Identifying the causes and consequences of motor vehicle injuries in China

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Abstract

Aims
Motor vehicle-related injuries are a leading cause of injury death in China. However, little is known about their causes and long-term consequences. This presentation outlines the development of a proposal to conduct a case-control and subsequent cohort study to address this lack of information.

Methods
An international collaborative group was established, involving Australian and Chinese researchers, local hospitals, other health authorities and the police. A draft proposal was prepared for review. The feasibility of case and control recruitment and follow-up was assessed. A draft questionnaire was pre-tested and procedures for the collection of alcohol measures were explored.

Results
Over a two year period, commencing in mid 2001, 1000 drivers of motor vehicles in which one or more individuals is hospitalised or killed, will be recruited through 11 hospitals in the city of Shenyang. Concurrently, 1000 drivers of motor vehicles being driven on the city roads will be randomly stopped and recruited. Information will be obtained on potential driver, vehicle and road environmental risk factors. Both case and control drivers will then be followed-up at 4 and 14 months to identify any longer-term consequences.

Conclusion
It is feasible to undertake a major collaborative study of motor vehicle crashes in China.

Introduction

Motor vehicle injuries are an important and growing public health problem in China. In 1996/7, they were the leading cause of injury death in urban areas and the second leading cause in rural areas. Between 1987 and 1997, while injury death rates decreased overall, death rates from traffic injury increased by 24%. These trends are consistent with those identified in the Global Burden of Disease study, in which it was projected that motor vehicle related injury in China would be the 4th leading cause of death and disability in 2020, compared with the 12th in 1990.

In addition to the observed steady increases in death rates from traffic injury, the cause-specific patterns of traffic injury death are changing dramatically. In urban areas, injuries sustained in multi-vehicle crashes are becoming more predominant compared with those involving pedestrians and bicyclists. In 1989 and 1990, for example, more than half of all traffic crashes in Guangzhou city involved cars, while studies of traffic crashes on the motorways outside of Shenyang city, showed that between 1994-5, more than 40% of crashes involved collisions between two motor vehicles.

Aims

Despite growing evidence showing the significance of motor vehicle related injury as an important contributor to the current and projected burden of injury death and disability in China, no controlled epidemiological studies have been conducted to determine the causes and consequences of such injuries in China. This paper outlines the development of a proposal to conduct a case-control and subsequent cohort study to address this lack of information.

Methods

An international collaborative group was established last year, involving researchers from the Institute for International Heath (University of Sydney, Australia), Peking Union Medical College (Beijing, China) and Shenyang Medical College (Shenyang, China). Additional collaboration was sought from local hospitals, other health authorities and the Traffic Police Bureau in Shenyang. Shenyang (pop.3.2 million) was selected as the site for these studies on the basis of the training, experience and enthusiastic support of the Shenyang Medical College staff, the participating hospitals' staff and the Traffic Police Bureau. It was also selected on the basis that the city is comparable in many ways to other large cities in China that are currently experiencing (or are soon likely to experience) significant increases in motorisation and associated vehicle-related injury.

A draft proposal outlining the methods and organisation of the studies was prepared, based on previous experience in the design and conduct of the Auckland Car Crash Injury Study (ACCIS). The feasibility of case and control recruitment and follow-up was assessed. A draft questionnaire was pre-tested and procedures for the collection of alcohol measures were explored. A finalised study protocol, taking into consideration the findings of the preparatory work, was prepared for submission and is outlined below.

Results

Study proposal

A case-control and subsequent cohort study are proposed. The case-control study aims to identify the causes of motor vehicle injuries and will also provide information about the nature, severity and in-hospital costs of the injuries sustained by drivers and injured passengers. The cohort study aims to determine the longer-term mortality, morbidity, disability and costs, specifically attributable to involvement in an injury crash, and to identify risk factors for adverse outcomes among drivers and injured passengers.

Case drivers will be recruited between July 2001 and June 2003 and will comprise drivers of all motor vehicles that crash on a road in central Shenyang city and in which one or more occupants (drivers or passengers) are killed or hospitalised. Individuals who die will be identified through the Coroner's office of the Traffic Police Bureau of Shenyang. Families of individuals who die will be contacted by a trained interviewer at 4-5 weeks following the death and invited to participate in the study. Hospitalised individuals will be identified from all 11 hospitals in the central city, and invited to participate in the study while still in hospital. For killed or injured individuals who were not driving the vehicle involved in the crash, the driver will be identified, contacted and invited to participate in the study. The driver of the "case" vehicle is the key informant for the case-control study.

Control drivers comprise drivers of a random sample of motor vehicles being driven on roads within the study area during the study period. Controls will be selected at random days and times, from vehicles identified randomly at randomly selected roadway sites. Control cars will be stopped over a period of two hours. The numbers of controls selected at any one site will be in proportion to the volume of traffic at the site, making the sample representative of car-kilometres travelled in the study region. Traffic density at each site will be measured, using vehicle classifiers, for the comparable day of week and time of day, one week prior to the stopping of vehicles, and this information will be used to ascertain the numbers of cars to be selected. At sites where it is not possible to stop vehicles for safety reasons, randomly selected cars will be photographed and drivers identified through their car registration numbers. Study staff will contact these individuals and invite them to participate in the study.

An estimated 1000 case drivers and 1000 control drivers will be recruited over a period of two years.

Blood or breath alcohol readings will be sought from all case and control drivers, and face-to-face interviews will be conducted as soon as is practically possible, by a trained interviewer. For cases, interviews will mainly be conducted in hospital. For controls, interviews will mainly be conducted at the roadside. The *driver questionnaire* will contain the following main sections: demographic information (age, sex, ethnicity, socioeconomic status); circumstances preceding the crash or survey (physical circumstances, fatigue, alcohol and drugs, distractions, passengers, visibility, seat belt use); personal factors (medical conditions, medications, usual alcohol and drug use, sleep patterns); driving experience (licence, amount of experience, usual driving behaviour, previous crashes); and vehicle details. Additional information of particular relevance to the cohort study will also be sought, relating to both current health status (SF-36) and potential risk factors (social support and social networks). Environmental information will be obtained from the crash sites, within four weeks of the crash at the same time of day and day of the week that the crash occurred. Environmental information will be collected from the selected "control" sites for a randomly selected time of day and day of week, one week prior to the survey (this information will subsequently be used to determine the sample size to be recruited at that site). The *environmental survey* consists of observations and measurements of the roadway and surroundings. The associations

between the exposures of interest and risk of motor vehicle occupant injury will be assessed from estimates of relative and attributable risks and their confidence intervals, using standard analytical methods for case-control studies. Additional information will be extracted from the *medical records* of all cases, as well as from additional hospital sources, to identify the nature, severity and costs of injuries sustained. Information on injury severity will be coded using standard instruments: the Abbreviated Injury Scale (AIS), from which Injury Severity Scores (ISS) will be calculated.

All case and control drivers and injured passengers will be followed prospectively and interviewed at 4 and 14 months after the initial interview to obtain information on current health status and use of health services. The follow-up information on physical, psychological and social functioning (collected using the SF36 and other standardised, validated tools) will be compared with similar information obtained in the initial interviews, for both case and control drivers. The incidence of morbidity, disability and costs attributable to involvement in an injury-related motor vehicle crash will then be determined by comparing data from cases and controls. Information collected at baseline from case drivers and injured passengers, and additionally from the police and emergency services with respect to information on pre-hospital care, will be used to identify potential risk factors for adverse outcomes.

Preparatory research for the proposed studies

All 11 hospitals in the central area of Shenyang have agreed to participate in the study and ethics committee approval to work in these hospitals has been obtained. Mandatory blood alcohol testing of hospitalised drivers has recently been introduced in Shenyang, in part, in anticipation of the commencement of the study. The Traffic Police Bureau of Shenyang have agreed to collaborate on this study, and from 2001 have assigned three of their staff to assist in the recruitment of controls. Specifically, the Traffic Police Bureau will assist in the establishment of roadside survey stopping sites for the recruitment of controls. This should facilitate good response rates, ensure the safety of the study staff and provide assistance with the control interviews. The police have also indicated that they will take responsibility for obtaining breath alcohol measures from control drivers. Both the Traffic Police Bureau and the Health Management Bureau of Shenyang have given permission for information about aspects of pre-hospital care to be accessed from their files.

In addition to these major logistic achievements, preliminary investigations have shown that it will be feasible to recruit 1000 drivers of vehicles in which one or more persons have died or been hospitalised as a result of a vehicle crash over a period of two years. Specifically, these investigations show that:

- over a three year period (1997-1999), there were 9,547 car or van crashes (not involving pedestrians or cyclists) reported to the police in Shenyang, involving 541 deaths and 4,642 injuries sustained by drivers or passengers (out of a total of 20,550 traffic incidents)
- in two of the 11 participating hospitals, examination of the medical records for 1999 identified 142 injured vehicle occupants, while in a third hospital, examination of the

medical records for the three month period from October to December 1999 identified 31 injured vehicle occupants

- over a one month period, from December 1999 to January 2000, 31 potential cases from the three hospitals referred to previously were approached and asked if they would agree to participate in a pilot study; all 31 individuals indicated their willingness to participate; eight of these individuals were contacted 15 days after the initial approach to determine the accuracy of their home contact details and their potential willingness to participate in follow-up interviews; all contact details were accurate and of the six individuals who were home at the time of the follow-up contact, all agreed to participate in follow-up interviews.
- since 1995, the Health Bureau and Police Bureau of Liaoning Province have determined that all individuals who are killed in vehicle crashes must have an autopsy; all deceased cases should therefore be identified through the Coroner's office of the Traffic Bureau of Shenyang.

Conclusion

Our activities to date have indicated that it is feasible to conduct a collaborative study to investigate the causes and consequences of motor vehicle-related injuries in China. The findings from this research should assist in reforms of existing legislation as well as improvements in both public health and transport services concerned with the prevention of motor vehicle injuries in China. They should also assist in the development of improved facilities for pre-hospital, in-hospital and post-discharge care of individuals with such injuries.