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Intervention Modalities to Address Relevant Psychosocial Predictors of Driving Behaviour among Adolescents: Primary Report

Victor J. Strecher, José A. Bauermeister, Jean Shope, Charlotte Chang, McHale Newport-Berra, Adam Giroux and Erin Guay

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SCIENTIFIC ADVISORY GROUP

Dr Robert West (Chairman)
Dr Claire Corbett
Dr Ray Fuller
Ms Elaine Forsyth
Ms Deirdre O’Reilly
Dr Nick Pidgeon
Dr Lily Read
EXECUTIVE SUMMARY

The goal of this report is to:

(a) identify psychosocial targets of safe driving behaviour;
(b) consider relevant population-based modalities to address these psychosocial targets;
(c) create an intervention map that examines the utility of each identified psychosocial target as it might be delivered within each communications modality; and
(d) present a rationale and description of an internet-based driver safety program that could be developed for pre-drivers and novice drivers.

Psychosocial targets included:
- behavioural intention;
- perceived threat;
- perceived benefits;
- affective beliefs;
- subjective norms;
- personality;
- identity;
- task difficulty; and
- habit associated with unsafe driving behaviours.

These targets were evaluated for the degree to which they were considered strong predictors of safe driving behaviour, and to have programmatic utility using a reasonable intervention strategy. By ‘programming utility’ we are referring to either the potential of changing the predictor or the potential for tailoring effective programming to the predictor.

Population-based communications modalities included:
- mass media;
- primary care physicians;
- teachers;
- peers;
- parents;
• theatre production; and
• interactive computer technology.

RE-AIM (www.re-aim.org) criteria developed by Glasgow et al. (1999) were used to evaluate these modalities for long-term impact on driver safety behaviour. Empirical evidence of intervention effects from a variety of health-related behaviours with similarities to driving behaviour provided new directions for pre-driver and novice driver safety programmes that are both effective and reach a large majority of those in need. We did this using evidence of interventions that have, and those that have not, worked.

On the basis of our analyses, we strongly recommend a specific focus on subjective norms, affective beliefs, personality, identity and task difficulty factors in driver safety programming. We consider the most promising intervention modality to be interactive computer strategies. The vast majority of pre-drivers and novice drivers regularly use the internet. This modality has the potential to:

(a) collect important data at an individual level;
(b) tailor information to specific needs and interests of the user and parents;
(c) create game-like instructional programming that is relevant and entertaining; and
(d) collect longitudinal information relevant to re-tailoring and evaluation.

In addition to interactive computer strategies, we recommend parental- and peer-based interventions, which have demonstrated positive results in a variety of health-related behaviours. We conditionally recommend mass media when it is combined with other intervention modalities (such as computer, parental or peer-based strategies). We also believe that, while little evaluative data exist for theatre-based interventions, this modality shows promise in addressing subjective norms and affective beliefs.

Using empirical results of numerous studies, we are not recommending either health care provider- or teacher-based interventions. Neither providers nor teachers are well trained in the area of driver safety education and skills training. Their influence on the most important psychosocial factors is considered minimal. Moreover, the time available to both professions is only shrinking. We therefore consider focusing efforts on other communication modalities.

In the last section of the report we present a rationale and description of an internet-based driver safety program that could be developed for pre-drivers and novice drivers. This communications modality shows promise as a potentially high reach, high efficacy, low-cost intervention.
1 INTRODUCTION

Young novice drivers account for a disproportionate number of traffic crashes in the United Kingdom and throughout the world. While the basic elements of driving can be taught rather quickly, the complexities of safely manoeuvring a fast moving, heavy vehicle in varying psychosocial and environmental conditions requires significantly more training than what is currently provided (Deery, 1999). In order to better address this important period of vulnerability, a comprehensive review was conducted to examine psychosocial, judgement and decision-making models and constructs relevant to traffic safety and related behaviours. The goal of this review is to improve the quality of traffic safety interventions through theoretically-informed programming.

This report begins by identifying psychosocial targets from a conceptual framework of safe driving behaviour.1 Psychosocial targets had to be:

(a) **strong predictors** of safe driving behaviour; and

(b) have **programmatic utility** using a reasonable intervention strategy (Green and Kreuter, 2004; Fishbein and Yzer, 2003).

By ‘programming utility’ we are referring to either the potential of changing the predictor or the potential for tailoring effective programming to the predictor.

Second, we consider relevant population-based communications modalities to address these psychosocial targets. These modalities include:

- mass media;
- primary care physicians;
- teachers;
- peers;
- parents;

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1 To build the foundation for this review, a comprehensive background review of the traffic safety and related literature was conducted. From this background review, a conceptual framework to explain safe driving behaviour was developed. The background review and evidence supporting the framework is provided in the Technical Report (Strecher et al., 2007) associated with this report. The conceptual framework incorporates elements of Fuller’s Task-Capability Interface (TCI) model (Fuller, 2005), Wilde’s Homeostasis Theory (Wilde et al., 2002), Deery’s model of crash risk perception (Deery, 1999), Bandura’s concept of reciprocal determinism within his Social Learning Theory (Bandura, 1978), Fishbein and Ajzen’s Theory of Reasoned Action (Fishbein and Ajzen, 1975), and Rosenstock’s Health Belief Model (Rosenstock, 1974). The conceptual model also includes a physiological perspective related to influences of neuroendocrine and prefrontal cortical activity on psychosocial, judgement and decision-making constructs.
• theatre production; and
• interactive computer technology.

We use RE-AIM criteria developed by Glasgow et al. (1999) to evaluate these modalities for long-term impact on driver safety behaviour.

Third, we attempt to create an intervention map that examines the utility of each identified psychosocial target as it might be delivered within each communications modality. By applying the empirical evidence gathered from years of intervention research in other health-related behaviours, we hope to identify new directions for developing practical pre-driver and novice driver safety programmes that are both effective and reach a large majority of those in need. The purpose of this mapping is to assist policy-makers in identifying the most relevant psychosocial targets and methods of addressing those targets. We do this using evidence of what has worked, and what has not worked.

Finally, we present a rationale and description of an internet-based driver safety program that could be developed for pre-drivers and novice drivers. This communications modality was highly rated relative to other modalities and shows promise as a potentially high reach, high efficacy, low-cost intervention.
2 RELEVANT PSYCHOSOCIAL FACTORS

In this section, we present psychosocial factors relevant to health behaviour change programming. The factors selected are considered potential candidates for driver safety interventions and are the focus of interventions in other health-related behaviour areas. Each factor is examined using two criteria:

(a) the strength of the factor in predicting safe driving behaviour; and
(b) the factor’s utility in driver safety programming.

By ‘programming utility’ we are referring to either the potential of changing the predictor or the potential for tailoring effective programming to the predictor.

2.1 Safe driving behaviour and behavioural intention

Safe driving behaviour refers to a set of practices, including:

- driving within the speed limit;
- non-aggressive manoeuvring;
- maintaining a safe braking distance;
- seat-belt use; and
- avoidance of driving when impaired by alcohol or other substances, or sleep deprivation.

If every driver who intended to drive safely actually did so, there would be no need to examine behavioural intention. The intention-behaviour relationship is central to the Theory of Reasoned Action (Fishbein and Ajzen, 1975), though is not well studied in the traffic safety literature. The distinction between intention and actual behaviour focuses consideration on:

(a) predictors of intention, understanding that intention does not always predict actual behaviour; and
(b) factors inhibiting the intention-behaviour relationship.

2.2 Predictors of intention: perceived threat

2.2.1 Is perceived threat a strong predictor of safe driving behaviour?

Defined as an individual’s perceived susceptibility to, and perceived severity of, a particular outcome (e.g. an automobile crash), perceived threat is a central construct of a number of theoretical models of health-related behaviours, including the Health Belief Model (Rosenstock, 1974) and the Protection Motivation Theory (Weinstein, 1988). It is also a component of other models of human behaviour, including the
Theory of Planned Behaviour and Social Cognitive Theory. Perceived risk is not synonymous with perceived threat and is more consistent with the concept of perceived susceptibility. This is an important distinction, since one might feel susceptible (at risk) of a crash but not believe that most crashes would be severe in nature. Perceived susceptibility and severity might also be influenced by specific equipment on a vehicle. Anti-lock brakes, for example, might reduce a driver's perception of susceptibility to a crash, whereas airbags may reduce a driver’s perception of crash severity.

Perception of risk is often studied in terms of the biases individuals have of their perceived versus actual risk. An optimistic perception or bias of risk is present when an individual considers his or her risk to be lower than their actual risk. At a population level, across a broad range of health issues, the average person perceives him or herself to be less at risk than the average person (Weinstein, 1984, 1987; Kulik and Mahler, 1987). While smokers have higher risk perceptions than non-smokers, they tend to perceive their risk as lower relative to other smokers (Strecher et al., 1995). Perceived optimism has been related to a variety of poor health behaviours and reduced likelihood in changing these behaviours (Skinner et al., 1998; Kreuter et al., 1995; Strecher et al., 1995).

Deery (1999) points out that optimistic perceptions of driving risk have been identified in Australia (Cairney, 1982; Job, 1990), Brazil (Sivak et al., 1989a), Britain (Groeger and Brown, 1989), Canada (Matthews and Moran, 1986), Finland (Naatanen and Summala, 1974), France (Delhomme, 1991), Germany (Sivak et al., 1989b), New Zealand (McCormick et al., 1986), Spain (Sivak et al., 1989b), Sweden (Svenson, 1981), and the United States (Svenson et al., 1985).

Young drivers perceive their personal crash risk to be significantly lower than that of their peers (Finn and Bragg, 1986). This optimistic bias is particularly high among young males, where the highest crash rates exist among all age-gender categories (e.g. DeJoy, 1989). Moreover, compared to young women, young men perceive their driving ability, as reflected by their reflexes, judgement and skill, to be higher than their peers (Harre et al., 2005).

2.2.2 Does perceived threat have utility in driver safety programming?

While threat perceptions are likely to be associated with driving behaviour, the question of whether they can be changed is hotly contested. In a meta-analysis of fear appeal impact, Witte and Allan (2000) found evidence for the effects of high versus low fear messages, particularly when combined with efficacy messages. However, in the HIV risk behaviour, which we consider somewhat similar in susceptibility (low) and severity (high) status to crash risk, a meta-analysis by Albarracin and colleagues (2005) found no effect to a possibly harmful effect of fear messages. This negative outcome was found even when fear messages were
combined with efficacy message; it was also found across all gender, age, ethnicity, risk group and post-condom-use groups.

Interestingly, the general public perceives fear appeals to be effective (e.g. Rhodes and Wolitski, 1990). One explanation for the counterintuitive poor effect of fear messages is that individuals tend to avoid or minimally attend to messages that may challenge existing beliefs and attitudes. In their meta-analysis, Witte and Allen (2000) found that individuals were more likely to use these strategies as efficacy messages became weaker.

Another protective strategy used by individuals with low perceptions of threat is to distance oneself from the models in fear-inducing messages. Harre and colleagues (2005) found that college students exposed to a series of messages depicting horrific results of a crash developed heightened perceptions of driving ability relative to their peers. The authors suggest that, rather than having their risk perception affected by the message, the subjects attributed the cause of the crash outcome to poor driving ability. This compensatory adjustment in cognition in order to maintain current behaviour is consistent with the perceived driver ability crash-risk perception of our conceptual framework; the driver ‘looks for evidence of distinction between the self and the image and facilitates this process (or search) by derogating the image’ (Gibbons and Gerrard, 1995, p. 506).

Findings from other health behaviour areas that may have common threads to driver safety support these results. Women were not differentially influenced to take protective action against rape from high versus low fear messages, though they were more likely to take action when exposed to any level of fear message (Morrison, 2005). Protective action against rape may be somewhat similar to hazard detection in driving, which we suggest is related to perceived threat.

High fear messages from ‘Scared Straight’ programs for juvenile delinquency appear to be more harmful than doing nothing (Petrosino et al., 2002). This programming is somewhat similar to victim impact panels (VIPs), requiring serious offenders to listen to individuals affected by a serious driving offence. Though inherently interesting, VIPs have not generally proven effective (Nochajski and Stasiewicz, 2006; Wheeler et al., 2004).

There is controversy over the efficacy of fear-based messages to address perceived threat. On the basis of the existing data for related psychosocial constructs and behaviours, we suggest that traditional approaches to changing perceived threat through high-fear messages should not be employed. Hazard detection programmes in driver education are likely to influence perceived threat, producing more accurate assessments of driving risk.
2.3 Predictors of intention: benefits of unsafe driving

2.3.1 Are perceived benefits of unsafe driving strong predictors of driving behaviour?

A recent study by McKenna and Horswill (2006), combined with evidence from Lawton and colleagues (in press), suggest that positive beliefs regarding unsafe driving are associated with unsafe driving behaviour. These beliefs are likely to evolve from more frequent, immediate, feedback provided by fast driving and positive outcomes (e.g. getting to the destination faster, exhilaration) and the lack of negative outcomes (e.g. a crash, a traffic fine). While not a focus of traditional models, such as the Health Belief Model, there is a strong body of research supporting the role of positive expectancies for alcohol, drug and sexual risk-taking behaviours (e.g. Goldberg et al., 2002; Katz et al., 2000; Fromme et al., 1999).

2.3.2 Do perceived benefits of unsafe driving have utility in driver safety programming?

Again, with only minimal evidence to support this assertion, we suggest that interventions addressing individuals who perceive benefits of unsafe driving may be useful. Goldberg and colleagues (2002) suggest a focus on alternate activities that produce similar benefits. Motivational interviewing also provides techniques for clarifying positive beliefs of unsafe behaviour, where such beliefs are acknowledged and discussed along with countervailing beliefs, attitudes and values, and may be a useful intervention strategy (Resnicow et al., 2002). Motivational interviewing applications are accumulating strong supportive research evidence in the areas of alcohol and drug use (Rubak et al., 2005; Burke et al., 2003).

2.4 Predictors of intention: affective beliefs

2.4.1 Are affective beliefs strong predictors of driving behaviour?

Recent evidence from Lawton and colleagues (in press) suggests that affective beliefs (e.g. fast driving evokes worry, guilt, anxiety, enjoyment) predict driving speed to a greater extent than do instrumental beliefs (e.g. fast driving is harmful, safe, timely). A second study in the area of smoking (also by Lawton and colleagues, in press) confirms the importance of emotions on behaviour.

2.4.2 Do affective beliefs have utility in driver safety programming?

Affective beliefs receive very little attention in the health behaviour literature, either in their assessment or in their propensity to change. More research in this area is clearly needed. This being said, one might anticipate a stronger impact on affective beliefs from vivid information sources and channels (e.g. theatre).
2.5 Predictors of intention: subjective norms

2.5.1 Are subjective norms strong predictors of driving behaviour?

Subjective norms are defined as an individual’s compliance with peers’, friends’ and family members’ beliefs and attitudes. Normative perceptions and the collective behaviour of others are likely predictors of risk acceptance. An adolescent driver’s perception of the approval or disapproval of other adolescents, particularly male adolescents inside the automobile, is a determinant of risk-taking behaviour and crashes. The presence of older adults influences safer driving behaviour. The collective behaviour of other drivers on the road significantly influences driver behaviour (Zaidel, 1992).

2.5.2 Do subjective norms have utility in driver safety programming?

Normative beliefs are pivotal as adolescents explore and adopt new, often-risky, behaviours. Owing to their importance, subjective norms tend to be incorporated into most ‘social influence’ interventions of smoking cessation, drug use and HIV prevention programmes within this population. In these areas, social norms have been addressed through:

- pointing out the actual behaviours of others, which generally reflect lower rates of problematic behaviour;
- identifying high-risk situations (e.g. when other teenage males are in the car); and
- methods for countering social pressure.

Refusal skills are an integral part of Botvin’s Life Skills training, one of the few effective programmes in adolescent tobacco and drug use prevention (Botvin and Griffin, 2004). Long-term outcomes of Life Skills for drug prevention found that there were differences over a longer period (over 10 years) from a control condition in drug and alcohol use, and in unsafe sexual behaviours. The Life Skills programme has a rich track record of success with a number of health-related behaviours. Unfortunately, the programming has not been broken into component parts to determine precisely its active elements. Subjective norms are one of many focal points in a 30-class curriculum.

The meta-analysis of HIV preventive behaviours by Albarracin and colleagues (2005) directly examines the role of normative messaging, finding positive effects only for subjects under the age of 21 years. In fact, significant negative effects for normative arguments among studies with subjects over the age of 21.

Taken together, these findings suggest a strong, positive effect of normative messages in adolescent driver safety programming. Specific details of effective messages is not clearly understood, though a recent study (Nichols et al., 2006) of
verbal refusal strategies (simple ‘no’, declarative statements, excuse, alternatives) in different situations (smoking and shoplifting) suggests the need to tailor refusal skills practice to specific situations.

2.6 Predictors of intention: personality

2.6.1 Are personality traits a strong predictor of driving behaviour?

Sensation-seeking and other personality traits have received significant attention in driver safety research. Sensation-seeking is defined as ‘the need for varied, novel, and complex sensations and experience, and the willingness to take physical and social risks for the sake of such experience’ (Zuckerman, 1979). The positive relationship between sensation-seeking and risky driving behaviours is well-established, tending to be stronger in men than women (Wagner, 2001; Jonah, 1997) and weaken with age (Jonah, 1997).

People with similar sensation-seeking personality types also tend to exhibit unsafe sex practices, use alcohol and drugs, and engage in violence (Caspi et al., 1997). Compelling evidence for personality factors associated with a range of poor health practices comes from Caspi et al. (1997), who examined temperament and personality traits in a birth cohort of over 1,000 individuals through the age of 21. High levels of aggression and low levels of control, harm avoidance, traditionalism and social closeness at age 18 were predictive of unsafe sexual behaviour, violence, alcohol dependence and dangerous driving habits at age 21. These traits were predicted, in general, by an uncontrolled temperament (e.g. irritable, impulsive, difficulty sitting still, rough and uncontrolled in their behaviour, labile in their emotional responses) measured at age three. Moreover, at least half of the variation in personality traits similar to those measured by Caspi are a result of genetic factors (Bouchard, 1994; Tellegen et al., 1988).

We therefore conclude that personality traits are strong predictors of driving behaviour. Still, most non-fatal crashes caused by adolescents appear to result from failing to pay attention to, and search the environment for, hazards, rather than from the driver’s thrill-seeking (McKnight and McKnight, 2003). In fact, although the literature shows significant indirect effects of sensation-seeking on traffic collisions through risky driving behaviours, the direct effects of sensation-seeking on traffic collisions have not been shown (Stead et al., 2005).

2.6.2 Do personality traits have utility in driver safety programming?

While personality traits, and obviously heredity traits, are not targets for change (unlike attitudes or skills), they can be used in segmenting audiences for health communications messages (Lawton et al., in press; Caspi et al., 1997). To our knowledge this type of segmentation has not been previously pursued. More research is also needed to understand how specific sensation-seeking characteristics
affect driving behaviour. For example, it is of interest to determine how well Sensation-Seeking Scale (SSS) scores predict traffic collisions, which may be possible through tracking driving records and determining threshold SSS scores (Jonah, 1997).

It will also be important to better understand the physiological determinants of personality characteristics. Changes in reward sensitivity, novelty and sensation-seeking occur early in adolescence (Steinberg, 2004). An increased need for the type of stimulation provided by risk-taking is possibly due to developmental changes in neuroendocrine activity. In animal models, the development of the limbic system during adolescence may, in part, account for changes in reward-seeking behaviour (Spear, 2000).

This limbic-controlled process is probably naturally selected, as animals must gain competence through taking risks (e.g. baby birds jumping from their nests). Steinberg (2004) suggests that the temporal gap in physiological development between puberty-triggered limbic activity and slower-maturing pre-frontal cortical development forms a ‘window of vulnerability’ where the propensity to accept risk is high and self-regulatory processing is low. Steinberg (2004) speculates that the most vulnerable adolescents might be those maturing earliest but developing self-regulatory functions latest. This could be tested in traffic safety research, examining the onset of puberty, risk acceptance, perceived risk and driving behaviour.

2.7 Predictors of intention: identity

2.7.1 Is identity a strong predictor of driving behaviour?

For many individuals, driving is simply a utilitarian endeavour; for others, driving is a personally relevant activity. Ego involvement in a particular behaviour could influence chronic dispositions towards the behaviour (West, 2006) and the response to messages attempting to influence the behaviour (Freeman et al., 2001).

Stronger identification as a smoker predicts both lower intentions to quit (Falomir and Invermizzi, 1999) and poorer cessation outcomes (Shadel and Mermelstein, 1996). A recent study of Irish adolescents (Stewart-Knox et al., 2005) found smoking uptake often to be driven by a desire to conform to the norms of a peer group as opposed to being through direct persuasion.

As West (2006) states, identity is a set of mental representations we have of ourselves as we both are and we could be. Markus and Nurius (1986) call these future states our ‘possible selves’ – what we ‘would like to become . . . could become . . . or afraid of becoming’ (p. 954). Freeman and colleagues (2001) operationalised the possible selves construct for future smoking identity by asking smokers to rate the likelihood of smoking one month, one year, 10 years and 20 years from now, and also with respect to specific life events, such as graduating from
college, living with a romantic partner, having a full-time job and having children. When smokers were then shown a series of anti-smoking videos, those with the strongest future identities (possible selves) as smokers were most likely to resist the messages of the videos. These smokers, however, were less resistant to videos focusing on the immediate impact of smoking (such as addiction). Together, these data point to the importance of measuring both current and future ego involvement with driving, and in tailoring safe driving messages to these specific identities.

2.7.2 Does identity have utility in driver safety programming?

Very little data exist studying the impact of health behaviour interventions on identity. However, based on the study by Stewart-Knox and colleagues (2005), one would expect that programmes addressing normative beliefs and peer resistance might influence identity, particularly among adolescents. More traditional belief change programming would seem less effective. This is borne out in two interventions for adolescents using the Theory of Planned Behaviour: one for dietary change and the other targeting physical activity (Tsorbatzoudis, 2005a, b). Each found significant improvements in attitudes, intention, self-efficacy and behavioural outcomes, but neither found effects on either subjective norms or role identity.

2.8 Factors inhibiting the intention-behaviour relationship

In a recent, comprehensive meta-analysis of the behavioural intention – behaviour relationship – Webb and Sheeran (2006) find that large changes in behavioural intention yield small to moderate changes in actual behaviour. With respect to safe driving, two moderating influences appear to preclude a stronger relationship: the habitual nature of driving behaviour and the difficulty of the specific driving task.

2.9 Intention-behaviour inhibitors: task difficulty

2.9.1 Is task difficulty a strong influence in the intention-behaviour relationship?

The interaction of driving ability and the demands of the driving task expresses itself as task difficulty: the difficulty of driving the automobile in a safe manner. This concept is central to Fuller’s Task-Capability Interface (TCI) model, a general theory of driver behaviour (Fuller, 2005). Task demands include actual hazards of the road as well as distractions such as mobile phones and others in the automobile. Task difficulty moderates the likelihood that behavioural intention will result in actual safe driving behaviour. For example, an individual who intends to engage in safe driving behaviours, but finds the particular driving task exceptionally difficult (a function of the driving demand-ability interaction), will not necessarily drive safely. When task difficulty is low, the intention-behaviour relationship will be strong.
This relationship is similar to the intention-behaviour perceived behavioural control relationships of the Theory of Planned Behaviour (Ajzen, 1985), and is strongly supported in other health-related behaviours. Webb and Sheeran (2006) found that the intention-behaviour relationship is strongest among those with higher levels of self-efficacy. In other words, intention can be turned into action among those with high self-efficacy and skills.

Self-efficacy may be a two-edged sword in traffic safety, since over-confidence could lead to an underestimate of risk, resulting in reckless driving behaviour. On the other hand, enhanced self-efficacy may also lead to greater focus on implementing behavioural intentions. Since actual driving skills improve with age, it is likely that this mechanism would result in a stronger intention-behaviour relationship over time.

2.9.2 Does task difficulty have utility in driver safety programming?

Following Lawton and colleagues’ (in press) recommendations, driver safety programming should focus on the perceived control over the speed a driver adopts: that one had direct control over the accelerator. The focus on perceived control, or self-efficacy, in health behaviour theories and interventions was ground breaking in the mid-1980s, leading the field out of traditional fear- and information-based programming. Given its consistently strong predictive power, the enhancement of self-efficacy through skills-based intervention is a focus in nearly every health promotion programme.

This enthusiasm for enhancing self-efficacy must be tempered, however, by the concern of developing over-confidence in one’s skills. In a study by Gregersen (1996), subjects using a ‘skid car’, designed to simulate a car on an icy road, and were assigned to either:

(a) skills-based instruction, focusing on braking and avoidance manoeuvring; or
(b) an ‘insight’ condition that left the subject without specific instruction.

One week following training, subjects in the skills condition estimated their driving skill to be higher than the insight group, while no difference was found in their actual skill. These results elucidate the complex role of self-efficacy enhancement in driver safety training. Unlike other health-related practices, such as smoking cessation, dietary changes or physical activity, where self-efficacy enhancement appears to have strong positive effects (Bandura, 1997), efficacy enhancement in driving may result in over-confidence, motivating unsafe driving without the requisite skills. Results of the study by Harre and colleagues (2005) suggest that adding dramatic crash outcome messages to driver training will do little to mollify this overestimation.

However, skills enhancement programming for safe driving behaviour should not
only involve improved driving technique, it should also focus on controlling the environment within the vehicle (e.g. asking people to hold down noise and disruption), possessing social resistance skills when pressured to drink before or during driving or to speed, and maintaining a calm demeanour while driving when pressed for time. The intention-behaviour relationship is strongest among behaviours that involve a reasoned action (e.g. exercise, screening behaviours) as opposed to behaviours that may be triggered by the social context. As Webb and Sheeran (2006) state: ‘Smoking and condom non-use may be determined more by social reaction than by intention because they are risky behaviours that generally are performed in social contexts’ (p. 261). Social skills are required to drive safely in hazardous social contexts.

2.10 Intention-behaviour inhibitors: habitual nature of the behaviour

2.10.1 Is the habitual nature of driving a strong influence of the intention-behaviour relationship?

Yates (1993) points out that, in many instances, unsafe driving behaviour may occur when no semblance of risk-taking is made. Yates uses the example of a person getting into a car who, with no consideration of risk acceptance, fails to use the seat belt. Routines that become habituated with driving experience may have very little to do with the other processes presented in the conceptual framework. Regardless of whether a person intends or does not intend to drive in a safe manner, habitual processes, similar to thoughtlessly lighting a cigarette, supersede cognitive processing.

A large body of research in other behavioural areas now supports the comments by Yates: that the relationship between intention and behaviour are not as strong among behaviours that are largely habitual, such as seat-belt use or cigarette smoking (Webb and Sheeran, 2006; Wood et al., 2002; Ouelette and Wood, 1998). A review of research found that, among behaviours conducted frequently and in stable contexts, past behaviour was the strongest predictor of future behaviour, whereas among less frequent behaviours conducted in unstable contexts, intention was the stronger predictor of future behaviour.

2.10.2 Does driving habit have utility in driver safety programming?

This finding suggests that intention-directed interventions may have more impact on novice drivers, whose driving behaviours are still developing (and becoming habituated). Conversely, intention-directed interventions may have little impact on experienced adult traffic safety violators. The meta-analysis by Webb and Sheeran (2006) suggests that behavioural incentives (e.g. laws) might have the strongest effect on habituated behaviours. Habit-breaking strategies such as reminders and
alert systems in the vehicle will likely have the greatest influence among drivers with bad driving habits.

### 2.11 Summary of relevant psychosocial factors

Table 2.1 presents our estimate of the relative strength of the predictors of safe driving behaviour and their respective utility in driver safety programming. By ‘programming utility’ we are referring to either the potential of changing the predictor or of tailoring effective programming to the predictor. Our confidence in each estimate (predictor strength and programming utility), based on a subjective assessment by the authors of the empirical evidence from driver safety and other health behaviour research, is also included.

<table>
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<th>Psychosocial predictor</th>
<th>Strength estimate</th>
<th>Confidence in strength estimate</th>
<th>Programming utility</th>
<th>Confidence in programming utility</th>
<th>Programming focus</th>
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<tbody>
<tr>
<td>Perceived threat</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Affective beliefs</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Subjective norms</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Personality</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
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<tr>
<td>Identity</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
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<tr>
<td>Task difficulty</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Habit</td>
<td>High</td>
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We are therefore recommending that driver safety programming focuses on subjective norms, personality, identify and task difficulty. We conditionally recommend a focus on affective beliefs and habitual aspects of safe driving behaviour. Finally, we do not recommend a focus on threat-based messaging.
This section examines the utility of intervention modalities with respect to their efficacy in addressing the psychosocial foci of the programme, and also in terms of their potential to reach a large proportion of the population in need and their potential for adoption, implementation and long-term maintenance. These criteria are highlighted in the RE-AIM framework (Glasgow et al., 1999) and are described in Table 3.1.

### Table 3.1: Definitions of the RE-AIM criteria (www.re-aim.org)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definitions</th>
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<tbody>
<tr>
<td>Reach</td>
<td>The absolute number, proportion, and representativeness of individuals who participate in a given initiative, intervention, or programme.</td>
</tr>
<tr>
<td>Efficacy/effectiveness</td>
<td>The impact of an intervention on important outcomes, including potential negative effects, quality of life, and economic outcomes.</td>
</tr>
<tr>
<td>Adoption</td>
<td>The absolute number, proportion, and representativeness of settings and intervention agents (people who deliver the programme) who are willing to initiate a programme.</td>
</tr>
<tr>
<td>Implementation</td>
<td>At the setting level, implementation refers to the intervention agents’ fidelity to the various elements of an intervention’s protocol, including consistency of delivery as intended and the time and cost of the intervention. At the individual level, implementation refers to clients’ use of the intervention strategies.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>The extent to which a programme or policy becomes institutionalised or part of the routine organisational practices and policies. Within the RE-AIM framework, maintenance also applies at the individual level. At the individual level, maintenance has been defined as the long-term effects of a programme on outcomes after six or more months after the most recent intervention contact.</td>
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### 3.1 Mass communication

When used alone, mass communication modalities such as television advertisements or public service announcements (PSAs), billboards, radio announcements and social marketing campaigns demonstrate high reach but limited efficacy. The inability of mass communication messages to tailor health education messages relevant to individuals varying in educational attainment, socio-economic status and racial/ethnic identification limits the efficacy of this approach.

Media campaigns aimed at smoking prevention among adolescents have demonstrated minimal or no long-term outcomes (Sowden and Arblaster, 1998). Similarly, while short-term outcomes have been found, long-term screening for HIV does not appear to be directly influenced by mass media (Vidanapathirana et al., 2005). Well-designed and evaluated media campaigns through either radio or television using attitudinal message targets failed to demonstrate significant effects
on smoking behaviour among adolescents (Bauman et al., 1991). A recent poster campaign relating to passive smoking had no demonstrable effect on either cessation of smoking or the intention to quit (Etter and Laszlo, 2005), similar to a campaign for increased condom use which had a low to moderate impact among adolescents.

Mass media appears to work better when used in conjunction with other prevention activities (Elder et al., 2004). Anti-smoking messages through the media have been effectively linked with quit lines offering comprehensive cessation programming (McAlister et al., 2004) and with school-based interventions (Flynn et al., 1994). In a review of mass media campaigns for reducing alcohol-impaired driving and crashes, Elder and colleagues (2004) found that mass media campaigns could have high reach (exposure) and implementation. Counter-advertising media programming through the ‘Truth Campaign’ also appears to effect tobacco use through a focus on the tobacco industry itself. This approach might be considered in drink-driving campaigns.

Mass communication modalities may be readily implemented once the communication materials are funded and created. The costs associated with high-quality mass media development, however, are extremely high. For television and radio, the costs of airing messages at specific times to the adolescent audience can be exorbitant. In other words, the costs of implementing and maintaining a television and radio campaign can be very high; the expenditure in human resources, however, is fairly low.2

2 Typically, communication resources would be devoted to changing the psychosocial predictors of behavioural intention and behaviour. Mean changes in relevant beliefs, for example, would be a relevant intermediate result of most health behaviour change campaigns. With this target in mind, interventionists generally focus on psychosocial targets that: (a) predict behavioural intention and/or behaviour, (b) have a significant population holding variant levels of the predictor (i.e. if everyone holds a particular belief, there is no room for change), and (c) are changeable through a reasonable intervention strategy (Fishbein and Yzer, 2003). This is the general approach we have taken in this report to examining potential approaches to safe driving interventions.

Rather than influencing change in the psychosocial predictor, media priming theory suggests that mass media influences the association between the psychosocial predictor and the outcome, making the existing relationship more cognitively accessible. This theory would suggest that attempts to address predictors of driver behaviour, such as the risk of injury or death from unsafe driving, might have a counter-intuitive effect. The intervention message would trigger greater salience of, and cognitive associations with, an existing relationship between a predictor and outcome (e.g. an adolescent’s perception of invulnerability and unsafe driving behaviour) while not actually changing the predictor (Fishbein and Yzer, 2003; Domke et al., 1998). Exposure to a message, therefore, takes on a more critical role than the content of the message.
3.2 Primary care providers

While adult-based smoking cessation and alcohol treatment programming by primary care providers has produced small but consistent effects (e.g. Ballesteros et al., 2004; Anderson and Jane-Llopis, 2004; Bertholet et al., 2005; Lancaster and Stead, 2004), interventions administered by primary care providers to adolescents have consistently demonstrated little or no effect. Reviewing medical or dental provider-based interventions for youth, Christakis and colleagues (2003) found very little evidence for short-term effects and no evidence for long-term effects. This is not surprising given the limited training and reimbursement health care providers receive for such counselling.

Health behaviour programmes delivered by primary care providers have shown moderate to high reach among adolescents. During the development of a provider-based programme, however, barriers hindering the adolescent target population’s access to medical services must be identified and removed. These barriers may include access to free or low-cost services or health insurance coverage, transportation to medical establishments and trust in their provider. From the provider’s perspective, additional barriers may also exist. Increasing demands in the provider’s workload and decreasing time allocation for physician–patient interactions may place constrains in the provider’s likelihood of adopting preventive health behaviour interventions during a consultation.

Inconsistencies in the delivery of messages create low fidelity in implementing preventive programming via health care providers. Poor implementation has been attributed to variations across providers’ communication styles and to variations across patients’ medical and behavioural risk profiles. However, many of these implementation barriers may be overcome by providing providers with patient education training and access to cueing devices (e.g. chart checklists) serving as reminders to maintain the expected protocol during the delivery of the intervention. Similarly, low maintenance may be observed if providers do not receive boosters such as patient communication workshops and monitoring. This long-term support can now be implemented using electronic medical records and data-centric continuing education.

3.3 Parents

Family dynamics and characteristics are related to driving as well as substance abuse behaviours, and therefore may be a relevant channel of intervention (Bingham and Shope, 2004; Ashery et al., 1998). In a large, well-controlled trial, Bauman and colleagues (2002) used a combination of health educators, tele-counselling and printed materials to successfully influence both tobacco and alcohol use among a national sample of 12–14-year-old adolescents. The intervention targeted a broad spectrum of possible predictors of substance use and communication, including risks substance abuse, normative beliefs, social support, peer and media pressure. In
addition, the intervention focused on family rules and sanctions related to substance use. Using a similar intervention strategy of nurse counselling (rather than health educators) and printed materials for parents, Werch and colleagues (2003) found significant reductions in drinking intention.

Bingham and Shope (2004) found that lower levels of parental monitoring and higher permissiveness were related to subsequent risky driving behaviour among young adults. Parents often set rules with their teenage drivers that relate to drinking and driving, knowing who will be in the vehicle, and when the teenager will be at home (Preusser et al, 1985). Other policies, particularly presence and the number of other teenagers in the vehicle, are less frequently employed (Hartos et al., 2000). Codifying a set of parental rules regarding driving privileges has been found to produce a sustained effect on safe driving behaviour (Simons-Morton et al., 2005). The ‘Checkpoints Program’ begins with initial driving privileges, including the number of passengers, times of the day for driving, and purposes of driving, then gradually allows more privileges as a result of experience and responsible driving behaviour. On the basis of discussion and negotiation between parent and novice driver, a ‘Parent–Teen Driving Agreement’ (Hartos et al., 2001) is developed.

High-reach and adoption rates in parent-delivered health education programmes, however, cannot be assumed. Parents may decide to not participate in health promotion activities or may lose interest during the implementation of a programme due to competing demands on their time (e.g. having a job or being the sole financial provider for a household, having more than one child to care for, already participating in extracurricular activities, care giving an elderly family member, among others). Implementation of parent-delivered programmes may be inconsistent due to different parent–adolescent communication patterns, beliefs about youth autonomy and parental involvement in adolescents’ decision making, as well as in the synchronicity between what parents ask their children and how parents behave themselves. In other words, ‘why are you asking me to do something that you don’t do yourself?’ Finally, the maintenance of successful parent-led behaviour change programmes may have diminishing returns as adolescents move into young adulthood. In other words, as adolescents age, the strength of their parents’ advice may decrease as youths attempt to achieve adult autonomy.

3.4 Peers

Many health education programmes, especially within the areas of violence and sexual behaviour, have relied on adolescents’ peers as a modality to deliver health education messages and promote behaviour change. These programmes have found moderate to high reach in school and community settings. Meta-analyses of peer-led programming among adolescents demonstrate a small but consistent advantage over teacher-led, didactic programming (Gottfredson and Wilson, 2003; Posavac et al., 1999). Peer-led programmes generate greater rapport between adolescents and greater openness around sensitive topics than when addressed by an adult.
Peer-led programmes may face varying degrees of adoption barriers. Depending on the setting and outcome, peer-led interventions may encounter resistance from programme stakeholders. Similar to provider- and parent-delivered programming, peer-led interventions may suffer from inconsistent message delivery. Peer-education programmes supported by schools and community centres report moderate to high maintenance in their behavioural outcomes. Given the brevity of the school experience, however, there is invariably high yearly turnover between peer educators.

The popularity of this approach makes the peer-based modality an enticing approach to adolescent behaviour change. Nonetheless, one must also recognise that peer educators are still adolescents who may still be uncovering and developing the skills required to make informed decisions regarding their health.

### 3.5 Teachers

With the growing pressure to focus teacher attention on specific math, science and reading skills, time and resources devoted to health promotion programming have dwindled. While offering high reach, school-based curricula have had difficulty getting adopted, implemented or maintained. Moreover, the typical health education approach in schools seems to have little long-term impact.

An important finding of the Webb and Sheeran (2006) meta-analysis is that research assistant and health educator-led interventions resulted in higher behaviour change than trained facilitator or teacher-led interventions. This finding suggests that individuals with deep knowledge of the behaviour change process might be more successful in eliciting health behaviour change. Many school-based curricula, even when found to be effective in a research study, are unlikely to be implemented as intended. Teachers tend to minimise interactive experiences, even when part of the planned curriculum, in favour of more traditional didactic approaches (Ennett et al., 2003; Ringwalt et al., 2002).

A Cochrane meta-analysis of school-based smoking prevention programmes found mixed results: half of the best-designed studies failed to show an effect of the intervention. The well-designed and long-running Hutchinson Smoking Prevention Project found no differences in rates of smoking between intervention and control groups at eight-year follow-up. With the notable exception of Botvin's Life Skills Training (Botvin et al., 1995), the effects of school-based curricula have been small (Ennett et al., 1994; Murry et al., 1988). Life Skills Training is a highly resource intensive, comprehensive cognitive-behavioural programme.

### 3.6 Theatre

This non-traditional educational method uses live drama to convey knowledge-, attitudinal-, environmental- and skills-based messages in a vivid manner. Conveying
messages through case histories and testimonials has consistently been found to be more vivid and persuasive than presentation through statistical or didactic methods (Taylor and Thompson, 1982). Moreover, children are involved in the development of the theatre stories, providing peer, coping modelling.

Theatre production has received little attention from researchers, though one study in particular stands out. Perry and colleagues (2002) evaluated theatre production for eating behaviour among children. The production messages focused on social cognitive factors ‘that seemed most predictive of eating behaviours in elementary-aged children and most amenable to change’ (p. 257). These included self-efficacy, knowledge, perceived benefits, perceived barriers and motivation to change. Social environmental factors included influence from peers and family. Using a delayed intervention design, significant improvements were found in knowledge, food choices and food recall.

Detailed guidelines for ‘Theatre-in-Education’ (TiE) for road safety have been developed with support of the Department for Transport (RoSPA, 2003). These guidelines provide clear rationale for such programming and suggestions for the planning, development, implementation and evaluation of theatre production programmes for traffic safety.

### 3.7 Interactive communications technologies

While still an emerging area, randomised trials of internet-based programs have demonstrated positive results for smoking cessation (Strecher et al., 2005; Etter et al., 2005), weight management (Williamson et al., 2005; Tate et al., 2001), hazardous drinking (Kypri et al., 2004), insomnia (Strom et al., 2004), and multiple risk factors (Kypri and McAnally, 2005). A number of these studies were conducted with adolescents and young adults (Williamson et al., 2005; Kypri and McAnally, 2005; Kypri et al., 2004). Joseph and colleagues (in press) used a randomised trial design to compare a tailored, interactive, story-based internet program for asthma control (‘Puff City’) against an existing set of internet sites for asthma control among African-American adolescents with asthma. At the 12-month follow-up, significant reductions in emergency room visits, hospital visits and absenteeism from school were found among subjects assigned to the ‘Puff City’ condition.

As a generation, adolescents and young adults are accessing the internet as a tool in their daily lives, whether to communicate with one another, look for information, buy products or keep track of their school assignments and financial records. Given the high proportion of adolescents with access to a computer terminal, computer-based modalities have the greatest potential to reach a high number of adolescents.

The possibility of creating tailored health promotion messages for adolescents with different beliefs, values and opinions through a vast number of multiple visual and textual materials also facilitates the delivery and scope of health promotion
programmes. Increasingly, governments, insurers, employers and schools are implementing computer-based programming for health promotion programming. Most costs associated with computer-based modalities occur during the development and initial implementation of the intervention. Computer-based health programs generally have high fidelity due to the scalability and stability of the programming.
The evaluation of population-based communications modalities by their potential for influencing recommended psychosocial targets is presented in Table 4.1. Psychosocial targets are divided into factors likely to predict safe driving intention, and those likely to inhibit the relationship between safe driving intention and behaviour. As stated previously, personality is not considered directly modifiable by any of the communications modalities examined. Messages can, however, be created that are tailored to personality traits. By ‘utility’ we are referring to either the potential of changing the predictor or the potential for tailoring effective programming to the predictor. Utility estimates are based on a subjective assessment by the authors of the empirical evidence from driver safety and other health behaviour research.

<table>
<thead>
<tr>
<th>Table 4.1: Utility of psychosocial target by communications modality</th>
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<tr>
<td><strong>Psychosocial target</strong></td>
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<td></td>
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<tr>
<td>Modality</td>
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<tr>
<td>Media</td>
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<tr>
<td>Providers</td>
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<td>Teachers</td>
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<td>Parents</td>
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<td>Theatre</td>
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<td>Computers</td>
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The evaluation of population-based communications modalities by RE-AIM criteria is summarised in Table 4.2. Please note that the ‘Reach’ and ‘Efficacy’ criteria of this summary have been based, when available, on empirical evidence. To evaluate less traditionally studied ‘Adoption’, ‘Implementation’ and ‘Maintenance’ criteria,
we used a combination of empirical evidence, discussions with practitioners and our own experience.

What is the right programme modality for driver safety education? Our conclusion is that no single solution will be completely satisfactory. No single modality creates uniformly high efficacy in changing all relevant psychosocial predictors. No single modality completely addresses all RE-AIM criteria for long-term population-based health programming. It is more likely that a judicious orchestration of modalities will produce the greatest impact on driver safety. We make the following recommendations:

- While not evaluated in the driver safety area, we recommend that interactive computer technologies receive serious consideration as a new driver safety intervention strategy. Evidence supporting the efficacy of interactive computer programs in other areas is strong and growing. Moreover, this modality offers very high reach to adolescents and can be readily scaled to large populations with high quality. This modality is discussed in greater detail in the next section.

- Another recommended modality is parental-based interventions. These interventions have received strong initial support in driver safety and in both smoking and alcohol prevalence. Effects on behaviour from parental interventions are likely to be mediated by personality, identity, affective beliefs and subjective norms. This is clearly a high reach intervention, though adoption, implementation and maintenance on a large scale need to be demonstrated. One option to facilitate adoption, implementation and maintenance is to integrate parental interventions with interactive computer technology (creating a tailored contract on the basis of an assessment completed by the novice driver and parent(s)).

- We also recommend peer-based interventions, which have consistently demonstrated small but finite outcomes. Peers are probably most effective in addressing identity and social norms, both considered important predictors of safe driving behaviour. Again, while reach is high for these interventions, significant attention to implementation and maintenance (due to turnover through high school) is required.

- We conditionally recommend mass media as a modality that can be effectively combined with other interventions. One-size-fits-all mass media interventions that run independently of other strategies have demonstrated little or no behavioural improvement. Moreover, the costs of developing high-quality mass media programming, combined with the very high costs of paying for specific segments of time on particular media channels, is prohibitive.

- Theatre-based programming shows promise but has not been evaluated in the area of driver safety and has only been minimally evaluated in other areas. Theatre-based programming, however, has many appealing features, likely influencing identity, affective beliefs and social norms, and can probably
establish vivid messages for sensation seekers. This type of programming, however, is very time consuming and is likely to have implementation and maintenance challenges. A recent guide supported by the Department for Transport provides excellent, detailed suggestions for adoption, implementation and maintenance (Royal Society for the Prevention of Accidents, 2003).

There are two modalities that we are not recommending: the primary care provider and the teacher. With the exception of resource-intensive cognitive-behavioural curricula (e.g. Life Skills Training), these two communications modalities have consistently failed to demonstrate long-term effectiveness in randomised trials. These two professions are increasingly beleaguered by competing demands for their time; both professions also lack serious training in preventive health counselling.
5 INTERNET-BASED DRIVER SAFETY PROGRAM

5.1 Overview

The proposed tool for driver safety programming among pre-drivers and novice drivers would take full advantage of the data collection, data processing, adaptation and communication features of the internet. Internet access and use is exceptionally high among teenagers (US Census Bureau, 2003). Popular internet subjects among adolescents include disease-related information, diet and nutrition, exercise and fitness, sex, alcohol and drug abuse, mental health, medicines, and violence (Borzekowski and Rickert, 2000).

Why do people use the internet rather than other sources of health information? A Pew Foundation report (Rainie and Packel, 2001) found that 93% of those using the internet for health information thought it was important to obtain the information at any hour. Gustafson et al. (1998) found that the modal time breast cancer patients used an interactive chat room was 2:00 in the morning!

‘You don’t have to speak to people who make you feel bad.’
(quote from adolescent subject: Frisby et al., 2002)

The internet also affords a sense of confidentiality. Blood donors were over 30 times as likely to be positively screened for HIV-related factors using a computer-based interview than through standard Red Cross elicitation procedures, which included both written questionnaires and face-to-face interviews (Locke et al., 1992). Eighty per cent of respondents in the Pew Foundation (Rainie and Packel, 2001) study found the internet particularly useful because they could obtain health information anonymously without having to talk with anyone:

‘...especially if it’s something very personal like it avoids confrontation and you don’t have to be like talking to a public health nurse or doctor about it, you can just like [find it].’
(quote from adolescent subject: Skinner et al., 2003)

A prerequisite for interactivity is the ability to understand the needs of the user, and over a decade of studies have now demonstrated that well-designed computer-based assessments can, at least, rival the validity of assessments using paper-and-pencil, trained interviewers or clinicians (e.g. Hasley, 1995; Bernhardt et al., 2001).

5.2 Theory-informed approaches to health-related programming on the internet

Most existing internet-based programs focused on health-related behaviour change or decision-making lack a conceptual approach to achieving positive outcomes
(Revere and Dunbar, 2001). A review of 24 websites designed to promote physical activity (Doshi et al., 2003) found very low utilisation of health behaviour change theory and a lack of attention to assessment or feedback tailored to the characteristics of the user.

Internet-based health programming continues to be focused on simple information transfer models. As Cline and Haynes (2001) state in their appraisal of the field: ‘Much of the literature reviewed here focuses on the internet as a high-tech conveyor in the rapid diffusion of information or health lessons. However, to do so is to ignore the very nature of the internet.’ The internet offers far more potential than a simple clearinghouse of health information or another form of mass media (Neuhauser and Kreps, 2003; Cassel et al., 1998).

5.3 Tailored interactions on the internet

Computer technologies allow us to tailor messages to the specific psychosocial needs and interests of the user. Tailoring, in this case, involves both the focus on relevant programming as well as the excision of irrelevant programming. The internet offers educational experiences through the user’s own navigation or through experience created by algorithmically-based software within the computer. The latter is termed an ‘expert system’. The driver safety intervention proposed here would include both user-navigated and expert system programming.

5.3.1 User navigation (a vast library at your fingertips)

Once in a site, the user searches for the information relevant to his or her needs and interests. A relevant metaphor to this form of navigation is ‘library’. Similar to a library, the internet has methods of searching for the large amount of available health information. Also like a library, however, the internet does not automatically make available the best information or advice that an individual needs at a particular time. Expecting users to create their own educational experiences is common on the internet, but just as in a library, one might not know just what to search for, or fail to search in the right places.

Users who begin a programme with low levels of knowledge or ability tend to perform poorly in user-navigated environments (Gay, 1986; Steinberg, 1977; Ross and Morrison, 1989). As Ross and Morrison (1989) state: ‘In general, while high achievers seem capable of using most forms of learner control effectively, low achievers seem much less able to benefit from forms that require them to make decisions about instructional properties of a lesson (i.e. what, how and how much information is being taught)’ (p. 29).

Encouraging pre-drivers and novice drivers to create their own educational experience has clear advantages. Users having greater control will likely build self-efficacy from positive experiences. There is a reason, however, that individuals look
to others, lay people and experts, for information and advice. The driver safety programming should therefore also provide guidance tailored to an assessment of psychosocial needs and interests.

### 5.3.2 Expert systems (when you need a coach)

These systems, which have undergone more health promotion research than any other computer-based system, attempt to apply an expert’s assessment, decision rules and feedback strategies to software. The expert systems tested in the health behaviour area typically require:

- a collection of characteristics, at an individual level, relevant to the targeted behaviour change (or movement through stages of change);
- an algorithm that uses these data to generate messages tailored to the specific needs of the user; and
- a feedback protocol that combines these messages in a clear, vivid manner.

The inferences made from the data are an attempt to reflect the standards of a human expert (Velicer, 1993; Negotia, 1985).

An expert system attempts to create an educational experience using methods similar to a real-world encounter with a clinician, counsellor, coach or adviser who initially conducts an assessment. The selection of factors on which to tailor feedback to the user is one of the most important steps in the development of an expert system.

Over the past 10 years, expert system interventions for a variety of health behaviours have been developed and evaluated in diverse settings. A rapidly growing number of research studies have demonstrated that tailored expert system interventions are more effective than generic health education materials, including those tested among underserved populations. These studies cover a range of topics, including smoking cessation, weight management, dietary fat reduction, fruit and vegetable intake, physical activity and cancer screening (Lancaster et al., 2000; Revere and Dunber, 2001; Skinner et al., 1999; Strecher, 1999).

### 5.4 Internet-based driver safety program description: assessment

Rather than a completely user-navigated experience, the internet program would begin with an assessment to determine the specific needs of the pre-driver and novice driver. Using the capabilities of the internet, the assessment would begin with a small number of questions, which would be used to generate a typology of the user. On the basis of this typology, a second set of questions, tailored to the typology, would be asked. The questions asked, and the immediate feedback
provided to the user, should maintain interest in this initial phase of the
programming.

Specific items used in the assessment, and specific typologies created from the
questions, would be determined on the basis of consultation with driver safety
experts in the field. The items, however, would be associated with the most relevant
psychosocial constructs of the conceptual model of driving behaviour previously
described:

• personality;
• identity;
• benefits of unsafe driving;
• affective beliefs;
• subjective norms;
• task difficulty; and
• habit.

An example of a typological structure was developed by Fylan and colleagues
(Fylan et al., 2006). These typologies relate to speeding behaviour and would need
to be significantly modified for pre-drivers and novice drivers, but the
methodological approach and rigor are relevant. Their typologies include the
following:

• **Unintentional speeders** – drivers unaware of the speed limit, who
  underestimate their speed, and/or who have attention lapses that cause speeding.

• **Moderate occasional speeders** – drivers who perceive themselves as safe,
  skilled drivers and whose speeding is only moderately over the limit. There is
  not a perceived benefit (e.g. pleasure) from speeding and road rules are generally
  not violated.

• **Frequent high speeders** – drivers who are aware that they drive faster than
  others and intend to drive faster. These drivers are also aware that they are at
  increased risk, though believe they are safe from injury or death. They perceive
  emotional benefits from driving.

• **Socially deviant drivers** – drivers who know that their driving speed is
dangerous, but enjoy taking such risks and breaking rules. These drivers, in
particular, perceive benefits of speeding.
Early in the internet program, an assessment would determine the typology of the driver and provide initial feedback. For example:

‘You told me that you usually drive faster than others on the road. You know that it is risky to drive this way but you also believe that your driving is safe.’

‘I’d like to ask you a few more questions about the benefits you get from driving fast, and some of the things you feel when you’re driving fast . . .’

Questions would then be related to the issues relevant within the typology. For example, a frequent high speeder would be asked about personality, identity and specific affective benefits derived from driving and speeding. Note that in this example we have personified the internet program. This can be done both graphically (i.e. providing a graphic image of a coach/counsellor/adviser) through video, audio and pictures, and through text messaging. Recent evidence from the MIT Media Laboratory suggests that this personification of the program elicits greater engagement with the computer.

In her 1995 book *Life on the Screen: Identity in the Age of the Internet*, ethnologist Turkle (1995) suggests that trends in computer interface design and artificial intelligence and in people’s experiences in virtual environments will lead to new ways of interacting with computers. Turkle also suggests that the new generation of computer users no longer give commands, but enter into dialogues and long-term relationships with the computer. Interactive multimedia allows the user to interact ‘on the fly’ – sending and receiving messages during the same interaction period, much like a conversation with a friend or counsellor. The process of asking initial questions, developing a typological profile of the user, then following up with questions relevant to the profile, is very similar to how an initial psychological consultation might proceed. Feedback provided by the computer of the type of driver profile is likely to elicit further interest in the program.

In addition to assessment only for the pre-driver and novice driver, we envision an assessment, where relevant, for parents as well. This assessment would be used to develop a behavioural contract with the pre-driver and novice driver for use of the automobile. This contract is described in further detail in the next section.

5.5 **Internet-based driver safety program description: tailored messaging**

Lawton and colleagues (in press) suggest that interventions for speeding behaviour should avoid a one-size-fits-all approach. Yet, the findings of Ennett et al. (2003) for school-based health promotion programmes are, indeed, implemented in a didactic, lecture-like, one-size-fits-all format. Typical classroom-based driver safety courses
focus on the reasons for speeding, consequences of speeding, individual responsibility, stopping distances, likelihood of killing pedestrians, the purpose of speed cameras, identifying the speed limit, hazard perception, practical safety tips and appropriate speed selection (Fylan et al., 2006). It is not likely that every pre-driver and novice driver requires each of these programme elements. An internet-based driver safety program would be able to use assessment data to generate a tailored education experience for the user. Tailored internet-based driver safety programming could focus on areas of greatest need while excising irrelevant information and activities.

Particular areas for tailoring are reflected in the conceptual framework for safe driving described earlier. These areas are also described by both Fylan and colleagues (2006) and Lawton and colleagues (in press):

- **Attitudes and values** – relevant messages could be tailored to specific attitudes of the user, including the appropriateness of speeding, whether speeding saves a significant amount of time, and the illegal nature of speeding, among others. Relevant values-based messages and imagery could be tailored to the specific values of the user, including the importance of being an exemplar to family and friends, of being cool, of being in control, of being responsible, among others. Related to this is the identity one assumes as a driver. The internet-based program would tailor messages directed towards the identity of a skilled driver as one who drives at the appropriate speed (Lawton et al., in press) and who maintains composure under stressful circumstances.

- **Social norms** – in other health behaviour areas, social norms have been addressed through: (a) pointing out the actual behaviours of others, which generally reflect lower rates of problematic behaviour, (b) identifying high-risk situations (e.g. when other teenage males are in the car), and (c) methods for countering social pressure. All three of these strategies could be tailored to users for whom social norms is identified as a potential influence of unsafe driving behaviour.

- **Task difficulty** – the internet program would focus on driving skills through an assessment of previous driving experiences (difficulties in detecting hazards, use of the instrumentation panel for scans of speed). Among users with low self-efficacy, tailored messages could provide suggestions for better detecting hazards, better use of the instrument panel, trip planning, and other safe driving skills. Following Lawton and colleagues’ (in press) recommendations, the programming would also focus on perceived control over the speed a driver adopts: that one had direct control over the accelerator.

- **Anticipated affect** – recent evidence from Lawton and colleagues (in press) suggest that affective beliefs (e.g. worry, guilt, anxiety, enjoyment) predict greater driving speed to a greater extent than do instrumental beliefs (e.g. harmful, safe, timely). A second study in the area of smoking (also by Conner and being prepared in the same manuscript) confirms the importance of
emotions on behaviour. The internet program would both elicit and address affective beliefs regarding unsafe driving. An important component of this programming might be the affective benefits of safer driving, such as feeling less anxious or stressed (Lawton et al., 2006).

• **Benefits of unsafe driving** – a recent study by McKenna and Horswill (2006), combined with evidence from Lawton and colleagues (in press) suggest that positive beliefs regarding unsafe driving are associated with driving behaviour. These beliefs are likely to evolve from more frequent, immediate feedback provided by fast driving and positive outcomes (e.g. getting to the destination faster, exhilaration) and the lack of negative outcomes (e.g. a crash, a traffic fine). While not a focus of traditional models, such as the Health Belief Model, positive beliefs of unsafe behaviour are central to Motivational Interviewing, where such beliefs are acknowledged and discussed along with countervailing beliefs, attitudes and values.

• **Implementation intentions** – Gollwitzer (1999) defines this extension of the Theory of Planned Behaviour as a ‘plan of how, where and when to commit a behaviour’. With respect to safe driving behaviour, an implementation intention could establish a plan to avoid driving with teenage males in the automobile during the first year of driving. Elliot and Armitage (2006) recently found that the specification of implementation intentions influenced self reported compliance with speed limits. The implementation intention construct may be readily assessed and provides a clear direction for tailored intervention.

• **Impairment** – while this internet-based program would not include formal substance abuse or sleep-deprivation programming, messages specifically identifying the impairment caused by substance abuse and sleep deprivation would be included. Suggestions for avoiding alcohol and drugs before and during driving, and for avoiding sleep deprivation, would also be included. A recent study by Strom and colleagues (2004) found beneficial effects of an internet-based treatment for insomnia using self-help strategies of sleep restriction, stimulus control, information about sleep hygiene and cognitive restructuring, among other strategies.

• **Personality** – in our conceptual framework, we identify sensation seeking, Type A, anger and hostility as predictors of unsafe driving. While one is not likely to significantly change personality traits through a behavioural intervention, it may be possible to identify and tailor to these traits (Lawton et al., in press).

• **Parental restriction of teenage driving privileges** – parents often set rules with their teenage drivers that relate to drinking and driving, knowing who will be in the vehicle, and when the teenager will be at home (Preusser et al., 1985). Other policies, particularly the presence and number of other teenagers in the vehicle, are less frequently employed (Hartos et al., 2000). Codifying a set of parental rules regarding driving privileges has been found to produce a sustained effect on safe driving behaviour (Simons-Morton et al., 2005). The Checkpoints
5.6 Internet-based driver safety program description: communication strategies

The internet affords a variety of interactive communication strategies, yet few programs on the internet take advantage of its vast interactive capabilities. The communications strategy of these messages can also vary greatly and should itself be aligned with the cognitive capabilities of the user. Research on Cognitive Load Theory (Sweller, 2006; Pass et al., 2003) focuses on the interaction between a user’s very limited working memory and their nearly unlimited long-term memory. Working memory is required to rehearse and encode new information for storage into long-term memory in the form of mental structures called schemas. When new information is presented in a format that calls up an existing schema, the need for limited working memory is reduced.

Providing information in a manner that primes informational (e.g. an automobile on a slippery road) or archetypal (e.g. hero, cool, father) schema from long-term memory may result in less need for working memory and greater encoding into long-term memory. This may be particularly true for those who have particularly limited working memory capacity. For example, Bakker (1999) found that a comic-book version of HIV prevention messages was more likely to positively influence attitudes regarding HIV prevention among subjects with a low need for cognition than a text-based, didactic version of the same materials.

Similarly, the use of models, testimonials and case histories similar to the user may stimulate greater attention to the message, greater cognitive elaboration, and subsequent changes in attitudes and behaviour (Bull et al., 1999). In our own recent research, we have found that highly tailored testimonials of smokers were more likely to influence smoking cessation than less-tailored testimonials. The information was tailored to the smoker’s specific cessation barriers, motives, social environment, smoking history and demographics. This suggests that the narratives of other drivers tailored to be similar to the user might be an effective communication strategy. Khalil and colleagues (2005) provide strategies that maximise the efficient use of working memory in communications. These strategies include tailoring the degree of learner control over the programming (more control...
for advanced learners) and multiple modalities (e.g. oral and visual for novices; control buttons to include text for advanced learners).

5.7 Internet-based driver safety program description: data centrism

A significant advantage of internet-based programs is their ability to collect and store assessment and use data. These data can be used to refine assessments over time, monitor frequency of use, and determine navigational patterns. Assessment and use data could also be merged with outcomes data, such as traffic accidents and violations. If this is not possible, internet-based follow-up surveys could assess similar data.

This program could also provide a research platform for traffic safety researchers. If every pre-driver and novice driver in the UK were required to complete this assessment, it would be an invaluable source of data for researchers to continually improve our understanding of psychosocial and other predictors, while also testing new components of the programming. Given the rapidly evolving nature of the internet, the potential of these programs is vast. Moreover, the data-centric nature of internet-based driver safety programming allows for continuous quality improvement and rapid feedback to policymakers.
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