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Review of Police Road Casualty Injury Severity Classification – A Feasibility Study

Heather Ward¹, Ronan Lyons², Belinda Gabbe³, Roselle Thoreau¹, Leila Pinder² and Steven Macey²
¹UCL
²Swansea University
³Monash University

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EXECUTIVE SUMMARY

In July 2009 the UK Statistics Authority reviewed the STATS19 dataset of road accidents reported to the police. It found areas of weakness that should be reviewed. One was the classification of severity of injury of road casualties.

Aims and objectives of the study

The Department for Transport commissioned this review of injury severity classification in order to assess whether the police could be helped to distinguish more serious injuries from the less serious consistently and how this might be achieved. The specific aims and objectives of the study were to:

• Understand how the police currently assign injury severity.
• Assess the feasibility of improving the classification of the existing police definition of serious injury.
• Review medical evidence on the range of serious and slight injuries, their frequency and type, and develop sub-categories of serious injuries that have medical validity but would be practical for a non-specialist police officer to assign.
• Provide a recommended set of sub-categories for the existing serious category that has been successfully piloted with a range of police officers.

Accurate measurement of ‘severe’ road casualties is essential to guide the development and evaluation of national and local road safety strategies and to target interventions at high-risk locations. The rationale behind this study is to determine whether the collection of a small number of additional data items would assist in distinguishing slight from severe injuries and provide more reliable statistics.

Current practice in assigning injury severity

Assessing severity at the side of the road is difficult, even for experienced clinicians, as it is difficult to fully examine individuals and the severity or otherwise of many injuries is often not immediately evident. So, assessment by lay persons such as police officers is understandably even more difficult.

To understand how the police currently assign injury severity, 36 officers from nine forces were interviewed to assess:

• the level of training in filling out collision report forms they receive and whether this is updated;
• how they acquire the knowledge of what constitutes a serious injury and whether this changes with experience;
• whether the sections on description of injury and hospitalisation are filled out, are read and who reads them, and whether the severity is re-coded if necessary; and
• whether there is any follow-up with hospitals or families to ascertain level of injury and if so whether the reports are amended.

If a paramedic is present at the scene of the collision, all officers reported asking them about the type and severity of injury and this is what is transferred to the collision reporting form. If a paramedic is not present the officer assesses the injury, mainly using previous experience.

There appears to be a lack of clarity about the definitions of serious and slight injuries. New terminology is appearing, such as ‘life threatening’ and ‘life changing’, and this is causing even more confusion with some forces only deeming ‘life changing’ injuries (there is no accepted definition for this) as serious.

Obtaining information about severity of injury once the injured person has been transferred to hospital is patchy. Even when it is available the five forces who record collision information on paper forms find it difficult to update their reports because they are usually required to submit them between 24 and 60 hours after the collision. The four forces with a computerised system have more opportunity to update the level of severity, although not all do so.

Injuries sustained in road traffic collisions

For this study, two sets of analyses were performed, using data on hospital inpatient admissions obtained from the Hospital Episode Statistics (HES) database.

First, injuries sustained by people admitted to hospital were linked to mortality records, which provided the annual number of cases for each specific injury (or group of injuries)\(^{1}\) and the number who subsequently died. This was used to identify those injuries most likely to result in death.

Second, data from HES was linked to the police dataset (STATS19) to look at the frequency of injuries resulting from road traffic collisions. This provided the distribution of injury types and body locations occurring in the more serious (i.e. hospitalised) cases of road traffic injury recorded in STATS19 and showed that the 23 most common injuries recorded (out of a total of some 855) accounted for nearly three-quarters of all cases in the linked dataset.

\(^{1}\) Using the ICD-10 International Classification of Diseases, which is the international standard diagnostic classification of diseases and other health problems and is used in hospitals and on mortality records http://www.who.int/classifications/icd/en/
Development of an injury severity classification system for use by the police

Using the analysis described above, supplemented with data from other sources and our expertise in clinical medicine, disease classification and road traffic epidemiology, two alternative approaches were devised with the aim of improving the measurement of severity within STATS19.

The first approach consisted of a series of observations police officers could make or questions they could ask at the scene of a collision which do not require direct clinical training or expertise. These included asking about consciousness, the ability of the injured person to speak and to stand, signs of breathing difficulty, extent of blood loss, method of extrication from the vehicle and whether he or she was conveyed to hospital by ambulance. These were developed into a form for use by officers and piloted as approach A.

The second approach was to ask police officers, with the help of paramedics if present, to assess the actual injury or injury category using a pre-defined list developed from analysis of injuries sustained in road traffic collisions. Such a categorisation needed to include the most common injuries, the entire range of severity, take into account the reality that roadside diagnoses are frequently only suspected rather than confirmed (often require imaging or more detailed examination for confirmation), and brief enough to be practical for busy officers to collect. Again, the list was developed into a form for use by officers and piloted as approach B.

Approaches A and B were piloted by 39 officers in two forces and 87 forms were returned. In general the forms were liked, being easy and quick to complete. Just under half (47%) of the forms were returned with officers having no preference between A and B, but where a preference was stated it tended to be for approach A (28% preferred A and 12% preferred B). Ten forms (12%) came back from four officers who disliked both approaches.

Recommendations

In the absence of a clear preference between approaches A and B, approach B was considered to be more straightforward to implement than approach A. It also has the advantage of being more ‘visible’ or transparent and should lend itself more immediately to being capable of splitting the severity category into two or more parts based on a scientific approach to classifying injury severity.
Some further work was undertaken to refine the descriptions of injuries in approach B. This has resulted in the following revised list of injuries and severity classification, which could be incorporated into CRASH, the new electronic system for collision reporting that will use mobile devices to record information.

Deceased
Multiple severe injuries, unconscious
Multiple severe injuries, conscious
Severe head injury, unconscious
Other head injury
Broken neck or back
Whiplash or neck pain
Severe chest injury, any difficulty breathing
Other chest injury, not bruising
Internal injuries
Loss of arm or leg (or part)
Fractured pelvis or upper leg
Fractured lower leg/ankle/foot
Fractured arm/collarbone/hand
Deep penetrating wound
Deep cuts/lacerations
Bruising
Shallow cuts/lacerations/abrasions
Sprains and strains
Shock
Details/other injury (user selected; also has free text description)

*No injury category specified

The revised list takes into account the requirements for simpler terminology and the need to cover all categories of serious injury, and is organised by body region starting with multiple injuries and then from the head downwards. It is also ranked by likely severity within body region. Serious injuries have been divided into three sub-categories (very, moderate and less).

In terms of further work to validate the list of injuries for inclusion in CRASH or other data gathering systems, a large scale STATS19/hospital data matching exercise would be needed to assess the levels of actual injuries (as recorded by hospitals) compared with suspected injuries. The sub-categorisation of severity within the overall serious category may need to be revised following this exercise. This might be particularly important in relation to the ‘other injuries’ category so it does not become a catch-all.

Collision Recording And SHaring (CRASH) is a new electronic system for police collision reporting. CRASH will provide a system for secure collection, validation, transmission and storage of road traffic collision reports to meet police business needs and also DfT statistical requirements. Mobile devices (where available) will allow data entry at the scene of a collision – police will no longer have to fill in paper forms.
1 BACKGROUND AND STUDY AIMS

In July 2009 the UK Statistics Authority reviewed the STATS19 dataset of road accidents reported to the police. It found areas of weakness that should be reviewed. One was the classification of severity of injury of road casualties as drafted below:

Requirement 2 Publish plans to improve the reporting of data by police forces – both to report more accidents, and to improve the classification of the severity of injuries – flagging up the implications for continuity over time.3

As a result, the Road Safety Research and Statistics Division of the Department for Transport (DfT) commissioned this review of injury severity classification in order to:

a. review the definitions used by the police and clinicians, and advise on the potential for a more refined definition of injury severity within the serious range that is practical for use by a non specialist officer; and
b. consider the misclassification of injured casualties between serious and slight injury.

The definition of ‘serious injury’ for the purposes of recording in STATS19 is very broad:

A casualty is recorded as seriously or slightly injured by the police. STATS19 defines a “serious injury” as an injury for which a person is detained in hospital as an “in-patient” or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushings, non-friction burns, severe cuts and lacerations, severe general shock requiring medical treatment and injuries causing death 30 or more days after the accident. Therefore any casualty admitted as an in-patient to a hospital overnight should be recorded as “seriously injured”. However, the police are not necessarily told that a casualty has been admitted to hospital, nor is there a duty on the hospital to reveal this personal information about an individual if it is requested.4

The assessment of injury severity at the roadside by paramedics is difficult and can be inaccurate (Mulholland et al. 2008), so, understandably, assessment by lay persons such as police officers can be even more difficult. The apparent severity of

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injuries can change very quickly. Therefore, it is no surprise that there are discrepancies in the categorisation of severity of injury between medically trained staff and lay persons, especially for injuries where there is little or no blood, the casualty is conscious at the roadside or there are no obvious external signs of injury such as broken bones.

It should also be recognised that not all injuries, even severe ones, come to the attention of the police. Some never do and some are reported subsequently, which means that no police officer attended the scene. However, in general, the more severe the collision, the more likely the police are to attend. Deaths (before 30 days) are well recorded and categorised.

It is important to monitor the severity of injury for road safety policy development and evaluation. A less broad category of ‘serious injury’ has the potential to add value to the monitoring of trends in the relatively more seriously injured road casualties. It has been noted that:

the category ‘seriously injured’ does not distinguish between those whose injuries have substantial lasting effects and those from which there is substantially complete recovery.\(^5\)

However, if any alternative categorisation is to be proposed, it should ideally be capable of aggregation to the current definition to ensure compatibility with the long-term time series published in Reported Road Casualties Great Britain (DfT annual report). The purpose of this study is to assess whether, and how, the police could be helped to distinguish the more serious injuries from the less serious in a consistent way. In many cases the most serious injuries are fairly obvious to recognise. The difficulty comes as the level of severity drops and the boundary between the less serious and slight injuries approaches, increasing the likelihood of misclassification (Ward, Lyons and Thoreau 2006). This results in some serious injuries being categorised as slight and some slight injuries being categorised as serious.

The specific **aims and objectives** of the study are to:

- Understand how the police currently assign injury severity.
- Assess the feasibility of improving the classification of the existing police definition of serious injury to something that is more meaningful and useful (i.e. it can be assigned by a non-specialist police officer and has medical validity).

• Review medical evidence on the range of serious and slight injuries, their frequency and type, and develop sub-categories of injuries for serious that have medical validity but would be practical for a non-specialist police officer to assign.

• Provide a recommended set of sub-categories that has been successfully trialed/piloted with a range of police officers (from experienced/expert traffic officers to inexperienced officers).
2 UNDERSTAND HOW THE POLICE CURRENTLY ASSIGN INJURY SEVERITY

The police have been recording information on collisions for about 60 years. During this time the reporting forms have changed. The current collision reporting form is known as MG NCRF. This is a standard form for use by all police forces so that information is collected consistently. The definitions of injuries to be recorded as serious are given on the form but only as fracture, death after 30 days, hospitalisation, etc. There is a space on the driver and vehicle page of the form, and on the casualty page, for a description of the injury (if known) and whether the casualty was hospitalised (if known). There is a separate form which is used to report information for statistical purposes (MG NSRF); this does not contain descriptions of injury or details of hospitalisation.

The knowledge and skills required for filling out the parts of the form related to injuries should be acquired through training and experience. This was assessed by interviewing a selection of police officers of different levels of experience from nine forces in England, Wales and Scotland. Forces were chosen to cover both rural and predominantly urban areas. The nine forces selected were:

- Avon and Somerset
- Greater Manchester
- Lancashire
- Lothian and Borders
- Merseyside
- South Wales
- Sussex
- The Metropolitan
- West Mercia

In six of the forces contacted it was also possible to interview staff in the statistics or quality control offices who are responsible for the input and quality of the data.

The Lothian and Borders interviews were conducted by telephone while visits were made to the other forces. In total, 36 officers and nine statistics clerks or quality assurance staff provided information.
This aspect of the study assessed:

- the level of training police officers receive in filling out collision report forms and whether this is updated;
- how police officers acquire the knowledge of what constitutes a serious injury and whether this changes with experience;
- whether the sections on description of injury and hospitalisation are filled out, are read and who reads them, and whether the severity is re-coded if necessary; and
- whether there is any follow-up with hospitals or families to ascertain level of injury and if so whether the reports are amended.

### 2.1 The interview questions and responses

In general, the officers came from the Roads Policing Units (RPU) and were either very experienced or quite new to the RPU. In three cases, beat officers (these are officers whose duties do not include specialist roads policing and for consistency the term ‘non-RPU’ will be used) were also interviewed. While these officers may be first on the scene of a serious collision, they usually hand over to the RPU officers. Their views on assessing the less serious injuries were very informative.

In all cases the officers were willing and helpful in giving up their time and showed great interest in the aims of this project. The following is a composite report of the interviews.

**Q1. What do you look for in the injured person to determine how badly injured they are?**

The control base that picks up the 999 call usually sends the ambulance service first then the police and fire (if necessary). The ambulance is often there first as a fast response unit would be sent. In some rural areas the ambulance is so far in advance of the police that the casualty has sometimes been removed before the RPU arrive.

If paramedics are present, all officers reported routinely asking them for their opinion of the extent of injury, which is usually, though not always, forthcoming. There is a feeling amongst officers that the level of injury indicated is assessed cautiously as being more severe than it turns out to be once the casualty has been seen by medical staff at the hospital. An example of this is the use of a body board for casualties, which is often used if the casualty indicates he or she has back or neck pain.

If the injury is very serious and may lead to death, the police need to undertake various investigations, including closing the road to gather evidence from the scene of the collision, so information on severity of injury is important.
There is a tendency for less experienced officers to look at damage to the vehicle first and from this assume severity.

If the casualty is conscious and making a lot of noise the assumption is that the injury is not immediately life threatening. In many cases officers will speak to the casualty to get personal details and will ask where and how much it hurts.

The police do not always attend – especially for slight collisions in rural areas. They are more likely to attend if the casualty is old or young. Slight injuries are sometimes attended by non-RPU officers and some are reported later by one of the parties involved either by phone or over the counter at a police station.

Q2. **How do you decide which category of injury (serious or slight) to tick on the form?**

Several officers used terms such as ‘life threatening’ and ‘life changing’ injuries but these are without consistent definition. Life threatening is more commonly used (by five of the forces) and is understood as being so severely injured the casualty might die. But life changing (used by three) is more subjective and examples given by officers include broken back, amputated foot or hand, or those that require surgery. These clearly fall into the existing serious category but some officers (in two forces) are using these as definitions of serious to the exclusion of lesser injuries (but still serious under the current definition).

To define severity the following are often used:

- fatal,
- life threatening,
- life changing injuries,
- serious, and
- slight.

Severity is more difficult to assess for the following injuries and officers often use guidance regarding assaults and cited examples of the level of injury for the assault to be considered Actual Bodily Harm⁶ as equating to a serious road traffic injury. This applies particularly to cuts, concussion and broken teeth.

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⁶ Examples are loss or breaking of tooth or teeth, temporary loss of sensory function (which may include loss of consciousness), extensive or multiple bruising, displaced broken nose, minor fractures, minor but not merely superficial cuts of a sort probably requiring medical treatment (e.g. stitches), see for example http://www.kent.police.uk/About%20Kent%20Police/policies/n/n065p.html
**Cuts:** Three of the forces have a guideline that if stitches, staples or gluing are needed the casualty is classed as seriously injured. Others use experience, and the appearance of the cut in terms of blood colour and density, depth, length, etc.

**Concussion:** This is particularly difficult to assess as some officers think that any bump on the head or loss of consciousness leads to concussion. Often if a casualty is or has been unconscious they are recorded as seriously injured.

**Shock:** Perhaps the most difficult of all to assess because most people are shaken after a collision and often people feel a bit anxious and wobbly. Slight shock is often classed as no injury. 7 Shock has different meanings when used by clinical and lay personnel.

**Dislocation:** It is sometimes difficult to distinguish a fracture from a dislocation and paramedics have a tendency to say injuries are a suspected broken arm, leg, etc.

**Broken teeth:** There is confusion when someone loses or breaks several of their front teeth as to whether this is slight or serious (to many officers it seems more serious than a broken finger, which is most often coded as slight).

**Other considerations**

**Older people:** There is a tendency among most forces to assign severity on the basis of ‘it is serious for that person’. An example of this is bruising from a seat belt in an older person or, potentially, any injury to an older person, as it may turn out to have serious consequences that might not arise in a younger person.

**Children:** It is generally recognised by officers that children tend to be taken to hospital and kept in for observation in circumstances when an older teenager or an adult might not be. This is especially common if the child is suspected to have hit his or her head. As with older people there is a tendency to assign severity on the basis of ‘it being serious for a child’.

**Language:** For those officers who follow the STATS20 8 definitions of injury severity, the use of medical terms such as laceration, shock or concussion result in different lay interpretations.

**Terminology:** Life-threatening and life-changing injuries are becoming part of the vocabulary, though the interpretation of these terms is left to the judgement of

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7 Determining shock is for medical professionals and is a very misunderstood condition for non-medically trained police officers, even those with first aid training.

8 STATS 20 is the instructions for the completion of road accident reports http://www.dft.gov.uk/collisionreporting/Stats/stats20.pdf
individual officers. In two of the forces only ‘life changing’ will be recorded as serious, and less severe injuries coded as slight.

*Severe trauma:* The more severe the injury, the easier it is to assign it to the serious category. The word trauma itself is often interpreted as being ‘a traumatic experience’.

**Q3. Do you go back and ask the family how the injured person is and what their injuries are? Do you follow up with hospitals?**

If the collision is very serious police will follow the ambulance to the hospital but if less serious they will go to the hospital later. However, the ambulance often takes the casualty to the most appropriate hospital and not necessarily the nearest – sometimes casualties are transferred between hospitals, which makes it difficult to find the person later. If the casualty has suffered severe trauma, the hospital might ask police to find the next of kin.

Of those casualties who go to hospital and are not very seriously injured, the police often visit to follow-up on questions to the injured person that could not be answered at the scene.

As RPU officers are regularly at the hospital, this affords the opportunity to follow-up severity of injury with the treating hospital.

It is common for officers to ask the family or the injured person about the nature of injuries received during the course of collecting witness statements. Some forces phone up the family to follow-up on the progress of the injured person – this is usually done within seven days. If the injuries are very serious then the family liaison officer assigned to the family will ask what the injuries are.

**Q4. What kind of training do you get to help you recognise which injuries are in the serious category and which in the slight? How much is through police college and how much though on-the-job training?**

There is no formal training in assessing injury but all officers undertake first aid training and can use this experience to help.

**Q5. How much training do you get to help you fill out the form? How much is through the police college and how much through on-the-job training?**

Across all forces there is no longer formal training in filling out the collision forms but some training is given on the job with a tutor constable. This can last 3–5 days depending on the force and the interest in roads policing of the new officer (i.e. if they have no interest they will not join the RPU during training but still may come across injury collisions while on general duties).
Some less experienced officers are reticent about attending collisions (partly because they are not sure what to do and how to fill in the form). However, there is always someone to help if they ask.

Q6. Do you or did you get any extra training – for example, from the local highway authority road safety department

None of the officers in the forces we spoke to had training from the road safety department of the highway authority or contact with them regarding the use to which data was put.

Q7. How does STATS20 help you in making these decisions and filling out the form? Are you are aware of/do you use the collision reporting website? (if so how/why?)

The instructions for the completion of the Road Accident Report Form STATS19 are given in a document called STATS20 and the Department for Transport has a website which gives guidance on how to fill out collision report and statistical forms. There is also help in filling out the STATS 19 form at http://www.stats19.org.uk/.

STATS20 is not seen to be very helpful because it does not give sufficient clarity in lay language as to which injuries fit into which severity category, although all except two forces had the STATS20 definitions of severity on the form they fill out (MG NCRF). These two forces did not use the STATS20 definitions of severity as they did not form part of their information pack or training. In this case, they used their own experience to decide into which category an injury fell.

None of the forces used the collision reporting website but two forces were aware of it and it was used by the statistics staff to help decide which category injuries fell into and to give guidance to officers. Officers who were aware of the collision reporting website but did not use it said that this was because they felt it was for public use rather than police use.

Other considerations

Clearer direction in lay language: All forces agreed it would help enormously to have better and clearer direction on what is serious and what is slight, and to have this with them on their PDAs or forms. In the absence of this information, each force (in some cases each officer) appears to use its own judgement as to what is serious (see the examples given above), such as different approaches to classifying severity of cuts and some fractures.

Lack of training leads to the form being intimidating to fill in until more experienced with it. Non-RPU officers are least comfortable with the form as they fill them in very infrequently and some not at all.
Q8. Staying with the form – do you fill out the sections on description of injury and whether the casualty is hospitalised? If so, who reads/uses this information? Is the casualty severity ever amended on the basis of what is recorded?

All officers we spoke to said they usually filled out the section on the form which describes the injuries, as this not only helps in defining severity but also helps in cases where information on levels of injury might be required (e.g. if there is a prosecution). Sometimes the description was left out due to time constraints, and in others only minimal information was given (e.g. broken arm).

In some cases the serious box is ticked (or circled) but the statistics clerks notice that the description is in their opinion more likely to be slight, so they change it, and vice versa.

Q9. Do you go back and correct the form on the basis of this information – can you correct the form or submit corrections to another person?

Another source of error arises when paramedics are asked about the injury severity; they may say ‘suspected broken leg’ and the officers may then need to go back and check whether it actually was a broken leg. This is not always done and the hospital does not always release the information. It is not clear in how many of such cases ‘suspected’ gets lost and ‘broken leg’ kept. For at least three of the interviewed forces the form cannot be signed off until the level of injury is established and corrected where necessary.

Most forces can make changes to severity when they obtain more information from the casualty, their family or the hospital. Several forces have a rule to have reports in within 24 hours (and all within about five days). Obtaining extra information within this timeframe is difficult, so updates are not made once submitted except for fatalities. This is a consequence of the Policing Pledge9 to which all forces have signed up, whereby the police undertake to have information available to victims as quickly as possible.

About half of the forces have a computerised system and these can easily be changed but in the rest, information is recorded manually on paper and transcribed either by officers or clerks onto a computer, and it is these cases where changes are less likely to be made.

For some forces, the forms filled in by less experienced officers are checked by a supervisor.

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9 http://www.direct.gov.uk/prod_consum_dg/groups/dg_digitalassets/@dg/@en/documents/digitalasset/dg_172297.pdf
Some damage-only reports turn into slight injuries a few days later. It is patchy as to whether these are amended and some over-the-counter reports of slight injuries do not get recorded at all.

Q10. How many times did you attend a road traffic accident where someone was injured in the last month

Most experienced RPU officers attend about 3–7 serious collisions a month depending on where they are based. Less experienced officers in the RPU attend fewer, and the non RPU officers may not attend any serious collision and maybe only one slight. Some officers attend less than one collision involving an injury a year.

Q11. How many times did you fill out the form in the last month?

It is common for more than one officer to attend a collision scene but only one person will fill out the form. For the RPU officers we spoke to they only completed about one form a month each.

2.2 Conclusions and observations

The picture is quite mixed but the strongest thread to emerge is the lack of clarity about the definitions of serious and slight injuries. New terminology is appearing, such as ‘life threatening’ and ‘life changing’, and this is causing even more confusion, with some forces only deeming ‘life changing’ injuries (whatever definition they may be using for this) as serious.

The officers we spoke to thought they probably over-estimated severity (especially for the elderly and children) on the basis of what the paramedics told them and their own ideas as to what constituted serious – this was universal and not restricted to those forces who did not know about the STATS20 definitions of serious and slight. This is interesting for two reasons. First, the perception of over-estimation is not supported by empirical studies where the studies of matching police and hospital records indicate that police consistently under-estimate severity (Ward, Lyons and Thoreau 2006). It is possible that more reliance is now being put on the opinions of paramedics but there is no empirical evidence for this. Second, officers no longer get formal training on how to fill out the accident report forms.

The practice of obtaining information about severity of injury once the injured person has been transferred to hospital is patchy and even when this is available the five paper-based forces find it more difficult to update their report form because they have to be submitted between 24 hours and 60 hours after the collision. The four forces with a computerised system have more opportunity to update the level of severity, although not all do so.
There are national crime recording quality standards but no equivalent for road traffic accidents. Forces carry out a monthly check to make sure all fatal collisions have been attended but this does not extend to other severities.

Officers generally do not understand what the information is used for and the completion of information might be better if they received feedback.
3 REVIEW OF THE RANGE OF INJURIES OCCURRING IN ROAD TRAFFIC COLLISIONS

3.1 Injuries sustained in road traffic collisions

Both the HES (Hospital Episodes Statistics) database\(^\text{10}\) on its own and the matched STATS19/HES databases are rich sources of information on road traffic injuries. For this study, two sets of analyses were performed. The first involved all injuries from a version of the HES database linked to mortality records, which provided the annual number of cases for each ICD10 (International Classification of Disease 10th revision)\(^\text{11}\) code and the number who subsequently died. The ICD10 codes are diagnostic codes for specific injuries or groups of injury. In the case of HES the codes are attached by expert clinical coders who read the hospital notes on discharge, interpreting the decisions and descriptors provided by treating clinicians. ICD-based survival rate ratios (SRRs) were calculated using the methodology employed in ICISS (International Classification of Diseases Injury Severity Score) (Davie, Cryer and Langley 2008). Some conditions are very uncommon and in order to follow National Statistics guidelines of non-disclosure of rare events, and also to make the information more interpretable, we grouped SRRs into bands. We then used the STATS19/HES matched database to look at the frequency of injury codes from road traffic injuries. This second analysis provided the distribution of injury types and body locations occurring in the more serious (i.e. hospitalised) cases of road traffic injury recorded in STATS19.

Table 1 shows the 23 most common injuries (out of a total of some 855) with more than 1,000 occurrences each in the six years of the matched STATS19/HES data (1999–2004), based on the main diagnosis.

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\(^{10}\) Hospital Episodes Statistics (HES) are records of finished consultant episodes for inpatients in English Hospitals. They contain codes for road-user group (V codes 010 to 899) and diagnoses made by clinicians based on ICD10 (International Classification of Diseases 10th Edition – see link below). Examples would be S720 Fracture of neck of femur or S010 open wound of scalp. The DfT with ONS undertook an exercise where STATS19 records for England were matched with HES data. This resulted in a set of records which could be found in each data set. This valuable resource has all the STATS19 fields and a subset of HES fields, which includes diagnoses. This allows investigation of many aspects of injury patterns and severities to injured road users of different types, age and gender. See http://www.dft.gov.uk/pgr/roadsafety/research/rsrr/theme5/roadaccidentscasualtiescomp.pdf for more information.

\(^{11}\) ICD-10 International Classification of Diseases is the International Standard Diagnostic Classification of diseases and other health problems and is used in hospitals and on mortality records – http://www.who.int/classifications/icd/en/
Table 1: ICD 10 descriptions of injury the 23 most common injuries in STATS19/HES matched dataset (75,000 records)

<table>
<thead>
<tr>
<th>ICD10 description of injury</th>
<th>Percentage of total matched STATS19/HES dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unspecified injury of head</td>
<td>22.8</td>
</tr>
<tr>
<td>Fracture of shaft of tibia</td>
<td>4.8</td>
</tr>
<tr>
<td>Open wound of other parts of head</td>
<td>4.4</td>
</tr>
<tr>
<td>Fracture of lower end of radius</td>
<td>3.9</td>
</tr>
<tr>
<td>Fracture of sternum</td>
<td>3.3</td>
</tr>
<tr>
<td>Open wound of scalp</td>
<td>3.1</td>
</tr>
<tr>
<td>Fracture of upper end of tibia</td>
<td>2.5</td>
</tr>
<tr>
<td>Sprain and strain of cervical spine</td>
<td>2.4</td>
</tr>
<tr>
<td>Unspecified injury of abdomen, lower back and pelvis</td>
<td>2.4</td>
</tr>
<tr>
<td>Superficial injury of other parts of head</td>
<td>2.4</td>
</tr>
<tr>
<td>Fracture of shaft of femur</td>
<td>2.2</td>
</tr>
<tr>
<td>Fracture of lower end of tibia</td>
<td>2.1</td>
</tr>
<tr>
<td>Fracture of clavicle</td>
<td>2.0</td>
</tr>
<tr>
<td>Fractures of other parts of lower leg</td>
<td>2.0</td>
</tr>
<tr>
<td>Superficial injury of head, part unspecified</td>
<td>2.0</td>
</tr>
<tr>
<td>Unspecified injury of neck</td>
<td>1.8</td>
</tr>
<tr>
<td>Fracture of neck of femur</td>
<td>1.7</td>
</tr>
<tr>
<td>Open wound of knee</td>
<td>1.7</td>
</tr>
<tr>
<td>Fracture of pubis</td>
<td>1.5</td>
</tr>
<tr>
<td>Intracranial injury, unspecified</td>
<td>1.5</td>
</tr>
<tr>
<td>Open wound of lip and oral cavity</td>
<td>1.4</td>
</tr>
<tr>
<td>Fracture of lower end of both ulna and radius</td>
<td>1.4</td>
</tr>
<tr>
<td>Multiple fractures of ribs</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Total of 23 injuries listed above</strong></td>
<td><strong>74.3</strong></td>
</tr>
</tbody>
</table>

In HES, burns affecting 60–90% of the total body surface area have one of the most severe injuries (lowest SRR), but in the six years of matched STATS19/HES records no burns of this severity were found. Severe burns resulting from road traffic collisions would appear to be extremely rare. Less severe burns exist in the dataset but these too are very few in number.

Subsequently, we used the information gleaned from a variety of sources: the analysis of the HES data for all injuries, the matched STATS19/HES dataset, data from the Lancashire Constabulary on the text descriptors and severity coding of a large series from local STATS19, together with our expertise in clinical medicine, disease classification and road traffic epidemiology to devise two alternative approaches (A and B) with the aim of improving the measurement of severity within STATS19. The rationale and proposed methodologies for each of the proposed approaches is described below.
3.2 Development of an injury severity classification system for use by police

3.2.1 Option A

A number of studies from different countries have reported on the difficulty of reconciling ‘severe’ road traffic-related injuries reported by the police with data obtained from health services (Hvoslef 1994; Elvik and Mysen 1999; Farmer 2003; Amoros, Martin and Laumon 2006; Ward, Lyons and Thoreau 2006; Gill, Goldacre and Yeates 2006; Lyons et al. 2008; Jeffrey et al. 2009; McDonald, Davie and Langley 2009). Accurate measurement of ‘severe’ road casualties is essential to guide the development and evaluation of national and local road safety strategies, and to target interventions at high-risk locations. The rationale behind this current study is to determine whether the collection of a small number of additional data items would assist in distinguishing slight from severe injuries and provide more reliable statistics.

Assessing severity at the side of the road is fraught with difficulty, even for experienced clinicians. It is difficult to fully examine individuals and the severity or otherwise of many injuries is not immediately evident. Many patients with momentary loss of consciousness are alert and orientated when they arrive at hospital and are rapidly discharged. Others, who appear to be initially well, may suffer from internal bleeding and deteriorate quickly after leaving the scene. The psychological shock of involvement in a collision may mask serious injury for some time. Hence, it is expected that a police officer’s assessment of injury severity at the scene will not always agree with medical assessment at hospital. It may also be the case that the meaning of certain observations differs between the police and clinical staff with systematic differences in the likelihood of attaching a ‘serious’ label when such observations are present or absent. However, very little systematic research has been carried out in this particular field.

A variety of systems are used by experienced clinicians to assess severity, including the Glasgow Coma Scale (GCS), which is a reliable and universally comparable way of recording the conscious state of a person and scores the injured person on motor response, verbal response and eye opening (Gabbe, Cameron and Finch 2003). A copy of the GCS is included in Annex A. However, in order to apply the instrument to assess injury severity, considerable clinical training and experience are necessary.

Paramedics dispatched to the scene of the injured or ill person by the ambulance services make an initial assessment of severity. However, even these skilled staff struggle to accurately categorise injury severity. A number of papers have addressed this issue. Mulholland et al. (2008) showed that while paramedics can accurately identify major trauma status, the discrimination of injury severity at the individual body regions was not very good. A systematic review of the literature on the accuracy of paramedic triage also revealed considerable difficulties (Mulholland,
Gabbe and Cameron 2005). It is unlikely that the detailed level of observations used by trained paramedics could be easily adopted by police officers.

Ambulance services also use a system called the Medical Priority Dispatch System (MPDS) to get bystanders to report on patients’ conditions in order to determine severity and prioritise ambulance response (Sporer et al. 2008). The dispatchers ask a series of questions over the telephone, such as:

- ‘What is the address of the emergency?’
- ‘What is the phone number you are calling from?’
- ‘What is the problem?’ ‘Tell me exactly what happened.’

Then, depending on the situation and particularly if someone else is phoning, they ask:

- ‘Are you with the patient now’ or ‘How many other people are hurt?’
- ‘How old is he/she?’, ‘Is he/she conscious?’ and ‘Is he/she breathing?’

Further questions are then asked depending on the responses to the initial questions.

After reviewing the literature on assessment of injury severity outside the hospital setting, and the instruments and questions used, we devised a series of questions on observations which we considered police officers could complete on casualties at the scene of a collision. The questions were based on observations which police officers could make or could ask about at the scene of a collision, and which do not require direct clinical training or expertise. As mentioned earlier, research has shown that experienced paramedics and emergency physicians struggle to accurately measure injury severity at the side of the road. It was our view that the following category of observations might be helpful in assessing which cases are likely to be of serious or slight injury.

1  Consciousness.
2  Ability of person to speak.
3  Ability of person to stand up and bear weight.
4  Signs of breathing difficulty.
5  Extent of blood loss.
6  Method of extrication from vehicle.
7  How conveyed to hospital – by ambulance?

The item on conveyed to hospital by ambulance might be predictive in its own right but would also be particularly useful in identifying cases for subsequent record
linkage to allow comparison of police and health service personnel assessment of injury severity.

These were developed into a form for use by officers and are further described in Section 4, which outlines the pilot study using this form.

### 3.2.2 Option B

A second approach is to ask police officers, with the help of paramedics if present, to assess what the actual injury or injury category might be. Table 1 gives us an idea of the most commonly occurring injuries in hospitalised cases. These (with the other 800 categories not shown), and information on the distribution of non-admitted injuries obtained from the All Wales Injury Surveillance System (AWISS) (Lyons et al. 2002) have formed the basis of a categorisation which we consider could be used at the roadside. Such a categorisation needs to include the most common injuries, the entire range of severity, take into account the reality that roadside diagnoses are frequently suspected rather than confirmed (often require imaging or more detailed examination for confirmation) and be brief enough to be practical for busy officers to collect.

Table 2 shows the descriptions of injury categories which would capture the majority of injuries of differing severities occurring in road casualties. The list is organised by body part and severity rather than frequency to ensure that severe injuries to specified regions are not coded to more general categories.

<table>
<thead>
<tr>
<th>Table 2: Injury description which capture the most commonly occurring injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major/multiple trauma with person unconscious</td>
</tr>
<tr>
<td>Major/multiple trauma with person conscious</td>
</tr>
<tr>
<td>Serious head injury with person unconscious</td>
</tr>
<tr>
<td>Definite or suspected skull or facial fractures with person conscious</td>
</tr>
<tr>
<td>Definite or suspected spinal cord injury</td>
</tr>
<tr>
<td>Whiplash or neck pain</td>
</tr>
<tr>
<td>Chest injury with difficulty breathing</td>
</tr>
<tr>
<td>Chest injury without difficulty breathing</td>
</tr>
<tr>
<td>Definite or suspected serious abdominal injury</td>
</tr>
<tr>
<td>Amputation of part of leg or arm</td>
</tr>
<tr>
<td>Definite or suspected fractures of pelvis or upper leg (including knee)</td>
</tr>
<tr>
<td>Definite or suspected lower leg fractures (including ankle and foot)</td>
</tr>
<tr>
<td>Definite or suspected upper limb fractures (includes hand and shoulder)</td>
</tr>
<tr>
<td>Deep penetrating wound (from an object)</td>
</tr>
<tr>
<td>Deep cuts or lacerations</td>
</tr>
<tr>
<td>Shallow cuts or lacerations</td>
</tr>
<tr>
<td>Bruises</td>
</tr>
<tr>
<td>Back pain</td>
</tr>
</tbody>
</table>

If collection of such data was shown to be practical then in the future categorisation of severity into several classes could be based on the presumptive diagnoses on its own or refined after further research with large-scale linkage between STATS19, emergency department, inpatient and mortality datasets.
The two approaches, A and B, were drafted into a form which was used by police officers at the roadside in a small-scale pilot study, in order to assess the feasibility of using these two approaches in collecting this type of information at the roadside.

The pilot took place in two forces, South Wales and Sussex. The following is the form which was piloted. The form was also discussed with the Metropolitan Police at a meeting and their views gathered but due to time constraints of the study they did not take part in the pilot. Feedback was collected from officers to assess whether either approach, or both, were acceptable, and how easy the form was to understand and to fill out.

The South Wales force used experienced officers from the RPU and expected to complete about 30 forms over the pilot period of about two weeks during March 2010. The pilot in Sussex also ran for about two weeks in late March and included experienced and less experienced RPU officers with a plan to engage some non-RPU officers. It was anticipated that about 30 forms would be completed.

It was judged in advance that observations/questions should take no more than 20 seconds to complete. Most of the information will already be available to police officers from their own observations or with the help of paramedics, if present.
Pilot form for assessment of injury severity within STATS19, with potential for collection through new hand-held computers

Two alternative approaches to collecting data will be tested with police officers from different forces to assess ease or difficulty of use and officers’ views.

Number: . . . . . . .

Casualty type: (circle most appropriate, P = Passenger):
Driver/front-seat passenger/rear-nearsie passenger/rear-centre passenger/
rear-offside passenger/pedestrian/cyclist/two-wheel vehicle driver/
two-wheel vehicle passenger/other

Approach A:
This is a list of eight proposed observations or questions and response categories which could be completed by traffic officers from direct observation or after discussion with paramedical staff.

Please **circle** the most appropriate response to each of the questions:

1. Was the person obviously unconscious at any time? **yes/no/unable to assess**
2. Is the person conscious now? **yes/no/unable to assess**
3. Is the person able to speak now? **yes/no/unable to assess**
4. Is the person able to stand up or weight bear on their own legs? **yes/no/immobilised on stretcher/unable to assess**
5. Is the person breathing normally or with some difficulty? **intubated/using oxygen/breathing with difficulty/breathing normally/unable to assess**
6. Is there much bleeding? **none/a little/a lot/unable to assess**
7. How was the person extricated from the vehicle? **thrown clear/cut out/self-extricated/not in a vehicle/unknown**
8. Was the injured person conveyed to hospital by ambulance? **yes/no/don’t know**
Approach B:

This is a list of categories of injury types which could be completed by road traffic officers following discussion with paramedics or from speaking with less severely injured casualties. Please tick all the appropriate boxes that apply. If any of the first two multiple trauma categories are ticked then no further boxes need to be ticked. In many cases only one category needs to be ticked.

☐ Major/multiple trauma with person unconscious
☐ Major/multiple trauma with person conscious
☐ Serious head injury with person unconscious
☐ Definite or suspected skull or facial fractures with person conscious
☐ Definite or suspected spinal cord injury
☐ Whiplash or neck pain
☐ Chest injury with difficulty breathing
☐ Chest injury without difficulty breathing
☐ Definite or suspected serious abdominal injury
☐ Amputation of part of leg or arm
☐ Definite or suspected fractures of pelvis or upper leg (including knee)
☐ Definite or suspected lower leg fractures (including ankle and foot)
☐ Definite or suspected upper limb fractures (includes hand and shoulder)
☐ Deep penetrating wound (from an object)
☐ Deep cuts or lacerations
☐ Shallow cuts or lacerations
☐ Bruises
☐ Back pain
☐ Other injuries
☐ Removed by ambulance – no further details available
☐ No apparent injuries
**General questions:** (please circle answers)

1. How easy did you find it to complete approach A?
   - very easy
   - easy
   - neutral
   - difficult
   - very difficult

2. How long did it take to complete approach A?
   - ......................... seconds
   - ......................... minutes

3. How easy did you find it to complete approach B?
   - very easy
   - easy
   - neutral
   - difficult
   - very difficult

4. How long did it take to complete approach B?
   - ......................... seconds
   - ......................... minutes

5. Which approach do you prefer:
   - A
   - B
   - liked both
   - disliked both
5 RESULTS OF THE PILOT

Both South Wales and Sussex forces undertook the pilot and returned the completed forms. Six experienced officers from one shift in South Wales took part and completed 33 forms, while in Sussex 33 officers from across the county took part and completed 54 forms, giving a total of 87 responses from 39 officers. All officers completed both approach A and approach B.

From the 87 forms all but two were rated very easy (59%) or easy (39%) to complete for approach A (state of the casualty). Approach B (list of injuries) was a little less straightforward with 48% being very easy and 46% easy and 6% were neutral. No one rated the task as difficult.

Fifty-three percent of forms were completed within 20 seconds, which is within the estimate before the pilot started. Six officers took 2 minutes to complete a total of seven forms from approach A and eight forms from approach B.

In general the forms were liked and found easy and quick to complete. Just under half (47%) of the forms were returned with officers having no preference between A and B but where a preference was stated it tended to approach A (28% preferred A and 12% preferred B). Ten forms (12%) came back from four officers who disliked both.

The distribution of casualties among the different groups is in line with what might be expected with 78% car occupants (39 drivers, 14 front-seat passengers, 8 rear-seat passengers). The next largest group was two-wheeled motor vehicles (TWMV) with eight casualties, then five pedestrians and one pedal cyclist. However, officers had failed to circle casualty class for about 15% (12 records) of cases.

For approach A, analysis of distribution of consciousness, ability to speak, ability to stand, breathing status, bleeding status, method of extraction from vehicle and conveyance to hospital by ambulance indicate, apart from the question on whether the casualty was unconscious at any time (15% unknown), that the prevalence of ‘unable to assess’ was very low (4%) and a single fatal case accounted for half of the ‘unable to assess’ categories.

There was some confusion regarding TWMV riders and passengers as to whether thrown clear should be circled or not in a vehicle. This would need clarification.

For approach B, all but three of the injury categories (definite or suspected serious abdominal injury, amputation of part of leg or arm, deep penetrating wound) applied to at least one casualty with about half having shallow cuts or lacerations (23%) and/or bruises (25%) (officers could tick more than one box). Back pain accounted for 17% and 9% had no apparent injuries. Other injuries not specified accounted for a
further 17%. This will need further thought as a longer list would make it more difficult and time consuming to complete but give better information in case an important injury class has been missed. If such a classification was to be introduced then a large scale STATS19 and health-data matching exercise would determine whether the ‘other injuries’ category contains many serious injuries. We think that this is unlikely, given the more specific choices provided on the list, and the vast majority of ‘other injuries’ would be coded as slight injuries.

Officers were asked about preferences for one form over the other and ease of understanding. The questions asked in approach B were found to be a little more difficult by some than those in approach A. There were 33 officers involved in the Sussex pilot and given there was no training and the explanation of what was expected of them in filling out the forms was informal, the number of obvious errors that came back was very small. This bodes well for a larger scale implementation.

At the meeting with the Metropolitan Police the forms were discussed but no pilot undertaken. A relevant point made was that police officers are increasingly wary of putting their name to any injury in case it is challenged in court when their version does not exactly match that of the hospital. No evidence of this reluctance was found in the pilot but a more in-depth investigation of this issue is warranted.

Both approaches relieve the officers of any judgement about severity but those spoken to in advance of the pilot would like to have the background software indicate a level of severity to them as this may be needed in cases of prosecution.

Discussions with a paediatric A&E consultant have raised issues about the difficulty in assessing injury to children, especially younger ones. This is directed at the paramedics rather than the police but will have a bearing on how their assessments at the scene are recorded by police officers. Given the reliance of officers on paramedics’ judgements, discussions with a small number of paramedics from different ambulance services on how they judge severity would seem to be important as part of the validation process for either approach.
6 RECOMMENDATIONS

The Collision Recording And SHaring (CRASH) project is a new electronic system for police collision reporting. CRASH will provide a system for secure collection, validation, transmission and storage of road traffic collision reports to meet police business needs and also Department for Transport (DfT) statistical requirements. Mobile devices (where available) will allow data entry at the scene of a collision – police officers will no longer have to fill in paper forms.

Pilots in three areas are planned for early 2011, followed by roll-out to as many police forces as possible during 2011 and 2012. As a result, any means of coding injury severity should be suitable for use with the CRASH system.

6.1 Injury list and severity coding recommended for inclusion in CRASH

In the absence of a clear preference between approaches A and B, approach B might be more straightforward to implement than approach A. It has the added advantage of being more ‘visible’ or transparent, and should lend itself more immediately to being capable of splitting the severity category into two or more parts based on a scientific approach to classifying injury severity.

Some further work has been undertaken to refine the descriptions of injuries in approach B and this is described below. The word trauma, for example, is used by the police to describe ‘traumatic events’ and discussion with police officers identified that many may not be fully aware of its more clinical terminology. This also highlighted the case for describing different body parts in language more comprehensible to non-clinical staff.

The following is a revised list of injuries and severity classification which could be incorporated into CRASH. The list has been revised following discussions amongst the authors, officials at DfT and the DfT police liaison officers, detailed inspection of the text used to describe a large number of injuries by Lancashire Police, and the consideration and comparison of three lists of injuries:

• the initial injury categories proposed for CRASH;
• that derived from the study with South Wales and Sussex forces, and
• the original STATS20 descriptors of a serious injury.

(See Annex B for details of the lists.) The revised list takes into account the requirements for simpler terminology and the need to cover all categories of serious injury.

The revised list is organised by body region starting with multiple injuries and then from the head downwards. It is also ranked by likely severity within body region. Severity is based on the probability of death obtained from analysis of survival rate ratios from HES data for groups of ICD10 codes matching the broad injury descriptor. Serious injuries have been divided into three sub-categories (very, moderate and less). The categorisation of severity within the overall serious category may need to be revised following the results of a large-scale STATS19/hospital data-matching exercise. A separate list of risk of disability could also be developed and this would differ from the ICISS-based risk-to-life measure. Many disabling injuries (e.g. hand injuries) have a low risk of death and some injuries with a high initial risk of death have a low likelihood of disability in survivors.

As the categories are designed for roadside assessment, usually by a police officer asking paramedics, many of the ‘diagnoses’ are suspected or presumptive, and many of these will be downgraded on further assessment at hospital. ‘Shock’ is not a physical injury but it is listed in STATS 20 and often recorded by officers at the scene. Removing it altogether would affect the time series for slight injuries so it has been included at the request of the police as an item without an injury classification so it can be accounted for. An alternative treatment would be to allow it to be described under the user-defined other injuries. ‘Clinical shock’ is likely to be a component of those injuries categorised as ‘Very serious’.

The final list has 20 categories which is comparable with the proposed 19 for CRASH (see Annex B1.1), including deceased, which could be on a separate screen – fatal/injured. Categories for side of body injured (i.e. left or right) have not been included as these would increase the number of categories. Side of body of injury could be captured in the free text ‘Details/other injury’ as can any other injury which does not fit the list. Burns have been excluded (and could be listed under other) as serious burns were very rare in the matched HES/STATS19 database.
<table>
<thead>
<tr>
<th>Injury Description</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deceased</td>
<td>Fatal</td>
</tr>
<tr>
<td>Multiple severe injuries, unconscious</td>
<td>Very serious</td>
</tr>
<tr>
<td>Multiple severe injuries, conscious</td>
<td>Moderately serious</td>
</tr>
<tr>
<td>Severe head injury, unconscious</td>
<td>Very serious</td>
</tr>
<tr>
<td>Other head injury</td>
<td>Less serious</td>
</tr>
<tr>
<td>Broken neck or back</td>
<td>Very serious</td>
</tr>
<tr>
<td>Whiplash or neck pain</td>
<td>Slight</td>
</tr>
<tr>
<td>Severe chest injury, any difficulty breathing</td>
<td>Very serious</td>
</tr>
<tr>
<td>Other chest injury, not bruising</td>
<td>Moderately serious</td>
</tr>
<tr>
<td>Internal injuries</td>
<td>Very serious</td>
</tr>
<tr>
<td>Loss of arm or leg (or part)</td>
<td>Moderately serious</td>
</tr>
<tr>
<td>Fractured pelvis or upper leg</td>
<td>Moderately serious</td>
</tr>
<tr>
<td>Fractured lower leg/ankle/foot</td>
<td>Less serious</td>
</tr>
<tr>
<td>Fractured arm/collarbone/hand</td>
<td>Less serious</td>
</tr>
<tr>
<td>Deep penetrating wound</td>
<td>Moderately serious</td>
</tr>
<tr>
<td>Deep cuts/lacerations</td>
<td>Less serious</td>
</tr>
<tr>
<td>Bruising</td>
<td>Slight</td>
</tr>
<tr>
<td>Shallow cuts/lacerations/abrasions</td>
<td>Slight</td>
</tr>
<tr>
<td>Sprains and strains</td>
<td>Slight</td>
</tr>
<tr>
<td>Shock</td>
<td>*</td>
</tr>
</tbody>
</table>

* No injury category specified

Given the absence of widespread training in completing STATS19 it would be helpful if a web-based training programme could be designed to help officers understand the rationale for STATS19, the terminology used and how to complete the forms. Such web-based training is now widely used in other areas and often has a small in-built test to ensure that the appropriate knowledge is understood. Such facilities usually provide a certificate of completion or achievement.

### 6.2 Further work recommended to validate the coding

In terms of further work to validate either method piloted as possible contenders for inclusion in CRASH or other data-gathering systems in order to provide official statistics, large-scale trials with record matching to hospital records (both emergency department and inpatient) would be extremely beneficial.

For approach B (i.e. the proposed method) a trial would be needed to assess the levels of actual injuries compared with suspected injuries in determining severity. Each category would be mapped to injury severity categories derived from the diagnoses in emergency department and inpatient systems, producing a probability that a person meeting such a category had an injury of differing severities. Samples of around 100 cases for each category should give reasonably robust estimates of the severity distributions. Computer algorithms in CRASH would then produce a
predicted severity classification. It would be possible to provide an option for the officer to accept or reject the severity classification and to change it giving reasons. This might be particularly important in relation to the ‘other injuries’ category, so it does not become a catch-all.

Approach A would require a larger scale trial with perhaps 10,000 or more records capable of matching with hospital data in order to collect information on diagnoses that would enable the probabilistic matching of patterns of response (i.e. yes to Q1, no to Q2, yes to 3, no to 4, etc.) to the final categorisation of the severity of injury. The actual number of records required would depend on the relative frequencies of specific categories, which cannot be assessed until such a system was operational. Essentially, each combination of pattern of responses would be shown to be predictive of an injury of varying severity, possibly using a three- or four-category severity scale in the matching exercise. Subsequently, that pattern appearing in the CRASH system would produce the most likely severity classification and could be used in official statistics.


Hvoslef H. Under-reporting of road traffic accidents recorded by the police, at the international level. Oslo: OECD-IRTAD and Norwegian Public Roads Administration, 1994.


McDonald G, Davie G and Langley J. Validity of police-reported information on injury severity for those hospitalized from motor vehicle crashes. Traffic Inj Prev 2009, April, 10(2): 184–90.


ANNEX A:

Glasgow Coma Scale

1. **Best Motor Response (M) – six grades**
   1. No response to pain.
   2. *Extensor posturing to pain*: The stimulus causes limb extension (adduction, internal rotation of shoulder, pronation of forearm) – decerebrate posture.
      Infant: withdraws from pain.
   5. *Localizing response to pain*: Put pressure on the patient’s finger nail bed with a pencil then try supraorbital and sternal pressure: purposeful movements towards changing painful stimuli is a ‘localising’ response.
      Infant: withdraws from touch.
   6. *Obeying command*: The patient does simple things you ask (beware of accepting a grasp reflex in this category).
      Infant: moves spontaneously or purposefully.

2. **Best Verbal Response (V) - five grades**
   Record best level of speech. If patient is intubated, a ‘derived verbal score’ is calculated via a linear regression prediction.
   1. No verbal response.
   2. *Incomprehensible speech*: Moaning but no words.
      Infant: Inconsolable, agitated.
   3. *Inappropriate speech*: Random or exclamatory articulated speech, but no conversational exchange.
      Infant: Inconsistently inconsolable, moaning.
   4. *Confused conversation*: Patient responds to questions in a conversational manner but some disorientation and confusion.
      Infant: Cries but consolable, inappropriate interactions.
   5. *Orientated*: Patient ‘knows who he is, where he is and why, the year, season and month.
      Infant: Smiles, orientated to sounds, follows objects, interacts.

3. **Best eye response (E) - four grades**
   1. No eye opening.
   2. Opening in response to pain to limbs as above.
   3. Eye opening in response to any speech (or shout), not necessarily a request to open eyes.
   4. Spontaneous eye opening.
ANNEX B:

Injury lists

B1.1 Initial list of injuries proposed for CRASH (by DfT police liaison officers)

<table>
<thead>
<tr>
<th>Injury</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deceased</td>
<td>Fatal</td>
</tr>
<tr>
<td>Broken left arm</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken right arm</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken left leg</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken right leg</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken fingers</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken ribs</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken back/neck</td>
<td>Serious</td>
</tr>
<tr>
<td>Broken collar bone</td>
<td>Serious</td>
</tr>
<tr>
<td>Fractured skull/other fracture</td>
<td>Serious</td>
</tr>
<tr>
<td>Internal injuries</td>
<td>Serious</td>
</tr>
<tr>
<td>Burns</td>
<td>Serious</td>
</tr>
<tr>
<td>Concussion</td>
<td>Serious</td>
</tr>
<tr>
<td>Severe cuts</td>
<td>Serious</td>
</tr>
<tr>
<td>Slight cuts</td>
<td>Slight</td>
</tr>
<tr>
<td>Shock with hospital treatment</td>
<td>Serious</td>
</tr>
<tr>
<td>Shock with roadside treatment</td>
<td>Slight</td>
</tr>
<tr>
<td>Bruising</td>
<td>Slight</td>
</tr>
<tr>
<td>Whiplash/sprains</td>
<td>Slight</td>
</tr>
<tr>
<td>Details/other injury (user selected; also has free-text description)</td>
<td></td>
</tr>
</tbody>
</table>

B1.2 List of injuries used in approach B in pilot study (tick as many as apply)

- Major/multiple trauma with person unconscious
- Major/multiple trauma with person conscious
- Serious head injury with person unconscious
- Definite or suspected skull or facial fractures with person conscious
- Definite or suspected spinal cord injury
- Whiplash or neck pain
- Chest injury with difficulty breathing
- Chest injury with no difficulty breathing
- Definite or suspected serious abdominal injury
- Amputation of part of arm or leg
- Definite or suspected fractures of pelvis or upper leg (inc. knee)
- Definite or suspected lower leg fractures (inc. ankle and foot)
Definite or suspected upper limb fracture (inc. hand and shoulder)
Deep penetrating wound (from an object)
Deep cuts or lacerations

Shallow cuts or lacerations
Bruises
Back pain
Other injuries
Removed by ambulance – no further details available
No apparent injuries

B1.3 **Injuries listed in STATS20**

<table>
<thead>
<tr>
<th>Injury</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture</td>
<td>Serious</td>
</tr>
<tr>
<td>Internal injury</td>
<td>Serious</td>
</tr>
<tr>
<td>Severe cuts</td>
<td>Serious</td>
</tr>
<tr>
<td>Crushing</td>
<td>Serious</td>
</tr>
<tr>
<td>Burns (excluding friction burns)</td>
<td>Serious</td>
</tr>
<tr>
<td>Concussion</td>
<td>Serious</td>
</tr>
<tr>
<td>Severe general shock requiring hospital treatment</td>
<td>Serious</td>
</tr>
<tr>
<td>Detention in hospital as an inpatient</td>
<td>Serious</td>
</tr>
<tr>
<td>Sprains, not necessarily requiring medical treatment</td>
<td>Slight</td>
</tr>
<tr>
<td>Neck whiplash injury</td>
<td>Slight</td>
</tr>
<tr>
<td>Bruises</td>
<td>Slight</td>
</tr>
<tr>
<td>Slight cuts</td>
<td>Slight</td>
</tr>
<tr>
<td>Slight shock requiring roadside attention</td>
<td>Slight</td>
</tr>
</tbody>
</table>

N.B. Persons who are merely shaken and who have no other injury should not be included unless they receive or appear to need medical treatment.