European Road Safety Observatory

Road Safety Thematic Report – Novice drivers

This document is part of a series of 20 thematic reports on road safety. The purpose is to give road safety practitioners an overview of the most important research questions and results on the topic in question. The level of detail is intermediate, with more detailed papers or reports suggested for further reading. Each report has a 1-page summary.

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Summary

Young drivers in road traffic

Young drivers are also novice drivers. We refer to 16 to 24 year old drivers as young novice drivers in this report. Young novice drivers are over-represented in crashes. This is true for all developed nations with mass motorization in which young people mostly start to drive as soon as they have reached the age limit for learning to drive. At its root, there are two causes for this over-representation in crashes: lack of mostly higher-order driving skills due to lack of experience; and risk-taking tendencies due to their young age. The age factor has two interrelated components: a biological component (i.e. having a brain which has not yet completely matured) and a social component (youth culture, lifestyle). Higher order driving skills include hazard perception, risk awareness, and calibration. Novice drivers do not always 'see' the potential hazards which are hidden in evolving traffic scenes when they drive; when they 'see' them they do not always assess risks properly, and they are also inclined to overestimate their skills. As a result, they sometimes tend to engage in driving tasks which exceed their still limited abilities. That is, their skills are poorly calibrated, such as driving too fast for the circumstances. Young drivers can also be more easily distracted, cannot always resist peer pressure, and are more often fatigued and they drive at night more often than older drivers. Drink driving occurs almost as often with young drivers than with older ones, but it has a more devastating effect on their driving capabilities. Although they do not drink and drive more often, they do drive more often under the influence of illegal psychoactive substances such as cannabis. What also contributes to their higher risk is that they drive more often in older cars with less safety features than in new cars, and drive more often in circumstances which are difficult for all drivers, such as driving at night and driving with peers. In general, young male drivers have a higher crash risk than young female drivers but only in relation to the most severe crashes.

Countermeasures

Given the severity of the problem, EU Member States have taken action, to varying degrees, to reduce young novice driver risk. There is no panacea that will resolve the problem entirely because driving skills tend to be impaired by a lack of experience and risk-taking tendencies are prevalent due to their young age. Moreover, not all young novice drivers are the same. There is evidence that the following measures can be effective:

- More emphasis on higher-order skill training in driving licence systems such as hazard perception and risk awareness training.
- The inclusion in driving licence systems of a learner phase (driving while accompanied by an older more experienced driver) and an intermediate phase where young drivers are allowed to drive independently but with restrictions such as not driving with peers, not driving in the dark, and not with devices which can distract such as mobile phones even when they are 'hands-free'.
- A low BAC limit for young drivers provided it is thoroughly enforced.

1 Highlights

- Over the years 2015-2019, 16% of European car drivers who died in traffic collisions were younger than 25 years of age whereas only 8% of the European population is between 18-24 years of age.
- Young novice drivers' risk is the result of a lack of driving experience and the very fact of being young. The age effect has two dimensions: a not yet completely matured brain and a social dimension (youth culture, lifestyle).
- Young novice drivers run a higher risk of being involved in single vehicle crashes and night-time crashes.
- Young novice drivers are over-represented in crashes mainly due to a lack of hazard perception and risk awareness skills, distraction, inappropriate speed management, and driving under the influence of psychoactive substances.
- Graduated Driver Licensing Systems decrease the crash risk of young drivers because they let them gain driving experience first in relative safe circumstances and only gradually expose them to more demanding traffic situations.

2 What is the problem?

Novice drivers are mostly also young drivers. We refer to 16 to 24 year old drivers as young novice drivers in this report. These young novice drivers are over-represented in crashes. They do not only pose a threat to themselves but also to their passengers and other road users. Their high crash risk is due to two factors: they have little driving experience; and they are young. The age effect has two intertwined dimensions. First, their not yet completely matured brains make them prone to distraction, peer pressure, limited impulse control, and to underestimating risks and overestimating their own skills. Second, there is a social dimension related to youth culture and lifestyle.

In the EU, over the period 2015-2019, on average 1,215 young car drivers (18-24 years of age) died each year in a crash (CARE, 2021), representing 16% of all car drivers killed over these years, whereas in 2016, only 8% of all car drivers in the EU were 18-24 years of age. Although there is a clear over-representation of young drivers in fatal car crashes, this over-representation is gradually declining (European Commission, 2018). Young drivers who die in car crashes are mostly male. Over the years 2015-2019, 82% of young car drivers killed were male. However, this over-representation of male drivers in fatal crashes is not unique to young drivers but also exists in other age-groups (CARE, 2021).

3 How Novice drivers gain their driving licence?

In Europe, young people typically start to practice driving between 16 and 18 years of age. The exact age depends on the age limits applying in the driver licence system of the particular member state. The age at which they can obtain their driving licence varies

between European countries, as do the restrictions that apply in the first years of their driving career (see for an overview: Helman et al., 2016). In most European countries, young drivers start driving with a provisional licence. The maximum Blood Alcohol Concentration (BAC) with which drivers are allowed to drive is often lower for drivers with a provisional licence and the demerit point system (if any) is often stricter for drivers with a provisional licence. Many European countries have also included a learner period in their driving licence system. During the learner period young novice drivers are only allowed to drive with a designated and experienced accompanying driver. In some European countries this accompanied driving period is before the final driving test (e.g. in Sweden) and in other countries it is after the learner has passed the final driving test but has not yet reached 18 years of age (e.g. in Germany).

4 Novice drivers and road safety

4.1 Typical crashes

An international review of crash circumstances reveals that young novice drivers are over-represented in crashes in the dark (especially during weekend nights), and on rural roads (Cassarino & Murphy, 2018). Single vehicle crashes (curves and straight roads), head-rear crashes (where the driver hits a car in front of him), and not giving way at intersections are the most common crashes for American teen drivers (McDonald, Sommers and Winston, 2017). The over-representation of young novice drivers in these crash types is also reported in a somewhat older European study (Clarke et al, 2006).

4.2 Crash risk or relative risk

The over-representation of young novice drivers in crashes is an old and persistent problem (Elvik, 2010). It was reported for the first time in the early 1960s and is present in all developed nations with mass motorization in which young people mostly start to drive as soon they have reached the age limit for learning to drive and for taking the driving test (Vlakveld, 2016). Crash risk (the number of crashes per distance driven) is highest after licencing (i.e. when drivers are allowed to drive without an experienced accompanying driver) and decreases rapidly in the first months of independent driving. However, it takes years for the crash risk to cease declining and it remains at a low level until it gradually starts to rise again after 65 years of age (e.g. Vlakveld, 2011). Although the size of the effect varies, serious crashes show a substantial over-representation of young drivers relative to the distance driven. This is found in all studies investigating this issue (McCartt et al., 2009). The risk of crashes resulting in at least one killed or seriously injured casualty is higher for young male drivers than for young female drivers but there are indications that the gender gap is narrowing (Helman et al., 2017).

4.3 Causation factors

The young novice driver question is a multi-faceted problem and it is not the same with all young drivers. Nevertheless, most causation factors are related to two characteristics: (1) lack of higher order skills due to inexperience, and (2) risky behaviours due to the fact of being young (i.e. not yet having a completely matured

brain, and youth culture). Higher order skills include mainly hazard perception skills (i.e. the skill of predicting accurately how traffic situations can develop in dangerous situations), calibration skills, and the ability to balance task demands and capabilities. People are ill-calibrated when they underestimate risks and overestimate their own capabilities (Watson-Brown et al., 2019). In addition, temporary factors such as peer pressure, fatigue, distraction, and being under the influence of psychoactive substances can increase the crash risk of young novice drivers (Cassarino & Murphy, 2018).

4.3.1 Brain development and higher-order skills

The human brain is not completely developed until approximately 25 years of age. The part of the brain that urges us to 'to think first and act later' is the last part to mature. It ensures that previous experience is used to make decisions (Gicquel et al., 2017). The part of the brain that regulates emotions, motivation, and satisfaction of needs matures much quicker (Gogtay et al., 2004). Due to this asynchronous development, young people are more inclined to take risks, are susceptible to peer pressure, and seek to satisfy their own needs such as 'pleasure' (Steinberg, 2008). The capacity of our working memory to enable us to remember items relevant to us also continues to develop during adolescence. The slower development of this capacity is associated with a self-reported increased crash risk (Walshe et al., 2019).

Reference is often made to the lack of higher-order skills in young novice drivers. These skills are not the pure driving skills such as vehicle control and mastering traffic situations but the skills to 'see' hazards, to know their own limitations, and to balance task demands and capabilities (i.e. calibration) (Hatakka et al., 2002). Young novice drivers have trouble in assessing risks (Kinnear et al., 2013) and are inclined to overestimate their skills (Fuller et al., 2008). As a result, their behaviour is not necessarily in line with their capabilities (de Craen, 2010). Young female and male drivers do not differ so much in their (limited) ability to 'see' risks but in their assessment of risks (Cordellieri et al., 2016). That is, young male drivers seem to be less concerned about the consequences of risks than young female drivers. Further, due to working memory and impulse control not yet being fully developed, young drivers are less able to process stimuli and focus their attention on relevant elements of the traffic situation, to make decisions, and to plan how to behave (Walshe et al., 2019).

4.3.2 Driving experience

Independent of their starting age, novice drivers have the highest crash risk in their first months of independent driving (i.e. when no longer being accompanied by an older and more experienced driver). During these first months the risk of single vehicle crashes in particular declines rapidly (McCartt et al., 2009; Sagberg, 1998). However, after the first year of independent driving, their overall crash risk is still higher than with more experienced drivers. After this first year the crash risk declines at a much slower pace. It takes years before their crash risk remains at a stable low level. This is because they still have to gain experience in applying the skills acquired in different situations and improve their calibration skills during the first few years after initial qualification (McDonald et al., 2017).

4.3.3 Factors that temporarily reduce fitness to drive

When comparing young drivers to middle-aged drivers and older drivers, temporary factors which affect driving have been studied:

- Alcohol consumption in young people varies strongly between EU member states (Bräker & Soellner, 2016). In member states with a high proportion of drinking adolescents, the proportion of excessive drinkers (binge drinking) is also high. On average, young drivers do not tend to drink and drive more often than middle-aged drivers in the EU (Goldenbeld et al., 2020). However, compared to middle-aged drivers, their crash risk is higher at a lower blood alcohol level (Jongen et al, 2018; Peck et al., 2008). This is probably caused by inexperience in driving and a lack of developed higher order skills. Inexperience in managing alcohol consumption may also be a factor. Young drivers also drive more often under the influence of alcohol with peers in their car (Houwing et al., 2015). Therefore, they not only put their own lives at risk but also those of their passengers, and of course those of the road users with whom they collide.
- In EU member states, young male drivers drive more often under the influence of illegal drugs than either drivers of 25 or more years or young female drivers, especially where cannabis use is concerned (Schulze et al., 2012). Meta-analyses show that crash risk is not the same for all drugs (Elvik, 2013; Rogeberg & Elvik, 2016; Rogeberg, 2019). While cannabis increases crash risk a little, cocaine and especially amphetamines considerably increase the crash risk. Driving while intoxicated by a combination of drugs, in particular the combination of alcohol and drugs, increases the crash risk most (Asbridge, Wickens, Mann, & Cartwright, 2017; Herrera-Gómez, García-Mingo, Colás, González-Luque, & Alvarez, 2019).
- Young people are inherently curious about new stimuli. They have trouble focusing on the most significant traffic stimuli, and their ability to suppress impulsive reactions is not fully developed. A naturalistic driving study from the USA reveals that while distracted the crash risk of young drivers (16-29 years of age) is increased and for most distracting activities (with the exception of operating a screen) the increase in crash risk is greater than for middle-aged drivers (30-64 years of age) (Gershon et al., 2019; Guo et al., 2017; Lu, Guo, & Li, 2020). Young drivers are not distracted more often than middle-aged drivers (Klauer et al., 2014) but the prevalence of particular distracting activities differs. Young drivers for instance text for 3.3% of driving time and middle-aged and older drivers for only 1.1% (Guo et al., 2017).
- For young drivers, fatigue is of more importance than for older drivers, because they more often drive at night, the time of day when people are naturally inclined to sleep (Lyon et al., 2020). In addition, there is a mismatch between the biological development of the sleep-wake rhythm, the amount of sleep young people need, and the daily rhythm imposed by school, education or work (Jolles, 2019). Yet, fatigue caused by lack of sleep is hard to recognize in young people and therefore difficult to control (Paterson & Dawson, 2017). A UK study shows that lack of sleep prior to driving is related to higher crash risk (Groeger, 2006).

4.3.4 Attitudes and social environment

Some young novice drivers adopt a 'sporty driving style' to impress friends (Arnett, 2002). The crash risk is particularly increased for young drivers who enjoy cars and driving, or for those who really enjoy going out (Møller & Sigurðardóttir (2009). Young drivers are influenced by their peers. The attitude of their friends towards risky driving behaviour (the peer group standards) affects the extent to which young drivers display risky driving behaviour (Geber, Baumann, Czerwinski, & Klimmt, 2019; Guggenheim, Taubman – Ben-Ari, & Ben-Artzi, 2020). In particular, young drivers who lack impulse control tend to violate traffic rules when peers in the car encourage them to do so (Cascio et al., 2014).

For young drivers with one or more young passengers, crash risk is higher than when they drive without passengers. The presence of young passengers increases risk more strongly for male drivers than for female drivers. For young male drivers, the effect of a passenger being present is more prominent when the passenger is male rather than female (Ouimet et al., 2015). Conversely, when young drivers are accompanied by an older passenger (>30 years of age), their crash risk is lower than when they are unaccompanied (Engström, Gregersen, Granström, & Nyberg, 2008; Ouimet et al., 2010). Parents set the example for their children; a parent's driving behaviour therefore predicts the driving behaviour of young drivers (Taubman - Ben-Ari, Musicant, Lotan, & Farah, 2014). Moreover, a young driver's risk behaviour depends on the extent to which parents encourage safe behaviour and set clear boundaries (Gicquel et al., 2017).

4.3.5 Speed

International literature shows that young drivers are relatively often involved in crashes caused by not adjusting their speed to traffic conditions (e.g. by not lowering their speed sufficiently in a curve or when it rains) (McKnight & McKnight, 2003; Clarke, Ward, Bartle & Truman, 2006). The inability to adjust speed to traffic conditions is related to several factors mentioned above, such as insufficient driving experience, lack of calibration skills, inadequately coping with peer pressure, and driving late at night with less traffic. Dutch research into self-reported speeds shows that young drivers do not exceed speed limits on motorways just after gaining their driving licence, but that speeds are at their peak two to three years after licensing (Vlakveld, 2011).

4.3.6 Environment

Young drivers drive relatively often in conditions that also increase crash and injury risk for experienced drivers: they often drive in somewhat older cars with fewer passive and active safety devices (Watson & Newstead, 2009), and they drive more often during periods of darkness, especially during weekend nights. For example, the risk of collision involvement for young drivers in Great Britain is eight times higher between 2am and 4am, on both weekdays and weekends (DfT, 2018).

5 Countermeasures

5.1 Driver education

5.1.1 Initial driver training to prepare for the driving test

Despite the idea having intuitive appeal, evaluation studies and meta-analyses have previously shown that formal initial driver training provided by a certified driving instructor generally did not result in lower crash rates after licensing than informal driver training provided by a lay instructor (e.g. a parent) (Beanland, Goode, Salmon, & Lenné, 2013; Blomberg & Fisher, 2012; Elvik, Høye, Vaa, & Sørensen, 2009; Lonero & Mayhew, 2010; Mayhew & Simpson, 2002; Peck, 2011; Wells et al., 2008). However, most of these evaluation studies are old and have a rather weak research design (e.g. no random assignment). Moreover, the effect of basic training at US-American high schools investigated in most of these studies might have been limited because the trainings did probably not address the main causes of crash involvement for their very young participants, namely a lack of higher order skills and motivation to avoid risks like drinking and driving, operating a mobile phone while driving, or peer pressure. Recent study results indicate that initial driver training programs that do so may reduce crash risk after licensing (Horswill et al., 2021; Watson-Brown, Scott-Parker, & Senserrick, 2021). In Great Britain, studies have shown the benefits of changes to the driving test that focus on 'real-world' driving rather than manoeuvres (Helman et al., 2017).

5.1.2 Graduated driver licence (GDL)

Graduated licensing implies that aspirant drivers first gain experience in safe conditions before they are allowed to drive in more demanding traffic situations. Several countries, including the United States, Canada, Australia and New-Zealand have a form of 'graduated driver licensing' system. In the EU, Ireland has recently implemented a graduated driver licence system.

Graduated licensing usually consists of three phases:

1. The learner phase. In this phase, candidates can only drive while accompanied. Supervisor and learner usually keep a logbook of the manoeuvres accomplished and how they were mastered by the learner. Often, the number of kilometres travelled is also logged. The learner phase typically lasts for a minimum time period (e.g. six months to a year) or requires the accumulation of a minimum number of certified hours of on-road practice. Learner drivers typically have to pass an on-road test and occasionally a theory test before they can proceed to phase 2.
2. The intermediate phase. During the intermediate phase, a candidate is allowed to drive independently, but only in conditions with low crash risk. This phase almost always implies a prohibition on driving under the influence of any alcohol. Often a restriction on driving in the dark (e.g. 11 pm to 5 am) and driving accompanied by peer passengers also applies. In some states handsfree mobile phone use is also not allowed during the intermediate phase. Progression to phase 3 usually occurs after a certain time period (e.g. 6, 12 or 18 months)
3. The full licence phase. During this phase, the novice driver is allowed to drive independently without restrictions. In some states, stricter rules (for instance about alcohol use or heightened strictness in demerit points) apply to novice drivers for a time period until they are considered an experienced driver.

There is strong evidence that fully implemented GDL systems reduce the crash risk of young novice drivers (Curry et al., 2014; Kinnear et al., 2013; McCartt et al., 2010; Russell, Vandermeer, & Hartling, 2011; Senserrick & Williams, 2015; Williams, 2017). The impact of GDL systems mainly stems from the fact that these systems postpone independent driving. However, there is some evidence that GDL systems also improve driving skills slightly (Foss, Masten & Martell, 2014). Strictness of the rules determines the effectiveness of GDL, especially in relation to the number of hours that have to be driven supervised. The minimum amount of time the driver has a learner's permit, harsher sanctions, logbook completion, and alcohol restrictions are also important aspects (Hirschberg & Lye, 2020). Although, with the exception of Ireland, no EU member state has fully implemented a GDL system, quite a few EU member states have included a learner phase (the first phase in a GDL system) in their driving licence system and some have introduced a provisional licence for beginners that is very similar to the third phase of a GDL system. However, intermediate phases with restrictions are rare in Europe.

5.2 Additional training

Some EU member states (e.g. Austria, Finland, Luxembourg, Sweden, Slovenia, Estonia, Latvia, and Lithuania) have included a so-called mandatory second phase driver education program in their driving licence system. After young drivers have acquired their driving licence, they have to attend additional driver education usually within the first two years of independent driving (Washington, Cole & Herbel, 2011). These training programs usually consist of a so-called feedback drive, training on an enclosed track, and a group discussion about motivations to drive safely. The feedback drive is a drive in real traffic with a driving instructor in which feedback is provided about the driving style of the novice driver. The training on the test track is not intended to be a skill training in how to operate a vehicle in emergency situations, but to make young drivers aware how easy it is to lose control and that they have to anticipate and avoid situations that increase risk. The effect of these second phase training programs on crash risk is inconclusive (Keskinen, Hatakka, Katila, Laapotti, & Peräaho, 1999; Mynttinen, Gatscha, Koivukoski, Hakuli, & Keskinen, 2010).

It has been demonstrated that short dexterity trainings adressing skills which drivers only have to apply occasionally, such as skid training, do not reduce crash risk. For instance, obligatory skid courses in Norway, Sweden and Finland have proved not to impact, or even to have an adverse effect, on crash risk (Katila, Keskinen, Hatakka, & Laapotti, 2004). The courses are too short to automatise the complex actions needed. But they nevertheless lure young drivers into thinking that they have mastered these skills and make them over-confident (Mayhew & Simpson, 2002).

5.2.1 Hazard perception

Hazard perception is the skill of 'reading the road and anticipating forthcoming events' (Horswill & McKenna, 2004). That is, the skill to identify potentially dangerous on-road situations and carry out actions that increase the safety margin so that a crash can be averted if the potentially dangerous situation were to materialise. Young novice drivers tend to have poor hazard perception skills (Boufous et al., 2011; Horswill &

McKenna,1999; Wells et al., 2008; Wetton, Hill & Horswill, 2011), and there is a correlation between hazard perception skill and crash risk (see for a review: Horswill, 2016). Young novice drivers with poor scores on hazard perception tests have a higher crash risk than young novice drivers with a high score on hazard perception tests (e.g. Horswill, Hill, & Wetton, 2015).

Fortunately, drivers can be trained and tested in hazard perception skill (see for reviews: McDonald et al., 2015; Moran, Bennett, & Prabhakharan, 2019). A large-scale randomized controlled trial in the United States has shown that, after taking the *Risk Awareness and Perception Training* (RAPT) in the first year of independent driving, the crash risk of young men decreased significantly (Thomas, Rilea, Blomberg, Peck, & Korbelak, 2016). A more recent example is the hazard perception training developed at the University of Queensland (Horswill et al., 2021). It makes use of video clips of real crashes shot by dashcams. These videos stop when the first precursors of a crash become visible and the learners have to predict what happens next. Afterwards they are shown what really happened and the trainers also explain what else could have happened. Participants who had attended the training had higher scores on a hazard perception test than participants who did not attend the training. The compulsory testing of hazard perception skill as part of licensing systems for novice drivers has led to reductions in novice driver crashes in at least two countries (the UK and Australia), presumably because it raises the skill levels needed before being allowed to drive (Wells, et al., 2008; Boufous et al, 2011).

5.2.2 Resilience training

Resilience training is about motivational skills that are not only relevant for driving but also relevant for other aspects of life, such as resisting peer pressure. Senserrick et al. (2009) evaluated the effect a resilience training course had on the crash risk of young novice drivers in Australia. They found that such a training program reduced crash risk and showed promise. However, the research design of this evaluation study was rather weak because no random assignment was applied.

5.3 Exposure measures

Elvik (2010) argues that the young novice driver problem is more difficult to solve than other road safety problems because part of the problem is inherent given the nature of young people and this cannot be changed. Due to the late development of the part of the brain involving executive function and early emotional maturity, young drivers will always remain somewhat more adventurous than older and more experienced drivers. If then the scope for improvement of attitudes towards safe driving is limited, it is still possible to reduce crash rates of young drivers by having them drive less. After the introduction of a free public transport pass for students in 1992 in the Netherlands, the crash involvement of young male drivers dropped by almost 50% but it did not drop for young female drivers (Twisk, 2000). This measure was not intended to be a road safety measure but it had at least a strong road safety effect on the crash involvement of young male drivers. As already mentioned, GDL systems postpone independent driving and therefore can also partly be considered as an exposure measure.

5.4 Enforcement

5.4.1 Lower alcohol limit for novice drivers

American and Australian research shows that lowering the alcohol limit for young people results in less drink-driving and fewer crashes (Byrne et al. 2016; Senserrick & Williams, 2015). However, in Dutch research no effect on the prevalence of drink-driving was observed after lowering the blood alcohol concentration (BAC) limit for young drivers (I&O Research, 2021). Nor did the number of alcohol-related fatalities or seriously injured young road users decrease in the first two years after the introduction of the lower (BAC) limit for young drivers (Weijermars & van Schagen, 2009). Having reviewed the relationship between crashes and the BAC limit for drivers of all ages in EU member states, Castillo-Manzano et al. (2017) conclude that member states with the lowest BAC limit do not necessarily have the fewest alcohol-related road fatalities per capita. In EU member states with a zero BAC limit, prevalence of drink-driving and the alcohol-related crash rate can still be high when enforcement is low. Therefore, low BAC limits for young drivers will only be an effective countermeasure if enforced thoroughly.

5.4.2 Rehabilitation courses

Some EU member states have special mandatory rehabilitation courses for young offenders. Most of the time these courses are linked to a demerit point system such as in Germany. Young offenders can keep their licence if they attend these courses. There are numerous evaluation studies and various meta-analyses on the effectiveness of these often short interventions, but only a few of these studies are about rehabilitation courses that are exclusively for young drivers. Furthermore, most evaluation studies have a weak design. Most studies do not have a sound control group, random assignment is not possible most of the time, and only few studies have recorded offences, or even better, officially recorded crashes as outcome variables. Although most studies find a positive effect (e.g. on the likelihood to reoffend), only few studies can actually identify a reduction in crash risk (Kluppels, Dellanoy & Sliverans, 2021; SUPREME, 2007). Not all courses are equally effective, as a recent Dutch study shows: no reduction of recidivism was found among the participants of a course specifically developed for young drink drivers (Blom, Bolderdijk, & Weijters, 2017). The authors of the SUPREME report conclude that effective rehabilitation courses should be tailored to the needs of the offenders, the group size should be small, the time between offence and course should be short, and course leaders should be skilled.

5.5 Vehicles

5.5.1 Advanced Driver Assistant Systems (ADAS)

Safe vehicles, for example vehicles with high Euro NCAP scores, provide greater protection for car occupants when involved in a crash. Vehicle safety equipment and technology protect occupants and other road users in the event of a crash, reduce the likelihood of a collision (e.g., autonomous emergency braking systems) or warn drivers for dangers (e.g., blind spot monitoring or drowsiness alert systems). Some ADAS can even take over part of the driving task, such as lane keeping systems and adaptive

cruise control. As of July 2022, some ADAS will become mandatory for new car types in EU member states (European Union, 2019). ADAS can be beneficial for young novice drivers because lack of practice means that the execution of driving tasks is not yet fully automated and therefore error prone. Although ADAS, like collision warning systems, can decrease crash risk for drivers in general, the specific effect of these systems on young drivers is not yet well studied. Research in the USA suggests that collision warning systems decrease the following distance that young drivers keep to the vehicle ahead (Bao et al., 2020; Jermakian et al., 2017). It is important to note that drivers have to learn when and how to safely apply ADAS and learn when to trust and/or use them, and when not to. In a discussion with driving instructors and driver examiners Helman and colleagues (2016) noted that training and testing on the safe use of ADAS is still limited. The most important reason reported was the lack of standardization: how to operate a system can differ from brand to brand.

5.5.2 Monitoring and feedback systems

In-car systems, commonly known as black box or telematics products, monitor driving behaviour with sensors and sometimes also cameras. They can detect harsh braking, speeding, rapid acceleration, and hard turning. Some systems have dashcams that record the road ahead. Implementation of monitoring/feedback systems is typically voluntary and often related to an insurance product. Typically, these systems provide aggregated feedback – either to the insurance or to the young drivers themselves (e.g. smooth driving score or number of times the speed limit was exceeded). Sometimes real-time feedback (e.g. “you are driving too fast!”) is provided as well. Research shows that monitoring/feedback systems can reduce risk-related driving behaviour (Toledo & Lotan, 2017). Moreover, research on young drivers has shown that driving style, as measured by g-forces (harsh braking, rapid acceleration, hard turning) is associated with the occurrence of minor crashes (Simons-Morton et al., 2012). Barriers to adoption of non-commercial systems include acceptance by young drivers and their parents, sometimes due to privacy issues. Positive framing may improve the acceptance rates, for example by adding a game element (Shanly, Ieti, Warren, & Sun, 2018).

5.5.3 ‘Do not disturb’ and soft blocking for cell phones

Cell phone use while driving can be prevented by certain phone apps. Various apps are available, such as the ‘do not disturb apps’ for Android phones and Apple phones. The apps can block incoming messages for as long as the young driver is behind the wheel, reducing the potential for distraction. Use of these apps is voluntary and may not reduce risk for young drivers who display the most dangerous behaviours (Caird & Horrey, 2017). Installing a ‘soft blocking’ app – which only blocks the telephone sound while driving – is a less rigorous option that might therefore be easier to accept (Albert & Lotan, 2019). In the Netherlands, the Auto-modus app of insurance company Interpolis was assessed. This app not only blocks incoming messages, but also hands out compliments or awards merit points to young drivers when they have not used their phones while driving. Compared to a control group, the participants reported less phone use in the weeks they used the app (de Groot-Mesken et al., 2016). Nevertheless, there is little evidence on the prevalence and use of ‘do not disturb’ settings or soft blocking apps.

6 Further reading

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