

Modeling Pathways to Affective Barriers on Colorectal Cancer Screening Among Japanese Americans

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The study aimed to identify the mechanisms through which colorectal cancer (CRC)-specific affective barriers, including fear of finding CRC, embarrassment, and concerns for screening discomfort, can be reduced to guide the development of interventions aimed at the secondary prevention of CRC. A model explaining these affective barriers was developed and tested among a random sample of 305 asymptomatic Japanese Americans using a path analysis. The model suggested that affective barriers could be reduced by increasing CRC-related knowledge, which could be enhanced by acculturation, social support, and physician recommendation. Interventions that focus on increasing CRC-related knowledge could reduce affective barriers to CRC screening for this population when taking the enhancement of communication skills and interpersonal interactions into account.

KEY WORDS: affective barriers to cancer screening; colorectal cancer; prevention; Japanese Americans.

INTRODUCTION

Colorectal cancer (CRC) is the second leading cancer in the United States, resulting in 147,500 new cases and an estimated 57,100 deaths in 2003 (American Cancer Society, 2003; Ries *et al.*, 1999). Despite the heightened awareness of colorectal cancer, CRC screening, which is essential for lowering the incidence and mortality rates of this disease, is substantially underutilized, particularly among ethnic minorities. As in other forms of cancer screening, increasing access to CRC screening can be hindered by cultural, linguistic, and economic barriers, and further complicated by additional psychological barriers that cause individuals to delay or to reject opportunities for early detection. Many people are reluctant or even embarrassed to talk about colorectal cancer and worry about the pain, discomfort, and embarrassment associated with the screening process (Bastani *et al.*, 2001; Weitzman *et al.*, 2001).

Japanese Americans have a substantially higher CRC incidence rate than do whites (Ries *et al.*, 1999), particularly Japanese American men born in the United States whose rate is about 60% higher than that of US-born white men (Flood *et al.*, 2000). The incidence of CRC among Japanese Americans exceeds the rate among non-Hispanic whites, leading Japanese American men to rank second-highest after Alaskan native men for age-adjusted CRC incidence by race and gender, and Japanese American women to rank third-highest after Alaskan native and African American women (Baquest and Commiskey, 1999). A study on Japanese Americans (Honda, 2004) found that the reduced uptake of CRC screening was significantly attributed to affective barriers, such as fear of cancer, embarrassment, and concerns for discomfort. Similar findings have been reported for other ethnic/racial sub-populations, in which affective barriers to CRC screening, such as embarrassment, discomfort, or cancer worry, have been associated with the avoidance of CRC screening (Macrae *et al.*, 1984; Codori *et al.*, 2001; Wardle *et al.*, 2000) and breast cancer screening (Kash and Dabney, 2001; Skinner *et al.*, 1998). This literature has made significant contributions to our understanding of the impact of

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affective factors on CRC screening uptake that need to be addressed within prevention programs in clinic- and community-based settings. In developing effective prevention strategies that meet the need of such special populations, it is important to further understand unique pathways to affective barriers to CRC screening, thereby increasing the precision and effectiveness of prevention strategies.

While interventions targeting psychological barriers to CRC screening adherence have demonstrated some success (Morgan *et al.*, 1998; Wardle *et al.*, 2003), how specific psychological barriers may act as facilitators or inhibitors is largely unknown and quite complex. There is considerable evidence for the mediating effects of both social support and knowledge on psychological distress in the context of health care use including cancer screening (Kouzis and Eaton, 1998; Suarez *et al.*, 2000; Berman and Wandersman, 1991), although little is known about the direction and strength of these influences.

Studies of patients undergoing invasive medical procedures (Koivula *et al.*, 2002) and CRC genetic testing (Vernon *et al.*, 1997) have found that a low level of social support is associated with fear and anxiety. In addition, those who experienced a high level of fear wanted informational support by experts. Similarly, a randomized study examining the relationship between coping style and precolonoscopy knowledge and anxiety reported that the provision of information congruent with coping style (information seekers vs. avoiders) significantly reduced anxiety (Morgan *et al.*, 1998). A theory of social support and social networks (Heaney and Israel, 1997), which borrows from several social psychology theories, offers a set of concepts supporting the connection between intra-personal characteristics (e.g., perceptions and individual coping resources), inter-personal environments (e.g., social support and interactions with potential helpers), and health outcomes. Heaney and Israel (1997) postulate that social support and networks, whether in the form of tangible, emotional, or informational, create health-enhancing inter-personal environments and interact with psychological barriers in affecting the use of health care services.

Using the frameworks of social support and social networks (Heaney and Israel, 1997), the paper examines the degree to which the affective barriers of fear, embarrassment, and concerns about discomfort vary as a function of selected intra- and inter-personal characteristics. The paper seeks to add to the scant literature on the pathways through which

affective barriers can be reduced to increase colorectal cancer screening in at-risk ethnic/racial subgroups. To our knowledge, the proposed research is the first to use path analysis to systematically study the structural relationships between intra- and inter-personal characteristics including demographics, acculturation, perceived risk, knowledge, social support, physician recommendation, and psychological barriers to CRC screening. With this understanding, we hope to inform the development of tailored interventions for at-risk ethnic/racial subgroups such as Japanese Americans.

METHODS

Study Population and Study Design

Data for this study were taken from a cross-sectional survey on the colorectal cancer screening of a randomly chosen sample of asymptomatic Japanese populations residing in the major metropolitan areas in the states of Illinois, Massachusetts, New Jersey, and Washington. The target population from which the survey sample was drawn included those aged 30 years and older who read and comprehended Japanese and/or English and who had never been diagnosed with CRC. Using a commercially available mailing list of US Japanese residents, a two-stage equal size cluster sampling obtained 800 names based on the target sample size of 360 with an expected return rate of 50% and 5% sampling error (Frery, 2001). Study procedures were approved by the University Committee on Activities Involving Human Subjects at New York University.

Of the 318 completed returned surveys, 12 respondents did not meet inclusion criteria (e.g., younger age and previous diagnosis of CRC) and were dropped from analysis; thus the final sample size was 306 with a 44% return rate. A full account of the survey methods are described in detail elsewhere (Honda, 2004). The study participants ranged in age from 30–93 years, with a mean age of 52.3 years ($SD = 15.3$); 61% were male. The majority of the participants were well educated with a Bachelor's degree or higher ($n = 203, 66\%$); (see Table I).

Survey Development and Measures

The instrument was a 28-item bilingual mail questionnaire survey assessing a range of socio-environmental, personal, and behavioral factors

Table I. Descriptive Sample Data ($N = 306$)

Characteristics	Category	No. of subject (% or <i>SD</i>)
Gender	Male	188 (61.4)
	Female	118 (38.6)
Age (yrs)	Mean ($\pm SD$)	52.3 (± 15.3)
	30–39	72 (23.5)
	40–49	78 (25.5)
	50–59	61 (29.9)
	60–69	45 (14.7)
	70–79	27 (8.8)
	>80	23 (7.5)
Language spoken	Only Japanese	12 (3.9)
	Japanese better than English	179 (58.5)
	Japanese & English equally well	65 (21.2)
	English better than Japanese	29 (9.5)
	Only English	21 (6.9)
Educational background	HS diploma or less	69 (22.5)
	Associate degree	34 (11.1)
	Bachelor degree(s)	131 (42.8)
	Graduate degree(s)	72 (23.5)
Family history of colorectal cancer	Yes	32 (10.5)
	No	274 (89.5)
Social support	Strongly disagree	11 (3.6)
	Disagree	24 (7.8)
	Neither agree nor disagree	47 (15.4)
	Agree	98 (32.0)
	Strongly agree	126 (41.2)
Received advice to have CRC screening from physician ^a	Yes	69 (22.6)
	No	236 (77.4)

^aPhysician recommendation information was missing for one person.

relevant to CRC screening. Consonant with the theory of social support and social networks (Heaney and Israel, 1997), a 3-item social support scale was adapted and modified by the researcher from a scale developed by OrthGomer *et al.* (1993) and used by Lugerlund *et al.* (2000) in the investigation of the relationship between social support and breast cancer screening. Selected items from the Health Belief Scale (Rosenstock, 1974), including perceived susceptibility and perceived affective barriers, such as fear of finding cancer, embarrassment, and concerns for discomfort, were adapted and modified by the researcher from those originally developed by Champion (1984) and revised in later work (Champion, 1993; Champion, 1995).

Items concerning the utilization of health care were derived from work by Andersen (1968, 1995).

All the instruments were first drafted in English by the bilingual researcher, translated into Japanese, then validated using the back-translation technique to assure accuracy (Brislin, 1976). Prior to data collection the questionnaire was pilot-tested for reliability and validity; psychometric testing indicated satisfactory internal consistency and validity of the instrument within the Japanese sub population. All the subscales had acceptable reliabilities, with alpha coefficients greater than 0.80 (Cronbach's $\alpha = 0.97$, perceived susceptibility (4-items); $\alpha = 0.81$, perceived affective barriers to CRC (4-items); and $\alpha = 0.94$, social support (3-items). For the given the high internal consistency of the items, to reduce respondent burden, one item was selected to represent each variable for susceptibility and social support.

Grouped into three domains: intra-personal factors, inter-personal characteristics, and the outcome of affective barriers to CRC screening, the measures used assess social support, physician recommendation, perceived susceptibility to CRC, CRC knowledge, acculturation (English language proficiency), family history, socio-demographic, and affective barriers to CRC screening.

Description of Proposed Model and Hypothesized Pathways

With the framework of social support and social networks as a guide (Heaney and Israel, 1997), we modeled the pathways to psychological barriers to CRC screening, with the aim of parsimony (see Fig. 1). Based on our model, the following hypotheses were tested: (a) education, social support, and English language proficiency directly influence CRC knowledge and indirectly influence affective barriers through CRC knowledge, (b) age and family history of CRC directly influence perceived susceptibility to CRC, which in turn directly influence affective barriers, and (c) age and family history of CRC directly influence physician recommendation, which in turn indirectly influence affective barriers through CRC knowledge.

Analyses

We used path analysis to test the proposed model, using the structural equation modeling program AMOS (version 4.0) (Arbuckle, 1995).

Table II. Bivariate Analysis: Fear, Embarrassment, and Unpleasantness According to Age, Gender, and Education Level ($N = 305$)

Scale	Age (years)	Gender		Education			
		Male (%)	Female (%)	HS diploma or less (%)	Asso. degree (%)	BA/BS (%)	Graduate degree (%)
Fear							
Strongly disagree	55.8 n.s.	28.8	16.9 n.s.	14.5	18.2	23.7	34.7*
Disagree	57.5	25.1	25.4	26.1	24.2	23.7	27.8
Neither	54.6	29.4	29.7	27.5	30.3	36.6	18.1
Agree	51.7	13.4	18.6	18.8	15.2	13.7	15.3
Strongly agree	49.6	4.3	9.3	13.0	12.1	2.3	4.2
Embarrassment							
Strongly disagree	57.2**	28.3	16.9 n.s.	23.2	18.2	18.3	37.5 n.s.
Disagree	52.7	19.8	22.0	17.4	12.1	22.2	25.0
Neither	54.0	24.1	21.2	27.5	30.3	24.2	12.5
Agree	46.8	18.7	22.9	17.4	24.2	23.7	15.3
Strongly agree	47.2	9.1	16.9	14.5	15.2	11.5	9.7
Discomfort							
Strongly disagree	52.6 n.s.	6.4	1.7 n.s.	1.4	9.1	5.3	4.2*
Disagree	50.6	7.5	5.9	8.7	0.0	3.1	15.3
Neither	51.9	19.3	16.1	24.6	30.3	16.0	9.7
Agree	54.0	42.2	41.5	42.0	36.4	45.8	37.5
Strongly agree	54.4	24.6	34.7	23.2	24.2	29.8	33.3

* $P < .01$ by chi-square analysis/ANOVA for the association between psychological barriers and this characteristic in question.

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Parameter estimates for the path model were generated via maximum likelihood estimation (Arbuckle, 1995). Maximum likelihood estimation procedures assume multivariate normality; a violation of the normality assumption can affect statistical testing (Byrne, 2001). The most appropriate solution for violations of normality is the use of robust test statistics

(Byrne, 2001). Therefore, robust test statistics will be reported in this study.

This data set contained relatively little missing data; less than 1% of the total number of cases were missing any data. In those few cases, imputation with the median value was employed (Graham *et al.*, 1997; Wothke, 2003). Physician recommendation

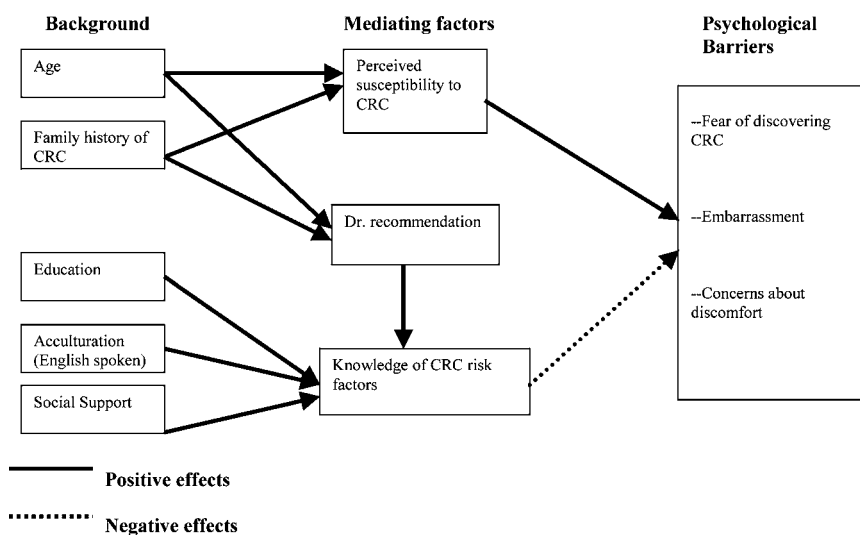


Fig. 1. Proposed parsimonious model.

information was missing for one person, who was dropped from the sample, with a resulting sample size of 305 for the final analysis.

We report four fit indices, each of which is sensitive to model misspecification but less affected by estimation method, non-normal distribution, and small sample size. The four are; the overall goodness of fit: the goodness-of-fit (GFI), adjusted goodness-of-fit (AGFI), the comparative fit index (CFI), and the root square error of approximation (RMSEA). GFI and AGFI values close to 1.00 indicate a good fit (Bryne, 2001). The CFI measures the reduction in lack of fit of the model compared to a baseline model (values > 0.95 are desired) (Bentler, 1990). The (RMSEA), a measure of error, indicates the mean of the squared discrepancies between all the elements of the predicted and observed correlation matrices (values < 0.08 is considered acceptable and <0.05 is desired) (Steiger and Lind, 1980). In addition, the chi-square was examined; chi-square is a test of the difference between the specified model and the just identified model. As chi-square is sensitive to sample size, it is recommended that chi-square be evaluated by dividing it by the degrees of freedom; a value less than three is desirable (Bollen, 1989; Kline, 1998). Path coefficients were standardized and path significance was based on the critical ratios (CR), with a CR >2 in absolute value considered significant.

Model Modification

Model modifications were carried out in two stages. First, the paths from background factors (age, education, English language proficiency, family history, and social support) to mediating factors

(perceived susceptibility, and CRC knowledge, physician recommendation) were estimated. Additional significant explanatory paths were added to the model and then non-significant paths from the background factors to the mediating factors were removed. Then the paths from the mediating factors to the measures of affective barriers to CRC and the direct explanatory paths from the background factors were estimated before removing all statistically insignificant parameters. All added effects were theoretically plausible in that they were consistent with the authors' understanding of socio-behavioral theory and field observations of CRC screening-related behavior. The structural disturbance terms for each of the affective barriers to CRC, the outcomes of the model (fear, embarrassment, and discomfort), were allowed to covary (Kline, 1988).

RESULTS

Bivariate Analysis

In the bivariate analyses, age was negatively and significantly associated with embarrassment in linear fashion. Fear was significantly associated with educational level, in which better-educated people are likely to perceive less fear (see Table II). Table III presents the zero-order correlations among the variables in the model. Fear was negatively associated with education, CRC knowledge, and social support, and positively associated with perceived susceptibility. Embarrassment was negatively associated with age, education, CRC knowledge, English language proficiency, and physician recommendation, and positively associated with female gender.

Table III. Correlations Among Variables (N = 305)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Age	1.00											
Gender	-.06	1.00										
Education	-.27**	-.10	1.00									
Family history of CRC	.08	-.05	.11*	1.00								
English spoken	.42**	.06	.03	.08	1.00							
Social support	-.14*	.06	.13*	.08	-.00	1.00						
Perceived susceptibility	.05	-.03	.02	.24**	.10	-.00	1.00					
Discomfort	-.17**	.13*	.07	.02	-.08	.20**	.06	1.00				
Fear	.03	.15*	-.19**	-.11	-.02	-.15**	.20**	.23**	1.00			
Embarrassment	-.26**	.15*	-.13*	-.01	-.27**	-.01	.07	.39**	.45**	1.00		
Dr. recommendation	.37**	-.04	-.01	.20**	.23**	.06	.22**	-.05	-.03	-.16**	1.00	
CRC knowledge	.23**	.07	.06	.15**	.31**	.09	.16**	-.07	-.12*	-.20**	.33**	1.00

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

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

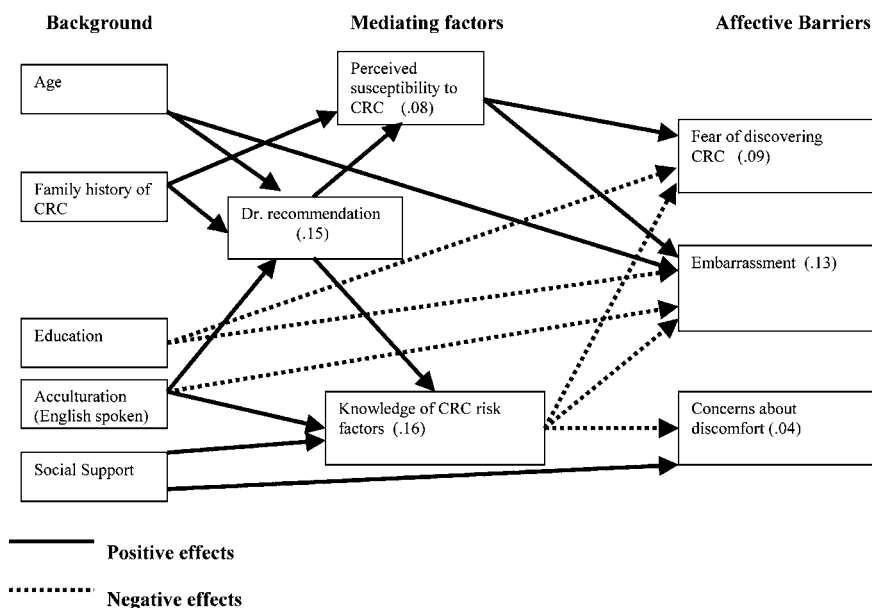


Fig. 2. Revised model with significant paths ($p < .05$) and adjusted R^2 (in parentheses).

Concerns about discomfort was negatively associated with age, and positively associated with female gender and social support.

Path Analysis

Figure 2 shows the revised model with the statistically non-significant paths removed. The test of model indicated a close fit: $\chi^2(24 \text{ df}) = 33.55$, $P = 0.093$; GFI = 0.980, AGFI = 0.947; CFI = 0.979; and RMSEA = 0.036. Although model fit was good, the model accounted for only a small proportion of the variance in fear, embarrassment, and concerns about discomfort, which were 9%, 13%, and 4% respectively.

Table IV shows the decomposition of the total effects for the final, reduced model, using unstandardized coefficients, to allow for ease of

interpretation and comparability across variables. The path analysis supports the study hypothesis (a). Three direct effects were further added from education to fear and embarrassment, from English language proficiency to embarrassment, and from social support to concerns about discomfort. Education directly predicts fear and embarrassment, but not concerns about discomfort. English language proficiency directly predicts embarrassment and indirectly predicts it through CRC knowledge and physician recommendation, resulting in the total effect size of -0.29 . Similarly, perceived social support directly predicts concerns about discomfort and indirectly predicts it through CRC knowledge, resulting in the total effect size of 0.15. In testing the study hypothesis (b), only family history predicts perceived susceptibility, which was positively associated with fear and embarrassment. Age directly predicts

Table IV. Decomposition of Total Effects (Direct and Indirect Effects) for Final Model Using Regression Weight (β)

Dependent variable	Independent variables							
	Age	Edu	FH	English language proficiency	Social Support	SUS	Physician recommendation	Knowledge of CRC risk factor
Perceived susceptibility	0.003	—	0.645	0.021	—	—	0.398	
Physician recommendation	0.007	—	0.233	0.052	—	—	—	
Knowledge of CRC risk factors	0.004	—	0.125	0.264	0.092	—	0.537	
Fear	—	-0.220	0.135	-0.044	-0.017	0.245	-0.001	-0.184
Embarrassment	-0.015	-0.233	0.077	-0.290	-0.015	0.152	-0.028	-0.164
Discomfort	-0.001	—	-0.017	-0.036	0.150	—	-0.074	-0.138

embarrassment. The study hypothesis (c) concerning the mediating role of physician recommendation was supported. One direct path from physician recommendation to perceived susceptibility was added.

DISCUSSION

The study findings, borne of a path analysis, have revealed how successfully, and under what conditions, individual differences in cognitive, socio-demographic, and medical history factors and inter-personal characteristics account for variations in affective barriers to CRC screening among Japanese Americans. The findings may lead to the development of interventions designed to reduce affective barriers to CRC screening, thus increasing the uptake of CRC detection tests and procedures among Japanese Americans.

The current study is unique in several respects. First, to our knowledge, it constitutes the first study of the structural relationship between intra- and inter-personal characteristics, and affective barriers to CRC screening. Although the effect sizes and explained variances were relatively small, the statistically significant paths and the well-fitting model provided empirical support for the study hypotheses and offer clear direction for future research. Relatively small effect sizes have been found in previous social psychological research examining barriers and distress related to cancer screening as well (Schwartz *et al.*, 1995; Bosompra *et al.*, 2000). Second, since the homogeneous sample consisted solely of persons of Japanese ancestry, albeit from different countries of origin, we were able to control for the possible confounding effect of ethnicity, thus permitting stronger inferences about the link between acculturation and affective psychological barriers. In addition, the research was administered in either English or Japanese, thereby enabling the study of persons with highly varying levels of acculturation. Third, our measures allowed us to capture each affective barrier to CRC screening, so that the contributions to each can be uniquely identified.

English Language Proficiency (Acculturation) and Maturation

The model suggests that English language proficiency was directly and indirectly associated with affective barriers to CRC. Specifically, English lan-

guage proficiency independently and directly reduced the perception of embarrassment, as it reduced all three psychological barriers by enhancing knowledge of CRC risk factors. Inability to freely express concerns in a non-native tongue may heighten a perception of embarrassment. Moreover, the complex medical vocabulary associated with CRC screening might pose an additional challenge to accessing medical information among those with inadequate English language proficiency. The unexpected alternative path from English language proficiency to physician recommendation added in the final model suggests that those who spoke English well were more likely to receive physician recommendation, which in turn enhanced their CRC knowledge. One could speculate that those who speak English well might raise more questions about CRC screening in the primary care office or could better understand what the physician said, thereby prompting a physician recommendation. Inadequate English language proficiency may impact how a physician's recommendation of CRC screening is understood and retained. This study underscores the importance of availability of language appropriate services to increase effectiveness of physician recommendation of CRC screening.

As expected, age, one of the risk factors for developing CRC, led to more physician recommendation. Interestingly, older age directly reduced a sense of embarrassment, but not fear or concerns about discomfort, indicating that a sense of embarrassment may dissipate over one's lifetime, so may be more relevant to younger patients than to older. A strong sense of embarrassment among younger high risk patients due to family or medical risk factors could lead to delay or procrastination in timely screening for CRC.

Education and Knowledge About CRC

Education emerged as a significant direct predictor of fear and embarrassment, even though the sample was relatively highly educated. Those with low education are more likely to be fearful and embarrassed about CRC screening. This finding is consistent with a study of the association of cancer worry and education level where those with lower education had increased depression and anxiety (Vernon *et al.*, 1997). Similarly, a number of investigators identified the role of education in enhancing knowledge of cancer, provider/patient communication, and

attitudes toward cancer screening (Davis *et al.*, 1996; Berman and Wandersman, 1991; Davis *et al.*, 2001). In the Japanese culture, cancer has been feared and uniquely communicated in a way that carries significant stigmatized social and psychological meaning around the disclosure of cancer diagnosis and prevention and treatment choices (Kagawa-Singer, 1998; Ruhnke *et al.*, 2000; Matsumura *et al.*, 2002). Cancer patients are often not told about their diagnosis and terminal status because the disclosure of cancer diagnosis is believed to be potentially harmful to patient's quality of life and psychological status (Mitchell, 1998). The taboo against open discussion of cancer and avoidance of psychological trauma deep-rooted in a traditional pragmatic fatalism (Sharts-Hopko, 1996) may be a reflection of predisposing cancer fear, possibly fear of death, widely shared by this population. Therefore, it would be important to further understand the cultural context and its potential effects on affective barriers as well as the mediating role of knowledge and education. Nonetheless, the current study supports interventions that provide accurate health information and enhance CRC-specific knowledge in order to reduce affective barriers. In particular, interventions should target those who are less acculturated and socially isolated.

The Role of Inter-personal Influences: Social Support and Physician Recommendation

The function of inter-personal influences such as social support and physician recommendation on knowledge and affective barriers was hypothesized to have "supportive" effect. However, we found that the roles of social support and physician recommendation were varied. Social support alleviated all three affective barriers through enhanced CRC knowledge, but directly elevated concerns about discomfort at the same time. It is possible to think that social support differently functioned as "informational" and at the same time as "appraisal" through the intra-personal pathway of CRC knowledge, as House (1981) suggested. That is, a person can be motivated to gain CRC knowledge as a result of constructive feedback from his or her friends. At the same time, a person may process information that CRC screening was painful or unpleasant from close friends and family members. The measure of social support used in this study was, however, narrowly defined and uni-dimensional, thereby making it difficult

to fully explore its influence on affective barriers to CRC screening.

The role of physician recommendation on affective barriers was complex, depending on what mediates the effect. As hypothesized, physician recommendation increased CRC knowledge, which in turn reduced the number of affective barriers. Screening recommendation by the physician may act as a form of affirmation prompting CRC knowledge acquisition. In contrast, the unexpected alternative direct path from physician recommendation to perceived susceptibility to CRC added in the final model suggests that screening recommendation by the physician elevated risk perception, which in turn heightened a perception of fear and embarrassment. It is possible that screening recommendation by physicians may unintentionally heighten the patient's perception of risk and may provoke fear. While we need to know more about the trade-offs of prompting CRC knowledge versus exacerbating risk perceptions, physician recommendation has been found as the single most powerful promoter of CRC screening among Japanese Americans in a previous correlational study (Honda, 2004). An intervention directed at physicians to promote CRC screening adherence among their patients should take potential secondary fear and embarrassment into consideration in order to avoid undermining its potential positive effect.

The Role of Perceived Susceptibility

The relationship between risk perceptions and affective barriers to CRC is not well documented in the literature (McCaul and Tulloch, 1999). Intra-personal theories of cognition-behavior linkages, such as the Health Belief Model (Strecher and Rosenstock, 1997), do not specifically address the relationship between cognitive components including susceptibility and affective barriers. Many researchers have measured these cognitive and affective components as direct and independent, while some have attempted multiplicative approaches based on the notion of these cognitive and affective components being simultaneously inter-related.

We found a positive association between perceived susceptibility and affective barriers (fear and embarrassment) where those with a family history of CRC had a higher risk perception, which in turn heightened fear and embarrassment. Whether perceived susceptibility is an antecedent to affective

barriers, whether the relationship between risk perceptions and affective barriers is linear, and whether cultural factors shape risk perceptions are unclear. The role of risk perceptions is therefore worthy of further investigation, using more extensive measures of the affective barriers, including distress.

There are certain limitations inherent to this study. The model should be considered as the first stage in the process of elaborating more complex mechanisms responsible for affective barriers in CRC screening compliance. First, the most serious limitation of this work is the cross-sectional nature of the data; interpretation must remain within the context of association, not prediction. A replication of this study employing longitudinal data would help to confirm whether implied causal pathways to affective barriers to CRC are justified. Replication using data on other ethnic groups would also improve our understanding of the pathways to affective barriers. Second, the measure of affective barriers is limited to fear, embarrassment, and concerns about discomfort and requires reservations about the comparability of the findings to those of previous studies. Although conceptually distinct, affective barriers/worry/anxiety/distress are often treated without clear conceptualization in cancer prevention studies. Evaluations of different affective barriers (e.g., cancer worry, anxiety, embarrassment, concerns about discomfort, etc) vary across studies, ranging from the use of a single-item question reflecting one aspect of affective barriers to a multiple-item composite measure which often measures a pathological level of distress. Third, constructs in the model such as CRC knowledge and social support were measured by a single-item and bear on critical limitation such as limited reliability due to considerable measurement error as well as the limited operationalization. Future studies should use multiple-item scales that capture various aspects of these constructs. Lastly, leaving a large proportion of the variance unaccounted for, the derived model does not come close to containing all the important socio-psychological causes of these three affective barriers. Because of reasons mentioned above, the results of this study should be generalized with caution.

In summary, clear benefits accrue from applying path analysis as a means of exploring specific hypotheses and identifying gaps in current knowledge. The results of the present study have both theoretical and practical implications as already noted. Our findings support the inclusion of inter-personal social support variables in addition to intra-personal

variables in models attempting to explain affective barriers to screening. The practical significance of these findings lies in their potential to guide the development of psychosocial interventions. For Japanese Americans, affective barriers including fear of cancer seem amenable to change through increased education about CRC, thereby reducing CRC-related morbidity and mortality.

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REFERENCES

- American Cancer Society. (2003). *Cancer facts and figures, 2003*. American Cancer Society, Inc., Atlanta, GA.
- Andersen, R. M. (1968). *Behavioral model of families' use of health services*. Center for Health Administration Studies, University of Chicago, Chicago, IL.
- Andersen, R. M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *J. Health Soc. Behav.* 36: 1–10.
- Arbuckle, J. L. (1995). *AMOS 4.0 programming reference guide*, Small Waters, Chicago.
- Baquest, C. R., and Commiskey, P. (1999). Colorectal cancer epidemiology in minorities: A review. *J. Assoc. Acad. Minor. Phys.* 10: 51–58.
- Bastani, R., Gallardo, N. V., and Maxwell, A. E. (2001). Barriers to colorectal cancer screening among ethnically diverse high- and average-risk individuals. *J. Psychosoc. Oncol.* 19: 65–84.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychol. Bull.* 107: 238–246.
- Berman, S. H., and Wandersman, A. (1991). Measuring knowledge of cancer. *Soc. Sci. Med.* 32: 1245–1255.
- Bollen, K. A. (1989). *Structural equations with latent variables*. Wiley, New York.
- Bosompra, K., Flynn, B. S., Ashikaga, T., Rairukar, C. J., Worden, J. K., and Solomon, L. J. (2000). Likelihood of undergoing genetic testing for cancer risk: A population-based study. *Prev. Med.* 30: 155–166.
- Brislin, R. W. (Ed.). (1976). *Translation: Application and research*. Gardner Press, New York.
- Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Lawrence Erlbaum Associated, Inc., Mahwah, NJ.
- Champion, V. L. (1984). Instrument development for Health Belief Model constructs. *ANS: Adv. Nurs. Sci.* 6: 73–85.
- Champion, V. L. (1993). Instrument refinement for breast cancer screening behaviors. *Nurs. Res.* 42: 139–143.
- Champion, V. L. (1995). Development of a benefits and barriers scale for mammography utilization. *Cancer Nurs.* 18: 53–59.
- Codori, A. M., Petersen, G. M., Miglioretti, D. L., and Boyd, P. (2001). Health beliefs and endoscopic screening for colorectal cancer: potential for cancer prevention. *Prev. Med.* 33: 128–136.

- Davis, T., Arnold, C., Berkel, H., Nandy, I., Jackson, R., and Glass, J. (1996). Knowledge and attitude on screening mammography among low literate, low income women. *Cancer* 78: 1912-1920.
- Davis, T. C., Dolan, N. C., Ferreira, R. M., et al. (2001). The role of inadequate health literacy skills in colorectal cancer screening. *Cancer Invest.* 19: 193-200.
- Flood, D. M., Weiss, N. S., Cook, L. S., Emerson, J. C., Schwartz, S. M., and Potter, J. D. (2000). Colorectal cancer incidence in Asian migrants to the United States and their descendants. *Cancer Causes Control* 11: 403-411.
- Frary, R. B. (2001). A brief guide to questionnaire development. Available at: <http://ericae.net/ft/tamu/vpiques3.htm>. Accessed May 2001.
- Graham, J. W., Hofer, S. M., Donaldson, S. I., McKinnon, D. P., and Schafer, J. L. (1997). Analysis with missing data in prevention research. In Bryant, K., Windle, M., and West, S. (Eds.), *The science of prevention: Methodological advances from alcohol and substance abuse research* (pp. 325-366). American Psychological Association, Washington, DC.
- Heaney, C. A., and Israel, B. A. (1997). Social networks and social support. In Glanz, K., Lewis, F. M., and Rimer, B. (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 179-205). Jossey-Bass Publications, San Francisco: San Francisco.
- Honda, K. (2004). Factors associated with colorectal cancer screening among the US urban Japanese population. *Am. J. Public Health* 94(5): 815-822.
- House, J. S. (1981). *Work stress and social support*. Addison-Wesley, Reading, MA.
- Kagawa-Singer, M. (1998). Cancer and Asian American cultures. *Asian Am. Pac. Isl. J. Health.* 6: 383-399.
- Kash, K. M., and Dabney, M. K. (2001). Psychological aspects of cancer screening in high-risk populations. *Med. Pediatr. Oncol.* 36: 519-524.
- Kline, R. B. (1998). *Principles and practice of structural equation modeling*. Guilford Press, New York.
- Koivula, M., Paunonen-Ilmonen, M., Tarkka, M. T., Tarkka, M., and Laippala, P. (2002). Social support and its relation to fear and anxiety in patients awaiting coronary artery bypass grafting. *J. Clin. Nurs.* 11: 622-633.
- Kouzis, A. C., and Eaton, W. W. (1998). Absence of social networks, social support and health service utilization. *Psychol. Med.* 28: 1301-1310.
- Lugerlund, M., Hedin, A., Sparen, P., Thurfjell, E., and Lambe, M. (2000). Attitudes, beliefs, and knowledge as predictors of nonattendance in a Swedish population-based mammography screening program. *Prev. Med.* 31: 417-428.
- Macrae, F. A., Hill, D. J., St. John, J. B., et al. (1984). Predicting colon cancer screening behavior from health beliefs. *Prev. Med.* 13: 1150126.
- Matsumura, S., Bito, S., Liu, H., et al. (2002). Acculturation of attitudes toward end-of-life care. *Journal of Gen. Intern. Med.* 17: 531-539.
- McCaul, K. D., and Tulloch, H. E. (1999). Cancer screening decisions. *J. Nat. Cancer Inst. Monographs* 25: 52-58.
- Mitchell, J. L. (1998). Cross-cultural issues in the disclosure of cancer. *Cancer Pract.* 6: 153-159.
- Morgan, J., Roufeil, L., Kaushik, S., and Bassett, M. (1998). Influence of coping style and precolonoscopy information on pain and anxiety of colonoscopy. *Gastrointest. Endosc.* 48: 119-127.
- Orth-Gomer, K., Rosengren, A., and Wilhelmsen, J. (1993). Lack of social support and incidence of coronary heart disease in middle-aged Swedish men. *Psychosom. Med.* 55: 37-43.
- Ries, L. A. G., Kosary, C. L., Hankey, B. F., Miller, B. A., Clegg, L. X., and Edwards, B. K. (Eds.). (1999). *SEER cancer statistics review, 1973-1996*. (NIH pub. no.99-2789). National Cancer Institute, Bethesda, MD.
- Rosenstock, I. (1974). Historical origins of the health belief model. In Becker, M. (Ed.), *The health belief model and personal health behavior* (pp. 1-8). Slack Press, Thorofare, NJ.
- Ruhnke, G. W., Wilson, S. R., Akamatsu, T., et al. (2000). Ethical decision making and patient autonomy. *Chest.* 118: 1172-1182.
- Schwartz, M. D., Lerman, C., Miller, S. M., Daly, M., and Masny, A. (1995). Coping disposition, perceived risk and psychological distress among women at increased risk for ovarian cancer. *Health Psychol.* 14: 232-235.
- Sharts-Hopko, N. (1996). Health and illness concepts for cultural competence with Japanese clients. *J. Cultur. Divers.* 3: 74-79.
- Skinner, C. S., Arfken, C. L., and Sykes, R. K. (1998). Knowledge, perceptions, and mammography stage of adoption among older urban women. *American J. Prev. Med.* 14: 54-63.
- Steiger, J. H., and Lind, J. M. (1980). *Statistically based tests for the number of common factors*. IA: Iowa City.
- Strecher, V. J., and Rosenstock, I. M. (1997). The health belief model. In Glanz, K., Lewis, F. M., Rimer, B. K. (eds). *Health behavior and health education*. Jossey-Bass Publishers, San Francisco.
- Suarez, L., Ramirez, A. G., Villarreal, R., et al. (2000). Social networks and cancer screening in four U. S. Hispanic Groups. *Am. J. Prev. Med.* 19: 47-52.
- Vernon, S., Perz, C., Gritz, E., et al. (1997). Correlates of psychological distress in colorectal cancer patients undergoing genetic testing for hereditary colon cancer. *Health Psychol.* 16: 73-86.
- Wardle, J., Sutton, S., Williamson, S., et al. (2000). Psychosocial influence on older adults' interest in participating in bowel cancer screening. *Prev. Med.* 31: 323-334.
- Wardle, J., Williamson, S., McCaffery, K., et al. (2003). Increasing attendance at colorectal cancer screening: Testing the efficacy of a mailed, psychoeducational materials in a community sample of older adults. *Health Psychol.* 22: 99-105.
- Weitzman, E. R., Zapka, J., Estabrook, B., and Valentine, G. K. (2001). Risk and reluctance: Understanding impediments in colorectal cancer screening. *Prev. Med.* 32: 502-513.
- Wothke, W. (2003). Longitudinal and multi-group modeling with missing data. Available at <http://www.smallwaters.com/whitepapers>.