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Reducing crashes and injuries among young drivers: what kind of prevention should we be focusing on?

H-Y Berg

Every year, drivers throughout the world are killed or injured in road traffic. Young drivers run a greater risk everywhere, and this problem is still largely unsolved. Better understanding of the underlying processes could, however, be a useful tool in preventive endeavours. To change a young driver’s goals behind driving and the context in which it is done, a variety of different methods of persuasion should be tested. Both “soft” and “hard” methods should be used. For example, communication and increased enforcement may be used simultaneously. Communication campaigns should highlight the dangers of unsafe behaviour and in particular target young males. Communication campaigns that employ persuasive, emotional messages are most effective where young drivers are concerned. Research shows that attitudes about safety are formed at an early age, long before legal driving, and therefore it would also be important to target young adolescents. Laws need enforcement to be effective and should target areas of particular risk to young drivers. Driver education or communication campaigns cannot be expected to radically change a young person’s life goals. For that purpose, active learning methods that make use of the learner’s own experiences have to be applied. Special courses for young drivers designed to make individuals conscious of their personal tendencies and the type of social context that affects their driving behaviour could be helpful, whether offered via the ordinary school system or at driving schools.

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Road traffic is the cause of one of the world’s greatest public health problems. In 2000, 1.26 million people died as a result of road crashes, representing 25% of all deaths caused by injuries. The majority of road deaths take place in developing countries, and the economic cost to the developing world amounts to 100 billion US dollars annually—more than the entire amount of money spent on development aid. The significance of traffic as a health problem is rising, especially in developing countries. Worldwide, road traffic injuries are the leading cause of death for people aged 15–44.

When, as in Sweden and many other countries, the ambition is to improve on an already high level of road safety, huge efforts are required. Existing measures have to be further developed, but this is probably not enough. As a result, new methods will have to be devised, especially with regard to young, recently qualified car drivers. The 18–24 year age category is the one with the highest risk of all new drivers. This is largely attributable to lack of experience of car driving and other age related factors.

Age, experience, and crash risk
Against this background, one important aspect that has been studied is how the age of licensure and the driving experience gained after licensure influence the risk of crashes on the road. An American study attempted to estimate the effects of age and experience, and also of “curfews”, as well as compulsory driver training and the minimum age for alcohol consumption. This study, which was carried out in the USA, showed that age was critical in terms of the level of crash risk, and that 15 year olds in particular were more at risk. According to the results of this study, experience is also significant, but not to the same degree as age. The results also show that the effect of high crash risk due to low driving experience decreases with increasing age.

There are also a large number of studies and reviews that show that experience is more significant than age with regard to crash risk in traffic.

The conclusions that can be drawn from the above studies and reviews are that both age correlated causes and experience are significant to the crash risk a driver is exposed to in traffic.

What are the factors affecting the way a driver drives a car?
The research of recent years in the field of driver training has indicated that a hierarchical approach to the task of driving can help to identify specifically which skills a driver needs to avoid crashes and injuries. The idea behind a hierarchical approach is that success as well as failure on the higher levels will affect the demand on lower levels. Keskinen divided the task of driving into four separate levels (fig 1), in which the higher levels are considered to always affect behavior on the lower levels, although the lower levels may also affect the higher ones.

Goals for life and skills for living
The fourth level, Goals for life and skills for living, deals with how a person’s various motives and goals for life, in a particular phase of his or her life, affect that person’s way of driving. Here, the car is regarded as a means of achieving the different goals for life that a person has set himself or herself. The idea is also that factors such as what we are like as individuals and how we live our day-to-day lives also affect our approach to driving and our behaviour as drivers. These factors also include personality factors such as self-control, as well as lifestyle, social background, gender, age, group affiliation and other preconditions that research has shown to have influence on attitudes, motives, choices, and behaviour as a driver.

Goals and context of driving
The third level, Goals and context of driving, refers to the goals and purpose of the journey and the environment in which it is made. In this context, the car is viewed as a tool for

Abbreviation: GDE, Goals for Driver Education.
A study of the model reveals that the tasks of a driver are many: first, any journey has to be planned; then, various choices have to be made to establish the best way of getting to a destination; and furthermore, the driver must be able to handle a car in a large number of different traffic situations, and do so in a way that minimizes risk. All of this must be done in a social context that influences the individual’s choices in some direction.

The model is constructed on the four hierarchical levels shown in figure 1. However, it also extends over three columns, Knowledge and skill a driver has to master, Risk-increasing factors a driver must be aware of and Self-evaluation. Knowledge and skills a driver has to master focuses on the theoretical knowledge and skill necessary to drive the car and use it in a way to convince the person to where he or she wants to go. Risk-increasing factors a driver must be aware of focuses on what may affect the risk of crash and injury that is always present during driving. Self-evaluation focuses on the ability of the individual driver to evaluate his/her knowledge and skills accurately. The main principle here is self-evaluation with regard to driving and traveling. The four levels, combined with the three areas of knowledge, lead directly to various driving skills. Together, they identify the proficiency that a driver needs to be able to drive a car safely. Table 1 provides examples of the skills encompassed by the GDE matrix.

FROM SOLELY SPECIFYING DRIVING SKILLS TO DEVELOPING PREVENTIVE MEASURES FOR YOUNG DRIVERS

The structure of the GDE may be modified from one that specifies only what a driver needs for essential skills, knowledge, and awareness into a tool for developing various different preventive measures aimed at improving safety among young drivers. If the GDE matrix is to be used for this purpose, the preventive measures must be developed by taking into account the background research behind the GDE matrix. The lowest level in the GDE matrix, Vehicle maneuvering, may be said to fall within the operational category of driving, while the second lowest level, Mastery of traffic situations, is classified within the tactical category and the third level, Goals and context of driving, is rather to be attributed to the strategic side of driving. Breaking down the GDE model via a scale ranging from operational to strategic, via tactical, in which the strategic element affects the tactical, which then affects the operational side, makes it possible to develop preventive measures at a higher level than those that merely try to train newly qualified drivers to improve their “car control handling skills”. When viewed from this perspective, it is easy to understand why several attempts to improve safety by improving skills on the two lowest levels, Vehicle maneuvering and Mastery of traffic situations, usually show a failure to reduce crashes.14 15 Hatakka et al find that: “if the motivational level fails to produce a safe strategy for driving, no level of skills in mastering traffic situations or vehicle handling is high enough to compensate for this lack of safety orientation and to produce a safe output” (page 15).16

The terms age and experience may be said to be two general concepts covering a host of qualities which affect the risk of a crash. Extensive driving experience is important in terms of the capacity to handle the large volume of information received by a driver, and, at the same time, to drive the car. In addition, great experience is a must in automating the task of driving as much as possible, thereby releasing mental resources for interacting with other road users. Age, for its part, more affects how and for what purpose a car is used. If age and experience are to be related to the GDE matrix, it may be said that the two lowest levels, Vehicle maneuvering and Mastery of traffic situations, have more to do with experience, because all drivers irrespective of age must...
Communication campaigns that employ persuasive, emotional messages are the most effective where young drivers are concerned. These should place particular emphasis on issues such as speed, drunk driving, mobile phone use, etc, and should target young males.\textsuperscript{12} Research also shows that attitudes about safety are formed at an early age, long before legal driving, and on that basis it would also be important to target young adolescents.\textsuperscript{11}

Laws need enforcement to be effective and should target areas of particular risk to young drivers.\textsuperscript{13} Enforcement and communication campaigns should be used in combination. Combination of different methods gives the best results.\textsuperscript{17}

Economic incentives could promote safer behavior and target young males in particular (for example, lower insurance premiums for young drivers who have no incidents or who use certain technology). It cannot be expected that driver education or communication campaigns will radically change a young person’s life goals. For that purpose, active learning methods that make use of the learner’s own experiences have to be applied.\textsuperscript{14} Special courses for young drivers designed to make individuals conscious of their personal tendencies and the type of social context that affects their driving behavior could be helpful for this purpose, whether offered via the ordinary school system or at driving schools. The key to learning about the higher levels in the hierarchy and to raising the level of self-evaluative skills lies in the activity of the learner himself or herself.\textsuperscript{13} Training of self-evaluative and meta-cognitive skills must therefore be included in courses for young drivers. This provides an opportunity for developing expertise after training, and for attaining and modifying motives and goals.

Table 1 Goals for Driver Education framework\textsuperscript{7}

<table>
<thead>
<tr>
<th>Hierarchical level of behavior</th>
<th>Essential contents (examples)</th>
<th>Risk increasing factors</th>
<th>Self-evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals for life and skills for living (general)</td>
<td>Knowledge and skills about control over how</td>
<td>Risky tendencies</td>
<td>Self-evaluation/awareness of</td>
</tr>
<tr>
<td></td>
<td>life goals and personal tendencies</td>
<td>acceptance of risks</td>
<td>personal skills for impulse control</td>
</tr>
<tr>
<td></td>
<td>affect driving behavior</td>
<td>self-enhancement through driving</td>
<td>risky tendencies</td>
</tr>
<tr>
<td></td>
<td>- lifestyle/life situation</td>
<td>high level of sensation seeking</td>
<td>safety negative motives</td>
</tr>
<tr>
<td></td>
<td>- group norms</td>
<td>complying with social pressure</td>
<td>personal risky habits</td>
</tr>
<tr>
<td></td>
<td>- motives</td>
<td>use of alcohol/drugs</td>
<td>etc</td>
</tr>
<tr>
<td></td>
<td>- self-control, other characteristics</td>
<td>values, attituded towards society</td>
<td>etc</td>
</tr>
<tr>
<td></td>
<td>- personal values</td>
<td>etc</td>
<td>etc</td>
</tr>
<tr>
<td>Goals and context of driving (trip related)</td>
<td>Knowledge and skills concerning</td>
<td>Risks connected with</td>
<td>Self-evaluation/awareness of</td>
</tr>
<tr>
<td></td>
<td>- effects of trip goals on driving</td>
<td>driver’s condition (mood, BAC, etc)</td>
<td>personal planning skills</td>
</tr>
<tr>
<td></td>
<td>- planning and choosing routes</td>
<td>purpose of driving</td>
<td>typical goals of driving</td>
</tr>
<tr>
<td></td>
<td>- evaluation of social pressure in car</td>
<td>driving environment (rural/urban)</td>
<td>typical risky driving motives</td>
</tr>
<tr>
<td></td>
<td>- evaluation of necessity of trip</td>
<td>social context and company</td>
<td>etc</td>
</tr>
<tr>
<td></td>
<td>- etc</td>
<td>extra motives (competing etc)</td>
<td>etc</td>
</tr>
<tr>
<td>Mastery of traffic situations</td>
<td>Knowledge and skills concerning</td>
<td>Risks caused by</td>
<td>Self-evaluation/awareness of</td>
</tr>
<tr>
<td></td>
<td>- traffic rules</td>
<td>wrong expectations</td>
<td>strong and weak points of basic</td>
</tr>
<tr>
<td></td>
<td>- observation/selection of signals</td>
<td>risk increasing driving style (aggressive)</td>
<td>traffic skills</td>
</tr>
<tr>
<td></td>
<td>- anticipation of course of situations</td>
<td>unsuitable speed adjustment</td>
<td>personal driving style</td>
</tr>
<tr>
<td></td>
<td>- speed adjustment</td>
<td>vulnerable road users</td>
<td>personal safety margins</td>
</tr>
<tr>
<td></td>
<td>- communication</td>
<td>not obeying rules/unpredictable behavior</td>
<td>strong and weak points for</td>
</tr>
<tr>
<td></td>
<td>- driving path</td>
<td>information overload</td>
<td>hazard situations</td>
</tr>
<tr>
<td></td>
<td>- driving order</td>
<td>difficult conditions (darkness etc)</td>
<td>realistic self-evaluation</td>
</tr>
<tr>
<td></td>
<td>- distance to others/safety margins</td>
<td>insufficient automation/skills</td>
<td>etc</td>
</tr>
<tr>
<td></td>
<td>- etc</td>
<td>etc</td>
<td>etc</td>
</tr>
<tr>
<td>Vehicle maneuvering</td>
<td>Knowledge and skills concerning</td>
<td>Risks connected with</td>
<td>Awareness of</td>
</tr>
<tr>
<td></td>
<td>- control of direction and position</td>
<td>insufficient automation/skills</td>
<td>strong and weak points of basic</td>
</tr>
<tr>
<td></td>
<td>- tyre grip and friction</td>
<td>Unsuitable speed adjustment</td>
<td>maneuvering skills</td>
</tr>
<tr>
<td></td>
<td>- vehicle properties</td>
<td>difficult conditions (low friction etc)</td>
<td>strong and weak points of skills</td>
</tr>
<tr>
<td></td>
<td>- physical phenomena</td>
<td>etc</td>
<td>for hazard situations</td>
</tr>
<tr>
<td></td>
<td>- etc</td>
<td>etc</td>
<td>realistic self-evaluation</td>
</tr>
<tr>
<td></td>
<td>- etc</td>
<td>etc</td>
<td>etc</td>
</tr>
</tbody>
</table>

BAC, blood alcohol content

possess the skills specified in the GDE matrix. The two top levels, Goals for life and skills for living and Goals and context of driving, are more age specific. Against that background, influencing the motivation of the young driver category for driving is more likely to be effective in terms of crash and injury prevention than attempting to make them into even more skilled drivers technically. The focus should therefore be to make young drivers aware that their personal motives, tendencies, and social relations in the broader sense always affect their goals and context of driving, with the aim of getting them to change their goals behind driving and the context in which driving is performed—that is, why a driver is driving on a certain occasion, where and when, and with whom. In this way, by bringing about a change in driving habits through improved planning of driving route and driving time (day or night), as well as choice of driving state (alcohol, stress, fatigue, etc) and driving company, it should be possible to reduce the number of driving related injuries.

**Which preventive measures could work?**

To change a young driver’s goals behind driving and the context in which it is performed, a wide variety of different methods of persuasion should be tested. Both “soft” and “hard” methods should be used. For example, communication and increased enforcement may be used simultaneously. Communication campaigns should highlight the dangers of unsafe behavior and should particularly target young males, as well as other young drivers, role models, and pre-driving teens.\textsuperscript{15} Long lasting effects of communication campaigns seem difficult to achieve, and therefore we can learn much from successful campaigns and the strategies they use.\textsuperscript{17}
on the highest levels of the hierarchy. This strategy could change a young driver’s choices about where, when, and with whom he or she drives a car.

In addition, modern technology is also available for preventive purposes, including protective measures based on technology targeting speed (for example, “black box” devices) and the alco-lock, which prevents drink driving. Smart cards could be used in preventing unauthorized driving.

DISCUSSION

Every year, drivers throughout the world are killed or injured in road traffic. Young drivers run a greater risk everywhere, and this problem is still largely unsolved. Better understanding of the underlying processes could, however, be a useful tool in preventive endeavors. The focus of this paper is to give an understanding that a person’s life ambition (goals for life) and goals and context of driving sometimes influence young drivers and their passengers in terms of traffic safety more than their ability of mastering different driving situations and their skill of vehicle maneuvering. Better knowledge of these factors will make it possible to design safety measures specially tailored for young drivers or different subgroups of drivers. This is expected to help make the measures more effective and to reduce the conflict between mobility and safety.

The idea behind the GDE matrix offers the possibility of developing different countermeasures for young drivers. If this is adapted as closely as possible to this group and their driving situations, it should be possible to significantly enhance safety. In most countries of the world, young drivers show a high crash risk relative to elderly and more experienced drivers. Examination of the actual figures indicates that only 1–2% of young drivers (per year) are involved in a fairly severe crash. Against that background, it is important to take the concept of health into consideration, since a healthy life does not consist only of the absence of misfortune. Human health also includes physical and psychological wellbeing. The World Health Organization defines health as:

1. A state of complete physical, social and mental wellbeing, and not merely the absence of disease or infirmity.
2. Health is a resource for everyday life, not the object of living. It is a positive concept emphasizing social and personal resources, as well as physical capabilities.

Being able to get around by car when and where one wants is a source of wellbeing for many young people. Restricting the needs of the majority because of the few who are involved in a crash risks lowering the collective level of health for young people as a group. Selective influence is therefore important from two viewpoints: eliminating as many crashes as possible, without simultaneously restricting mobility for young people as a whole. If this is done in a way that is properly suited to the target groups and the situation at hand, it should be possible to achieve significant positive effects on safety and health at the same time.

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Hans-Yngve Berg is a Driver Education Expert with The Swedish Road Administration. Dr Berg is working on the development of the Swedish and European driver education system and also manages research projects conducted by universities and other independent research units in the field of behavioral science. Dr Berg also provides information and support to the public, to authorities, and to other people involved in the area of traffic safety. He is a senior lecturer at the Karolinska Institutet in Stockholm, primarily on the topics of traffic safety, driver education, and research methodology.

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