The development of a new low cost accident database, with the addition of an online feature to allow information-sharing by different institutes

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I. INTRODUCTION

Head injuries are the most frequent injuries for bicyclists and pedestrians involved in accidents [1-2]. Therefore, it is important to understand these injuries and to assess how protection can be improved. Understanding the human head crash biomechanics is mostly done by means of cadaver or animal experiments. In the last few years, however, real life accidents are claiming a place between these two sources of information [3]. To perform real life accident simulations of sufficient quality and relevance, there is a need for well-documented accidents. And in order to produce statistically relevant results, there must be enough cases for each type of accident.

Several big accident databases exist, like the GIDAS [4-5] and the IMPAIR [6] study in Germany, and the EDA of IFSTTAR [7] in France. These databases record accidents reported to the police in several cities. They gather a detailed description of the accident situation, mostly combined with a shorter medical report. Databases like these have pushed the real life accident simulation scene in the right direction, and have formed a basis for many safety features on cars to protect Vulnerable Road Users (VRU). These databases are costly, however, due to the intensive work they require to maintain and update them. In addition, they tend to gather predominantly VRU crashes in which a vehicle is involved [8], even though 70% of cyclists requiring hospital treatment are injured in single-sided crashes [9]. This shows that single-sided bicycle accidents are also a major source of injuries, but these accidents are hardly reported in literature [8-10]. Another downside is the fact that most VRU crashes with vehicles result in a double impact on the head, which makes it harder to find the relation between cause and injury than is the case in simple fall accidents.

To get a better view of the most common cycling accidents that result in traumatic brain injury (TBI), another approach is needed. A search based on hospital admissions, instead of traffic police call-outs, is one possible solution. This will not only show the VRU-to-vehicle crashes, but also the single VRU accidents resulting in head injuries. Naturally, the gathering of hospital data alone will not provide the details needed for accident reconstructions. Therefore, the hospital data is combined with a questionnaire sent to eye-witnesses and to the victim. Nonetheless, questionnaires have a certain amount of uncertainty, which has to be tackled somehow. One way to counter this problem would be to increase the number of cases. Accordingly, the questionnaire is composed carefully to gather the necessary information, but without taking too much time to fill out. Efforts have been made to store all the information in a single, central database that can be accessed by different hospitals and universities. Good documentation and cooperation between institutes will also help to increase the number of cases, not only for car-VRU accidents, but especially for single VRU accidents. The main goal is to establish a scientific environment that enables multiple universities to do accident reconstructions without the high costs of detailed crash research. This should increase the understanding of head injuries, by boosting the number of documented and simulated real life accidents.

II. METHODS

Data gathering

Data from real life crashes can be acquired through hospitals' records. With ethical approval, it is possible to store the medical data in a database. The medical data includes medical images and a detailed report of the injuries sustained. Without crash kinematics, these reports are not suitable for accident reconstructions. Hence a lot of care and attention went into making a tailored questionnaire for the accident victims. A questionnaire should be useful to gain insights into the accident environment and crash kinematics, but should also be quick and easy to fill in for the user. This was achieved by studying literature from multiple sources [11-14] and through the input of medical doctors.

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Database development

The digital age creates the opportunity to share data via the internet. For this purpose, work was undertaken to create a simple but effective database. The focus of this database is accident reconstructions, therefore it has been developed to capture a combination of the crash descriptions, personal measurements, medical records, and reconstruction results, such as velocity and acceleration profiles. As a result of cooperation with the HEADS network, which is a Horizon 2020 project focusing on head injuries and helmet standard improvement, the system will also be tested for equestrian and snow sports.

The basis of this project is a relational database with a clear interface, built in Microsoft Access. Through a screen with five buttons, users are guided to different forms. The first form is to add basic personal data, like weight, height and age. The next form is to submit general medical information. The general information is useful to quickly connect accident data via a simple overview of the medical conditions. In the third form, the user can add specific injury data, mainly related to the head. Easy navigation is ensured through a submenu on the side, which contains subforms for injuries such as ASDH, contusions and fractures. These subforms are useful to capture a detailed description of the different injuries. The fourth form is to add details about the accident, which is mainly based on the questionnaire. Every form has a relation with every other form, which means that one person can have multiple crashes, and a crash can result in multiple injuries. The last form is to submit reconstruction results, with some additional information to check the background of the simulation in an efficient way. These details include the institute of the researcher, the type of simulation that was used and possible publication details.

A simple reading form has also been created, showing only the most important information for accident reconstructions. This includes a description of the persona that is needed to scale the person, accident information needed for the reconstruction, and the location and description of the different injuries. Furthermore, there is an opportunity for statistical analysis and relational searches of different topics. One example is to relate gender or age with different injuries or reconstruction results, which might result in age- or gender-specific injury thresholds.

The possibility to work together with other universities is created through a coupling with Microsoft Sharepoint. Users can be invited to work online in the interface, which allows the addition of new data and the reading of all other data. With this database it will become possible to cooperate with different institutes in a low cost way. It is a simple, open-source platform that will create a wealth of accident reconstruction material.

III. INITIAL FINDINGS

The database was tested and altered based on data collected by our group in the past, and new cases from UZ Leuven. Next to this, there was an opportunity to work together with KBC Insurances, a private insurance company, to gain access to casefiles of work accidents. This means the files were organised and written for insurance purposes. The database helped to skim through the text and made sure all the important details were found. It showed that even without any prior knowledge, it is possible to work with the database and gather useful information of existing data sources.

IV. DISCUSSION

Based on the findings so far, the database shows high potential for the gathering and saving of accident information. However, it must be noted that the crash information collected through a questionnaire has more uncertainties than police file and medical expert data, which might be a disadvantage of this database. Managing uncertainties is an inherent challenge in this work, and efforts should be made to keep uncertainties in the entry data as low as possible. Working together with the police, gathering police data, video data or GPS data, will have a positive effect on the uncertainties, but will also increase the workload again. Another approach that might be explored is to categorise accidents on different accident types and outcomes, to create a statistical base with a bigger sample size. This will decrease the input uncertainties of individual cases and create a more general overview of the accidents. The end goal would be to find a correlation between input parameters and injury outcomes, to increase the knowledge of head crash biomechanics and to create a basis for innovation in pedestrian and cyclist protection. A good correlation can only be established if the sample size of data is sufficient. This, again, stresses the importance of an accident database with a considerable amount of cases.

V. REFERENCES

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