DEVELOPMENT OF AN ON-SCENE IN-DEPTH MOTORCYCLE ACCIDENT INVESTIGATION RESEARCH PROGRAM IN THAILAND USING THE HURT STUDY AS A MODEL

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Abstract

This paper reports the development, training, and monitoring of an on-scene, multidisciplinary, motorcycle accident investigation team in Bangkok, Thailand. The basic model for this research program was the original *"Motorcycle Accident Cause Factors and Identification of Countermeasures"*, commonly known as the Hurt Study which was conducted over 20 years ago at the University of Southern California in Los Angeles, California. This paper describes training an investigative team, developing cooperative agreements and collecting on-scene in-depth motorcycle accident data in Thailand, and how the methods used in the Hurt Study were adapted to Thailand. The improved methodology of on-scene, in-depth motorcycle accident research in Thailand can be applied to any future motorcycle accident research program that plans to collect similar data. In particular, it is expected that some of the solutions and adaptations developed in Thailand may be applicable to the challenges that will exist for any future international on-scene in-depth motorcycle accident research study.

Introduction

Since it was published in 1981, the document titled *"Motorcycle Accidents Cause Factors and Identification of Countermeasures"* (Hurt et al., 1981), commonly known as the Hurt Report continues to be considered the most comprehensive and complete motorcycle accident research study in North America. Motorcycle safety policies and practices of both government and private organizations continue to be developed based upon the data that was collected during this study.

The fundamental purpose of the Hurt Study was to collect detailed, reliable and useable information about motorcycle crashes. This included the basic facts of how and why the accident happened and how injuries occurred or were prevented. In order to collect this information, trained investigators with previous motorcycle riding experience traveled to the accident scenes and collected accident scene information such as skids and scrape marks, witness information, rider and passenger interviews, medical information, and often obtained accident-involved helmets. When all these data had been collected, the crash was then reconstructed and analyzed.

Although the basic idea was straightforward and clear, development and monitoring of such a project covering an area of over 432 square miles (i.e. the City of Los Angeles) involved a tremendous amount of coordination and collaboration. Cooperative

agreements were required between many different agencies and groups including those that had jurisdiction over ambulance dispatch and patient transport (Los Angeles Fire Department) the roadway (Los Angeles Police Departments, California Highway Patrol, Los Angeles County Sheriffs, etc.), the accident scene, the accident vehicles (police and tow yards) as well as the personal and medical information of those persons involved in the accident. Investigation of fatal cases also required cooperative agreements with the Los Angeles County Coroner's office.

Once all necessary agreements had been obtained, a team of investigators was hired and trained. A prerequisite of the job of investigator was experience riding motorcycles. These investigators spent four months in a combination of classroom training, motorcycle skills development, working with cooperating agencies to understand their jobs and functions and how to interface successfully with each agency; and simple practice training at investigating and reconstructing motorcycle accidents in order to sharpen their skills.

The initial four months of training were followed by 24 months of on-scene in-depth motorcycle accident investigation. Throughout the entire data collection and analysis process, the quality was monitored in order to ensure that the highest quality of data was collected and entered into the computer database.

In 1975 the cost of the Hurt Study was $501,814.00 and as mentioned above, it involved a tremendous amount of collaboration and coordination with different agencies. Much has changed in the last 23 years, both within the motorcycle community as well as within society in general. Current costs for research programs of this type remain very high; however, a more significant problem is obtaining the cooperation of the many agencies that exercise much more strict control over privacy of records and access to the information necessary to conduct an identical study. It is possible that in many motorcycle accidents, collection of the same information today (e.g. driving records, medical records, personal interviews, etc.) may be very difficult due to limitations of access to information.

However, given the tremendous success and solid scientific basis of the original Hurt Study, it is appropriate to use the methodologies developed during that study as the first step towards the development of an international model for present day motorcycle accident research projects. This paper describes the results of such an effort involving the application and adaptation of the methodologies used in the Hurt Study methods for a large on-scene, in-depth motorcycle accident research project in Thailand.

Methodology

Identification of Research Partner and Training of Investigators

Following the development and completion of the overall research plan for an on-scene in-depth motorcycle accident research program in Thailand, a suitable local research partner was identified by thorough research and investigation. The requirement for the

research partner was that it would be a University or similar facility with colleges or schools of both engineering and medicine. The research partner needed access to both engineering consultants and qualified medical consultants, all of whom had an interest in motorcycle accident research. Chulalongkorn University in Bangkok, Thailand was identified as a research partner that could provide the necessary base technical expertise, as well as a pool of recent graduates from which a team of investigators could be assembled.

A group of sixteen investigators was hired and provided with an intensive, 12-week course which included training in accident investigation methodology, interviewing methods, photography, accident reconstruction methods, motorcycle rider injury mechanisms, human factors, team field relations, motorcycle dynamics and motorcycle systems. Table 1 provides a listing of major topic areas covered in the training phase of the project. In addition, considerable time was required to explain and illustrate usage of the comprehensive data form consisting of over 2300 data elements. All investigators also participated in a one week motorcycle training course at a rider training center near Bangkok. Finally, the training course was completed with three weeks of on-scene investigation skills training under the supervision of the HPRL faculty. This activity provided the investigators with the opportunity to practice applying their skills in motorcycle accident investigation by investigating and analyzing approximately two dozen actual accidents that occurred in Bangkok.

Table 1: List of training topics covered during investigator training

Training topics
Field relations with outside agencies
Accident investigation methodology
Interviewing methodology
On-scene photographic techniques
Motorcycle systems and dynamics
Human factors in motorcycle accidents
Motorcycle accident injury mechanisms
Accident analysis and reconstruction
Motorcycle traffic proficiency
Practice accident investigations

At the same time as the investigator training, the Thailand principal investigator (medical) was trained in the techniques required to perform detailed head and neck autopsies according to the procedures developed by Noguchi and Rehman (1983).

Data Collection, Accident Reconstruction and Causation Analysis

Accident notification and access to the accident scene were identified as critical factors for both the Hurt Study and the Thailand study. Therefore, considerable early efforts were devoted to securing police cooperation to permit access to accident scenes and

determining how motorcycle accident information is transmitted within and between police and emergency medical systems. In Bangkok, the Thai research team developed the method of monitoring police communications at the ambulance dispatch centers of two large public hospitals. Dispatchers at the hospitals monitored police radio communication frequencies, dispatched ambulances as needed, and notified the research team, which responded immediately in an emergency vehicle with lights and sirens activated. Similar arrangements were made in the other five geographical regions that were sampled as part of this research project (Sara Buri, Petchaburi, Trang, Khon Kaen, Chiang Rai).

Access to the accident scene was secured through the Chief of Police of each sampling region. However, it proved necessary to assure local law enforcement officers that the purpose of the research was to collect research data, and not to monitor or evaluate the activities of the local police force or individual officers.

Once on-scene, the investigation team was divided into units which measured and photographed vehicles and damage, measured the accident scene and documented skid marks, scrape marks, points of impact and rest, and examined the motorcycle for modifications, maintenance condition, rider contacts and interactions, etc. Investigators also conducted interviews with riders, passengers, car drivers (if applicable) and eyewitnesses. In many cases, injuries were identified and photographed directly while the motorcycle rider or passenger was still at the accident scene. Once the on-scene investigation was complete, the injured parties were followed through the medical system to determine the details of injury. During hospital follow-up, x-rays were also photographed whenever possible. In fatal accidents, a special in-depth autopsy procedure was performed which included a detailed documentation and special analysis of head and neck injuries.

Upon completion of the collection of all basic data elements of the accident (i.e. environmental factors, human factors and vehicle factors), each accident was scientifically reconstructed to determine speeds, pre-crash motions and collision avoidance actions and the critical factors that caused or contributed to each crash. Rider dynamics and injury contact surfaces were determined, and helmet performance was evaluated. The data form was then completed and the entire file was reviewed by the principal investigator in Thailand. This case file was then forwarded to HPRL for oversight review and technical assessment. The data were then entered into Microsoft Access ™ and SPSS ™ computer databases for analysis.

Results and Discussion

A total of 1070 accidents has been collected in Thailand using this established methodology. The data collection took place over 20 months in six different regions within Thailand. The first 12 months were devoted to research in Bangkok and the remaining eight months involved collecting accidents from other sampling regions of Thailand which were located 150 to 700 km from Bangkok. As was found in the original Hurt Study, the development of cooperative agreements between the research team and

the appropriate agencies appeared to be one of the most important aspects that assured the success of this research program.

Once an injured rider or passenger was transported to the hospital, access to the medical information of injured Thailand motorcycle riders was greatly facilitated by these cooperative agreements between the research team and the treating hospitals. During the Hurt Study, access was obtained in one of two ways – by investigators going into emergency rooms with the investigating officer, or via direct contact between the team medical consultant and the treating physician. In Thailand, injury information could usually be collected by the direct contact between the principal investigator and the treating physicians. While this method was successful in Thailand, patient privacy laws in many other countries, including the USA, may not permit direct contact with the treating physicians and this could severely limit access to injury information. Future motorcycle research programs will most likely require specific cooperative agreements among medical care providers in order to gain access to the injury information of an accident-involved motorcycle rider.

Accident Notification and On-scene Activities

Within each sampling region of Thailand, the use of a hospital based notification system proved to be very successful for acquisition of motorcycle accidents. The use of emergency response vehicles to get to the accident scene also greatly increased the number of case acquisitions. By comparison, the Hurt Study monitored the ambulance dispatch system of the Los Angeles Fire Department. These notifications were supplemented by direct telephone contact from the Los Angeles Police Department dispatchers.

Significant differences in police methods of handling accidents were noted between Bangkok and Los Angeles, and these differences affected the way the investigations were handled in each region. In Los Angeles, police typically took longer to investigate accidents and, except for freeways, were more willing to restrict traffic flows during the on-scene phase of the accident investigation. Traffic was found to be more congested in Bangkok, and police officers placed more emphasis on quickly returning traffic flow to normal. This meant that vehicles were quickly moved from points of rest and much less time was available for documenting physical evidence such as skids, scrapes, cloth marks, blood, etc., in the roadway.

As a result of this limited amount of time, four to six team members were sent to each accident scene so that all on-scene data collection could be completed as quickly as possible. In Los Angeles most cases were investigated by two or three team members, or only one in some cases, with approximately one hour spent on scene by the investigator. In Thailand, the on-scene data collection phase was typically completed within 30 minutes of arrival.

The rapid on-scene investigation of Thailand accidents placed a heavy requirement on investigators to coordinate their activities and findings. For example, if the investigator

responsible for conducting interviews went to the hospital, it was his duty to notify and make arrangements with those investigators on-scene to be sure that all on-scene interviews were completed. Similarly, all on-scene investigators needed to communicate with each other via radio or cellular phone during the on-scene investigation procedures. This was due to the fact that an investigator at one location might discover information that needed to be communicated to the other on-scene investigators so that they could look for and document additional evidence at their location.

The on-scene response of the investigators also exposed each investigator to additional safety risks that would not be present during follow-up investigations. Exposure to a disrupted and uncontrolled traffic flow pattern and on-scene blood borne pathogens such as HIV demanded that a strict on-scene safety plan be developed and implemented.

During the data collection phase of the Hurt Study, sixty-six percent of accidents were investigated on-scene, immediately after the accident occurred. This was due to the fact that it was impossible to have a team available at all times of day, seven days a week. Therefore, one-third of cases were investigated by follow-up within twenty-four hours after the accident.

In contrast, investigation teams from Chulalongkorn University were on-call twenty-four hours per day, seven days per week. As a result, over eighty percent of Bangkok accidents were investigated on-scene, immediately after the occurrence. In the five other sampling regions, the percentage of immediate on-scene responses was lower due to the fact that many riders were taken to hospital by relatives prior to the arrival of the investigators. It is doubtful that the follow-up method could be used in Thailand, because so many motorcycle riders did not have a residential or business telephone, and locating vehicles after an accident scene had been cleared from the roadway proved to be very difficult.

Given this need to immediately obtain witness and rider information, the ability of the investigator to collect relevant information as quickly as possible becomes critical. This requirement demands that the investigator has a complete understanding of motorcycle riding and motorcycle dynamics prior to attempting an interview with another motorcycle rider or prior to attempting to understand and interpret the physical evidence provided at the scene of a motorcycle accident (e.g. skid marks and scrape marks).

Accident Reconstruction and Quality Control

Motorcycle accidents are unique events and although motorcycles obey the laws of physics they often do not provide as much physical evidence when compared to automobile accidents. The crash dynamics of a single-track vehicle tend to be more uncontrolled when compared to dual track vehicles, thus making interpretation of the physical evidence even more challenging.

The need for motorcycle dynamics familiarity and knowledge of motorcycle crash performance also becomes very important when completing the reconstruction and

analysis for a given accident. Collision performance is known to vary depending upon the size and style of motorcycle. Such factors as wheel type (wire spoke or cast), front suspension type (conventional or inverted forks) and frame geometry, construction and strength all play a major role in motorcycle deformation and collision kinematics. When evaluated at a similar impact speed, the damage profile of each of these different types of motorcycles is also very different. Therefore, a complete understanding of the limitations of the available literature regarding motorcycle crash performance is critical to developing accurate motorcycle accident reconstructions. While motorcycle crash test studies have been conducted in the past to document the relationship between wheelbase deformation and crash speed (Severy et al., 1970), the available literature regarding motorcycle crash studies is very limited when compared to automotive crash research literature. The lack of a large database of motorcycle crash tests makes it difficult for investigators to compare real world accident damage to well documented laboratory crash data. This shortage of comprehensive crash test data definitely placed limitations on speed analysis in some complex accident cases.

As with the Hurt Study, the need for several stages of quality control was necessary in order to ensure that the data remained at a very high level of quality. Every qualified case was evaluated by both the principal investigator in Thailand and HPRL staff in order to identify any reconstruction or analysis errors. Additional quality control analyses were conducted in order to identify any coding errors on the data forms or data entry errors during data entry into the computer database.

Summary and Conclusions

This paper has described the development and implementation of an in-depth motorcycle accident research program in Thailand. The methodology used in this research program was based upon the methodology originally developed for the Hurt Study conducted in Los Angeles, California between 1975 and 1981.

Comparisons between the two programs clearly indicate that an on-scene in-depth motorcycle accident research program relies heavily upon the ability to obtain the proper authority and access to information and the ability to obtain full cooperation from all agencies that are involved. A successful program also relies upon the experience and expertise of the motorcycle investigators who are collecting the on-scene information and the availability of medical consultants and other specialists who can provide specific information whenever necessary.

Overall, the success of the current research program in Thailand has illustrated that the research model developed by the Hurt Study can be adapted by other countries for use as the basis of future motorcycle accident research projects aimed at finding the causes of motorcycle accidents and injuries and identifying countermeasures. Such an effort is currently taking place with the development of a common international methodology for on-scene motorcycle accident investigations with HPRL staff contributing the draft manuscripts (OECD, 1999).

Acknowledgement

The authors gratefully acknowledge the support of Honda Motor Company Limited, Japan, Asian Honda, Thailand and AP Honda Limited, Thailand.

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