Cancer Screening Belief Scale – Chinese Version (CSBS-C): Validation on Scale Psychometric Properties Among a Chinese Worksite Population

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Abstract

Objective: To develop and validate a culturally sensitive scale measuring cancer screening beliefs for Chinese; and to examine the validity and reliability of the scores of the new instrument (CSBS-C). Methods: A modified instrument measuring cancer screening beliefs in general was developed, adapting from the previous Cervical Smear Belief Inventory (CSBI) developed by Hou and Luh (2005) among Chinese women, and tested among a Chinese worksite population in Taiwan. Items consisted in the CSBS-C were carefully reworded from Hou's previously validated CSBI to reflect statements that would apply to cancer screening beliefs in general. Participants were asked to complete the self-administered screening belief items at baseline and one month follow-up (follow-up rate = 81%). Structural equation modeling (SEM) was used to assess the stability of the scores of the three-factor scale measured over time. Confirmatory factor analysis (CFA) was then used to validate these hypothesized theoretical constructs (factors). Results: SEM analysis revealed that the standardized coefficients of the three factors measured over time ranged from .30 to .75, indicating reasonable stabilities, and all three models revealed acceptable model fits (RMSEA=.06 ~ .09; GFI=.90~.99; IFI=.92~.99; TLI=.89~.97; and CFI=.92~.99). The final version of the CSBS-C, validated by CFA, consisted of 17 items that were clustered into three subscales: pros (eight items), cons (six items), and perceived cancer risks (three items); with all items loaded consistently and significantly with their corresponding factors (p<.001). Internal consistency ranged from 0.72 to 0.90. Conclusion: Evidence showed that psychometric properties of the CSBS-C demonstrated satisfactory reliability and validity. The instrument with its side-by-side English-Chinese comparison provides researchers and practitioners a valuable tool to reach Chinese population in a culturally sensitive and linguistically appropriate way.

Keywords: cancer screening, beliefs, scale validation, Chinese

Introduction

Cancers is the number one cause of death among Asian Americans (Kagawa-Singer & Pourat, 2000) as well as in many countries in Asia such as Taiwan. Although cancer statistics data in the U.S. show that in general, Asians tend to have lower incidences or mortalities comparing with other racial/ethnic groups, recent studies involving cancer mortality data find that death rates for Asians are often understated. Similarly, the U. S. Cancer Statistics Working Group comments that incidence data for Asians may be underestimated, although those data are generally reliable for whites and blacks. One major reason suspected is possibly due to racial misclassification or differences in cancer registry operations (U. S. Cancer Statistics Working Group, 2003).

Although cancer screenings for cervical, breast, and colorectal cancers have been proven to be effective to detect cancers early and significantly reduce cancer mortality, Asians is the group least likely to receive cancer screenings of any kind (U. S. Cancer Statistics Working Group, 2003). According to American Cancer Society's most recent report based on nation-wide surveillance surveys, only 59% of the Asians reported a mammography within the past 2 years, comparing to 70% among Whites (American Cancer Society, 2006). Only 68% of Asians reported a cervical smear test within the past three years, as compared to 80%, 82%, and 75% for White, African American, and Hispanic or Latina women, respectively. Disparities in colorectal cancer screening rates were observed across racial or ethnic groups, with Asians still ranked at the bottom. Only 14% of the Asian overall had a fecal occult blood test (FOBT) in the past year, and 25% had an endoscopy in the past 5 years (American Cancer Society, 2006). These low cancer screening rates may lead to cancers being identified at more advanced stages, less effective treatments, and higher cancer mortalities.

According to the 2006 World Population Data Sheet (Population Reference Bureau, 2006), China ranked number one among the top ten World's largest countries in population. China has about 4.4 times the population compared with that in the U. S. (1,311 versus 299 millions). Asian is also among the highest growing group in the United States. In 1990, there were 6.9 million Asians living in the U.S. Between 1990 and 2000, the Asian population grew by 3.3 million to 10.2 million. This is represents a growth of 48% compared to 13% for the total U.S. population (U. S. Census Bureau, 2003). About a quarter of the U.S. Asian population was of Chinese origin (U.S. Census Bureau, 2005). Despite these facts, Asians, the fastest growing population both in the U. S. and around the world, have received the least attention of all ethnic populations in cancer control research studies or targeted intervention programs by the national government. One of the major reasons for this lack of attention is the paucity of disaggregated and accurate Asian data (Kagawa-Singer & Pourat, 2000). Aggregated data imply a lack of need for targeted screening programs or public policies for these populations. Therefore, it is important to understand factors influencing cancer screening utilization among this population, Chinese in particular, in order to develop appropriate and effective cancer screening promotion and educational programs. It is also important to develop and validate a Chinese version of the cancer screening belief instrument in order to better understand and reach this group in a culturally sensitive and linguistically appropriate way.

To date, there have been some published articles providing systematic efforts on developing and validating instruments used for measuring cancer screening beliefs related to cancers of specific types. Several studies have reported on scale development for mammography screening related belief (Champion, 1995; Champion & Scott, 1997; Rakowski, Fulton, Feldam, 1993). Rakowski et al. (1997) tried to extend perceived pros and cons from decisional balance constructs to both mammography and cervical smear compliance (Rakowski, Clark, Pearlman, Ehrich, Rimer, Goldstein, et al., 1997). Hou and Luh (2005) were among the first that developed and validated a theory-based screening belief inventory specifically to cervical smear screening and for Chinese women (Hou & Luh, 2005). Results from their Cervical Smear Belief Inventory (CSBI) showed that many of the psychometric scores of the inventory had satisfactory reliability and validity. Nevertheless, most of the validated belief scales available apply to cancer of specific type. There remains a need to have similar scales being validated that could to be used to assess beliefs related to cancer screening in general for broader applications among Asians such as Chinese.

This study examined the psychometric properties of the Cancer Screening Belief Scale – Chinese version (CSBS-C), a modified instrument adapted from the previous Cervical Smear Belief Inventory (CSBI) developed by Hou and Luh (2005) among Chinese women (Hou & Luh, 2005). This paper describes the reliability and validity of the scores of CSBS-C on assessing theory-based constructs related to belief towards cancer screening among a Chinese worksite population that includes both men and women. The main output of the study is to provide an English-Chinese bilingual measurement tool that has satisfactory reliable and valid psychometrics. Such tool is necessary for researchers and health care practitioners to reach Chinese communities in a culturally sensitive and linguistically appropriate way.

Materials and Methods

Development of the Initial Items

The initial item pool of beliefs related to cancer screenings in general were developed based on items published in Hou's previously validate cancer screening belief inventory specifically developed for cervical smear test among Chinese women (CSBI). Items were reworded carefully from the CSBI to reflect statements that would apply to cancer screening beliefs in general. For example, the term "cervical smear test" was replaced with a general term "cancer screening", if the statement can apply to cancer screening in general or early detection overall. Items specifically relate to gender or cervical smear test were removed.

Twenty items were drafted in the initial item pool, reflecting three theoretical constructs (factors). These constructs were derived from existing models of health behavior and inherent in the original CSBI (Hou & Luh, 2005). These included perceived pros and cons from the Transtheoretical Model (Prochaska, Norcross, & Diclemente, 1994), and perceived risk (susceptibility) from the Health Belief Model (Rosenstock & Krischt, 1974). Scale items were drafted in English, translated into Chinese, and then back translated. Items on the two English versions were compared for consistencies. The draft was then given to an expert panel (including three cancer researchers, two health care professionals, and three lay Chinese adults) to evaluate the item clarity, relevancy, comprehensiveness, and literacy demand. One item was identified as redundant thus was removed from the initial item pool. Comments and suggestions were used to further refine these belief statements in order to enhance clarity and readability.

Study Sample and Procedure

The study participants were selected from a convenient sample of worksite population and their family member age 40 years and older. Participants in the study were recruited from a Fecal Occult Blood Test (FOBT) screening trial for colorectal cancers screenings. Each participant was asked to complete a survey with items measuring their beliefs related to cancer screenings in general (the 19-item CSBS-C scale), along with their screening history, knowledge related to colorectal cancers screenings, as well as demographics. A total of ten worksites in one of the major cities in Taiwan participated in the study. The questionnaires were administered by the researchers, with the assistance of managers or supervisors from each participating worksite. Follow-up surveys were administered to all participants, after one month of the initial survey, when the researchers went to the same study sites and collect their stool test result cards. The detailed process on the actual fecal occult blood test trial is documented elsewhere (Hou & Chen, 2004). Data on cancer screening beliefs in general were analyzed in the current study to assess the internal consistencies, stability (test-retest reliability), and structure validity of the three factors which measured in the CSBS-C scale.

Data Analysis

Before data were analyzed using SPSS 14.0 software, all items were examined to ensure reflection of positive expressions in their corresponding scales. Listwise deletion was used to exclude missing data. Descriptive statistics, item-total correlation, and Cronbach's alpha coefficients were calculated for each construct (see Table 1).

Structural equation models were used to test separately whether each of the three factors remained stable over time. Items with low loading were dropped. Confirmatory factor analysis was then applied to examine the proposed three-factor model. The purpose of this process was to confirm if there was sufficient empirical evidence suggesting that the model, as specified, might be a viable representation of the true relationships between observed and latent variables (Mueller, 1996). Judgments about model fit were made jointly by assessing the ratio of chi-square to degrees of freedom (χ^2/df), root mean square error of approximate (RMSEA), non-normed fit index (NNFI) or Tucker-Lewis Index (TLI), incremental fit index (IFI), and comparative fit index (CFI). The criteria used to determine if the model fit the data were the χ^2/df less than three (Bollen, 1989), RMSEA no more than .08 (Raykov, 2001), and values of NNFI, IFI, and CFI at least .90 (Byrne, 1998). Factor loadings were considered statistically significant if the ratio of the factor loading to its standard error was greater than 1.96 or less than -1.96 (Joreskog & Sorbom, 1996). Finally, reliabilities of each of the factors in the cancer screening belief scale were calculated.

Results

A total of 450 survey were distributed to employee and their family members aged 40 and over among the ten participating worksites in Taiwan. Among these people, 375 participants completed and returned their consent form and initial surveys (83%). At the one-month follow up, 304 participants were reached and completed a follow-up survey (81%). Among these, 272 participants completed all items in the cancer screening belief section of the survey and thus were included in the following reliability and validity analyses.

Demographics

The mean age of the participants was 48.18 (SD=8.79), most of them were married (93.3%). About 58.8% were male. Over half of the participants had a college education level or higher (54.0%), and 78.6% had a full time job. Most people (88.9%) indicated their general health condition as “fair” (39.0%) or “good” (49.9%). Even though near half (49.9%) of the participants indicated they had someone in their family who had been diagnosed with cancer of any types, over 90% of the participants rated their perceived risk of getting cancers in the next five years as either the same (49%), low (22%), or very low (20.4%) compared to others in their ages.

Initial Reliabilities

The initial reliabilities for the three constructs measured in the initial 19-item pool showed satisfactory internal consistencies, with Cronbach alphas all greater than .70. The corrected item-total correlations of all the items were greater than .20, and ranged from .32 to .80, indicating that all the pros, cons, and perceived risk items showed sufficient correlations with other items in their corresponding constructs (see Table 1). The correlation matrix among items is available upon request.

Test-Retest Reliabilities

Structural equation models were then used to test separately whether each of the three factors hypothesized remained stable over time. The path from initial to follow-up perceived benefits of cancer screenings (pros) was significant (coefficient=.30; $p<.001$); suggesting that participants’ perceived screening benefits were stable over time. All items, except one (Pros_9), had significant loading weights to the “PROS” factor. Excluding Pros_9, model fit index for the remaining 8 items were satisfactory; with χ^2 (99) = 312.12, RMSEA=.09 (90% CI=.08, .10), GFI=.90, IFI=.93, TLI=.91, and CFI=.93. Similarly, the path from initial to follow-up perceived cons was significant (coefficient = .75; $p<.001$); revealed stabled scores on perceived screening barriers. All items were loaded significantly to the “CONS” factor, except one item (Cons_7) showed negative estimates at follow-up and thus were removed. The model with the remaining 6-items fit well, with χ^2 (48) = 125.81, RMSEA=.08 (90% CI=.06, .09), GFI=.92, IFI=.92, TLI=.89, and CFI=.92. Finally, the path from initial to follow-up perceived risk was also significant (coefficient = .71; $p<.001$), indicating participants’ perceived risk of getting cancer was stable overtime as well. The model also fits well with all items loaded significantly ($\chi^2(6)$ = 11.59, RMSEA=.06 [90% CI=.00, .11], GFI=.99, IFI=.99, TLI=.97, and CFI=.99).

Confirmatory Factor Analysis (CFA)

The CFA was then applied to test the remaining 17-item three-factor model. The structure of item loadings was consistent with the intended theoretical constructs. All items measuring perceived benefits of cancer screening in general or early detection were loaded to “PROS” factor, and those measuring perceived barriers to cancer screening were loaded to “CONS” factor. In addition, items measuring perceived cancer risk were loaded to “RISK” factor. Although chi-square test was significant, the ratio of chi-square and degree of freedom was small (272 / 116=2.34), indicating good model fit (Bollen, 1989). The values of Comparative Fit Index

(CFI), Incremental Fit Index (IFI), and Non-Normed Fit Index (NNFI) or Tucker-Lewis Index (TLI) were .92, .92, and .90, respectively, demonstrating adequate fit (Byrne, 1998). Furthermore, the Root Means Square Error of Approximation (RMSEA=.07; 90% CI= [.06, .08]) was small, which also indicated a good fit (Raykov, 2001).

Table 1
Item means, standard deviations, corrected item-total correlation (CITC), and alpha if item deleted for each sub-scale (N=272)

Item*	Description	Mean (SD)	CITC	Alpha if item deleted
Pros				
Pros_1	A cancer screening can find cancer early.	4.53 (0.56)	0.52	0.90
Pros_2	Routine cancer screening gives me peace of mind.	4.27 (0.64)	0.75	0.88
Pros_3	Routine cancer screening is a way to show I take care of my health.	4.33 (0.59)	0.80	0.88
Pros_4	My family members will feel I care my health if I do routine cancer screening.	4.28 (0.59	0.78	0.88
Pros_5	My family members will support me if I have routine cancer screening.	4.30 (0.59)	0.77	0.89
Pros_6	I am willing to do routine cancer screening for my family and my health.	4.17 (0.66)	0.74	0.89
Pros_7	I think routine cancer screening is a way to show I take care of my family.	4.09 (0.75)	0.57	0.90
Pros_8	If found early and treat early, the cancer cure rate is very high.	4.28 (0.64)	0.64	0.89
Pros_9	[Cancer screening is not important to me.]	4.01 (0.71)	0.54	0.90
Cons				
Cons_1	It is too much trouble to obtain a cancer screening.	3.10 (1.03)	0.36	0.73
Cons_2	I do not want to know if I have cancer.	2.22 (0.91)	0.48	0.70
Cons_3	I do not want to spend time on cancer screening.	2.27 (0.87)	0.60	0.68
Cons_4	Unless I have symptoms or feel uncomfortable, I will not go screening.	2.90 (1.03)	0.56	0.68
Cons_5	I rather not know if I have cancer.	2.03 (0.77)	0.49	0.70
Cons_6	I do not have time to obtain cancer screening.	2.95 (0.97)	0.39	0.72
Cons_7	[I will not go screening unless health care providers remind or suggest me to do.]	2.55 (0.86)	0.32	0.74
Risk				
Risk_1	I think I have the possibility of getting cancer.	3.01 (0.76)	0.62	0.64
Risk_2	It is possible for me to get cancer during my lifetime.	3.50 (0.74)	0.54	0.73
Risk_3	I feel my chance of getting cancer is higher than other people in my age.	2.87 (0.71)	0.61	0.66

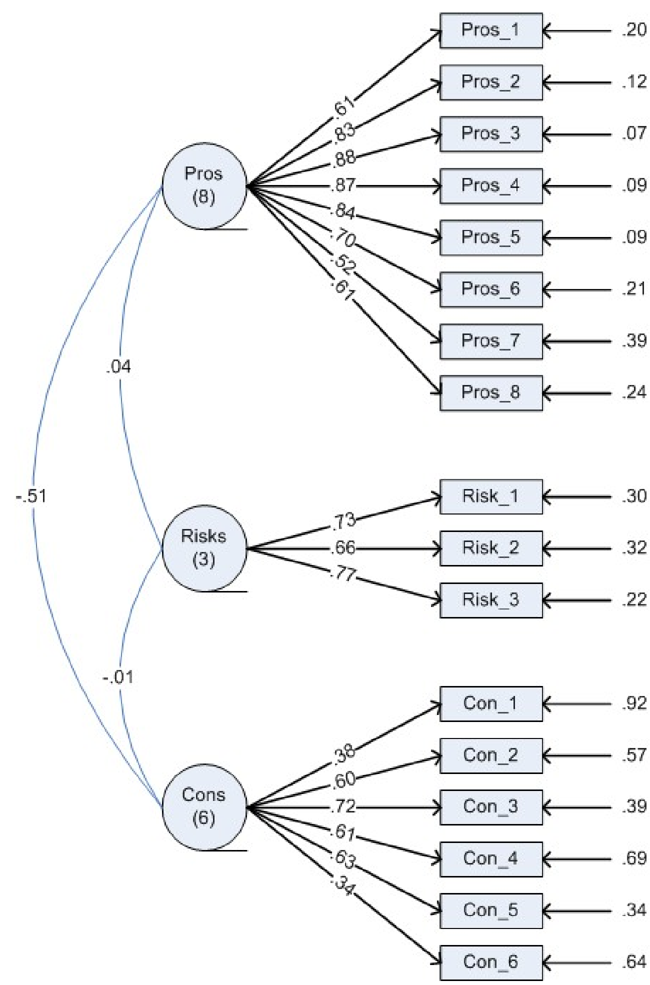
* Cronbach alphas: Pros (8 items) = .90; Cons (6 items) = .72; Risk (3 items) = .90
Note: "Risk" means "perceived risk" (or susceptibility) scale. Items in bracket [ ] were dropped during the CFA analysis, thus were not included in the final scale.

Based on Bagozzi and Yi' criterion (Bagozzi & Yi, 1988), all of the factor loadings, standard errors, and t ratios indicated a good fit of internal structure of model, with items of significant coefficients. The results revealed (1) no coefficients with theory contradicting signs;

and (2) all standard errors seem small as indicated by large t-ratios. All t values were significantly greater than 1.96 based on Joreskog and Sorbom's criterion (Joreskog & Sorbom, 1996). Figure 1 summarized the interrelations among the three constructs (i.e. identified using circles) and the relations between each latent variable and observed indicator (i.e., identified using rectangles). Examination of the factor coefficients revealed that all were substantially loaded by the corresponding factors. Finally, there were no negative variance estimates in the latent variable and the error covariance matrices. These results revealed no obvious mis-specifications, and supported that the hypothesized model was satisfactory. Findings supported that the CSBS-C assessed three theoretical constructs (see Figure 1).

Reliabilities of the final version of the CSBS-C

The internal consistencies of the 17-item three-factor scale in the final item pool were then calculated again. Again, data showed satisfactory reliabilities, with Cronbach alpha ranged from .72 to .90 (see Table 1). The final version of the CSBS-C with the side-by-side Chinese-English comparisons is presented at the end of this paper in Appendix A.



Model fit index: χ^2 (116) = 272, GFI=.90, CFI=.92, IFI=.92, ITL=.90, RMSEA=.07

Figure 1
The structure and item loadings of the 17-item CSBS-C.

Discussion

Current data showed that psychometric properties of the CSBS-C demonstrated satisfactory reliability and validity. The test-retest reliabilities assessed by structural equation modeling suggested the scores of the three-factor scale were stable over time. The structure of the CSBS-C measurement examined by confirmatory factor analysis demonstrated reasonable model fits indicating satisfactory construct validity. In addition, the scores of the final 17-item three-factor scale revealed good internal consistencies to assess cancer screening beliefs in general. These convergence evidence from current data demonstrated that the structure of the CSBS-C scale was consistent to the theoretical constructs with satisfactory reliabilities and validities. Furthermore, current results supported evidence-based psychometric properties of the scale to measure cancer screening beliefs among a Chinese worksite middle-aged population including both males and females.

The descriptive results of the current study showed that participants on average scored high on perceived screening benefit, moderate on barriers towards cancer screenings, and moderate on perceived risk of cancers (Table 1). The findings indicated that, in general, participants in the study might believe cancer screenings were beneficial and themselves being at similar risk of getting cancers compared with other people their age, yet at the same time also perceive moderate barriers towards various cancer screenings. How middle-aged adults weight the benefits and concerns of cancer screenings and potential consequences of finding out having cancers, and how health care providers could address the various screening barriers to encourage screening non-adherent adults to obtain regular cancer screenings might warrant further research and discussions.

One thing to note is that the CSBS-C scale was developed and tested among middle-age, relatively highly educated Chinese participants. Therefore, generalization of the study results needs to consider these factors. Nevertheless, this instrument serves as an important tool developed specifically for Chinese population measuring general cancer screening related beliefs.

In summary, current study indicated that the CSBS-C is reliable and valid for assessing beliefs towards cancer screenings in general among Chinese population. The scores of the CSBS-C demonstrated both good reliabilities and appropriate validities consisted with existing social and behavioral theoretical constructs (perceived pros, cons, and susceptibility). It provides a multidimensional measurement to assess general cancer screening related beliefs. The brief inventory (17 items) makes it practical for future adoptions. Current findings also shed light on issues related to screening related barriers (concerns of finding out having cancers, the mentality of rather not knowing having cancers, etc.). Public health programs that aim to encourage screenings should consider these potential mental barriers associated with cancer screening. On the other hand, health promotion and preventive programs might take advantage of the relatively high perceived benefits of cancer screening to install values of early detection. Specifically, for Chinese population, emphasizing values of family such as “screening for family” might worth more attention. Information obtained from the CSBS-C can help researchers establish evidence-based priorities for encouraging cancer screenings. The CSBS-C with the proven psychometric properties has implication on future application to the development and evaluation of cancer prevention programs delivered to Chinese population.

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Appendix A

Hou's Cancer Screening Belief Scale – Chinese version (CSBS-C)

	Cancer Screening Beliefs	非常同意 SA	同意 A	不確定 U	不同意 D	非常不同意 SD
Pros_1	癌症篩檢可以早期發現癌症。 A cancer screening can find cancer early.	□	□	□	□	□
Pros_2	定期癌症篩檢可以使我對我的健康放心。 Routine cancer screening gives me peace of mind.	□	□	□	□	□
Pros_3	定期癌症篩檢是照顧自己健康的一種表現。 Routine cancer screening is a way to show I take care of my health.	□	□	□	□	□
Pros_4	如果我定期做癌症篩檢我的家人會覺得我很關心我的健康。 My family members will feel I care my health if I do routine cancer screening.	□	□	□	□	□
Pros_5	若我去做癌症篩檢，家人會支持我。 My family members will support me if I have routine cancer screening.	□	□	□	□	□
Pros_6	我願意為了自己健康，和我的家人定期做癌症篩檢。 I am willing to do routine cancer screening for my family and my health.	□	□	□	□	□
Pros_7	我覺得接受定期癌症篩檢是我對家庭負責的一種表現。 I think routine cancer screening is a way to show I take care of my family.	□	□	□	□	□
Pros_8	癌症若早期發現早期治療，它的治癒率很高。 If found early and treat early, the cancer cure rate is very high.	□	□	□	□	□
		非常	同意	不確定	不同意	非常

	Cancer Screening Beliefs	非常同意 SA	同意 A	不確定 U	不同意 D	非常不同意 SD
		同意 SA	A	U	D	不同意 SD
Cons_1	我覺得癌症篩檢很麻煩。 It is too much trouble to obtain a cancer screening.	□	□	□	□	□
Cons_2	我不想知道自己是否有癌症。 I do not want to know if I have cancer.	□	□	□	□	□
Cons_3	我不想花時間做癌症篩檢。 I do not want to spend time on cancer screening.	□	□	□	□	□
Cons_4	除非有任何症狀或不適，否則我不會去做檢查。 Unless I have symptoms or feel uncomfortable, I will not go screening.	□	□	□	□	□
Cons_5	若發現有癌症，我寧願不知道。 I rather not know if I have cancer.	□	□	□	□	□
Cons_6	我沒有時間做癌症篩檢。 I do not have time to obtain cancer screening.	□	□	□	□	□
Risk_1	我覺得我有得癌症的可能。 I think I have the possibility of getting cancer.	□	□	□	□	□
Risk_2	我在一生中，有可能得到癌症。 It is possible for me to get cancer during my lifetime.	□	□	□	□	□
Risk_3	我得癌症的機率比其他同年齡的人高。 I feel my chance of getting cancer is higher than other people in my age.	□	□	□	□	□