



# Stages of Change for Fruit and Vegetable Intake Among New Zealand Men: Readiness to Eat Five Servings a Day and Impact of Contextual Factors

*Successful behavior change according to the transtheoretical model involves progressing through a series of stages of change. This paper examines the proportion of men in each stage of change for fruit and vegetable intake, compares stage classification with intentions and behavior, and the impact of contextual factors on stage membership. Men randomly selected from the New Zealand electoral roll completed a postal questionnaire (n = 518; 45% response rate). One-third (32%) of respondents were not intending to eat five or more servings of fruit and vegetables a day (precontemplation stage), 10% were contemplating change (contemplation stage), 7% preparing to change (preparation stage), and 51% were already doing so in the combined action/maintenance stage. Intentions increased on average across stages, and fruit and vegetable intake was at least two servings higher in action/maintenance. Dietary guideline knowledge, older age, higher income, education and food security increased the likelihood of being in action/maintenance. Simple health promotion messages should be directed toward men, promoting conventional and affordable produce, and dietary guidelines. Community and policy approaches that increase food skills and knowledge, fruit and vegetable access and affordability would support behavior change.*

**Keywords:** fruit and vegetable, stages of change, transtheoretical model

Fruit and vegetable (F&V) intake is one factor amenable to change to reduce the risk of chronic health problems including heart disease, stroke, and some cancers (World Cancer Research Fund/American Institute for Cancer Research, 2007; World Health Organization, 2003). High F&V consumption may also protect against chronic disease risk factors including diabetes and hypertension, and lower the risk of obesity when combined with physical activity (Nanney, Haire-Joshu, Hessler & Brownson, 2004; Roberts & Barnard, 2005; Sullivan, Oakden, Young, Lau & Lawson, 2004; Van

<sup>a</sup> School of Psychology, Massey University, New Zealand.

Correspondence concerning this article should be addressed to Dr. Ross Flett, School of Psychology, Massey University, Private Bag 11-222, Palmerston North 4442, New Zealand. Email: r.a.flett@massey.ac.nz



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Duyn & Pivonka, 2000). Similar to World Health Organization (2003) recommendations, New Zealand (N.Z.) food and nutrition guidelines for healthy adults advise eating a variety of nutritious foods including at least five servings of F&Vs a day (Ministry of Health, 2003). A large proportion of adults do not eat the minimum daily recommended amount of F&Vs and the risk is higher among men (Blanck, Gillespie, Kimmons, Seymour & Serdula, 2008; Ministry of Health, 2006, 2008; Serdula, Gillespie, Kettel-Khan, Farris, Seymour & Denny, 2004; Tobias, Jackson, Yeh & Huang, 2007).

Despite the health benefits conferred by eating plenty of F&Vs, the modification of lifestyle behaviors can be complex and challenging, and people differ in their readiness to change. The transtheoretical model (TTM; also known as the stages of change model) is a prominent model of health behavior. The model has been applied to a wide range of health behaviors, has apparent face validity, and has generated optimism about behavior change (Bunton, Baldwin, Flynn & Whitelaw, 2000; Kristal, Glanz, Curry & Patterson, 1999). The TTM conceptualises behavior change as a process which takes place over time through a series of five discrete stages of change (Prochaska & DiClemente, 1992). The stages include precontemplation, contemplation, preparation, action and maintenance. According to the TTM (e.g., Greene, Rossi, Rossi, Velicer, Fava & Prochaska, 1999; Prochaska, Redding & Evers, 2002), those in the precontemplation stage have no intention of changing their behavior within the next six months. In the contemplation stage people are thinking about changing their behavior within the next six months, while those in the preparation stage are planning on changing within the next month. The target behavior is successfully being performed in the action and maintenance stages, which are usually differentiated by a six month time period.

The stages of change reflect a sequence that one moves through in order to achieve behavior change. While regression to an earlier stage can occur, stage models assume movement occurs from one stage to the next (Weinstein, Rothman & Sutton, 1998). The most stable stages are precontemplation and maintenance, in which people may remain for long periods of time (Velicer, Rossi, Prochaska & DiClemente, 1996). The contemplation, preparation and action stages are more dynamic and only a small proportion of people are expected to take meaningful action at any one given time (Greene et al., 1999; Nigg et al., 1999). Those factors which facilitate progression through stages are expected to differ depending on the stage one is in. Interventions matched to stages are therefore expected to be more effective in eliciting behavior change than standardised intervention programmes.

Identification of the stage distribution in the population could aid the design of health promotion programmes aimed at increasing F&V intake. Studies examining stage distributions for dietary behaviors have been reviewed by Horwath (1999) and Spencer and colleagues (2007). Stage distributions found for dietary behaviors depend on methods used to classify people into one of the mutually exclusive and discrete stages. While most measures include a short series of branching yes/no type questions examining current behavior and intentions (Rosen, 2000), the specificity of the target behavior differs (see Horwath, 1999). Studies which have assessed stages using subjective ratings based of the direction of F&V intake (e.g., low or high) result in a large

proportion of respondents in the postaction stages of action and maintenance (e.g., Lechner, Brug, De Vries, van Assema & Mudde, 1998; Van Duyn et al., 1998), compared to those using specific action criteria such as five servings of F&Vs a day (e.g., De Vet, De Nooijer, De Vries & Brug, 2005; Laforge, Greene & Prochaska, 1994; Ma, Betts, Horacek, Georgiou, White & Nitzke, 2002).

Accurate stage assignment is a requisite for the delivery of appropriate stage matched interventions. Previous research has called for greater attention to the psychometric properties of stage measures (e.g., Bridle et al., 2005; Brug, Conner, Harre, Kremers, McKellar & Whitelaw, 2005; Buntun et al., 2000). Evidence suggests intentions increase on average across stages for F&V intake when stage assessment includes a specific action criterion (e.g., Armitage, Povey & Arden, 2003). F&V intake is also higher on average in the postaction stages, and a greater proportion of participants are classified correctly based on cut-off values, when assessment includes a specific action criterion (e.g., Campbell et al., 1998; De Vet et al., 2005; Ling & Horwath, 2000; Ma, Betts, Horacek, Georgiou & White, 2003). The use of a clearly specified action criterion that is agreed upon by researchers and professionals in the field, and associated with a lower risk of disease has therefore been recommended (Horwath, 1999; Prochaska et al., 2002; Prochaska & Velicer, 1997).

Factors which aid progression from one stage to the next in order to achieve behavior change differ depending on the stage one is in. That is, different factors are important in different stages of change (Weinstein & Sandman, 2002). Although similar factors are expected to be important among those in the same stage (Weinstein et al., 1998; Weinstein & Sandman, 2002). To develop effective stage matched interventions a clear understanding of factors important in each stage is required (Bridle et al., 2005; Horwath, 1999; Weinstein et al., 1998). Psychosocial factors amenable to change are the primary focus of health behavior theories including the TTM. Contextual factors may also impact on behavior directly or indirectly through psychosocial variables. An examination of sociodemographic and background factors would provide a more comprehensive understanding of behavior change and help identify other avenues for intervention.

Previous research indicates males are more likely to be in the precontemplation stage for F&V intake, while the chances of being in the postaction stages are higher for females (Campbell et al., 1998; De Vet et al., 2005; Ling & Horwath, 1999; Resnicow, McCarty & Baranowski, 2003; Van Duyn et al., 1998). Older age, higher education and income also increase the likelihood of being in the maintenance stage, while awareness of F&V guidelines tends to increase across stages (Campbell et al., 1998; De Vet et al., 2005; Kloeck, van Lenthe, van Nierop & Mackenbach, 2004; Resnicow et al., 2003; Van Duyn et al., 1998).

Food insecurity may be important and refers to the limited or uncertain availability of nutritious, safe and personally acceptable foods that can be acquired in socially acceptable ways (Anderson, 1990). Food insecurity ranges in degree from food security (access to nutrition and safe foods at all times), to worry and uncertainty over the household food supply, to reduced variety and quality of foods eaten, to food insufficiency. Although food insecurity and insufficiency are associated with lower F&V con-

sumption (Dixon, Winkleby & Radimer, 2001; Kendall, Olson & Frongillo, 1996; Quine & Morrell, 2006; Radimer, Allsopp, Harvey, Firman & Watson, 1997), there is a paucity of research examining these factors across stages. In one N.Z. study of Māori women (Tassell & Flett, 2005) food insecurity increased on average between the combined precontemplation/contemplation and preparation/action stages, then declined in the maintenance stage for F&V and dietary fat intake.

This study will examine the stage distribution for F&V intake among N.Z. men. An action criterion of five or more servings of F&Vs a day will be used to assess stages and the validity of the measure will be examined in relation to intentions and behavior. Intentions and behavior are expected to be highest in the postaction stages. The impact of contextual factors on stage distributions will also be examined. Significant differences are expected to be found across stages in age, education, income, awareness of F&V guidelines and food insecurity.

## METHOD

### *Participants*

A sample of 1200 men aged 18 years and over was randomly selected from the N.Z. electoral roll and invited to participate in the cross-sectional mail survey. In total, 59 men could not be contacted due to incorrect address details or illness. Of the remaining 1,141 men, 518 completed the questionnaire (45% response rate).

### *Procedure*

Data was collected using a self-administered questionnaire during September and October 2006. A three stage Dillman (2000) method was used that involved mailing out a pre-letter, followed by the questionnaire, freepost reply envelope, and information sheet ten days later. A thank you/reminder postcard was posted two weeks later. The study was conducted in accordance with Massey University ethical guidelines. Consent to take part in the study was implied by completion and return of the survey questionnaire.

### *Measures*

Stage of change was assessed with a single item adapted from other stage measures of fruit, high fat foods and health risk behaviors (DeVet et al., 2005; Greene & Rossi, 1998; Nigg et al., 1999). The time frames used were based on TTM stage definitions (Prochaska & DiClemente, 1992). Respondents selected the most appropriate statement for themselves in response to the question "Do you consistently eat at least 5 servings of fruit and vegetables each day?". Participants were classified in precontemplation (*no, and I do not intend to change within the next 6 months*), contemplation (*no, but I intend to change this within the next 6 months*), preparation (*no, but I intend*

to change within the next month), action (yes, and I started doing this less than 6 months ago), or maintenance (yes, and I have done so for more than 6 months). Examples of F&V servings were outlined to participants prior to stage being assessed.

Usual F&V intake was assessed with a brief food frequency questionnaire (FFQ) containing six items based on those used in U.S. surveys (Block, Gillespie, Rosenbaum & Jenson, 2000; Serdula et al., 2004; Stables et al., 2002). Participants were asked how often over the last month they had consumed fruit juice, fruit (fresh, frozen, canned or stewed), salad, and other cooked vegetables (including those in mixed dishes), potatoes, and hot potato chips (including kumara chips, french fries and wedges) (see Kristal, Glanz, Tilley & Li, 2000; Thompson et al., 2000). Response options ranged from *rarely or never* to *4+ per day*. Based on 5 A Day and N.Z. food and nutrition guidelines, total intake excluded hot potato chips and included a maximum of one serving of juice (Ministry of Health, 2003; Serdula et al., 2004). Similar measures have correlations in the range of .50 and .70 with longer FFQs, diet records and recalls (Block et al., 2000; Campbell et al., 1999; Kristal et al., 2000; Serdula et al., 1993), and have been associated with biomarkers of intake (Coyne et al., 2004; Resnicow et al., 2000).

Intentions were assessed with a single item based on previous research (Armitage et al., 2003). Participants rated the extent to which they agreed with the statement "I intend to eat 5 or more servings of fruit and vegetables each day in the future" on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Household food insecurity was assessed with eight items used in N.Z. nutrition surveys (Parnell, Reid, Wilson, McKenzie & Russell, 2001; Parnell, Scragg, Wilson, Schaaf & Fitzgerald, 2003). For example, "food runs out in our household due to a lack of money." Items were rated on a 7-point scale ranging from 1 (*never*) to 7 (*all of the time*). One item "we can afford to eat properly" was reverse scored. Participants who seldom or never experienced food insecurity were classified as *food secure*. Remaining participants who experienced one or more aspects of food insecurity at least once in awhile were coded *food insecure*.

Awareness of F&V guidelines were assessed separately and based on items used in previous research (Havas, Anliker, Damron, Lagenberg, Ballesteros & Feldman, 1998; Steptoe, Perkins-Porras, McKay, Rink, Hilton & Cappuccio, 2003). Participants were asked "how many servings of fruit (vegetables) do doctors recommend each day?". Response options ranged from *1 or fewer* to *5 or more*. In line with guidelines promoted by the Ministry of Health (2003) and 5 A Day programme (Ashfield-Watt, Stewart & Scheffer, 2004), participants were categorised as *aware* if the total number was at least five.

Sociodemographic data was collected using questions modelled on the 2006 N.Z. Census (Statistics N.Z., 2006) and included age, personal income, education and ethnicity.

### *Analyses*

Data was screened prior to analysis and four cases with more than 25% of missing data were removed from the study. Pairwise deletion was used for remaining cases

with missing data. Fifteen men were in the action stage but as the power to detect significant mean differences is influenced by sample size, the action and maintenance stages were combined (see Cohen, 1992). Chi-square tests were used to analyse differences in categorical variables across the stages of change, and one way analysis of variance with Games Howell post-hoc tests for continuous variables.

The magnitude of standardised mean differences was assessed with Cohen's  $d$ , using the standard deviation of the two groups being compared. Based on Cohen's (1992) guidelines, standardised mean differences of .20, .50, and .80 reflect small, medium and large effects respectively. Eta squared ( $\eta^2$ ) was used to determine the total proportion of variance accounted for in the dependent variable due to differences in group means. For measures of association, Cohen's (1992) guidelines suggest 1%, 9% and 25% represent small, medium and large effects respectively. All statistical analyses were performed using SPSS version 14.0.

## RESULTS

Participant characteristics are summarised in Table 1. The stage distribution or proportion of men in each stage of change for F&V intake is presented in Table 2. One-third (32%) of men in the precontemplation stage were not intending to eat five or more servings of F&Vs a day in the future, 10% were contemplating change, 7% were preparing to change within the next month, and 51% reported already eating at least five servings daily in the action/maintenance stage.

Table 1  
*Descriptive Characteristics of Participants, N = 514*

	<i>M (SD)</i>	<i>n (%)</i>
Age <sup>+</sup>	51.20 (16.16)	
F&V intake <sup>†</sup>	3.92 (2.08)	
Ethnicity <sup>*</sup>		
Māori		35 (7)
Pacific		12 (2)
Asian		32 (6)
N.Z. European/other		454 (89)

*Note.* <sup>+</sup> range 18-97 years. <sup>†</sup> Median intake = 3.54. <sup>\*</sup> 22 participants belonged to more than one ethnic group. F&V = fruit and vegetable, N.Z. = New Zealand.

Mean F&V intake assessed with the brief FFQ differed significantly across the stages of change  $F(3, 505) = 52.04, p < .001, \eta^2 = .24$ . As expected, F&V consumption was on average significantly higher in action/maintenance ( $M = 5.08, SD = 2.21$ ) compared to the precontemplation ( $M = 3.08, SD = 1.60, d = 1.04$ ), contemplation ( $M = 2.70, SD = 1.70, d = 1.21$ ), and preparation stages ( $M = 2.80, SD = 1.34, d = 1.25$ ).

Men in action/maintenance consumed 2.00 to 2.38 more servings of F&Vs a day on average. F&V intake did not differ between the preaction stages.

Intentions differed significantly  $F(3, 504) = 97.66, p < .001, \eta^2 = .37$ ) and increased on average across stages. Significant differences in intentions were found between each stage, except action/maintenance and preparation, which was approaching significance ( $p = .06$ ). Between precontemplation ( $M = 3.39, SD = 1.64$ ) and contemplation ( $M = 4.59, SD = 1.43$ ) intentions increased by .78 standard deviations, and by about half a standard deviation between contemplation and preparation ( $M = 5.32, SD = 1.23, d = 0.55$ ), and preparation and action/maintenance ( $M = 5.88, SD = 1.36, d = 0.43$ ). As expected, intentions were highest on average in action/maintenance.

Age, education, income, food insecurity, and awareness of dietary guidelines differed significantly across stages as expected (see Table 2).

## DISCUSSION

The study investigated the proportion of respondents in each stage of change for F&V intake, level of intentions and behavior in each stage, and impact of contextual factors on stage membership, in a random sample of N.Z. men.

A parsimonious stage measure adapted for F&V intake was used to classify men into one of the stages of change for eating at least five servings of F&Vs daily. Intentions increased on average across stages in line with previous research (Armitage et al., 2003). While F&V intake did not differ across the preaction stages of precontemplation, contemplation and preparation, a large increase was found in the postaction stages. On average, men in action/maintenance were eating five servings of F&Vs a day in line with dietary guidelines. The pattern of F&V intake corroborates with earlier studies that assessed behavior with brief FFQs (e.g., Campbell et al., 1998; Greene, Fey-Yensan, Padula, Rossi, Rossi & Clark, 2004). Although research using other dietary assessment methods (e.g., 24 hour recalls, quantitative FFQs) have found small to moderate increases in F&V intake across the preaction stages, moderate to large increases in consumption have been found in the postaction stages (e.g., De Vet et al., 2005; Greene et al., 2004; Ling & Horwath, 2000; Ma et al., 2003). Findings provide some evidence to support the validity of the stage measure used.

Half the men surveyed were in the action/maintenance stage for F&V intake. The direct comparison of findings with earlier studies is limited by the range of stage measures used. Research in the U.K., U.S., and the Netherlands have found slightly fewer participants in the postaction stages for F&V intake using similar action criteria (e.g., Armitage et al., 2003; De Vet et al., 2005; Ma et al., 2002). While secular trends may partly explain these findings, international comparisons suggest F&V intake may be slightly higher in N.Z. (Ministry of Health & University of Auckland, 2003). The slightly older age of participants compared to the general population also likely influenced results given the positive relationship between age and F&V intake (e.g., Guenther, Dodd, Reedy & Krebs-Smith, 2006; Ministry of Health, 2008). A wide variety of fresh produce was also available when the study was undertaken. While the propor-



Table 2

*Descriptive Characteristics of Participants (row percentage)\**

	Full sample		Stage of change			
	<i>n</i>	%	PC	C	P	A/M
	509		32	10	7	51
<i>Age</i>						
18-44 years	169	33	30	14	15	40
45+ years	339	67	32	9	4	56
<i>Education<sup>+</sup></i>						
£ High school	194	40	38	11	9	42
> High school	296	60	27	9	7	57
<i>Income</i>						
Loss/zero - \$20,000	101	20	42	13	7	39
\$20,001 - \$40,000	137	27	31	10	10	49
\$40,001 - \$70,000	157	31	28	13	8	51
\$70,001 and over	105	21	26	7	3	65
<i>Household food insecurity</i>						
Food insecure	161	32	30	16	15	39
Food secure	345	68	32	8	4	56
<i>Aware of F&amp;V guidelines</i>						
No	115	23	57	14	4	25
Yes	387	77	24	9	8	58

*Note.* PC = Precontemplation, C = Contemplation, P = Preparation, A/M = Action/maintenance. F&V = fruit and vegetable.

<sup>+</sup> The highest level of education could not be determined for 14 participants with qualifications obtained overseas.

\* All Chi-square tests  $p < .05$

tion of men in the postaction stages is in line with N.Z. surveys (Tobias et al., 2007) nearly half of men may benefit from higher F&V consumption.

Men with low F&V intake differed in their readiness to change. In total, one-third of men were in the precontemplation stage and had no intentions of changing their behavior. Although precontemplators are often considered more resistant to change, on average they only mildly *disagreed* with the statement they intended to eat five or more servings of F&Vs a day in the future. One in six men were either in the contemplation or preparation stages and thinking about modifying their behavior. On average, research using similar action criteria for F&V intake has found fewer respondents in precontemplation and slightly more in the contemplation and preparation stages (Armitage et



al., 2003; De Vet et al., 2005; Laforge et al., 1994; Ma et al., 2003; Sullivan et al., 2004). The variation is attributed to gender differences. Finding the largest proportion of men with low F&V intake were in the precontemplation stage is in line with previous research and TTM predictions. To improve dietary behavior interventions are required that target men with low intake (particularly precontemplators) and encourage them to start thinking about eating more F&Vs.

The proportion of men in each stage for F&V intake differed in relation to income, education, age, food security and dietary guideline knowledge. Men who were older, who had a higher level of education, income, food security and awareness of dietary guidelines were more likely to be in the action/maintenance stage. The stage distributions found for contextual variables corroborate with earlier studies (Campbell et al., 1998; De Vet et al., 2005; Kloek et al., 2004; Resnicow et al., 2003; Tassell & Flett, 2005; Van Duyn et al., 1998). The 5+ A Day study (Van Duyn et al., 1998) for example found those in the maintenance stage for F&V intake tended to have a higher level of education and income. On average, N.Z. Māori women in the maintenance stage for F&V and dietary fat intake were also more food secure (Tassell & Flett, 2005).

Results have practical implications for nutrition education and messages aimed at promoting F&V intake. Dietary guidelines should continue to be promoted given more than three-quarters of men who were unaware of F&V recommendations had a low intake. The 5 A Day program has increased awareness of F&V guidelines (Ashfield-Watt et al., 2004; Stables et al., 2002). Avenues used to promote F&V guidelines however require further consideration to reach men. Nutrition and health information is often directed towards women (Courtenay, 2000; Lyons & Willott, 1999), despite men considerably influencing household food choices (Brown & Miller, 2002; Jensen & Holm, 1999). U.S. surveys suggest both men and women frequently use television, magazines and newspapers as sources of nutrition information (American Dietetic Association, 2002). While the internet offers new avenues for health promotion, internet access is not universal and less common among those who are older and from lower socioeconomic backgrounds (Couper, 2000; Dillman, 2000; Statistics N.Z., 2008; Tu & Hargraves, 2003). Continued promotion of F&V guidelines is recommended using appropriate communication channels to reach men.

To improve dietary behavior health promotion messages need to be simple and emphasise F&Vs commonly eaten. Half of men with low education were in the precontemplation or contemplation stages. Conversely, two-thirds of men with high education were in the preparation or action/maintenance stages. Education may influence access and understanding of nutrition and health-related information (Turrell & Kavanagh, 2006; Worsley, Blasche, Ball & Crawford, 2003). Evidence suggests education is related to dietary knowledge (Axelson, Federline & Brinberg, 1986). A lower level of education is also associated with preferences for more traditional and familiar foods (Steptoe & Wardle, 1999). Messages aimed at improving dietary behavior therefore need to be simple, emphasise conventional F&Vs and effectively disseminated to reach target audiences.

Household food insecurity needs improving if men thinking about eating a healthy diet are to translate their intentions into action. Men contemplating or preparing to

change their dietary behavior were more likely to experience household food insecurity. A recent review found food insecurity was most frequently associated with household income (Gorton, Bullen & Ni Mhurchu, 2010). Other food insecurity risk factors include younger age, lower socioeconomic status, larger household size and having dependent children (Parnell et al., 2001; 2003; Nord, Andrews & Carlson, 2007). These risk factors may influence food insecurity in part by impacting on the level of household disposable income. Achieving successful behavior change may be more challenging for food insecure households.

Several reports summarise initiatives aimed at improving food security, including food access, skills and knowledge (Te Hotu Manawa Maori, 2007; NSW Centre for Public Health Nutrition, 2003). Interventions include advice on purchasing and the preparation of healthy meals within a limited budget, cooking demonstrations and supermarket tours. Practical means of storing and keeping F&Vs fresh for longer may also be beneficial. A recent review (Gorton et al., 2010) on food insecurity has also called for community and policy approaches addressing multiple areas to improve food insecurity, such as labour market, family support and welfare policies. Such strategies may contribute to improving F&V access and affordability.

Men who were eating sufficient servings of F&Vs daily in the current study were more food secure and had greater resources enabling them to do so including higher income. Food cost is perceived as a greater barrier to the consumption of a healthy diet in low income groups (Eikenberry & Smith, 2004; Giskes, Turrell, Patterson & Newman, 2002; Pollard, Kirk & Cade, 2002; Turrell & Kavanagh, 2006). Food pricing currently favours energy dense, nutrient poor foods high in grains, sugars and fats rather than healthier food choices (Drewnowski & Darmon, 2005; Rush, Puniani, Snowling & Paterson, 2007). A review of randomised controlled trials suggests monetary incentives may positively influence dietary behavior (Wall, Ni Mhurchu, Blakely, Rodgers & Wilton, 2006). Fiscal approaches may include the use of coupons or vouchers for high risk groups, discounting or reduced taxes on healthy food items, increased taxes on energy dense foods, and food industry incentives for the production and marketing of healthy food items (Glanz & Hoelscher, 2004; Ni Mhurchu & Ogra, 2007; Popkin, Duffey & Gordon-Larsen, 2005; Wall et al., 2006). In Australia healthy food is exempt from goods and services tax (Australian Taxation Office, 2006) and evidence suggests taxing energy dense foods such as fast foods, could be effective for improving overall diet quality (Beydoun, Powell & Wang, 2008).

Future research should consider the pathways by which contextual variables impact on behavior. Local access and availability of F&Vs may be important. Although access to supermarkets and convenience stores selling healthy food items is better in N.Z. in more deprived areas (Pearce, Blakely, Witten & Bartie, 2007; Pearce, Witten, Hiscock & Blakely, 2007), barriers may include transport, the quality of produce available, and storage facilities (e.g., Giskes et al., 2002; Reicks, Randall & Haynes, 1994). While the current study design precluded an examination of cultural factors, these should be examined in future research given their impact on food acceptability, taboos and preferences, along with the value and meaning of different foods, and health beliefs (Crotty, 2001; Fieldhouse, 1995; Rozin, 1996).

Several limitations need to be taken into account when interpreting results. Although the action and maintenance stages have been combined in previous research (Lechner et al., 1998; Ling & Horwath, 1999), this strategy limits an examination of factors discriminating between these stages. F&V intake was also assessed with a brief FFQ given its relative ease, suitability for self-administration, and low respondent burden. Although earlier studies (Campbell et al., 1998; De Vet et al., 2005; Greene et al., 2004; Ma et al., 2003) have used FFQs, more comprehensive dietary assessment methods are available, such as multiple diet records and recalls. Such estimates may be used in future research to assess predictive values or the proportion of participants classified correctly in each stage based on cut-off values (Ling & Horwath, 2000).

The study response rate was in line with expectations based on earlier dietary surveys. It is likely participants were however more health conscious and interested in dietary behavior than non-respondents. The proportion of men in the preaction stages may be underestimated. Men who were younger and from lower socioeconomic backgrounds were also underrepresented, and likely influenced rates of food insecurity and knowledge of dietary guidelines. Household rather than personal income may have been more important to consider given income is often shared among household members (O'Dea & Howden-Chapman, 2000). As the majority of participants were N.Z. Europeans, the impact of ethnicity on stage classification was not examined and limits the generalisability of findings. Given the study also used a cross-sectional research design, causation cannot be assumed.

Finally, finding intentions and behavior differed across the stages of change does not necessarily support the assumption that behavior change follows a stage process (see Horwath, 1999). Several reviews have questioned whether the stages, or subsets of them, reflect genuine stages or an underlying continuum based on intentions and behavior (Bandura, 2000; Littell & Girvin, 2002; West, 2005). The pattern of scores on intentions and behavior suggests the stages do not reflect a single underlying continuum (see Sutton, 2000; Weinstein et al., 1998). It is however possible the preaction stages reflect a continuum based on intentions. In which case, similar factors may facilitate progression in the preaction stages. Rather than progressing through stages, behavior change may also involve small naturally occurring shifts along a continuum (Weinstein et al., 1998). The use of longitudinal and experimental research designs in future research would enable stronger tests of these stage model assumptions.

In conclusion, the stages of change were used to describe men's readiness to eat five or more servings of F&Vs a day. Half the men had low F&V intake. Given F&V intake is one factor amenable to change to protect against chronic health problems and reduce the burden of future disease, a large number of men may benefit from greater consumption. Although the proportion of men in the precontemplation stage presents a challenge to health promoters, the characteristics of men in each stage could aid in targeting interventions. Moreover, interventions which reach and have a positive impact on men in the preaction stages could help reduce socioeconomic inequalities in health attributed to dietary factors. Positive shifts in dietary behavior may be brought about by multiple-level and comprehensive approaches which combine individual, community and policy interventions and strategies.

Recommendations for promoting F&V intake:

- direct health promotion messages towards men
- use appropriate communication channels
- use simple key messages
- emphasise affordable and inseason F&Vs
- promote traditional and commonly eaten F&Vs
- increase dietary guideline knowledge

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# Stages of change for fruit and vegetable intake among New Zealand men: Readiness to eat five servings a day and impact of contextual factors

Jury A

2010