A BEHAVIOURAL STUDY OF QUADBIKE DRIVERS

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ABSTRACT
As quadbikes are becoming more and more common in Sweden the number of accidents also increases. The first aim of this study was therefore to increase our knowledge of how and where quadbikes are used, the mistakes and violations drivers make and what situations they consider as hazardous. The second aim was to increase our knowledge of the accidents. Seven injured and 22 non-injured quadbike drivers were interviewed. The results show that quadbikes are highly appreciated as tools, as vehicles for recreation and as means of transport. Inexperienced drivers’ lack of knowledge, alternatively experienced drivers’ stress and/or carelessness combined with the quadbikes special characteristics; underage drivers and passengers; quadbike-driving under the influence of alcohol and excessive speed are all factors that could contribute to accident involvement; and without a helmet the consequences of these accident might become more severe. To combat these problems, and to reduce the number of quadbike accidents, the authors suggest changes to the law for helmets, a short specialized course focusing on practical quadbike driving in combination with a theoretical education focusing on risk awareness as well as a national mobilization against quadbike driving under the influence of alcohol and underage drivers.

1. INTRODUCTION
In Sweden, the number of quadbikes has risen sharply in recent years and according to the Swedish Transport Administration (2013) there were approximately 100 000 quadbikes by 2012. As the number of quadbikes has grown, so has the number of accidents; between 2003 and 2012, a total of 23 people were killed, while 377 people (133 of whom were under 24 years) were injured according to police reports (Forsman & Vadeby, 2014). The police reporting does, however, only cover road traffic accidents, which means that while the reporting of car accidents is reliable the reporting of quadbike accidents is much more uncertain as they can occur both on and off-road. In addition, quadbikes can in Sweden be registered as ATVs, motorbikes, tractors or mopeds which makes it complicated to single them out in the Swedish Traffic Accident Data Acquisition (STRADA). Regardless of the exact number of accidents, it is however important to gain more knowledge about how quadbikes are used and why accidents happen in order to work preventively.

In one study (Clay et al 2015), a total of 216 New Zealand farmers were interviewed. The results show that overconfidence in their driving ability, the desire to test the boundaries, fatigue, stress, multitasking and inexperience were all factors that led to risky behaviours (such as excessive speed and/or driving in too difficult terrain) and loss of control.
According to Reason, Manstead, Stradling, Baxter and Campbell (1990) different types of car driving behaviours (including risky behaviours) can be categorised into three different factors: lapses (harmless slips and lapses), errors (dangerous mistakes and slips) and violations (dangerous deliberate violations). This categorisation has been extensively empirically tested and even though different factor solutions sometimes been found, the distinction between involuntary mistakes (lapses and errors) and deliberate violations, first shown by Reason et al. (1990), seems to be robust for different types of vehicles, private and professional drivers, both within and across different countries and cultures (Wallén Warner, 2006; for an overview).

The distinction between involuntary mistakes and deliberate violations is also supported by the fact that this two-factor solution was the most stable solution (among possible solutions with two to six factors) over a three-year follow-up study in Finland (Özkan, Lajunen & Summala, 2006).

The first aim of this study is to increase our knowledge of how and where quadbikes are used, the mistakes and violations drivers make and what situations they consider as hazardous. The second aim is to increase our knowledge of the accidents.

2. METHOD

2.1. Participants

2.1.1. Injured quadbike drivers

According to police reports 51 quadbike drivers were seriously injured during 2011-2012. Six of those drivers were, for different reasons, not contacted for an interview (four were still under 18 years at the time for the interview, one lived abroad and one had died). The remaining 45 injured drivers received a written invitation (including a reminder) to participate in an interview. Seven injured drivers agreed to participate. As reimbursement for their participation they received two cinema tickets when the interview was completed.

All seven injured drivers were men with an average age of 49 years at the time of the accident (16-65 years). Six of the injured drivers had a car driving license and three also had a motorbike driving license. One of the injured drivers had licenses for ATV.

The injured drivers who had driven a quadbike the longest had driven for approximately 20 years, while those who had driven the shortest had driven for a few weeks. Five of the injured drivers drove all year around while two only drove when there was no snow. All of the injured drivers lived in rural areas, one of which lived in the archipelago. Six of the quadbikes were registered as ATVs while one was registered as a motorbike.

2.1.2. Non-injured quadbike drivers

From the Swedish Transport Agency's vehicle register a national sample, matching the geographic spread of the injured quadbike drivers, was made. Instead of sending out a general reminder a second recruitment was done in the three geographically restricted areas which had receive the most replies in the first recruitment. A total of 26 non-injured drivers agreed to participate in an interview and of those the 22, with the least geographical spread, were chosen. As reimbursement for their participation they received two cinema tickets when the interview was completed.
Of the 22 non-injured drivers 19 were men and three were women with an average age of 51 years at the time of the interview (23-70 years). All of the non-injured drivers had a car driving license and 13 also had motorbike driving license. One of the non-injured drivers had attended a specific course for ATV drivers.

The non-injured driver who had driven a quadbike the longest had driven over thirty years, while the driver who had driven the shortest had driven for approximately one year. Thirteen of the non-injured drivers drove all year around while nine only drove when there was no snow. The majority of the non-injured drivers lived in rural areas, two of which lived in the archipelago. It should also be noted that some of the non-injured drivers had their permanent residence in a city but were driving their quadbikes on their properties in rural areas. Thirteen of the quadbikes were registered as ATVs while 13 was registered as motorbikes. For two of the quadbikes there were no information of registration. Six of the non-injured drivers had more than one quadbike.

2.2. Procedure
The drivers who agreed to participate in the interview were contacted by telephone to determine suitable time and place (e.g. in a local hotel or library, a café or in the driver's home). In total, 29 interviews (including two telephone interviews) were conducted during May to September 2014. The analysis showed that the number of interviews with the injured as well as non-injured drivers were large enough to reach a theoretical saturation, which means that additional interviews would not have added anything that would affect the results (see Bryman & Bell, 2011).

The drivers were informed, both in writing in connection with the invitation and verbally during the interview, that their confidentiality was guaranteed, that they did not have to answer the questions and that they could cancel the interview at any time without giving a reason. After getting the drivers' consent all the interviews were recorded to reduce the risk of misinterpretation (Lantz Friedrich, 2008). These recordings were then transcribed by an outside consultancy. During some of the interviews notes were also taken to make sure that no data was lost due to e.g. poor sound quality.

The transcribed interview material was first roughly structured based on the interview guide's themes and issues (Widerberg, 2002). Then similarities and differences, disagreements and consensus were further analysed.

To illustrate drivers' reasoning translated quotes has been used. Clarifications of the text has been written in brackets [ … ] while exclusions are highlighted with / ... /.

2.3. Material
The interview guide contained a number of general areas, which meant that the interviewer, to some extent, could choose between different follow-up questions depending on the drivers’ response. These areas focused on drivers' background, the use of quadbikes in the household, driving habits, drivers’ view on safety and whether they or someone else in the household had been involved in a quadbike accident (including accidents that had not been reported by the police).
3. RESULTS

3.1. Where and how quadbikes were used

The results show that quadbikes were, primarily, used as tools but also as recreational vehicles and means of transport.

As a working tool, quadbikes were used for ploughing snow, clearing, feeding animals, harrowing paddocks and transporting European elk carcasses during the hunting season (see quote below). For the elderly and for people with disabilities and/or limited mobility, quadbikes were especially important. Some of the older drivers even stated that the quadbike made it possible for them to continue managing their farms despite being older and less fit. One of the drivers was also active in a quadbike club that, among other things, helped Missing People searching for persons in difficult terrain.

One of them [the quadbikes] I use, mostly, for ploughing snow and the other I have when I drive in the forest / ... / I do some hunting of wild boars so I have to go down and give them some food too. I have a bait, which means that I drive almost every day.

Non-injured man

As a recreational vehicle, quadbikes were used by two broadly divided groups. The first group included those who used the quadbikes for driving in the forest looking for mushrooms, fishing, or more generally making a trip on their own or in the company of others. One of the drivers in this group believed that the quadbikes create a sense of freedom because one can make detours into the forest in a different way than is possible with the car. The second group included those who were seeking the thrill of more advanced off-road driving, where the capabilities of the quadbike and the drivers’ own skills were tested (see quote below). One of the drivers was also active in a club which, among other things, was working to build an off-road track for quadbikes.

The challenge is to test the machine to see what it can handle and to see what you yourself are capable of ... / ... /. Sometimes it happened that one tried to climb something steep and then it flipped ... / ... / One wanted to challenge the worst there was. We take this road, it is much muddier.

Injured man

Finally quadbikes were also used as means of transport. In particular this applied to people in rural areas who used the quadbikes, for example, to get between their home and a neighbour living some distance away.

3.2. Mistakes

The majority of the drivers thought that they drove safely at the same time as several of them admitted that they sometimes made mistakes. Roughly speaking, these mistakes were divided into errors of judgment and inattention/negligence.

Errors of judgment were often connected to the ground; like it being wetter, steeper or having lower friction than expected. These errors of judgment can result in the quadbike getting stuck or flipping over. Drivers also talked about how they misjudged the speed; particularly in curves.
Also inattention/negligence occurred among drivers. One driver talked about how he drove a shorter distance while he held an object in one hand. Because the steering was hard to handle with only one hand free, he drove into a tree-stump by mistake. Many drivers also talked about how they botched the loading by excessive weight or distributing the weight wrongly on the trailer.

3.3. Violations
Several drivers argued that they did not knowingly violate any rules while others said that they sometimes drove in the terrain for recreational purposes, drove on roads with ATVs, drove under the influence of alcohol, allowed children to ride along as passengers, drove with excessive speed or did not wearing a helmet on quadbikes registered as motorbikes.

Off-road driving for recreational purposes is prohibited in Sweden which some drivers ignored. Often this was justified by the drivers feeling that they had the right to do what they wanted on their own land (see quote below).

*I do not care. It's my land. I do as I please on my land, I think. I do not care a damn. if the rules say that I can or not.*

Non-injured man

Driving on roads with the quadbikes registered as ATVs are also prohibited in Sweden, but some drivers reported that they nonetheless tend to drive short distances on roads.

Driving under influence of alcohol was, by a large majority, regarded as totally unacceptable but a small minority did not share this view. Those who drove under the influence of alcohol could be roughly divided into two groups; those (often young men) who drove under the influence of alcohol (often heavily intoxicated) for recreational purposes and those who used their quadbikes as means of transport and drove home in the countryside after small amounts of alcohol (see quote below).

*I think one or two beers is absolutely no danger, not the slightest. / ... / But I would never drive in traffic with the quadbike or with car if I was drunk, but I’ve driven in the forest.*

Non-injured man

To allow children to ride along as passengers on quadbikes that are not approved for passengers was something several drivers talked about. Some drivers were not aware that they broke the rules while others argued that it was acceptable as long as one drove at low speeds in secure locations such as their own yard.

Excessive speed also occured; for example in connection with work, driving for recreational purposes in difficult terrain or for transport between two different locations on the farm.

Not wearing a helmet on quadbikes registered as motorcycles or mopeds are also prohibited in Sweden (while it is legal to drive a quadbike registered as an ATV or a tractor without wearing a helmet). Regardless of how the quadbike was registered it seemed to be common to use a helmet when driving long distances on the highway while it was less common on short distances in the terrain.
3.4. Hazardous Situations

To identify the drivers’ perceptions of hazardous situations, general questions, unrelated to the drivers’ own behaviour, were asked. The situations that drivers identified as hazardous were inexperienced drivers, stress and carelessness of experienced drivers, the quadbikes’ special characteristics, driving under the influence of alcohol, underage drivers and excessive speed.

**Inexperienced drivers** were considered to contribute to hazardous situations and many drivers mentioned the increase of inexperienced drivers using their quadbikes for recreational purposes. This involved, for example, inexperienced drivers’ lack of respect for, and knowledge of the vehicle and not realizing that it is not the same thing as handling a car or motorcycle (see quote below).

> And one drives in hazardous environments, and they [quadbikes] do not behave as one might think, like a car. If one are used to drive a car one have to relearn, that this is something quite different. This is a tool that goes very fast and that lack roadholding.

*Injured elderly man*

**Stress or carelessness of experienced** drivers was also thought to contribute to hazardous situations. Working on a farm can, for example, be stressful; which in turn may affect the driver negatively (see quote below).

> I do not experience that farmers drive so that they have accidents, it is rather the stress.

*Non-injured younger man*

How the **quadbikes’ special characteristics** can lead to hazardous situations was something that was brought up by most drivers. Because of the wheels placement (relatively close together) and the high centre of gravity, quadbikes are quite unstable and roll over easily when braking or turning at high speed, driving into a rock/stump or driving on a steep slope (see quote below). In addition, the consequences of a rollover can be very serious if the driver gets crushed under the weight of the vehicle (250-350 kg). Other factors cited were the significant difference between different tires and the risk of accidentally accessing the thumb-throttle.

> All wheels are very close together, not like they are on a stable car; racing cars are long, and the wheels are far out in the four corners. Quadbikes are just the opposite, all wheels are under the vehicle and the centre of gravity is very high.

*Injured elderly man*

**Driving under the influence of alcohol** was by many drivers considered to contribute to hazardous situations. Although the majority of drivers would never drive under the influence of alcohol themselves they still thought that drunk driving was common among quadbike drivers. Interesting to note is that drivers in southern and central parts of Sweden believed that it was common to drive both snowmobiles and quadbikes under the influence of alcohol in the northern part of the country; while drivers in the northern part of Sweden believed that it was common to drive quadbikes, for recreational purposes, under the influence of alcohol in the southern and central parts of Sweden. Some drivers also suggested that it was mainly the older generation who drives under the influence of alcohol.
Underage drivers were also considered to create hazardous situations. One driver gave the example of how a child, in sheer panic, involuntarily began to accelerate so that the quadbike went even faster. Many of the drivers could, however, understand that it was difficult for parents to forbid children to drive when the children think it is so fun (see quote below).

Where I live, you will sometimes see a parent sitting with a small child in their lap, and then you see the happy child driving and steering. That in some way, one wants to allow the child to do something fun, and then it goes wrong.

Non-injured man

Finally, excessive speed were considered to be a contributing factor to the development of hazardous situations (see quote below). At higher speeds the quadbike become unstable and easily begin to sway or yaw; and in a worst case scenario, might flip over.

Single accidents happens when driving fast. I think. They [quadbikes] become harder to manage when driving fast. / ... / When you start approaching 70 kilometres per hour it goes fast on a quadbike.

Injured young man

3.5. Accidents

Table 1 gives a short description of the seven accidents the injured drivers has been involved in. All of the accidents were single-vehicle accidents.

Table 1. Accident description.

<table>
<thead>
<tr>
<th>No.</th>
<th>Use</th>
<th>Mistake</th>
<th>Violation</th>
<th>Risky</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work</td>
<td>Too narrow curve</td>
<td>-</td>
<td>-</td>
<td>Brain haemorrhage 50% working capacity</td>
</tr>
<tr>
<td>2</td>
<td>Work</td>
<td>Misjudgement of ground</td>
<td>-</td>
<td>Stress</td>
<td>Brain haemorrhage Problems with speech Problems with writing Epilepsy</td>
</tr>
<tr>
<td>3</td>
<td>Transport</td>
<td>Too hard breaking</td>
<td>Alcohol</td>
<td>-</td>
<td>Paralysed waist down</td>
</tr>
<tr>
<td>4</td>
<td>Transport</td>
<td>Too high speed</td>
<td>Alcohol</td>
<td>Inexperience Stress</td>
<td>Broken neck Problems with speech Problems to swallow</td>
</tr>
<tr>
<td>5</td>
<td>Transport</td>
<td>Misjudgement of ground</td>
<td>-</td>
<td>-</td>
<td>Broken ribs</td>
</tr>
<tr>
<td>6</td>
<td>Pleasure</td>
<td>Too high speed</td>
<td>Off road</td>
<td>-</td>
<td>Neck pain</td>
</tr>
<tr>
<td>7</td>
<td>Pleasure</td>
<td>-</td>
<td>Sitting the wrong way around Alcohol</td>
<td>-</td>
<td>Brain haemorrhage Injured leg</td>
</tr>
</tbody>
</table>
3.6. Comparisons between injured and non-injured drivers

Since this is a qualitative study with few participants the comparison between injured and non-injured drivers should be interpreted with great caution.

The injured and non-injured drivers were in many ways similar. In both groups there were those who primarily used the quadbike as a tool and those who drove mostly for recreational purpose; those who said they sometimes drove at excessive speed and those who said they drove very carefully.

Stress associated with quadbike driving was, however, only seen among the injured drivers where it was considered to be a contributing factor to two of the accidents (3.6. Accidents; No. 2 and 4). The results of the interviews also show that drivers believed that stress could be a contributing factor to the quadbike accidents due to higher speeds and/or more careless driving. These claims were, however, general and do not relate to the drivers' own experiences.

In three of the described accidents (3.6. Accidents; No. 3, 4 and 7) the drivers were under the influence of alcohol which probably contributed to the accidents. Two of these accidents involved young drivers who mainly used their quadbikes for recreational purposes in order to test limits and try new stunts and challenges. Among the non-injured drivers a large majority believed that driving under the influence of alcohol was completely unacceptable while a few thought it was somewhat acceptable. Among those who thought that driving under the influence of alcohol was somewhat acceptable there still seemed to be a difference between the injured and non-injured drivers where the non-injured drivers only thought that it was acceptable under certain circumstances (e.g. driving in the terrain after consuming small amounts of alcohol; see quote below).

*If I’m driving on public roads it [driving a quadbike under the influence of alcohol] does just not exist at all. But if I should just fetch some firewood, for example, and I have had a beer, I do not care at all and drive anyway.*

*Non-injured man*

One of the accidents (3.6. Accidents; No 4) was partly due to lack of knowledge about the vehicle and its special characteristics. This differs from the other accidents where the injured drivers said that they had a lot of experience of quadbike driving and almost daily use their quadbikes in work on their farms. Several of the most experienced drivers were, in fact, surprised that they got involved in an accident at the same time as they said that they sometimes drove a bit careless.

4. DISCUSSION

The first aim of this study was to increase our knowledge of how and where quadbikes were used, the mistakes and violations drivers make and what situations they considered as hazardous. The second aim was to increase our knowledge of these accidents.

The results show that quadbikes are, primarily, used as tools but also as recreational vehicles and means of transport. Generally speaking, quadbikes are greatly appreciated and, for many drivers, absolutely crucial in order to continue working on their farms and in their forests despite age and/or partial infirmity. The quadbikes also makes it possible for these people to continue spending time in the countryside to hunt, fish, and/or pick berries and mushrooms which is very important for their quality of life.
With regard to mistakes, the majority of the drivers think that they drive safely at the same time as several of them admit that they sometimes make mistakes; mainly due to errors of judgment (e.g. misjudging the ground or the speed) or inattention/negligence (e.g. with regard to loading). Looking at car drivers, the association between self-reported tendency to make mistakes and accident involvement is quite antagonistic (Wallén Warner, 2006). This study, does, on the other hand, suggest that mistakes contributed to six of the seven accidents reported and it would therefore be of great interest to explore this relationship further.

Some of the drivers do also admit to committing violations such as driving in the terrain for recreational purposes, driving on roads with ATVs, driving under the influence of alcohol, allowing children to ride along as passengers, driving in excessive speed or not wearing a helmet on quadbikes registered as motorbikes. Some of these violations, such as driving in the terrain for recreational purposes or driving on roads with ATVs, might not be directly associated with accident involvement. Others, such as driving under the influence of alcohol, allowing children to ride along as passengers and driving in excessive speed are more likely to be associated with accident involvement. Both driving under the influence of alcohol and in excessive speed are, for example, identified by the drivers as factors contributing to hazardous situations and they are also thought to be contributing factors in five of the seven accidents reported. Looking at car drivers, the association between self-reported violations and accident involvement has been confirmed (Wallén Warner, 2006).

The last violation mentioned, not wearing a helmet, are not likely to be associated with accident involvement but with the consequences of the accidents. In Sweden, wearing a helmet is obligatory for quadbikes registered as motorbikes or mopeds but not for quadbikes registered as ATVs or tractors. To increase the acceptance of helmets the authors believe that the practical reality must be taken into consideration and therefore suggest that the law should be connected to the task conducted rather than to how the quadbike is registered; it could, for example, be obligatory for drivers of all types of quadbikes to wear a helmet when driving faster than 6 or 10 kilometres per hour or when driving on a public road.

In addition to the factors mentioned above (driving under the influence of alcohol and excessive speed) drivers also identifies inexperienced drivers, stress and carelessness of experienced drivers, the quadbikes’ special characteristics and underage drivers as factors contributing to hazardous situations. This is also in accordance with previous research (Clay m.fl. 2015) which has identified the lack of experience and stress as factors that contribute to risky behaviours and loss of control.

To increase the drivers’ skills and risk awareness the authors suggest that the requirements for driving a quadbike, regardless of how it is registered, should be extended to include a short specialized course focusing on practical quadbike driving in combination with a theoretical education dealing with the risks of driving under the influence of alcohol, driving with excessive speed, driving while stressed as well as underage drivers. The suggestion of a short specialized course did also get support from the drivers participating in the interviews.
In order to combat the problem with driving under the influence of alcohol and underage drivers a theoretical course focusing on risk awareness is probably not enough. In addition, different stakeholders need to join forces to make a behavioural change. Driving under the influence of alcohol has previously been a big problem among drivers of snowmobiles in Sweden but in recent years a national mobilization have managed to change the trend and it is reasonable to believe that some of the lessons learnt could also be useful when trying to combat the problem among quadbike drivers. Also, with regard to underage drivers, a national mobilization is needed to spread information about the risk of accident involvement which could result in serious injuries or even fatalities.

In conclusion, quadbikes are highly appreciated as tools, as vehicles for recreation and as means of transport. Inexperienced drivers’ lack of knowledge, alternatively experienced drivers’ stress and/or carelessness combined with the quadbikes special characteristics; underage drivers and passengers; quadbike-driving under the influence of alcohol and excessive speed are all factors that could contribute to accident involvement; and without a helmet the consequences of these accident might become more severe. To combat these problems, and to reduce the number of quadbike accidents, the authors suggest changes to the law for helmets, a short specialized course focusing on practical quadbike driving in combination with a theoretical education focusing on risk awareness as well as a national mobilization against quadbike driving under the influence of alcohol and underage drivers.

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