Author(s): Brown, D.J.; Hagger, Martin; Morrissey, S.; Hamilton, K.

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D.J. Brown, M.S. Hagger, S. Morrissey, K. Hamilton

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Predicting fruit and vegetable consumption in long-haul heavy goods vehicle drivers: Application of a multi-theory, dual-phase model and the contribution of past behaviour

D. J. Brown[a], M. S. Hagger[abc], S. Morrissey[a], K. Hamilton[ab]

[a]School of Applied Psychology and Menzies Health Institute, Griffith University, BRISBANE, Australia.

[b]School of Psychology and Speech Pathology and Health Psychology and Behaviour Medicine Research Group, Curtin University, PERTH, Australia

[c]Faculty of Sport and Health Sciences, University of Jyväskylä, JYVÄSKYLÄ, Finland

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Correspondence concerning this article should be addressed to Dr. Kyra Hamilton, Health and Psychology Innovaitons (HaPI) Research Lab, School of Applied Psychology, Griffith University, 176 Messines Ridge Road, Mt Gravatt, QLD 4122.

Email: kyra.hamilton@griffith.edu.au or hapiresearch@gmail.com

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Abstract

Fruit and vegetable intake is insufficient in industrialized nations and long-haul heavy goods vehicle (HGV) drivers are considered a particularly at-risk group. The aim of the current study was to test the effectiveness of a multi-theory, dual-phase model to predict fruit and vegetable consumption in Australian long-haul HGV drivers. A secondary aim was to examine the effect of past fruit and vegetable consumption on model paths. A prospective design with two waves of data collection spaced one week apart was adopted. Long-haul HGV drivers (N = 212) completed an initial survey containing theory-based measures of motivation (autonomous motivation, intention), social cognition (attitudes, subjective norms, perceived behavioural control), and volition (action planning, coping planning) for fruit and vegetable consumption. One week later, participants (n = 84) completed a self-report measure of fruit and vegetable intake over the previous week. A structural equation model revealed that autonomous motivation predicted intentions, mediated through attitudes and perceived behavioural control. It further revealed that perceived behavioural control, action planning, and intentions predicted fruit and vegetable intake, whereby the intention-behaviour relationship was moderated by coping planning. Inclusion of past behaviour attenuated the effects of these variables. The model identified the relative contribution of motivation, social cognition, and volitional components in predicting fruit and vegetable intake of HGV drivers. Consistent with previous research, inclusion of past fruit and vegetable consumption led to an attenuation of model effects, particularly the intention-behaviour relationship. Further investigation is needed to determine which elements of past behaviour exert most influence on future action.

Introduction

Professional long-haul heavy goods vehicle (HGV) drivers are a population that is particularly at risk of chronic disease. Drivers spend long hours in a single, sedentary body posture, have poor sleep hygiene, and lack adequate nutrition (Apostolopolous, Sonmez, Shattell, Gonzales, & Fehrenbacher, 2013; Birdsey et al., 2015; Sieber et al., 2014). It is, therefore, not surprising that long-haul HGV drivers have been documented to have obesity rates three times higher than the average population (Birdsey et al., 2015), with other studies reporting over 80% of the sample of HGV drivers being overweight or obese (Body Mass Index $\geq$ 25) (Hamilton, Vayro, & Schwarzer, 2015). In an attempt to address the health risks associated with long-haul driving and to understand the poor health habits of this at-risk group, studies have investigated the social and psychological beliefs that may guide long-haul drivers' eating decisions. For example, Vayro and Hamilton (2016) identified a number of salient behavioural, normative, and control beliefs that relate to HGV drivers' dietary decisions, which is consistent with previous research in other health behaviour contexts (Chan et al., 2015; Cowie & Hamilton, 2014; Hamilton, Kirkpatrick, Rebar, White, & Hagger, 2017; Hamilton, Peden, Pearson, & Hagger, 2016; Hamilton, White, et al., 2012; Rowe et al., 2016; Tanna, Arbour-Nicitopoulos, Rhodes, Leo, & Bassett-Gunter, 2015), and eating behaviours in the general population (Sainsbury & Mullan, 2011; Spinks & Hamilton, 2015).

The elicitation of the salient beliefs provides a starting point for examining the multiple social psychological factors that likely underpin drivers' decisions to consume fruit and vegetables. The beliefs are components of broader behavioural theories derived from social psychology that may provide a framework for identifying the salient factors that relate to fruit and vegetable consumption, and the processes by which they affect behaviour. The purpose of the current study was to apply a behavioural model comprising constructs from multiple social cognitive and motivational theories to predict fruit and vegetable consumption in long-haul HGV drivers. The model incorporates multiple processes purported to underpin behaviour, including the factors that determine intentions to act, the mechanism by which the intentions are enacted, and how past participation in the behaviour may affect the determinants of subsequent behavioural enactment.

Multi-theory, dual phase model of fruit and vegetable consumption

Many theories applied to predict and understand health-promoting dietary behaviours have adopted a social cognitive perspective. According to the theories, engaging in dietary behaviours is a deliberative and intentional process (Ajzen, 1991, 2011) and intention is assumed to be the most proximal antecedent of behavioural engagement (Armitage & Conner, 2000; Conner & Norman, 2015). Prominent among intentional theories applied to dietary behaviour is the theory of planned behaviour (TPB; Ajzen, 1991; Emanuel, McCully, Gallagher, & Updegraff, 2012; Guillaumie, Godin, & Vézina-Im, 2010; Kothe, Mullan, & Butow, 2012). According to the TPB, intentions to perform a given behaviour in the future is a function of attitudes (i.e., the positive or negative evaluations of performing the behaviour), subjective norms (i.e., the perceived social expectations to perform the behaviour), and perceived behavioural control (i.e., the amount of control an individual believes he/she have over performing the behaviour). The TPB has been shown to account for up to 41% of the variance in intention and 35% of the variance in behaviour across a number of health related behaviours (Conner & Armitage, 1998; Godin & Kok, 1996; McDermott et al., 2015; Riebl et al., 2015; Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008) including up to 41% of the variance in intention and 45% of the variance in dietary behaviours (Collins & Mullan, 2011; Fila & Smith, 2006; Guillaumie et al., 2010; Hamilton, Daniels, White, Murray, & Walsh, 2011; Mullan, Wong, & Kothe, 2013; Mullan, Wong, Kothe, & Maccann, 2013; Spinks & Hamilton, 2016; White, Terry, Troup, Rempel, & Norman, 2010). The TPB will therefore form the basis of the current hypothesised model. However, research applying the TPB in health behaviour has identified substantive limitations (Sniehotta, Presseau, & Araújo-Soares, 2014). Sniehotta et al. (2014) has been particularly critical of the future use of the TPB as a sole behavioural change framework. Prominent limitations of the TPB include the lack of explicit detail on why certain beliefs are pursued (Hagger & Chatzisarantis, 2009), and the imperfect link between intentions and behaviour suggesting that while many individuals tend to make intentions to perform health behaviours, many do not act on them (Orbell & Sheeran, 1998). Integrating other theoretical perspectives has been recommended as a possibility to address these limitations and provide a more effective explanation of the determinants of dietary behaviour (Sniehotta et al., 2014). A number of theoreticians and researchers have proposed and tested 'extended' or integrated models of behaviour change such as the integrated behaviour change model (Hagger & Chatzisarantis, 2014), the integrated model of behavioural prediction (Fishbein & Yzer, 2003), and the trans-contextual model (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003).

One perspective that may assist in explaining the origins of people's beliefs regarding health behaviours is self-determination theory (SDT). The theory is an organismic, macrotheory of human motivation which focuses on motivation quality rather than intensity (Deci & Ryan, 1985, 2008b). SDT identifies two broad types of motivation: autonomous and controlled. Autonomous motivation refers to the engagement in an activity because it is perceived to be self-endorsed, freely chosen, and absent from any external contingency. In contrast, controlled motivation reflects acting due to externally-referenced pressure or contingency, or to attain a reward or avoid punishment (Deci & Ryan, 2008a, 2008b). According to SDT, it is autonomous motivation that is the most likely form of motivation to be related to persistence on tasks and attainment of adaptive outcomes (e.g., positive affect, enjoyment, interest, well-being) because the reasons for participating are consistent with an individual's true autonomous self. In contrast, controlled motivation is related to persistence only as long as the controlling contingencies are present, and is not related to adaptive outcomes. Deci and Ryan (1985) explicitly align motivational forms from SDT with social cognitive factors that underpin behaviour. They suggest that individuals perceiving a given behaviour to be autonomously motivated are likely to strategically align their beliefs about performing the behaviour in future (e.g., attitudes, perceived behavioural control) with their motives. Research has shown that individuals classify their beliefs accordingly (Chatzisarantis, Hagger, Wang, & Thøgersen-Ntoumani, 2009; Hamilton, Cox, & White, 2012; McLachlan & Hagger, 2011; Wilson & Rodgers, 2004) and formed the basis of an integrated model in which autonomous beliefs served as an antecedent of the belief-based constructs from the TPB (Hagger & Chatzisarantis, 2009). The integrated TPB and SDT model provides a basis for the antecedent beliefs from the TPB and demonstrates the process by which generalized motives are enacted.

Research applying the model that integrate the TPB and SDT in health behaviour contexts has demonstrated significant effects of autonomous motivation on the belief-based constructs from the TPB (attitudes, subjective norms, and perceived behavioural control), significant effects of belief-based constructs on intentions, and a significant intention-behaviour relationship (Girelli, Hagger, Mallia, & Lucidi, 2016; Hagger, Trost, Keech, Chan, & Hamilton, 2017; Hamilton, Cox, et al., 2012; Hamilton, Kirkpatrick, Rebar, & Hagger, 2017). Importantly, significant effects of autonomous motivation on behaviour were found mediated by the belief-based constructs from the TPB and intentions. An earlier meta-analysis examining the cumulative findings of research on the integrated TPB and SDT model in health-related behaviour context supported its predictions (Hagger & Chatzisarantis, 2009). Specifically, attitudes, subjective norms, and perceived behavioural control were able to mediate the relationship between autonomous motivation and intentions. These effects have been predominantly tested using prospective studies with follow-up periods ranging from one to five weeks (Hagger & Chatzisarantis, 2009). One study investigated the integration of SDT variables with the TPB in a three-wave prospective design in two university samples; one for diet and one for exercise behaviours (Hagger, Chatzisarantis, & Harris, 2006). Structural equation modelling supported the sequence of indirect effects in exercise behaviours and both the direct and indirect effects of the sequence in dieting behaviours. Given the effectiveness of the model in accounting for variance in the antecedents of intentions and health behaviour, the current investigation adopted a model that integrated constructs from the TPB and SDT to explain fruit and vegetable consumption in long-haul HGV drivers. Specifically, we included autonomous motivation as a direct predictor of attitudes, subjective norms, and perceived behavioural control. We did not include controlled motivation for three reasons. First, controlled motivation has a limited role relative to autonomous motivation as a determinant of adaptive behavioural outcomes (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003). Second, meta-analytic research (Chatzisarantis et al., 2003; Howard, Gagné, & Bureau, 2017) supports the notion that autonomous and controlled motivation can be conceptualised as operating on a continuum. For example, graduated indexes of motivation based on weighted composites of autonomous and controlled forms of motivation tend to correlate well with single measures of autonomous motivation (Pelletier & Sarrazin, 2007). Finally, the single construct of autonomous motivation reduces the number of constructs in an already complex model.

This model alone, however, does not provide sufficient explanation for people's failure to implement their intentions. Sheeran (2002) identified an intention–behaviour 'gap' in social cognitive models, noting that a substantial proportion of individuals who stated having an intention to act often failed to do so, an effect noted in many studies of health behaviour (Orbell & Sheeran, 1998; Rhodes & Bruijn, 2013). One perspective on the shortfall in the prediction of health behaviour by intentions comes from dual-phase models of behaviour, such as Heckhausen and Gollwitzer's (1987) model of action phases and Schwarzer's (1992) health action process approach (HAPA). The model of action phases differentiates between a motivational phase, in which intentions are formed, and a volitional phase, in which action is initiated (Heckhausen & Gollwitzer, 1987). Heckhausen and Gollwitzer (1987) noted that many people, after forming an intention, forget to carry the intention out or miss cues to initiate the action. They identified that after an intention is formed, individuals need to engage in planning to provide an explicit link between relevant cues in the environment or social context and action initiation.

Planning is a key self-regulatory strategy in the volitional phase which has been shown to 'bridge' the intention-behaviour 'gap' (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; Hamilton, Bonham, Bishara, Kroon, & Schwarzer, 2017; Hamilton, Kothe, Mullan, & Spinks, 2017). Planning is conceptualised as comprising both action planning and coping planning. Action planning is a task-facilitating self-regulation strategy where individuals specify relevant cues to an intended behaviour (Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012). This is usually achieved by prompting individuals to state when, where, and how the behaviour will be carried out (Hagger & Luszczynska, 2014; Sniehotta, 2009). Coping planning is a self-regulation strategy where individuals anticipate barriers that may hinder performance and mentally link an appropriate response (Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Action planning variables have been hypothesised to act as a mediator (Schwarzer, 2008) and moderator (Heckhausen & Gollwitzer, 1987; Hagger and Chatzisarantis, 2009) of the effect of intentions on behaviour. The moderating relationship is consistent with the prediction of the model of action phases (Heckhausen & Gollwitzer, 1987), suggesting that introducing plans lead to stronger effects of intentions on behaviour. Empirical literature has shown support for this effect (de Bruijn, Rhodes, & van Osch, 2012;

Norman & Conner, 2005; Wiedemann et al., 2009). The mediation account suggests that intentions are enacted because individuals engage in planning, consistent with hypotheses from the HAPA and recently referred to as a *dual mediation model* (Carraro & Gaudreau, 2013). Empirical literature has also provided support for this effect (Schwarzer et al., 2010; Schwarzer et al., 2007; Zhou et al., 2015). In the current study, we aim to augment the integrated TPB and SDT model to incorporate volitional components from dual phase models in an integrated multi-theory, dual-phase model to predict long-haul HGV drivers' fruit and vegetable consumption. Specifically, we propose that action and coping planning will mediate and moderate the intention–behaviour relationship, consistent with the model of action phases and HAPA, respectively.

Our proposed multi-theory, dual-phase model reflects the hypotheses derived from motivational and social-cognitive theories which assume behaviour is enacted through a deliberative process (Ajzen, 1991; Deci & Ryan, 1985). Evidence, however, also indicates that implicit and automatic processes may play an important role in health behaviour decision making (Hagger & Chatzisarantis, 2014; Strack & Deutsch, 2004). Individuals' past actions therefore, may be important to consider. There is consistent evidence that including past behaviour as a predictor of behaviour in tests of social cognitive models increases the amount of explained variance in intentions and, particularly, future behaviour (Aarts, Verplanken, & Knippenberg, 1998; Ouellette & Wood, 1998; Verplanken & Orbell, 2003). Researchers suggest two functions for past behaviour. First, it likely models habitual processes, that is, the aspects of behaviour that are unaccounted for by the social cognitive components that reflect deliberative, reasoned decision-making in advance of acting. This is modelled by the unique effects of past behaviour on future behaviour that bypass intentions and its antecedents in social cognitive models. Second, past behaviour may reflect effects of unmeasured constructs on behaviour. It is possible that these may be deliberative but not accounted for by the specified social cognitive variables, or implicit, which may reflect non-conscious beliefs related to automatic, non-conscious processes. Despite the importance of past behaviour on future behaviour, research has rarely explicitly tested the impact of past behaviour on individual or integrated health behaviour models. Importantly, for the current investigation, long-haul HGV drivers often follow a relatively fixed driving schedule and route which determines where and when they can eat. It is therefore likely that long-haul drivers' dietary decisions may be guided by routine and, thus, strongly affected by past behaviour. We aimed to test the impact of past behaviour on the multi-theory, dual-phase model's ability to predict and explain fruit and vegetable consumption for long-haul HGV drivers.

The Current Study

The aim of the current study was to test a multi-theory, dual-phase model to predict fruit and vegetable consumption in a sample of long-distance HGV drivers in Australia. The proposed model is presented in Figure 1 and hypothesized relations among model constructs are summarised in Table 1. The motivation phase comprised hypotheses derived from research integrating the TPB (Ajzen, 1991) and SDT (Ryan & Deci, 2000). Given that research has shown that autonomous motivation acts as a distal predictor to the belief-based antecedents of action from the TPB (Hagger & Chatzisarantis, 2009), autonomous motivation was expected to predict attitudes (H_1), subjective norms (H_2), and perceived behavioural control (H_3). Consistent with the TPB, attitudes (H_4), subjective norms (H_5), and perceived behavioural control (H_6) was expected to predict intention, intention was expected to predict behaviour (H_7) and perceived behaviour control (H_8) was also expected to directly predict behaviour to the extent that it acts as a proxy for actual control (Ajzen, 1991). The volitional phase of the hypothesised model integrates hypotheses from the model of action phases (Heckhausen & Gollwitzer, 1987) and the HAPA (Schwarzer, 2008). It was expected that intention would predict action planning (H_9) and coping planning (H_{10}), and action planning

(H_{11}) and coping planning (H_{12}) were hypothesized to predict behaviour. It was expected that there would be no direct relationship between autonomous motivation and behaviour (H_{13}). We also expected action planning (H_{14}) and coping planning (H_{15}) to moderate the intention on behaviour relationship. A number of indirect relationships were also expected. We predicted that attitudes (H_{17}), subjective norms (H_{18}), and perceived behavioural control (H_{19}) would have indirect effects on behaviour mediated by intention. Autonomous motivation was hypothesised to predict intention (H_{20}) and behaviour (H_{21}) indirectly, mediated by the social cognitive variables in the model. The effects of intentions on behaviour were expected to be mediated by action planning (H_{22}) and coping planning (H_{23}), respectively, consistent with hypotheses from the HAPA. Collectively, these hypotheses replicate the explicit components of reflective and deliberative processes. We also predicted that past behaviour would significantly and directly predict all constructs in the hypothesised model (H_{16}). However, consistent with theory and findings from the literature on past behaviour frequency and habit (Ouellette & Wood, 1998; Perugini & Bagozzi, 2001; Rothman, Sheeran, & Wood, 2009) we expected that effects in the model would be attenuated with the inclusion of past behaviour. The attenuation notwithstanding, we predicted that the pattern of effects proposed in the theory would remain statistically significant. We expected results would demonstrate the relative contribution of constructs from the two phases (motivational and volitional) on fruit and vegetable consumption as well as the effect of past behaviour on motivational and social-cognitive constructs.

Table 1. Summary of hypothesised direct and indirect effects in the multi-theory, dual phase model of fruit and vegetable consumption

Hypothesis	**Independent Variable**	**Dependent Variable**	**Mediator**	**Prediction**[a]
Direct effects				
H_1	Autonomous motivation	Attitude	-	Effect (+)
H_2	Autonomous motivation	Subjective norm	-	Effect (+)
H_3	Autonomous motivation	Perceived behavioural control	-	Effect (+)
H_4	Attitude	Intention	-	Effect (+)
H_5	Subjective norm	Intention	-	Effect (+)
H_6	Perceived behavioural control	Intention	-	Effect (+)
H_7	Intention	Behaviour	-	Effect (+)
H_8	Perceived behavioural control	Behaviour	-	Effect (+)
H_9	Intention	Action planning	-	Effect (+)
H_{10}	Intention	Coping planning	-	Effect (+)
H_{11}	Action planning	Behaviour	-	Effect (+)
H_{12}	Coping planning	Behaviour	-	Effect (+)
H_{13}	Autonomous motivation	Behaviour	-	No effect
H_{14}	Action planning x Intention	Behaviour	-	Effect (+)
H_{15}	Coping planning x Intention	Behaviour	-	Effect (+)
H_{16}	Past behaviour	Autonomous motivation Attitude Subjective norms Perceived behavioural control Intention Action planning Coping planning Behaviour	-	Effect (+)
Indirect effects				
H_{17}	Attitude	Behaviour	Intention	Effect (+)
H_{18}	Subject norm	Behaviour	Intention	Effect (+)
H_{19}	Perceived behavioural control	Behaviour	Intention	Effect (+)
H_{20}	Autonomous motivation	Intention	Attitude Subjective norm Perceived behavioural control	Effect (+)
H_{21}	Autonomous motivation	Behaviour	Attitude Subjective norm Perceived behavioural control Intention	Effect (+)
H_{22}	Intention	Behaviour	Action planning	Effect (+)
H_{23}	Intention	Behaviour	Coping planning	Effect (+)

Note. [a]Denotes whether the hypothesis specifies a positive (+) effect, or no effect.

Method

Participants and procedure

Participants (N = 212; M_{age}= 45.18, SD_{age} = 11.90) were male, long-haul heavy HGV drivers, who drove a ≥ 12-tonne HGV, travelled at least 200km in one work period, and spent most of their work time driving (weekly driving hours, M = 67.20, SD = 15.08). Drivers were recruited face-to-face at HGV events/locations (e.g. HGV stops, HGV charity events) and through social media (e.g. Facebook groups) and offered the opportunity to enter into a draw to win one of three AUD100 gift vouchers as an incentive to participate. The study received approval from the Institution Human Research Ethics Committee. A prospective-correlational design was used. At Time 1 (T1), participants completed a survey either face-to-face (N = 132) or online (N = 80) assessing social cognitive and motivational measures as well as demographic factors. One week later (Time 2; T2), participants completed a follow-up survey assessing their FV intake over the previous week. Participant data across the time points was anonymized and matched using a unique code identifier created by the participant.

Measures

Social cognitive and motivational constructs (i.e., attitudes, subjective norms, perceived behavioural control, and intention) were measured on previously-validated multi-item psychometric instruments developed using standardised guidelines (Ajzen, 1991; Ryan & Connell, 1989; Sniehotta et al., 2005) adapted to make reference to the target behaviour in the current study. These guidelines are consistently used in research on dietary behaviours (Fila & Smith, 2006; Hagger et al., 2017; Spinks & Hamilton, 2016; White et al., 2010). Brief details of the measures are provided below, and a full set of items are available in Appendix A (supplemental materials). Items from each instrument were used as indicators of latent variables representing each model construct in a structural equation model. We referred to the target behaviours in each measure as: "eat fruit and vegetables following the recommended serves each day in the next week". The definition is in accordance with health-promotion guidelines (i.e., five serves of vegetables and two serves of fruit) and time frame (i.e. per day) derived from Australian dietary guidelines for adult males (National Health and Medical Research Council, 2013). The health-promotion guidelines including examples of portion sizes for one serving of fruit and vegetable were provided to participants at the beginning of the survey.

Behavioural intention was measured by three items (e.g., "I intend to eat fruit and vegetables following the recommended serves every day…") on 7-point scales with 1 (*strongly disagree*) and 7 (*strongly agree*) as endpoints. Attitude was measured on four items with responses provided on 7-point semantic differential scales (e.g., "For me to eat fruit and vegetables following the recommended serves every day in the next week would be…,") from 1 (*unfavourable*) to 7 (*favourable*). Subjective norm was measured on three items (e.g., "Most people who are important to me would approve of me eating fruit and vegetables following the recommended serves every day…,") with responses made on a 7-point scale with 1 (*strongly disagree*) and 7 (*strongly agree*) as end points. Perceived behavioural control was measured using two items on a 7-point scale (e.g. "I have complete control over whether I eat fruit and vegetables following the recommended serves every day…,") with 1 (*strongly disagree*) and 7 (*strongly agree*) as endpoints. Autonomous motivation was measured using an adapted version of Ryan and Connell's (1989) measure. Participants were presented with a common stem: "The reason I would eat the recommended serves of fruit and vegetables each day …" followed by four reasons relating to autonomous motives on a 7-point scale (e.g., "Because I personally believe it is the best thing for my health…,") with 1 (*not at all true*) and 7 (*extremely true*) as end points. A measure of action planning and coping planning for the target behaviour was developed based on Sniehotta et al.'s (2005) recommendations. Action planning was measured starting with the stem "I have made a plan regarding…"

followed by four items (e.g., “when to eat fruit and vegetables”) on a 7-point scale from 1 (*not at all true*) to 7 (*extremely true*) as endpoints. Coping planning was measured using four items on the same 7-point scale and stem as action planning (e.g., “What to do if something interferes with my plan). Behaviour at T2 was measured consistent with Australian Dietary Guidelines using three self-report questions (e.g., “In the previous week, to what extent did you eat fruit and vegetables following the recommended serves every day?”). Two of the items used a 7-point scale including from 1 (*not at all*) to 7 (*a large extent*) as end points and one item (i.e., “In the previous week, on how many days did you eat fruit and vegetables following the recommended serves every day…”) used an 8-point scale from 0 days to 7 days as endpoints.

Data Analysis

Variance-based structural equation modelling (VB-SEM) was used to test our hypothesised model. VB-SEM is similar to covariance-based SEM, but is based on ranked rather than ordinal data and is therefore distribution-free and less affected by model complexity, sample size, or departures from normality (Henseler, Ringle, & Sinkovics, 2009). Models were estimated using the Warp PLS v5.0 software (Kock, 2015). Missing data (total missing data = 4.24%) were treated using hierarchical regression imputation. All paths among constructs detailed in Figure 1 and the hypotheses listed in Table 1 were specified as free parameters in the model. In addition, we statistically controlled for the effects of age and past behaviour by setting these variables as predictors of all other variables in the model. Moderator effects were modelled using the product-indicator procedure described and validated by Chin, Marcolin, and Newsted (2003).

Validity of the proposed measures was assessed by observing the measurement aspects of the SEM. The loading of each indicator on its respective latent factor were expected to exceed .700. Composite reliability coefficients (ρ) and average variance extracted (AVE) statistics, which test the sufficiency of scale items as indicators of the latent variables and whether the items account for sufficient variance in the factor, respectively, were expected to exceed .700 and .500. Discriminant validity was assessed by observing that the square-root of the AVE for each latent variable exceeds its correlation coefficient with other latent variables. Overall model fit was evaluated using multiple criteria: the goodness-of-fit (GoF) index with values of .100, .250, and .360 corresponding to small, medium, and large effect sizes, respectively, the average path coefficient (APC) and the average R^2 (ARS), both of which should be significantly different from zero for an adequate model, and the average variance inflation factor for model parameters (AVIF) statistic, with values less than 5.000 indicating a well-fitting model (Kock, 2015).

Results

Participants and attrition analysis

One hundred and thirty participants dropped out of the study after completing the initial T1 survey resulting in a final sample of 84 participants[1]. Demographic characteristics of the sample at the two time points are presented in Table 2. Attrition analyses indicated that there were no significant differences in age ($t(172) = -.382$, $p = .703$), BMI ($t(184) = 1.428$, $p = .155$), number of years driving ($t(175) = -.547$, $p = .585$), weekly kilometres driven ($t(164) = -.607$, $p = .545$), highest education attainment ($\chi^2(5) = 6.804$, $p = .236$), and ethnicity ($\chi^2(5) = 4.720$, $p = .451$) between participants that dropped out of the study and those who remained.

[1] The large attrition rate raises concerns over statistical power. To ensure we had adequate power, we computed reproduced statistical power of the key dependent variables in our model using current findings. Power analyses with multiple regression analyses (path analysis is an extension of this kind of analysis) presents some challenges in identifying the appropriate statistical power. One option is to use R^2 values as the effect size for the key outcome or dependent variables of interest. In the current model, these were intentions ($R^2 = .772$) and fruit and vegetable consumption ($R^2 = .261$). Converting these to f^2 values (1.32 for intentions and .354 for behaviour), we used G*Power to compute reproduced power with alpha set at .05, sample size at 84, and four predictors for intentions (attitudes, subjective norms, perceived behavioural control, past behaviour) and five predictors for behaviour (action planning, coping planning, intentions, perceived behavioural control, past behaviour). The analysis produced statistical power values of 1.000 and .992 for intentions and behaviour, respectively, indicating sufficient statistical power.

Attrition analysis indicted there were differences between participants remaining and those who dropped out on some of the psychological and behavioural variables (Wilks' Lambda = .891, $F(7,138) = 2.417$, $p = .023$, partial eta-squared = .109). Post-hoc analysis revealed significantly higher levels of attitudes ($F(1,144) = 12.226$, $p = <.001$, $\eta_p^2 = .078$), intentions ($F(1,144) = 4.550$, $p = .035$, $\eta_p^2 = .031$), subjective norm ($F(1,144) = 4.471$, $p = .036$, $\eta_p^2 = .030$), and autonomous motivation ($F(1,144) = 11.697$, $p = .025$, $\eta_p^2 = .034$) in the participants who completed both time point one and two compared to those who dropped out. There was no differences between fruit and vegetable consumption of participants who dropped out at T1 and the participants who remained at T2 ($t(189) = -.568$, $p = .571$).

Preliminary analysis

Measurement model statistics from the VB-SEM confirmed that the latent variables met criteria for construct and discriminant validity. Factor loadings for each latent factor exceeded the .700 criterion supporting the validity of the factors. Composite and Cronbach alpha (α) reliability coefficients, AVE, and intercorrelations for model variables are presented in Table 3. Reliability coefficients exceeded the .700 criterion and AVE values exceeded the recommended .500 criterion. Correlations among the latent variables also indicated no problems with discriminant validity. The correlations showed significant positive relations among the TPB variables as well as significant and positive relations among past behaviour and most of the model variables. The strong, positive correlation between past behaviour and future FV consumption shows behavioural stability for HGV drivers' dietary decisions. Goodness of fit statistics revealed acceptable overall fit of the model with the data according to the multiple indices adopted (GoF Index = .523; APC =.212, p =.010; ARS = .331, p <.001; AVIF = 1.702.

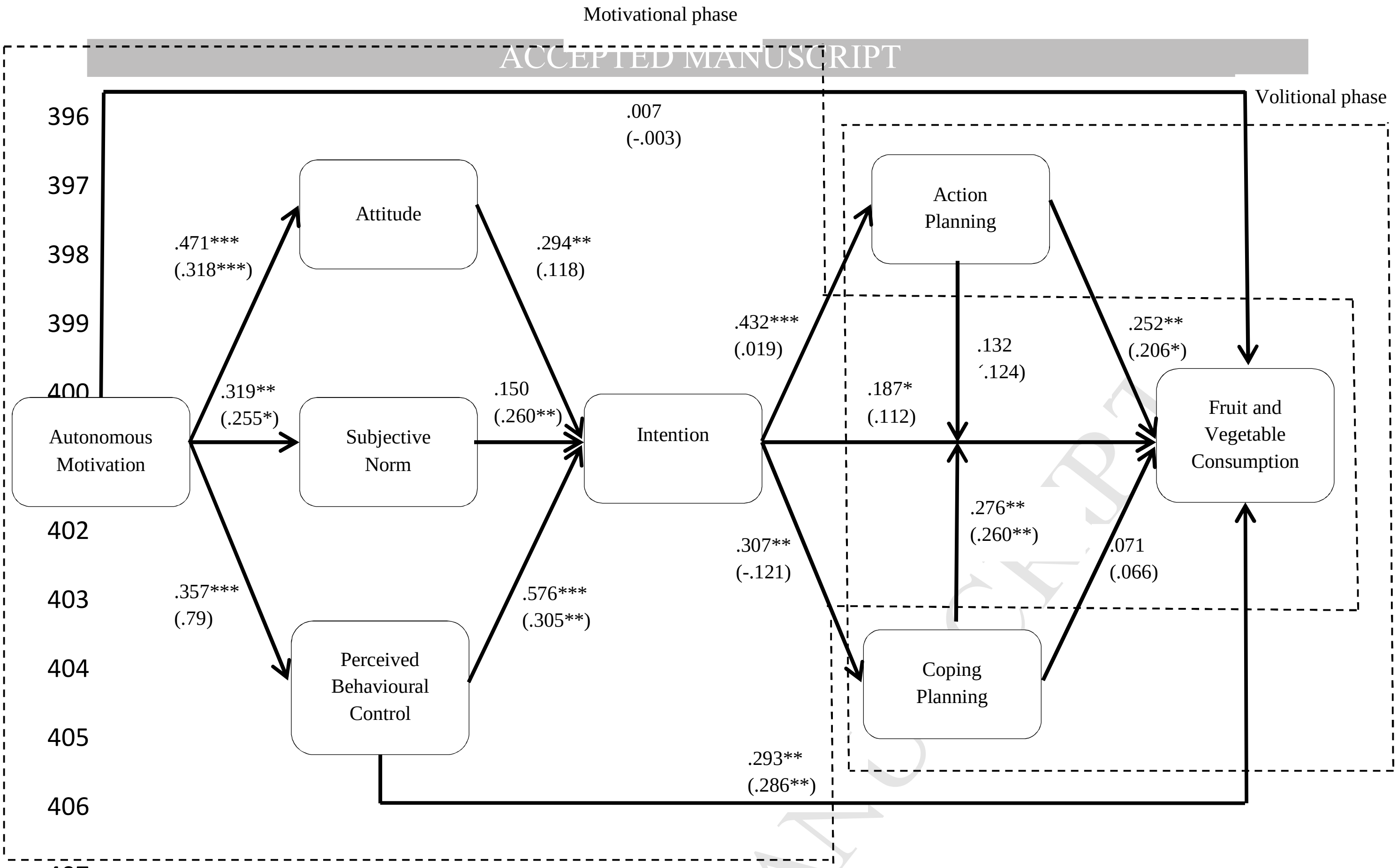

Figure 1. Hypothesised multi-phase, multi-theory model of health behaviour. *Note:* Effects of age and past behaviour on each of the variables has been omitted for clarity but standardised path coefficients for each relationship can be found in Table 5. Figures in parentheses are standardised path coefficients inclusive of the effects of past behaviour in the hypothesised model.

Model Effects

Standardised parameter estimates for the hypothesized relations among model factors are presented in Figure 1 and Table 4. Overall, the model accounted for 77.2% of the variance in HGV drivers' intentions to eat fruit and vegetables and 26.1% of the variance in their fruit and vegetable consumption. With regards to the motivational phase of the model, autonomous motivation had a statistically significant positive direct effect on attitudes (H_1), subjective norm (H_2), and perceived behavioural control (H_3), as predicted. Also, as hypothesized, attitude (H_4) and perceived behavioural control (H_6) were statistically significant positive predictors of intentions, but subjective norms (H_5) was not, leading us to reject this hypothesis. There was a statistically significant positive effect of intentions (H_7)

and perceived behavioural control (H_8) on fruit and vegetable consumption, as predicted. There was no direct effect of autonomous motivation on fruit and vegetable consumption (H_{13}), as predicted.

Table 2. Participant (*N* = 84) characteristics and descriptive statistics for study variables for those that completed the initial survey (Time 1) and those that completed the initial and follow-up survey (Time 2)

Variable	Time 1	Time 2
Participants, *N*	212	84
Age, *M* years (SD)	45.18 (11.90)	45.94 (12.07)
BMI, *M* (SD)	30.91(8.05)	29.90 (6.08)
Weekly work kilometres	4353.59 (4253.84)	5183 (6314.51)
Ethnicity:		
Caucasian	196	75
Indigenous	6	3
Maori	2	1
Indian	1	1
Other	6	4
High education level:		
Primary School	3	1
Some high school	43	18
Junior high school	53	21
Senior high school	43	10
Tafe / trade	61	29
University	9	5
Attitude	5.53 (1.72)	6.04 (1.37)
Subjective norm	5.77 (1.25)	5.92 (1.18)
Perceived behavioural control	4.74 (1.69)	4.84 (1.68)
Intention	4.75 (1.62)	4.93 (1.18)
Autonomous motivation	5.23 (1.59)	5.64 (1.39)
Action planning	3.54 (1.92)	3.81 (1.85)
Coping Planning	3.21 (1.79)	3.28 (1.72)
Past fruit and vegetable consumption	3.83 (2.19)	4.02 (2.31)
Fruit and vegetable consumption	-	3.89 (2.04)

Contrary to expectations there were no indirect effects of attitudes (H_{17}), subjective norms (H_{18}), and perceived behavioural (H_{19}) on fruit and vegetable consumption mediated by intentions. However, we found a total indirect effect of autonomous motivation on intentions mediated by attitudes, subjective norms, and perceived behavioural control (H_{20}). There was no significant indirect effect of autonomous motivation on behaviour (H_{21}) mediated by attitudes, subjective norms, or perceived behavioural control, and intentions

Focusing on the volitional phase of the model, intentions significantly predicted action planning (H_9) and coping planning (H_{10}), and action planning (H_{11}) significantly predicted fruit and vegetable consumption as hypothesised. There was no effect of coping planning on fruit and vegetable consumption (H_{12}), so we rejected our hypothesis for this effect. As predicted, coping planning moderated the relationship between intention and fruit and vegetable consumption (H_{15}). Specifically, the intention-behaviour relation was stronger in the presence of coping planning. Action planning did not moderate the intention-behaviour relationship, so we rejected our hypothesis (H_{14}). There was no indirect effect of intention on fruit and vegetable consumption mediated by action planning (H_{22}) or coping planning (H_{23}), leading us to reject these hypotheses.

Finally, past behaviour was shown to be a significant predictor of all but two of the variables in the model, although the effects did approach conventional levels for statistical significance for subjective norms (p = .084) and behaviour (p = .088) (H_{16}). The inclusion of past behaviour resulted in a number of effects in the model being reduced to trivial values and failed to reach statistical significance including the direct effect of autonomous motivation on perceived behavioural control; the direct effect of attitudes on intentions; the direct effects of intentions on action planning, coping planning, and behaviour; the indirect effects of autonomous motivation on intentions via attitudes and perceived behavioural control; and the total indirect effect of autonomous motivation on intentions and fruit and vegetable consumption via attitudes, subjective norms, and perceived behavioural control.

Table 3. Factor intercorrelations, composite reliabilities, and average variance extracted for latent variables in the multi-theory, dual phase model for FV consumption (*N* = 84)

Note. ρ = Composite reliability coefficient; **α** = Cronbach's alpha; AVE=Average variance extracted; Values on principal diagonal are square-

	ρ	α	AVE	R^2	1	2	3	4	5	6	7	8	9	10
1. Autonomous motivation	.941	.930	.801	.271	.895									
2. Attitude	.918	.920	.736	.294	.421***	.858								
3. Subjective norm	.894	.849	.739	.182	.268*	.334**	.860							
4. PBC	.851	.744	.740	.357	.338**	.242*	.496***	.860						
5. Intention	.950	.919	.864	.772	.486***	.503***	.549***	.734***	.929					
6. FV Behaviour	.965	.937	.901	.261	.311**	.285**	.317**	.496***	.527***	.949				
7. Action planning	.958	.961	.850	.409	.551***	.199	.072	.405***	.442***	.389**	.922			
8. Coping planning	.944	.950	.809	.102	.479***	.191	-.013	.250*	.239*	.266*	.670***	.900		
9. Age	-	-	-	-	-.117	.099	-.128	-.053	-.086	.069	-.043	.011	1.000	
10. Past behaviour	-	-	-	-	.487***	.431***	.211	.570***	.689***	.510***	.605***	.382***	.032	1.000

root of average variance extracted (AVE); PBC = Perceived behavioural control; FV = Fruit and vegetable consumption.

***p < .001 **p < .01 *p < .05.

Table 4.
Standardised parameter estimates for the direct, indirect effects, and total effects of the multi-theory, dual-phase model of fruit and vegetable consumption (*N* = 84)

Effect	Without Past Behaviour				With Past Behaviour			
	β	*p*	95%CI		β	*p*	95%CI	
			LL	UL			LL	UL
Direct Effects								
Autonomous motivation → Attitude	.471	<.001	0.284	0.657	.318	<.001	0.124	0.512
Autonomous motivation → Subjective norm	.319	.001	0.124	0.513	.255	.007	0.057	0.453
Autonomous motivation → PBC	.357	<.001	0.164	0.549	.079	.230	-0.131	0.289
Attitude → Intention	.294	.002	0.098	0.490	.118	.133	-0.088	0.324
Subjective norm → Intention	.150	.077	-0.053	0.353	.268	.005	0.070	0.466
PBC → Intention	.576	<.001	0.395	0.756	.305	.001	0.109	0.501
Autonomous motivation → FV Behaviour	.007	.476	-0.206	0.220	-.003	.489	-0.217	0.211
PBC → FV Behaviour	.293	.002	0.097	0.489	.286	.003	0.090	0.482
Intention → FV Behaviour	.187	.037	-0.014	0.388	.112	.145	-0.096	0.320
Intention → Action planning	.432	<.001	0.243	0.620	.019	.429	-0.193	0.231
Intention → Coping planning	.307	.001	0.111	0.503	-.121	.127	-0.327	0.085
Action planning → FV Behaviour	.252	.007	0.054	0.449	.206	.024	0.004	0.408
Coping planning → FV Behaviour	.071	.253	-0.138	0.280	.066	.270	-0.144	0.276
Action planning X Intention → FV Behaviour	.132	.107	-0.073	0.337	.124	.121	-0.082	0.330
Coping planning X Intention → FV Behaviour	.276	.004	0.078	0.473	.260	.006	0.062	0.458
Age → Autonomous motivation	-.121	.126	-0.326	0.084	-.141	.091	-0.347	0.065
Age → Attitude	.143	.088	-0.062	0.348	.123	.123	-0.083	0.329
Age → Subjective norm	-.224	.016	-0.423	-0.024	-.237	.011	-0.437	-0.037
Age → PBC	-.053	.312	-0.262	0.156	-.128	.113	-0.334	0.078
Age → Intention	-.067	.265	-0.276	0.142	-.081	.224	-0.291	0.129
Age → Action planning	-.145	.085	-0.350	0.060	-.130	.109	-0.336	0.076
Age → Coping planning	.043	.347	-0.168	0.254	-.007	.473	-0.221	0.207
Age → Behaviour	.162	.061	-0.041	0.365	.140	.093	-0.066	0.346
Past behaviour → Autonomous motivation	-	-	-	-	.506	<.001	0.322	0.690
Past behaviour → Attitude	-	-	-	-	.292	.002	0.096	0.488
Past behaviour → Subjective norm	-	-	-	-	.143	.088	-0.063	0.349
Past behaviour → PBC	-	-	-	-	.552	<.001	0.370	0.734
Past behaviour → Intention	-	-	-	-	.452	<.001	0.266	0.638
Past behaviour → Action planning	-	-	-	-	.603	<.001	0.425	0.781
Past behaviour → Coping planning	-	-	-	-	.342	<.001	0.148	0.536
Past behaviour → Behaviour	-	-	-	-	.146	.084	-0.058	0.350
Indirect Effects								
Attitude → Intent → FV Behaviour	.055	.235	-.094	.204	.013	.432	-.138	.164
Subjective norm → Intention → FV Behaviour	.028	.357	-.123	.179	.030	.347	-.120	.179
PBC → Intention → FV Behaviour	.108	.076	-.041	.257	.034	.327	-.115	.183
Autonomous motivation → Attitude → Intention	.139	.032	-.006	.284	.038	.312	-.111	.187
Autonomous motivation → Subjective norm → Intention	.048	.265	.057	.355	.068	.184	-.081	.217
Autonomous motivation → PBC → Intention	.206	.003	.063	.349	.024	.377	-.127	.175
[a]Autonomous motivation→TPB constructs→ Intention	.392	<.001	.205	.585	.130	.109	-.076	.336
Autonomous motivation → Attitude → Intention → FV Behaviour	.026	.340	-.097	.149	.004	.473	-.119	.127

Autonomous motivation → Subjective norm → Intention → FV Behaviour	.009	.443	-.114	.132	.008	.451	-.115	.131
Autonomous motivation → PBC → Intention → FV Behaviour	.038	.269	-.084	.160	.003	.483	-.120	.126
[a]Autonomous motivation→TPB constructs→Intention→FV Behaviour	.073	.247	-.140	.283	.015	.447	-.199	.229
Intention → Action planning → FV Behaviour	.109	.075	-.038	.256	.004	.479	-.147	.155
Intention → Coping planning → FV Behaviour	.022	.388	-.129	.173	-.008	.459	-.159	.143
Total effects								
Autonomous motivation → Intention	.392	<.001	0.202	0.582	.130	.109	-0.080	0.336
Attitude → FV Behaviour	.094	.142	-0.080	0.265	.013	.443	-0.160	0.187
Subjective norm → FV Behaviour	.048	.294	-0.120	0.220	.029	.372	-0.140	0.201
PBC → FV Behaviour	.476	<.001	0.290	0.662	.319	<.001	0.125	0.513
Autonomous motivation → FV Behaviour	.236	.011	0.036	0.436	.034	.378	-0.180	0.246
Intention → FV Behaviour	.318	<.001	0.124	0.512	.108	.154	-0.100	0.316

Note. β = Standardized parameter estimate; 95%CI = 95% confidence intervals of standardized parameter estimates; LL = Lower limit of 95% confidence intervals; UL = Upper limit of 95% confidence intervals; PBC = Perceived behavioural control; FV = Fruit and vegetable consumption. [a]Effect represents total indirect effect through TPB constructs (attitude, subjective norm, PBC) as multiple mediators.

Discussion

The aim of the current study was to apply an integrated multi-theory, dual-phase model to predict fruit and vegetable consumption in a sample of long-distance HGV drivers in Australia. The model integrates constructs and hypotheses from self-determination theory, the theory of planned behaviour, the model of action phases, and the health action process approach. Findings supported a number of effects found in similar integrated theories applied to health behaviour (Hagger & Chatzisarantis, 2014; Hamilton, Cox, et al., 2012; Hamilton, Kirkpatrick, Rebar, & Hagger, 2017; Mullan, Wong, Kothe, et al., 2013; Perugini & Bagozzi, 2001; Schwarzer et al., 2010), including effects of autonomous motivation, and belief-based social cognitive variables on intentions to consume fruit and vegetables. However, the inclusion of past-behaviour resulted in the attenuation of model effects. Critically, the effect of intentions on behaviour was non-significant and trivial on the inclusion of past behaviour. This finding is consistent with multiple studies in the field which have observed similar attenuating effects of past behaviour, particularly the intention-behaviour relationship

(Danner, Aarts, & Vries, 2008; Norman & Conner, 2006). Overall, current findings indicate that very little of the variance in fruit and vegetable consumption is accounted for by variables in the model beyond past behaviour.

Focusing first on the prediction of intentions, results of our test of the integrated model are consistent with previous research (Chatzisarantis et al., 2009; Hamilton, Cox, et al., 2012; Hamilton, Kirkpatrick, Rebar, & Hagger, 2017) that has identified autonomous motivation as an indirect predictor of intention mediated via the TPB variables. For long haul HGV drivers, attitudes and perceived behavioural control, but not subjective norms mediated autonomous motivation on intentions. These findings suggest that long-haul HGV drivers' intentions to eat fruit and vegetables are based on internalised, personally-relevant motives, tastes and beliefs regarding their ability to eat the recommended serves each day, and are less influenced by their beliefs about significant others expectations. This result is consistent with the solitary lifestyle of a long-haul HGV driver who is likely to eat by themselves for days or weeks at a time (Apostolopolous et al., 2013) and therefore has less exposure to normative influences. However, it is important to note that when past behaviour was included in the model the indirect relationship between autonomous motivation and intention through the TPB variables did not hold. This attenuation effect probably models the fact that the drivers had made these kinds of decisions in the past, and that any decisions are largely dominated unmeasured, possibly implicit, processes. Importantly, inclusion of past behaviour in the model did not lead to the extinction of the significant direct effect of PBC on FV consumption. This effect suggests that HGV drivers' perception of control within their work context is an important factor to consider. It is unsurprising that given HGV drivers' low control over food choices, particularly healthy food choices at truck stops, plays a significant role in their overall FV consumption (Hamilton & Hagger, 2017). This low perceived control within the HGV drivers' work context is consistent with research which identified poor availability of healthy food as a significant barrier for drivers (Passey et al., 2014). Drivers have also indicated they would eat healthier food choices if they are available (i.e., within their control to purchase) (Jacobson, Prawitz, & Lukaszuk, 2007).

However, effects of past behaviour in the current research were more wide-reaching than effects of social cognitive and motivational variables on intentions alone. Past behaviour was found to significantly and positively correlate with most of the psychological variables in the model and such attenuated many of the relationships within the model. This was expected given previous research that has found similar attenuation effects in other health behavioural contexts (Danner et al., 2008; Gardner, de Bruijn, & Lally, 2011; Norman & Conner, 2006). Most important, the effect of intention on behaviour was reduced to a trivial value and was not statistically significant, meaning that if the current study were to be replicated on multiple occasions, zero would be a probable value for the intention-behaviour relationship 95% of the time. Given that past behaviour does not capture a specific variable or construct, interpreting the attenuation effects is difficult. To speculate, past behaviour may model habitual effects, possibly mediated by unmeasured implicit cognition. Alternatively, it may model unmeasured variables that predict behaviour and account for (mediate) the effects of past behaviour on future behaviour.

Research has shown that past behaviour may serve as a proxy for habitual behaviour (Gardner, 2014; Gardner et al., 2011). In this case, past behaviour may model the fact that HGV drivers have undergone the deliberative decision-making processes multiple times in the past. The significant positive correlation of FV consumption at T1 and T2, that is, the effects of past behaviour on subsequent behaviour, demonstrates the stability of the FV consumption. The measure of past behaviour may also represent other unmeasured implicit representations of the action and context, initiated by relevant contextual cues (e.g., pulling into the service station or observing snack foods placed on a plinth near a service station checkout). This would be consistent with research on dual-process models which show that constructs and measures representing the non-conscious, automatic processes play an important role in predicting health behaviour (Hagger et al., 2017; Strack & Deutsch, 2004). The attenuating effect of past behaviour in the current model test may provide an analog for the effects of these implicit constructs on action in the current integrated model. A possible avenue for future research would be to examine effects of past behaviour alongside other constructs representing non-conscious and automatic processes to arrive at a more comprehensive understanding of health behaviour (Gardner, 2014; Gardner et al., 2011; Hagger & Chatzisarantis, 2014; Sniehotta et al., 2014; Strack & Deutsch, 2004).

Focusing on the volitional processes in the current integrated model, current findings are in line with the hypotheses drawn from the model of action phases (Heckhausen & Gollwitzer, 1987). Specifically, we found support for a moderating role of coping planning on the intention–behaviour relationship. The predictions regarding action planning and coping planning drawn from the HAPA (i.e., a mediating role: Schwarzer, 1992) were not found, although the mediating effects of action planning did approach conventional levels for statistical significance (p = .075). Interestingly, the inclusion of past behaviour had little attenuating effect on the moderating role of coping planning on the intention-behaviour relationship, demonstrating this effect is independent of behavioural repetition. Given that some HGV drivers may have multiple delivery destinations, it follows that their plans to overcome general barriers to consume fruit and vegetables (i.e., coping plans) are able to consolidate intentions given coping plans are less reliant on specific dates, times, or destinations. Action plans, however, have been shown to play an important role in behaviours that can be performed in a consistent context (e.g., physical exercise; de Bruijn et al., 2012; Luszczynska et al., 2016), or in general population samples (e.g., eating fruit and vegetables in adults; van Osch et al., 2009). The continually changing context of HGV drivers may disfavour the rigidity of action plans to further strengthen intentions. More generally, this result is consistent with propositions that planning variables are able to strengthen intentions, a moderating effect, rather than explain the intention-behaviour relationship, a mediating effect (Hagger & Chatzisarantis, 2014; Heckhausen & Gollwitzer, 1987; Wiedemann et al., 2009). The results seem to point to the key role of planning as a volitional strategy that augments intentions and leads to more efficient, effective implementation (Heckhausen & Gollwitzer, 1987). In contrast, the mediating effect in which planning explains the effect did not occur, despite action planning significantly predicting fruit and vegetable consumption. Overall, current findings imply that planning alters rather than explains the effects of intentions on fruit and vegetable consumption.

The current study had a number of strengths including identifying a hard-to-reach and under-researched group of male long-haul HGV drivers with a high risk of health problems due to their lifestyle, the adoption of an appropriate integrated theoretical approach for the prediction of fruit and vegetable consumption, and explicitly testing how effects in the integrated model are affected by past behaviour. The research, however, is not without limitations. To reduce the time-burden on drivers we did not collect overall fruit and vegetable consumption but targeted whether drivers were eating the recommended serves. This data would have allowed us to compare adherence rates to other epidemiological studies. Also, the sample size of the current investigation is small with high attrition. HGV drivers is a hard-to-reach population many of whom have never engaged in research before and are naturally wary of answering questions outside their community. This is may be a reason for the high attrition rates. Future research may overcome this issue by working closely with relevant HGV organisations to reduce any perceived distrust with researchers. Future research may also benefit from a smaller questionnaire to reduce the burden of completing them in such a time-poor population. While we had sufficient statistical power, results must still be treated with caution given the high attrition rate and possibility of that we recruited a sample of individuals who were favourable to healthy eating. The research also relied on self-report data which may have facilitated socially desirable responses. However, anecdotally, the authors found through face-to-face data collection that many of the long-haul drivers were equally at ease verbally reporting their unfavourable as well as favourable attitudes towards fruit and vegetable consumption. A further limitation is the current study adopted a correlational design, so the direction of proposed effects can only be inferred from theory and not the data. Future research could use intervention or cross-lagged designs to confirm causality and the direction of the relationships. Similarly, future research would benefit from utilising a daily or situational assessment measure (i.e., ecological momentary assessment) to gain a deeper understanding of the timeline of dietary decisions.

Overall, current findings suggest that the integrated model is adequate in accounting for intentions to eat fruit and vegetables in HGV drivers, but fails to account for substantive variance in actual behaviour once accounting for past behaviour. Taken together, these findings seem to indicate that drivers' decisions to eat fruit and vegetables is not controlled by intentional processes, and may be controlled by habitual or implicit processes that affect behaviour beyond the drivers' awareness. We cannot be sure of the nature of the factors that result in these decisions as we did not measure habits, automaticity, or implicit cognition which may have served to mediate the past behaviour effects and provide an explanation for this pathway. We can speculate that because of constraints on availability and the routine nature of their profession, drivers do not engage in much conscious deliberation over their fruit and vegetable intake. Rather, since their decisions have been repeated consistently, it is likely that habits and non-conscious processes predominate for this behaviour, as it is likely for all their dietary behaviours. This presents considerable challenges for interventions aimed at promoting fruit and vegetable consumption in this vulnerable group. Strategies that might assist would be those that help raise awareness of contextual eating cues (e.g., when and where food is eaten, what alterative choices are available), assist in self-monitoring of consumption, identifying alternative courses of action, and planning suitable alternatives when a self-directed cue is presented.

Appendix A

Scale Items for Constructs of the Multi-theory, Dual-Phase Model of Fruit and Vegetable Consumption

Variable	Item	Scale
Intention	Do you agree that in the next week…?	1 = “strongly disagree”, 7 = “strongly agree”.
	…I intend to eat fruit and vegetables following the recommended serves every day	
	…I plan to eat fruit and vegetables following the recommended serves every day	
	…I expect that I will eat fruit and vegetables following the recommended serves every day	
Attitude	For me to eat fruit and vegetables following the recommended serves every day in the next week would be:	1 = “bad”, 7 = “good” 1 = “unfavourable”, 7 = “favourable” 1= “undesirable”, 7 = “desirable” 1 = “harmful”, 7 = “beneficial”
Subjective norm	Do you agree that in the next week…?	1 = “strongly disagree”, 7 = “strongly agree”.
	…Most people who are important to me would approve of me eating fruit and vegetables following the recommended serves every day	1 = “strongly disagree”, 7 = “strongly agree”.
	…Those people who are important to me think that I should eat fruit and vegetables following the recommended serves every day	1 = “strongly disagree”, 7 = “strongly agree”.
	…The people in my life whose opinion I value would think my eating fruit and vegetables following the recommended serves every day is desirable	
Perceived behavioural control	Do you agree that in the next week…?	1 = “strongly disagree”, 7 = “strongly agree”.
	…I have complete control over whether I eat fruit and vegetables following the recommended serves every day	1 = “strongly disagree”, 7 = “strongly agree”.
	…I am confident that I could eat fruit and vegetables every day following the recommended serves everyday	
Autonomous motivation	The reason I would eat the recommended serves of fruit and vegetables each day …	
	… Because I personally believe it is the best thing for my health	1= “not at all true”, 7= “exactly true”
	… Because I have carefully thought about it and believe it is very important for many aspects of my life	1= “not at all true”, 7= “exactly true”
	… Because it is an important choice I really want to make	1= “not at all true”, 7= “exactly true”
	… Because it is very important for being as healthy as possible	1= “not at all true”, 7= “exactly true”
Action planning	I have made a plan regarding …	
	… When to eat fruit and vegetables	1= “not at all true”, 7= “exactly true”
	… Where to eat fruit and vegetables	1= “not at all true”, 7= “exactly true”
	… How to eat fruit and vegetables	1= “not at all true”, 7= “exactly true”
	… How often to eat fruit and vegetables	1= “not at all true”, 7= “exactly true”
Coping planning	I have made a plan regarding …	
	… What to do if something interferes with my plans	1= “not at all true”, 7= “exactly true”
	… How to cope with possible setbacks	1= “not at all true”, 7= “exactly true”
	… What to do in difficult situations in order to stick to my intentions	1= “not at all true”, 7= “exactly true”
	… When I have to pay extra attention to prevent lapses	1= “not at all true”, 7= “exactly true”

Past fruit and vegetable consumption	On how many days in the course of the past week, did you eat fruit and vegetables following the recommended serves?	0 = “0 days”, 7 = “7 days”
Fruit and vegetable consumption (T2)	In the previous week, to what extent did you eat fruit and vegetables following the recommended serves every day?	1 = “not at all, 7 = “a large extent”
	In the previous week, on how many days did you eat fruit and vegetables following the recommended serves every day?	0 = “0 days”, 7 = “7 days”
	In the previous week, how often did you eat fruit and vegetables following the recommended serves every day?	1 = “never’, 7 = “very often”

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