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Social-cognitive Antecedents of Hand Washing: Action Control Bridges the Planning-Behaviour Gap

Abstract

Objectives. To examine motivational and volitional factors for hand washing in young adults, using the Health Action Process Approach (HAPA) as a theoretical framework.

Design. In a longitudinal design with two measurement points, six weeks apart, university students (N = 440) completed paper-based questionnaires.

Main outcome measures. Prior hand washing frequency, self-efficacy, outcome expectancies, intention, and action planning were measured at baseline, and coping planning, action control, and hand washing frequency were measured at follow-up.

Results. A theory-based structural equation model was specified. In line with the HAPA, the motivational factors of self-efficacy and outcome expectancies predicted intention, whereas the volitional factors of planning and action control mediated between intention and changes in hand washing frequency. Action control was confirmed as the most proximal factor on hand washing behaviour, thus representing a bridge of the planning–behaviour gap.

Conclusions. Both motivational and volitional processes are important to consider in the improvement of hand hygiene practices. Moreover, the statistically-significant effects for planning and action control illustrate the importance of these key self-regulatory factors in the prediction of hand hygiene. The current study highlights the importance of adopting models that account for motivational and volitional factors to better understand hand washing behaviour.

Keywords: motivation, volition, hand washing, action control, self-regulation

Background

There is much evidence demonstrating the protective role of hand washing for a wide range of pathogens (Cannon & Davis, 2005). Despite the health benefits of hand washing, hand hygiene is poorly practiced globally (Freeman et al., 2014), and the psychological mechanisms which may lead to its performance are not well understood. Taking a theoretical approach to better understand the mechanisms underpinning hand washing behaviour is important as it provides an a priori framework on which to base hypotheses. In trying to explain people's health behaviour, several dual-process models (e.g., Health Action Process Approach; Schwarzer, 2008) have differentiated between motivational and volitional phases when it comes to understanding motivated action. A wide range of motivational and volitional factors, such as intention, outcome expectancies, self-efficacy, planning, and action control, have been found to influence health behaviour (Hamilton, Cox, & White, 2012; Schwarzer, 2008; Schwarzer et al., 2007; Zhou et al., 2015a). Recent studies have provided evidence on the relevance of some of these factors for hand hygiene (Lhakhang, Lippke, Knoll, & Schwarzer, 2015; McLaws, Maharlouei, Yousefi, & Askarian, 2012; Zhou, Jiang, Knoll, & Schwarzer, 2015b). Other studies have been conducted on hygienic food handling, which is a behaviour closely related to hand hygiene (Chow & Mullan, 2010; Mullan, Allom, Sainsbury, & Monds, 2015; Mullan, Wong, & O'Moore, 2010). However, the extent to which volitional processes operate in concert with, or independent of, motivational processes for hand washing is not yet fully understood. The current study, therefore, extends this previous line of research, paying particular attention to what has been called a planning-behaviour gap (Sniehotta, 2009). In addition, studies on

hand hygiene commonly target healthcare professionals in hospital settings (Wilson, Jacob, & Powell, 2011). Other populations also deserve attention as infectious diseases are known to be transmitted in public places (Zapka et al., 2011). For example, there are studies addressing hygienic food handling, based on university students and on other settings and theoretical frameworks (Bai, Tang, Yang, & Gong, 2014; Chow & Mullan, 2010; Fulham & Mullan, 2011; Mullan & Wong, 2010). However, studies specially focused on hand hygiene are less frequent. The current study will examine motivational and volitional factors as predictors of hand washing behaviour among young adults attending university settings.

Theoretical Background: The Health Action Process Approach (HAPA)

The Health Action Process Approach (HAPA, Schwarzer, 2008) provides a general theoretical framework that can describe, explain, and predict health behaviour change. It suggests a distinction between (a) pre-intentional motivation processes that lead to a behavioural intention, and (b) post-intentional volition processes that lead to the actual health behaviour. Within the two phases, different patterns of social-cognitive predictors may emerge. In the motivational phase, outcome expectancies (e.g., “If I wash my hands frequently every day, then I'll stay healthy”) are hypothesized to predict intentions. The motivational orientation for action is derived out of individuals considering the pros and cons of certain behavioural outcomes (e.g., social, emotional, or health-related consequences). Perceived self-efficacy is also considered important in the motivational phase. Here, the motivational root for action is derived from the individual believing they have the capability to perform the goal behaviour (e.g., “I am confident I can clean my hands regularly, even when I am in a hurry”). Outcome expectancies and perceived self-efficacy are thought to operate in concert to predict intention.

After an individual has formed an intention to engage in a goal directed behaviour, a range of self-regulatory strategies need to be enacted to ensure an intention is realized, and once initiated, maintained. Planning and action control are two self-regulatory determinants in the volitional phase that have received empirical support in the literature. Good intentions are more likely to be translated into action when people plan to attain a concrete behavioural goal and prepare for how to overcome barriers to its achievement. Thus, planning is thought to mediate the relationship between intention and behaviour, as shown in meta-analyses of the effects of planning on health behaviours (for an overview, see Hagger & Luszczynska, 2014). Two kinds of plans can be distinguished: (1) action plans, which pertains to a mental simulation of when, where, and how to act in line with the intention; and (2) coping plans, which is a barrier-focused self-regulation strategy where individuals mentally link anticipated situations that hinder performance of their intended behaviour with appropriate coping responses to overcome such challenging situations (Carraro & Gaudreau, 2013; Kwasnicka, Presseau, White, & Sniehotta, 2013; Sniehotta, Scholz, & Schwarzer, 2005a). Both kinds of planning imply that a link between situational cues and behavioural responses has to be established (Sniehotta, Schwarzer, Scholz, & Schüz, 2005b). Thus, after intention formation, action planning contributes in the behaviour initiation (Caudroit, Boiche, & Stephan, 2014), and subsequently, coping planning helps to deal with possible difficulties. However, planning might not translate to behaviour (de Vries, Eggers, & Bolman, 2013; Parschau et al., 2014; Scholz, Ochsner, & Luszczynska, 2013; Sniehotta, 2009) and other, more proximal cognitive strategies may need to be enacted to ensure those plans are maintained over time. Such strategies may be particularly relevant for a behaviour like hand washing, where maintaining daily frequent practice is associated with health benefits (Merk, Kuhlmann-Berenzon, Linde, & Nyren, 2014).

While planning is a prospective strategy, that is, behavioural plans are made before the situation is encountered; action control is a concurrent self-regulatory strategy, where the ongoing behaviour is continuously evaluated with regard to a behavioural standard. Action control can comprise three facets: self-monitoring (e.g., "I consistently monitored when, where, and how I used soap and water"), awareness of standards (e.g., "I have always been aware of my intention to wash my hands carefully"), and self-regulatory effort (e.g., "I took care to wash my hands as much as I intended to") (Carver & Scheier, 2002; Reyes Fernandez et al., 2015; Sniehotta et al., 2005a). Studies testing the effects of planning and action control on health-enhancing behaviour have found action control to have the strongest direct effect on behaviour compared to planning and self-efficacy (Scholz, Nagy, Goehner, Luszczynska, & Kliegel, 2009). Other studies, however, have observed a mediation effect. For example, a study on fruit and vegetable consumption found planning to serve as a mediator between action control and fruit and vegetable intake (Zhou et al., 2015a), which is contrary to other studies testing such meditational effects (Sniehotta et al., 2005b). Although planning and action control are key volitional determinants of behaviour, the mechanisms by which these factors operate between intention and behaviour is an important line of research. Few studies have examined these constructs jointly and even fewer have examined their effects on hand washing behaviour.

The Current Study

The aim of the current study is to determine the motivational and volitional processes that underpin hand washing, an important health behaviour yet the mechanisms guiding behavioural action are not fully understood. The current study adopts the HAPA to gain this understanding, and extends recent knowledge on the planning-behaviour gap. For this purpose, a longitudinal design is used to examine theory-based motivational and volitional

factors that may account for changes in the frequency of hand washing behaviour. A structural equation model is specified that treats outcome expectancies and self-efficacy as motivational predictors of intention; and action planning, coping planning, and action control as volitional predictors of hand washing behaviour. A theory-based mediational six-step chain is postulated that provides an a priori framework on which to specify and test hypotheses in a meaningful order.

Method

Participants

Participants comprised of 440 undergraduate university students (M_{age} = 21.82 years, *SD* = 3.89 years) from a large university in Costa Rica. They were visited in their respective classrooms, and those interested in participating were recruited. Approximately 61% of the sample was female, and just over half (53.4%) were studying a health related subject. Six weeks later, 307 (69.77%) of the participants completed the follow-up questionnaire.

Design and procedure

Ethics approval was obtained from the University Human Research Ethics Committee. The study adopted a longitudinal design with a six-week follow-up of behaviour. Participants were invited to voluntarily participate in the study during class, and after affirming consent, students completed the questionnaires in their classrooms at the end of their class. At baseline, participants completed demographic questions, as well as questions pertaining to outcome expectancies, self-efficacy, and behavioural intention. Six weeks later, in the same classrooms after class, participants completed a follow-up questionnaire assessing action planning, coping planning, action control, and behavioural measures.

Measures

All responses, except behaviour, were measured on a four-point Likert scale ranging from 1 (*not at all true*) to 4 (*exactly true*). Items were adapted from Schwarzer (2008).

Self-efficacy. Three items assessed self-efficacy at Time 1. The items started with the stem ''*I am confident I can wash my hands regularly in the long term…*', and were correspondingly followed by sentence endings such as '*even when I am hurried*'. The scale was reliable with a Cronbach's alpha coefficient of .78.

Outcome expectancies. Two items measured outcome expectancies at Time 1. The items started with the stem '*If I wash my hands frequently every day…*', and were correspondingly followed by sentence endings such as '*then I'll stay healthy most of my life*'). The scale showed moderate internal consistency with Spearman-Brown coefficient of .63. Spearman-Brown Coefficient provides a more appropriate reliability assessment for a two-item measures than Cronbach's alpha (Eisinga, Te Grotenhuis, & Pelzer, 2013).

Intention. Two items measured the strength of intention to perform the target behaviour at Time 1 (e.g., '*Today and for the next days ... I intend to properly wash my hands with soap and water more than ten times a day.*'). The scale showed moderate internal consistency with a Spearman-Brown coefficient of .62.

Action planning. Three items assessed action planning at Time 1. The items started with the stem '*Thinking in the next week, I have made a concrete and detailed plan…*' and were correspondingly followed by sentence endings such as '*regarding how often to wash my hands*'. The scale was reliable with a Cronbach's alpha coefficient of .83.

Coping planning. Three items assessed coping planning at Time 2. The items started with the stem '*To keep my habit in difficult situations, I made a concrete plan…*' and were correspondingly followed by sentence endings such as '*considering how to face the*

situation where soap and water are not available'. The scale was reliable with a Cronbach's alpha coefficient of .88.

Action control. Three items assessed action control at Time 2 (e.g., '*During the week, I had often on my mind my intentions to wash my hands*'). The scale was reliable with a Cronbach's alpha coefficient of .81

Hand washing. At both Time 1 and Time 2, hand washing was measured with the single item, '*During the past week I have washed my hands with soap and water*' followed by these five response options: [1] *0-2 times a day,* [2] *3-4 times a day,* [3] *5-6 times a day,* [4] *7-9 times a day,* [5] *10 or more times a day*'. Single item assessments have been shown to be valid ways of measuring health behaviour against objective measures (Hamilton, White, & Cuddihy, 2012).

Data Analysis

Structural equation modeling was conducted using AMOS 21, using Full Information Maximization Likelihood (FIML). This provides fit indices to evaluate complex models, estimates of their parameters, and controls for measurement error. To assess fit, chi square (χ^2), the comparative fit index (CFI), Tucker-Lewis index (TLI), Akaike Information Criterion (AIC), and the root mean square error of approximation (RMSEA) were used. According to Hu and Bentler (1999) CFI and TLI values close to 0.95 and RMSEA values close to 0.06 indicate an adequate model fit. We also considered the Akaike Information Criterion (AIC) to examine parsimony. Lower values indicate a superior model. The part of the model ranging from intention to behaviour constitutes a serial multiple mediation (for a detailed description of serial mediations, see Hayes, 2013).

Results

Attrition Analysis

There was an attrition rate of 30.2% (completers, n = 307; non-completers, n = 133). An attrition analysis was conducted to examine whether there were any differences between those who completed both measurement points in time and those who completed baseline only. ANOVAs were used for continuous variables and χ^2 was used for categorical variables. Differences were found for baseline behaviour ($M_{\text{completers}}$ = 2.74, $SD_{\text{completers}}$ = 1.46; $M_{\text{non-completers}}$ = 3.23, $SD_{\text{non-completers}}$ = 1.38, $p < .01$), outcome expectancies ($M_{\text{completers}}$ = 3.18, $SD_{\text{completers}}$ = 0.67; $M_{\text{non-completers}}$ = 3.02, $SD_{\text{non-completers}}$ = 0.71, $p < .05$), and action planning ($M_{\text{completers}}$ = 2.54, $SD_{\text{completers}}$ = 0.96; $M_{\text{non-completers}}$ = 2.33, $SD_{\text{non-completers}}$ = 0.91, $p < .05$). No significant differences regarding self-efficacy, intention, sex, and age were found.

Descriptive Statistics

The means, standard deviations, and inter-correlations between all the variables included in the model are shown in Table 1. All variables demonstrated significant associations with each other. The mean of hand washing behaviour were, at both points in time, between 3 and 4, which means that hands were washed on average between 5 and 9 times a day.

Insert Table 1 over here

Measurement Model

A confirmatory factor analysis (CFA) was carried out to evaluate the fit of the measurement model to the correlational structure of the observed variables. Six factors (namely, self-efficacy, outcome expectancies, intention, action planning, coping planning, and action control) were specified and allowed to freely inter-correlate. All factors were

standardized by fixing their variances to 1.00. The measurement model yielded a good fit: $\chi^2(89) = 154.08$, $p < .001$, $\chi^2/df = 1.73$, CFI = .96, TLI = .95, RMSEA = .049, 90% CI [.036; .062], indicating that the items measured the six constructs distinctly. Refer to Table 2 for the standardized factor loadings of the confirmatory factor analysis.

Insert Table 2 over here

Examining the Mediation Model

The relationships among variables were specified in line with the HAPA (see Figure 1). The model fit was satisfactory: χ^2 (121) = 286.54, $\chi^2/df = 2.37$, CFI = .92, TLI =.89, RMSEA = .067, 90 % CI [.57, .67], AIC= 422.54. In the motivational phase of the model, Time 1 self-efficacy and outcome expectancies were both associated with Time 1intention, accounting for 76% of the variance. In the volitional phase of the model, Time 1 intention was associated with Time 1 action planning and Time 2 action control. In the further mediation chain, Time 1 action planning was associated with Time 2 coping planning which, in turn, was associated with Time 2 action control. Finally, Time 2 action control was associated with Time 2 hand washing behaviour, controlling for Time 1 behaviour. The variance explained at the level of Time 2 behaviour was 39%. Effects of intention on behaviour emerged as indirect by a sequence which involved action planning, coping planning, and action control ($\beta = .13$)[1]. The total effect of intention on behaviour was $\beta =$ .16 and the direct effect was $\beta = .02$. Based on the significance of the regression paths (see Figure 1), all the indirect effects from intention and planning on behaviour seemed to pass through action control which was the most proximal factor of hand washing behaviour.

[1] With FIML imputed data sets, as was the case here (missing values < 9%), AMOS does not provide bootsrapped confidence intervals. However, we created an additional data set with EM imputation and found concurring results , β = .13, bootstrapped 95% CI [.04, .25] (5,000 resamples)

Insert Figure 1

Discussion

A range of psychological processes may underpin health behaviour and, accordingly, diverse strategies may need to be enacted to motivate and maintain action. Hand washing is an important health behaviour to protect against illness and disease, yet the motivational and volitional factors to better understand this behaviour are not yet fully understood. In addition, few studies have examined this range of psychological constructs jointly or in a sample of non-healthcare professionals. The current longitudinal study adopted the HAPA to understand hand washing behaviour and, in particular, investigated the planning-behaviour gap. In general, the findings of the current study supported a model based on the HAPA in which self-efficacy and outcome expectancies were associated with hand washing intentions; and intention, action planning, and coping planning were indirectly associated with hand washing behaviour via action control. Overall, these findings provided support for the relevance of motivational and volitional factors included in the HAPA in understanding hand washing behaviour.

The findings of the current study concur with recent health hygiene investigations (Reyes Fernandez et al., 2015), providing further evidence for the role of action control that seems to bridge the planning-behaviour gap (Reyes Fernandez et al., 2015; Sniehotta, 2009). It could be that action control contains a ‘summary of behavioural instructions’ elaborated when intention and plans are set and, thus, in individuals who have previously passed through the motivational and volitional phases but relapsed, an action control

intervention might be enough to reactivate their goals and plans. Action control might be prompted by means of a daily diary calendar making individuals aware of their plans and intentions, and establishing a habit of self-monitoring. Further experimental research, however, on the working mechanisms of planning and action control in health behaviour change is needed to confirm such pathways of action.

Some authors have provided alternative ways in which plans and planning could be measured and conceptualized (de Vries et al., 2013; Sniehotta, 2009). Plan enactment has also been proposed to bridge the planning-behaviour gap (de Vries et al., 2013). The relationship between action control and plan enactment still needs to be examined. Action control might support plan enactment, or moderate its effect on behaviour. Plans might be more easily enacted and translated into behaviours due to self-monitoring. Performing preparatory behaviours represent a step forward towards the enactment of plans (Barz et al., 2016).

The current study has some limitations. All variables were measured by means of self-report, and hand washing behaviour was measured retrospectively. Recall bias, therefore, may have been evident in participant responses. One technique to deal with this issue may be direct observation, where trained observers could quantify the need for hand washing and assess the quality of its practice (Sax et al., 2009). However, the use of such a technique implies that only the occurrence of hand washing in defined settings could be studied; many relevant occasions for hand washing are outside pre-defined environments. A further limitation is related to the assessment of the frequency of behaviour where only two measurement points in time were assessed. Accordingly, the longitudinal relationships among variables assumed in the HAPA cannot be fully ascertained. Six points in time for the proposed model would have been ideal. It should be noted, however, that the

associations observed in the current study were found to concur with the theoretical assumptions of the HAPA and indicate that the model is useful in this context (Schwarzer, 2008; Sniehotta et al., 2005a). In addition, the current study did not investigate risk perception that is included as a construct in the HAPA. This decision was based on accumulating evidence that shows a lack of support for the contribution of this construct in explaining behaviour (Sheeran, Harris, & Epton, 2014). Finally, although some concern might be raised on the internal consistency of the scales for intention and outcome expectancies (below .7) their factor loadings clearly demonstrate validity.

Overall, the current study adds to the cumulative evidence for the importance of motivational and volitional processes in understanding hand washing behaviour, and for the mediating role of planning and action control between intention and behaviour (Amireault, Godin, & Vezina-Im, 2013; Carraro & Gaudreau, 2013; Hagger & Luszczynska, 2014; Kwasnicka et al., 2013; Reyes Fernandez et al., 2015). The findings of the current study also support the general structure of the HAPA in this context. Future interventions aimed at improving hand hygiene practices may want to consider the application of this model and the dual-phases it advocates as necessary for motivated action.

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Table 1. *Means, standard deviations, and correlations of the main study variables based on composite scores*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Mean (SD)
(1) T1 Self-efficacy	-								3.34 (0.66)
(2) T1 Outcome expectancies	.26***	-							3.21 (0.64)
(3) T1 Intention	.44***	.25***	-						2.59 (1.02)
(4) T1 Action planning	.36***	.35***	.34***	-					2.56 (.95)
(5) T2 Coping planning	.26***	.17**	.19**	.41***	-				2.36 (0.93)
(6) T2 Action control	.28***	.21***	.21**	.35**	.48**	-			2.75 (0.85)
(7) T1 Hand washing	.32**	.15**	.56***	.26***	.29***	.32***	-		3.49(1.21)
(8) T2 Hand washing	.26***	.11†	.30***	.24***	.35***	.42***	.58***	-	3.43 (1.20)

Note. † p=.06; * p < .01;**p < .01; ***p < .001

431 Table 2. *Standardized Factor Loadings of the Confirmatory Factor Analysis*

Items	Factors					
	Self-efficacy	Outcome expectancies	Intention	Action planning	Coping planning	Action control
1. Self-efficacy "... even when I cannot see positive changes immediately"	0.59					
2. Self-efficacy "…even when I am hurried"	0.79					
3. Self-efficacy "…even when it gets a lot of time for that to be part of my daily routine"	0.79					
4. Outcome expectancies "…then I'll stay healthy most of my life"		0.60				
5. Outcome expectancies "…then I'll feel good with clean hands all the time"		0.72				
6. Intention "…intend to wash my hands more than ten times a day"			0.80			
7. Intention "…intend to wash my hands at least ten times a day"			0.56			
8. Action planning "…when and where wash my hands"				0.76		
9. Action planning "…... how often to wash my hand".				0.89		
10. Action planning "…how to wash				0.73		

my hands with soap and water or disinfectant".		
11. Coping planning "…considering what to do if something interferes with my goal"	0.91	
12. Coping planning "…considering what to do when I'm in a hurry".	0.86	
13. Coping planning "…considering how to face the situation where there is no soap and water".	0.78	
14. Action Control "…I watched consistently when, how often and how to wash my hands".		0.85
15. Action Control "…I had often in my mind my intentions to wash my hands"		0.79
16. Action Control "…I tried really hard to frequently wash my hand"		0.70

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