Determining Motivation to Engage in Safe Food Handling Behaviour

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Abstract

Purpose: To apply the protection motivation theory to safe food handling in order to determine the efficacy of this model for four food-handling behaviours: cooking food properly, reducing cross-contamination, keeping food at the correct temperature and avoiding unsafe foods. Design: A cross-sectional approach was taken where all protection motivation variables: perceived severity, perceived vulnerability, self-efficacy, response efficacy, and protection motivation, were measured at a single time point. Findings: Data from 206 participants revealed that the model accounted for between 40-48%% of the variance in motivation to perform each of the four safe food handling behaviours. The relationship between self-efficacy and protection motivation was revealed to be the most consistent across the four behaviours. Implications: While a good predictor of motivation, it is suggested that protection motivation theory is not superior to other previously applied models, and perhaps a model that focuses on self-efficacy would offer the most parsimonious explanation of safe food handling behaviour, and indicate the most effective targets for behaviour change interventions. Originality: This is the first study to apply and determine the efficacy of protection motivation theory in the context of food safety.

Keywords: Food poisoning; hand washing; Protection Motivation Theory; motivation; hygiene; safe food-handling

1. Introduction

Food poisoning, also known as foodborne disease, refers to any illness that occurs following ingestion of contaminated food or drink. It is a public health issue in both developed and underdeveloped countries (Kuchenmüller, et al., 2009). Common pathogens implicated in food poisoning include Campylobacter, Salmonella and Escherichia coli. According to recent estimates foodborne illness affects a quarter of the population in the developed world (Food Safety Information Council, 2014; McKercher, 2012; Scallan, et al., 2011), which corresponds to nearly 6 million people in Australia. The consequences of food poisoning can be severe, with an average of 120 deaths annually in Australia, at a cost of $1.25 billion (Hall, et al., 2005; NSW Food Authority, 2015). Similar statistics have been reported in the United Kingdom (Adak, Meakins, Yip, Lopman, & O'Brien, 2005; Food Standards Agency, 2002; Redmond & Griffith, 2006) and the United States of America (Mead, et al., 1999). It is likely, however, that the true incidence of food poisoning is higher than that described, as not all cases are reported (Crerar, Dalton, Longbottom, & Kraa, 1996; Mead, et al., 1999). Indeed, it has been estimated that reported cases of foodborne illness represent only 10% of all cases (Lacey, 1993; see also Majowicz, et al., 2005).

Importantly, many cases of foodborne disease could be prevented if consumers practiced safer food handling behaviours, including implementing hand hygiene techniques and avoiding cross-contamination (Food Safety Information Council, 2014). However, despite the prevalence of foodborne illness and the relative ease of preventing the majority of cases, the literature on interventions attempting to target consumer food-safety behaviours is currently sparse. A recent systematic review found only ten relevant studies (Milton & Mullan, 2010), with only two of these classified as using a theory-based approach to change behaviour. Moreover, many of the interventions relied on education or instruction as their primary mode of change; despite knowledge that these are ineffective when used in isolation

for changing health behaviour generally (Rimal, 2000), and food-safety behaviour specifically (Mullan & Wong, 2010). Given that interventions based on a theoretical framework are more effective than non-theory-based interventions (Michie, Johnston, Francis, Hardeman, & Eccles, 2008), these findings demonstrate the need for further research into the use of theory-based approaches to prevent foodborne illness.

1.1. Use of theoretical frameworks

A variety of theoretical models have been developed in order to explain and predict behaviour (Conner & Norman, 2005; Schwarzer, 1992), and social cognition models in particular are commonly used and known to be effective for developing theory-based health interventions (Jenner, Watson, Miller, Jones, & Scott, 2002). A core assumption of social cognition models is that people make rational decisions based on cost/benefit analysis of the potential outcomes of behaviour (Conner & Norman, 2005). Such models have been found to successfully predict health behaviours such as physical activity (Young, Plotnikoff, Collins, Callister, & Morgan, 2014), health eating (Stacey, James, Chapman, Courneya, & Lubans, 2014) and condom use (Snead, et al., 2014); however, few have investigated safe food handling behaviour.

There are currently a number of commonly used theories in health psychology (for overview, see: Conner & Norman, 2015), but the Theory of Planned Behaviour (Ajzen, 1991) is the most frequently used model in food research (e.g., Kim, Jang, & Kim, 2014; Kothe, Mullan, & Butow, 2012; Sainsbury, Mullan, & Sharpe, 2013), and has specifically been applied to food handling behaviour in both adolescents (Mullan, Wong, & Kothe, 2013) and adults (Mari, Tiozzo, Capozza, & Ravarotto, 2012). In this theory, attitude, perceived societal pressure, and perceived control over behaviour, are said to influence whether one intends to perform a behaviour, which in turn influences actual performance (Ajzen, 1991).

Despite its established utility, the Theory of Planned Behaviour has received strong criticism regarding the suitability of the model for designing behaviour change interventions (e.g., Hardeman, Kinmonth, Michie, & Sutton, 2011). Several recently published theory of planned behaviour-based interventions have failed to confirm the meditational hypotheses specified by the theory suggesting that alternate mechanisms are driving any observed changes – that is, changes in attitude, subjective norm, and perceived behavioural control do not necessarily account for observed changes in intention, while changes in intention and perceived behavioural control do not predict changes in behaviour following intervention participation (e.g., Hardeman, et al., 2011; Kothe & Mullan, 2014). Based on these problems, it has therefore been suggested that rather than adding to a model that has been shown to consistently fall short, other theoretical approaches should be explored (Sniehotta, Presseau, & Araújo-Soares, 2014). One such model that may have application to safe food handling is protection motivation theory (PMT; Rogers, 1975; Rogers, Cacioppo, & Petty, 1983).

1.1.1. Protection Motivation Theory

PMT (Rogers, 1975; Rogers, et al., 1983) was developed initially as a framework for understanding the impact of fear appeals on attitudes and behaviour. It was later revised in order to extend to persuasive messages in general (Norman, Boer, Seydel, & Mullan, 2015; Rogers, 1975; Rogers, et al., 1983). A message may be seen as threatening (threat appraisal) if an individual believes they are vulnerable to the threat and that the outcome would be severe. Following the perception of a threat, the message recipient then selects an adaptive or maladaptive way in which to reduce the negative emotional state induced by the threat (coping appraisal). Adaptive coping responses include following behavioural advice, whereas a maladaptive coping response (if following the advice does not reduce fear, or no advice was presented) may be to avoid or deny the message altogether (Norman, et al., 2015).

The probability of performing an adaptive response is related to both the belief that the recommended behaviour will effectively reduce the threat (response efficacy), and the belief that the individual is capable of performing that behaviour (self-efficacy; Norman, et al., 2015). As self-efficacy is the extent of one's belief in one's own ability to complete a task, while response efficacy is referred to one's belief whether a certain action will avoid the threat, the former is more "subjective", while the latter is more "objective". According to PMT, these variables, in turn, contribute to protection motivation, which is the intention to follow the behavioural advice and is considered a proximal determinant of behaviour. However, research has demonstrated that threat perceptions are more likely to influence protection motivation if an individual believes they can cope with the threat (Ho, 1992; Maddux & Rogers, 1983; Schwarzer & Fuchs, 1995). Thus, high levels of vulnerability and severity are more likely to lead to motivation at high levels of efficacy (Maddux & Rogers, 1983).

In relation to the behaviour of interest here (safe food handling), in order for an individual to properly clean their hands they would need to believe that food poisoning is a severe outcome to which they are susceptible. They would additionally need to believe that hand washing is an effective way to minimise the threat of food poisoning, and that they are capable of correctly carrying out this behaviour. Despite the apparent relevance of this theory for safe food handling, to date very few studies have investigated the application of PMT to this behaviour. One study involving American school students found that severity and self-efficacy were correlated with behaviour, while perceived susceptibility was not (Haapala & Probart, 2004). Importantly, in this study response efficacy was not investigated, as the authors argued that the students, having no previous instruction on safe food handling, would be unable to respond to this aspect appropriately. It may therefore be the case that response efficacy is more applicable for an adult population. Using the Health Action Process

Approach but measuring similar constructs in a young adult population, risk awareness, vulnerability and self-efficacy were found to be important predictors of intentions to perform food-safety behaviours (Chow & Mullan, 2010).

1.2. Aims and Hypotheses

The aim of this study was to examine the utility of PMT in the context of safe food handling in order to determine effective targets for interventions. It is hypothesised that higher levels of perceived severity of a negative outcome and perceived vulnerability to experiencing that outcome will relate to greater protection motivation to engage in safe food handling behaviour. Additionally, it is hypothesised that greater self-efficacy and response efficacy will relate to greater protection motivation to engage in safe food handling behaviour. Finally, it is hypothesised that perceived severity and vulnerability will be more strongly related to protection motivation when self-efficacy and response efficacy are high.

2. Material and Methods

2.1. Design

The study employed a cross-sectional design, where all variables hypothesised to predict protection motivation to perform behaviour were measured at one time point. The primary outcomes of interest were protection motivation to engage in four distinct safe food handling behaviours: 1) Cook food properly; 2) Reduce cross-contamination; 3) Keep food at the correct temperature; and 4) Avoid unsafe foods. These four broad behaviours were informed by the Australian Food Safety Information Council guidelines (Food Safety Information Council, 2014).

2.2. Participants

Participants were recruited via the University's research participation pool of first year students. They received course credit for participation. The study received approval from the University's Human Research Ethics Committee. Participation was voluntary and

occurred only following informed consent. Participants also completed some additional measures that were not part of this study and that are reported elsewhere (Mullan, Allom, Sainsbury, & Monds, 2015a).

2.3. Materials

Participants reported their gender, age, living situation, and ethnicity.

2.3.1. Severity

Severity was assessed using the mean of two items (e.g., "How severe would the following health related problems be for you: to suffer from food poisoning?") rated on a five-point scale (1 = not at all – 5 = extremely severe). Internal consistency was $r_{sb} = 0.75$.

2.3.2. Vulnerability

Vulnerability was assessed using the mean of two items for each of the four behaviours (e.g., "Compared to other people of your age and sex, if you don't cook food properly, how do you estimate the likelihood that you will ever: suffer from food poisoning?"). Items were rated on a seven-point scale (1 = definitely less likely – 7 = definitely more likely), with the following internal consistency estimates obtained (cook food properly: $r_{sb} = 0.80$; reduce cross-contamination: $r_{sb} = 0.84$; correct temperature: $r_{sb} = 0.84$; avoid unsafe foods: $r_{sb} = 0.83$).

2.3.3. Response Efficacy

Response efficacy was assessed using the mean of three items for each behaviour (e.g., "I am confident that I am able to cook food properly over the next week even if I have to make a detailed plan in order to have the appropriate materials."), rated on a seven-point scale (1 = strongly disagree – 7 = strongly agree) with higher scores indicating greater response efficacy for the behaviours. The following internal consistency estimates were obtained (cook food properly: $\alpha = 0.91$; reduce cross-contamination: $\alpha = 0.91$; correct temperature: $\alpha = 0.90$; avoid unsafe foods: $\alpha = 0.91$).

199 *2.3.4. Self-Efficacy*

200 Self-efficacy was assessed as the mean of three items for each behaviour (e.g., "If I
201 wanted to, I could easily cook food properly every time I prepare food over the next week."),
202 rated on a seven-point scale (1 = strongly disagree – 7 = strongly agree), with higher scores
203 indicating greater self-efficacy for the behaviours. The following internal consistency
204 estimates were obtained (cook food properly: $\alpha = 0.78$; reduce cross-contamination: $\alpha =$
205 0.82; correct temperature: $\alpha = .77$; avoid unsafe foods: $\alpha = .75$).

206 *2.3.5. Protection Motivation*

207 Protection motivation was assessed using two items for each behaviour (e.g., "I will
208 try to cook food properly every time I prepare food over the next week."), rated on a six-point
209 scale (1 = strongly disagree – 6 = strongly agree), with higher scores indicating greater
210 motivation to perform safe food-handling behaviours. The following internal consistency
211 estimates were obtained (cook food properly: $r_{sb} = 0.91$; reduce cross-contamination: $r_{sb} =$
212 0.87; correct temperature: $r_{sb} = 0.90$; avoid unsafe foods: $r_{sb} = 0.92$).

213 *2.4. Procedure*

214 After providing informed consent, participants completed an online questionnaire
215 including all demographic information, and PMT variables. At the beginning of the
216 questionnaire, and as a reminder on each page, participants were given safe food-handling
217 guidelines. See Supplementary Material for the exact information that was provided.
218 Participants were fully debriefed about the study.

219 *2.5. Data Analyses*

220 Pearson correlation coefficients were calculated to investigate the relationships
221 between the PMT variables. A series of hierarchical regression analyses were used to
222 determine the variance accounted for by severity, vulnerability, response efficacy, and self-
223 efficacy, and the interactions between severity and self-efficacy and response efficacy

(severity x self-efficacy; severity x response efficacy), and vulnerability and self-efficacy and response efficacy (vulnerability x self-efficacy; vulnerability x response efficacy), in protection motivation to perform each of the following food-handling behaviours: 1) Cook food properly; 2) Reduce cross-contamination; 3) Keep food at the correct temperature; and 4) Avoid unsafe foods. All variables were standardized before calculating interaction terms, and the standardised terms were entered into the regressions. Any demographic variables that were significantly related to protection motivation were entered first into the regression to control for these factors, followed by all PMT variables in the next step, and the interaction terms in the final step.

3. Results

3.1. Sample Characteristics

Two-hundred and six participants (75.2% female) with a mean age of 19.7 (*SD* = 3.97, range 17-47) completed the questionnaire. The majority were single (88.8%), identified themselves as Australian (85.4%), and lived with their parents (70.4%).

3.2. Descriptive statistics

Gender was related to protection motivation to perform three of the four behaviours. Point bi-serial correlations revealed that females tended to have a stronger protection motivation for reducing cross-contamination (r_{pb} = .74, p < .01), keeping food at the correct temperature (r_{pb} = .80, p < .01), and avoiding unsafe foods (r_{pb} = .76, p < .01). No other demographic variables were significantly related to protection motivation to perform any of the specific behaviours, all p > .05. Table 1 shows the mean scores for all PMT variables for each of the four food-handling behaviours separately. See Tables 1 – 4 in supplementary material, for correlations between the PMT variables for each of the four safe food handling behaviours.

Table 1. Means and standard deviations of protection motivation theory variables for each safe food-handling behaviour

	Cook food properly		Reduce Cross-Contamination		Correct temperature		Avoid unsafe food	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Vulnerability	3.47	0.91	3.67	0.82	3.51	0.90	3.67	0.92
Response Efficacy	5.89	1.05	5.91	1.07	5.76	1.11	5.50	1.16
Self-Efficacy	6.28	0.75	6.42	0.70	6.29	0.71	6.37	0.67
Protection Motivation	5.32	0.70	5.29	0.71	5.26	0.71	5.33	0.70

Note: Severity was an overall measure rather than for each behaviour (M = 3.31; SD = 0.88).

3.3. Cook food properly

At step 1, the model accounted for 45.1% of the variance in protection motivation to cook food properly, $F(4,201) = 41.34$, $p < .01$. Self-efficacy contributed significantly to the explained variance, $\beta = .68$, $p < .01$; however, all other variables were non-significant, all $p > .05$. At step 2, the interaction accounted for a further 2.4% of variance in protection motivation, which was marginally significant, $F(4,197) = 2.26$, $p = .06$. The interaction between severity and self-efficacy was significant, $\beta = .13$, $p = .04$; see Figure 1, while all other terms were not. Self-efficacy remained significant in the final model, $\beta = .72$, $p < .01$, which accounted for 47.5% of the variance in protection motivation to cook food properly, $F(8,197) = 22.32$, $p < .01$. Note that adding gender in to the model did not change the significance or direction of these results (see Supplementary material for analyses with gender).

INSERT FIGURE 1 NEAR HERE

3.4. Reduce cross-contamination

Gender accounted for 4.2% of the variance in protection motivation, $F(1,204) = 9.04$, $p < .01$, such that females tended to have a higher protection motivation to reduce cross-contamination, $\beta = .21$, $p < .01$. Severity, vulnerability, response efficacy, and self-efficacy were entered into the model next and accounted for an additional 38.0% of variance in protection motivation to reduce cross-contamination, $F\Delta(4,200) = 32.88$, $p < .01$. Self-efficacy was the only variable that contributed significantly to the explained variance in protection motivation, $\beta = .56$, $p < .01$. At step 3, the interaction terms did not account for further variance in protection motivation, $F\Delta(4,196) = 1.36$, $p = .251$. The final model accounted for 43.8% of the variance in protection motivation to reduce cross-contamination, $F(9,196) = 16.96$, $p < .01$. Self-efficacy remained significant in the final model, $\beta = .58$, $p < .01$; however, gender did not contribute to the explained variance in the final model, $\beta = .11$, $p = .06$.

3.5. Correct temperature

Gender accounted for 4.8% of the variance in protection motivation, $F(1,204) = 10.36$, $p < .01$, such that females tended to have a higher protection motivation to keep food at the correct temperature, $\beta = .22$, $p < .01$. Severity, vulnerability, response efficacy, and self-efficacy were entered into the model next and accounted for an additional 40.0% of variance in protection motivation to keep food at the correct temperature, $F\Delta(4,200) = 36.28$, $p < .01$. Response efficacy, $\beta = .15$, $p = .01$, and self-efficacy, $\beta = .54$, $p < .01$, significantly contributed to the explained variance in protection motivation. At step 3, the interaction terms did not account for further variance in protection motivation, $F\Delta(4,196) = 0.15$, $p = .964$. The final model accounted for 45.0% of the variance in protection motivation to keep food at the correct temperature, $F(1,196) = 17.83$, $p < .01$. Gender, $\beta = .12$, $p = .03$, self-efficacy, $\beta = .56$, $p < .01$, and response efficacy, $\beta = .15$, $p = .02$, remained significantly related to protection motivation in the final model.

3.6. Avoid unsafe foods

Gender accounted for 3.7% of the variance in protection motivation, $F(1,204) = 7.81$, $p < .01$, such that females tended to have a higher protection motivation to avoid unsafe foods, $\beta = .19$, $p < .01$. Severity, vulnerability, response efficacy, and self-efficacy were entered into the model next and accounted for an additional 34.7% of variance in protection motivation to keep food at the correct temperature, $F\Delta(4,200) = 28.18$, $p < .01$. Severity, $\beta = .14$, $p = .02$, response efficacy, $\beta = .19$, $p < .01$, and self-efficacy, $\beta = .48$, $p < .01$, significantly contributed to the explained variance in protection motivation. At step 3, the interaction terms did not account for further variance in protection motivation, $F\Delta(4,196) = 1.34$, $p = .256$. The final model accounted for 40.0% of the variance in protection motivation to avoid unsafe foods, $F(9,196) = 14.55$, $p < .01$. Severity, $\beta = .13$, $p = .04$, self-efficacy, $\beta = .53$, $p < .01$, and response efficacy, $\beta = .17$, $p < .01$, remained significant; however, gender did not contribute to the explained variance in the final model, $\beta = .06$, $p = .29$. See Figure 2 for relationships between PMT variables and protection motivation to perform each safe food-handling behaviour

INSERT FIGURE 2 NEAR HERE

4. Discussion

The current study represents the first to investigate the utility of PMT in the context of safe food handling behaviours. Interestingly, depending on the behaviour in question, not all PMT variables were significantly related to protection motivation. While self-efficacy accounted for unique variance in protection motivation for each behaviour type, response efficacy was only related to protection motivation to keep food at the correct temperature, and to avoid unsafe foods. Further, severity was only related to protection motivation in the avoidance of unsafe foods, and vulnerability did not explain any of the variance in the four

behaviours. Finally, an interaction between self-efficacy and severity was detected for cooking food properly.

Overall, the model accounted for between 40-48% of the variance in protection motivation to perform safe food handling behaviour. This is comparable to previous research that has employed other 'rational' models such as the Theory of Planned Behaviour and the Health Action Process Approach. Namely, Phillip and Anita (2010) demonstrated that the Theory of Planned Behaviour accounted for 48% of variance in intention, while Chow and Mullan (2010) demonstrated that the Health Action Process Approach model accounted for 31% of the variance in intention. This is unsurprising given that the variable that consistently predicted protection motivation was self-efficacy, which is an integral determinant of motivation in the Health Action Process Approach (Schwarzer, 1992). Similarly, perceived behavioural control, a construct theoretically similar to self-efficacy, is an important predictor of intention in the Theory of Planned Behaviour (Ajzen, 1991). While PMT accounted for a substantial proportion of variance in protection motivation to engage in each of the four food safety behaviours, the full model was not supported for any of the behaviours given that several of the hypothesised relationships between variables were not found. The most consistent relationship across behaviours was between self-efficacy and protection motivation. This result suggests that the more capable an individual feels at performing safe food handling behaviours, the more motivated they will feel to engage in said behaviour. This is similar to previous findings that suggest that perceived behavioural control is the most important predictor of intention to engage in safe food handling behaviour (Shapiro, Porticella, Jiang, & Gravani, 2011). Together these findings suggest that self-efficacy is an important target for food safety interventions.

The relationship between self-efficacy and protection motivation to cook food properly was qualified by level of perceived severity. This effect appeared to indicate that

individuals who perceived the outcome of not cooking food properly to be severe, would be more motivated to cook food properly if they had the self-efficacy to do so, and less motivated if they had low self-efficacy. This is supports previous findings in which increases in perceived susceptibility to an adverse outcome resulted in higher protection motivation only when the coping response was considered effective (Stainback & Rogers, 1983) or achievable (Maddux & Rogers, 1983). This is important for health campaigns aiming to increase motivation to perform safe food-handling behaviours, as it suggests that emphasising the severity of the outcome may only be helpful if self-efficacy is also encouraged (Witte & Allen, 2000).

Response efficacy was important for the behaviours of keeping food at the correct temperature and avoiding unsafe foods. Thus, whether or not an individual believed that keeping food at the correct temperature, and avoiding unsafe foods, would reduce the threat of food poisoning influenced their motivation to engage in these behaviours. That response efficacy did not relate to motivation to cook food properly and reduce cross-contamination suggests that the outcome of performing these behaviours is less reliability associated with performance of the behaviours. It is suggested that future research aiming to increase motivation to engage in these particular safe food handling practices increase the salience of the relationship between performing the behaviour and the outcome of doing so.

Perceived severity and perceived vulnerability were not related to motivation to engage in safe food handling behaviour, suggesting that risk awareness is not a contributing factor to motivation to engage in safe food handling behaviours. This is similar to the findings of Chow and Mullan (2010) in which a relationship between the Health Action Process Approach variable “risk awareness severity” and intention was not observed. That risk awareness was not related to motivation to engage in a behaviour that will reduce said risk suggests that there may be a disconnect between what individuals in this sample believed

the risk to be and what it actually was. In order to increase the correspondence between perceived severity and actual severity, interventions may wish to include information regarding the consequences of unsafe food handling behaviour.

It is worth noting that gender accounted for a significant proportion of the variance in keeping foods at the correct temperature even after all PMT variables had been entered in to the model. This finding suggested that women were more likely to have a higher protection motivation to keep foods at the correct temperature. Previous research has found that females report greater motivation to engage in safe food handling behaviours (Shapiro, et al., 2011). It is suggested that future research focuses on the predictors of engagement in safe food handling behaviours within male and female populations separately in order to determine the relevant targets for intervention.

4.1. Implications

The findings of this study indicate numerous targets for interventions designed to increase motivation to engage in safe food handling behaviour. Firstly, as self-efficacy was consistently related to all four safe food handling behaviours, this element of motivation appears to be a relevant target for intervention. Two ways in which self-efficacy can be improved are by verbal persuasion and monitoring of performance accomplishments (Bandura, 1993). Verbal persuasion can be used to encourage progress, and attribute accomplishments to an individual's own abilities. Performance accomplishments can be monitored and reviewed by an activity log (Schunk & Ertmer, 2012). Secondly, given that the relationship between PMT variables and motivation differed across the four safe food handling behaviours, it is recommended that specific intervention strategies are developed for each of the behaviours. Similarly, the results of the current study suggest that there may be different determinants of safe food handling behaviour in men and women and this should be taken into account when designing interventions.

4.2. Limitations

The current data are cross-sectional making inferences regarding causality of effects difficult. While the goal of this study was to determine relationships between PMT variables and motivation to engage in safe food handling behaviours, it is suggested that these variables are manipulated in future research in order to determine causal relationships. Additionally, as the aim of this research was to only look at the precursors of protection motivation, the current study did not measure behaviour. Thus, while we are able to account for variance in motivation to perform safe food handling behaviours, we cannot determine whether this leads to behaviour. However, considerable previous research has looked at the relationship between intention and behaviour and factors that may reduce this gap (Fulham & Mullan, 2011; Mullan, et al., 2015b).

5. Conclusions

Despite the intuitive appeal of PMT in the context of safe food handling behaviour, the model appears to account for similar variance in motivation to other models such as the Theory of Planned Behaviour and the Health Action Process Approach. While the research provides numerous avenues for intervention design it may be that future research focus on the construct of self-efficacy, and perhaps adopt a social cognitive theory (Bandura, 1991) approach to predicting and explaining safe food handling behaviour.

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Figures

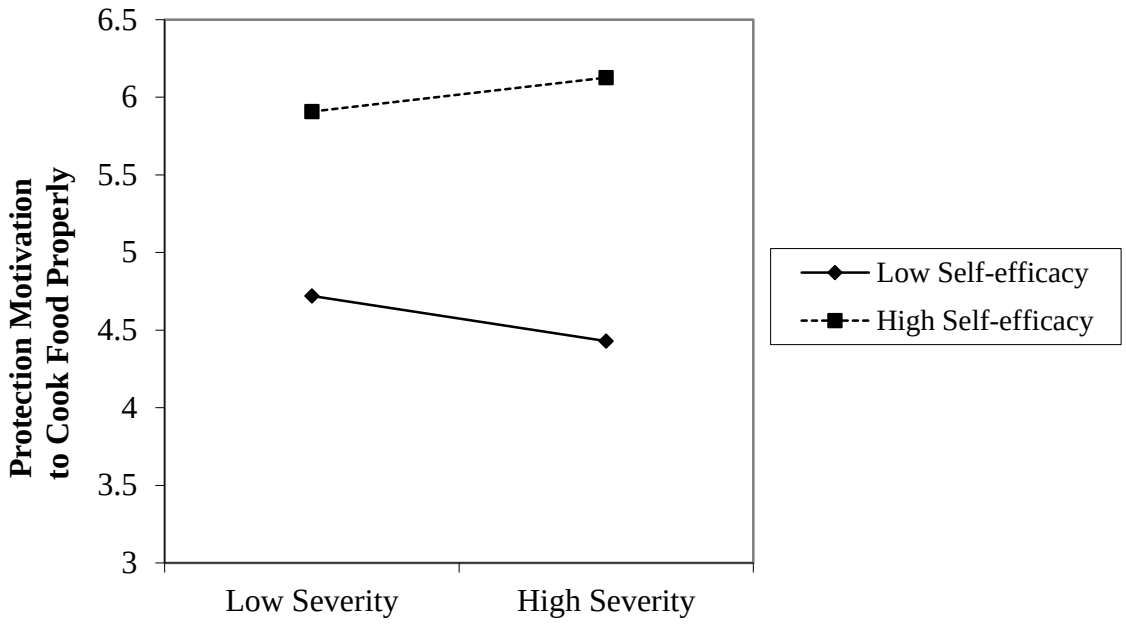

Fig. 1.

Moderation effect between self-efficacy and severity. Lines are plotted at +/- 1SD above and below the mean

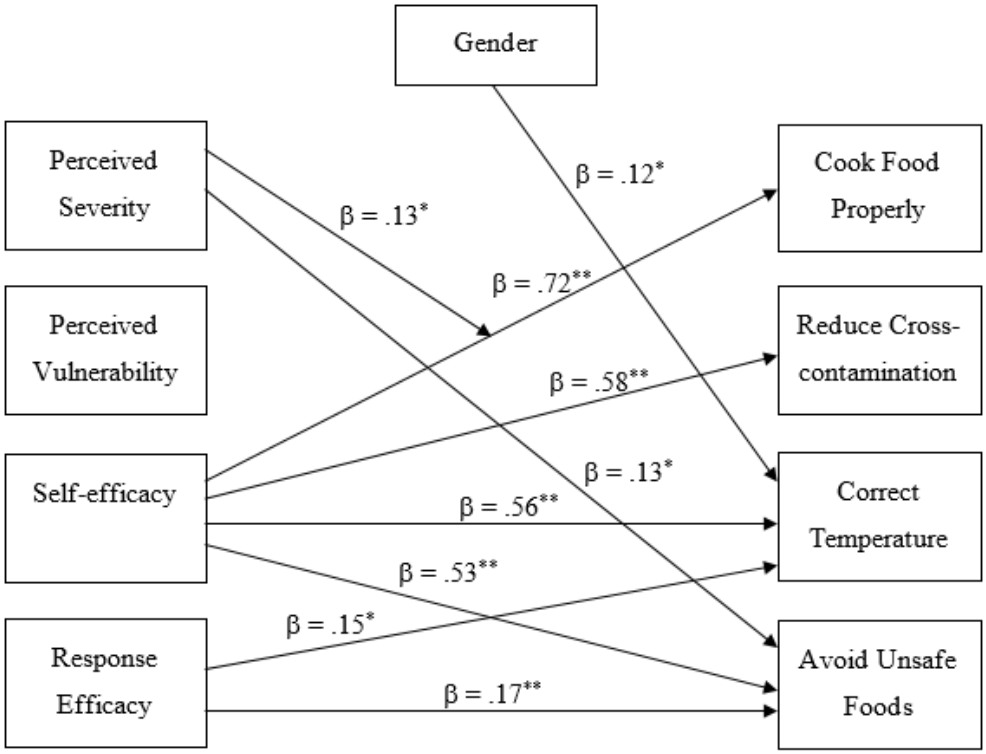

Fig. 2.

Significant relationships between gender, Protection Motivation Theory variables, and protection motivation to engage in each safe food-handling behaviour. Note that lines connecting to other lines represent moderation effects. $^{*}p < .05$; $^{**}p < .01$.

Supplementary Material

Information provided to participants.

The following questions will ask you to reflect upon four safe food handling behaviours.

Please read the descriptions below in which examples of these four behaviours are given in order to give you an idea of what each of the behaviours are referring to.

1. Cooking food properly:

- Cook poultry until the meat is white – there should be no pink flesh
- Cook hamburgers, mince, sausages, and rolled or stuffed roasts right through until any juices run clear
- Thoroughly cook foods made from eggs such as omelettes and baked egg custards
- Cook white fish until it flakes easily with a fork.

2. Washing hands and cleaning cooking surfaces:

- Wash hands for at least 30 seconds in warm, soapy water before preparing food
- Wash your hands thoroughly before preparing food and after handling raw meats, chicken, seafood, eggs and unwashed vegetables
- Use hot soapy water to wash things and ensure they are thoroughly dry before using them
- Don’t use the same equipment and utensils for raw foods and for ready-to-eat foods, without thoroughly cleaning them first

3. Keeping food at the correct temperature:

- Keep chilled food at 5°C or colder
- Keep frozen food frozen solid
- Keep hot foods at 60°C or hotter

4. Avoiding unsafe foods:

- Throw out high-risk food that has been left in the Temperature Danger Zone (5°C - 60°C) for more than four hours
- Check the 'use-by date' and do not eat foods past their use-by date
- Avoid food that seems spoiled, such as mouldy or discoloured product

Questionnaire

Demographics

- *For sample recruited through SocialSci*

1. Are you
   - Male
   - Female

2. How old are you?

   [ ] years

3. Please select your current living situation:

   - With parents
   - With friends
   - With partner
   - College (catered)
   - College (uncatered)
   - Alone
   - Other

3. How would you classify yourself?

   - Indigenous Australian
   - Australian
   - Maori
   - New Zealander
   - Pacific Islander (e.g. Fijan, Samoan)
   - Melanesian (e.g. Papua New Guinean, Solomon Islander)
   - North-West European (e.g. UK, Irish, German)
   - Southern and Eastern European (e.g. Italian, Macedonian, Polish)
   - North African and Middle Eastern (e.g. Turkish, Iranian, Egyptian)
   - South-East Asian (e.g. Vietnamese, Indonesian)
   - North-East Asian (e.g. Chinese, Korean)
   - Southern and Central Asian (e.g. Indian, Pakistani)
   - North American
   - Central and Southern American
   - Sub-Saharan African (e.g. South African, Zimbabwean)
   - Other

Protection Motivation Theory

- *Vulnerability*
  (1 = definitely less likely; 7 = definitely more likely)

1. Compared to other people your age and sex, if you don't cook food properly, how do you estimate the likelihood that you will ever: -suffer from food poisoning?
2. Compared to other people your age and sex, if you don't cook food properly, how do you estimate the likelihood that you will ever: -feel less healthy?
3. Compared to other people your age and sex, if you don't wash your hands and clean your cooking surfaces before you prepare food, how do you estimate the likelihood that you will ever: -suffer from food poisoning?
4. Compared to other people your age and sex, if you don't wash your hands and clean your cooking surfaces before you prepare food, how do you estimate the likelihood that you will ever: -feel less healthy?
5. Compared to other people your age and sex, if you don't keep food at the correct temperature, how do you estimate the likelihood that you will ever: -suffer from food poisoning?
6. Compared to other people your age and sex, if you don't keep food at the correct temperature, how do you estimate the likelihood that you will ever: -feel less healthy?
7. Compared to other people your age and sex, if you don't avoid unsafe food, how do you estimate the likelihood that you will ever: -suffer from food poisoning?
8. Compared to other people your age and sex, if you don't avoid unsafe food, how do you estimate the likelihood that you will ever: -feel less healthy?

- *Severity*
  Likert Scale 1 to 5 (1 = not at all; 2 = mild, 3 = moderate, 4 = severe, 5 = extremely severe)

1. How severe would the following health problems be for you:-suffering from food poisoning?
2. How severe would the following health problems be for you:-feeling less healthy?

- *Response efficacy*
  Likert Scale 1 to 7 (1 = strongly disagree to 7 = strongly agree)

1. I am confident I am able to cook food properly even if I have to:-make a detailed plan to have appropriate materials
2. I am confident I am able to cook food properly even if I have to:-rethink my behaviours and options regarding safe food handling
3. I am confident I am able to cook food properly even if I have to:-overcome the usual habit of not handling food safely

4. I am confident I am able to wash my hands and clean my cooking surfaces before preparing food even if I have to:-make a detailed plan to have appropriate materials
5. I am confident I am able to wash my hands and clean my cooking surfaces before preparing food even if I have to:-rethink my behaviours and options regarding safe food handling
6. I am confident I am able to wash my hands and clean my cooking surfaces before preparing food even if I have to:-overcome the usual habit of not handling food safely
7. I am confident I am able to keep food at the correct temperature even if I have to:-make a detailed plan to have appropriate materials
8. I am confident I am able to keep food at the correct temperature even if I have to:-rethink my behaviours and options regarding safe food handling
9. I am confident I am able to keep food at the correct temperature even if I have to:-overcome the usual habit of not handling food safely
10. I am confident I am able to avoid unsafe foods even if I have to:-make a detailed plan to have appropriate materials
11. I am confident I am able to avoid unsafe foods even if I have to:-rethink my behaviours and options regarding safe food handling
12. I am confident I am able to avoid unsafe foods even if I have to:-overcome the usual habit of not handling food safely

- *Self-efficacy*
  Likert scale 1 to 7 (1 = strongly disagree to 7 = strongly agree)

1. Over the next week, if i wanted to, I could easily:-cook food properly every time I prepare food
2. I am confident that over the next week if I wanted to, I could:-cook food properly every time I prepare food
3. Over the next week, it is under my control whether or not I: -cook food properly every time I prepare food
4. Over the next week, if i wanted to, I could easily:-wash my hands and clean my cooking surfaces every time before I prepare food
5. I am confident that over the next week if I wanted to, I could:-wash my hands and clean my cooking surfaces every time before I prepare food
6. Over the next week, it is under my control whether or not I: -wash my hands and clean my cooking surfaces every time before I prepare food
7. Over the next week, if i wanted to, I could easily:-keep food at the correct temperature every time I prepare food
8. I am confident that over the next week if I wanted to, I could:-keep food at the correct temperature every time I prepare food
9. Over the next week, it is under my control whether or not I: -keep food at the correct temperature every time I prepare food
10. Over the next week, if i wanted to, I could easily:-avoid unsafe foods
11. I am confident that over the next week if I wanted to, I could:-avoid unsafe foods
12. Over the next week, it is under my control whether or not I: -avoid unsafe foods

- *Protection Motivation*

  Likert scale 1 to 7 (1 = strongly disagree to 7 = strongly agree)

1. Over the next week, I intend to:-cook food properly every time I prepare food
2. Over the next week, I will try to:-cook food properly every time I prepare food
3. Over the next week, I intend to:-wash my hands and clean my cooking surfaces everytime before I prepare food
4. Over the next week, I will try to:-wash my hands and clean my cooking surfaces everytime before I prepare food
5. Over the next week, I intend to:-keep food at the correct temperature everytime I prepare food
6. Over the next week, I will try to:-keep food at the correct temperature everytime I prepare food
7. Over the next week, I intend to:-avoid unsafe foods
8. Over the next week, I will try to:-avoid unsafe foods

Table 1. Correlations between PMT variables: Cook food properly

	Severity	Vulnerability	Response Efficacy	Self-Efficacy	Protection Motivation
Severity	1	.317**	.081	.108	.078
Vulnerability		1	.232**	.171*	.149*
Response Efficacy			1	.561**	.369**
Self-Efficacy				1	.681**
Protection Motivation					1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Correlations between PMT variables: Reduce cross-contamination

	Severity	Vulnerability	Response Efficacy	Self-Efficacy	Protection Motivation
Severity	1	.233**	.107	.127	.118
Vulnerability		1	.226**	.329**	.248**
Response Efficacy			1	.518**	.414**
Self-Efficacy				1	.640**
Protection Motivation					1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3. Correlations between PMT variables and behaviour: Correct Temperature

	Severity	Vulnerability	Response Efficacy	Self-Efficacy	Protection Motivation
Severity	1	.330**	.150*	.152*	.177*
Vulnerability		1	.218**	.346**	.291**
Response Efficacy			1	.459**	.430**
Self-Efficacy				1	.643**
Protection Motivation					1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4. Correlations between PMT variables and behaviour: Avoid unsafe food

	Severity	Vulnerability	Response Efficacy	Self-Efficacy	Protection Motivation
Severity	1	.273**	.093	.183*	.246**
Vulnerability		1	.254**	.349**	.268**
Response Efficacy			1	.350**	.382**
Self-Efficacy				1	.571**
Protection Motivation					1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).