days of the PI becoming aware of the event.

Audits/Record-Keeping: Your research records may be audited at any time during or after the implementation of your project. Federal and University policies require that all research records be maintained for a period of three (3) years following the close of the research project. For research that involves drugs or devices seeking FDA approval, the research records must be kept for a period of three years after the FDA has taken final action on the marketing application. For research that involves Protected Health Information (PHI) under HIPAA, the research records must be kept for a period of six (6) years following the close of the research project.

Additional Information: Complete information regarding research involving human subjects at The University of Iowa is available in the "Investigator's Guide to Human Subjects Research." Research investigators are expected to comply with these policies and procedures, and to be familiar with the University's Federalwide Assurance, the Belmont Report, 45CFR46, and other applicable regulations prior to conducting the research. These documents and IRB application and related forms are available on the Human Subjects Office website or are available by calling 335-6564.


Appendix C: TraumaHawk Program




The slide features a dark grey background with a white crescent moon at the top center. On the left, the word "Introduction" is written in a yellow, sans-serif font. Below it, the text "Three critical cues to consider" is in white. To the left of this text is a white speaker icon with sound waves. Below the speaker icon is the text "Intrusion = Injury" followed by a bulleted list: "• Restraint Status" and "• Direction of force: Frontal vs Side". On the right side of the slide, there are two logos. The top one is a circular logo for "AUTOMOTIVE TRAUMATOLOGY" with a caduceus in the center, and below it, the text "The University of Iowa Emergency Medicine". The bottom logo is for "THE NATIONAL ADVANCED DRIVING SIMULATOR" and features a stylized orange figure of a person in a car seat next to a grey steering wheel.


Introduction

Three critical cues to consider

 Intrusion = Injury

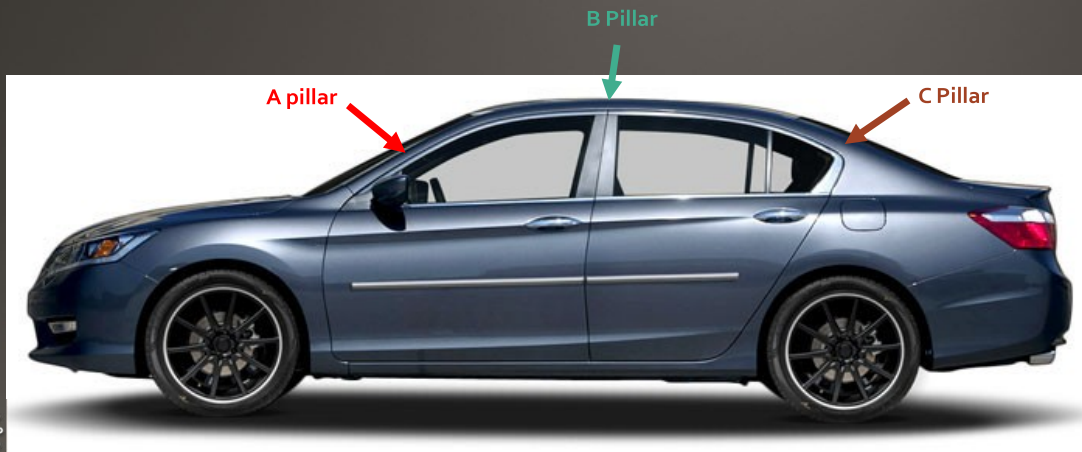
- Restraint Status
- Direction of force: Frontal vs Side


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Slide Audio: TraumaHawk is a special app that was designed to help law enforcement and first responders document photos of the crush patterns of vehicles at the scene of a crash that can remotely send pictures to the emergency department. These pictures are meant to help clinicians understand the severity of the crash and determine injury mechanisms. When arriving at a crash scene, there are 3 main critical clues to consider when identifying injuries. These include: Intrusion = Injury (meaning assessing the intrusion into the occupant compartment that determines the higher likelihood of injury), restraint status, and the crash type: a frontal, side, rear impact, or rollover. In general, when a crashed vehicle sustains 12 or more inches of crush or intrusion into the occupant compartment, this heightens the awareness that the occupants may have sustained severe injuries. TraumaHawk allows the emergency department to assess the triage, type of transport, and prepare for potential treatment.

The basic anatomy of a car

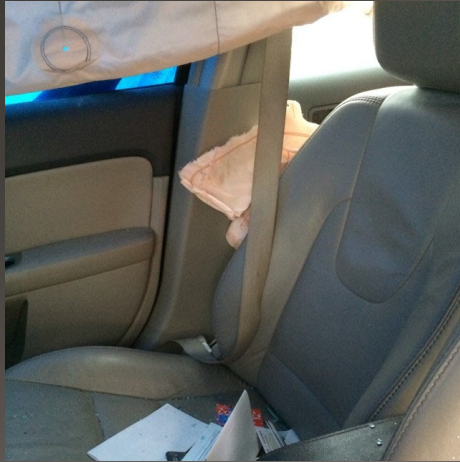


<https://www.shopsar.com/v/vsfiles/assets/images/cbm-accord.jpg>

Slide Audio: Let's talk about car crashes and how to assess a damaged vehicle at the crash scene to anticipate patient injuries. First it is important to understand the basics of car anatomy. In this section, we'll cover: the A, B, C, structural support pillars; the steering wheel and column; and the floor and toe pans plus how to examine if the seatbelt was used or not.

Vehicles are designed with structural support pillars of the passenger cabin. These pillars are some of the most important parts of a car and if damaged will be the best indicators to assess a severe crash. The pillars that frame each side of the windshield are called the A-pillar. Buckling of the A pillar rearward is a sign of significant frontal force and possible intrusion into the passengers. The second roof pillar just behind the front doors is called the b-pillar, which is especially important to examine if any lateral movement into the vehicle occurred in a side impact crashes. The third pillar or C pillar is behind the second door on each side or frames the back window of the passenger area. When any damage that has occurred to these structural pillars of the vehicle, the probability of severe injury should be considered.

Seat belts & Air bags



Worn seat belt (spooled out)



No seat belt (tight against b-pillar)

Slide Audio: When you explore vehicle's interior one needs to assess if the seat belts were used and airbags deployed. Seat belts save lives and are the main protection for occupants by distributing the force to their bodies and prevents the occupant from contacting the interior surface or from being ejected.

Assessment of occupants restrained with a seatbelt is a one of the critical clues for determining the severity of injury. In most cases if the occupant was belted the interior photo will show the seatbelt is loose or spooled out over the seat and not retracted. On the other hand, if seat belts or found retracted or pulled up tight against anchor point on the B-pillar, this may indicate that the driver or occupant may not have worn it the time of the crash.

When you see that airbags have deployed in the vehicle this is another sign of more serious crash and provides supplemental protection to the occupants.

Steering wheel deformity



Slide Audio: The steering wheel can also be an important indicator of driver injury. If any sign of deformation occurred to the steering wheel this will be a good indicator that the driver's torso contacted it via the airbag and could have a significant injury to the chest or abdomen.

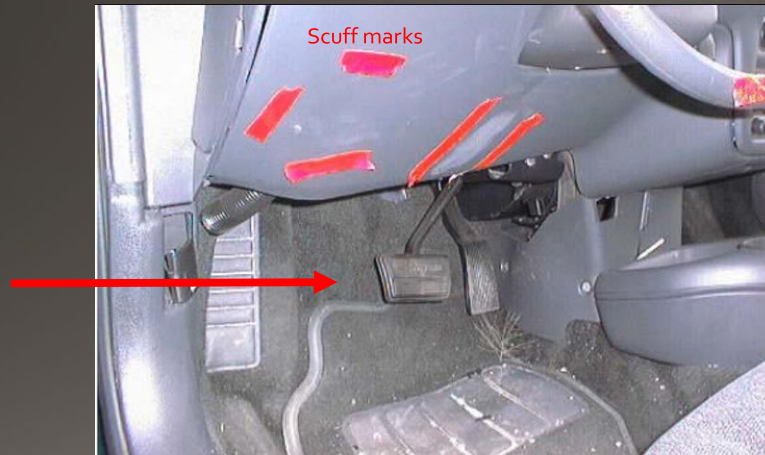
Frontal Crash: Level of Intrusion



Slide Audio: It's important to talk about the floor or toe pans. This is the metal sheet under the occupants' feet, and behind the foot pedals. Any sign of intrusion of the toe pan is a good indicator of serious injury to the lower legs or feet.

Here you can first see scuff marks on the underside of the instrument panel front the driver's lower leg and knee. You can also see that the toe pan has intruded and pushed back against the accelerator and the brake and would indicate the likelihood that the driver sustained foot and ankle fractures, as well as fractures to the tibia and fibula. The sign of scuff mark means some knee thigh hip load occurred. This could lead to a fracture of the femur or even a hip fracture too.

Frontal Crash: interior picture



Toe Pan

Slide Audio: It's important to talk about the floor or toe pans. This is the metal sheet under the occupants' feet, and behind the foot pedals. Any sign of intrusion of the toe pan is a good indicator of serious injury to the lower legs or feet.

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Frontal Crashes Review

- Intrusion= Injury
- A Pillar
- Air bag
- Restraints
- Foot Well
- Steering Wheel



<http://nhtsa-nrdap.nhtsa.gov/bis/crash.html> CIRENID=504867

Slide Audio: In a frontal crash, it is important to pay particular attention to the A-pillar and whether or not it is deformed. You also want to look at the airbags and identify if they have deployed. You want to look at restraint status. Remember that if the restraints were used during the crash, they are often hanging loose in the car; whereas if they were not being utilized, they will be pulled up taut against the seat or the B pillar. Pay attention to the steering wheel and if there is any deformity. Look at the dashboard to look for any scuff marks or impact marks. Look at the foot well to see if the footwell has been pushed up behind the accelerator and brake pedals. Impact marks or footwell intrusion indicate a much higher likelihood of specific leg and ankle injuries.

Side Impact Crashes

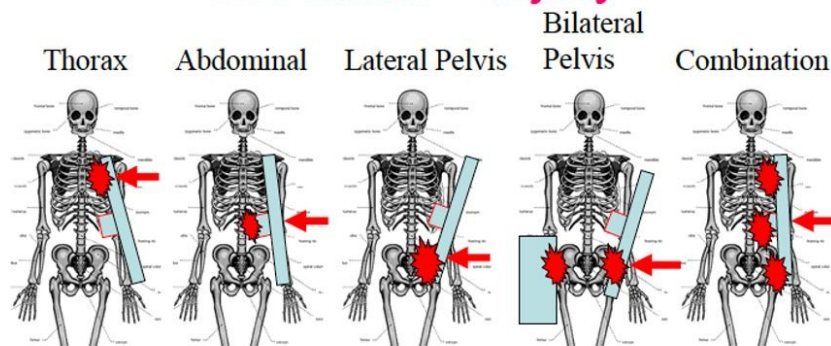
- Intrusion = Injury
- Seat belt status
- Air bag deployment
- Location of intrusion



Slide Audio: With side impact crashes examine if any intrusion occurred into an occupant seated on the impact side. It is important to assess the level of intrusion into their seat location as it oftencorrelates with a greater likelihood of injury severity. Documenting the seat belt status and side air bag deployments are also of importance.

Lateral Impact Mechanism Reviews

Intrusion = Injury



Source: CIREN, NHTSA's *Crash Injury Research and Engineering Network's* public available electronic case access <http://nhtsa-nrdapps.nhtsa.dot.gov/bin/cirenfilter.dll>

Slide Audio: Here is a diagram that shows the type of lateral intrusion into the driver's side. The location of the intrusion will be correlated with a potential injury pattern to the body.

A higher side impact you can expect more thoracic and chest injuries. In a lower side impact, you can expect more pelvic injuries. If the door panel has an arm rest, you could expect more abdominal injuries. Then it is important to examine if there is a raised center console with a low side impact that increases risk of pelvic fractures

Side Impact Crashes

Major intrusion
with low bumper



Slide Audio: This is a 45-degree photo of the damage to the previous car. This is one of the standardize photos to be taken and gives the best perspective of the depth of crush and location of the intrusion. In general, in side impact is important to assess the amount and location of intrusion and look for the presence or absence of a raised center console and door arm rest.

Inside the car



Slide Audio: This picture shows the interior view of a vehicle with a low passenger side impact. Notice the magnitude of intrusion from the door into the vehicle compartment while paying attention to the vehicle had a raised center console. Predictably this patient had severe pelvic injuries with bladder rupture.

Side Crashes Review

- Intrusion = Injury
- Restraint status
- High, middle, low or combined strike
- Arm rest
- Raised center console



Slide Audio: To review, with side impact crashes, it is critical to identify if the crash was a high, middle, or low a strike or a combination of those. The type of impact predicts injuries. With side impact crashes, you will need to pay attention to the interior shots of the vehicle particularly to identify if an armrest on the door and a raised center console are present. an armrest on the door can cause particular damage to solid organs. The presence of a raised center console can dramatically increase the risk of pelvic fracture.

Rear and Rollover crashes

- Intrusion = Injury
- Degree of intrusion
- Direction of intrusion



Slide Audio: Any significant crush occurring to the back in a rear end crash is still sign of a serious crash especially if there is intrusion into the rear seating compartment. In rollover crashes the intrusion rule of 12 inches or more still applies. Any signs of roof crush over the seated occupant space should a concern since it may have contacted the head causing serious brain injuries or even fractures to the C spine. The most important thing to remember about TraumaHawk program is that it captures the amount of crush and assesses the amount of intrusion that is predictive of the severe injuries.

TraumaHawk Program

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The University of Iowa
Emergency Medicine

Slide Audio: This concludes the TraumaHawk presentation discussing the anatomy of a car that impact injuries during a crash. If you have any questions or would like additional information regarding TraumaHawk please feel free to contact Dr. Daniel McGehee or Dr. Chris Buresh at the University of Iowa. Thank you.

Appendix D: TraumaHawk Mobile App Training

TraumaHawk Mobile App Training for the field



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Using TraumaHawk Mobile App

Why it is important to use TraumaHawk

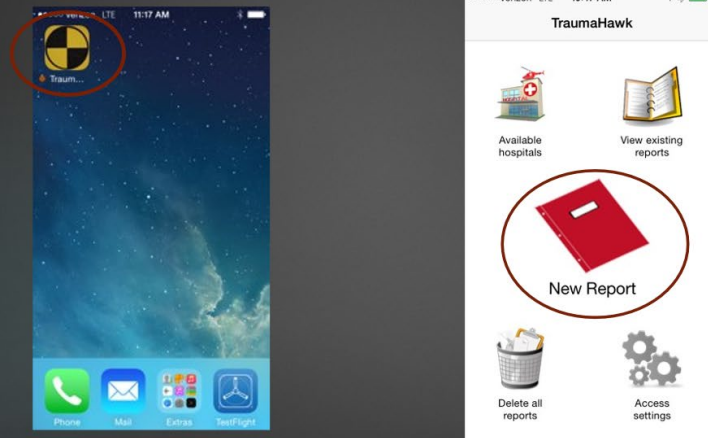
- Advance notice to ED about incoming Trauma patients
- Details regarding level of intrusion thus indicating type of injuries.
Important to Remember: Intrusion = Injury
- Increased communication between first responders and ED

When to use TraumaHawk

- Crash involves a fatality
- Crash involves an injury that will be sent to IHC
- Intrusion into occupant compartment 12" or greater
- A-Pillar movement

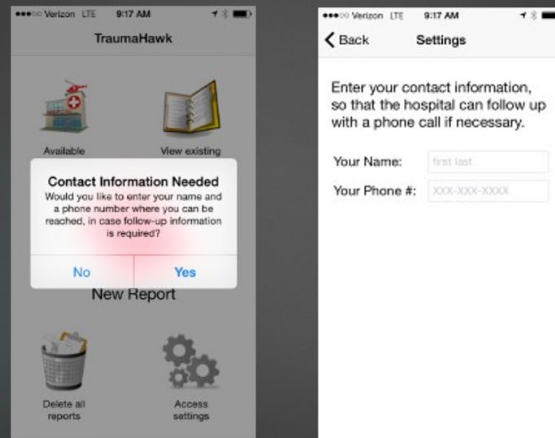
Slide Audio: Welcome to the TraumaHawk mobile app Training presentation. During this presentation you will learn when to use the app, how to create a report, how to take and edit photos and submitting the report. TraumaHawk is important because it provides additional time for the emergency department to prepare for crash victims as well as proper preparation for the types of injuries prior to crash victims arrival. When to use the app. The app is designed to alert the Trauma Center when a serious collision has taken place. The pictures provide the ED with insights into the injuries they should prepare for.

Starting a New Report



Slide Audio: When you decide that a TraumaHawk report should be generated, you should tap on the TraumaHawk app on your iPhone screen. After selecting the app a new screen will appear. To start a new report, tap on the New Report icon

Contact information



Slide Audio: If you have not set already set up your contact information, you will be promoted to do so before starting a new report. When prompted, tap on Yes. A new screen will appear, please enter your name and badge # and your phone number. This information should be store for future reports.

Select a crash type and number of occupants

The image displays two screenshots of a mobile application interface for reporting a crash. Both screenshots show a 'Details' screen for a crash on 'Apr 28, 2015 09:17 AM'. The left screenshot shows the 'Number of Occupants' set to '0' and no crash type selected. The right screenshot shows the 'Number of Occupants' set to '2' and 'Rear-End' selected with an 'X' in the checkbox. Both screens include a 'Next' button at the bottom.

Left Screenshot (9:17 AM):

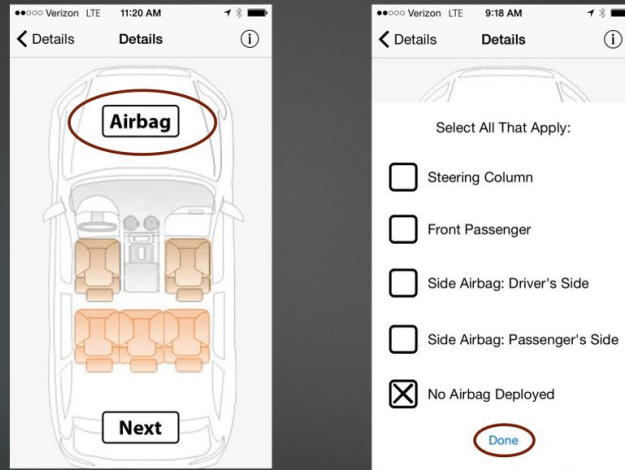
- Crash Type: Frontal, Side, Rollover, Rear-End
- Number of Occupants: 0
- Distance: 0.10 km
- Change Hospital: University of Iowa Hospitals and Clinics
- Next

Right Screenshot (9:18 AM):

- Crash Type: Frontal, Side, Rollover, Rear-End
- Number of Occupants: 2
- Distance: 0.10 km
- Change Hospital: University of Iowa Hospitals and Clinics
- Next

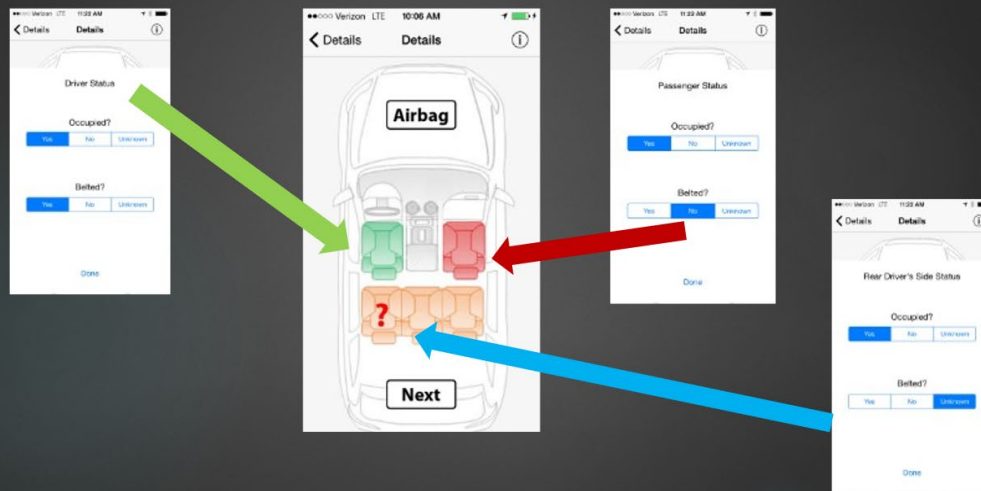
After a new report is begun, you will need to select the crash type and the number of occupants. Once you select that type of crash you will see an X in the box of your selection. It is required to enter the number of occupants. If you try to select “Next” prior to entering number of occupants, you will be prompted to enter the occupant number. After selecting the crash type and number of occupants, select next.

Select Airbag deployment



A new screen will appear. It will include a car with an Airbag and passenger seats. First choose the airbag button. A new screen will appear, make selections by tapping on the box next to each air bag that deployed during the crash. No Airbag deployed is the Default Setting so please make sure to change it if an airbag deployed. After selecting the airbag deployment, tap on done.

Select occupants and seatbelts

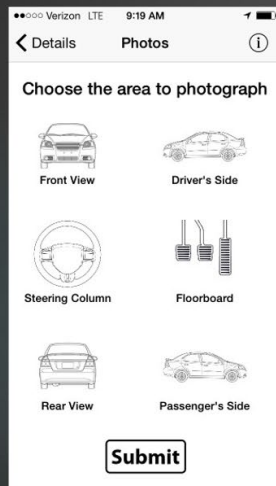


Now you will choose where the occupants were sitting and if they were wearing a seatbelt. Tap on the driver seat. A New screen will appear. If it was occupied select yes and whether or not driver was belted. If unknown, select unknown. Select Done. It will take you back to the car, if there was a front passenger, tap on the front passenger seat. When the new screen appears select whether the seat was occupied and if belted then select done. Again it will go back to the car. If there were passengers in the rear, select which seat and continue process. If passengers were thrown from the vehicle you will need to select unknown for seat occupancy.

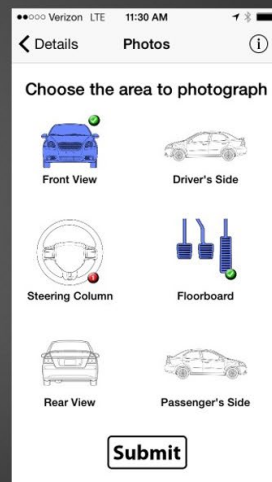
If an occupant was belted their chair will appear green (see driver's seat). If an occupant was not wearing a seatbelt the seat will appear red (see front passenger). If belted status is unknown, the seat will appear with a question mark as shown in the rear passenger seat. In the picture above, the two additional rear seats in the back are not occupied. When you have identified where the occupants were seated and their belted status, select Next.

Once you have completed the occupant status, tap Next

Photo selection screen



Before pictures are taken

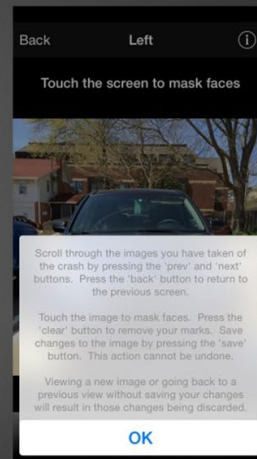
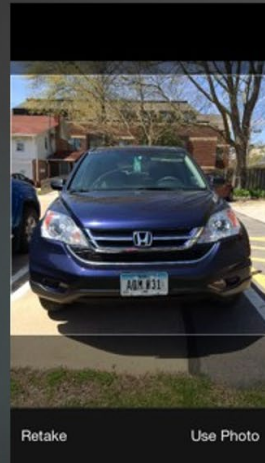


After pictures are taken

A new screen will appear. You will use this screen to choose which pictures to take. For each set of pictures just tap on the icon you wish to take pictures of. Tap on Front View for frontal crashes, Drivers' side for driver's side collisions, Rear view for rear collisions, and passenger side for collision on passenger side. For rollover collisions, choose front view??? Steering Column and Floorboard pictures should always be taken.

You will notice in the picture on the right that the front view and the floorboard have a little green check mark by it. That indicates that all the required pictures for the front view have been taken. You may notice that the steering column has a little red circle with #1 in side of it. That indicates that 1 picture has been taken. The red indicates that additional pictures may be necessary. The driver's side, rear view and passenger's side do not have a red or green dot by them. This indicates that no pictures have been taken. Once all pictures are taken and edited, tap on submit.

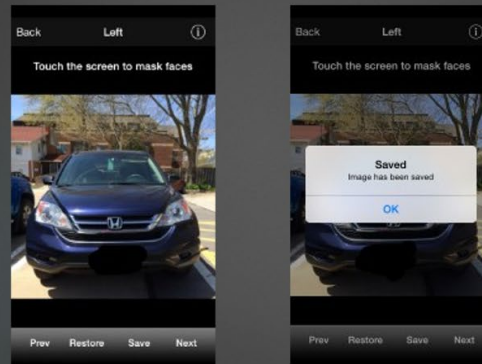
Taking Photos



After making a selection on the photo selection screen you will be taken to a page that instructs you on what image you should take. If you need an example press help. If you wish to take a picture, tap on the Camera button. When taking the picture make sure to get as much of the vehicle in the picture as you can. Try to include the A Pillar. To take the picture, tap the white circle on the screen of your camera. If you like the picture, tap on Use Photo. If you do NOT like the picture, tap on Retake and take the picture over until you like the photo. Once you have a picture you like, tap use photo.

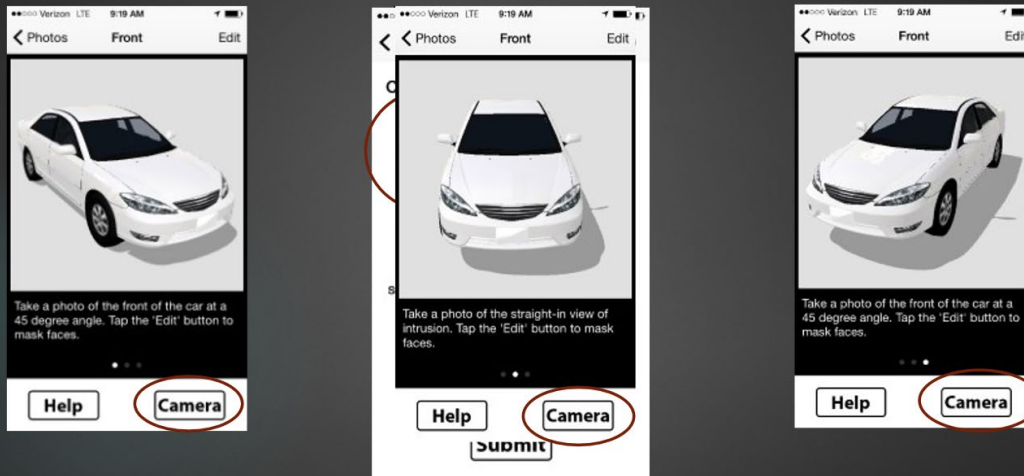
You can take zoom in or out by pinching or moving your fingers father apart on the screen.

Editing Photos



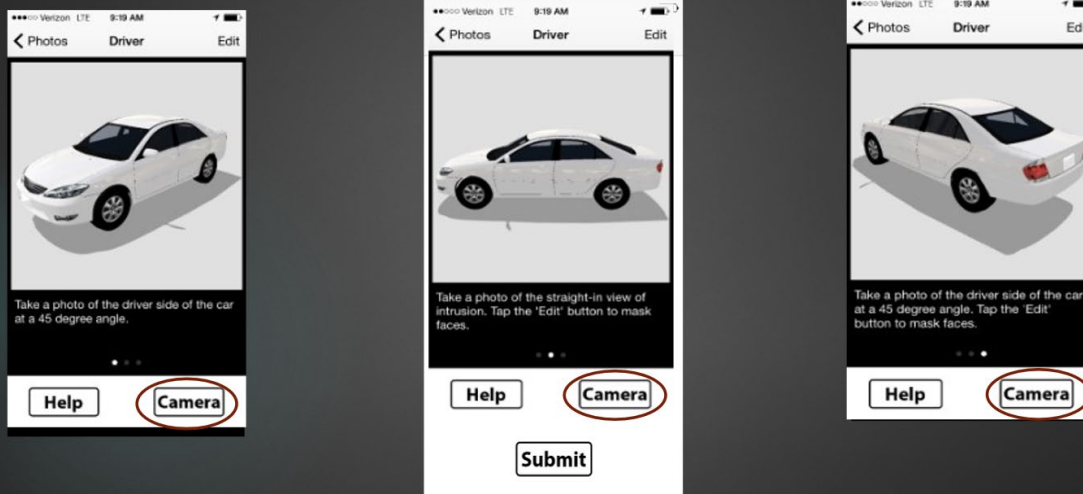
Sometimes you will need to edit a photo by blacking out any identifying information such as faces or License plates. Once you tap Use Photo it will take you back to a screen where you have the option to Edit the photo (Upper Right corner). To edit, tap on the Edit button. A new screen will open. All you have to do to edit the photo is place your finger on the screen and move it like a pencil to black out anything you want hidden. If you like the edits then tap on Save. After hitting save, a prompt will come up indicating that the image was saved. Tap Ok to continue. If you do not like the edits, tap on restore and redo your edits. The prev and Next buttons will take you through the other photos in the grouping. They are only useful if you have taken all the necessary photos for that sequence of photos.

Front Collision



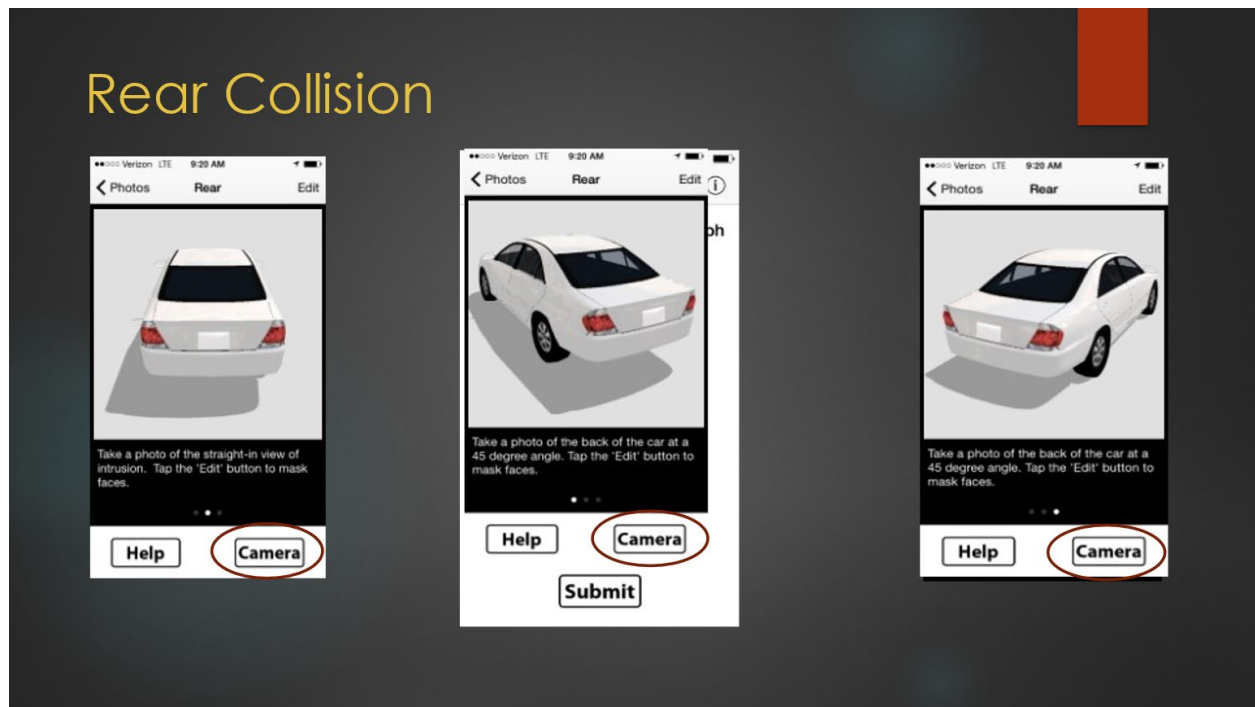
After selecting Front View, a screen will appear telling you to take a photo of the front of the vehicle at a 45 degree angle. To see an example, tap on help. To take a picture click on Camera. You will take a picture from the front passenger side at 45 degree angle, straight-in view of intrusion and 45 degree angle from driver's side. Remember to take a picture, press camera. Make the shot is wide enough to include the intrusion and the A-pillar. Zoom in and out by pinching or moving your fingers father apart on the screen.

Side Collision-Driver Side



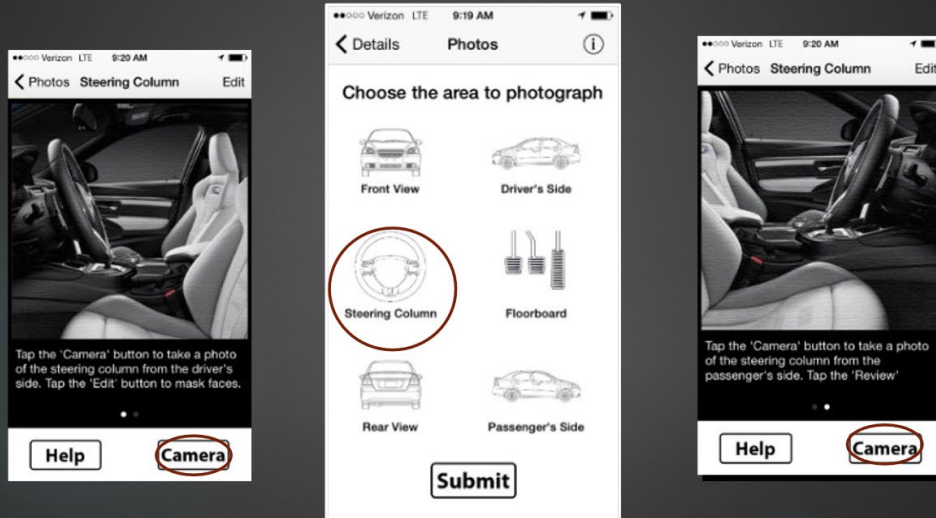
After selecting Side collision-passenger side, a new screen will appear telling you to take a photo of the front of the vehicle at a 45 degree angle. To see an example, tap on help. Then take a picture straight in view of the intrusion followed by a 45 degree angle of the intrusion from the back of the vehicle. Remember to take a picture, press camera. Make the shot is wide enough to include the intrusion and the A-pillar. Zoom in and out by pinching or moving your fingers father apart on the screen.

Rear Collision



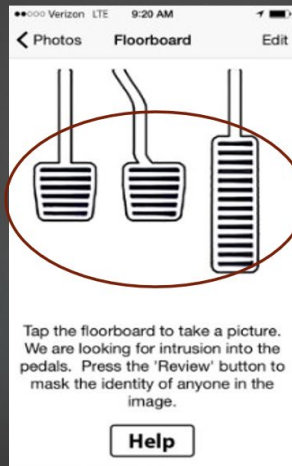
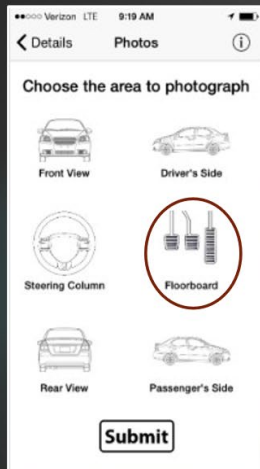
To take pictures for a rear collision, tap on the Rear view icon. You will be instructed to take pictures from 45 degree angle of the back driver's side of vehicle, straight in view of the intrusion and at 45 degree angle from back passenger side of vehicle. Remember to take a picture, press camera. Make the shot is wide enough to include the intrusion. Zoom in and out by pinching or moving your fingers father apart on the screen.

Steering column



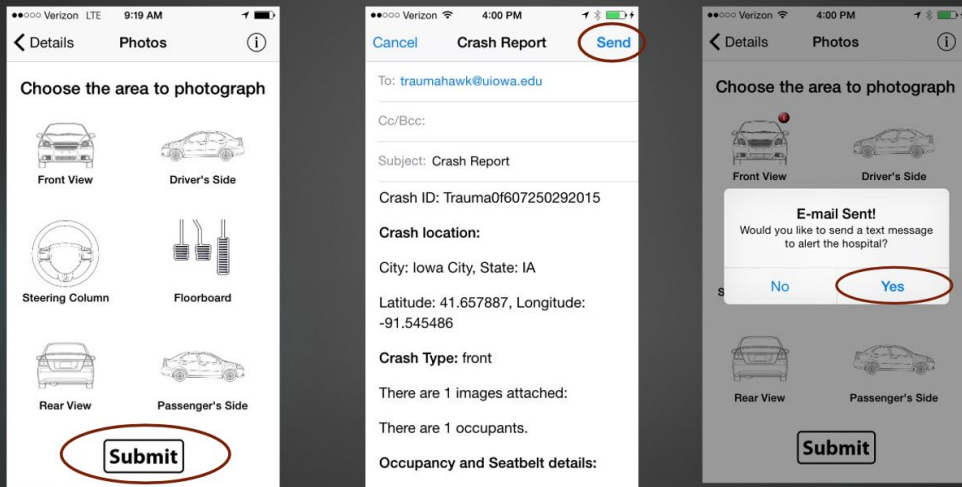
It is important to know if the steering was broken in any way. Picture of the steering wheel also can provide a visual of any airbag deployment. On the photo selection screen, tap on the steering wheel icon. You will be instructed to take a picture of the steering wheel from both the driver's side and the passenger side. Make sure the picture is wide enough to include the steering wheel and the driver's seat as well as the roof and floor.

Floorboard



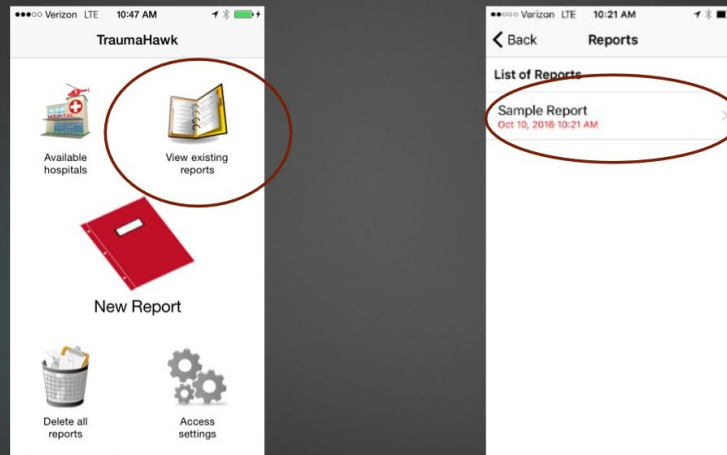
To take a picture of the floorboard, go to the photo selection screen and tap on any of the pedals. The floor board picture is important to show if there is intrusion into the pedals as well as any scuff marks on the knee bolster. When taking a picture of the floorboard it is important to take it at an angle so that the knee bolster is visible. As seen in this picture, there is a mark on the knee bolster indicating that the occupant's knee made contact. the If you tap the Help button you will see an example

Submitting the Report



Once you have taken all of the appropriate photos and edited out any identifying information you are now ready to submit the report. Tap on the Submit button at the bottom of the photo selection screen. After you hit submit, a copy of the email should appear on your phone. Once you review the email, tap send in the upper right hand corner. It should then send the email to the appropriate address which is traumahawk@uiowa.edu. You will then receive a prompt asking if you wish to send a text message to alert the hospital? Tap Yes to notify hospital.

Starting a Sample Report



Important information about your phone

Unlocking your phone

- Each phone is locked with the last four digits of the assigned phone
- This number is highlighted in green on the TraumaHawk label

Updating your phone

- Your app will need an update about every 60 days.
- You will receive an email from the developer to your phone's email.
- Open the email & Tap Update.
- If you need your Apple ID and password to update the app:
 - Your Apple ID is your Gmail on your phone. Each phone is assigned a number which is found in the upper right hand corner of label. This is used in your Gmail address traumahawkapp#@gmail.com (i.e. if you have 1 you would be traumahawkapp1@gmail.com)
 - Your password associated with your Apple ID is Firstresponder# (i.e. Firstresponder1)



Thank you!

Questions, comments, or requests for modifications to the TraumaHawk mobile app, please contact Cherie Roe

319-335-6803 work

319-621-2552 cell

cheryl-roe@uiowa.edu.