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The relationship between self-reported and actual driving-related behaviours: A literature review

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TITLE

The relationship between self-reported and actual driving-related behaviours: A literature review

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ABSTRACT

Self-report approaches include questionnaires, interviews, focus groups and driver diaries. They are relatively inexpensive, provide detailed information and can reach large numbers of people. However, it is unclear to what extent they validly measure actual behaviours. Twenty studies are discussed in which the relationship between self-reported and actual behaviour was considered inconsistent and problematic. Socially desirable responding has received the greatest attention, but individuals may consciously or unconsciously bias their responses by lying, imagining or omitting information. In addition, a driver's ability to self-report accurately can be affected by psychological limitations such as memory. However, one of the most serious issues is lack of due diligence by researchers in relation to the format and context of self-reporting questions, something that researchers themselves can easily attend to. A researcher can improve the accuracy of self-reporting format and context by: providing appropriate time scales for responding; seeking objective sources of data where possible; carefully defining terms; assuring confidentiality of responses; identifying individuals who erroneously believe inappropriate driving behaviours such as speeding are really quite safe; considering the use of pre-determined response categories; and considering having a control group *not* exposed to a campaign or other intervention.

KEY WORDS

Mass media campaign, evaluation, behaviour, self-report

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Summary

Self-reports of driving behaviour are commonly used in traffic behaviour research studies and in evaluating road safety behavioural change mass media campaigns. Typical self-report approaches are questionnaires, interviews, focus groups and driver diaries. They are relatively inexpensive, can provide more detailed information than observations and they can reach large numbers of people. Interactive approaches such as interviews and focus groups allow the researcher to probe further into aspects of behaviour under study, and can allow the researcher to adjust their questions accordingly.

The main disadvantage of self-reporting approaches is that it is unclear to what extent they validly measure actual behaviours. Reasons for these validity issues include conscious and unconscious behavioural antecedents such as: the problem of socially desirable responding biases in self-reporting; self-deception, lying or imagining; psychological limitations such as forgetfulness when recalling behaviours; the manner in which the self-reporting occurs (e.g. how questions are framed); and contextual factors such as the time lapse between making a self-report and carrying out the behaviour.

This literature review discusses 20 studies in which the relationship between self-reported and actual behaviour was considered inconsistent and problematic, although a few studies found evidence of a moderately strong positive relationship. Some themes about the problematic nature of self-reporting emerged, illustrating a range of causes for the generally weak relationship, and the extent to which they may be overcome. Socially desirable responding has received the greatest degree of attention in the literature. However, one of the most serious issues is lack of due diligence by researchers in relation to the format and context of self-reporting questions, something that researchers themselves can easily attend to.

Allowing survey respondents to be anonymous may improve accuracy of responses but there is little opportunity for a researcher to probe individuals for further details about their responses. On the other hand, face to face and telephone interviews, while time-consuming for the researcher and not anonymous for the participant, can provide opportunity to tailor questions to suit the participant's circumstances and allow the researcher to probe for further detail.

The literature usefully emphasised a wide range of ways in which a researcher can improve the accuracy of self-reporting format and context: providing appropriate time scales for responding; seeking objective sources of data where possible; carefully defining terms (e.g. crashes); assuring confidentiality of responses; identifying individuals who erroneously believe inappropriate driving behaviours such as speeding are really quite safe; considering the use of pre-determined response categories (e.g. 1-2 times a week); and considering having a control group *not* exposed to a campaign or other intervention.

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1 Background

Self-reporting of behaviour has been a research tool for social psychology since the 1970s and a tool in road safety research since the 1980s, with researchers becoming increasingly aware of its problematic nature since those eras (Baumeister, Vohs & Funder, 2007). Self-reports of driving behaviour are commonly used in traffic behaviour research studies and in evaluating road safety behavioural change mass media campaigns. Sometimes specific road safety behaviours are studied such as speeding, mileage or distances travelled (exposure), or offence and crash history. On other occasions a driver's behaviour in general is explored, perhaps employing a standard questionnaire such as the internationally used Manchester Driver Behaviour Questionnaire (DBQ). Irrespective of whether a research or evaluation study focuses on specific driving behaviours or driving behaviour in general, questions are likely to arise as to how validly any self-reporting approaches used will indicate actual behaviours.

To assist with preparing a business case for road safety behavioural change communication campaigns, the Motor Accident Commission of South Australia (MAC) has requested a review of literature into the relationship between self-reported and actual driving-related behaviours.

1.1 The nature of self-reporting

Self-report approaches typically include the use of questionnaires, interviews, focus groups and driver diaries. Among the advantages of these approaches are:

- they are relatively inexpensive
- they can provide more detailed information than observations
- they can reach large numbers of people
- the representativeness of the sample is easy to establish and control for.

In addition, interactive self-report approaches such as interviews and focus groups allow the researcher to probe further into aspects of behaviour under study, such as any attitudes, intentions, beliefs, personal circumstances and external factors that can affect the behaviours in question. Interviews and focus groups in particular can allow the researcher to adjust their questions of the subject accordingly.

The main disadvantage of self-reporting approaches is that, on their own, it is unclear to what extent self-reports of behaviours validly measure actual behaviours. Among the reasons for these validity issues, discussed by Wählberg (2009) and Lajunen & Özkan (2011), are conscious and unconscious behavioural antecedents and environmental factors such as:

- the problem of socially desirable responding biases in self-reporting
- self-deception, lying or imagining (which can underlie socially desirable responding or occur on their own)
- psychological limitations such as forgetfulness when recalling behaviours
- the manner in which the self-reporting occurs (e.g. how questions are framed) and contextual factors such as the time lapse between making a self-report and carrying out the behaviour.

Such problems are discussed in detail in the main part of this literature review.

It is also important when considering the literature on self-reporting of behaviour to distinguish between a participant's expressed *intentions* to commit a behaviour and their self-reporting of what behaviours took place. The former essentially precedes the behaviour, while in the latter the subject reports on a behaviour after it occurs. Both forms of indicator can occur in evaluations of behaviour change campaigns under the same label 'self-report' but they do not necessarily or consistently indicate the *actual* behaviour that occurs, or even at all.

1.2 Method

To conduct the literature search examining the relationship between self-reported and actual driving-related behaviours, the following sources were used: Google Scholar and the University of Adelaide library search engine which has the capacity to search multiple online journal, ebook collections and databases including Web of Science, ScienceDirect, PsychINFO, PubMed, Medline, Informat, EBSCOhost, Scopus etc. The search was conducted by examining literature (journal articles, conference papers, technical reports) published from 2000 to 2017, using these terms: self-report, actual behaviour and evaluation.

As mentioned above, critiques of self-report methodology have been available for several decades now, with the topic commanding exclusive chapters in textbooks on road safety research methodology. For this reason, the literature search was confined to post 2000 references and was not an exhaustive review.

The literature included studies of the relationship between self-reporting and actual behaviour in road safety contexts, and studies of this relationship generally or in other human factors contexts (29 studies in all). Studies in the latter category, while not directly concerning driver behaviour, could be relevant to the driving context, (e.g. studies of self-reports of alcohol consumption, of mobile phone use, and Facebook use). Coverage of the relationship between self-reporting and actual behaviour is not confined to driving contexts, but can be found in a range of behaviour measuring contexts (Wahlberg, 2009).

The studies examining the relationship between self-reporting and actual behaviour are briefly discussed and summarised in tabular format in section 2. Section 3 provides a more detailed discussion of the themes and key issues surrounding self-reporting from the literature. The review finishes with a concluding remarks section.

2 The relationship between self-report and actual behaviour

2.1 Self-report versus objective measures of behaviour

Twenty studies were found in the literature that examined the relationship between self-report and objective measures of actual behaviour. Summary details of these studies are presented below in Tables 2.1-2.5 with the studies grouped by the behaviours measured: crashes and traffic offences, travel/driving exposure, speeding, risky driving behaviours and other behaviours. A number of additional studies (n=9) provide discussion about the usefulness or otherwise of self-report approaches, often based on collective reviews of several individual studies investigating the relationship. These are summarised in tabular format in Appendix A and are discussed further in Section 3.

Overall, the 20 studies in the reviewed literature indicated that the relationship between self-reported and actual behaviour is a problematic one (a weak or inconsistent relationship), although some studies found evidence showing up to a moderately strong positive relationship. Not all studies looking at self-report in comparison to actual behaviour gave a correlation; many merely discussed that the relationship was inconsistent.

2.2 Crashes and traffic offences

The relationship between self-reported and official records of crashes and traffic offences has been examined fairly extensively in the literature. Table 2.1 provides a summary of the key literature examining this relationship. The most recent study (Barracough et al., 2016), a meta-analysis of 99 studies investigating this relationship, found drivers self-report more crashes and traffic offences than those in official records. It was acknowledged that official records may not contain all crashes (i.e. many do not record non-injury crashes) or traffic offences (i.e. offences may be incurred in other jurisdictions) and therefore self-reporting may yield extra information. However, there are no real means to confirm or validate the extra information. Another review (Wählberg, 2009) acknowledged that the relationship between self-report and actual behaviour was inconsistent, unreliable and subject to various biases (discussed later in this report).

Table 2.1

Summary of studies examining the relationship between self-report and actual behaviour for crashes and traffic offences

Author(s), location	Context of study	Strength of relationship, as stated	Brief summary of findings Crashes and traffic offences
Wählberg, 2009, Sweden	Examination of validity in various studies self-reported traffic behaviour	Fairly low, problematic and unreliable	Prior studies of self-report of crashes (typically interviews, diaries and questionnaires) versus actual crash numbers show consistencies ranging between 21% and 97% (with the strongest relationships found when using insurance claims data). Problems included under/over reporting of crashes, poor memories among drink drivers, time lag between self-report and crash, and social desirability bias. Prior studies of agreement between self-reports of traffic offences and actual records of offences have found correlations between 0.09 and 0.59. Problems experienced include respondents reporting offences occurring in other states with records not available to the researcher (in general, respondents self-reported greater numbers of offences than indicated by official records). The level of agreement between self-report and actual behaviour has been unreliable and subject to various biases for the following behaviours: driving exposure (mileage) - both under

			and over reporting; speed - both under and over reporting; and seatbelt wearing - both under and over reporting, but more over reporting. The authors concluded that while self-reporting can yield depth of detail not readily apparent from actual behaviour records, it may not be possible to confirm that detail. The overall recommendation (p.63) is to 'abstain from using self-reports' in favour of employing a range of objective measures of actual behaviour (for cross-checking). This can include in-vehicle technological data logging of driver behaviours.
Wählberg, 2011, Sweden	Examination of how self-reporting of crashes varies with driver exposure for bus drivers	Self-reported crashes underestimated when greater driving exposure	Study was conducted among bus drivers in a Swedish company and was an extension of the author's 2002 study. Those drivers who drove for more hours had more crashes, but were more likely than those working fewer hours to under-report crash numbers in surveys. This was when comparing the self-report data with company records. Wählberg suggested the difference might be due to drivers when they self-report remembering only their most recent crashes. However, in the 2002 study, a quarter of the company's drivers reported crashes that were not in the company's database, suggesting that some drivers in the self-report surveys were recalling their crashes as car drivers.
Wählberg, 2013, Sweden	Controlling for self-reported exposure in crash prediction studies	Associations between self-reported and safety indicators varied	Using existing data sources, this study found that correlations between safety indicators (crashes, penalty points) and self-reported questionnaire scales were strongly reduced when controlling for self-reported mileage. This resulted in the effects of predictors of safety indicators being overestimated in self-report studies. The authors also noted that studies using self-reports of behaviour, such as self-reported mileage, also suffer from a tendency for subjects to project themselves in a positive manner, or socially-desirable light. However, to some extent this can be controlled for in groups under study by using rating scales that measure the participants telling of lies (lie-scales).
Barraclough et al., 2016, International	Meta-analysis of international studies using self-reports and archival data for crashes and traffic offences	Discrepancies between self-reported and archival data	This meta-analysis of 99 studies examined the relationship between crashes and traffic offences and, importantly, also examined the difference between self-reported data and archival data (official records of actual behaviour) for crashes and traffic offences separately. Drivers self-reported (mean=0.24, SD=0.23) more crashes than those reported in official records (mean=0.11, SD=0.15). This result was not unexpected given that the self-reporting of crashes permits a wider range of crash types (i.e. lower crash severity) to be reported. Drivers also self-reported more traffic offences (mean=0.50, SD=0.68) than recorded in archival data (mean=0.28, SD=0.25). The authors consider the official records they used may not adequately encompass crashes (and offences) that drivers have outside their state or country, but they also note that approximately 25% of all crashes are forgotten each year, with drivers more likely to recall crashes that happened closest to the time of survey.

2.3 Travel/driving exposure

In contrast to official records of crashes and traffic offences, Global Positioning System (GPS) devices provide relatively accurate measures of actual behaviour, particularly driving exposure or travel patterns. This allows researchers to more easily compare self-reported and actual travel-related behaviour. Each of the recent studies employing this method, as seen in Table 2.2, found

discrepancies in self-reported and actual travel behaviour, with self-report measures under-reporting travel distances, particularly for non-work related travel. Studies examining older driver travel also found self-report methods under-reported challenging driving situations but accurately reported avoidance of difficult driving situations, where they drove and time of day (Blanchard et al.; 2010, Molnar, et al., 2013; Thompson et al., 2013). Most studies agreed that a combination of self-report and objective methods were optimal for capturing travel behaviour.

Table 2.2
Summary of studies examining the relationship between self-report and actual behaviour for travel and driving exposure

Author(s), location	Context of study	Strength of relationship, as stated	Brief summary of findings: Travel/driving exposure
Blanchard et al., 2010, Canada	Older driver self-reports of their driving habits compared to electronic logging	Self-reports were mainly inaccurate	The older drivers (N=61, aged 67+) often underestimated their travel distances in interviews and their diaries missed many trips and stops made. They also tended to under-report challenging situations (such as turning left at intersections (driving on the right hand side in Canada). However, drivers did accurately report time of day of driving, night driving and where they drove.
Bricka et al., 2012, United States	Comparison between self-reported and GPS travel behaviour	Some agreement for work trips but limited agreement for non-work trips	Participants aged 16 years and over (N=265) provided self-reported diary details about their travel survey day and also carried wearable GPS units for the same 24 hour period. For work travel, most participants reported the same number of trips in the survey as recorded by the GPS unit (63%), while 32% reported more survey trips relative to GPS trips, and 5% reported fewer survey trips relative to GPS trips. However, there was a greater discrepancy for non-work related travel: 18% had more survey trips, 42% equally reported, and 40% had fewer survey trips. The results suggest that GPS should continue to be used with, rather than in lieu of, the traditional diary approach and that assignment of participants to the GPS or self-report diary should consider demographics and other characteristics.
Molnar, et al., 2013; Victoria, Australia	Self-regulation of driving behaviour among older drivers: comparison of self-report with objective data	Some association but with notable discrepancies	In this study, older drivers (N=156, aged 75+) drove using their normal driving patterns for four months, as technologically recorded with in-vehicle data loggers. After this four month period, the drivers completed a self-report questionnaire about their driving over that time. The study found that the drivers' self-reports of avoidance of certain traffic situations (driving at night, driving in unfamiliar areas, and on high speed roads) were consistent with the objective data. However, participants tended to under-report their average number of days per week and distances driven compared to their data log. The authors concluded that the discrepancy between self-report and objective measures is of concern, as the ability to measure driving exposure contributes to a better understanding of self-regulation and in understanding crash risk.
Thompson et al., 2013, South Australia, Australia	Use of self-reports concurrently with GPS data among older drivers	Electronic logged data is more accurate, but self-reports provides useful extra information	Older drivers (N=54, aged 75+) had their driving electronically monitored for one week. While the electronic logging data was superior in accuracy, the self-report (diary) information provided supplementary information on driving exposure. For example, the travel diary provided information when the installed GPS device failed to record data. However, the diary also afforded information not recordable by the electronic logging, such as trip purpose and driver identification. Nonetheless, diaries can be forgotten to be filled in or contain inaccurate detail. To some extent this was overcome by a researcher telephoning a driver for an interview and filling in their diary on their behalf.

2.4 Speeding

Various technologies allow relatively easy measurement of actual speeding behaviour. Four of the five studies in Table 2.3 reported some level of correlation (low to medium) between self-reported speeding and actual speeding behaviour measured by speed/video cameras, driving simulators or GPS. One study (Corbett, 2001) found low correlations between self-reported and actual speeding behaviour and that speeding drivers consistently self-reported their speeds as lower than what was objectively observed by speed cameras. The other three studies (Connor et al., 2007; Haglund & Åberg, 2000; Kaye, et al., 2016) found moderate correlations such that self-reported speeding intentions and behaviour were associated with actual behaviour, although one of the studies involved a small sample size (Kaye, et al., 2016). The study that did not find a relationship between self-reported speeding intentions and actual speeding behaviour also reported a small sample size with the authors suggesting their study may have lacked statistical power (Paris & van den Broucke, 2008).

Table 2.3
Summary of studies examining the relationship between self-report and actual behaviour for speed

Author(s), location	Context of study	Strength of relationship, as stated	Brief summary of findings: Speeding
Haglund & Åberg, 2000, Sweden	Exploration of factors underlying speed choice compared with actual speed	Statistically significant moderate correlations	Speed measurements (recorded on road by video cameras with timers), data from roadside interviews (straight after speed recorded) and data from a self-reported questionnaire on driving behaviour were obtained (N=533). A strong relationship ($r=0.58$) was found between observed speeds and drivers' self-reports of the speed they were travelling immediately before they were stopped ($r=0.58$) and the speed they normally keep according to responses in interview and questionnaire ($r=0.44$ and $r=0.49$, respectively).
Corbett, 2001, United Kingdom	Comparisons of self-reported speeding behaviour with actual speeds	Correlations statistically significant but low	In this study, six speed surveys were undertaken in England and all found significant low correlations between objective measures of speed (speed cameras) and self-report (questionnaire sent after observation). Drivers travelling above the speed limit 'consistently and systematically' reported their speeds were lower than those measured by speed cameras. Drivers travelling below the limit reported their speeds as above those measured. Possible reasons for the discrepancies of underestimation and overestimation between self-report and actual speeds included: <ul style="list-style-type: none"> • the frequency of <i>inadvertently</i> exceeding a limit; • driving while not being consciously aware of one's speed; • psychophysical limitations (e.g. speed adaption distorts speed perception) in reporting accurately; • deliberately choosing <i>not</i> to report accurately (e.g. a slow driver may not want to admit they are slow) • drivers not considering their speeding was unsafe or morally wrong.
Connor et al., 2007, United Kingdom	Application of theory of planned behaviour to objectively measured vehicle speeds	Statistically significant positive correlations between speeding intentions and behaviour	Within this report, two studies used various measures associated with the theory of planned behaviour to predict self-reported intentions to travel over the speed limit and objectively assessed speeding behaviour. The behavioural measures were based on performance in a simulator (Study 1, N=83) and unobtrusive on-road speed camera assessment taken without driver awareness (Study 2, N=303). All measures used roads with varying posted speed limits. Self-reported speeding intentions were statistically significantly positively correlated with speeding behaviour demonstrated on a simulator ($r=.48$, $p<.001$) and observed on the road ($r=.41$, $p<.001$).

Paris & van den Broucke, 2008, The Netherlands	Measuring cognitive determinants of speeding	Speeding behaviour not predicted by self-reported intentions to speed	A questionnaire administered by post (n=116) found self-reported speeding was predicted by intention to speed and perceived internal control. In contrast, actual speeding behaviour (measured by in-vehicle GPS for a subset, n=55) was not significantly predicted by intentions to speed and perceived control. The study demonstrated the validity of the theory of planned behaviour to predict self-reported speeding behaviour (including cognitive concepts) but suggested that actual speeding behaviour can only be partially predicted from these concepts.
Kaye, et al., 2016, Queensland, Australia	A comparison of self-report and objective measures in young drivers' responses to anti-speeding campaigns	Statistically significant medium correlation between self-report and objective measures	A sample of young drivers (N=20) viewed either a positive or a negative emotion-based anti-speeding TV advertisement. Self-report measures after seeing the campaigns involved rating scales of emotional response and arousal, and self-reporting of speeding behaviour. The objective measures involved emotional responses measured by sweat production recorded electronically through a skin-cuff worn by the participants and also GPS tracking devices installed in the drivers' vehicles. The study found that the self-report measures generally corresponded to the objective measures. For participants who viewed the negative advertisement, there was a significant, large negative correlation between the self-report and objective driving data ($r=-0.772$, $p=.005$), indicating that those who self-reported higher ratings of staying within the speed limit spent less time driving over the posted speed limit. For the positive advertisement, there was a moderate negative relationship between the self-report and objective driving data ($r=-0.522$, $p=.150$) which was not significant. Further statistical analyses revealed that the correlation between the self-report and objective measures of driving was similar for both the negative and positive advertisement conditions and was associated with a medium effect size.

2.5 Risky driving behaviours

The few recent studies that have examined the relationship between self-reported risky behaviours and actual behaviour, presented in Table 2.4, have produced very inconsistent/varied results. One study found no relationship between a self-report measure of risky driving and performance based measures of risky behaviour (Le Bas et al., 2015). Of the two studies that compared self-report data to data obtained from in-vehicle data loggers, one found young drivers self-reported fewer risky events than those recorded (Albert et al., 2014) while the other found self-reported risky driving styles were related to on road risky driving behaviour (and on a driving simulator) (Taubman et al., 2016).

Table 2.4

Summary of studies examining the relationship between self-report and actual behaviour for risky driving behaviour

Author(s), location	Context of study	Strength of relationship, as stated	Brief summary of findings: Risky driving behaviour
Albert et al., 2014, Israel	Comparison of in-vehicle data recorders and self-reported data	High correlation for driving exposure, self-reports underestimated risky driving events	In vehicle data recorders were installed in young drivers' vehicles (N=32) for eight months. During this time, young drivers self-reported driving exposure and risky events (based on the rate and severity of manoeuvres, such as braking, and the speed profile) at random times. There was a high correlation (i.e. 0.90 at individual level) between self-reported and in vehicle data for driving exposure. Young drivers also self-reported fewer risky events than those recorded. However, the sample size is small and not representative of the general young driver population (self-selected and many completing military service).
Le Bas et al., 2015, Victoria, Australia	Exploration of the use of online self-reports of personality and behavioural indicators to predict risky young drivers	No significant correlations	This study of young drivers (N=102) found significant correlations between online (self-report) responses to questions on two personality traits (impulsivity and harm avoidance) and a self-report measure of risky driving. However, it found no such correlations between the self-report measure of risky driving and performance based measures of risky behaviour. The behavioural measures were not driving behaviours as such, but behaviours exhibited in a series of gambling-style simulation exercises/games in controlled settings. The authors concluded that the self-report personality questions they used could be incorporated into an online tool for predicting risky drivers but that the actual behaviours exhibited in the simulations "were not sufficiently sensitive to predict driving risk" (p.187).
Taubman-Ben Ari et al., 2016; Israel	Investigation into the use of self-reports of driving style as indicators of driving behaviours among young drivers	Statistically significant positive associations	Young drivers (N=150) were given a questionnaire (the established Multidimensional Driving Style Inventory) covering four basic driving styles: reckless and careless driving, anxious driving, angry or hostile driving, and patient and careful driving. Their actual driving behaviours were measured naturalistically with an in-vehicle data logger. The authors found high scores on risky and hostile driving styles were associated with risky driving behaviours, and that anxious and careful driving styles were inversely (negatively) associated with risky driving. Their allied study of 80 drivers given the established Reckless Driving Habits Scale found associations between self-reported frequency of risky driving habits and risky driving on a driving simulator. From the two studies the authors concluded that self-report measures can reliably assess driving behaviours for purposes of research, evaluation and intervention.

2.6 Other behaviours

Due to the wide variety of behaviours measured (i.e. obesity, phone use, Facebook use, driving skill) in Table 2.5, few comments can be made apart from the fact that there were inconsistencies in the relationship resulting in self-reports under and over estimating the different measures of actual behaviour.

Table 2.5

Summary of studies examining the relationship between self-report and actual behaviour for other behaviours

Author(s), location	Context of study	Strength of relationship, as stated	Brief summary of findings: Other behaviours
Gorber, et al., 2007, Canada	Review of obesity studies using self-report data compared with objective data	Self-reports related to both under reporting and over reporting	The study examined 64 published investigations of obesity prevention that used both self-report and objective measures of height, weight, and body mass index. Trends of under reporting were found for weight and BMI but over-reporting for height, with some gender differences in this as well. The authors emphasised the need for accurate assessments of obesity-related variables through improving the quality of reporting, basing recommendations on comprehensive data, and determining in what circumstances self-reports should be used, while also developing correction factors for use when direct observation of behaviour is not feasible.
Boase & Ling, 2013, Norway	Comparison of self-report and logged data on mobile phone use (calls and text messaging)	Moderate association only	The study compared technologically-logged usage data with two self-report measures: 1) number of times they used their phone 'yesterday' and 2) generally how often the phone was used, with the answer selected from a list of options. The study found that asking respondents generally how often they used their phone provided more accurate estimates of behaviour use for comparison to the logged data. This may be because providing predetermined responses to choose from reduced the chances of respondents over-reporting or exaggerating their answers.
Junco, 2013, United States	Comparison of self-report and logged data on Facebook use	Moderate association	This study compared students' (N=45) self-reports of their Facebook use with actual (recorded) use. Facebook usage was general usage, not in relation to specific postings on Facebook (e.g. advertisements). Author concluded that self-reports can <i>approximately</i> but not accurately measure actual usage. The students frequently overestimated their actual time spent. Author recommended that researchers use specific survey questions such as, "How many minutes did you actually spend looking at XXX on Facebook?"

3 Self-reporting

A range of themes about self-reporting emerged from the review and are worthy of some discussion, particularly in relation to considered causes for the generally weak relationship with actual behaviour, and to what extent issues may be overcome. While not necessarily the most serious problem surrounding self-reporting approaches, the phenomenon of socially desirable responding has received the greatest degree of attention in the literature, even to the extent of some researchers constructing special lie-scales in efforts to detect and quantify the extent of socially desirable responses in a study. It is also possible that participants may intentionally bias their responses in other ways, such as deliberately lying, imagining or omitting information independent of any socially-desirable responding. In addition, a new study found that a driver's ability to self-report their behaviours depends on their skill level as a driver.

Perhaps the most serious issue surrounding self-reporting is lack of due diligence by the researcher in relation to factors they can easily attend to, such as designing self-report question formats that lead the participant to report accurately, providing clear definitions of terms used, ensuring appropriate responding time-frames, and seeking objective behavioural data to confirm the self-report data. As a final theme, it is worth discussing those studies that found a moderately strong relationship between self-reporting and actual behaviour, together with tips for improving the accuracy of self-report data.

3.1 Social desirability biases

Of all the issues affecting the validity of self-reporting of behaviours, social desirability bias has received the most attention in the literature. Social desirability refers to:

“...a tendency to present oneself in a favourable way, that is, more or less consciously lying with the intention of making people think that you are a nice person.” (Wählberg, 2009, p. 48).

One early commentator on self-reporting approaches, Corbett (2001), conducted six surveys involving speeds being measured objectively and drivers self-reporting their speed behaviours. All six surveys found low correlations or associations between the self-reports and actual speeds, as typically measured by roadside speed cameras. Drivers travelling above the speed limit 'consistently and systematically' reported their speeds were lower than those measured. Drivers travelling below the limit typically reported their speeds as above those measured. Corbett postulated several reasons for the discrepancies of underestimation and overestimation between self-report and actual speeds, including that some drivers deliberately chose *not* to report accurately (lying). For example, a slow driver may not want to admit they were driving slowly as this may bring negative connotations. Similarly, a driver who knows they were speeding may choose to imaginatively underestimate their actual speed to “...paint oneself in the best light in efforts to appear as good citizens and drivers” (Corbett, 2001, p. 149).

Corbett went on to comment that part of this social biasing choice, at least among the speeding drivers, was influenced by a false belief in those drivers that their faster driving was safer than if they had remained at or under the speed limit. Corbett considers there is a “social context where exceeding [speed] limits may be complying with normative behaviour *which may be perceived safer* than adhering to the speed limit” (2001, p. 149). Additionally, she believes, this tends to occur where lower levels of excess speed are seen to be condoned [by the public] and are normally condoned by police.

In some other studies involving self-reporting, social desirability effects were found but not necessarily explored further or even commented on. In Canada, Blanchard, Myers and Porter (2010) studied the self-reports of 61 older drivers (age 67+) of their driving habits compared to in-vehicle electronically logged data. They found that while the drivers accurately reported their time of day of driving, night

driving and where they drove, they often underestimated their travel distances in interviews and their diaries missed many trips and stops made. They also tended to under-report challenging situations (such as turning left at intersections (driving on the *right* hand side in Canada). It may be that the older drivers preferred not to admit that they had difficulty with turning left, particularly if they feared potential licence loss.

As well as an unintended research outcome (as in Corbett, 2001), social desirability phenomena have been the deliberate focus of investigations of self-reporting research methodology. Lajunen and Summala (2003), for example, compared the effects of socially desirable responding in self-reporting of driving in both public and private settings. For the public settings, the study required 47 participants to disclose their name, social security number and address as part of the entrance exam to be a driving instructor. These 47 participants completed the standard Driver Behaviour Questionnaire (DBQ)¹ (an internationally recognised measurement tool developed in Manchester by Reason et al., 1990) plus a questionnaire designed to measure social desirability. Another 54 examinees (who were already studying the instructor course) completed both questionnaires anonymously and in a private setting. Generally, the study found that responses to the DBQ were influenced by social desirability only to a small extent. However, six DBQ questions relating to aberrant driver behaviours were self-reported less frequently in public settings than in private settings. This was particularly so in relation to drink driving. In the public setting, none of the respondents admitted to drink driving (social desirability bias), whereas, in the private setting, nearly a quarter of the respondents confessed to drink driving.

Lajunen and Summala (2003) noted that, in their study, the effect of social desirability was maximised by altering the degree of publicity and benefits of respondents embellishing their answers. They considered that the social desirability bias was strongest when the respondents stood to benefit from giving embellished answers. Moreover, social desirability bias occurred *more frequently as under-reporting of undesirable behaviours* than over-reporting of desirable behaviours.

Many studies show that most drivers will consider themselves to be better than average, and may over-estimate their own driving skills in comparison with 'an average' driver. Some of this over-estimation may have social desirability antecedents, but it is possible for drivers to simply believe they are a better driver without further thought (self-deception). Drivers who see themselves as skilful might simply not notice or admit their mistakes (Lajunen & Summala, 2003). However, as discussed in section 3.2, there can also be a relationship between drivers' self-assessments of their driving skill and their *actual* driving skill levels.

Social desirability effects have formed much of the research focus of Wählberg (2010a, 2010b, 2013). In his 2010a study, Wählberg examined self-report issues when evaluating a driver education program, concluding briefly that self-report data are unreliable, largely due to social desirability biases, particularly when the situation encountered (or imagined) is a socially sensitive one, such as where there would be a legal sanction or penalty. Consequently, he considered that use of self-report data should involve corroboration from objective sources such as offence and crash records.

In a follow-up study (2010b) Wählberg looked more specifically at social desirability effects. He gave several driver behaviour questionnaires (including the DBQ), along with a Driver Social Desirability Scale to a driver education group and two randomly chosen groups on two to three occasions, two to six months apart. He found that the results from all the questionnaires were affected by social desirability biases to the extent that he concluded relying on self-report approaches "...can lead to directly misleading results, with negative effects on traffic safety" (p.103), and going so far as to advocate that the use of driver inventories (such as the DBQ) that rely on self-reports should be re-

¹ In the DBQ, respondents are asked to rate on a six-point scale (1=never; 2=hardly ever; 3=occasionally; 4=quite often; 5=frequently; 6=nearly all the time) how often they experience a wide range of specific types of aberrant driving behaviours, e.g. "Do you drive too closely to the car in front as a signal to the driver to go faster or get out of your way?"

evaluated as a scientific method. Still later, in 2013, Wählberg advocated using special lie-scales when using self-report questionnaires. He noted that lie-scales do not so much measure faking tendencies as such when answering questionnaires, but they do seem to *measure* the general tendency for people to present oneself in a positive light.

In Victoria, Harrison (2014) essentially extended the above work of Wählberg by comparing the results of various surveys (online and telephone) using a sample of 676 young (probationary licence) drivers to investigate social desirability effects. Broadly, the survey topics covered experiences as a learner driver, distances driven, self-assessment of driver skills, the DBQ, and offences and crashes. The surveys were administered in three waves, six months apart. Harrison found that there were small but statistically significant associations between socially desirable responding for recalling learner driver experience, self-confidence in relation to hazards, unfamiliar roads, changing lanes, predicting other driver's behaviours, overtaking, driving at higher speeds, mobile phone use, restraint use, crash history and items on the DBQ. Harrison considered that social desirability bias (a "motivation to appear a 'good' driver") was associated with safer or better-behaved responses to the questionnaire items.

Barracough, Wählberg, Freeman, Davey and Watson (2014) gave 214 drivers two surveys to explore the association between social desirability and driver behaviours (DBQ). No differences between men and women were found but older drivers in the sample were more likely to present themselves in a more socially desirable light. Social desirability was found to be associated with driver's reports of their behaviours, but not self-reported crashes or offences. However, drivers who scored highly for social desirability bias were less likely to report aberrant driving behaviours and drivers with lower social desirability scores recorded a higher frequency of aberrant driving behaviour. The authors also considered that drivers more likely to drive dangerously may be less concerned with how they are regarded by others (lower social desirability bias), and that lie-scales would be ineffective in detecting such a possibility. In fact, it could be said that such drivers do not lie about their behaviour, even though their honesty is somewhat misplaced.

3.2 Skill-level biases

A different kind of self-reporting problem was found by Martinussen, Møller and Prato (2017) in their study of young male drivers' self-assessments of their driving skill. It seemed the accuracy of the self-reporting depended on their actual skill level as a driver (p. 232),

"... we found that self-assessments of driving skill were more inaccurate in *less* skilled drivers than high skilled drivers."

It is likely that the high skilled drivers had a deeper understanding of their skills in relation to driving and were in a better position to articulate them. However, Martinussen et al. also found (p. 232):

"...more *experienced* drivers and drivers with high sensation-seeking propensity were inaccurate in their self-assessments."

Note that high skill drivers are not necessarily those who are also more experienced (and vice versa). While Martinussen et al. did not discuss their latter finding further, it is possible that some of those drivers' self-reports were influenced by social desirability; although, as Lajunen and Summala (2003) found, the more experienced drivers may not have as readily noticed their deficiencies (perhaps due to over-confidence), and the self-reporting of the high sensation seeking drivers may have been flavoured by such a personality profile. Martinussen et al. did note that the self-assessments were particularly inaccurate with respect to hazard prediction, hazard detection and ability to maintain a safe distance from the vehicle in front. Consequently, skill level might be a form of bias in self-report

studies that favours the ability of high skill drivers in self-reporting better than low skill drivers can. Further studies need to validate these findings.

3.3 Psychological limitations in reporting accurately

Lajunen and Summala (2003) noted that forgetting is a common a problem, particularly when recalling crashes and near-misses. It can be difficult to remember all occasions over a number of years. Wählberg (2009) also raised the problematic nature of self-reporting's reliance on drivers' memories, but added (p. 19): "Not only do we forget, but we also 'remember' things that have *not* happened, and in general change our perceptions of what has happened in accordance with later information." In later research, Wählberg (2011) noted a tendency for drivers to report only their most recent crashes and that drivers of heavy vehicles may confuse their heavy vehicle crash history with their crash history as car drivers. This might even be the case for drivers who drive different vehicle types.

In the Harrison (2014) study cited earlier, Harrison found that the responses concerning learner driver experience were 'surprisingly inconsistent' across the three survey waves, with the number of hours of self-reported learner driving experience varying by as much as fifty hours. Harrison conceded that it might be unreasonable to expect young drivers to recall the exact number of hours accrued as a learner driver, but that the variation from one survey wave to another was surprising.

Corbett's (2001) research principally involved driver's self-reporting their speeds and, as mentioned earlier, many drivers either underestimated or overestimated their speeds in the study. Aside from social desirability effects, Corbett considers that drivers may sometimes unconsciously experience inability to report their speeds accurately. This can happen, for example, if a driver inadvertently briefly exceeded a speed limit. Corbett remarks that modern cars run more quietly, thus reducing audible feedback to a speeding driver by way of engine noise. Such feedback would be reduced still further if the driver is listening to music or other soundtracks while driving. Also, it is common for drivers to say they didn't realise they were speeding when this is brought to their attention. Additionally, some drivers may have been genuinely unaware of the speed limit applying at the time. However, Corbett goes on to astutely comment that 'inadvertent speeding' can be an easy or convenient response from those who to make a post-hoc rationalisation of their intentional speeding (p. 145):

"An appeal to inadvertence, while encompassing an element of negligence, tends to remove some responsibility from the driver for breaking the law."

While inadvertence may help to explain drivers' *underestimates* of their speeds in their self-reports, it does not apply well to drivers' overestimating their speeds (Corbett, 2001). A related phenomenon is the concept of automaticity in driving (Corbett, 2001, p. 145):

"Essentially, some components of the driving task, once learned, are... automatically executed, making limited or no demands on attentional processing...."

A good example is changing gears in a manual transmission vehicle. An experienced driver changes gear almost effortlessly and typically without conscious thought. In the same manner, a driver may be unaware that they are driving slowly, and overestimate their actual speeds when self-reporting. Equally, they may be unaware they are driving faster than the limit and consequently underestimate their speed. Corbett also notes that underestimation of speed tends to be greater after a driver has decelerated than after the driver has accelerated.

3.4 Bias from the self-report format or context

It is also possible for a self-reporting approach to permit or even facilitate inaccuracy by virtue of the required self-report format (e.g. the way questions are expressed in a questionnaire or interview) or the context in which the self-reporting occurs (e.g. whether the self-reporting is done anonymously). Several of the reviewed studies made such observations, often in discussion about the study's limitations and/or ways to improve the accuracy of the self-reporting.

Lajunen and Summala (2003) found that self-reports of driver behaviour were most reliable when anonymity and confidential treatment of responses are stressed (especially in relation to drink driving). They added that anonymity in self-reporting can provide a useful and reliable means for studying driver behaviour and attitudes.

Wählberg (2009) notes that drivers seemingly forgetting information about traffic experiences and events may not be so much a driver problem as a researcher problem. If the time-scale over which a study asks a driver to recall events is too great, then the driver will not be able to recall the earliest events, or those less memorable, or the driver may invent them. He also notes the importance of clear definitions when constructing questions for drivers. For example, when drivers are asked to recall accidents they have been involved in, they need to have a clear definition of 'accidents' (i.e. 'crashes') - does the definition include crashes not reported to the police, or crashes in which the driver concerned was not at fault?

A related problem alluded to by Wählberg (2009) can be the way the structure of a self-report question can influence a response. For instance, if a question offers a scale of response between polar extremes, some respondents may tend to pick or lean towards middle options rather than the extremes, whereas other respondents will tend to pick only extremes, and both of these can occur regardless of whether a driver is stating their future behavioural intentions or reporting their past behaviour. It is possible to detect such trends over an individual's collective responses and apply some statistical correction, but this is at the risk that a respondent favouring either central or polar options may be accurately or genuinely indicating their behaviour. A simpler but partial solution is to ensure that the response scale has an *even* number of choices (e.g. very satisfied; satisfied; unsatisfied; very unsatisfied). The DBQ, for example, does this. Because there is no 'middle' option with an even number of choices, the respondent is forced to favour one polar direction over the other. However, the drawbacks to doing this are that it doesn't counter the respondent who is biased towards extreme positions, and it doesn't offer any choice to an undecided or 'don't know' respondent, who may simply refuse to answer.

Soole, Lewis, Fleiter, Newnam and Watson (2011) also provided useful perspectives on constructing questionnaire items. In relation to self-reporting of speeds, they suggested considering response categories and formats that accurately capture the *frequency* and *degree* of speeding. They recommended clearly distinguishing low-level from moderate to high level speeding (as each of these can be value-laden terms) by using categories such as: 1-5 km/h above the limit and 6-10 km/h above the limit. In addition, if the *context* of where the speeding occurs is relevant to the research, then researchers should give several different examples of applicable speed zones (e.g. passing road works, emergency vehicles, school buses, etc). Soole et al. also reported that percentage style response formats were preferred by subjects to Likert scales (e.g. % of time at or under speed limit vs % of time above the limit).

Although they were studying self-reported mobile phone use, Boase and Ling (2013) found a source of further advice for constructing self-report questions. They recommended avoiding open questions

about the target behaviour's frequency in favour of providing pre-determined response categories (e.g. 1-2 times a week, 3-6 times a week 11+ times a day, etc.). They concluded (p. 517):

"The categorical 'how often' frequency measure that used predetermined response categories fared better than the ... frequency measure that used an open-ended response approach. Perhaps this was because providing predetermined responses constrained respondents who would have more widely over reported, and cued them to an appropriate range of possible responses."

However, Boase and Ling went on to caution (p. 517):

"The downside of using the categorical measure is that it can be more difficult to incorporate it into certain types of sub analyses and it provides less information than the [open] measure".

Nonetheless there is much agreement about the need to guide self-report responding in order to maximise response accuracy. In a study of reported Facebook usage, Junco (2013) concluded that self-reports can *approximately* but not accurately measure actual usage. The students in the study frequently overestimated their actual time spent. Junco recommended that researchers use specific survey questions in their self-report formats, such as, "How many minutes did you actually spend looking at XXX on Facebook?"

Sometimes when designing self-report approaches, it may be a matter of choosing between prioritising and balancing two different needs: the need to obtain self-report data that can be readily quantified and compared on the one hand, with providing opportunity to obtain further detail volunteered by the participant that may not be revealed in more structured or focussed questions. Thompson, Baldock, Mathias and Wundersitz (2013) realised this after their study involving older drivers recalling their journeys in diary format. While they found electronic logging data on the drivers was superior in accuracy, the drivers' self-report (diary) information provided supplementary information on driving exposure. For example, the travel diary provided information when the installed device (e.g. GPS) failed to record data. The diary also afforded information not recordable by the electronic logging, such as trip purpose and driver identification. However, Thompson et al. found the diaries might be forgotten to be filled in or contain inaccurate detail. To some extent this was overcome by arranging for a researcher to telephone a driver for an interview and fill in their diary on their behalf.

Blanchard, Myers and Porter (2010), also from a study involving older drivers, made similar comments about the use of diaries as self-reports. While diaries can capture more detail, diaries can be onerous to complete, especially over a long period, and this can lead to non-compliance, as well as completion at the last-minute.

Another study, examining the travel patterns for both work and non-work trips for participants aged 16 years and over, also reached the conclusion that GPS units and self-reported travel diaries should be used in tandem for the most accurate outcomes (Bricka, Sen, Paleti & Bhat, 2012). Around 63% of participants reported the same number of work trips in the survey as was obtained from the GPS data but only 42% of all participants reported the same number of non-work trips in the survey as was obtained from the GPS data. The study also found some differences by particular characteristics and recommended that GPS should be considered as the data collection method when dealing with younger (i.e. more technology savvy) individuals and those with high travel propensities to ensure that all trip details are recorded. More traditional self-reported methods were recommended for older and more leisurely travellers.

Another issue raised by Wählberg (2009) is that self-report data when viewed collectively can be unrepresentative of the actual picture if the drivers are allowed to self-select themselves for taking part in the research. Drivers who volunteer to participate may also be more inclined to project themselves in a socially desirable light than in a randomly chosen sample. However, the terms for conducting the research may be that the drivers can only participate if they have volunteered to take part.

While driver behaviour inventories such as the DBQ can encompass a wide range of driver behaviours for the subject to self-report on, there are often very few studies confirming valid links between responses and actual behaviours. Of the DBQ, Wählberg (2009, p. 45) wrote:

“This inventory measures what is called aberrant driving behaviours: intentional violations of safe driving practices, and various driving errors that can be the result of lack of attention, erroneous decisions and/or unintended actions. Although many of the items are about intentions versus outcomes (for example, mistakenly put on the wipers instead of the lights) that cannot readily be compared against an objective source, there are some that could be validated by observation [and electronic in-vehicle logging].”

Thus, the inability to confirm a driver’s particular behaviour by objective means (short of an in-vehicle camera) can lead to biased results if the only evidence for some of the behaviours is self-reported evidence.

3.5 In defence of self-reporting

To provide a more balanced view of the value of self-reporting approaches, this section is devoted to those studies where the authors have found moderately strong relationships between self-reporting and objective data, and to studies in which the authors found poor relationships but appreciated what self-report approaches can offer. Additionally, as has been seen so far, some authors have offered tips on how to improve the accuracy of self-report data, if only to verify it with objectively obtained data.

In this regard, a variety of objective sources of behavioural data were used in the reviewed studies to match against self-report data, including: speed cameras (Corbett, 2001; Haglund & Åberg, 2000, Connor et al., 2007); electronic in-vehicle data logging (Blanchard et al., 2010; Molnar et al., 2013; Boase & Ling, 2013; Thompson et al., 2013; Albert et al., 2014; Kaye et al., 2016); offence and crash records (Wählberg, 2010a, 2011; Barraclough et al., 2016); driver simulators (Connor et al., 2007; Le Bas et al., 2015; Taubman-Ben Ari et al., 2016; Martinussen et al., 2017); and skin response (sweat) (Kaye et al., 2016).

In two studies that found moderately strong relationships, Boase and Ling’s (2013) study of mobile phone use and Junco’s (2013) study of Facebook use, the researchers understood the weaknesses of self-reporting and designed their studies to overcome those weaknesses. Boase and Ling (2013) found that using predetermined response categories when asking respondents how often they used their phone provided more accurate estimates of behaviour use for comparison to the logged data. This may be because providing predetermined responses to choose from reduced the chances of respondents over-reporting or exaggerating their answers. Likewise, Junco (2013) concluded that self-reports can *approximately* but not accurately measure actual usage. As noted above in Section 3.4, Junco recommended that researchers use specific survey questions such as, “How many minutes did you actually spend looking at XXX on Facebook?”

In another study finding a moderately strong relationship, Taubman-Ben Ari, Eherenfreund-Hager and Prato (2016) found associations between self-reported frequency of risky driving habits and risky driving on a driving simulator. However, this may be because when using a simulator, the participants

would have known to some extent that their behaviour was being observed and measured, and that would have allowed little freedom to intentionally falsify their reporting. This may have also been the case in the study by Connor et al. (2007) where self-reported speeding intentions and speeding behaviour based on performance using a driving simulator were statistically significantly positively correlated. However, a second study by the authors found a positive correlation of a similar order between self-reported speeding intentions and driver on-road speeds measured without driver awareness by cameras.

Albert et al. (2014) installed in-vehicle data recorders within young drivers' vehicles (n=32) for eight months. During this time, young drivers self-reported driving exposure and risky events (based on the rate and severity of manoeuvres, such as braking, and the speed profile) at random times. There was a high correlation (i.e. 0.90 at individual level) between self-reported and in vehicle data for driving exposure (i.e. driving time) but young drivers self-reported fewer risky events than those recorded. However, the results from this study are constrained by the small sample size (n=32) and the authors note that the sample was not representative of the general young driver population (self-selected and many were completing military service).

One of the most relevant and recent studies examining the relationship between self-reported speeding and actual speeding behaviour reported correlations (with a medium effect size) between the two measures (Kaye, Lewis, Algie & White, 2016). Young drivers (N=20) viewed either a positive (i.e. depicting of enjoying the ride when complying with speed limit) or negative (i.e. depicting car crash) emotion-based anti-speeding television advertisement. Self-report measures after viewing the advertisement involved rating emotional and arousal responses and self-reporting speeding behaviour. Objective measures included measuring sweat production through a skin cuff to assess arousal responses while viewing the advertisement. A GPS device was also installed in participants' vehicles in the following week to measure on-road speed-related driving behaviour.

The study revealed that for the negative advertisement condition, participants who reported higher ratings of staying within the speed limit spent less time driving over the posted speed limit. Similar results were found for the positive condition, although it was not statistically significant. Further analysis indicated that irrespective of the advertisement type, young drivers showed concordance between their self-reported compliance with the speed limit and their objective speeding behaviour. The authors noted these findings were 'not consistent with predictions' and recommended that any future research extending their study should employ a larger driver sample and a control group, to 'remove queries' as to whether any effects found (or not found) reflect a 'true finding' (content validity) of correspondence between self-report and objective data.

Among the studies that highlighted the value of self-reporting, despite the drawbacks, is Le Bas et al.'s (2015) study of risky driving, in which the researchers stated (p. 186):

“...self-report measures are valuable because they are a straightforward and easily acquired indication of personality attributes relevant to risky driving.”

Others have offered more expansive commentary. Chan (2010) appraises four key issues with regard to self-report data:

1. to what extent self-reported data consistently indicate actual behaviour;
2. correctly determining associations (correlations) between variables;
3. social-desirability bias problems; and that
4. self-report data is inferior to objectively obtained data.

Chan considers that these issues are largely overstated in the research literature. He points out that such issues are often relevant to objectively obtained data as well. Moreover, he states there is no strong evidence that self-report data are necessarily *inherently* flawed, or that their use will impede ability to meaningfully interpret correlation calculations, for example. In fact, he considers there can be research situations in which use of self-report data is not only appropriate but the most appropriate approach. However, he does believe it is incumbent on the researcher to carefully weigh up the possibility of each of the four issues when reporting research results.

Finally, Lajunen and Summala (2003) made some concluding recommendations for improving the reliability of self-reports:

- Make self-reports anonymous and use contexts or settings where individuals cannot be singled out
- Provide test instructions that stress the importance of honest answers
- Use lie-scales for controlling socially desirable responding statistically.

4 Concluding remarks

Research examining the effectiveness of road safety communication campaigns has tended to rely predominantly on self-report measures of message effectiveness (i.e. awareness of messages, attitudes, behaviours) as indicators of the extent to which a campaign has achieved its objectives and/or behaviour change.

This literature review discussed 20 studies in which the relationship between self-reported and actual behaviour was considered and found that the relationship was inconsistent and problematic, although a few studies found evidence of a moderately strong positive relationship. Some themes about the problematic nature of self-reporting emerged that illustrate a range of causes for the generally weak relationship, and the extent to which they may be overcome. Socially desirable responding has received the greatest degree of attention in the literature, but it is also possible that participants may consciously bias their responses in other ways, such as deliberately lying, imagining or omitting information, independent of any socially-desirable responding. In addition, a driver's ability to self-report their behaviours accurately is dependent on their psychological limitations such as memory. However, one of the most serious issues is lack of due diligence by researchers in relation to the format and context of self-reporting questions, something that researchers themselves can easily attend to.

Despite such disadvantages, self-reporting remains a common method of exploring road safety issues and in evaluating behavioural change programs, including mass media campaigns. While not an ideal approach without confirmation from objectively sourced data, self-reporting does offer some advantages, particularly in obtaining depth of detail from a participant that cannot be obtained in any other way.

It might be desirable to be able to translate self-reported behaviours to actual behaviour (i.e. in a dose response relationship whereby x% of self-reported behaviour change converts to y% of change in actual behaviour) but the relationship is too problematic to make such a generalisation. As discussed, there are a variety of reasons as to why self-report may be unreliable.

For MAC, mass media campaign evaluation is likely to be largely self-report based, using telephone and online surveys and face to face interviews. Surveys can reach large audiences, permit statistical analysis and can be cost-efficient. Some research has suggested that allowing survey respondents to be anonymous may improve accuracy of responses, for example, in online surveys. However, there is little opportunity in online surveys for a researcher to probe individuals for further details about their responses. On the other hand, face to face and telephone interviews, while time-consuming for the researcher and not anonymous for the participant, can provide opportunity to tailor questions to suit the participant's circumstances and allow the researcher to probe for further detail about the responses made.

One way of combining the advantages of survey and interview/focus group approaches might be to conduct a survey with a large sample, but conduct interviews or focus groups either with a smaller sample from the whole survey group or an independent small sample. The interview responses can then be compared with the survey responses from the whole sample to gauge consistency, with the added benefit that further detail has been obtained via the interviews. Furthermore, while it is desirable to confirm self-report responses with objectively obtained data, this would be difficult to do with anonymous surveys but could be done in conjunction with interviews. The interview responses plus objective behavioural data can then be compared with responses from the wider sample.

Importantly, technological advances mean that potentially more insights into road user behaviour may be gained by incorporating objective measures of actual driving behaviour obtained via in-vehicle behaviour monitoring devices such as Global Positioning System (GPS) or instrumented vehicles in naturalistic studies. Experiments using such new technologies could be undertaken to further examine the relationship between self-reported measures and actual behaviour for specific behaviours of interest, using reasonable sample sizes.

The literature usefully emphasised a wide range of ways in which researchers can improve the accuracy of self-reporting format and context, while noting many have both advantages and disadvantages:

- Providing appropriate time scales for responding (e.g. driving behaviours in latest month of driving, not driving behaviours in last year or generally) to minimise opportunities for forgetfulness
- Seeking objective sources of data where possible (such as crash records, insurance claims, in-vehicle logging)
- Carefully defining terms, e.g. 'injury crash'
- Assuring confidentiality of responses (for example, among older drivers who fear any responses admitting driving difficulties may lead to administrative licence loss)
- Identifying individuals who erroneously believe inappropriate driving behaviours such as speeding are really quite safe (for example by including questions to identify which behaviours the respondent considers to be safe or unsafe); note, such drivers may be happy to overestimate their speeds to conform with the mistaken view that low level speeding above the limit is safer than the actual speed limit
- Considering the use of pre-determined response categories (e.g. 1-2 times a week; 5-10km/h over the speed limit) in addition to any open-ended questions on the same topic
- Considering having a control group *not* exposed to a campaign or other intervention (e.g. a control group comprising respondents from another state) whose self-report responses can then be compared with the responses of those who received the campaign, to more accurately gauge the extent to which the campaign achieved its desired effect.

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Appendix A — Summary of studies containing general discussion about self-reporting

Author(s), location	Context of study	Brief summary of findings
Lajunen & Summala, 2003; Finland	Effects of social-desirability bias on self-reporting of driver behaviour	In public settings requiring participants to disclose their name, social security number and address as part of the entrance exam to be a driving instructor, 47 participants completed the standard Driver Behaviour Questionnaire and a social desirability questionnaire. Another 54 participants of the exam completed the questionnaires anonymously and in a private setting. Generally, the study found that responses to the DBQ were influenced by social desirability only to a small extent. However, six DBQ items relating to aberrant driver behaviours were self-reported less frequently in public settings than in private settings (i.e. anonymously).
Baumeister, et al., 2007, United States	Review of studies in social psychology that examine actual behaviours	Authors found that in 1976, 80% of papers published in social psychology journals relied on objectively measured behavioural data, in addition to or instead of, self-report data. By 2006, this had dropped to 17%. The authors advocated a “renewed commitment to including direct observations of behaviour whenever possible”. (p.396)
Chan, 2010, unstated	Theoretical perspectives on the value of self-report data	Chan appraises four key issues with self-report data: to what extent self-reported data indicate actual behaviour; correctly determining associations (correlations) between variables; social-desirability bias problems; and that self-report data is inferior to objectively obtained data. Chan considers that these issues are largely overstated in the research literature. He points out that many of these issues can apply to objectively obtained data as well. Moreover, he states there is no strong evidence that self-report data are necessarily <i>inherently</i> flawed, or that their use will impede ability to meaningfully interpret correlation calculations, for example. He considers there can be research situations in which use of self-report data is not only appropriate but the most appropriate approach. However, he does believe it is incumbent on the researcher to carefully weigh up the possibility of each of the four issues when reporting research results.
Wählberg, 2010a Sweden	Examination of issues surrounding use of self-report in evaluating a driver education program	Author considered that self-report data are unreliable, largely due to social desirability biases, particularly when the situation encountered (or imagined) is a socially sensitive one, such as where there would be a legal sanction or penalty. Consequently, he considered that use of self-report data should involve corroboration from objective sources such as offence and crash records.
Wählberg, et al., 2010b, Sweden,	Study involved applying a lie-scale within driver questionnaires used previously by other researchers	The lie-scale was the Driver Social Desirability Scale, which had two sub-scales: the Driver Impression Management Scale (focussing on the faking of one’s driving behaviours); and the Driver Self Deception Scale (focussing on having overly positive beliefs about one’s driving). It was found that use of lie-scales can measure the extent to which biases such as social desirability are at play, and consequently their use was recommended. However, it was noted that lie-scales may not catch all socially desirable responding because, for example, traffic safety may not be seen as a socially desirable goal by some groups.

Soole et al., 2011, Queensland, Australia	Focus group and interview study of how to improve self-reports of speeding in surveys, etc	<p>Authors made several recommendations for improving self-reports by subjects:</p> <ul style="list-style-type: none"> • Provide a set timeframe for responding to questions about speeding behaviour • Carefully consider response categories and formats in survey to accurately record the frequency and degree of speeding • Clearly distinguish low-level from moderate to high level speeding (as these can be value-laden terms) (e.g. use categories like 1-5 km/h, 6-10 km/h above the limit) • If context of speeding is relevant to the research, give several different examples of applicable speed zones (e.g. passing road works, emergency vehicles, school buses, etc) • Percentage style response formats were preferred to Likert scales as they more accurately reflected behaviour (e.g. % of time at or under speed limit vs % of time above the limit).
Barraclough et al., 2014, Queensland, Australia	An investigation of social-desirability in self-reporting	<p>Two surveys were completed by drivers (N=214) to explore the association between social desirability and driver behaviours (DBQ). No differences between men and women were found but older drivers in the sample were more likely to present themselves in a more socially desirable light. Social desirability was found to be associated with driver's reports of their behaviours, but not self-reported crashes or offences. Drivers who scored highly for social desirability bias were less likely to report aberrant driving behaviours and drivers with lower social desirability scores recorded a higher frequency of aberrant driving behaviour. The authors also consider that drivers more likely to drive dangerously may be less concerned with how they are regarded by others (lower social desirability bias), and that lie-scales (as suggested by Wählberg) may be ineffective in detecting such a possibility.</p>
Harrison, 2014, Victoria, Australia	An investigation of social-desirability in self-reporting and self-report consistency over time	<p>This study extended the work of Wählberg (2009) by using the results of three types of survey (DBQ, self-assessments of driving skill, and self-report of offences and crashes) on 676 probationary (provisional) drivers to investigate social desirability and accuracy over time. The surveys were delivered on line and by telephone, and occurred in three waves, six months apart. A major finding was that questions about how much experience (hours) the drivers obtained in their learner phases yielded quite inconsistent answers across the three time periods, on average varying by about 50 hours.</p>