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Similar but different: Health behaviour pathways differ between men and women

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Abstract
The purpose of the study was to examine middle to older aged Australians’ healthy eating, eating out, and physical activity behaviours and to investigate their relationships with likely antecedents such as demographics, personal values, health background, and attention to weight and health habits. A mail survey was conducted among a random sample of men and women aged between 38 and 79 years; 1105 usable questionnaires were obtained. Structural equation modelling was used to examine relationships between the variables. The results showed that there were distinct relationships between predictive variables and behavioural and BMI outcomes for men and women. For example, healthy eating, eating out behaviours were positively associated with body weight for women but not men while attention to weight and health habits was positively related to hedonism values for women but not for men. The interrelationships among the predictors and the outcome variables appear to be more complex for women than men. The implications of the findings for nutrition communication are discussed.

**Keywords**: Personal values, health habits, body weight, demographics, intention to weight and health habits, dietary behaviours, physical activity.

**Introduction**
Many of the challenges of ageing populations in developed countries relate to the poor state of older people’s health. Larger numbers of people are living longer with relatively high prevalence of chronic disease (Mathers & Loncar, 2006). This is a major problem that may have a fundamental effect on the economic sustainability of modern society, especially the viability of publically funded health and social services (Berwick, Nolan, & Whittington, 2008).

Fortunately, many of the leading causes of death and morbidity are lifestyle-related illnesses, which may be reversed or ameliorated by changing individuals’ health risk behaviours such as poor dietary and physically inactive behaviours, and substance abuse, particularly smoking and alcohol abuse (Sacks et al., 2001). To bring about changes in health risk behaviours, more understanding of the influences on them is required. In this paper, we examine the likely influence of several sets of personal characteristics on selected eating and physical activity behaviours of middle and older aged Australians.

Much research has been reported on the likely antecedents of health risk behaviours; most of it relates to possible demographic influences such as the effects of age, income, education, marital status. For example, there is considerable evidence that food behaviours are associated with:

(a) Age: older individuals tend to have different food consumption behaviours to younger people (Dean, Raats, Grunert, Lumbers, & The Food in Later Life Team, 2009).
(b) Socio economic status: people from lower socio-economic status (SES) backgrounds (as indicated by education and family income) tend to consume more energy dense foods (e.g., Drewnowski & Specter, 2004; Worsley, Blasche, Ball, & Crawford, 2004).

There is also a stream of research which examines the likely influence of psychological factors such as personal values (e.g., Grunert & Juhl, 1995; Povey, Conner, Sparks, James, & Shepherd, 2000); and social ideologies (Wang, Worsley, & Cunningham, 2008; Wang, Worsley, & Cunningham, 2009). In particular, universalism (appreciation, of community and nature (Schwartz, 1992)) may be positively related to healthy diet (Brunso, Scholderer, & Grunert, 2004). In contrast, hedonist values focus on pleasure and sensuous gratification (Schwartz, 1992) and may be negatively related to the practise of healthy eating and health behaviours (Hoyer & MacInnis, 2008).

One recent study which incorporated several sets of lifestyle behaviours was that by Kruger, Blanck, and Gillespie (2008). In the American 2004 Styles survey, they found that adults who controlled their eating behaviours when dining out, who ate five or more servings of fruit and vegetables per day and undertook regular physical activity through the week, were more successful at maintaining their body weight. However, BMI was assessed only in terms of broad categories, and the precursors of the healthy eating, dining out and physical activity behaviours were not examined.

The associations of antecedent factors with health risk behaviours and more distal outcomes such as body weight are variable, complex and often interdependent. This has
made it difficult to make strong generalisations about the likely influence of particular variables such as age or socio economic status on behaviours. In part, this can be remedied through the inclusion of “mediating” variables in predictive models between demographic and personal characteristics, and, behavioural or biomedical outcomes (such as body weight). So weight consciousness and weight monitoring may mediate relationships between demographics, and food and physical activity behaviours and body weight (Conner & Sparks, 2005). Similarly, alcohol drinking and tobacco smoking may moderate relationships between personal characteristics and food and health behavioural outcomes (Padrao, Lunet, Santos, & Barros, 2007).

This discussion however, treats all variables as epistemologically equal. From a historical and sociological perspective gender is, perhaps, one of the more important variables when it comes to food and health. In most societies men and women had and continue to have quite different food and health behaviours (Fieldhouse, 1995). More women are responsible for food shopping and preparation, care of children, the sick and disabled than men; they tend to monitor their weight and health more than men, and they live longer than men. For example, women tend to be more aware of health issues and choose more nutritious foods than men (Beardsworth et al., 2002; Worsley, 1988; Worsley & Scott, 2000; Worsley & Skrzypiec, 1997, 1998). It is likely that the predictive pathways underlying food and health behaviours and body weight may differ substantially between women and men but they have rarely been examined in detail.
Therefore, the principal aim of the present study was to examine the likely predictors of food and health behaviours separately in women and men in order to identify both common and sex specific predictive pathways.

Methods
The findings reported here are based on data from the third Baby Boomer survey, one of three random population surveys among 38 to 79 year olds living in Victoria, Australia (Worsley, Wang, & Hunter, 2010).

Participants
The survey was administered to a simple random sample drawn from the Electoral Rolls in Victoria, Australia. Two thousand four hundred and seventy two people aged over 35 years were invited to participate in 2008, of whom 1105 returned usable questionnaires.

Procedure
The survey was mailed to the sample following the procedures recommended by Dillman (2009). First, a preparatory letter was sent, followed a week later, by the questionnaire along with an explanatory letter; two weeks later a reminder postcard, and two weeks thereafter, a replacement questionnaire, were sent to non respondents. The demographic characteristics of the respondents are described in Table 1.

Questionnaire
Health behaviours
Respondents were asked: “How often do you do any of the following to achieve or maintain a healthy weight?” then followed a list of 10 items of
heath behaviours on healthy eating, eating out, and physical activity (Table 2). The items were derived from Kruger, Michels Blanck, and Gillespie’s (2008) study. The response options ranged from never (0) to always (4).

**Attention to weight and health habits** This set of items asked “How much attention do you usually pay to?” (a) your personal health habits; (b) getting enough physical activity; (c) eating a healthy low-fat diet; and (d) controlling your weight. A five point response scale was given ranging from none (1) to very much (5).

**Personal Values** Twenty two items from the Schwartz Values Inventory (Schwartz, 1992), similar to those used in our previous studies (e.g., Worsley & Skrzypiec, 1998) were listed. Respondents were asked to rate the importance of each of these values in their lives by circling a number on five point rating scales ranging from 0 (not important) to 4 (extremely important). Two domains of personal values, universalism and hedonism, were used in the present analyses.

**BMI, drinking and smoking** BMI was calculated from self-reported height (cm) and weight (kg). Several studies have shown that self-reported height and weight are valid measures for BMI estimation (e.g., Venn et al., 2007). Alcohol drinking was assessed by a single question: drink more than two glasses of alcohol most days? Smoking was assessed by the question: Do you smoke cigarettes or other tobacco? Both questions had a response option of no and yes.
Demographic information was elicited including sex, age and family income (categorised as less than $35,000 pa, $35,000 to $50,000 pa, $50,000 to $100,000 pa, and over $100,000 pa.) Level of education was coded as primary school or less, some secondary school, completed secondary school or on-job training, technical or college diploma, certificate or formal trade qualification, graduate tertiary qualification, and postgraduate tertiary qualification.

Analytical procedure

Structural equation modelling (SEM) was the main analytic procedure as it extends traditional multivariate statistical analyses (e.g., multiple regression) in at least three important ways. It accounts for measurement errors involved in psychometric measures, provides assessment of goodness-of-fit for the hypothesised model to the sample data, and allows theory testing (Bollen, 1989).

The data was analysed using SPSS 17 (SPSS, 2008) and Mplus 6 (Muthén & Muthén, 1998-2011). The robust maximum likelihood (MLR) estimation method was used to account for non-normally distributed data. Model evaluations were examined by chi-square statistics and accompanying significance tests. Goodness-of-fit indices reported are the standardized root mean square residual (SRMR), root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), and Comparative fit index (CFI) (Jackson, Gillaspy, & Purc-Stephenson, 2009). When the models were considered to fit the data well, the following criteria were met: chi-square probability p > .05, SRMR < .05, RMESA < .05, TLI > .95, and CFI > .95.
The item parcelling method (Kishton & Widaman, 1994; Nasser & Takahashi, 2003) was used to form the scale scores. Once composite variables had been computed through parcelling the items measuring the same construct, it was possible to fix both the regression coefficients, which reflect the regression of each composite variable on its latent variable, and the measurement error variances associated with each composite variable via the formulae proposed by Munck (1979). Using Munck’s formula, regression coefficients can be derived from $SD\sqrt{\alpha}$ and error variances from $SD^2 (1 – \alpha)$. Both fixed values were used for single indicator construct in the structural equation model.

The independent variables included in these analyses were the demographic variables: age, family income and education; health background variables: smoking, alcohol, and BMI. The single indicator latent variables were the personal values: universalism and hedonism; weight and health habits; and three health behaviour constructs: healthy eating, eating out, and physical activity. The three health behaviour constructs were the dependent variables in the SEM model. This structural model was estimated separately among male and female participants because gender differences in food and health literature appear to be quite significant (e.g., Beardsworth, et al., 2002; Wardle et al., 2004).

**Results**

Table 1 shows the demographic characteristics across the sexes. The respondents were aged between 38 and 79 years with a mean age of 57.05 years and a standard deviation of 7 years (mean age of 57.51 years for men and 56.74 years for women). Thirty six
percent of the respondents had tertiary education (37.4% men and 35.5% women). The majority of the respondents had annual household incomes over $50,000 (62.3% for men and 53.7% for women). Eleven percent (11.1%) of men and 11.6% of women reported that they currently smoked and 25.4% of men and 10.9% of women reported that they drank more than two glasses of alcohol on most days. The respondents’ BMI ranged from 15.05 to 64.32 kg/m² with a mean of 26.86 kg/m² and a standard deviation of 5.36 kg/m² (a mean BMI of 27.32 kg/m² for men and 26.55 kg/m² for women).

When compared with the 2006 Victorian census data (Australian Bureau of Statistics, 2007), women were over represented in our sample: 59.9% (current sample) versus 50.9% (census data).

Table 1 here

The three health behaviour constructs were derived from Kruger, et al. (2008), namely eating, eating out, and physical activity; they had internal reliability values of .80, .61, and .59 respectively. Overall, the variances of these three health behaviour constructs were reasonably well explained by the SEM model for men and women, with 48.2% and 66% for healthy eating, 10.6% and 19.8% for healthy eating out, and 30.5% and 56.4% for physical activity for men and women, respectively.

Table 2 presents the items measuring each construct and its Cronbach’s alpha as well as the percentages reported by the respondents as to whether they practiced these
behaviours “usually” or “always” on each item across gender and its chi-square statistics. It can be seen that there were gender differences on most of the health behaviour items (i.e., women reported higher scores than men did) except for two items measuring physical activity (i.e., how often do you do at least 30 minutes activity each day and how often do you do flexibility exercises several times a week).

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Table 2 here

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Based on the dimensionality reported in the personal values literature (Schwartz, 1992), two constructs were used in the present analyses, namely universalism (5 items) and hedonism (2 items); their Cronbach’s alpha values obtained from the current data were 0.75 and 0.51, respectively. Furthermore, the four items measuring attention to weight and health habits showed high reliability; Cronbach’s alpha was 0.86.

Separate SEM models were constructed for the men and women. The SEM results confirmed our expectation (based on the literature) that the relationships between the health behaviour and their predictors differed significantly between men and women. The fit statistics suggested that the proposed models fitted the data well for men and women, as indicated by non significant chi-square statistics, \( \chi^2 (81) = 116.15, p = .01 \) with a scaling correction for MLR \( p = 1.07 \). The other fit indices were all in the desired range: CFI = 0.98, TLI = 0.96, RMSEA = 0.03 (90% CI: 0.02, 0.04), and SRMR = 0.03.
Figure 1 illustrates the structural equation models with the standardized parameter estimates for both genders. The pattern of male interrelationships (Figure 1a) is simpler than the female interrelationships (Figure 1b). For both genders, weight and health habits played an intervening role between the independent and dependent variables.

For men (Figure 1a), healthy eating, eating out, and physical activity behaviours were positively related to attention to weight and health habits. That is, the more attention paid to weight and health habits, the more healthy eating, eating out, and physical activity were practised by the men. Furthermore, attention to weight and health habits was negatively associated with smoking and drinking but positively related to universalism. In other words, smokers and alcohol users paid less attention to weight and health habits but universalists paid more attention. Interestingly, there was a positive relationship between drinking alcohol and physical activity.

Among the women, there quite complex interrelationships between the antecedents and attention to weight and health habits, as shown in the left of Figure 1b.

- As age increased, women paid more attention to weight and health habits but reported lower hedonism scores.
- Higher educated women had higher universalism scores than less educated women.
- Heavier women were more likely to practise healthy eating and to control their eating out but were less likely to attend to their weight and health habits. Conversely, thinner women attended more to their weight and health habits.
habits but were less likely to eat healthily or control their eating when dining out.

- Smokers attended to their weight and health habits less than non smokers.
- Women who drank more than two glasses a day of alcohol had lower universalism scores.
- Both universalist and hedonist women were more likely to attend to their weight and health habits than other women.
- Finally, attention to weight and health habits, as for men, was a central mediating variable. Women who paid attention to their weight and health habits practised healthy eating and physical activity and controlled their eating when dining out more than other women.

In summary, women and men’s healthy eating, eating out, and physical activity behaviours were related to attention to weight and health habits and personal values as well as in the case of women only, to BMI and demographics.

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Figure 1 here
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Discussion

This study has confirmed several earlier findings but has extended our knowledge of the likely causal pathways associated with healthy eating, eating out behaviours and physical activity and BMI. Perhaps the overarching finding lies in the different pathways exhibited among the men and women; the women’s pathways were far more
complex than the men’s. Other novel findings relate to the roles of personal values, the importance of substance abuse behaviours and BMI and the central role played by attention to weight and health habits. These new findings have several implications for research in health behaviours and health promotion.

**Substance abuse** The finding that men who currently smoked and drank more than two glasses of alcohol a day were less likely to pay attention to their weight and health habits is consistent with the study by Padrão, Lunet, Santos, and Barros (2007). They found an inverse relationship between smoking or drinking alcohol, and other health behaviours such as healthy eating. Similarly, the finding that women smokers attended less to their weight and health habits than other women is consistent with the lower interest in health of substance abusers (Osler et al., 2002). This agrees with previous work which suggests that smokers weigh less than smokers (Molarius, Seidell, Kuulaasmaa, Dobson, & Sans, 1997). However, in our multivariate study there was no relationship between smoking and BMI in either sex. Further work is required to examine the context and the reasons for these findings, for example, why are alcohol users and smokers less interested in their weight and health habits? Is it because they have decreased self-efficacy over their health or are they less interested in health and weight and perhaps in how they appear to others?

Two unexpected findings in relation to substance abuse were the greater physical activity of male drinkers and the lower universalism score of drinking women. From a health promotion standpoint, drinking and physical activity do not go together. However, it is likely that in Australian male culture regular drinking and physical
activity may be normal. Certainly, many male dominated sports venues in Australia promote alcohol (National Preventative Health Taskforce, 2009) and being active and drinking frequently are seen to be male defining characteristics among certain sections of the population (Roche et al., 2008). Sociability and group membership is implicit in both these forms of behaviour. More investigation is required of the social context in which these activities occur among men, perhaps with a view to identifying the mediators which influence the balance between drinking and physical activity.

The observed link between alcohol use and universalism among women also requires further investigation. The level of drinking reported here is likely to represent substantial alcohol intake. Two glasses or more per day was reported. This is above medically recommended limits (one small glass a day, (NHMRC, 2003)); most Australian women drinkers consume wine in large glasses (each glass being 2-3 time greater than the daily limit (Carruthers & Binns, 1992)). So, these women were likely to be consuming relatively large amounts. Thus, they may have had alcohol abuse problems which are often associated with depression and other mental health conditions (Patel, 2010). Their lower univeralism may result from this state; universalism is essentially a self-transcendent value which may not appeal to people with low self-esteem and depression associated with alcohol abuse. Of course, an opposite explanation is possible; it may be low universalism values which may make alcohol consumption more attractive. Again, more research is indicated, probably of a qualitative type to investigate the social context in which these two variables are associated in women.
The role of BMI

Among men, BMI was unrelated to any other variable but it played a multifaceted role among women. It directly influenced eating out and healthy eating, and, indirectly influenced physical activity through attention to weight and health habits. Similar associations have been seen before. Overweight and obese women appear to eat more poorly and be are less physically active than slimmer people (Drewnowski & Specter, 2004). It is noteworthy that in our study these relationships were independent of socio economic status (indexed by education) or age. Zdrodowski (1996) found that overweight women tend not to choose what they would really like when they eat out because they are conscious of the fact that they should be seen to be eating a “healthy” meal. Similarly Brindal, Wilson, Mohr, and Wittert (2011) observed that women in female-only dining groups eat more in fast food restaurants than women in mixed sex groups. It may be that social norms discourage women from eating when they are with others, and, discourage overweight and obese women more than slim women. This suggests that social contexts and norms require further investigation.

When constructing our SEM model we opted for the view that BMI is a stable factor along with demographic and values variable which are likely to precede the other variables; hence Figure 1 b suggests that BMI predicts the other variables. However, reverse causality is equally plausible; BMI may be the result of poor eating and physical activity behaviours. A longitudinal study is required to decide which of the two options is the more plausible for the general female population (or for particular segments of it).
The influence of demographic variables

For men, demographics had no predictive power. This runs contrary to earlier work which suggests that better educated and older men tend to eat more healthily and take more physical activity (Ross & Wu, 1996). In part, our negative finding could be due to poor measurement of the outcome variables though clearly this was not the case for the women. More likely, our use of intervening variables may have accounted for variance which may have been associated with demographic variables in earlier studies. However, this possibility needs further scrutiny.

Among women, education and age were predictive of other variables, age being positively related to attention to weight and health habits, negatively to hedonism, and education positively with universalism. Previous studies have shown that hedonism decreases with age (Schwartz, 2006) and education has been shown to be positively associated with universalism (Schwartz, 2006) and with increases in both future orientation and ability to deal with society (Ippolito, 2002), both sharing self-transcendence with universalism. The association of age with greater attention to weight and health habits is consistent with the greater prevalence of health problems among older people (Grundy & Sloggett, 2003), and also with the greater awareness of women in health matters (Beardsworth, et al., 2002).

Personal values

Universalism played a role which was independent of demographics among men in predicting attention to weight and health habits. This finding is supported by Brunsø,
Scholderer, and Grunert (2004) who found a positive link between universalism and healthy, natural dietary choices.

Among women, universalism was influenced by education and alcohol consumption and in turn, predicted attention to weight and health habits. Hedonism played no role among men but among women it was associated with age and it predicted attention to weight and health habits. To our knowledge these relationships have not been reported previously.

Among women, the positive associations of hedonism and universalism (opposing values in Schwartz’s (1992) circumplex model) with attention to weight and health habits present a paradox. How can these two opposing values be positively related to this variable? We suggest that they represent two distinct motivations to attend to weight and health. Perhaps hedonists are more interested in the instrumental value of body weight and good health in that they may make them attractive and socially desirable (Hayes & Ross, 1987). Alternatively the universalists may be attracted to the same mediating variable because of the social benefits which accrue from good health such as the ability to care for their families and to play a role in wider society. These are speculations which require qualitative investigations (for example) of women within different social and life course contexts. In any further investigation it will be important to assess the social context in which these variables operate. It is likely that membership of different social groups is associated with different sets of social norms which influence the expression of values and attitudes. We suggest social norms and associated social contexts as one direction in which this model might be expanded.
Attention to Weight and Health Habits

One of the central findings of our study was that men and women who paid more attention to their weight and health habits were more likely to practise healthy eating, eating out, and physical activity behaviours. This variable appears to be an important mediator between BMI, demographics and values, and, the behavioural variables. Experimental work would be useful to examine its status as a mediator, for example, increases in attention to weight and health habits might be followed by the development of healthier eating and physical activity. Recently, in the context of food labelling, Grunert, Bolton, and Raats (2011) has concluded that it is lack of motivation that prevents people from accessing information on food labels, Similar lack of motivation to perform healthy eating and physical activity might be reduced through greater awareness of the importance of these behaviours. This finding could be used to inform the design of social marketing campaigns around healthy eating and physical activity. It suggests that women who attempt to take care of their health are likely to perform healthy lifestyle behaviours, (Wang, et al., 2008).

Men and Women’s health behaviours – two distinct pathways

It is clear from our findings that men and women have quite different pathways to health behaviours. Whilst there are similarities there are also great differences, women being affected by a greater range of the variables we examined. In part this may reflect several factors which affect women more than men. First, generally women hold greater responsibility for food provision within families. Although this is changing, especially in younger groups, most women remain responsible for family food provision and preparation; hence they tend to be more aware of food and eating than men (Lake et al.,
Second, most women are still judged according to their body weight and shape to a greater extent than men (Etilé, 2007) so they are motivated to use behaviours to control the impressions they make on other people, for example by dieting to control their body shape (Etilé, 2007). This in turn is related to the different social networks and norms that women experience to dieting and body shape norms. Men also belong to social networks and are also affected by social norms, but as we have seen in the relationship between drinking and physical activity, these may differ from women’s. Third, women remain more interested in health than men, reflecting their greater responsibility for child and family health (Beardsworth, et al., 2002). So, in summary, women’s eating and physical activity behaviours are likely to be affected by more influences than similar behaviours in men.

**Implications for nutrition communication and promotion**

The study has shown that the pathways to eating and physical activity behaviours in men and women are complex but identifiable. The value of path analysis is that it helps identify potential mediators (and moderators) of behaviour. One such mediator is attention to weight and health. It may be possible to raise awareness of weight and health which, if our model is correct, should increase the practice of healthy eating, control when eating out and physical activity. A proof of concept communication experiment could be conducted to see if large scale communication program might bring about these effects. Other potential interventions might be conducted on more distal mediators, for example, raising of value salience might be expected to bring about greater attention to weight and health, especially among women. Alternatively, individuals might be segmented into different groups based on their value orientations,
addictive health risk behaviours, body weight, or demographic characteristics. Specific moderators could be identified within these segments and then leveraged in targeted health communications. Such tailored communications to population segments are more likely to achieve effective behaviour change outcomes (Oenema, Brug, & Lechner, 2001).

Limitations
The internal reliabilities for some of the scales were relatively low. For example, hedonism ($\alpha = .51$), healthy eating out ($\alpha = .61$), and physical activity ($\alpha = .59$) were comprised by only 2, 3, and 2 items. Future research requires developing psychometric sound scales. The present study examined people’s health behaviours within the age range of 38 to 79 year old. Younger people aged less than 38 years were not represented. Future studies need to include a wider range of age groups. Causal relationships could not be claimed through the current cross sectional study and a longitudinal design is necessary for future studies.

Conclusions
Men and women had dissimilar eating and physical activity pathways. These behaviours were associated with their attention toward weight and health habits, their personal guiding values in life, and their demographic background. Further investigation of these influences is required in longitudinal studies. The preliminary causal models identified in this study suggest new mediators of eating and physical activity behaviours which could be used in health promotion programs.
Competing interests
The authors declare that they have no competing interests.

Authors' contributions
WCW performed the data analyses and the writing of the manuscript. AW provided advice on the survey design, acquisition of data, and the comments on the manuscript. WH conducted the data collection.

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