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Cross-cultural Adaptation and Validation of Lung Cancer Screening Health Belief Scale

Author
Lei, Fang

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Cross-cultural Adaptation and Validation

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by

Fang Lei

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ABSTRACT OF THE DISSERTATION

Cross-cultural Adaptation and Validation of Lung Cancer Screening Health Belief Scale

by

Fang Lei

Doctor of Philosophy in Nursing

University of California, Los Angeles, 2022

Professor Eunice Eunkyung Lee, Chair

Abstract

Background: Lung cancer is the leading cause of cancer death and the third prevalent disease among Chinese Americans. Lung cancer screening with low dose computed tomography is an effective method to detect lung cancer. Compared to chest X-ray, low dose computed tomography can reduce the mortality rate of lung cancer by 20% in the high-risk smokers. Since 2013, lung cancer screening has been recommended by most health organizations and covered both by private and public insurances. However, the uptake rate of lung cancer screening is still low in the US, and there are few studies on lung cancer screening among Chinese Americans. Previous studies indicated that the uptake rate of lung cancer screening was significantly associated with the health belief of lung cancer screening. However, there is no instrument available to investigate the health belief of lung cancer screening among Chinese Americans.

This study aims to cross-culturally adapt and validate the Lung Cancer Screening Health Belief Scale and enable its application in Chinese Americans.

Methods: The study adapted an existing instrument by conducting instrument translation, expert reviews, and cognitive individual interviews in order to establish cross-cultural equivalence between the original and adapted instruments as well as to establish its content validity. The instrument was translated using the Brislin's back-translation approach. The instrument modification included expert reviews among a panel of 5 experts in cancer nursing and cross-cultural research, and cognitive individual interviews with 9 participants.

Results: We adapted a cross-cultural fitted instrument measuring Chinese American high-risk smokers' health belief toward lung cancer screening. The modified culturally fitted Lung Cancer screening Health Belief Scale included 57 items and 6 sub-scales, which content was proved highly valid through the expert review and participants' review. The forward and backward translation step established the translated scale's semantic equivalency. The expert review step established the modified scale's content equivalency, with the item level-content validity index ranged from 0.8 to 1 at the item level and the scale level content validity index/universal agreement ranged from 0.75 to 1 at the scale level. The content validity coefficients for clarity and translation equivalent ranged from 0.76 to 0.79, which were at an acceptable level. The cognitive interview step established the translated scale's semantic and content equivalency. Strategies including changing wording, adding extra explanations to the items, changing/combing the two sections in the sentence to one section, and deleting redundant item were used in the adaptation process.

Conclusions: This study adapted the Lung Cancer Screening Health Belief Scale to be used in Chinese Americans. It provides a content valid instrument to evaluate Chinese Americans' health belief toward lung cancer screening. This study reported a reliable methodology for cross-culturally adapting an instrument to be used in another culture. It also provided an example for novice cross-cultural researchers to adapt an instrument to be used in another population with different language. Further research is needed to establish the modified instrument's reliability and validity.

The dissertation of Fang Lei is approved.

Mary-Lynn Brecht

Wei-Ti Chen

Zuo-Feng Zhang

Eunice Eunkyung Lee, Committee Chair

University of California, Los Angeles

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CURRICULUM VITAE

Name: Fang Lei, PhD, MSN, MPH, RN

Research interest:
Cancer prevention and care, Cross-cultural research, Nursing safety, Geriatric nursing, Instrument development adaptation and validation, Diabetes, Hypertension

Contact information:
Tel: +1-310-733-0963
Email: airlf201314@gmail.com

ACADEMIC/PROFESSIONAL QUALIFICATIONS

- **Doctor of Philosophy in Nursing**
  University of California, Los Angeles 9/2016-03/2022

- **Master of Nursing**
  University of California, Los Angeles 9/2016-12/2018

- **Master of Public Health**
  University of South China 9/2013-6/2016

- **Bachelor of Nursing**
  Wuhan University 9/2001-6/2006

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Chapter 1: Introduction

Lung cancer is the leading cause of cancer deaths in Chinese Americans (Gomez et al., 2015). It is the second and fourth most common cancer among U.S. Chinese men and women, respectively (Gomez et al., 2015). Only 16% of lung cancers are diagnosed at a localized stage in the U.S. population, for which the five-year survival rate is 55% (McCarthy, 2014). As the diagnosed time prolongs, the five-year survival rate for lung cancer patients drops to 4% when lung cancer is diagnosed at a late stage (stage IV) (McCarthy, 2014). Lung cancer screening with low dose computed tomography increases the possibility of detecting lung cancer at an earlier stage and decreases the mortality of lung cancer compared to X-ray (Tota et al., 2014). However, the uptake rate of lung cancer screening with low dose computed tomography was low among overall U.S. population and lacking report among Chinese Americans. Although previous studies conducted among U.S. overall population showed health beliefs about lung cancer screening were significantly associated with the uptake of lung cancer screening (Cataldo, 2016), no culturally adapted lung cancer screening health belief instrument was available to be used for lung cancer screening education and intervention programs among Chinese Americans. This study aims to cross-culturally adapt the existed Lung Cancer Screening Health Belief Scale to be used in Chinese Americans. Background information related to lung cancer's pathogenesis, incidence, mortality and survival rates, prevention, history of lung cancer screening guidelines, lung cancer screening uptake rates, health beliefs of lung cancer screening, existed instrument measuring health beliefs toward lung cancer screening and the significance of the study will be addressed in this chapter.

Pathogenesis of Lung Cancer

Lung cancer, also known as lung carcinoma, is the malignant lung tumor caused by uncontrolled cell growth in tissues of lung (Lemjabbar-Alaoui, Hassan, Yang, & Buchanan, 2015). Most primary lung cancers that start in the lung are carcinomas (Lemjabbar-Alaoui et al., 2015). Small-cell lung carcinoma (13%) and non-small-cell lung carcinoma (84%) are two major types of lung cancer (Zappa & Mousa, 2016). Non-small-cell lung carcinoma includes adenocarcinoma, squamous cell carcinoma, and large cell carcinoma which were categorized by the histological types of lung cancer (Lemjabbar-Alaoui et al., 2015).

Common symptoms of lung cancer include persistent cough, sputum streaked with blood, chest pain, voice change, worsening shortness of breath, and recurrent pneumonia or bronchitis (American Cancer Society, 2019a). The symptoms do not usually occur until lung cancer is advanced to stage IIIB or IV (American Cancer Society, 2019a). Appropriate treatments for lung cancer are based on the type, stage, and molecular characteristics of lung cancer, which include surgery, radiation therapy, chemotherapy, immunotherapy, and targeted therapy (American Cancer Society, 2019a).

Incidence and Mortality Rates of Lung Cancer

Global Trends

Lung cancer is the first commonly diagnosed cancer in the world (World Health Organization, 2018a). It is also the leading cause of cancer death in the world (World Health

Organization, 2018a). In 2018, it was estimated that more than 2.09 million cases and more than 1.7 million deaths were related to lung cancer (World Health Organization, 2018a). It was the leading cause of cancer death in males in 87 countries and in females in 26 countries (Islami et al., 2015). The incidence rate and mortality rate are highest in North America, Europe, and East Asia, and tend to be still relatively low in many African countries and some Asian countries (Cheng et al., 2016) (Table 1, Appendix A).

Trends in the United States

Incidence rate. Lung cancer is the second most-commonly diagnosed cancer in both males and females in the United States (American Cancer Society, 2019b). In 2018, it was estimated that more than 234,000 new cases (13% of total cancer incidence) and more than 1.5 million deaths (25% of total cancer mortality) in the U.S. were caused by lung cancer, which was more than those caused by breast, colorectal and prostate cancers (American Lung Association, 2019). In 2019, it was estimated that 228,150 people were newly diagnosed with lung cancer (13% of total cancer incidence) (American Cancer Society, 2019b). The incidence rate of lung cancer has declined since the middle 1980s in males, but it didn't decline in females until the early 2000s (Berlia, 2016), possibly due to the subsequent decline in smoking (Wingo et al., 1999). From 2005 to 2014, the incidence rates of lung cancer decreased by 2.5% per year in males and 1.2% per year in females (American Cancer Society, 2018). In 2019, the incidence rate of lung and bronchus cancer was 54.9 per 100,000 men and women per year (American Cancer Society, 2019b).

Mortality rate. Lung cancer is the leading cause of cancer death in both genders in the United States (American Cancer Society, 2018). It was estimated that 155,870 people died from lung cancer in 2017, which was 25% of total cancer deaths (American Cancer Society, 2017). The mortality rate of lung cancer has declined by 43% in males since 1990 and 17% in females since 2002 (Boloker et al., 2018). From 2010 to 2014, the mortality rates of lung cancer decreased by 3.5% per year in males and by 2.0% per year in females (American Cancer Society, 2017).

Trends in China

Incidence rate. Lung cancer is the most common cancer in China (Feng et al., 2019). It was reported that more than one third of all newly diagnosed lung cancer cases occurred in China (Chen et al., 2015). As the most populous country in the world, China has 19% of the world population (Chen et al., 2015). In 2012, about 21.75% of all newly diagnosed cancer cases in the world were contributed by Chinese population; and about 35.78% of newly diagnosed lung cancer cases worldwide occurred in China (Chen et al., 2015). From 2000 to 2014, it was reported that the incidence rates of lung cancer increased sharply in both males and females due to tobacco smoking, aging, air pollution and lifestyle change (Zhang et al., 2018). The incidence rate of lung cancer for men in 22 cancer registry areas in China were 56.98 per 100,000 in 2000 and 89.51 per 100,000 in 2014. For women in the same areas, the rates were 27.77 per 100,000 in 2000 and 51.31 per 100,000 in 2014 (Zhang et al., 2018). The incidence rates were consistently higher in men than in women over the 14-year period (Zhang et al., 2018). Among the Chinese patients diagnosed with lung cancer, approximately two thirds of them were diagnosed at a late stage, which made them lost the opportunity for radical surgery (Hong et al., 2015).

Mortality rate. Lung cancer is the leading cause of cancer death in China (Feng et al., 2019). In 2012, about 26.90% of deaths in the world were contributed by Chinese population; and 37.56% of lung cancer deaths worldwide were occurred in China (Chen et al., 2015). According to the statistical data from National Office on Tumor Cure and Prevention in China, it was estimated 600,000 people died from lung cancer every year in China (She, Yang, Hong, & Bai, 2013). Data from World Health Organization also showed that the annual mortality of lung cancer may reach 1 million by 2025 in China (She et al., 2013). In the past 30 years, the mortality rates of cervical, stomach, and esophageal cancers have steadily declined in China. However, a significant increase was noticed in the mortality rate of lifestyle-related cancers, such as lung, colon, and breast cancer in China (She et al., 2013). Especially notably, the mortality rate of lung cancer increased by 464.84% in the past 3 decades (She et al., 2013). Among patients with malignant tumors in China, lung cancer has replaced liver cancer as the number one cause of death (She et al., 2013). Patients diagnosed with lung cancer at a late stage usually die within one to two years (World Health Organization, 2018b). The estimated age-standardized mortality rate in 2008 for lung cancer was 28.7 per 100,000 population in China, which was significantly higher than the world average (19.4 per 100,000 population) (Hong et al., 2015).

Trends Among Chinese Americans

Incidence rate. Studies (Jemal et al., 2009) have shown that incidence rates of lung cancer among Asian Americans have been under-reported, the rates are disproportionately high compared with the general U.S. population (Underwood et al., 2012). From 1990 to 2010, the overall incidence rate of lung cancer decreased significantly among Chinese Americans (−1.4% per year among males and −1.0% per year among females, respectively) (Gomez et al., 2015). Among Chinese male Americans, the incidence rates of small cell (APC, −2.4; 95% CI, −3.8 to −0.9) and non-small cell lung cancer (APC, −1.6; 95% CI, −2.3 to −0.9) decreased statistically significantly, especially for the squamous cell (APC, −4.7; 95% CI, −5.8 to −3.7) and large cell carcinoma lung cancer sub-types (APC, −8.6; 95% CI, −10.5 to −6.6). Among females, statistically significant declines were observed for non-small cell lung cancer (APC, −0.8; 95% CI, −1.5 to −0.1), most notably the squamous cell carcinoma subtype (APC, −4.9; 95% CI, −6.5 to −3.1) (Gomez et al., 2015). In addition, a slightly higher proportion of female Chinese Americans relative to male Chinese Americans were diagnosed at local stage (14.7% vs. 13.6%, respectively), women also had a slightly higher rate of distant lung cancer compared with men (63.3% vs. 60.8%, respectively) (Gomez et al., 2016).

Mortality rate. Lung cancer is the leading cause of cancer deaths in Chinese Americans (Gomez et al., 2015). Chinese Americans have the highest mortality rates of lung cancer among all Asian American subgroups (Association of Community Cancer Centers, 2016). As the second and fourth most common cancer among U.S. Chinese men and women, respectively, lung cancer accounted for approximately 30% of all cancer-related deaths in Chinese Americans (Gomez et al., 2015). In trend analyses, the mortality rate of lung cancer was either stable or declining among Chinese American males. However, non-significant increasing trend of annual percentage change of lung cancer mortality rate was noticed among Chinese American females (Thompson et al., 2016).

Survival Rate of Lung Cancer

Patients with lung cancer have one of the lowest five-year survival rates (18.6%) compared to other types of cancer in the U.S., such as colorectal (64.5%), breast (89.6%) and prostate (98.2%) cancer. Only 16% of lung cancers are diagnosed at a localized stage, for which the five-year survival rate is 55% (McCarthy, 2014). As the diagnosed time prolongs, the five-year survival rate for lung cancer patients drops to 4% when lung cancer is diagnosed at a late stage (stage IV) (McCarthy, 2014). More than half of people with lung cancer die within one year of being diagnosed (McCarthy, 2014). The five-year survival rate for lung cancer is 15% for males and 21% for females (McCarthy, 2014). Among Chinese Americans, women had longer survival time compared with men (HR, 0.82; 95% CI, 0.75 to 0.89) (Gomez et al., 2016). The median survival time was 13.0 months (95% CI, 12.0 to 14.2 months) for Chinese American males and 18.7 months for Chinese American females (95% CI, 17.1 to 20.6 months) (Gomez et al., 2016). Among Chinese population, the 5-year survival rate of lung cancer in China was 16.1% (Cao & Chen, 2019). From 2012 to 2015, the lung cancer survival rate in Chinese men was 16.8% (Cao & Chen, 2019). It is 62.5% worse than in thyroid cancer, which has the highest survival rate (Cao & Chen, 2019). The lung cancer survival rate in Chinese women was 25.1% from 2012 to 2015, which was classified as low survival (Cao & Chen, 2019).

Prevention of Lung Cancer

Risk Factor of Lung Cancer and Primary Prevention

Tobacco use is the most important risk factor of lung cancer, which contributes to 80% of lung cancer death in the United States (American Cancer Society, 2019c). The duration of smoking, the number of cigarettes smoked, and exposure to second-hand smoke are positively associated with the risk of lung cancer (Xie, Croce, & Tian, 2014). With an increase amount of quantity and duration of cigarette smoking, the risk of lung cancer increases (Xie et al., 2014). Compared to the U.S. general population, the smoking rate among Chinese Americans was relatively high, ranging from 17.4% (Yu, Chen, Kim, & Abdulrahim, 2002) to 18% (Shelley et al., 2004) and, much higher in men (29% to 34%) than in women (2% to 4%) (Shelley et al., 2004; Yu et al., 2002), whereas the smoking rate was 15.1% in U.S. adults, 17.5% among U.S. men and 13.5% among U.S. women aged 18 years and older in the United States (Centers for Medicare & Medicaid Services, 2015a). Other risk factors of lung cancer include cigar and pipe smoking, exposure to radon gas, occupational or environmental exposure to secondhand smoke, asbestos, certain metals, some organic chemicals, radiation, air pollution, and diesel exhaust (American Cancer Society, 2019c). The primary approach to prevent lung cancer is smoking cessation, which has been proved effectively decreasing the incidence rates of lung cancer among males and females (American Cancer Society, 2019c).

Secondary Prevention

Lung cancer screening with low dose computed tomography is an effective secondary prevention method for lung cancer (Tota et al., 2014). Screening for individuals at high risk for lung cancer has the potential to improve lung cancer survival rates by finding the disease at an earlier stage when it is more likely to be curable. It was reported that about eight million Americans qualify as high risk for lung cancer and are recommended to receive annual screening with low dose computed tomography scans (Cheung, Katki, Chaturvedi, Jemal, & Berg, 2018). If half of these high-risk individuals were screened, over 12,000 lung cancer deaths could be prevented (Cheung et al., 2018). Lung cancer screening with low dose computed tomography has been proved to reduce the mortality rate of lung cancer by 20%, compared to the standard chest X-ray, among current or former smokers who had smoked at least 30 pack-year (smoked one pack of cigarettes per day for 30 years) or had quit smoking within the past 15 years (Tota et al., 2014; Wender et al., 2013). Since 2013, the United States Preventive Services Task Force and other organizations have issued guidelines for the early detection of lung cancer with yearly low dose computed tomography among high-risk population (Latimer & Mott, 2015). It was covered both by the private and public health insurances for the high-risk population (adults aged 55 to 74 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years) (Bindman, 2015).

History of Lung Cancer Screening Guidelines

In 1970, American Cancer Society issued a guideline to screen lung cancer. In the guideline, Chest X-ray with or without sputum cytology was recommended as an effective way to find lung cancer early (Wender et al., 2013). However, in 1980, American Cancer Society retracted this guideline, because limited evidence was found to support the Chest X-ray's efficiency to decrease lung cancer mortality rate (Wender et al., 2013). They decided that the remain high mortality rate of lung cancer as well as significant false positive and false negative results for lung cancer after Chest X-ray screening were not able to benefit the high-risk population (Wender et al., 2013). In 2002, the National Lung Screening Trial began to conduct an eight-year randomized clinical trial to test the efficacy of Chest X-Ray and low dose computed tomography on the outcome of decreasing the mortality rate of lung cancer (Aberle et al., 2013). This clinical trial was conducted with 53,454 participants who were at high risk for lung cancer (people who were aged 55-74 years old, had smoked at least one package of cigarettes every day for 30 years, and were current smokers or quit smoking in the past 15 years) (Aberle et al., 2013). The participants were required to receive three annual lung cancer screening with Chest X-Ray or low dose computed tomography. Results showed that the death rate of lung cancer among the participants who screened lung cancer by low dose computed tomography was 20% less than that among the participants who screened lung cancer by Chest X-Ray (Aberle et al., 2013).

Based on the National Lung Screening Trial results, in 2013, the United States Preventive Service Task Force began to recommend high risk population to receive annual low dose computed tomography to screen lung cancer (United States Preventative Services Task Force, 2015). In January 2015, the Affordable Care Act mandated private health insurance companies to cover lung cancer screening with low dose computed tomography for eligible high-risk U.S. population (people who were aged 55-74 years old, had smoked at least one package of cigarettes every day for 30 years, and were current smokers or quit smoking in the past 15 years) (Bindman, 2015). In February 2015, the Centers for Medicare and Medicaid Services began to cover low dose computed tomography lung cancer screening with the physicians' prescription and shared decision-making documents (Centers for Medicare & Medicaid Services, 2015b). After that, several other organizations, such as American Cancer Society, American College of Chest Physicians, American Society of Clinical Oncology, American Lung Association, and National Comprehensive Cancer Network started to support and recommend lung cancer screening with low dose computed tomography (Latimer & Mott, 2015).

Lung Cancer Screening Uptake Rates

Although the supportive landscape has changed, uptake rates of lung cancer screening with low dose computed tomography remain low after the United States Preventive Service Task Force guideline was published (Hoffman et al., 2015; Lewis et al., 2015). The percentage of eligible population who had received lung cancer screening with low dose computed tomography just increased from 3.3% in 2010 to 3.9% in 2015 among U.S. population (Jemal & Fedewa, 2017). Reports about the uptake rates of lung cancer screening among minority populations were lacking. Although the uptake rate of lung cancer screening with low dose computed tomography among Chinese Americans was not reported in the literature, a recent study showed 22% of the elderly Chinese men in Chicago met the eligibility criteria of the United States Preventive Service Task Force low dose computed tomography screening (Li, Matthews, & Dong, 2017). Compared to the adults aged 55 to 77 years in the U.S., the percentage was 13.2% in 2010 (Okereke et al., 2019). A higher percentage for elderly Chinese men in Chicago to meet the eligibility criteria of the United States Preventive Service Task Force low dose computed tomography screening may possibly relate to the high smoking rate among male Chinese Americans.

Health Beliefs of Lung Cancer Screening

Previous studies indicated that health beliefs about lung cancer screening were significantly associated with the uptake of lung cancer screening. Reports showed people who were significantly more likely to have a low dose computed tomography screening had several common health beliefs toward lung cancer screening (Cataldo, 2016). In a cross-sectional survey study among 338 older smokers (aged older than 55 years) with a smoking history more than 30 pack-year, the results showed the participants who were more likely to screening lung cancer would perceive a high risk for lung cancer, were not afraid of computed tomography scans, believed low dose computed tomography screening results were accurate and detecting lung cancer earlier would more likely improve lung cancer prognosis (Cataldo, 2016). Several other studies also indicated that cultural factors such as beliefs and attitudes about the lung cancer screening process or illness, knowledge, mistrust of the healthcare system, and fatalistic beliefs were related to high-risk population's participation in lung cancer screening programs (Carter-Harris, Brandzel et al., 2017; Carter-Harris, Ceppa, et al., 2017; Duong et al., 2017; Gressard et al., 2017; Tanner et al., 2013), especially among minorities (e.g., Blacks and Hispanics) (Jonnalagadda et al., 2012).

Although reports exploring Chinese Americans' lung cancer screening behavior and cultural beliefs were lacking, some cultural factors were found associated with other types of cancer screening behaviors among Chinese Americans. Literature showed that cultural traditions related to the lifecycle and disease prevention (e.g., Fatalism) appeared to be a significant barrier to the participation in breast cancer screening among Chinese Americans (Kwok & Sullivan, 2006).

Also, English language proficiency, health literacy, acculturation, the need for help with transportation, and physicians' recommendation were identified or perceived as important factors influencing cancer screening behaviors (e.g., breast cancer screening, cervical cancer screening, colorectal cancer screening and prostate cancer screening) among Chinese Americans (Li, Matthews, & Dong, 2018; Ma et al., 2012). Results from a quantitative survey study among 3,157 Chinese elderly in Chicago showed that higher health literacy (odds ratio range = 1.39-1.72) and acculturation (odds ratio range = 1.28-2.06) levels were associated with an increased likelihood of lifetime and current cancer screening among older Chinese Americans, including breast cancer, cervical cancer, prostate cancer, and colorectal cancer screening (Li, Matthews, & Dong, 2018). Consistently, results from another survey study among 815 Asian Americans showed that more acculturated Chinese Americans were more likely to screen colorectal cancer (Ma et al., 2012).

Existing Instrument Measuring Health Belief Toward Lung Cancer Screening

The Lung Cancer Screening Health Belief Scale was developed based on the Health Belief Model. It measures health beliefs toward lung cancer screening for the overall general U.S. population (Carter-Harris, Slaven, et al., 2017), not specifically for Chinese Americans. Also, the Lung Cancer Screening Health Belief Scale was English version instruments. It hasn't been culturally adapted for the minority or Chinese American population. It was developed through an extensive literature review, focus groups with long-term smokers, and feedback from a panel of 10 experts. The overall scale was validated by the survey among 497 long-term smokers. Its content validity was established with the expert panel. Its internal consistency reliability was established with Cronbach's alpha ranging from 0.88 to 0.92. Its construct validity was established with confirmatory factor analysis. The Initial testing showed the scale was valid and reliable (Carter-Harris, Slaven, et al., 2017).

Problem Statement

Gaps that Exist in the Literature

As an efficient method to decrease the mortality rate of lung cancer, lung cancer screening with low dose computed tomography should be utilized more frequently to benefit larger scope of high-risk population. Although health beliefs toward lung cancer screening may be associated with lung cancer screening behaviors among minority population (Jonnalagadda et al., 2012), and Chinese cultural beliefs (e.g., fatalism and perceived low health literacy as a barrier to screening lung cancer) may particularly explain a low uptake rate of lung cancer screening in Chinese Americans, no study has explored Chinese Americans' knowledge, beliefs, behaviors about receiving lung cancer screening with low dose computed tomography.

Using an efficient and effective instrument to evaluate high-risk Chinese Americans' health beliefs toward lung cancer screening can help to design tailored lung cancer screening programs to increase the uptake rate of lung cancer screening and potentially decrease the mortality rate of lung cancer among this population. Although a previous study (Carter-Harris, Slaven et al., 2017) provided an appropriate instrument to investigate health beliefs about lung cancer screening among U.S. population, scales that were developed for western cultures did not include constructs (e.g., fatalism, some culturally specific perceived barriers such as language barriers) which were fitted to the eastern culture (Thompson, 2009). The Lung Cancer Screening Health

Belief Scale was developed for the general U.S. population (Carter-Harris, Slaven, et al., 2017). Some cultural beliefs related to the Chinese Americans' cancer screening behaviors, e.g., fatalism, perceived language barriers, and perceived cues to action from physicians, were lacking in the original scales. When existing instruments have different content or constructs, development of new scales is necessary. However, if the content or constructs overlap but are slightly different, scale adaptation or refinement are appropriate (Van de Vijver & Leung, 1997). Existing studies of lung cancer screening showed that even though several differences were observed in minority versus non-minority participants' health beliefs about lung cancer and screening (Jonnalagadda et al., 2012), health belief constructs (e.g., barriers) overlap somewhat among minority versus non-minority populations (Carter-Harris, Brandzel et al., 2017; Carter-Harris, Ceppa, et al., 2017; Cataldo, 2016; Duong et al., 2017; Gressard et al., 2017; Tanner et al., 2013). Adapting and validating an existing instrument to be used in a different population is a cost efficient and time-saving choice (Chang & Chau, 1999; Li et al., 2001; de Paula Lima et al., 2005). This study aims to cross-culturally adapt the existed Lung Cancer Screening Health Belief Scale (Carter-Harris, Slaven, et al., 2017) to be used in Chinese Americans.

Study Purpose

The purposes of this study are to 1) adapt the existing Lung Cancer Screening Health Belief Scale to be culturally appropriately for use in Chinese American population; and 2) establish the content validity of the adapted Chinese version of Lung cancer Screening Health Belief Scale among Chinese Americans. The hypothesis related to the second aim of this study is: The total scale level content validity index (S-CVI/UA) exceeds 0.8.

Significance of the Study

Potential Contribution to Nursing Research

This study reported a reliable methodology for cross-culturally adapting an instrument to be used in another culture. It also provided an example for novice cross-cultural researchers to adapt an instrument to be used in another population with different language. This study will contribute to the growing literature focusing on the specific cultural beliefs and attitudes toward lung cancer screening among minority populations in the U.S. It provides a content valid instrument to investigate the health beliefs about lung cancer screening among Chinese Americans, and further potentially contribute to develop linguistically and culturally appropriate interventions to increase the uptake rates of lung cancer screening.

Potential Contribution to Nursing Practice and Health Care

This study provides a content valid tool to evaluate lung cancer screening health beliefs among Chinese Americans as well as provides potential evidence for health care providers who want to design and implement lung cancer screening programs to decrease lung cancer related morbidity and mortality among Chinese Americans. At the nursing practice level, this study will provide a vehicle for health care providers to understand factors that influence Chinese Americans' lung cancer screening uptake decisions and offer potential evidence for designing lung cancer screening programs to facilitate and increase the adherence of Chinese Americans' behaviors on lung cancer screening. At the health care system level, targeted promotion of lung cancer screening program would make significant contributions to the public health care system (World Health Organization, 2013), efficiently reduce both the incidence and mortality rates of lung cancer in Chinese American population (Baluja, Park, & Myers, 2003; Maxwell, Crespi, Alano, Sudan, & Bastani, 2012; Weiss, Garbanati, Tanjasiri, Xie, & Palmer, 2006).

Appendix A

Table 1. Incidence rates (per 100,000) of microscopically verified lung cancer by histological type[1]

	Males				Females			
Country or area of registry/ethnicity	SCC[2]	AC	LCC	SCLC	SCC	AC	LCC	SCLC
Australia	6.7	9.5	4.7	3.8	0.6	0.4	0.3	0.0
Canada	9.5	11.9	3.7	5.0	3.9	11.8	2.5	4.0
China	6.5	9.3	1.3	2.6	1.1	7.1	0.6	0.6
China, Beijing City	8.3	9.4	2.2	3.8	1.7	8.6	1.2	1.2
China, Cixian County	15.4	20.7	-	3.5	7.1	9.5	-	1.1
China, Hong Kong	9.9	19.1	1.5	4.5	1.3	12.6	0.5	0.6
Japan	9.1	14.9	1.8	4.3	1.0	8.7	0.3	0.7
Thailand	3.6	8.1	2.1	1.5	1.1	4.4	0.9	0.5
United States								
US, American Indian	8.9	7.9	1.9	4.8	4.6	7.6	1.2	4.9
US, Asian & Pacific Islander	4.3	10.3	1.5	2.3	1.3	8.4	0.8	0.9
US, Black	15.8	18.4	4.2	6.0	5.8	11.8	1.9	3.9
US, White	11.6	14.3	2.9	7.0	5.4	12.6	1.8	6.0
India	1.6	1.4	2.1	1.0	0.4	0.8	0.7	0.3

1. Data sources: Cancer Incidence in Five Continents Volume X (2003–2007) (Forman et al., 2014)

2. SCC, squamous cell carcinoma; AC, adenocarcinoma; LCC, large cell carcinoma; SCLC, small cell lung cancer

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Chapter 2: Literature Review

Lung cancer is the leading cause of cancer death among Chinese Americans (Jemal & Fedewa, 2017). With the utilization of lung cancer screening with low dose computed tomography, lung cancer can be detected at the early stage, and patients' 5-year survival rate can be increased significantly (McCarthy, 2014). However, utilization of lung cancer screening with low dose computed tomography is suboptimal among Chinese Americans (Li et al., 2017).

As the largest subgroup among Asian American population, Chinese American constitutes 25.9% of the Asian American population in the U.S. (U.S. Bureau of the Census, 2010). Due to the limited research has been done to investigate Chinese Americans' health beliefs toward lung cancer screening, this literature review included the studies focusing on the health beliefs toward lung cancer screening among Asians/Asian Americans. Originated from nearby countries and shared with multiple similar cultural elements, Asian Americans/Asians have lots of similar cultural and ethical perceptions regarding health, such as fatalism, collectivism, and Confucianism (Sin, Ha & Taylor, 2016). The purpose of this literature review was to 1) synthesize the current research state on the health beliefs of lung cancer and lung cancer screening with low dose computed tomography among Asians and Asian Americans, compare their health beliefs with those of U.S. general population, and provide possible evidence for cross-culturally adapting Lung Cancer Screening Health Belief Scale to be applied among Chinese Americans; and 2) discuss issues related to adapting and validating an existing instrument to be appropriately used for another culture.

Part 1: Literature Review of Health Beliefs about Lung Cancer Screening among Asians, Asian Americans, and General Populations in the U.S.

Literature Search Process

The literature search process included two phases. In the first phase, electronic database including PubMed, Google scholar, CINAHL®, and PsycINFO were searched. Key words were applied, including health belief, perception, attitude, perspective, knowledge, belief, conception, barrier, risk, benefit, self-efficacy, seriousness, severity, lung cancer screening, low dose computed tomography, low dose CT, LDCT, lung screening, lung cancer, preventive, Asian, Asian American. Both compound and singular forms of the key words were searched. After titles of the articles were checked, the abstracts of the filtered articles were read further to identify eligible articles. Inclusion and exclusion criteria were applied. Inclusion criteria included: (1) relevant to the health belief about lung cancer screening with low dose computed tomography; (2) targeted on Asians or Asian Americans; (3) peer-reviewed articles, and (4) published in English or Chinese language. Informal articles, such as comments, conference abstracts, letter to editors, were excluded. As limited studies have been done on this research topic, the publication year was not filtered in the search process. In the second phase, references from the included articles were inspected further to check any additional relevant publications which met the eligibility criteria. Results showed no review articles were included.

Furthermore, to compare Asians/Asian Americans' and general U.S. population's health beliefs toward lung cancer screening, research articles addressing general U.S. population's health beliefs of lung cancer screening were also searched. Key words regarding the health beliefs of lung cancer screening were mostly the same, except for the keywords about the population which were entered as: U.S. population, U.S., United States, Americans, or left it out. The rest literature selection processes were the same.

For each included article, information on the study's purpose, setting, sample, methods, results, and discussion was extracted and synthesized further. The literature review procedure's rigor and each included article's quality were checked by the Whittemore and Knafl's approach (Moher, Liberati, Tetzlaff, & Altman, 2009).

Synthesis of Current Evidence

To date, limited studies have been done on this research topic, especially among Asians/Asian Americans. Through the literature search process, seven studies were found to be relevant to the health belief of lung cancer screening with low dose computed tomography among Asians and Asian Americans.

Study Characteristics

Among the seven studies addressed the health beliefs of lung cancer screening among Asians/Asian American, two were qualitative (Scott et al., 2014; Sin, Ha, & Taylor, 2016), and five were quantitative descriptive studies (Al-Naggar et al., 2013; Nhung et al., 2015; Bui et al., 2018; Lu et al., 2018; Ren et al., 2014). One study was conducted in Australia with mixed minority populations (Scott et al., 2014); one was conducted in Malaysia with Malaysian (Al-Naggar et al., 2013); another one was conducted in the U.S. with Korean Americans (Sin, Ha, & Taylor, 2016); two were conducted in Korea with Korean men (Nhung et al., 2015; Bui et al., 2018); and the rest two were conducted in China with Chinese (Lu et al., 2018; Ren et al., 2014). The sample size ranged from 24 to 1730. The publication year was from 2013 to 2018. Six articles were published in English language (Al-Naggar et al., 2013; Nhung et al., 2015; Bui et al., 2018; Lu et al., 2018; Scott et al., 2014; Sin, Ha, & Taylor, 2016) and one was in Chinese language (Ren et al., 2014).

Descriptive and multivariate analysis were commonly used in the five quantitative studies (Al-Naggar et al., 2013; Nhung et al., 2015; Bui et al., 2018; Lu et al., 2018; Ren et al., 2014). One study used the Health Belief Model (Lu et al., 2018), another one used the Health Behavior Framework (Sin, Ha, & Taylor, 2016), the other five studies did not mention any theoretical framework in their study report. Of the two qualitative studies, one used the written record transcription, key quotes translation and systematic thematic coding methods (Scott et al., 2014). The other used the verbatim transcription followed by the translation and content analysis (Sin, Ha, & Taylor, 2016) (Appendix A, Table 1).

Description of the Studies

The first study was a cross-sectional survey study conducted with secondary school male teachers in Kudat, Sabah, Malaysia, where 10% of the population was ethnic Chinese (Al-Naggar et al., 2013). The study aimed to determine knowledge about lung cancer among this population. No theory was mentioned in the study report. As English was the main language spoken in this area, data were collected by self-administrated English language questionnaire. A randomized sampling method was used and 150 secondary male teachers from three secondary schools (50 participants each) participated in the study. The participants' age ranged from 23 to 50 years old, with a mean age of 35.6 years old. Fifty two percent of the participants were Malay, and 79% of them married. No information was provided on the percentage of Chinese included in the study, and no descriptive data was included in the article to indicate the participants' smoking history and current smoking status. Independent variables included socio-demographic variables. The dependent variable was general knowledge of lung cancer. Data were analyzed using ANOVA and t-test for univariate analysis and multiple linear regression for multivariate analysis.

The second study was a secondary data analysis study conducted in Korea (Bui et al., 2018). The study aimed to examine Korean males' intentions to screen lung cancer with low dose computed tomography and to determine factors correlated with their lung cancer screening intentions. Data were obtained from the 2015 Korean National Cancer Screening Survey by using a stratified multistage random sampling method which was based on the resident registration population's geographic area, age, and sex. Totally, 1,730 male participants who were aged between 40 and 74 years old were included in the study. The survey data were collected through face-to-face interviews. Among the participants, 58.7% were aged 40 to 54 years old; 92.6% were married; 58.1% had six to 12 years education; and 99.1% had private health insurance. Of the 1,730 participants, 65.2% were current smokers and 16.8% were former smokers. Total smoking years in former and current smokers ranged from 31.9 to 42.8 pack-year. Data were analyzed using descriptive statistics and univariate logistic regression methods.

The third study was a quantitative survey study conducted by Lu et al. (2018) in Hefei, China. The purpose of the study was to explore the relationship between demands for lung cancer screening and the constructs derived from the Health Belief Model (HBM). Independent variables in the study included socio-demographic variables and five construct indexes derived from the HBM, which were perceived risk to cancer, perceived severity of the condition, perceived effectiveness of cancer screening, perceived benefits of cancer screening, and perceived difficulties to taking cancer screening. The dependent variable was demand index for lung cancer screening which was used to measure participants' intention to taking lung cancer screening. The demand index for lung cancer screening was measured by six items including times of past lung cancer screening, willingness to undertake lung cancer screening, preferred frequency of the screening and willingness to pay for the screening. A total of 823 participants from eight communities in Hefei, China completed the face-to-face Chinese language household survey. The participants were aged from 40 to 69 years old. No information was provided on the participants' smoking and cancer history as well as current smoking status. Most of them were female (55.7%) and had less than 10 years of education (75.9%). Almost all the participants (95%) had one or more types of health insurance. Data were analyzed using descriptive and multivariate regression analysis.

The fourth study was a survey study conducted in Korea (Nhung et al., 2015). The purpose of the study was to assess Korean males' intentions to receive lung cancer screening before and after being informed about exposure to radiation during the screen and to identify factors influencing their intentions. Participants who received any cancer screening test within the last two years were randomly selected from the 2013 Korean National Cancer Screening Survey. The survey data were collected through face-to-face interviews. Of the 414 male participants, 50% were current smokers; 10.6% reported having received lung cancer screening within the past 2 years; 94.2% were married; and 59.7% had a high school graduate education level. Most of the participants (37.9%) aged between 50 and 59 years old with a total age ranging from 40 to 74 years old. Data were analyzed by STATA software using Chi square, Fisher's exact test, unconditional univariate, and multivariate logistic regression.

The fifth study was a survey study conducted among 1,633 Chinese in China and published in Chinese language (Ren et al., 2014). The aim of the study was to investigate the awareness level of lung cancer prevention and control, and to identify the association between individual characteristics and lung cancer awareness. A cluster sampling method was used to choose random clusters of samples from the participants who worked at the Tianjin Dagang Oil Field. A total of 1,807 participants were reached, and 1,633 participants completed the questionnaires. All the respondents previously completed low dose computed tomography lung cancer screening. Mean age of the respondents was 60.08 years old; 82.2% of the participants were males; and 41.2% participants had an education level equal to middle school. While 71.4% participants had a smoking history that was more than 30 pack-year, over 80% participants had alcohol drinking history, and 19.5% participants had a family history of cancer. Independent variables included demographic variables, smoking history (pack-year), and prior tuberculosis history. Dependent variables were lung cancer awareness and health examination willingness. Data were analyzed using descriptive and multiple logistic regression analysis methods.

The sixth study was a qualitative study conducted by Scott et al. (2014). Seven focus groups (N = 51) were conducted to explore knowledge, attitudes, and beliefs about lung cancer among Chinese, Vietnamese and Arabic-speaking communities in Sydney, New South Wales. The study was conducted in four languages (Cantonese, Mandarin, Vietnamese, and Arabic) with 13 females and 38 males aged between 44 to 65 years old (smokers and non-smokers). Among the seven focus groups, three groups consisted of non-smokers (Cantonese, Vietnamese, and Arabic-speaking groups) and four groups were current smokers (Cantonese, Mandarin, Vietnamese, and Arabic-speaking groups). In Mandarin, Cantonese, and Vietnamese-speaking focus groups, all the current smokers were male. The other four groups included a mixture of males and females (Cantonese, Vietnamese and Arabic-speaking smoker groups and non-smoker group) in each group, with the number of males versus females ranged from three to five. Each focus group discussion took up to 90 minutes. A discussion guide including information on demographic, stereotypical lung cancer patient, knowledge of lung cancer (susceptibility and signs/symptoms awareness), perceptions and knowledge of lung cancer diagnosis and treatment, and lung cancer information sources was developed for guiding the group discussion. Translated summaries were analyzed using Strauss and Corbin's systematic approach, which incorporated thematic analysis and initial theoretically sensitive coding, axial coding, and secondary coding together (Scott et al., 2014).

The last study was a qualitative study which aimed to explore facilitators of and barriers to lung cancer screening with 24 Korean immigrant men in the U.S. (Sin, Ha, & Taylor, 2016). A convenience sample of Korean men was recruited from Korean churches, senior centers, and the Korean Women's Association in Washington State. Inclusion criteria for the participants were: Korean immigrants, be able to speak Korean, aged 55–79 years old, had a 30 pack-year smoking history, and were current smokers or former smokers who had stopped smoking within the past 15 years. While men with a history of low dose computed tomography were included, men with a history of lung cancer were excluded. Most of the participants were married (88%), retired (50%), and had a more than high school education (63%). The average age of participants were 69 years old (ranged 55 to 79 years old), and the average age when they moved to the U.S. was 40 years old. Because the participants lived in diverse geographic areas, therefore, five focus groups (that included two to five men) and nine individual interviews were conducted depending on the available number of participants in each area. The focus group discussions lasted 30-45 min, and individual interviews lasted 25–30 min. The study was conducted in Korean and guided by the Health Behavior Framework which described the context within which a desired behavior occurred. The Health Behavior Framework domains include individual factors (knowledge, past health behaviors, communication with providers, facilitators and barriers, and social norms and support), provider and health care factors, and health insurance coverage (Sin, Ha, & Taylor, 2016). Data were transcribed verbatim in Korean, translated into English, and analyzed by content analysis method.

Regarding the health beliefs of lung cancer screening among general U.S. population, 31 eligible articles were included in this literature review. Of the 31 studies, 17 studies were quantitative survey study, 11 were qualitative interview study, one was intervention study, and two were mix-method studies. The sample size ranged from 18 to 5586. The data analysis methods most frequently used were logistic regression for quantitative studies and thematic content analysis for qualitative studies. Five of the 31 studies were guided by conceptual models (Carter-Harris, Ceppa et al., 2017; Gressard et al., 2017; Jonnalagadda et al., 2012; McDonnell et al., 2019; Park et al., 2014). The models most frequently used were Self-regulation Theory (Jonnalagadda et al., 2012; Park et al., 2014) and Health Belief Model (Carter-Harris, Ceppa et al., 2017; Park et al., 2014).

Based on the Health Belief Model, findings from the literature search were categorized as perceived severity, perceived risks, perceived benefits, perceived barriers, self-efficacy, and cues to action. This taxonomy was partially consistent with the categories utilized by the Lung Cancer Screening Health Belief Scales, which included four constructs (perceived risks, perceived benefits, perceived barriers, and self-efficacy) deriving from the Health Belief Model. Within each category, further information was addressed by subcategories.

Perceived Severity

Perceived severity is the personal evaluation of the seriousness of the consequences related to a disease, which refers to individuals' perception on whether the disease will have serious effects on their lives if they contract it (Glanz et al., 2008). In this literature review, perceived severity refers to high-risk smokers' (55–74 years of age, current smokers or quit smoking within the past 15 years, and with a smoking history of 30 pack-year or more) evaluations of the impact of lung cancer on their future lives.

Perceived severity of lung cancer can be evaluated by the perceived survival rate and survival time. In the focus group study conducted by Scott et al. (2014), although participants had some awareness of the importance of early diagnosis of cancer, all groups thought the survival rate would be very low for people with lung cancer. While Arabic-speaking smokers believed that the survival time for people with lung cancer would be no more than six months after diagnosis (Scott et al., 2014), Cantonese and Vietnamese smokers thought people would not survive more than five years (Scott et al., 2014), and Mandarin-speaking smokers reported that a person with lung cancer would die three years after diagnosis (Scott et al., 2014). However, in the secondary data analysis study conducted by Bui et al. (2018) with 1730 Korean males, only 78.3% of the participants agreed lung cancer can lead to death and 65.7% agreed the five-year survival rate of lung cancer was low.

In addition, fatalistic views towards lung cancer appeared to influence the perceived severity of lung cancer among Asian population. According to Scott et al. (2014), Arabic-speaking smokers felt that cancer was a greater concern compared with other illnesses, as participants believed cancer could not be managed and cured, whereas other diseases could be. Although participants in the Chinese and Vietnamese groups in the study felt that the prognosis was more promising with early diagnosis than late diagnosis, some participants in the Cantonese non-smoking group thought it was not possible to be diagnosed at the early stages of lung cancer, and all the groups could not recall any cases showing lung cancer treatment was successful (Scott et al., 2014).

Health beliefs about the perceived severity of lung cancer among Asians/Asian American population were similar with those among U.S. population. According to a qualitative study conducted by Park et al. (2014) among 35 U.S. participants (mean age = 61 years old; 50% were male, and 50% were current smokers), almost all participants perceived that lung cancer and smoking-related diseases were very severe. Of the 35 participants, 91.4% were White/non-Hispanic, 5.7% were Black/African American, and 2.9% were Hispanic or Latino. The participants described lung cancer was essentially a "death sentence," if it was not discovered early on.

Relationship between lung cancer screening behavior and the health belief of perceived severity of lung cancer were found different in studies conducted in the U.S and China. According to Cater-Harris, Slaven et al. (2017), who developed the Lung Cancer Screening Health Belief Scales, decided not to include the construct of perceived severity in the Lung Cancer Screening Health Belief Scales. They thought perceived severity was not useful in explaining cancer screening behavior as they drew a conclusion from the literature that cancer was universally perceived to be severe (Aiken et al., 1994; Champion & Scott, 1997; Holm et al., 1999). However, studies with Chinese (Lu et al., 2018) found that among the variables in the Health Belief Model, the perceived severity of lung cancer was statistically significant with demands for lung cancer screening ($p < .05$), which meant Chinese who had a higher level of perceived severity of lung cancer were more likely to receive lung cancer screening.

The differences between these studies may be caused by the different contexts of the studies. Lu et al. (2018) conducted their survey study recently, while Aiken et al. (1994), Champion and Scott (1997), and Holm et al. (1999) conducted their studies two decades ago. Lu et al. (2018) did their study with Chinese population, while Champion and Scott (1997) conducted their study among 329 African American women; Holm et al. (1999) conducted their survey among 25 African Americans and 72 white women; and Aiken et al. (1994) conducted their survey among 615 predominantly middle-class White women. With the development of health care system as well as the preventive care programs around the world, people's knowledge about cancers may change, and their perceptions about the severity of lung cancer may change accordingly. In terms of the changed context, it may be necessary to examine the construct of perceived severity of lung cancer in the Lung Cancer Screening Health Belief Scales, and the relationship between receiving lung cancer screening and the health belief of perceived severity of lung cancer may need further exploration.

Perceived Susceptibility

Perceived susceptibility is individuals' subjective beliefs on the risk of getting a disease (Glanz et al., 2008). It refers to how strongly people believe that they are susceptible to the disease (Glanz et al., 2008). In this literature review, perceived susceptibility refers to high-risk smokers' perception on their possibility to get lung cancer.

Although smoking was the most discussed risk factor which increased the smokers' possibility to get lung cancer, the susceptibility of lung cancer was not clearly understood by the minority smokers. In Scott et al. (2014)'s qualitative focus group study, prevalent misconceptions reported by the participants included "smokers did not definitely have higher susceptibility to develop lung cancer". Further, perceptions towards smoking and lung cancer were mixed in the study. While some smokers felt they had no greater susceptibility of lung cancer than ex-smokers or non-smokers, some smokers felt their healthy lifestyle choices enabled their bodies immune to the smoking-related diseases (Scott et al., 2014). Smokers in the Arabic-speaking smoker group in Scott and colleagues' (2014) study denied that they were at high possibility of developing lung cancer or any kind of cancer in general; they also denied that smoking would increase their possibility of getting lung cancer. Prevalently, ex-smokers in the non-smoker groups saw themselves as not susceptible to lung cancer, particularly the Cantonese-speaking non-smoker and

Vietnamese-speaking non-smoker groups (Scott et al., 2014). Additionally, interestingly, water pipe smokers felt they had a lower possibility of getting lung cancer than those who smoked cigarettes whereas cigarette smokers felt they had a lower possibility of getting lung cancer than those who smoked water pipe (Scott et al., 2014). Consistently, in the study conducted by Bui et al. (2018) with 1,730 Korean males (65.2% were current smokers and 16.8% were former smokers), only 25.9% of the participants agreed they had a chance of getting lung cancer in their lifetime; 24% agreed it was possible for them to get lung cancer compared to similar age group; and 20.3% agreed they were often worried about getting lung cancer.

Asians/Asian Americans' perceived susceptibility of lung cancer may be directly associate with their intentions to undergo lung cancer screening. In the study conducted by Lu et al. (2018), participants' perceived susceptibility of lung cancer was statistically positively associated with their demands for lung cancer screening ($p < .05$) (Lu et al., 2018), which meant that the participants who had a higher level of perceived susceptibility of lung cancer were more likely to receive lung cancer screening. Also, according to Bui et al. (2018), Korean men who had higher perceived susceptibility scores for lung cancer reported a higher level of intentions to undergo lung cancer screening.

Furthermore, Asians/Asian Americans' perceived susceptibility of lung cancer screening may be associated with their current smoking status. Although there is no evidence about the association between Asians/Asian Americans' perceived susceptibility of lung cancer screening and the current smoking status, evidence about the relationship between perceived susceptibility of lung cancer screening and current smoking status has been found among U.S. population. In a qualitative telephone interview study conducted with 35 high-risk U.S. smokers, the results showed that participants' levels of perceived susceptibility were mostly attributed to their current smoking status (Park et al., 2014). Compared to those with similar smoking history, most current smokers described equal or higher susceptibility of developing lung cancer and smoking-related diseases, and former smokers reported lower comparative susceptibility for lung cancer and smoking-related diseases (Park et al., 2014). Although both current and former smokers perceived lung cancer and smoking-related diseases were severe, former smokers perceived having a greatly lessened susceptibility to lung cancer by quitting smoking despite their heavy smoking histories (Park et al., 2014).

For the U.S. population, findings about their perceived levels of susceptibility of lung cancer are inconsistent. A cross-sectional national online survey conducted in the U.S. with 338 older smokers indicated that over 82% of the participants believed that a person who continued to smoke after 40 years old would have a 25-100% chance of developing lung cancer (Cataldo, 2016). Results from another descriptive study with 55 female heavy smokers (at least 15 pack-year smoking history) in the U.S. also showed that all the participants recognized their elevated lung cancer risk (Schnoll et al., 2002). However, contrary to the findings in the studies conducted by Cataldo (2016) and Schnoll et al. (2002), results from the study conducted by Carter-Harris and Ceppa et al. (2017) as well as Patel et al. (2012) indicated that the perceived levels of susceptibility of lung cancer were low among U.S. population. The qualitative study conducted by Carter-Harris and Ceppa et al. (2017) among 26 U.S. long-term smokers showed that the participants' awareness of their long-term smoking-associated lung cancer susceptibility was suboptimal (Carter-Harris, Ceppa et al., 2017). When asked about the causes of lung cancer, most participants focused primarily on environmental and occupational exposures, emphasizing tobacco smoking less as a cause of lung cancer. Similar findings were also reported in the qualitative study of Patel et al.

(2012), 40% of 60 ex-smokers (n = 24) who denied participating in a lung cancer screening trial perceived themselves as having low susceptibility to lung cancer.

The participants' perceived susceptibility of lung cancer in these studies may be related to the participants' willingness of lung cancer screening participation. In the studies conducted by Schnoll et al. (2002), the participants who recognized their elevated lung cancer susceptibility were the people who already attended the lung cancer screening program (Schnoll et al., 2002). Also, in the study conducted by Cataldo (2016) among 338 older smokers (aged older than 55 years old) with a smoking history larger than 30 pack-year, most of the participants (82%) recognized the elevated lung cancer risk among smokers and most of them (77.2%) agreed to have a lung cancer screening on the survey day. However, in the study conducted by Patel et al. (2012) among 24 U.S. participants, the participants had a low susceptibility to lung cancer, and they denied lung cancer screening. Similarly, the participants in the study conducted by Carter-Harris and Ceppa et al. (2017) perceived their susceptibility of lung cancer was low. They described the lung cancer screening as a scam, and they distrusted the results of lung cancer screening, which were identified by them as the reasons for the denial to screening lung cancer (Carter-Harris, Ceppa et al., 2017).

Perceived Benefits

Perceived benefit is people's assessment about the value of taking the advised action to reduce risks or seriousness of diseases (Glanz et al., 2008). In this study, it refers to eligible individuals' perceptions on the beneficial outcomes of screening lung cancer with low dose computed tomography, such as early-stage diagnosis of lung cancer.

Asians/Asian Americans' perceived benefits of lung cancer screening may positively relate to their intention to undergo lung cancer screening. A survey study conducted among 1,633 high-risk Chinese smokers showed that only 49.6% of the participants would like to take lung cancer screening. One of the three important reasons mentioned by 63% of the participants was lacking awareness of the benefits of lung cancer screening (Ren et al., 2014). In the study conducted by Lu et al. (2018) among 823 Chinese, a linear regression modeling revealed a significant association between the average score of the subscale measuring the perceived benefits of lung cancer screening and the average score of the intention to undergo lung cancer screening ($p < .05$). Results showed the participants who had a higher level of perceived benefits of lung cancer screening reported a stronger intention to undergo lung cancer screening. According to Bui et al. (2018), a positive relationship between the perceived benefits of lung cancer screening and the intention to undergo lung cancer screening was also found among Korean males.

No relationship was found between perceived benefits of lung cancer screening and smoking history among Asian Americans. In the study conducted by Bui et al. (2018) among 1,730 Korean males, the results showed participants' smoking history was not associated with the perceived benefits of lung cancer screening. Although a higher percentage of the high-risk participants (current smokers and ex-smokers who quit smoking in the past 15 years, aged 55 to 74 years with a smoking-history of 30 pack-years or more) than average-risk group (men aged 40-74 years not in the high-risk group) agreed that low dose computed tomography could be helpful in detecting and treating lung cancer, the result was not significant (67.5%, 65.1%, respectively, $p>0.05$).

Similar with the findings found among Asian Americans (Bui et al., 2018; Lu et al., 2018), a positive relationship between the perceived benefits of lung cancer screening and the intention to undertake lung cancer screening was found among U.S. population. According to a study conducted by Carter-Harris and Slaven et al. (2017), the scores of perceived benefits of lung cancer screening were significantly higher among screeners than non-screeners (18.07, 16.68, respectively; p=.0016). However, differently with the findings found in Asian Americans (Bui et al., 2018), findings in the U.S. population showed a negative relationship existed between participants' smoking history and the perceived benefits of lung cancer screening among U.S. population. In the study conducted by Silvestri et al. (2007) among 2,001 U.S. participants, the results showed current smokers were less likely than never smokers to believe that early detection would result in a good chance of survival ($p < 0.05$).

Shared similar perspectives as those for Asians/Asian Americans (Scott et al., 2014), the perceived benefits of lung cancer screening among U.S. population were mostly the same, which included finding lung cancer early, giving peace of mind, motivation to quit smoking, and absence of lung cancer concerns (Carter-Harris, Ceppa et al., 2017; Roth et al., 2018; Simmons et al., 2017). According to a qualitative focus group interview study conducted by Simmons et al. (2017) among 38 U.S. high-risk community members, one major reason to undergo lung cancer screening provided by the participants was early-detection benefit. Furthermore, the results from Young et al. (2018)'s study conducted among 31 U.S. long-term smokers aged 51 to 74 also showed a positive result of lung cancer screening may work as a wake-up call causing changes in perceived susceptibility of smoking-related diseases and arousing a feeling that now is the time to stop smoking.

Misconceptions of the perceived benefits of lung cancer screening were prevalent among U.S. population although no report could be found among Asians/Asian Americans on this topic. The misconceptions of perceived benefits of lung cancer screening among U.S. population included: one is too old to benefit from lung cancer screening (Patel et al., 2012), or everyone who participates in screening will benefit (Zeliadt eat all., 2015). Some other misconceptions of the perceived benefits of lung cancer screening among U.S. population included the belief that the routine lung cancer screening and any additional imaging protect them from getting lung cancer, and a belief in some individuals that a negative screening test result indicated that they were among the lucky ones who would avoid the harms of smoking (Zeliadt eat all., 2015).

Perceived Barriers

Perceived barrier is people's belief about the negatively valued aspects of taking the action, which is the obstacle to the behavior change (Glanz et al., 2008). Perceived barriers to health behaviors include perceived internal barriers such as physical barriers, psychological barriers, personal characteristics, and perceived external barriers such as accessibility factors, cost, and inconveniences (Agha, Karlyn, & Meekers, 2001; Rosenstock, Strecher, & Becker, 1988). In this literature review, perceived barriers refer to high-risk smokers' perception on the possible blocks or hindrances to get lung cancer screening.

High-risk Asians/Asian American smokers' perceived barriers toward lung cancer screening may be associated with their intention to screening lung cancer. In the study conducted by Lu et al. (2018) among 823 Chinese participants, the perceived barrier of lung cancer screening was significantly associated with the demand for lung cancer screening ($p < 0.05$) (Lu et al., 2018). It suggested that the perceived barriers of lung cancer screening had important impacts on the participants' demand for lung cancer screening.

Among Asians/Asian Americans, the common perceived barriers to screening lung cancer included lack of knowledge, costs of health care in the U.S., lack of time, attitudes about prevention, and lack of physicians' recommendation (Ren et al., 2014; Sin et al., 2016).

Lack of knowledge about lung cancer and lung cancer screening was a prevalent barrier for Asians/Asian Americans to screening lung cancer. In a qualitative study conducted by Sin et al.

(2016) among 24 Korean immigrant men in the U.S., one significant barrier to screening lung cancer particularly for the participants was lack of knowledge about lung cancer and lung cancer screening. Results showed most of the participants had never heard about lung cancer screening with low dose computed tomography, which was a primary reason for them not getting lung cancer screening (Sin et al., 2016). Similarly, results from Ren et al. (2014)'s study showed that the awareness rate of low dose computed tomography was lower than 61.7% among the 1,807 Tianjin Dagang Oil Field workers. Three reasons were identified for the low-level awareness rate among this population: participants' unawareness of the benefits of screening for lung cancer (63%), the burden from lung cancer (66.5%), and participants' unwillingness to screen when they were asymptomatic (56.1%) (Ren et al., 2014). The low-level awareness of lung cancer and lung cancer screening was associated with the willingness to screening lung cancer (P=0.002, OR=2.06, CI=1.304-3.253) (Ren et al., 2014). A low-level awareness of lung cancer and lung cancer screening predicted a low level of willingness to screening lung cancer (Ren et al., 2014).

Another prevalent barrier for Asians/Asian Americans to screening lung cancer was the high cost of U.S. health care. In the study conducted by Sin et al. (2016), the participants reported the high cost of U.S. health care is a barrier for them to screening lung cancer because most of them had low income or didn't have health insurance. Furthermore, participants also reported that they had very little time to receive lung cancer screening because they were self-employed and receiving preventive health services when they did not have symptoms was not a priority for them. Many of the participants believed preventive health check-ups were unnecessary in the absence of physical symptoms. Also, most participants reported never receiving recommendations of low dose computed tomography from their health care providers hindered their motivation to screening lung cancer as well (Sin et al., 2016).

As a minority population, Asian Americans' perceptions toward the barriers of lung cancer screening may be different than those of non-minority populations (Jonnalagadda et al., 2012). In a survey study conducted among 335 high-risk U.S. smokers (21% were black, 20% were Hispanic, and 59% were nonminority), the results showed that several differences were observed in minority versus non-minority participants' beliefs toward lung cancer screening; The concerns about cost, as well as fatalism and radiation exposure fears may be particularly prominent to hinder the utilization of lung cancer screening among black and Hispanic participants (Jonnalagadda et al., 2012). Data also showed that the fatalistic beliefs and fears related to the screening test were more common among minority subjects and were independently associated with decreased intention to undergo screening (Jonnalagadda et al., 2012). As a subgroup of minority population, fatalistic beliefs, radiation exposure fears, and concerns about cost (Lillie et al., 2017) also reported to be prominent among Asian Americans which may hinder their motivation to screening lung cancer as well.

Although differences on the perceived barriers of lung cancer screening may exist between Asians/Asian Americans and U.S. population (Jonnalagadda et al., 2012), reports regarding the perceived barriers of lung cancer screening among Asians/Asian Americans are limited. Compared to the Asians/Asian Americans, the perceived barriers toward lung cancer screening were reported more frequently among U.S. high risk population, which significantly influenced their lung cancer screening behaviors (screeners vs. non-screeners=33.05 vs. 35.03; $p=.0387$) (Cater-Harris Slaven et al.,2017). The perceived barriers to screening lung cancer among U.S. population included lack of knowledge, practical barriers, financial barriers, psychological barriers (worry and anxiety, blame and stigma, fear of cancer, and fatalism), confusion around lung cancer screening, and distrust of medical system. Although lack of knowledge, practical barriers and financial barriers have been reported in previous studies related to lung cancer screening among Asian Americans, the psychological barriers, confusion around lung cancer screening and distrust of medical system have not been studied or reported in lung cancer screening research among Asian Americans. Also, some perceived barriers such as patient and healthcare provider relationship on the uptake of lung cancer screening haven't been studied yet.

Lack of knowledge. High-risk U.S. smokers seem to know little about lung cancer screening (Gressard et al., 2017), which may be a barrier to screening lung cancer among U.S. population. In a focus group qualitative study (Gressard et al., 2017) among 105 high-risk smokers, lack of knowledge about screening was reported as a perceived individual-level barrier to screening lung cancer by the participants. Similarly, in another quantitative study conducted among 185 smokers (Raz et al., 2019), 50.8% of the participants reported lacking knowledge about the lung cancer screening was a common barrier for them to screening lung cancer (Raz et al., 2019).

High-risk U.S. smokers' lacking knowledge of lung cancer screening may be related to the little information about screening they received. According to Wiener et al. (2018), most of the participants reported receiving little information about screening or its trade-offs and did not realize the computed tomography was intended as a screening test for lung cancer. Some participants reported receiving minimal information ("My PCP wasn't really all that communicative") and were not even told the implication for the computed tomography (Wiener et al., 2018).

Practical barriers. The perceived practical barriers to screening lung cancer among U.S. population included inconvenience of traveling to hospitals for screening investigation, time constraints and scheduling conflicts (Carter-Harris, Ceppa et al., 2017; Patel et al., 2012). In a qualitative study which aimed to explore the reasons why some people decided to or not to take part in the lung cancer screening trail (Patel et al., 2012), the participants who declined participation reported that the need to travel to study centers for computed tomography scans was an important factor for them to opt out participation. About 50% of the respondents said the possibility of travel was their most significant reason to decline; several of the respondents said they would join the trial if any possible tests could be performed at their local hospitals (Patel et al., 2012). Similarly, in another qualitative study to explore the reasons why some people opt out of lung cancer screening (Carter-Harris, Brandzel et al., 2017), one of the five primary themes emerged from the discussion among 18 high-risk smokers was practical barriers. The participants reported that they chose to opt out of lung cancer screening because of the inconvenience associated with the screening location and time it would take to travel to and from the facility to have the scan (Carter-Harris, Brandzel et al., 2017).

Financial barriers. The financial barriers related to the cost of lung cancer screening may hinder high-risk population's motivation to screening lung cancer. According to Raz et al. (2019), 35.2% of the 185 participants reported the cost of the screening was a common barrier for them to get screened. In a qualitative study among 38 high-risk community members, one of the major perceived barriers to screening lung cancer was also the financial costs (Simmons et al., 2017).

As a source of financial aid, insurance coverage for lung cancer screening was essential which may evolve in high-risk population's decision-making process of screening for lung cancer, especially for those who were on limited and fixed incomes (Delmerico et al., 2014). The insufficient authorization of health insurance reimbursement by insurance companies may hinder the utilization of lung cancer screening (McDonnell et al., 2019). Results from a quantitative survey study (Wildstein et al., 2011) showed that the adherence to the annual lung cancer screening follow-up was lower for the self-pay cohort than the no-pay cohort (62%, 88%, respectively). Lacking a health insurance coverage for lung cancer screening was likely to be a main barrier for the high-risk populations who were not willing to get screened (Delmerico et al., 2014). In the study, 33% of current smokers and 25% of former smokers reported that lack of insurance coverage was a reason why they were not willing to get screened (Delmerico et al., 2014).

Psychological barriers. The perceived psychological barriers such as fatalistic beliefs, fear of radiation exposure, and worry related to computed tomography scans were significantly associated with high risk U.S. population's intention to screening lung cancer ($p<0.05$) (Jonnalagadda et al., 2012). The psychological barriers to screening lung cancer among U.S. population included worry, blame and stigma, fear of cancer, and fatalism.

Worry. A common psychological barrier for the high-risk U.S. smokers to screening lung cancer is worry. Results showed that worry was one of the four typological perceptions perceived by the participants from a qualitative study conducted among 60 respondents who declined lung cancer screening (Patel et al., 2012). A survey study showed that although more than 80% of the participants agreed lung cancer screening could give peace of mind and decrease worry for both patients and families, however, among the 185 current smokers, 49.4% of the participants ($n = 91$) agreed that they would postpone low dose lung cancer screening because of the worry related to the result, 34.6% of them ($n = 64$) would postpone it because of the worry related to the possibility of being blamed for having smoked, and 35% (n = 65) would postpone it because of the worry related to the feeling like a social outcast for smoking (Raz et al., 2019).

High-risk smokers' worry toward lung cancer screening may be caused by the false-positive results. In a qualitative individual telephone interview study to explore the reasons for screening-eligible patients to opt out of lung cancer screening after receiving a recommendation from their health care providers, one of the five primary themes emerged from the participants' discussion was worry about having a false-positive result (Carter-Harris, Brandzel et al., 2017). The participants reported that they decided not to screen after reading the take-home materials which described the likelihood of a false-positive result that could lead to invasive procedures. The participants also described that having a false-positive result would induce too much stress and caused them to distrust the tests' value (Carter-Harris, Brandzel et al., 2017).

Blame and stigma. Perceived blame and stigma around lung cancer and smoking may work as a self-inflicted burden on high-risk smokers, thus deterring their participation in lung cancer screening. In a qualitative study which explored the barriers toward lung cancer screening among 26 long term smokers (77% Caucasian, 20% African American, and 3% Hispanic), one of the three perceived barriers identified by the participants was stigma (Carter-Harris, Ceppa et al., 2017). The participants described feeling stigma from self-blamed for having smoked or being made to feel like a social outcast for smoking. Most of the participants reported feeling smoking-related stigma from younger health-care providers and the culture they grew up in was not able to be understood by the younger health-care providers (Carter-Harris, Ceppa et al., 2017).

Fear of cancer diagnosis and fear of screening procedures. Fear of cancer diagnosis is a common concern among high-risk smokers. In a focus group study among 38 high-risk community members, one of the perceived barriers for the participants to screening lung cancer was fear of bad news (Simmons et al., 2017). Fear related to further examinations or investigation procedures following a suspicious or indeterminate cancer result may also hinder high-risk smokers' utilization of lung cancer screening. According to Patel et al. (2012), negative perceptions of bronchoscopy including fear of bronchoscopy were powerful deterrents for those participants declining lung cancer screening trial participation. Similarly, in another focus group qualitative study (Gressard et al., 2017) conducted in 105 high-risk smokers, fear of screening procedure was also reported as one perceived individual-level barrier to screening lung cancer by the participants.

***Fatalism*.** As a cultural level barrier to lung cancer screening (Gressard et al., 2017), fatalistic beliefs were reported being associated with avoidance of early detection of lung cancer, predicting lower screening intentions, and resulting in later stage lung cancer at diagnosis (Jonnalagadda et al., 2012). In a focus group qualitative study (Gressard et al., 2017) conducted in 105 high-risk smokers, fatalism was reported as one perceived cultural-level barrier to screening lung cancer by the participants. Due to the fatalistic beliefs around lung cancer, high-risk smokers tended to avoid knowing the potential lung cancer diagnosis, which was also the reason why they opted out of lung cancer screening (Carter-Harris, Brandzel et al., 2017). In another survey study conducted among 175 individuals from socioeconomically deprived communities with high smoking prevalence, results showed that fatalism was an important social deterrents of lung cancer screening participation (Quaife et al., 2017). The belief that lungs were not a treatable organ appeared to be a common lay explanation for poor survival and undermined the potential value of lung cancer screening (Quaife et al., 2017). Similarly, results from a qualitative study conducted among 60 respondents also showed that fatalism was one of the four typological perceptions perceived by the participants who declined lung cancer screening (Patel et al., 2012).

Confusion around lung cancer screening. The confusion around lung cancer screening among high-risk population included the financial cost of lung cancer screening, the potential harm of lung cancer screening, and the accuracy of lung cancer screening.

Confusion around the financial cost of lung cancer screening. Although lung cancer screening was covered both by private and public health insurances with zero-dollar co-pay under the Affordable Act since February 2015 (Centers for Medicare and Medicaid Services, 2015), confusion around the financial cost of lung cancer screening was still prevalent among high-risk smokers. In a qualitative telephone interview study to explore the reasons for screening-eligible patients to opt out of lung cancer screening after receiving a provider recommendation, one of the five primary themes emerged from participants' interview was patients' misunderstanding-associated out-of-pocket cost. The participants described the lung cancer screening was very expensive. They thought the cost of lung cancer screening would not be covered by the insurances. Therefore, they decided to opt out of lung cancer screening (Carter-Harris, Brandzel et al., 2017).

Confusion around the potential harms of lung cancer screening. The potential harms of lung cancer screening include false-positive results, radiation exposure, and incidental findings. While an appropriate level of perceived harm would motivate high-risk smokers to complete lung cancer screening (Roth et al., 2018), overestimating or underestimating the potential harm of lung cancer screening would both function as the barriers to screening lung cancer (Lillie et al., 2017).

Confusion around the accuracy of lung cancer screening. The accuracy of lung cancer screening was an important determinant in the decision-making process of lung cancer screening among high-risk population. According to Silvestri et al. (2007), while 92% of the never smokers (n=851) believed the accuracy of computed tomography test was an important factor influencing their decisions to screening lung cancer, 71% of the current smokers (n=397) believed that the accuracy of the computed tomography test influenced their willingness to be screened ($p < 0.05$). In a focus group interview study among 105 current smokers (Gressard et al., 2017), the participants also expressed the same perception about false-positive and false-negative results. The participants did not believe lung cancer screening test could tell them whether they had cancer; instead, they thought once they went over the lung cancer screening, doctors would force them to do another ultrasound examination because the doctors were not able to tell them the results, which was also the reason why they didn't want to screen lung cancer (Gressard et al., 2017).

Distrust of medical system. High level distrust of medical system may impede high-risk smokers' screening behavior and impact the implementation of lung cancer screening programs (Carter-Harris, Ceppa et al., 2017). In a qualitative study among 26 long-term smokers (Carter-Harris, Ceppa et al., 2017), one of the major perceived barriers to screening lung cancer emerged in the focus group discussion was distrust of medical system. The participants reported uncertainty about the value of lung cancer screening. They perceived the screening test as a new method to scam money (Carter-Harris, Ceppa et al., 2017). In another focus group qualitative study (Gressard et al., 2017) conducted in 105 high-risk smokers, distrust of medical system was also reported as one perceived barrier to screening lung cancer by the participants. The participants described the doctors and insurance companies were in cahoots; doctors did not have time for them and just pushed them in and out. However, in another qualitative telephone interview study among 20 lung computed tomography screen-completed high-risk smokers, one of the four perceived motivations for completing lung cancer screening was trust in the referring clinicians. The participants described their high level of trust in their clinicians motivated them to schedule and complete a lung screening scan (Roth et al., 2018).

Self-efficacy

Self-efficacy was first introduced by Bandura (Glanz et al., 2008). It was added to the Health Belief Model in the late 1980s, referring to the belief that one can achieve the outcome by changing his health behavior (Glanz et al., 2008). In this literature review, self-efficacy refers to high-risk smokers' own confidence in personal ability to successfully taking actions (lung cancer screening) by responding to unfamiliar or difficult situations and dealing with any associated setbacks or obstacles.

While research studies which focused on self-efficacy of lung cancer screening among Asians/Asian Americans were lacking, studies which focused on self-efficacy of lung cancer screening among U.S. population were also limited. The existing evidence showed that high-risk smokers' self-efficacy to screening lung cancer can be reflected by their confidence to arrange activities around lung cancer screening. In a survey study conducted by Jonnalagadda et al. (2012), high-risk smokers' self-efficacy to screening lung cancer was evaluated by the items related to arranging transportation for lung cancer screening and the ability to talk to doctor about lung cancer screening. The results showed a stronger sense of self-efficacy, reflected by the expression of confidence that "I can discuss a CT scan with my doctor" was significantly associated with an increased intention to screen ($p = 0.003$).

Furthermore, evidence from U.S. population study suggested that high-risk smokers' adherence to lung cancer screening may be positively associated with self-efficacy. It was reported that individuals classified as screeners had higher levels of self-efficacy for lung cancer screening than those who had not screened (30.38 vs. 28.55; $p=.0012$) (Cater-Harris, Slaven et al., 2017).

Vice versa, previous research also showed that self-efficacy of lung cancer screening was an important predictor to screening lung cancer. In the study conducted by Cater-Harris, Slaven et al (2017), the results showed that high-risk smokers' self-efficacy of lung cancer screening was positively associated with their intentions to screening lung cancer. Also, according to Jonnalagadda et al. (2012), increased self-efficacy was associated with increased intention to screening lung cancer.

Cues to Action

The Health Belief Model described that a cue, or trigger, was necessary for health promotion behavior change programs (Glanz et al., 2008; Janz & Becker, 1984; Rosenstock, 1974). Cues to action could be internal or external (Carpenter, 2010; Janz & Becker, 1984). Internal cues to action (e.g., pain, symptoms) as well as external cues (e.g. events or information from close others, the media, or health care providers) could motivate individuals to take an action to change their health-related behaviors (Carpenter, 2010: Glanz et al., 2008; Janz & Becker, 1984).

Recommendations from others as well as health problems and symptoms were important cues to action for Asian Americans. In a study conducted by Sin et al. (2016) among 24 Korean men, results showed that primary care physicians, family members, and health organizations all played an important role in the lung cancer screening participation among Korean immigrant men. Existing health problems and/or respiratory symptoms (from long term smoking) were also associated with receipt of lung cancer screening among this population (Sin et al., 2016).

Evidence from studies conducted among U.S. population also showed the importance of cues to action on lung cancer screening behavior. In an observational survey study conducted among 1,388 lung cancer screening eligible Veterans, results showed that exposure to direct lung cancer screening invitation with decision aid increased Veterans' attention to the decision making factors of lung cancer screening, such as false positive results (30.8% vs. 20.2%, X2 = 7.21, $p < 0.01$), convenience of lung cancer screening (37.2% vs. 28.1%, X2 = 4.71, $p < 0.05$), lung cancer screening knowledge (22.8% vs. 15.7%, X2 = 4.09, $p < 0.05$), and anxiety waiting for low dose computed tomography results (28.0% vs. 19.8%, X2 = 4.58, $p < 0.05$) (Lillie et al., 2017). In a qualitative interview study conducted among 20 lung cancer screening-completed men and women, one of the four primary themes emerged as motivations for completing low dose computed tomography lung cancer screening was friends or family members with advanced cancer (Roth et al., 2018). Several participants (30%) described family members' and friends' experiences with advanced cancer as a story which motivated their desire to avoid a similar fate, as well as a cue to care for their own health and participate in lung cancer screening (Roth et al., 2018).

Although evidence indicated cues to action was an important construct influencing both U.S. and Asian Americans' motivation to screening, the original Lung Cancer Screening Health Belief Scale did not include the items measuring cues to action of lung cancer screening. It may be necessary to add this construct to the adapted Chinese Lung Cancer Screening Health Belief Scale to measure the cues to screening lung cancer for Chinese Americans.

Other Factors Related to Lung Cancer Screening Behavior

Using the Health Belief Model for health promotion, other factors which may influence U.S. population as well as Asians/Asian Americans' lung cancer screening behaviors, but not directly related to the health belief perspectives, were identified by demographic factors, socio-psychological factors, and structural factors.

Demographic factors. High-risk smokers' screening behavior may be associated with their demographic factors such as smoking history, ethnicity, education level, and age. According to Raz et al. (2019), a common barrier among high-risk smokers to screening lung cancer was being a current smoker. About 56.6% high-risk smokers cited that being a current smoker was a reason they may not undergo lung cancer screening (Raz et al., 2019). In addition, minority smokers may be less likely to receive lung cancer screening than the general population. According to the study conducted by Wildstein et al. (2011) among 2,083 self-pay and 1,304 no-pay high-risk patients, the adherence rates of lung cancer screening were significantly lower among the self-pay and no-pay cohort minority population (African American, Hispanic, Asian) than Caucasians (Wildstein et al., 2011). Furthermore, education level may be positively associated with the screening rate. It was reported that participants who had a college degree tend to be more adherent to lung cancer screening than the participants who did not have a college degree in both self-pay and no-pay cohorts (Wildstein et al., 2011). Lastly, older smokers tended to be less willing to screening lung cancer. According to a qualitative study conducted by Patel et al. (2012), one of the four typological behaviors emerged within those participants who declined screening was “too old to be bothered” or “too old to benefit”, which might relate to the fatalism that is prevalent in this population.

Social-psychological factors. High-risk smokers’ psychological status may be associated with their intention to screening lung cancer screening. Negative psychological status, including anxiety, distress, and inaccurate beliefs, may hinder high-risk smokers’ motivation to screening lung cancer.

Anxiety. The anxiety related to indeterminate or suspicious screening results may be a barrier for high-risk smokers to undergo screening. In a longitudinal survey study, which investigated the psychological influences of indeterminate screening results among 400 high-risk smokers (Byrne et al., 2008), participants with either indeterminate or suspicious screening results had a significant higher state anxiety (which defined as an unpleasant emotional arousal in the face of threatening demands and dangers) following screening than at the baseline. The average state anxiety did not fall substantially until the 12-mo survey for those with indeterminate results and 6-mo survey for those with suspicious results (Byrne et al., 2008). The increased anxiety level brought by the indeterminate or suspicious lung cancer screening results may affect the adherence to follow-up screening.

Distress. High level of psychological distress may hinder high-risk smokers' motivation to screening lung cancer. In a longitudinal survey study among 351 smokers (Bunge et al., 2008), the results showed lung cancer specific distress (measured by the Impact of Event Scale [IES]) were significantly higher one day before screening than six months after screening. Although levels of distress were not severe, the participants with a high affective risk perception (the participants' perceived risks of getting lung cancer) had significantly higher IES scores than participants with a low affective risk perception (6.5 vs. 1.0, $p < 0.01$). The distress around the lung cancer concern that brought by the lung cancer screening may hinder high-risk smokers' adherence to the follow-up screening.

Inaccurate beliefs. High-risk population's inaccurate beliefs toward the causes of lung cancer, as well as the inaccurate interpretation of the screening results may hinder their motivation to screening lung cancer. In a qualitative study among 26 high-risk smokers (Carter-Harris, Ceppa et al., 2017), most of the participants agreed lung cancer was deadly, but inaccurate beliefs existed regarding the associated risk factors of lung cancer. The participants seemed to assign greater importance to occupational and environmental exposure and placed less emphasis on smoking which was the number one risk factor of lung cancer (Carter-Harris, Ceppa et al., 2017). In another qualitative study among 31 high-risk smokers (Young et al., 2018), the participants expressed a prevalent misinterpretation of the beliefs toward the risk of lung cancer implied by the screening test results. The negative result was interpreted as "an all-clear from lung cancer" and a positive result was interpreted as "lung cancer would definitely develop" (Young et al., 2018).

Inaccurate beliefs were also reported around the perceived low risk of smoking-associated lung cancer. In a qualitative study conducted by Patel et al. (2012) among 60 smokers, the participants who denied to screening lung cancer believed that negative family histories of lung cancer and good health were protective factors which could against the effect of continuing smoking and avoiding them from getting lung cancer. In another qualitative study among 37 current smokers in the U.S. (Zeliadt et al., 2015), 17 participants described lung cancer screening lowered their chance of getting lung cancer, because they perceived undergoing a screening test yielded the same health benefits as smoking cessation.

Furthermore, inaccurate beliefs were also related to the perceived low value of lung cancer screening. In a qualitative interview study conducted by Carter-Harris, Brandzel et al. (2017), the participants described screening lung cancer was a waste of their effort. The participants didn't recognize the benefit of potentially finding lung cancer early. They believed nothing could be done if lung cancer was detected (Carter-Harris, Brandzel et al., 2017). They felt the screening test was of little to no benefit. They described that even if they got a negative screening result, they still suspected their possibility of getting lung cancer in the long run (Carter-Harris, Brandzel et al., 2017). The various inaccurate beliefs toward lung cancer and lung cancer screening may decrease high-risk smokers' motivation to screening lung cancer and hinder their lung cancer screening behavior.

Structure factors. A common structure factor influencing U.S. population as well as Asians/Asian Americans' lung cancer screening behaviors was knowledge.

Knowledge. Although in some studies lacking knowledge of lung cancer and lung cancer screening was identified as a perceived barrier to screening lung cancer, however, some other studies didn't clearly define the relationship between knowledge and the lung cancer screening behavior, but just described the phenomenon related to lacking knowledge of lung cancer and lung cancer screening among high-risk population.

According to Scott et al. (2014), compared with non-smokers, the smokers in the study seemed less knowledgeable about symptoms of lung cancer; and Cantonese smokers were less knowledgeable about lung cancer symptoms than Mandarin smokers. While coughing up blood (hemoptysis) was commonly identified as the symptom of lung cancer (Al-Naggar et al., 2013; Scott et al., 2014), only 53.3% and 42.7% of the participants knew that repeated respiratory infection and wheezing were the main symptoms of lung cancer, respectively (Al-Naggar et al., 2013). Furthermore, compared with other preventive methods, lung cancer screening with low dose computed tomography was less likely to be known for the 150 male participants in the study conducted in Malaysia (Al-Naggar et al., 2013). When asked about the preventive measures of lung cancer, the participants only mentioned quitting smoking, avoiding second-hand smoking, and avoiding unnecessary x-ray image of the chest. The secondary prevention method (lung cancer screening with low dose computed tomography) was not mentioned (Al-Naggar et al., 2013).

Furthermore, in a quantitative study with 172 U.S. smokers (Schnoll et al., 2003), although 62% of the participants expressed high interest in lung cancer screening, 77% of the participants didn't know the spiral computed tomography for lung cancer screening. In another telephone survey study conducted with a random sample of 500 Ohio residents with low social economic status, 41% (n = 205) of the study participants described there was nothing people could do to decrease the risk of developing lung cancer (Price & Everett, 1994). Even though among the participants who had been screened previously, few of them could recall enough information about the screening test (Gressard et al., 2017).

Discussion

To date, little was explored about Asians/Asian Americans' health beliefs about lung cancer screening with low dose computed tomography. Understanding Asians/Asian Americans' health beliefs about lung cancer screening is essential for designing culturally tailored lung cancer screening programs which may potentially help to increase the adherence of lung cancer screening and decrease the mortality rate of lung cancer.

Asians/Asian Americans' health beliefs toward lung cancer screening may be associated with their intention to screening lung cancer, which may be consistent to the findings found among U.S. population. Previous studies conducted among U.S. population showed that a positive relationship existed between perceived severity/susceptibility/benefits/self-efficacy and lung cancer screening behavior and a negative relationship existed between perceived barriers and lung cancer screening participation (Carter-Harris, Slaven et al., 2017; Jonnalagadda et al., 2012). Studies conducted among Asians/Asian Americans also indicated that perceived severity, susceptibility, benefits, barriers, and self-efficacy of lung cancer screening were associated with the intention to screening lung cancer (Bui et al., 2018; Lu et al., 2018).

In addition, previous studies conducted among U.S. population showed that health beliefs about lung cancer screening may be different between participants with different smoking status and screening history (Cater-Harris, Slaven et al., 2017), which may also be true among Asians/Asian Americans. While screeners had higher levels of perceived benefits/self-efficacy and lower perceived barriers for lung cancer screening than those who had not screened (Cater-Harris, Slaven et al., 2017), current smokers perceived higher susceptibility of lung cancer

(Park et al., 2014) and higher perceived benefits of lung cancer screening than former smokers (Bui et al., 2018).

Furthermore, Asians/Asian Americans' health beliefs of lung cancer screening may be associated with several demographic factors, such as educational level, family income (Lu et al., 2018), and age (Patel et al., 2012). While a positive relationship was existed between educational level/family income and the perceived benefits of lung cancer screening (Lu et al., 2018), a negative relationship was existed between age and the willingness of screening lung cancer (Patel et al., 2012).

Also, several differences were observed in previous studies about Asians/Asian Americans versus U.S. general population' health beliefs toward lung cancer screening. For example, the fatalistic beliefs and fears related to the screening test were independently associated with decreased intention to undergo screening and were more common among minority population (Jonnalagadda et al., 2012). With a different cultural background than the U.S. population, the traditional eastern beliefs, such as those pertaining to fatalism, self-care, and cancer-related stigma, may have a particular influence on Asians/Asian Americans' perceptions of lung cancer screening.

Using a culturally adapted and validated lung cancer screening health belief instrument to investigate Asians/Asian Americans' lung cancer screening health beliefs is essential. It will help to understand Asians/Asian Americans' health beliefs toward lung cancer screening, facilitate the communication between health care providers and high-risk Asian/Asian American smokers regarding early detection of lung cancer, design culturally adapted lung cancer screening programs for Asians/Asian Americans, and eventually contribute to a decreased mortality of lung cancer. In the original Lung Cancer Screening Health Belief Scales, high-risk population's health beliefs toward cues to action and self-efficacy of lung cancer screening were lacking. Also, perceived barriers of lung cancer screening such as psychological barriers, confusion around lung cancer screening, and distrust of medical system that were prevalent among U.S. population were not reported by Asians/Asian Americans. These perceived barriers along with the prominent fatalism related to lung cancer screening reported by the minority ethnicities in the U.S. may need to be further explored and evaluated in Asian American population. Suggested by the literature (Jonnalagadda et al., 2012), the original Lung Cancer Screening Health Belief Scale will be revised to culturally adapted to be used in Asians/Asian American population. A literature review focusing on the methodology of cross-cultural instrument adaptation and validation was conducted and described in part two of this chapter.

Part II: Culturally Adaptation and Validation of the Instruments Measuring Health Beliefs of Cancer Screening: Literature Review

Introduction

Previous study indicated that cultural-specific health beliefs toward screening among various ethnic groups may lead to racial/ethnic differences in cancer screening (Jonnalagadda et al., 2012). Although overall health beliefs may be associated with lung cancer screening behaviors, and Asian culture beliefs (e.g., fatalism) may explain low lung cancer screening rates in the Asians/Asian American population, only a few studies have examined health beliefs and lung cancer screening behavior among Asians/Asian Americans. Although health belief scale of lung cancer screening was developed and available to be used, however, the scale developed in the U.S. for the general population may lack culturally-appropriateness, reliability, and validity in Asians/Asian American population. As cultural influences on constructs (e.g., perceived susceptibility) could differ by racial and ethnic group (Sanders, 2009), instruments developed in and for Western cultures may not include constructs particular to Asian culture. When existing instruments lack appropriate constructs or items to be used for a targeted sample, development of new scales or adaptation of existing scales is suggested. When constructs or items overlap but are slightly different, scale adaptation is more appropriate and practical than development of new scales (van de Vijver, & Leung, 1997). Existing studies of lung cancer screening showed that some of the health belief constructs (e.g., barriers) overlapped for U.S. population and Asians/Asian Americans (Carter-Harris, Ceppa et al., 2017; Gressard et al., 2017; Patel et al., 2012; Scott et al., 2014; Sin et al., 2016). Therefore, adaptation of the existed Health Belief of lung cancer screening scales is a better choice for this study.

Adaptation of an existing instrument to be used in the target population is a cost efficient and time-saving choice. According to Chang and Chau (1999), the best method of describing and measuring a construct is developing a research instrument from the perspective of the population under investigation, but this is rarely feasible because of cost and time constraints. Chang and Chau (1999) suggested the most practical choice is to use an instrument that has already been developed. Li et al. (2001) also suggested that researchers should make optimal use of existing knowledge by building on the work of others. Translation and adaptation of instruments that have already been validated and tested is an optimal way to minimize the extensive cost of instrument development and facilitate exchange of information between researchers (de Paula Lima et al., 2005).

In this part, the methods of culturally adaptation and validation of instruments measuring health beliefs of cancer screening will be reviewed. With the purpose of yielding a more reliable and valid instrument to be used in Chinese Americans, the methodologies regarding instrument adaptation and validation were summarized, analyzed, and compared for further application in this study.

Literature Search Procedure

Electronic databases, including PubMed, Google scholar, CINAHL®, and PsycINFO were searched. Key words including constructs about instrument adaptation and validation, health belief, and cancer screening were applied. Detailed key words from each construct included: 1) instrument adaptation: instrument modification, modify, revise, adapt, adaptation, refinement, refine; 2) health belief: perception, attitude, belief, perspective; and 3) cancer screening: cancer, screening, prevent, prevention. Inclusion and exclusion criteria were applied. The inclusion criteria for the articles were: 1) peer-reviewed articles; 2) related to the instrument adaptation and validation of health beliefs toward cancer screening; and 3) published in English or Chinese language. The exclusion criteria were: 1) informal articles (e.g., commentary, letter to editor, and conference abstract, etc.), 2) not an instrument adaptation and validation study, and 3) not related to the health beliefs of cancer screening.

After the articles were located, the titles and the abstracts of the articles were read for further inclusion and exclusion. Articles which were listed in the reference list of the included articles were searched for further inclusion. Information on the purpose, sample, setting, methods, results, and discussion parts of the included articles were extracted and entered the table of evidence. Methodological rigor of the included articles was evaluated using the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies developed by the National Heart, Lung, and Blood Institute (2019).

Synthesis of Current Evidence

Searching Findings

Initially, 1,312 articles were located after applying the key words searching. After assessing the titles of the articles, 1,291 articles were excluded because the studies were not related to the health beliefs of cancer screening. After assessing the abstracts of the articles, two more articles were excluded because they were not related to the culturally adaptation and validation of the instrument. Also, one article was further excluded because it was related to the cultural beliefs of cancer screening instead of health beliefs of cancer screening. Finally, 19 eligible articles were included in this literature review (Dewi, 2018; Gozum & Aydin, 2004; Guvenc, Akyuz, & Açikel, 2011; Hashemian et al., 2013; Juárez-García et al., 2019; Karayurt & Dramalı, 2007; Kharameh et al., 2014; Lee, Kim, & Song, 2002; Lee & Lee, 2015; Marmarà, Marmarà, & Hubbard, 2017; Medina-Shepherd & Kleier, 2010; Mikhail & Petro-Nustas, 2001; Parsa et al., 2008; Secginli & Nahcivan, 2004; Taymoori & Berry, 2009; Tsangari & Petro-Nustas, 2012; Wu et al., 2020; Yilmaz & Sayin, 2013; Zelviene & Bogusevicius, 2007).

Studies Characteristics

Of the 19 studies, 18 were published in English and 1 was published in Chinese language (Wu et al., 2020); four of them were conducted in Turkey (Gozum & Aydin, 2004; Guvenc et al., 2011; Karayurt & Dramalı, 2007; Yilmaz & Sayin, 2013), three were conducted in Iran (Hashemian et al., 2013; Kharameh et al., 2014; Taymoori & Berry, 2009), and two were conducted in the United States (Lee & Lee, 2015; Medina-Shepherd & Kleier, 2010). The other studies were conducted in Indonesia (Dewi, 2018), Mexico (Juárez-García et al., 2019), South Korea (Lee et al., 2002), Malta (Marmarà et al., 2017), Jordan (Mikhail & Petro-Nustas, 2001), Malaysia (Parsa et al., 2008), Istanbul (Secginli & Nahcivan, 2004), Cyprus (Tsangari &

Petro-Nustas, 2012), Kaunas (Zelviene & Bogusevicius, 2007), or China (Wu et al., 2020). For the two studies conducted in the United States (Lee & Lee, 2015; Medina-Shepherd & Kleier, 2010), the target population were Korean Americans (Lee & Lee, 2015) and Hispanic women (Medina-Shepherd & Kleier, 2010), respectively. The sample size of the studies ranged from 15 (Marmarà et al., 2017) to 656 (Secginli & Nahcivan, 2004). Convenience and randomized sampling methods were the recruitment methods used most-commonly. Most of the participants in the studies were recruited from hospitals or schools/Universities. The instrument most frequently adapted in the studies was Champion's Health Belief Model Scale. Sixteen studies were about health beliefs of breast cancer screening and breast self-examination. Two studies were about health beliefs of colorectal cancer screening (Lee & Lee, 2015; Wu et al., 2020). The left one was about health beliefs of cervical cancer screening (Guvenc et al., 2011). The theoretical framework most frequently used in the studies was Health Belief Model (Appendix B, Table 2).

Translation Methods

The translation process is essential in a cross-cultural instrument adaptation study. During the translation process, language barriers and cultural differences should be considered (Varricchio, 1997). Among the 19 studies, the translation method used most-commonly (n = 18) was back-translation, which included the use of a panel of experts, translators, or interpreters to translate the instrument from the source language to the target language and then back-translate them to the source language (Brislin, 1986; Chapman & Carter, 1979). Another translation method used by one of the 19 studies was committee translation (Lee & Lee, 2015). The translation committee was formed by three bilingual translators who completed the translation process.

Back-translation method. The back-translation method included two steps: forward translation and back translation. Most of the studies involved one to three translation persons in both steps. However, one study included ten translation persons in the forward translation step (Karayurt & Dramalı, 2007). According to the types of personnel which involved in the translation process, the individual translation method was categorized as four types, including using professional translators, using professional interpreters and/or involving the first author, using bilingual individuals, and involving bilingual investigators.

Using professional translators. In the study, professional translators were involved in the translation work for the instrument. It included seven studies (Dewi, 2018; Hashemian et al., 2013; Juárez-García et al., 2019; Kharameh et al., 2014; Marmarà et al., 2017; Taymoori & Berry, 2009; Yilmaz & Sayin, 2013).

Using professional interpreters and/or involving the first author. The professional interpreters were persons who had an educational background related to the field of the instrument, were familiar about the instrument, or knowledgeable of the instrument. Usually, the professional interpreters were bilingual health care providers, such as surgeons, nurses, or physicians (Gozum & Aydin, 2004; Medina-Shepherd & Kleier, 2010; Wu et al., 2020).

Using bilingual individuals, such as university staff, speakers, or other non-health care system individuals. It included six studies (Guvenc et al., 2011; Karayurt & Dramalı, 2007; Lee et al., 2002; Parsa et al., 2008; Secginli & Nahcivan, 2004; Zelviene & Bogusevicius, 2007).

Involving bilingual investigators. In these studies (Mikhail & Petro-Nustas, 2001; Tsangari & Petro-Nustas, 2012), the instruments were translated and back-translated separately by the bilingual investigators.

Committee translation method. The committee translation method was characterized by a translation procedure conducted by the translation committee. In the study conducted by Lee and Lee (2015), three bilingual translators who were fluent in both Korean and English formed the translation committee. The primary investigator drafted initial items in English language for the health belief scales from existing instruments and added items from searched studies. The committee translated the English version of the health belief scales into Korean. After that, the primary investigator and translation committee members reviewed the modified instruments to check the discrepancies as well as unclear or awkward sentences in translation.

Modification Methods

The modification process of the instruments varied which could happen at different stages of the translation process. According to the stage of the modification process happened in the translation process, the modification process was categorized as embedded modification and afterward modification.

Embedded modification. The embedded modification was characterized by a modification process conducted between forward and backward translation. It was less commonly used (Gozum & Aydin, 2004; Karayurt & Dramalı, 2007; Kharameh et al., 2014; Mikhail & Petro-Nustas, 2001; Tsangari & Petro-Nustas, 2012) compared to the afterward modification. In the study conducted by Kharameh et al. (2014), the instrument used for the breast cancer screening was adapted to be used in the context of colorectal cancer screening. The modification was made after the forward translation and before the back translation. In another study conducted by Gozum and Aydin (2004), the original instrument was translated to the target language by two translators. The forward translated instrument was given to six bilingual health professional judges which consisted of two gynecology nursing professors and four public health nursing professors. The judges worked independently and reported their views on the scale. The views were collected on a single form. The judges suggested some changes in wording. The two translators who forward-translated the instrument agreed on the modifications, and the translated scale was revised accordingly. After that, the modified instrument was given to another bilingual medical doctor for the back-translation.

In another study conducted by Karayurt and Dramalı (2007), the forward translated instrument was given to ten bilingual health professional experts who consisted of four nursing faculty members, two surgical oncology professors, a medical oncology professor, a psychology professor, and two psychologists to review. The judges suggested minor changes in wording, and the translated instrument was revised accordingly. After that, the translated tool was then back translated into English by a bilingual person (Karayurt & Dramalı, 2007). The same procedure was used in the studies conducted by Mikhail and Petro-Nustas (2001) as well as Tsangari and Petro-Nustas (2012). The number of professional judges invited in the studies ranged from three to six. The judges also validated the content validity of the forward translated instrument and determined the translated instrument was culturally appropriate.

Afterward modification. The afterward modification was characterized by a modification process that happened after the forward and backward translation. It was commonly used in most of the studies. Among the 19 studies included in this literature review, 14 studies used the afterward modification method (Dewi, 2018; Guvenc et al., 2011; Hashemian et al., 2013; Juárez-García et al., 2019, Lee et al., 2002; Lee & Lee, 2015; Marmarà et al., 2017; Medina-Shepherd & Kleier, 2010; Parsa et al., 2008; Secginli & Nahcivan, 2004; Taymoori & Berry, 2009; Wu et al., 2020; Yilmaz & Sayin, 2013; Zelviene & Bogusevicius, 2007). Three viewing methods, including individual participants review (n=3 to 10), focus group review (n=4 to 6), and expert review (n=3-12) were used in the afterward modification process.

In the study conducted by Dewi (2018), to be updated with the revision of HBM which included cues to action and self-efficacy, the authors added items representing two dimensions (cues to action and self-efficacy) and removed the motivation dimension in the scales after the forward and backward translation procedures. In another study conducted by Guvenc et al. (2011), after the instrument was forward and backward translated, four items adapted from other scales and thought to be appropriate to Turkish culture (cost, fatalism, preference for female healthcare professionals, distance from the health center) were added to the perceived barriers subscale by the authors. Also, the revised instrument was given to four bilingual healthcare professionals which consisted of two gynecological oncologists and two nursing university staff members to review. Minor changes in wording were suggested and revised accordingly.

In another study conducted by Hashemian et al. (2013) which aimed to translate Champion's Health Belief Model Scale and validate it in a sample of Iranian women with family history of breast cancer, the forward and backward translated instrument was given to 13 experts and 30 participants as well as four focus groups (n=42) to check the instrument's quality. The 30 participants were women who had breast cancer history in their family; and the participants for the focus groups were selected from two groups of ten women with breast cancer and two groups of 12 women with the family history of breast cancer. Items were added to or eliminated from the translated instrument per experts' suggestions and participants' discussions to make it culturally appropriate. In another study conducted by Juárez-García et al. (2019) which aimed to adapt and validate the Spanish version of the Champion's Health Belief Model Scale for mammograms to be used among Mexican women, focus group and expert evaluation were held to check the forward and backward translated instruments' adequacy, compatibility, and relevance. Following the evaluation, some items were removed due to redundancy. Minor changes in wording were amended. Some items were added, such as items concerning risk factors for breast cancer in the perceived susceptibility subscale. Furthermore, the pretest of the instrument also leaded to an amendment in the response options of the instrument. The same afterward modification method was also used in the other studies.

Modification Strategies

According to the instrument modification results, strategies used in the modification process included (1) changing wording, (2) deleting redundant or irrelevant items, (3) expanding the original instrument, and (4) changing the order of items.

Changing wording. This strategy was used most frequently in the studies. It included changing titles of the factors/subscales, minor changes in the wording of the items, and changing the response options.

Changing titles of the factors/subscales. In one study, although the authors didn't mention the rationale why they decided to change the title of the factors/subscales in the Maltese version of the instrument, the authors amended the title of "risk factors" domain to "Risk/Lifestyle Factors" in the perceived risk subscale (Marmarà et al., 2017).

Minor changes in the wording of the items. According to the presented comments and perspectives by the experts and participants, some minor changes in wording of the items were slightly simplified and modified during the modification phase (Dewi, 2018; Kharameh et al., 2014; Mikhail et al., 2001; Tsangari et al., 2012). The minor changes were made by rephrasing the words in the items, deleting parts of the sentences in the item, adding extra explanation to the items, and changing the subject of the items.

Rephrasing the words in the items.

(1) Size. Regarding the three items "I am able to find a breast lump which is the size of a quarter", "I am able to find a breast lump which is the size of a dime", and "I am able to find a breast lump which is the size of a pea" in the original scale, different strategies were used for translating. The first strategy is using similar size of items. According to Dewi (2018), the word "quarter" was modified into "walnut", and "dime" was modified into "hazelnut" in the Indonesian version of the instrument. The author described that the sizes of a walnut and hazelnut were more like that of a quarter and a dime, so walnut and hazelnut were chosen as a more appropriate translation (Dewi, 2018). In the study conducted by Secginli et al. (2004), the authors found it was difficult to find a size of the Turkish coins equal to the sizes of "quarter, dime, and pea", so they used "chickpea, hazelnut, and walnut" per most of the experts' suggestion (Secginli et al., 2004). In another study, according to the experts' suggestion, the authors used "filbert" and "rather greater than filbert" instead of dime and quarter, because there were no Iranian coins like quarters and dimes (Taymoori & Berry, 2009). The second strategy is using similar size of coins. In one study, the authors used different sizes of Turkish coins which were equalized to the sizes of the American quarter and dime. In addition, sizes of the original quarter and dime were given in centimeters (Karayurt & Dramalı, 2007). In another study which aimed to assess the reliability and validity of the revised Champion's Health Belief Model Scale in measuring Lithuanian women's beliefs about breast cancer and screening, the statements regarding the size of palpable lump were changed according to the sizes of Kaunas' currencies (Zelviene & Bogusevicius, 2007). In the study conducted by Lee et al. (2002), an inconsistency was observed on the two translated versions of "dime". One translator translated the word of a dime into 10 Won (one type of Korean coin) and the other translated into 50 Won. At last, 50

Won was chosen instead of 10 Won because the size of 50 Won was more like that of a dime (Lee et al., 2002).

(2) Accuracy. In the study conducted by Lee et al. (2002), the two back-translated instruments were pretested by three participants. Per one participant's suggestion, the word hok (meaning lump or mass) was changed into the word meaning meongwooli (another expression of lump or mass) in Korean for reaching better understanding（Lee et al., 2002). In another study conducted among 606 employed women (20-69 years old) from Sanandaj, Iran, the experts asked to change the word "komik" (meaning funny) into "tuhaf" (another expression of funny), and "gizlilik" (meaning privacy) into "mahremiyet" (another expression of privacy), so the two words were replaced (Taymoori & Berry, 2009). Also, in the study conducted by Taymoori and Berry (2009) among 606 Iranian women, the item "When I do breast screening examination, I feel good about myself" was changed to "I feel self-satisfied" as it was closer to the Farsi meaning than "feel good" (Taymoori & Berry, 2009). In the study conducted by Medina-Shepherd and Kleier (2010), the term used in the translated Hispanic instrument for mass was bulto. To reach the consistency of the terminology used for breast mass, discussion was held among the focus group participants. Although bulto was not a frequently used term, the group agreed that the definition of bulto meant space-occupying matter and it was adequate for use in reference to breast mass (Medina-Shepherd & Kleier, 2010).

(3) Medical term. In the study conducted by Lee and Lee (2015), the medical term "fecal occult blood test" was replaced with lay language "stool blood test", as the medical term may be difficult to understand for the Korean American participants who are not employed in a health-related field. Therefore, the English phrase "stool blood test" was translated into Korean with the meaning of "a test to detect blood in stool" by consensus among the committee

members (Lee & Lee, 2015). In the study conducted by Yilmaz and Sayin (2013), the term 'lump' in the original instrument was translated to 'kitle' from English to Turkish primarily. However, all the members in the focus group agreed that Turkish women would not understand the word 'kitle', because it was a medical term in Turkish. Thus, the members agreed that the phrase 'sert yumrubeze' would be better understood by the target population as a Turkish expression for 'lump' in the original version (Yilmaz & Sayin, 2013).

(4) General known term. In a pilot study conducted by Marmarà et al. (2017), the Maltese Breast Screening Questionnaire was evaluated by an expert panel (n=12) which included the lead researcher and statistician for the study, the four translators, screening/medical professionals, and lay women. During the expert panel discussion, one controversial term was mammogram, for which two panel members argued that some women in the target population may not be aware of early diagnostic breast tests. Although mammografija in the translated Maltese instrument was acceptable, the general known term was mammogram. Following this debate, the panel decided that both words were suitable and could be used interchangeably (i.e., mammogram, mammografija). Another word discussed by all the expert panel members was nipple. Several controversies arose on whether to use the word nipple as it was, nippla, or the pure technical phrase rasilbizla. Most members argued that some women in the target population were not aware of the technical phrase but were familiar with the English term. So it was literally translated to nipil (Marmarà et al., 2017). In the study conducted by Medina-Shepherd and Kleier (2010) among 200 Hispanic women who were literate in speaking and reading Spanish, aged 45 to 75 years, and without history of breast cancer, some disputes emerged during the expert panel discussion. Some of the expert members did not agree that mama, an original term used for breast, could be understood by the Hispanic subgroups in the U.S. After a debate of various

common terms for breast, the group decided that the term seno would be most understood in all Hispanic groups (Medina-Shepherd & Kleier, 2010).

(5) Changing direction of the meaning. In the study conducted by Marmarà et al. (2017), to avoid arousing misunderstanding, confusion, and anxiety, items of the instrument were changed by reversing direction of the meaning as well as asking participants' personal views about breast cancer rather than their perceptions of an illness personally affecting them. For example, the item "My illness will last for a short time" with reverse scoring was replaced with "Breast cancer will last for a long time" in the translated Maltese instrument (Marmarà et al., 2017).

Deleting parts of the sentences in the item. To reach culturally-adaptation or clarity, parts of the sentences in the item were deleted. (1) *Culturally adaptation.* In one study conducted among 200 Persian women who were family members of breast cancer patients, the terms "boyfriend" as well as "partner" from the item of the original perceived severity subscale, "Breast cancer would, threaten a relationship with my boyfriend, husband, or partner", were deleted according to Islamic roles (sexual relationship outside the marriage was forbidden). Only "husband" was retained in the translated Iranian instrument (Hashemian et al., 2013). Similarly, in another study conducted among 606 employed women (20-69 years old) from Sanandaj, Iran, due to the same Islamic religion limitation related to the relationships between women and men's marriage, which was also the Iranian norm, the terms "partner" and "boyfriend" were deleted, and only ''husband'' was retained (Taymoori & Berry, 2009). (2) *Clarity*. In one study conducted among Korean Americans, some participants understood "stool blood test" to be a general blood test. After consulted and discussed with the translation committee members, the

Korean translation was modified to the words meaning “stool test” to emphasize stool rather than blood (Lee & Lee, 2015).

Adding extra explanation to the items. To make the meaning of the items clear and easily to be understood, extra explanation was added to the items. *(1) Clarity. In* one study, difficulty emerged in translating the item “not having privacy would keep you from having a stool blood test” into Korean. Because privacy could be interpreted as several different Korean words depending on the context (Lee & Lee, 2015), the author and committee members carefully considered the situation of conducting a stool blood test and translated the afore-mentioned item to Korean with the sentence meaning “not wanting to let other people know that he or she was doing the stool blood test or handling stool for the test.” (Lee & Lee, 2015). In the same study, several participants reported they did not understand one item in the perceived barriers subscale, “I have other problems more important than having a stool blood test”. Some participants subsequently asked, “What other problems? What does that mean?”. After discussion with the translation committee members, the item was rephrased to “Having a stool blood test is not the most urgent and important problem I have, which keeps me from having it (Lee & Lee, 2015). (2) *General known terms*. In one study conducted among 209 Turkish women (35–70 years of age, experienced no difficulty in communicating, did not have a previous diagnosis of breast cancer), one controversial term was ‘radyasyon’ in the translated Turkish instrument. Two expert panel members argued that some women in the target population would not know this word, because the general understanding of the word was ‘X-ray’. After the issue was debated, the group decided to use both the words together [i.e., radiation, X-ray/in other words (radyasyon-rontgen)]. In the same study, another word discussed by all group members was “mammography”. Because research indicated that many women in Turkey do not know about early diagnostic methods for breast cancer, especially mammography (Yilmaz & Sayin, 2013), the group decided to use the terms “mammography” and “breast X-ray” together (Yilmaz & Sayin, 2013). In another study, after pretested with ten women, two alternatives of the original response meaning “privacy”, solitude, severalty, together with the original meaning, were written next to the item “I don’t have enough privacy to do breast examination.” in the translated instrument for Kaunas population (Zelviene & Bogusevicius, 2007).

Changing the subject of the items. In the study conducted by Marmarà et al. (2017) which aimed to adapt the Champion’s Health Belief Model Scale to be used in Maltese women, instead of reporting the perceptions of an illness personally affecting them, the participants were asked to report their personal views about breast cancer in the translated Maltese instrument. For example, “My illness has serious economic and financial consequences” was replaced with “Breast cancer has serious economic and financial consequences” (Marmarà et al., 2017). In the study conducted among 606 employed women (20-69 years old) from Sanandaj, Iran, the third person was used to describe two items from the perceived benefits scale and three items from the perceived severity scale instead of first person. Because in Iranian culture, people believe that expressing an ominous event in the first person causes interpretation that the event will occur. For example, “If I developed breast cancer, I would not live longer than 5 years” was changed to the third person “If someone developed breast cancer, she would not live longer than 5 years” (Taymoori & Berry, 2009).

Changing the response options. In the study conducted by Juárez-García et al. (2019), although no comprehension difficulties were identified through the pretest in 50 women aged 40 years and above, the response options of the translated Mexican instrument did find to be problematic for the participants, so the authors amended the options as follows: 4 = “yes,” 3 = “I think so," 2 = "I don't think so," and 1 = "no." (Juárez-García et al., 2019). In the study conducted to translate the Champion's Health Belief Model Scale to Farsi and to examine the psychometric properties of the Farsi version, most of the 25 Iranian women participants in the pretest phase reported problems with the format of the response scale. They suggested that "not at all true" to "very true" (rather than the original "strongly disagree" to "strongly agree") made more sense for the perceived severity, susceptibility, benefits, and barriers subscales. Similarly, they felt that "never" to "always" was better for the health motivation subscale (rather than the original "strongly disagree" to "strongly agree"). Therefore, these changes to the response options were made in the translated Iranian instrument (Taymoori & Berry, 2009). In the study conducted by Lee and Lee (2015), for the 5-point Likert scale (1=strongly disagree, 2=disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) options used for all the original health belief scales, the committee members had difficulty finding an equivalent Korean word conveying the same meaning of "neutral" to English. They found that one literature had translated "neutral" into Korean as "don't know." However, they consulted an expert in survey methodology who indicated that "neutral" means "in-between agree and disagree" and deemed it inappropriate to label the midpoint "don't know" or "no opinion." After searching for various published literature from South Korea that involved a 5-point Likert scale and used Korean words for "neutral", one Korean word meaning "so-so" was ultimately agreed upon by all translation committee members (Lee & Lee, 2015).

Deleting redundant or irrelevant items. According to the content deleted, it was categorized as deleting subscales and deleting items.

Deleting subscales. In the study conducted by Dewi (2018), to be updated with the recent revision of Health Belief Model, the authors removed the motivation dimension when adapting the original Champion's Health Belief Model Scale to Indonesian scale (Dewi, 2018). In another study, because most women perceived breast cancer as a serious threat (Lagerlund, Sparén, Thurfjell, Ekbom, & Lambe, 2000), the author decided not measuring the construct "perceived severity" in the translated Maltese instrument (Marmarà et al., 2017).

Deleting items. Some of the items in the studies were removed primarily due to redundancy, irrelevance, or a low content validity index at the item level (Juárez-García et al., 2019). In one study conducted among 200 Iranian women, the author deleted the item "I am too old to need a routine mammogram" in the subscale of perceived barriers, because the participants in the study were not old and their ages (mean age of the participants was 46.15 years with the range from 28 to 69 years old, SD=7.26) were less than the participants in the original study carried out by Champion (aged 50 years old and over) (Hashemian et al., 2013). Also, the item "People doing mammograms are rude to women" was eliminated with the suggestion of women participating in the discussions and with consultation with the expert panel because the statement lacked compatibility in Iranian culture. Participants believed that the sense of shame prevents receiving mammography instead of the issue of obscenity. Furthermore, the item "I don't know how to go about doing a mammogram" was eliminated because the city was quite small (Hashemian et al., 2013). In another study, two items, "Breast cancer will last for a long time" and "I expect to have breast cancer for the rest of my life", were removed from the cancer timeline domain because they were found to confuse the Maltese participants and cause consistent heightened anxiety in responders (Marmarà et al., 2017). Also, one item, "a mammogram prior to breast screening" from the lifetime mammography use domain was deleted to avoid overlap (Marmarà et al., 2017).

Expanding the original instrument. It included adding subscales and adding items.

Adding subscales. In one study, to be updated with the recent revision of Health Belief Model Scale, which included cues to action and self-efficacy, the author added items representing those two dimensions in the translated Indonesian instrument (Dewi, 2018). In another study, the authors added sociodemographic and socioeconomic factors as well as lifetime mammography use in the translated Maltese instrument to acknowledge these factors' contributions as breast screening determinants because they thought using Health Belief Model Scale often failed to address contextual constraints such as low income and education level that may influence women's screening behavior (Marmarà et al., 2017). Also, the panel further added cues to action (such as physician recommendations and family history) which was often omitted from empirical studies when using the Health Belief Model Scale (Marmarà et al., 2017). In another study, the researcher developed and added two sections to the translated Malaysia instrument, i.e., "benefits of clinical breast exam" (four items) and "barriers to clinical breast exam" (six items), because the original instrument did not have beliefs regarding clinical breast examination (Parsa et al., 2008).

Adding items. In one study, the authors added four items which were thought to be appropriate to Turkish culture (cost, fatalism, preference for female healthcare professionals, and distance from the health center) to the barrier subscale (Guvenc et al., 2011). In another study, one item, "I am more likely than the average woman to get breast cancer", was added to the adapted Iranian instrument per expert panel's suggestion regarding the special features of the participants in the study who had the history of breast cancer in their family. The author added this item also because the item was maintained in the previous version of Champion's questionnaire (Hashemian et al., 2013). Furthermore, four items were added: "I don't know where to go for the test of mammography"," I don't have any problem in my breasts, I don't need doing the test of mammography", " I do self-examination of the breasts, there is no need for doing the test of mammography", and "I don’t have enough money to do the test of mammography" were added to the subscale of perceived barriers per participants’ discussion (Hashemian et al., 2013). In another study conducted among 612 Mexican women, two items concerning awareness of the age and frequency at which mammograms should be undertaken were added to the self-efficacy subscale. Additionally, upon experts’ evaluation of the items’ adequacy, compatibility, and relevance, two items concerning myths were added to the barrier subscale, two items concerning risk factors for cancer were added to the susceptibility subscale, and one item on drug use avoidance was added to the health motivation subscale (Juárez-García et al., 2019). In another study conducted among 519 female university students and employees in Jordan, the consultant radiologist from the expert panel suggested the addition of one item related to women’s fatalistic beliefs as a barrier to the practice of breast screening examination, so the item “If I get sick with breast cancer, I believe this is my fate and practicing breast screening examination will not change my fate regardless of when the tumor is detected.” was added to the translated Jordanian barriers scale (Mikhail et al., 2001).

Changing the order of items. Although this strategy was reported in the literature (Survey Instrument refinement, n.d.), there is no report about this strategy used in the literature found in this study.

Debate solution strategies. When a debate was risen and the consistency was not able to be reached on the translated items among the panel members, strategies including consultation with experts or literature search, following the majority, and consultation with the author who developed the scales were used to help reaching consensus.

Consultation with experts or literature search. In the study conducted by Lee and Lee (2015), when the primary investigator and translation committee members encountered difficulty reaching a consensus on translation, they sought guidance from either an expert or literature published in both Korean and English to solve the dispute (Lee & Lee, 2015).

Following the majority. In one study, a debate concerning the terms used for marital status ensued over the comment from an expert panel member. The expert did not believe that every Hispanic would understand estado civil to mean marital status. However, a consensus was reached by the majority of the panel, so the term, estado civil, was used in the translated instrument (Medina-Shepherd & Kleier, 2010).

Consultation with the author who developed the scales. When meanings of the items in the original scale were not stated clearly, consulting with the author who developed the scales may help to clarify the confusion. In a study conducted with Korean Americans, some participants did not understand the meaning of the term "privacy" in the barrier items. Participants reported that it was difficult to understand the relationship between privacy and the stool blood test. Hence, the primary investigator consulted with the author who developed the barrier scale. The author clarified that the term privacy related to the ability to conduct the fecal occult blood test alone at home, e.g., someone in a large family may have only one bathroom and be unable to take the required amount of time to perform the test, indicating a lack of privacy. The primary investigator and translation committee members discussed this item and decided to rephrase the item in Korean as "It is hard to use a bathroom alone, which would keep me from having a fecal occult blood test" (Lee & Lee, 2015).

Validation Methods

The validation process is a process aimed to validate the instrument in the target population, which was usually measured by the validity and reliability. The SPSS software was commonly used for the data analysis. Construct validity and internal consistency reliability were the most frequently used analysis methods. Other frequently used tests were test-retest reliability and item-total subscale correlations. Some of the studies also used the analysis of content validity, face validity and predictive validity.

Content validity. Two of the 19 studies reported the content validity of the revised instrument (Dewi, 2018; Wu et al., 2020). The content validity was measured by the content validity index, which was evaluated through the expert panel discussion. Also, the expert panel assessed and commented the suitability, reasonability, logical sequence, conciseness, and comprehensiveness of the items (Dewi, 2018).

Discussion

The Lung Cancer Screening Health Belief Scale was originally developed to evaluate health beliefs toward lung cancer screening among U.S. population (Carter-Harris, Slaven, et al., 2017). Although it was proved to be a valid and reliable instrument to be used in U.S. population, however, using this instrument in another culture required a cultural adaptation of the instrument. In the original Lung Cancer Screening Health Belief Scale, two important constructs included in the Health Belief model (perceived susceptibility and cues to action) were lacking. In addition, wordings of the items and additional items related to the perceived barriers, benefits, severity, and self-efficacy need to be modified/added to the original Lung Cancer Screening Health Belief Scale.

Culturally adapting the Lung Cancer Screening Health Belief Scale to be used among Chinese Americans is a cost-efficient and time-saving choice (Chang & Chau, 1999). Current research evidence related to the health beliefs of lung cancer screening among Chinese Americans is lacking. Using a valid and reliable instrument to evaluate Chinese Americans' health beliefs toward lung cancer screening can help health care providers to promote and design effective lung cancer screening programs to increase the uptake rate of lung cancer screening and eventually decrease the mortality rate of lung cancer among Chinese Americans.

Cross-cultural instrument adaptation included three steps: translation, modification, and validation. Translation is essential when a study's goal is to reference a construct across cultures (Karayurt & Dramalı, 2007). To translate an instrument, the language barriers and cultural differences should be considered (Beaton et al., 2000; Gozum & Aydin, 2004). Also, the investigators must have knowledge of the instrument-evaluated disease and the related customs, beliefs, and practices of the target population (Gozum & Aydin, 2004).

Translating a questionnaire for multicultural research requires more than just literal word conversion. Direct and simple translation of a validated instrument may not result in a culturally equivalent version in the target language (Hayes-Bautista & Chapa, 1987). The word-by-word translation can result in awkward language and incomprehensible meaning in the target language. Therefore, changes and adaptation of the items in the source language may be necessary to achieve conceptual equivalence in the target language.

Although there have been no consistent criteria established for translation of research instruments, the method most-commonly used was back-translation, which included the use of a panel of experts and interpreters to translate the items from the source language to the target language and then back-translate them to the language of origin (Brislin, 1986; Chapman &

Carter, 1979). The translators and back-translators worked independently and then reviewed the product together (Brislin, 1986). The main goal of back-translation was to ensure that items in the two languages had equivalent meanings.

To increase the equivalency of the items between the translated and original instruments, ideally, measurement of the concepts should be done from the perspective of the culture under investigation. A bilingual/bicultural team with researchers indigenous to the culture was the optimal choice. It allowed for collaborative decision making about the concepts addressed in the instrument (Medina-Shepherd & Kleier, 2010). Also, to make the translated instrument culturally appropriate, researchers must use words that are preferred and commonly used by the target population. If appropriate attention is not given to the choice of words, the translation may be meaningless to the participants from the target population and accurate responses might not be obtained (Bravo, Canino, Rubio-Sitpec, & Woodburry-Farina, 1991). Furthermore, in some studies, professional translators translated the instrument. Although the translations prepared by translators were correct, however, the targeted group may not understand some words or phrases in the translations. Therefore, to judge the equivalency and cultural relevance of the translation, it was recommended that the translation be examined by a group of judges represented of the target population or ‘focus groups’ that were bilingual, or typical of the target population (Chen & Boore, 2010; Hilton & Skrutkowski, 2002; Yilmaz & Sayin, 2013).

Modification is the second step in the cross-cultural instrument adaptation process. It is an essential step to reach the cultural equivalency of the instrument. According to Medina-Shepherd and Kleier (2010), the validity of studies using translated instruments without the process of modification may be problematic. As the translation methodology progressed, more attention should be given to the modification of instruments. The researcher's emphasis should place on procedures for determining equivalence between the primary and secondary language of the instrument (Medina-Shepherd & Kleier, 2010).

Compared to the embedded modification, afterward modification appears to be a better method to be used because both the translated and back-translated versions of instruments can be checked by the expert panel and focus group judges. It was the most frequently used modification method in previous studies. It can ensure the culturally equivalent of the translated and original versions of instruments, thus increase the reliability of the instrument.

Validation is the last step in the cross-cultural adaptation process. After completing the translation and modification of the research instrument, researchers should do psychometric testing on the instrument. Translation and modification may change the internal structure of the instruments and require that validity and reliability be established for the revised instrument. According to Parsa et al. (2008), the target-language version should be tested as a new instrument. The translated version will be considered equivalent to the source tool if its reliability and validity are found to be similar with those of the source language instrument (Mikhail & Petro-Nustas, 2001).

Construct validity was one of frequently used validation tests in the literature. The construct validity was often tested by confirmatory factor analysis, exploratory factor analysis and principal component analysis. Differences existed among these three analysis methods.

In summary, cross-cultural adaptation of the Lung Cancer Screening Health Belief Scale is cost-efficient and less time consuming compared to a newly developed one. Three steps including translation, modification and validation were often used to cross-culturally adapt the scale. The theoretical framework to guide the adaptation of the Lung Cancer Screening Health

Belief Scale is the Health Belief Model. The original Lung Cancer Screening Health Belief Scale was also developed based on the Health Belief Model. In next chapter, the constructs in the Health Belief Model will be discussed. The application of Health Belief Model in this study will also be further explained.

Appendix A

Table 1. Study Characteristics for Studies Included in the Literature Review Part I

Citation	Design	Purpose	Sample & Setting	Data Analysis Method
Al-Naggar et al., (2013)	Cross-sectional survey, descriptive study	To determine knowledge about lung cancer among this population.	• Sample: 150 secondary male teachers from three secondary schools; randomized sampling method • Sample characteristics: Age: 23-50 years old, mean=35.6 52% Malay, 79% married • Setting: Kudat, Sabah, Malaysia	• Independent variables: socio-demographic characteristics • Dependent variable: general knowledge of lung cancer. • Data were analyzed using ANOVA and t-test for univariate analysis and multiple linear regression for multivariate analysis.
Bui et al., (2018)	Secondary data analysis study	To examine Korean males' intentions to screen lung cancer with low dose computed tomography and to determine factors correlated with their lung cancer screening intentions.	• Sample: 1,730 male participants were selected from the 2015 Korean National Cancer Screening Survey; stratified multistage random sampling method • Sample characteristics: Age: 40- 74 years old, 58.7% aged 40-54 years old; 92.6% married; 58.1% had six to 12 years education; 99.1% had private health insurance; 65.2% were current smokers; 16.8% were former smokers. Total smoking years in former and current smokers ranged from 31.9 to 42.8 pack-year. • Setting: Korea	• Data were analyzed using descriptive statistics and univariate logistic regression methods.
Lu et al., (2018)	Quantitative survey, descriptive	To explore the relationship between demands for lung	• Sample: 823 participants from eight communities • Sample characteristics: Age 40-69 years old; 55.7% female; 75.9% had less than 10 years of education; 95%	• Independent variables: socio-demographic variables, perceived risk to cancer,

	study	cancer screening and the constructs derived from the Health Belief Model.	had one or more types of health insurance. • Setting: Hefei, China	perceived severity of the condition, perceived effectiveness of cancer screening, perceived benefits of cancer screening, and perceived difficulties to taking cancer screening. • Dependent variable was demand index for lung cancer screening. • Data were analyzed using descriptive and multivariate regression analysis.
Nhung et al., (2015)	Quantitative survey, descriptive study	To assess Korean males' intentions to receive lung cancer screening before and after being informed about exposure to radiation during the screen and to identify factors influenced their intentions.	• Sample: 414 male participants who received any cancer screening test within the last 2 years were randomly selected from the 2013 Korean National Cancer Screening Survey. • Sample characteristics: 50% were current smokers; 10.6% had received lung cancer screening within the past 2 years; 94.2% were married; 59.7% had a high school graduate education level; 37.9% aged between 50 and 59 years old. Age: 40-74 years old. • Setting: Korea	• Data were analyzed by STATA software using Chi square, Fisher's exact test, unconditional univariate, and multivariate logistic regression.
Ren et al., (2014)	Quantitative survey, descriptive study	To investigate the awareness level of lung cancer prevention and control, and to identify the association	• Sample: 1,633 Chinese who worked at the Tianjin Dagang Oil Field; cluster randomized sampling method • Sample characteristics: All the respondents previously completed low dose computed tomography lung cancer screening. Mean age of the respondents was 60.08 years	• Independent variables: demographic variables, smoking history (pack-year), and prior tuberculosis history. • Dependent variables: lung

		between individual characteristics and lung cancer awareness.	old; 82.2% of the participants were males; 41.2% participants had an education level equal to middle school; 71.4% participants had a smoking history that was more than 30 pack-year; over 80% participants had alcohol drinking history; and 19.5% participants had a family history of cancer. • Setting: China	cancer awareness and health examination willingness. • Data were analyzed using descriptive and multiple logistic regression analysis methods.
Scott et al., (2014)	Qualitative study	To explore knowledge, attitudes, and beliefs about lung cancer among Chinese, Vietnamese and Arabic-speaking communities.	• Sample: 7 focus groups (N = 51) with 13 females and 38 males aged between 44 to 65 years old • Sample characteristics: 3 groups consisted of non-smokers (Cantonese, Vietnamese, and Arabic-speaking groups) and 4 groups were current smokers (Cantonese, Mandarin, Vietnamese, and Arabic-speaking groups). In Mandarin, Cantonese, and Vietnamese-speaking focus groups, all the current smokers were male. The other 4 groups included a mixture of males and females (Cantonese, Vietnamese, and Arabic- speaking smoker and non-smoker groups) in each group, with the number of males versus females ranged from 3 to 5. • Setting: Sydney, New South Wales	• Translated summaries were analyzed using Strauss and Corbin's systematic approach, which incorporated thematic analysis and initial theoretically sensitive coding, axial coding, and secondary coding together.
Sin, Ha, & Taylor., (2016)	Qualitative study	To explore facilitators of and barriers to lung cancer screening with 24 Korean immigrant men in the U.S.	• Sample: 5 focus groups and 9 individual interviews with 24 Korean men; convenience sample. • Sample characteristics: Korean immigrants, be able to speak Korean, aged 55–79 years old, had a 30 pack-year smoking history, and were current smokers or former smokers who had stopped smoking within the past 15 years. While men with a history of low dose computed	• Data were transcribed verbatim in Korean, translated into English, and analyzed by content analysis method.

		tomography were included, men with a history of lung cancer were excluded. 88% were married; 50% were retired; 63% had a more than high school education. Age 55-79 years old; mean= 69 years old; and the average age when they moved to the U.S. was 40 years old. • Setting: Korean churches, senior centers and the Korean Women's Association, Washington State, U.S.	

Appendix B

Table 2. Study Characteristics for Studies Included in the Literature Review Part II

Citation	Setting	Translation method	Modification method	Validation method
Dewi, 2018	Indonesia	• back-translation • using professional translators	• afterward modification • Modification strategies: Rephrasing the word in the items; deleting subscales; adding subscales.	• construct validity • internal consistency reliability • content validity
Gozum & Aydin, 2004	Turkey	• back-translation • using professional interpreters and/or involving the first author	• embedded modification	• construct validity • internal consistency reliability • item-total subscale correlations
Guvenc et al., 2011	Turkey	• back-translation • using bilingual individuals	• afterward modification • Modification strategies: Adding items	• construct validity • internal consistency reliability • test-retest reliability
Hashemian et al., 2013	Iran	• back-translation • using professional translators	• afterward modification • Modification strategies: Deleting parts of the sentences in the item； deleting items; adding items	• construct validity • internal consistency reliability • test-retest reliability
Juárez-García et al., 2019	Mexico	• back-translation • using professional translators	• afterward modification • Modification strategies: Changing the response options; deleting items; adding items	• construct validity • internal consistency reliability • item-total subscale correlations

Karayurt & Dramalı, 2007	Turkey	• back-translation • using bilingual individuals	• embedded modification • Modification strategies: Rephrasing the word in the items.	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability • predictive validity
Kharameh et al., 2014	Iran	• back-translation • using professional translators	• embedded modification	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability
Lee et al., 2002	South Korea	• back-translation • using bilingual individuals	• afterward modification • Modification strategies: Rephrasing the word in the items.	• construct validity • internal consistency reliability • item-total subscale correlations
Lee & Lee, 2015	United States (Korean Americans)	• Committee translation	• afterward modification • Modification strategies: Rephrasing the word in the items; deleting parts of the sentences in the item; changing the response options	• construct validity • internal consistency reliability
Marmarà et al., 2017	Malta	• back-translation • using professional translators	• afterward modification • Modification strategies: Changing titles of the factors/subscales; rephrasing the word in the items; changing the subject of the items; deleting subscales; deleting	• construct validity • internal consistency reliability • test-retest reliability • face validity

			items; adding subscales.	
Medina-Shepherd & Kleier, 2010	United States (Hispanic women)	• back-translation • using professional interpreters and/or involving the first author	• afterward modification • Modification strategies: Rephrasing the word in the items.	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability.
Mikhail & Petro-Nustas, 2001	Jordan	• back-translation • involving bilingual investigators	• embedded modification • Modification strategies: Minor changes in the wording of the items; adding items	• construct validity • internal consistency reliability • predictive validity
Parsa et al., 2008	Malaysia	• back-translation • using bilingual individuals	• afterward modification • Modification strategies: Adding subscales.	• construct validity • internal consistency reliability • item-total subscale correlations
Secginli & Nahcivan, 2004	Istanbul	• back-translation • using bilingual individuals	• afterward modification • Modification strategies: Rephrasing the word in the items.	• construct validity • internal consistency reliability • item-total subscale correlations
Taymoori & Berry, 2009	Iran	• back-translation • using professional translators	• afterward modification • Modification strategies: Rephrasing the word in the items; deleting parts of the sentences in the item; changing the subject of the items; changing the response options	• construct validity • internal consistency reliability • item-total subscale correlations
Tsangari &	Cyprus	• back-translation	• embedded modification	• construct validity

Petro-Nustas, 2012		• involving bilingual investigators	• Modification strategies: Minor changes in the wording of the items.	• internal consistency reliability • predictive validity
Wu et al., 2019	China	• back-translation • using professional interpreters and/or involving the first author	• afterward modification • Modification strategies: Detailed information was not provided	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability • content validity
Yilmaz & Sayin, 2013	Turkey	• back-translation • using professional translators	• afterward modification • Modification strategies: Rephrasing the word in the items; deleting parts of the sentences in the item.	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability
Zelviene & Bogusevicius, 2007	Kaunas	• back-translation • using bilingual individuals	• afterward modification • Modification strategies: Rephrasing the word in the items; deleting parts of the sentences in the item.	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability

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Chapter 3: Theoretical Framework

Lung cancer screening with low dose computed tomography is a relative new recommendation for high-risk smokers to detect lung cancer at an early stage. Although it has been proven to decrease the mortality rate of lung cancer by 20% compared with chest X-ray detection (Aberle et al., 2013), the uptake rate of lung cancer screening is quite low among high-risk smokers (Jemal & Fedewa, 2017). To explain the low uptake rate of lung cancer screening, health behavior theories focusing on the utilization of health services could be used to help understanding health behaviors related to lung cancer screening. Four health behavior theories are frequently used, including the Health Belief Model, the Transtheoretical Model, Theory of Planned Behavior, and Precede-Proceed Theory.

One of the most frequently used health behavior models, Health Belief Model (HBM), is a social psychological model developed to explain and predict health-related behaviors, particularly related to the health beliefs toward the uptake of health services (Janz & Becker, 1984). More details about the HBM could be found in the later section of this chapter.

Health Belief Model

The theoretical framework used to guide this study is the Health Belief Model (HBM) (Appendix A). The HBM is a social cognition model focusing on health behavior change (Ajzen, 1998). It originated from psychological science (Brink, 1999), and was developed in the 1950s by Rosenstock, Hochbaum, Kegeles, and Leventhal, four social psychologists at the United States Public Health Service Organization (Carpenter, 2010; Glanz, Rimer, & Viswanath, 2008). Amendments to the model were made in the late 1980s to incorporate emerging evidence about the role of self-efficacy in decision-making and health behavior (Glanz et al., 2008).

The HBM is one of the most frequently used theories in health promotion, disease prevention, and health education (Brink, 1999). It was initially developed to explore the reasons of the widespread failure of tuberculosis screening programs. Later, it was used for predicting and explaining health-related behaviors, especially for the utilization of health services (Siddiqui, Ghazal, Bibi, Ahmed, & Sajjad, 2016). For more than half a century, the model has been widely used in various studies to understand patients' responses to symptoms of disease, lifestyle behaviors (e.g., sexual risk behaviors), compliance with medical regimens, and behaviors related to chronic illnesses, which may require long-term behavior maintenance in addition to initial behavior change (Janz & Becker, 1984). More recently, it has been applied to understand health behaviors including HIV prevention (condom use), patient safety promotion, disease screening, etc. (Tarkang & Zotor, 2015). The HBM provides organized assessment concepts related to individuals' abilities and motivations to change their health statuses. Both primary and secondary prevention health education and intervention programs can be developed based on the HBM to better fit the needs of individuals (Glanz & Bishop, 2010).

Concepts of Health Belief Model

The key concepts of HBM are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (Glanz et al., 2008).

Perceived Susceptibility.

Theoretical definition. Perceived susceptibility is individuals' subjective beliefs on the risk of getting a disease (Glanz et al., 2008), which refers to how strongly people believe that they are susceptible to the disease (Glanz et al., 2008).

Operational definition. In this study, perceived susceptibility refers to eligible Chinese American high-risk smokers' perception on their possibility to get lung cancer.

Perceived Severity.

Theoretical definition. Perceived severity is personal evaluation of the seriousness of the consequences related to a disease, which refers to individuals' perception on whether the disease will have serious effects on their lives if they contract it (Glanz et al., 2008). Perceived severity includes beliefs about the medical consequence caused by the disease itself (e.g., whether it is life-threatening or may cause disability or pain) as well as broader impacts of the disease on the function of work and social roles (Glanz et al., 2008).

Operational definition. In this study, perceived severity refers to eligible Chinese American high-risk smokers' evaluations of the impact of lung cancer on their future lives.

Perceived Benefit.

***Theoretical definition*.** Perceived benefit is people' s assessment of the value to take the advised action to reduce risks or seriousness of diseases (Glanz et al., 2008).

Operational definition. In this study, it refers to eligible Chinese American high-risk smokers' perceptions on the beneficial outcomes of screening lung cancer with low dose computed tomography, such as early-stage diagnosis of lung cancer.

Perceived Barrier.

Theoretical definition. Perceived barrier is people's belief about the negatively valued aspects of taking the action, which is the obstacle to the behavior change (Glanz et al., 2008). Perceived barriers to health behaviors include internal factors such as physical barriers, psychological barriers, and personal characteristics, as well as external factors such as accessibility factors, cost, and inconveniences (Agha, Karlyn, & Meekers, 2001; Rosenstock, Strecher, & Becker, 1988).

Operational definition. In this study, perceived barrier refers to eligible Chinese American high-risk smokers' perceptions on the barriers of screening lung cancer with low dose computed tomography, such as financial cost.

Self-efficacy.

Theoretical definition. Self-efficacy was first introduced by Bandura (Glanz et al., 2008). It was added to the HBM in the late 1980s to better explain individual differences on health behaviors (Glanz et al., 2008). It refers to the belief that one can achieve the outcome by changing health behavior (Glanz et al., 2008). Self-efficacy is individuals' own confidence in personal ability to successfully taking actions by responding to unfamiliar or difficult situations and dealing with any associated setbacks or obstacles. It is the self confidence that motivates individuals to initiate and maintain the actions.

Operational definition. In this study, self-efficacy refers to eligible Chinese American high-risk smokers' confidence to screen lung cancer with low dose computed tomography.

Cues to Action.

Theoretical definition. Cues to action refers to the strategies used to activate one's readiness to taking actions. It serves as the catalyst for the decision-making process. It includes events or experiences, personal, interpersonal, or environmental factors that motivate a person to taking actions (Glanz et al., 2008), such as advices from health care providers, health information from family members and friends, advertising, symptoms of illness, etc. (Bartholomew, Parcel, Kok, & Gottlieb, 2006; Glanz et al., 2008). Cues to action can be internal or external (Glanz et al., 2008). An example of internal cues to action is the physiological cues from individual body (e.g., pain, symptoms) (Glanz et al., 2008). External cues include information or events from close others, health care providers, or social media promoting engagement in health behaviors (Glanz et al., 2008).

Operational definition. In this study, cues to receive lung cancer screening with low dose computed tomography may come from a symptom of lung cancer, screening information from social media, education from health care provider, etc.

Components of Health Belief Model

The HBM includes three major components: 1) Individual's perceived threat of health. It includes individual's health beliefs about his own susceptibility to and the seriousness of the illnesses (Onega, 2000). In this study, individuals' perceived threat of health refers to eligible Chinese American high-risk smokers' beliefs about their susceptibility to and perceived severity of lung cancer; 2) The perceived net benefit of taking preventive measures (Onega, 2000). The perceived net benefit of implementing a specific health-oriented action includes the perceived benefits and barriers to take the action (Onega, 2000). It affects a person's attitude towards the action. In this study, it refers to eligible Chinese American high-risk smokers' perceived net benefit of screening lung cancer with low dose computed tomography; and 3) The modifying factors. The modifying factors include structural, socio-psychological, and demographic factors (Onega, 2000). Structural factors include knowledge and consultation service, etc. (Glanz et al., 2008). Socio-psychological factors include social class, personality, etc. (Glanz et al., 2008). Demographic factors include age, gender, race, ethnicity, education, etc. (Glanz et al., 2008).

Relationships Among Concepts of Health Belief Model

The HBM include crucial concepts that could facilitate or hinder eligible Chinese American high-risk smokers' motivation to screening lung cancer with low dose computed tomography. It describes that if individuals perceive their susceptibility to lung cancer are low, perceived the consequences of lung cancer are not serious, perceive the barriers to lung cancer screening are high, and perceive the benefits from lung cancer screening are limited, then the individuals may be less likely to receive lung cancer screening (Glanz et al., 2008).

For the perceived threat of health (perceived susceptibility and perceived severity), when eligible individuals recognize their possibility of getting lung cancer, it does not definitely motivate them to receive lung cancer screening with low dose computed tomography unless they realize that getting lung cancer would cause serious physical and social limitations to them (Glanz et al., 2008). It is when they realize the impact of the negative consequences of lung cancer that they could be motivated to screen lung cancer with low dose computed tomography to avoid the negative consequences (Glanz et al., 2008).

For the perceived net benefit of taking preventive measures (perceived benefits and perceived barriers), when making the decision to receive lung cancer with low dose computed tomography, eligible individuals will consider what they need to cost and what they will get from screening, as well as whether the benefit is worth the cost (Glanz et al., 2008). It is only when eligible individuals realize that the benefits of the action outweigh the barriers that they would prefer to take the action (Polit & Beck, 2004) of screening lung cancer.

For the modifying factors, possible structural, socio-psychological, and demographic factors could indirectly affect (Glanz et al., 2008) perceived severity and susceptibility of lung cancer as well as perceived benefits and barriers of lung cancer screening, thus hindering high-risk smokers' motivation to screening lung cancer. For example, if the eligible high-risk smoker is lack of knowledge about possible consequences of lung cancer, the individual may perceive it is not necessary to take lung cancer screening with low dose computed tomography to prevent the consequence of lung cancer, thus their actions of screening lung cancer may be hindered.

For the self-efficacy, eligible individuals may perceive there is a need for them to receive lung cancer screening with low dose computed tomography screening, however, they may lack of confidence to receive it, thus they may be stuck in a difficult struggling situation of whether receive lung cancer screening with low dose computed tomography, which may prolong or halt their behaviors of screening lung cancer.

Limitation of Health Belief Model

The HBM is one of the first theories developed to explain the process of health behavior change (Polit & Beck, 2004). Although it is one of best fitted theories in for the studies that aim to explain the utilization of health services (Siddiqui et al., 2016), it still has several limitations, including the concepts mainly focusing on individual variables (Janz & Marshall, 1984), not considering the impact of emotional factors on health-related behaviors (Glanz et al., 2008), and broadly defined theoretical constructs (Carpenter, 2010).

In addition, the HBM does not include other individual determinants that influence a person's acceptance of a health behavior, such as habitual behaviors (e.g., smoking) and behaviors that are performed for non-health related reasons (e.g., social acceptability) (Janz & Marshall, 1984). It also does not include environmental or economic factors that may prohibit or promote the recommended action (Janz & Marshall, 1984). Furthermore, the purpose of HBM is to describe and explain health-related behaviors but does not suggest strategies for changing health-related behaviors (Janz & Marshall, 1984). It may require an integration of other models to effectively promote health-related behaviors (Janz & Marshall, 1984).

The Contribution of Health Belief Model to Promote Lung Cancer Screening

Although limitations exist, the HBM can be used to develop effective interventions to promote high-risk population’s lung cancer screening behavior by targeting various aspects of the model's key constructs. Interventions based on the HBM may target to increase perceived susceptibility to and perceived severity of lung cancer by providing health education about incidence rate and mortality rate of lung cancer, estimated individual risk of lung cancer, and information about the medical, social, and financial consequences of lung cancer (Glanz et al., 2008). Interventions may also target to decrease perceived barriers and increase perceived benefits of lung cancer screening by identifying common perceived barriers, providing social support or other resources to encourage lung cancer screening, providing information about the benefits of screening lung cancer to reduce risk of lung cancer, and providing incentives to engage in lung cancer screening, thus decreasing the cost-benefit of engaging in lung cancer screening behavior (Glanz et al., 2008). Interventions based on the HBM may also provide cues to action to encourage and remind high-risk individuals to engage in lung cancer screening (Glanz et al., 2008). Furthermore, interventions may also target to build high-risk population's self-efficacy by providing guidance for lung cancer screening, such as helping to make an appointment for lung cancer screening, providing detailed information on the interpretation of lung cancer screening results, etc. (Glanz et al., 2008).

Lung Cancer Screening Studies Using the Health Belief Model as A Theoretical Framework

Although HBM has been applied to guide different cancer screening studies (e.g., breast cancer screening, colorectal cancer screening), lung cancer screening studies based on HBM in the U.S. are limited. In 2013, Park et al. (2013) conducted a qualitative telephone interview study among 35 high-risk U.S. smokers. The results showed that most participants perceived a high-risk of lung cancer and smoking-related diseases. They also perceived lung cancer and smoking-related diseases were very severe (Park et al., 2013). In 2016, Carter-Harris et al. (2016)

developed a conceptual model to illustrate individuals' perception about the decision-making process in lung cancer screening. Key psychological variables, such as stigma, medical mistrust, fatalism, worry, and fear, were added to the Health Belief Model and Precaution Adoption Process Model (Carter-Harris, Davis, & Rawl, 2016). In 2017, Cater-Harris et al. (2017) did a qualitative focus group study to explore long-term smokers' knowledge and beliefs about lung cancer and its associated risk factors as well as lung cancer screening. The study showed that the perceived benefits of screening included finding lung cancer early, giving peace of mind, and motivation to quit smoking, and the perceived barriers to screening included inconvenience, distrust, and stigma (Carter-Harris, Ceppa et al., 2017).

Limited research about lung cancer screening based on the HBM has been done in China/Chinese Americans. To date, only one study could be found on this topic. In 2018, Lu et al. (2018) did a cross-sectional survey in Hefei, China to explore the relationship between demands for lung cancer screening and the constructs derived from the health belief model. The results showed that 6.4% of the 823 respondents had ever undertaken lung cancer screening, and 60.1% of them expressed willingness to accept the service of lung cancer screening if it is free. Among the variables in the HBM, education displayed significant positive association with demands for lung cancer screening ($p = .044$), and most of the HBM constructs' indexes (perceived risk and severity of the cancer; and perceived benefits and difficulties of the screening) were statistically significant with demands for lung cancer screening ($p < .05$) (Lu et al., 2018).

Relationship of Health Belief Model to the Study

This study will adapt and validate the Lung Cancer Screening Health Belief Scale to be used in Chinese American population. The original Lung Cancer Screening Health Belief Scale was developed based on the Health Belief Model. Four subscales related to the constructs of perceived susceptibility, perceived barriers, perceived benefits, and self-efficacy were included in the original scale. To comprehensively evaluate the health beliefs toward lung cancer screening among Chinese Americans, this study will utilize the same theory used in the original study (Health Belief Model) to adapt the Lung Cancer Screening Health Belief Scale.

Cultural Differences Toward Lung Cancer Screening Related to the Health Belief Model

Although previous studies conducted among U.S. population and Asians/Asian Americans suggested several similar health beliefs toward lung cancer screening (refer to chapter 2), however, originated from countries with different cultures, Chinese Americans as a minority population may have different health beliefs toward lung cancer screening than the native Americans. The concerns about cost, fatalism, and radiation exposure fear as well as fear related to the screening test were more common among minority subjects than non-minorities (Jonnalagadda et al., 2012). In addition, as a population who spoke Mandarin as the official language, over half of Chinese Americans had low English language proficiency and low heath literacy (58%, 64.64%, respectively) (Li et al., 2018; Sentell et al., 2015), which may impact their ability to get access to the lung cancer screening service, obtain information or resources about screening lung cancer, receive support from social services or health care providers, etc. The barriers caused by the low English language proficiency and low health literacy may be negatively associated with up-to-date lung cancer screening behavior, similarly as the findings which were showed in previous studies conducted for cervical, colorectal and breast cancer screening (Li et al., 2018; Sentell et al., 2015). Furthermore, as a population group who had a long history and profound culture related to the tobacco, Chinese Americans' health beliefs toward tobacco smoking and lung cancer/lung cancer screening were quite different than those of

U.S. population. Previous studies showed that the perceived susceptibility and severity of lung cancer caused by smoking was not clearly understood by Asians/Asian American smokers (Bui et al., 2018; Scott et al., 2014). Also, while a negative relationship existed between smoking history and the perceived benefits of lung cancer screening among U.S. population (Silvestri et al., 2007), no relationship was found between perceived benefits of lung cancer screening and smoking history among Asian Americans (Bui et al., 2018). Guided by the HBM, these cultural differences toward the health beliefs of lung cancer screening will be further integrated to the original Lung Cancer Screening Health Belief Scale and adapted to be used in Chinese Americans.

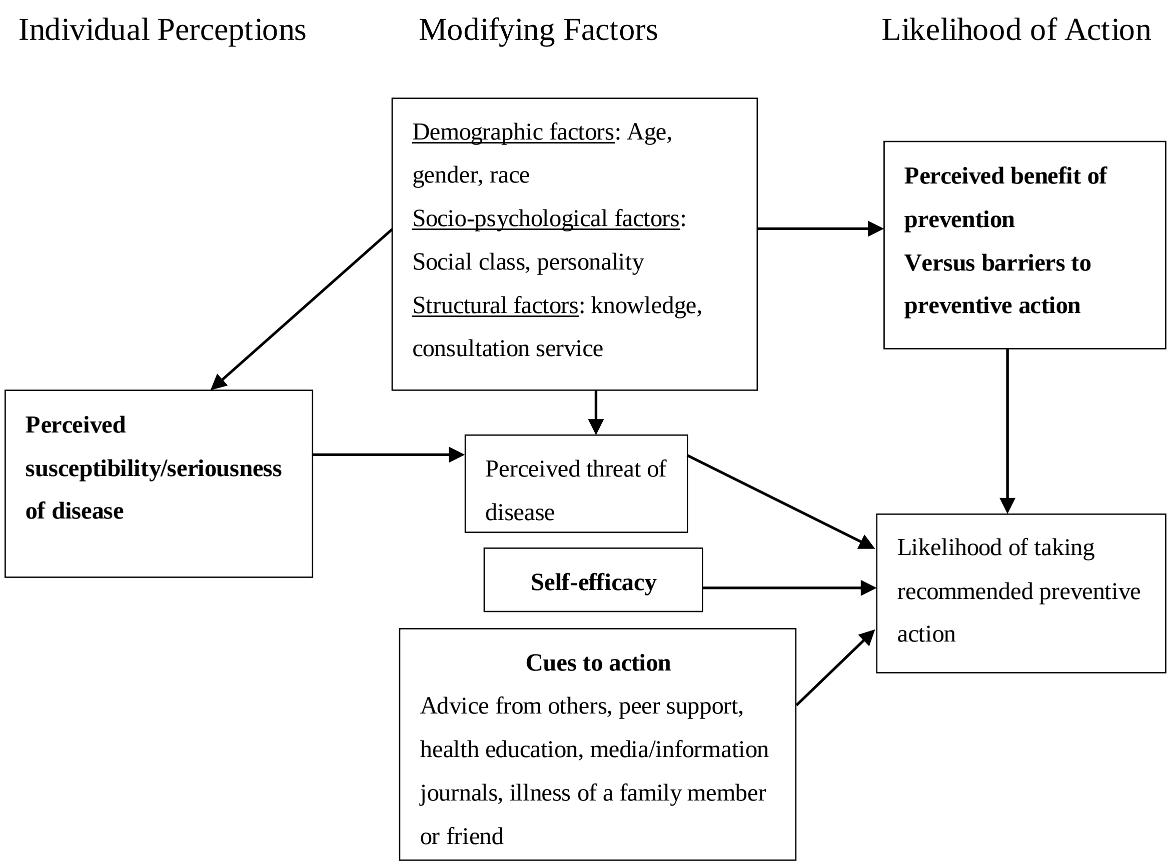
Theoretical Framework for Lung Cancer Screening Participation

The theoretical framework for lung cancer screening participation (Appendix B) used in this study was adapted from the Health Belief Model. The demographic factors related to age, gender, marital status, number of children, education level, income, health insurance status, religion, years moved to the U.S., years stayed in the U.S., employment, language usage and the six concepts in the Health Belief Model (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action) will be measured in the study.

The application of HBM in Chinese culture provides a potential possibility to change eligible Chinese American high-risk smokers' lung cancer screening behavior. More details about the methodology for utilizing the HBM to cross-culturally adapt the Lung Cancer Screening Health Belief Scale will be discussed in chapter 4.

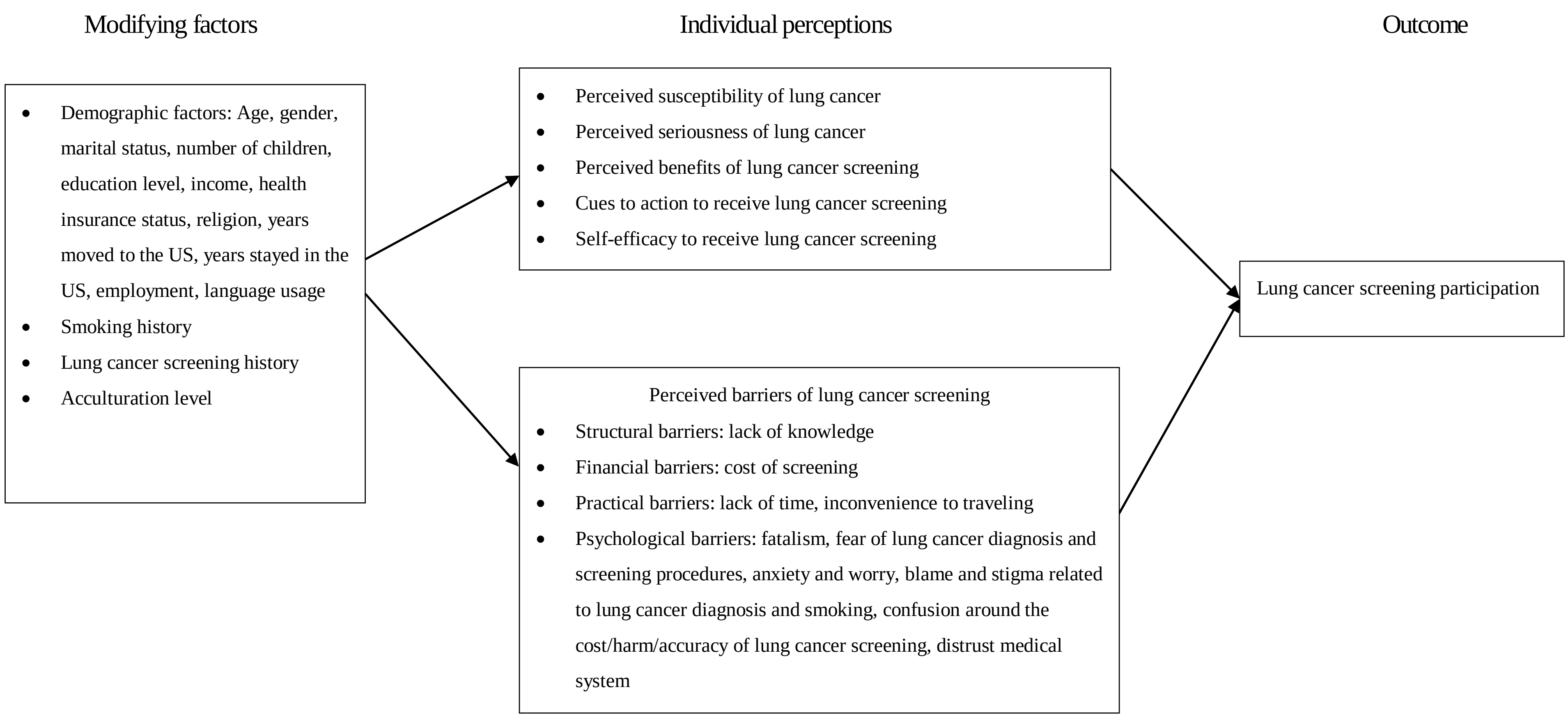
Appendix A

Figure 1. Conceptual framework of Health Belief Model



Appendix B

Figure 2. Theoretical Framework for Lung Cancer Screening Participation



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Chapter 4. Methods

This study is an instrument adaptation study guided by the Health Belief Model. The instrument translation and modification were conducted in the study. The Lung Cancer Screening Health Belief Scale was adapted to the Chinese version following the comprehensive literature review, instrument translation, expert review, and cognitive individual interviews procedure.

Comprehensive Literature Review

A comprehensive literature review about the health beliefs of lung cancer screening among Asians/Asian Americans and U.S. population was conducted. Findings were categorized by the constructs of the Health Belief Model (refers to chapter 2). Items in the original Lung Cancer Screening Health Belief Scale was compared with the findings from literature review by the primary investigator.

Original Lung Cancer Screening Health Belief Scale

The original Lung Cancer Screening Health Belief Scale is composed of four subscales, including perceived risk of lung cancer, perceived barriers of lung cancer screening, perceived benefits of lung cancer screening, and self-efficacy (Appendix A) (Carter-Harris, Slaven, et al., 2017). A total of 35 items are included in the overall scale, including three items for the perceived risk of lung cancer subscale, 17 items for the perceived barriers of lung cancer screening subscale, six items for the perceived benefits of lung cancer screening subscale, and nine items for the self-efficacy subscale. The perceived risk, perceived benefits, and perceived barriers subscales use four-point Likert-style responses with items ranging from strongly disagree to strongly agree (strongly disagree=1, strongly agree=4). The self-efficacy subscale uses four-point Likert-style responses with items ranging from not at all confident to very confident (not at all confident=1, very confident=4). Content validity of the scale was established by the total scale level content validity indexes (CVIs) ranging from 0.88 to 0.92 for the four subscales. Internal consistency reliability of the scale was estimated using Cronbach's alpha ranging from 0.80 to 0.92. Construct validity test of the scale showed a moderate model fit (four-factor model) with a Standardized Root Mean Square Residual (SRMR) value of 0.074 and a Root Mean Square Error of Approximation (RMSEA) of 0.087. Predictive validity test showed there were no significant differences between screeners and non-screeners for total perceived risk scores (6.55 vs. 6.51; p=0.84). However, significant differences were observed between groups for total perceived benefits, total self-efficacy, and total perceived barriers scores. Screeners had significantly higher total perceived benefits (18.07 vs. 16.68; p=.0016) and self-efficacy scores (30.38 vs. 28.55; p=.0012) as well as lower total perceived barriers (33.05 vs. 35.03; p=.0387) scores (Carter-Harris, Slaven, et al., 2017).

Modification of the original Lung Cancer Screening Health Belief Scale

Permission for using the Lung Cancer Screening Health Belief Scale for translation, modification, and application had been obtained from the first author of the Lung Cancer Screening Health Belief Scale (October 1, 2018) (Carter-Harriers et al., 2017). According to the findings from the literature review (refers to chapter 2), wordings of the original items such as "It is likely that I will get lung cancer sometime in my lifetime." were modified to "It is likely that the smokers who smoke as much as I will get lung cancer sometime in his lifetime". In addition, items with similar meanings such as "How confident are you that you can get a lung scan even if you are worried about the results?" and "How confident are you that you can get a lung scan even if you are anxious about the results?" were further discussed and the redundant items were deleted for the modified version.

Items for the perceived severity subscale added to the Lung Cancer Screening Health Belief Scale

The items added to the perceived severity of lung cancer subscale derive from the existed scale measuring perceived severity of breast cancer. Items in the perceived severity subscale of Champion's Health Belief Model Scale (Appendix B) were revised and adapted to fit the context of lung cancer screening among Chinese Americans. The perceived severity subscale of Champion's Health Belief Model Scale (Champion, 1993) has seven items. All items are scored on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The severity scale has demonstrated good reliability with Cronbach's alpha of 0.80 (Champion, 1993). Items such as "The thought of breast cancer scares me" were revised to "The thought of lung cancer scares me" by fitting the lung cancer screening context. In addition, items such as "Breast cancer would threaten my relationship with my husband" were revised to "Lung cancer would threaten my relationship with my family members" to address an expanded impact of lung cancer among family members.

Items for the cues to action subscale added to the Lung Cancer Screening Health Belief Scale

Items evaluating cues to action of lung cancer screening were added to the original Lung Cancer Screening Health Belief Scale based on existed scale measuring cues to action of colorectal cancer screening (Lee, 2019) (Appendix C). The cues to action of colorectal cancer screening scale has six items. All items are scored on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Lee, 2019). It demonstrated good reliability with Cronbach's alpha of 0.80 (Lee, 2019). Items measuring external cues to action such as "If a doctor recommends colorectal cancer screening, I will have it" as well as internal cues to action such as "If I have symptoms of colorectal cancer, I will have it" (Lee, 2019) were revised to "If a doctor recommends lung cancer screening, I will have it" and "If I have symptoms of lung cancer, I will have it" by fitting the lung cancer screening context.

Procedures for the pre-modification based on the literature review

A table was created with all the reworded, added, and deleted items of the subscales by the primary investigator. Rationales for the rewordings as well as added and deleted items were included in the table as well. The table were submitted to the committee to review and approve. An initially modified Lung Cancer Screening Health Belief Scale (English version 1) was generated after the process.

Instrument Translation

The initially modified Lung Cancer Screening Health Belief Scale (English version 1) was translated using a backward translation method, which included forward translation and backward translation of the instrument.

Forward translation

The initially modified Lung Cancer Screening Health Belief Scale (English version 1) was translated to Chinese version independently by the primary investigator of the study and a bilingual Registered Nurse who is also a bilingual nurse researcher. The two versions of the translated scales were compared by them for any discrepancies between them. Intensive discussions were held to reach consistency between the two translated versions. Any unsolved discrepancies were included in a table and submitted to the committee for further discussions. An initial Chinese version of Lung Cancer Screening Health Belief Scale was obtained (Chinese version 1) after reaching the consistency between the primary investigator and the bilingual physician.

Backward translation

Two bilingual doctoral-prepared nurse researchers independently back-translated the Chinese version of Lung Cancer Screening Health Belief Scale (Chinese version 1) to English. The two nurse researchers have a medical nursing education background and have some prior work experience with the scale translation. They independently back translated the Chinese version 1 of Lung Cancer Screening Health Belief Scale to the original language (English). The two versions of back-translated Lung Cancer Screening Health Belief Scale were compared for any discrepancies by them. Discussions were held by them until consistency of the items was reached. The primary investigator compared the back-translated Lung Cancer Screening Health Belief Scale and initially modified Lung Cancer Screening Health Belief Scale (English version 1) to check the clarity of the items. The primary investigator consulted the committee members about the inconsistencies between the two versions. Discussions were held with the committee members for reaching consistency between the two versions. Necessary modifications to the scales were made upon the committee members' recommendations. An initially modified Lung Cancer Screening Health Belief Scale (English version 2 and Chinese version 2) was generated after the process.

Instrument Modification

The instrument modification included expert review by five bilingual experts and cognitive individual interviews with nine Chinese American participants who were high-risk current or former smokers. These numbers were determined by the evidence from literature review and supported by the data saturation in the data analysis process.

Expert review

The initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) and the initially modified Lung Cancer Screening Health Belief Scale (English version 2) were given to five bilingual experts to review via email. The experts have specialized expertise in the areas of cancer nursing or cross-cultural research. The experts include cancer nursing care experts, instrument refinement experts, and the cancer research experts who know Chinese culture well.

Recruitment. To recruit experts for the instrument review, connections with bilingual cancer research experts, cross-cultural research experts, and cancer nursing care experts were obtained through a Wechat group which includes 284 group members. The group is composed of nursing educators, researchers and registered nurses from China living around the world. Most of the members in the group are bilingual and have a PhD degree in Nursing field. In addition, the primary investigator searched Nursing researchers' information through PubMed and Google Scholar databases. Invitations to review the instruments were sent to the experts through emails and Wechat app. Follow up emails and Wechat messages were sent three days after the initial invitation to increase response rate of the invitation.

Procedures. After obtaining agreement to review the instruments from the experts, the primary investigator sent the modified Lung Cancer Screening Health Belief Scale (English version 2), the initially modified Chinese version of Lung Cancer Screening Health Belief Scale (Chinese version 2), expert review form, and content validity scale to the experts. The experts provided comments to the modified Lung Cancer Screening Health Belief Scale (English version 2 and Chinese version 2) and determined the clarity, relevance, appropriateness, and representativeness levels as well as cultural appropriateness of the two-language version tools.

Follow-up emails were sent one week after the initial emails regarding the reviewing materials. After receiving responds to the instrument review from the experts, a thank-you e-card and a small amount of reward were emailed to the experts for compensating their time for the review. Upon receiving all the comments from the experts, a comprehensive evaluation of the comments was conducted. Suggestions from the experts' comments were discussed among the primary investigator and the committee members. In addition, the item-level content validity index (I-CVI) and the scale-level content validity index (S-CVI/UA) were calculated. More information on the calculation methods can be found in the data analysis section of this chapter. The primary investigator reviewed I-CVIs lower than 0.79 and S-CVIs/UA lower than 0.80 to consider item revision and/or deletion (Polit & Beck, 2006). A table was created with the synthesized information on the experts' suggestions, comments and potential modifications for the items which have a low I-CVI and low S-CVI/UA. It was submitted to the committee to review and approve. The items were ultimately modified based on committee members' recommendations. Agreed-on recommendations were applied to revise the modified Lung Cancer Screening Health Belief Scale (English version 2 and Chinese version 2).

Instruments.

Expert review form. The expert review form is a form designed by the primary investigator to collect the experts' comments to the initially modified Lung Cancer Screening Health Belief Scale (Appendix D). It is developed by comprehensive literature review focusing on the cross-cultural instrument adaptation (refer to chapter 2). It is a quantitative and qualitative data collection method regarding experts' ratings and comments to the items in the initially modified Lung Cancer Screening Health Belief Scales. Instructions to fill the form are given at the beginning of the form. A table including expert's name, review time, rating to the clarity, relevance, appropriateness, and representativeness levels as well as comments to each item is provided.

Content validity scale. The content validity scale used in this study is to evaluate the extent to which the Lung Cancer Screening Health Belief Scale represent all facets of the health beliefs toward lung cancer screening (Pennington, 2003). It is developed following the recommendations from the study conducted by Polit and Beck (2006). It is a four-point Likert scale with items rated from 1 to 4. It includes four items with one each measuring the clarity, relevance, appropriateness, and representativeness levels of the measured scale (Appendix E). Using the content validity scale, the experts rated the semantic equivalence of the items in the initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) to the meaning of the items in the modified English version (English version 2) with responses ranging from not appropriate to very appropriate (not appropriate =1, very appropriate =4). The experts also rated the clarity of the initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) and the included items with responses ranging from not easy to understand to very easy to understand (not easy to understand=1, very easy to understand=4). The relevance of the items in the initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) to the overall scale context was also rated by the experts with responses ranging from not relevant to very relevant (not relevant=1, very relevant=4). Furthermore, the experts were also asked to rate the representativeness of the items in the subscales to the overall scale context with responses ranging from not representative to very representative (not representative=1, very representative=4). The items were ultimately modified based on experts' review and approved by the committee members' recommendations. The

English version 3 and Chinese version 3 of Lung Cancer Screening Health Belief Scale were generated after the process.

Data analysis for the content validity. The Content Validity Index (CVI) was used to analyze the scales' content validity. The primary investigator calculated the item-level content validity index (I-CVI) and the scale-level content validity index (S-CVI/UA). The S-CVI/UA was the proportion of all items that are rated as content valid. It was calculated by summing the items rated as 3 or 4 across all the various judges and dividing by the number of all items (Polit & Beck, 2006). The primary investigator reviewed I-CVIs lower than 0.79 and S-CVI/UA lower than 0.80 to consider item revision and/or deletion (Shi, Mo, & Sun, 2012.). The items were ultimately modified based on committee members' recommendations.

Cognitive individual interviews

The cognitive individual interviews were conducted to assess Chinese Americans' health beliefs toward lung cancer screening, to examine cultural differences in the health beliefs to screening lung cancer, and to make the scales culturally appropriate for Chinese Americans. The individual interviews with nine Chinese American participants included two components: a discussion of health beliefs toward lung cancer screening and a review of the Lung Cancer Screening Health Belief Scale (Chinese version 3).

Sample. Using a combination of convenience and chain referral sampling (multiple snowballs) methods, nine Chinese American high-risk smokers were recruited from a popular Chinese website (https://www.chineseinla.com/). Inclusion criteria for the participants were aged 50 to 80 years old, self-identified as descendants of Chinese, current smokers or quit smoking in the past 15 years, smoked at least 20 pack-year cigarettes (smoked one pack of cigarettes every day for 20 years), can speak Chinese (either Cantonese or Mandarin) and read Chinese. The exclusion criterion for the participants was having been previously diagnosed with lung cancer. To reflect gender constitution of the smoking prevalence among Chinese American population, eight males and one female were recruited in this process.

Recruitment. The recruitment flyers or posters were distributed both online and offline. The purpose of the study, inclusion and exclusion criteria, reimbursement amount, and the primary investigator's phone number as well as email address were listed in the flyers and posters. The primary investigator has established email connection with some potential settings, such as St. Barnabas Chinese Senior Services Center, 99 Rancho markets, Shun Fat Supermarkets, Chinese Baptist Church of West Los Angeles, Chinese Bible Church, and Culver Palms Chinese Church. A request email for assisting in connecting with participants was sent to those organizations. After getting a further contact through email or telephone, the primary investigator visited and talked to the staff in the settings. Flyers were posted on the bulletin boards which were available to be used for posting the approved information in the facilities. In addition, posters related to the study were posted in the discussion forum on the chineseinla.com website. The primary investigator updated the poster occasionally and kept the information updated.

When a Chinese American who was interested in participating in the study contacted the primary investigator via telephone or email, s/he was screened for the eligibility by answering the screening questions over the phone, Wechat text message, or through email. If the individual was eligible and agreed to participate in the study, s/he could choose either to be interviewed through online chat app (Wechat), via telephone, or in person, depending on the participant's preference. Before the interview, the primary investigator sent or gave the informed consent form, the expert reviewed and adapted Lung Cancer Screening Health Belief Scale (Chinese version 3), and a self-administrated questionnaire package including the sociodemographic information questionnaire, smoking and lung cancer screening history questionnaire, as well as Suinn-Lew Self-identity Acculturation Scale to the participants through email, online chat app or in person.

Research assistant recruitment and training. A research assistant who can speak both Cantonese and Mandarin was recruited from the Wechat group and was trained for this study. The research assistant was a health care provider who has some experience in the qualitative interview research area. He has work experience both in China and in the United States. Training content included information about the study, cognitive interview process, and data analysis strategies. The research assistant transcribed the cognitive interviews and helped with the data analysis process. During the training and the interview processes, close communication was maintained by the primary investigator with the research assistant to ensure the reliability of the study.

Cognitive interview procedure. The participants were interviewed individually via online chat app (Wechat), telephone, or in person, using the cognitive interview technique. The cognitive interview technique is an evidence-based, qualitative method specifically designed to investigate whether a survey question (attitudinal, behavioral, or factual) fulfills its intended purpose (Willis & Artino, 2013). A semi-structured interview guide based on the Health Belief Model was developed to guide the interview (Appendix F). The primary investigator developed the interview guide under the guidance of the members of the dissertation committee. Questions related to the health beliefs of lung cancer screening (e.g., “What benefits do you think a smoker can get from screening lung cancer?”) were asked and recorded by a digital recorder. Any themes emerging in the interviews were considered for modifying the adapted Chinese Lung Cancer Screening Health Belief Scale. The participants also reviewed the Lung Cancer

Screening Health Belief Scale (Chinese version 3). The primary investigator asked the participants to answer the Chinese version 3 of Lung Cancer Screening Health Belief Scale first. After the participants finish answering the scale, the primary investigator discussed the scale with the participants item by item using the think-aloud interviewing and verbal probing techniques. The techniques were applied to understand participants' thought processing route (Willis & Artino, 2013). The think-aloud interviewing technique were used to encourage participants actively verbalize their thoughts related to the diagnostic information on the assessment of the survey questions as they attempt to answer the survey questions (Willis & Artino, 2013). The verbal probing technique is a data collection technique in which the primary investigator administers a series of probe questions specifically designed to elicit detailed information beyond the normally provided responds. The probing techniques such as paraphrasing, recall, and interpretation were used to elicit details (Sample questions can be found in table 1, Appendix G) (Willis & Artino, 2013). The cognitive interviews were recorded by the digital recorder. A $25 Target card was emailed/mailed or given to the nine participants after the interviews for compensating their time in the interviews.

Data Analysis of Cognitive Interviews. Content analysis was used to analyze the qualitative data collected from the interviews. Main content of the semi-structured interviews was transcribed verbatim to Chinese language by the primary investigator and the research assistant. Themes emerged in the qualitative data were categorized and summarized to help the adaptation of the Chinese Lung Cancer Screening Health Belief Scale by the primary investigator. The primary investigator discussed the discrepancies in the data analysis with the research assistant to reach consistency. Combing the participants' suggestions and themes emerged in the individual interviews, the expert-reviewed-and-adapted Chinese Lung Cancer Screening Health Belief

Scale was further modified by the primary investigator. Potentially added items from the emerged themes as well as suggested modifications to the instrument were summarized in a table with the rationales in English by the primary investigator. The table was checked by the committee members. Necessary discussions were held to reach the consistency on a final version (English version 4) that could be used for the validation test. The modifications made by the committee members were reflected in the Chinese version 4. A table with the activities and outcomes for the instrument adaptation can be found in table 2 (Appendix H).

Appendix A

Lung Cancer Screening Health Belief Scale

Part 1. Perceived Risk of Lung Cancer (LCSHB-PRisk) Subscale

Perceived Risk of Lung Cancer (LCSHB-PRisk) Scale

Thank you for your interest in our Perceived Risk of Lung Cancer Scale. We have found this very valuable in our own research and hope this can be useful in your research. The LCSHB-PRisk has been published and we would appreciate your appropriate citation when referred to in your own work. The citation is:

Carter-Harris, L., Slaven, J., Monahan, P.O. & Rawl, S.M. (2016). Development and Psychometric Testing of the Lung Cancer Screening Health Beliefs Scales. 2016 May 27 [Epub ahead of print]

The full scale follows. Please do not hesitate to contact Dr. Lisa Carter-Harris with any questions. Her contact information is:

Indiana University School of Nursing
600 Barnhill Drive, NU W427
Indianapolis, IN 46202
(317) 274-2043 office
lcharris@iu.edu
twitter: *@DrCarterHarris*
Facebook Page: Healthy Lungs Initiative

Below are some statements about your risk of getting lung cancer. Please tell me how strongly you **AGREE *or* DISAGREE** with each statement.

1. It is likely that I will get lung cancer sometime in my **lifetime**.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

2. It is likely that I will get lung cancer in the next **ten** years.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

3. It is likely that I will get lung cancer in the next **five** years.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

4. Compared to other people your same age who have smoked about as much and as long as you have, what would you say your risk of getting lung cancer is:
   a. Much higher
   b. Higher
   c. About the same
   d. Lower
   e. Much lower
5. Compared to other people your same age who have never smoked, what would you say your risk of getting lung cancer is:
   a. Much higher
   b. Higher
   c. About the same
   d. Lower
   e. Much lower

Lung Cancer Screening Health Belief Scale

Part 2. Perceived Benefits of Lung Cancer Screening (LCSHB-PBen) Subscale

Perceived Benefits of Lung Cancer Screening (LCSHB-PBen) Scale

Thank you for your interest in our Perceived Benefits of Lung Cancer Screening Scale. We have found this very valuable in our own research and hope this can be useful in your research. The LCSHB-PBen has been published and we would appreciate your appropriate citation when referred to in your own work. The citation is:

Carter-Harris, L., Slaven, J., Monahan, P.O. & Rawl, S.M. (2016). Development and Psychometric Testing of the Lung Cancer Screening Health Beliefs Scales. 2016 May 27 [Epub ahead of print]

The full scale follows. Please do not hesitate to contact Dr. Lisa Carter-Harris with any questions. Her contact information is:

Indiana University School of Nursing
600 Barnhill Drive, NU W427
Indianapolis, IN 46202
(317) 274-2043 office
lcharris@iu.edu
twitter: @*DrCarterHarris*
Facebook Page: Healthy Lungs Initiative

The following are some statements about having a lung scan. Please tell me how strongly you **AGREE *or* DISAGREE** with each statement.

1. Having a lung scan will help find lung cancer early.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

2. Having a lung scan will lower my chances of dying from lung cancer.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

3. Having a lung scan will help me not worry as much about lung cancer.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

4. Having a lung scan will help me plan for the future.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

5. Having a lung scan will help my family not worry as much.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

6. Having a lung scan will give me peace of mind.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

Lung Cancer Screening Health Belief Scale

Part 3. Perceived Barriers to Lung Cancer Screening (LCSHB-PBarr) Subscale

Perceived Barriers to Lung Cancer Screening (LCSHB-PBarr) Scale

Thank you for your interest in our Perceived Barriers to Lung Cancer Screening Scale. We have found this very valuable in our own research and hope this can be useful in your research. The LCSHB-PBarr has been published and we would appreciate your appropriate citation when referred to in your own work. The citation is:

Carter-Harris, L., Slaven, J., Monahan, P.O. & Rawl, S.M. (2016). Development and Psychometric Testing of the Lung Cancer Screening Health Beliefs Scales. 2016 May 27 [Epub ahead of print]

The full scale follows. Please do not hesitate to contact Dr. Lisa Carter-Harris with any questions. Her contact information is:

Indiana University School of Nursing
600 Barnhill Drive, NU W427
Indianapolis, IN 46202
(317) 274-2043 office
lcharris@iu.edu
twitter: @DrCarterHarris
Facebook Page: Healthy Lungs Initiative

The following are some reasons people give for putting off having a lung scan. Please tell me how strongly you **AGREE _or_ DISAGREE** with each reason for YOURSELF.

1. I might put off having a lung scan because I worry about finding something wrong.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

2. I might put off having a lung scan because I don't have the time.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

3. I might put off having a lung scan because I don't have a regular healthcare provider to order the lung scan.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

4. I might put off having a lung scan because no one in my family had lung cancer.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

5. I might put off having a lung scan because the cost would be a problem.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

6. I might put off having a lung scan because I don't have any lung problems or symptoms.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

7. I might put off having a lung scan because transportation would be a problem.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

8. I might put off having a lung scan because I am afraid the lung scan will damage my lungs.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

9. I might put off having a lung scan because I have had a bad experience with a hospital or healthcare provider.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

10. I might put off having a lung scan because I don't know enough about the test.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

11. I might put off having a lung scan because I think I am too old to benefit from screening for lung cancer.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

12. I might put off having a lung scan because I am a smoker.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

13. I might put off having a lung scan because I would rather **_not_** know if I have any lung problems.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

14. I might put off having a lung scan because I worry about feeling like a social outcast for smoking.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

15. I might put off having a lung scan because I worry about being blamed for having smoked.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

16. I might put off having a lung scan because it is not worth the effort.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

17. I might put off having a lung scan because I do not trust the healthcare system.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

Lung Cancer Screening Health Belief Scale

Part 4. Self-Efficacy for Lung Cancer Screening (LCSHB-SE) Subscale

Self-Efficacy for Lung Cancer Screening (LCSHB-SE) Scale

Thank you for your interest in our Self-Efficacy for Lung Cancer Screening Scale. We have found this very valuable in our own research and hope this can be useful in your research. The LCSHB-SE has been published and we would appreciate your appropriate citation when referred to in your own work. The citation is:

Carter-Harris, L., Slaven, J., Monahan, P.O. & Rawl, S.M. (2016). Development and Psychometric Testing of the Lung Cancer Screening Health Beliefs Scales. 2016 May 27 [Epub ahead of print]

The full scale follows. Please do not hesitate to contact Dr. Lisa Carter-Harris with any questions. Her contact information is:

Indiana University School of Nursing
600 Barnhill Drive, NU W427
Indianapolis, IN 46202
(317) 274-2043 office
lcharris@iu.edu
twitter: *@DrCarterHarris*
Facebook Page: Healthy Lungs Initiative

The following are some statements about your confidence in your ability to arrange and complete a lung scan. Please tell me how **CONFIDENT** you are that you can do it.

1. How confident are you that you can make an appointment to have a lung scan?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

2. How confident are you that you can find the time to have a lung scan?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

3. How confident are you that you can find transportation to get to and from the clinic/hospital to have a lung scan?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

4. How confident are you that you can get enough information about having a lung scan?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

5. How confident are you that you can cover the cost of a lung scan, if needed?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

6. How confident are you that you can get a lung scan even if you are worried about the results?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

7. How confident are you that you can have a lung scan even if you don't know what to expect about the procedure?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

8. How confident are you that you can have a lung scan even if you are anxious **about the process**?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

9. How confident are you that you can have a lung scan even if you are anxious **about the results**?

Not at all Confident	Not too Confident	Somewhat Confident	Very Confident
1	2	3	4

Appendix B

Champion's Health Belief Model Scale (1993 Version)

Items in the Perceived Severity Subscale

(1) The thought of breast cancer scares me.

(2) When I think about breast cancer, my heart beats faster.

(3) I am afraid to think about breast cancer.

(4) Problems I would experience with breast cancer would last a long time.

(5) Breast cancer would threaten my relationship with my husband.

(6) If someone had breast cancer, her whole life would change.

(7) If someone developed breast cancer, she would not live longer than 5 years.

Appendix C

Cues to Action of Colorectal Cancer Screening Subscale

(1) If a doctor recommends colonoscopy, I will have it.

(2) If my friends or family recommend colonoscopy, I will have it.

(3) If mass media (Radio or TV) recommends colonoscopy, I would have it.

(4) If I have symptoms of CRC, I will have it.

(5) I will have colonoscopy as I concern about my health.

(6) If I had a family or acquaintance with CRC, I would have colonoscopy.

Appendix D

Expert Review Form

Cover Letter

Dear Dr. __________,

Thank you for accepting our invitation to review the original English version and the adapted Chinese version of Lung Cancer Screening Health Belief Scales. The adapted Chinese version of Lung Cancer Screening Health Belief Scales was generated from forward and backward translation based on the original Lung Cancer Screening Health Belief Scales. It has been discussed and revised among members of our translation team. The Chinese version of Lung Cancer Screening Health Belief Scales will be used to evaluate Chinese American high-risk smokers' health belief toward lung cancer and lung cancer screening. Your effort in reviewing these scales will potentially benefit high-risk Chinese American smokers and help with the implementation of lung cancer screening programs among Chinese American population. It will potentially help to decrease the mortality rate of lung cancer among Chinese Americans.

Please read the attached English and Chinese versions of Lung Cancer screening Health Belief Scales as well as the Content Validity Scale related to the scales and provide us with your valuable evaluation. Please put appropriate number, ranges from 1 to 4 of your evaluation for the relevance, clarity, equivalent, and comments to each item in the scales. Definitions for the relevance, clarity, and equivalent are provided in the following page. You can provide your feedback in the table after each item or make any additional comments (e.g., suggestions on adding or deleting items, advice on how to improve the items, etc.) by adding "new comment" under "review" function in word software. We appreciate if you can return the reviewed scales within one week via email to alicelf@ucla.edu. Should you have any question related to the scales and review form, please do not hesitate to contact me.

Thank you very much for your reviewing and valuable suggestion! I am looking forward to hearing from you soon.

Fang (Alice) Lei, RN, PHD(c), MPH, BSN

School of Nursing, UCLA

Phone: 310-733-0963

Email: alicelf@ucla.edu

Final Chinese version of Lung Cancer Screening Health Belief Scale

A **lung scan** is an imaging test to look at lungs and help diagnose certain lung problems. Computed tomography (CT) lung cancer screening is a noninvasive, painless procedure that uses low-dose X-rays to screen the lungs for cancer in just 30 seconds. It is performed on a multi-slice spiral computed tomography scanner.

肺部扫描是一种用来观察并帮助诊断肺部疾病的影像检查。肺癌筛查 CT 是一种无创无痛的检查项目，使用低剂量 X 光在 30 秒钟内通过多层螺旋计算机断层扫描仪筛查肺癌。

Lung Cancer Screening Health Belief Scales

肺癌筛查健康信念量表

Dear expert reviewers: Please put appropriate number, ranging from 1 to 4, of your evaluation for the relevance, clarity, translation equivalent, and comments to each item in the scales. You can provide your feedback in the table after each item or make any additional comments to the scales (e.g., suggestions on the scale title, instruction, and response options, adding or deleting items, advice on how to improve the items, etc.) by adding "new comment" under "review" function in word software.

Question/Translation	Relevance Score*	Clarity Score*	Translation Equivalent Score*	Comments
Perceived Risks of Lung Cancer Scale **肺癌风险感知量表** Instruction: Below are some statements about your risk of getting lung cancer. Please tell me how strongly you AGREE or DISAGREE with each statement. 说明：以下是一些关于肺癌风险的陈述。请告诉我您对每个陈述**同意**或**反对**的程度。				
Response options for the following items in the scale: **O** Strongly disagree 强烈反对 **O** Disagree 反对 **O** Agree 同意 **O** Strongly agree 强烈同意				
1. It is likely that someone who smoked about as much and as long as I have would get lung				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

cancer sometime in his/her lifetime. 和我抽烟数量和烟龄差不多的人，他/她这辈子可能会得肺癌.				
2. It is likely that someone who smoked about as much and as long as I have would get lung cancer in the next ten years. 和我抽烟数量和时长差不多的人，在接下来的十年里可能会得肺癌。				
3. It is likely that someone who smoked about as much and as long as I have would get lung cancer in the next five years. 和我抽烟数量和时长差不多的人，在接下来的五年里可能会得肺癌。				
Response options for the following items in the scale: **O** Much higher 很高 **O** Higher 较高 **O** About the same（和他/她们）一样 **O** Lower 较低 **O** Much lower 很低				
4. Compared to other people your same age who smoked about as much and as long as you have, what would you say your risk of getting lung cancer is: 和您抽烟数量和时长差不多的同龄人比，您觉得您得肺癌的风险：				
5. Compared to other people your same age who have never smoked, what would you say your risk of getting lung cancer is: 和其他不吸烟的同龄人比，您觉得您得肺癌的风险：				
Perceived Benefits of Lung Cancer Screening Scale **肺癌筛查益处感知量表** Instruction: The following are some statements about having a lung scan. Please tell me how strongly you AGREE or DISAGREE with each statement. 说明：以下是一些关于肺部扫描的陈述。请告诉我您对每个陈述**同意**或**反对**的程度。				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

Response options for the following items in the scale: **O** Strongly disagree 强烈反对 **O** Disagree 反对 **O** Agree 同意 **O** Strongly agree 强烈同意				
1. Having a lung scan will help find lung cancer early. 进行肺部扫描能帮助早点发现肺癌。				
2. Having a lung scan will lower the chances of dying from lung cancer. 进行肺部扫描会降低死于肺癌的机率。				
3. Having a lung scan will help me not worry as much about lung cancer. 进行肺部扫描能降低我对肺癌的担忧。				
4. Having a lung scan will help me plan for the future. 进行肺部扫描会帮助我计划未来。				
5. Having a lung scan will help my family not worry as much. 进行肺部扫描能让我的家人不用那么担心。				
6. Having a lung scan will give me peace of mind. 进行肺部扫描会让我感到安心。				
Perceived Barriers to Lung Cancer Screening Scale **肺癌筛查障碍感知量表** Instruction: The following are some reasons people give for putting off having a lung scan. Please tell me how strongly you AGREE or DISAGREE with each reason for YOURSELF. 说明：以下是人们给出的推迟做肺部扫描的一些原因。请根据您的情况，告诉我您对每个陈述**同意**或者**反对**的程度。				
Response options for the following items in the scale: **O** Strongly disagree 强烈反对 **O** Disagree 反对 **O** Agree 同意 **O** Strongly agree 强烈同意				
1. I might put off having a lung scan because I worry about finding something wrong.				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

我可能会推迟做肺部扫描，因为我担心会发现问题。				
2. I might put off having a lung scan because I don’t have the time. 我可能会推迟做肺部扫描，因为我没有时间。				
3. I might put off having a lung scan because I don’t have a regular healthcare provider. 我可能会推迟做肺部扫描，因为我没有固定的医护人员。				
4. I might put off having a lung scan because no one in my family had lung cancer. 我可能会推迟做肺部扫描，因为我家里没有人得过肺癌。				
5. I might put off having a lung scan because the cost would be a problem. 我可能会推迟做肺部扫描，因为费用会是个问题。				
6. I might put off having a lung scan because I don’t have any lung problems or symptoms. 我可能会推迟做肺部扫描，因为我没有任何肺部问题或症状。				
7. I might put off having a lung scan because transportation would be a problem. 我可能会推迟做肺部扫描，因为交通会是个问题。				
8. I might put off having a lung scan because I am afraid the lung scan will damage my lungs. 我可能会推迟做肺部扫描，因为我害怕肺部扫描会损伤我的肺。				
9. I might put off having a lung scan because I have had a bad experience with a hospital or health care provider. 我可能会推迟做肺部扫描，因为我和医院或者医护人员有过不愉快的经历。				
10. I might put off having a lung scan because I don’t know enough about the test. 我可能会推迟做肺部扫描，因为我对这个检查了解得不够。				
11. I might put off having a lung scan because I think I am too old to benefit from screening for lung cancer. 我可能会推迟做肺部扫描，因为我觉得我年龄太大而不能从肺癌筛查中受益。				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

12. I might put off having a lung scan because I am a smoker. 我可能会推迟做肺部扫描，因为我是吸烟者.				
13. I might put off having a lung scan because I would rather not know if I had any lung problems. 我可能会推迟做肺部扫描，因为如果我肺部有问题，我宁愿不要知道。				
14. I might put off having a lung scan because I do not believe the result will tell me whether I have lung cancer. 我可能会推迟做肺部扫描，因为我不相信结果能告诉我有没有得肺癌。				
15. I might put off having a lung scan because I worry about feeling like a social outcast for smoking. 我可能会推迟做肺部扫描，因为我担心自己吸烟而受到社会排斥。				
16. I might put off having a lung scan because I worry about being blamed for having smoked. 我可能会推迟做肺部扫描，因为我担心会因吸烟而受到指责。				
17. I might put off having a lung scan because I worry about feeling like a social outcast if I will be diagnosed with lung cancer. 我可能会推迟做肺部扫描，因为我担心如果诊断出肺癌而受到社会排斥。				
18. I might put off having a lung scan because it is not worth the effort. 我可能会推迟做肺部扫描，因为这样做不值得。				
19. I might put off having a lung scan because I do not trust the healthcare system. 我可能会推迟做肺部扫描，因为我不信任医疗系统。				
20. I might put off having a lung scan because I believe going through the scan will not change the fate of dying from lung cancer. 我可能会推迟做肺部扫描，因为我相信进行肺部扫描不能改变死于肺癌的命运。				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

Self-Efficacy for Lung Cancer Screening Scale (LCSHB-SE)[1] 肺癌筛查自我效能量表 Instruction: The following are some statements about your confidence in your ability to arrange and complete a lung scan. Please tell me how CONFIDENT you are that you can do it. 说明：以下是一些关于您安排和完成肺部扫描能力的信心的陈述。请告诉我您对于完成肺部扫描的信心。				
Response options for the following items in the scale: **O** not at all confident 完全没有把握 **O** not too confident 没有太大把握 **O** somewhat confident 有一些把握 **O** very confident 很有把握				
1. How confident are you that you can make an appointment to have a lung scan? 您对自己能成功预约肺部扫描有多大信心？ 并请说明无法成功预约肺部扫描的原因：______________________________				
2. How confident are you that you can find the time to have a lung scan? 您对自己能安排时间去做肺部扫描有多大信心？				
3. How confident are you that you can find transportation to get to and from the clinic/hospital to have a lung scan? 您对安排来回诊所/医院做肺部扫描的交通工具有多大信心？				
4. How confident are you that you can get enough information about having a lung scan? 您对于充分获取有关肺部扫描的信息有多大信心？				
5. How confident are you that you can cover the cost of a lung scan, if needed? 如果需要费用，您有多大把握能自行支付肺部扫描的费用？				
6. How confident are you that you can get a lung scan even if you are worried about the results? 即使您担心检查结果，您有多大把握去做肺部扫描？				
7. How confident are you that you can have a lung scan even if you don’t know what to expect about the procedure?				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

即使您不知道检查步骤，您有多大把握去做肺部扫描？				
8. How confident are you that you can have a lung scan even if you are anxious about the process? 即使您对检查过程感到焦虑，您有多大把握去做肺部扫描？				
9. How confident are you that you can have a lung scan even if you are anxious about the results? 即使您对结果感到焦虑，您有多大把握去做肺部扫描?				
10. How confident are you that you can discuss the lung scan with your doctor? 对于能够和医生讨论肺部扫描，您有多大信心？ 并请说明没有信心和医生讨论肺部扫描的原因：_________________________________				
Perceived Severity for Lung Cancer Scale (LCSHB-PS) **肺癌严重度感知量表** Instruction: Below are some statements about getting lung cancer. Please tell me how strongly you AGREE or DISAGREE with each statement. 说明：以下是关于患肺癌的一些陈述。请告诉我您对每个陈述**同意**或**反对**的程度。				
Response options for the following items in the scale: **O** Strongly disagree 强烈反对 **O** Disagree 反对 **O** Agree 同意 **O** Strongly agree 强烈同意				
1. When I think about lung cancer, my heart beats faster. 我想到肺癌就心跳加快。				
2. I am afraid to think about lung cancer. 我害怕想起肺癌。				
3. If someone had lung cancer, problems he/she would experience with lung cancer would last a long time. 如果某人得了肺癌，他/她所经历的和肺癌有关的问题会持续很长一段时间。				
4. If someone had lung cancer, it would threaten his/her relationship with the family members.				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

如果某人得了肺癌，疾病会威胁到他/她和家人的关系。				
5. If someone had lung cancer, his/her whole life would change. 如果某人得了肺癌，他/她的整个人生会发生改变。				
6. If someone developed lung cancer, he/she would not live longer than 5 years. 如果某人得了肺癌，他/她将活不过 5 年。				
Cues to Action of Lung Cancer Screening Scale (LCSHB-CTA) **肺癌筛查行动线索量表** Instruction: The following are some statements about having a lung scan. Please tell me how strongly you AGREE or DISAGREE with each statement. 说明：以下是一些关于进行肺部扫描的陈述。请告诉我您对每个陈述**同意**或**反对**的程度。				
Response options for the following items in the scale: **O** Strongly disagree 强烈反对 **O** Disagree 反对 **O** Agree 同意 **O** Strongly agree 强烈同意				
1. If a doctor recommends lung scan, I will have it. 如果医生建议，我会去做肺部扫描。				
2. If my friends or family recommend lung scan, I will have it. 如果我的朋友或者家人建议，我会去做肺部扫描。				
3. If mass media (Radio or TV) recommends lung scan, I would have it. 如果大众媒体（电台或电视）建议，我会去做肺部扫描。				
4. If I have symptoms of lung cancer, I will have it. 如果我有肺癌的症状，我会去做肺部扫描。				
5. I will have lung scan as I concern about my health. 我会去做肺部扫描，因为我担心我的健康。				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

6. If I had a family or acquaintance with lung cancer, I would have lung scan. 如果我有家人或者熟人患有肺癌，我会去做肺部扫描。				

*1=not relevant, 2=somewhat relevant, 3=quite relevant, 4=very relevant; 1=not clear, 2=item needs major revision to be clear, 3=item need minor revision to be clear; 4=item is clear; 1=different meaning, 2=somewhat the same, 3=almost the same, 4=exactly the same

Appendix E

Content Validity Scale

FOR EACH ITEM

1. On a scale of 1 to 4, please rate the degree to which the item in the Chinese version Lung Cancer Screening Health Belief Scale is believed to be **RELEVANT** to the concept (perceived susceptibility/perceived severity/perceived benefits/perceived barriers/self-efficacy/cues to action)?

1	2	3	4
Not relevant	Somewhat relevant	Quite Relevant	Very relevant

2. On a scale of 1 to 4, please rate: How **CLEAR** is it for you to understand the item in the translated Chinese version of Lung Cancer Screening Health Belief Scale?

1	2	3	4
Not clear	Item needs major revision to be clear	Item needs minor revision to be clear	Item is clear

3. On a scale of 1 to 4, please rate the degree to which the item in the Chinese version Lung Cancer Screening Health Belief Scale is believed to be **EQUIVALENT** to the item in the original Lung Cancer Screening Health Belief Scale?

1	2	3	4
Different meaning	Somewhat the same	Almost the same	Exactly the same

Appendix F

Cognitive Interview Guide

- **Entry question**

1. When you hear “lung cancer” or “lung cancer screening”, what comes to your mind?

- **Perceived susceptibility**

2. Who get lung cancer? Do you think that you will get lung cancer? Why do you think like that?

- **Perceived severity**

3. Do you know anybody who get lung cancer?

PROBE: (If yes,) How does that impact their life? What if it happened in your case?

(If no,) What impact do you think it will be on a person’s life, if he/she diagnosed with lung cancer? Why do you think like that?

- **Perceived benefits**

4. Did your doctor or other health care providers discuss lung cancer or recommend lung cancer screening with/to you?

PROBE: (If yes,) How do you/they benefit from screening lung cancer?

(If no,) What benefits do you think a smoker can get from screening lung cancer? Why do you think like this?

- **Perceived barriers**

5. Further probe questions for question 4.

PROBE: (If yes,) Tell me more about the difficulties that you/they encountered or what you

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think could be improved in the screening processes.

(If no,) What could be reasons for you not having a lung cancer screening? What help do you think is necessary for you to obtain lung cancer screening?

6. What do you think may prevent a smoker from screening lung cancer? Why do you think so?

- **Self-efficacy**

7. Do you know where and how to screen lung cancer?

PROBE: (If yes,) Tell me more about the places and procedures for screening lung cancer.

(If no,) What could be done to make that information more accessible to smokers like you?

8. Are you confident to schedule an appointment for screening lung cancer by yourself, if it is necessary?

PROBE: (If yes,) Tell me more about the processes to schedule the appointment.

(If no,) What could be done by you or health care providers to make it feasible?

9. Are you confident to discuss results of lung cancer screening with your doctor?

PROBE: (If yes,) Tell me more about your interpretation of the screening results.

(If no,) What could be improved to make it feasible?

- **Cues to action**

10. Did you get any information on lung cancer screening before?

PROBE: (If yes,) Where did you get the information? How do you feel when you got that information?

(If no,) Who do you want to get the information from? What do you like to know most?

11. What could trigger a smoker to decide to screen lung cancer? Why do you think so?

- **Ending Question**

12. Is there anything that you think I should know about your perceptions or experiences about lung cancer or screening?

Comments on the Chinese version of Lung Cancer Screening Health Belief Scale

肺部扫描是一种用来观察并帮助诊断肺部疾病的影像检查。肺癌筛查 CT 是一种无创无痛的检查项目，使用低剂量 X 光在 30 秒钟内通过多层螺旋计算机断层扫描仪筛查肺癌。

4. 肺癌筛查健康信念量表

问题	答案	意见
肺癌风险感知量表 说明：以下是一些关于肺癌风险的陈述。请从**强烈反对**到**强烈同意**的选项中选择一项。		
选项：1 强烈反对　**2** 反对　3 同意　**4** 强烈同意		
1. 和我抽烟数量和烟龄差不多的人，他/她这辈子可能会得肺癌.		
2. 和我抽烟数量和时长差不多的人，在接下来的十年里可能会得肺癌。		
3. 和我抽烟数量和时长差不多的人，在接下来的五年里可能会得肺癌。		
选项：1 很高　**2** 较高　3（和他/她们）一样　**4** 较低　5 很低		
4. 和您抽烟数量和时长差不多的同龄人比，您觉得您得肺癌的风险：		
5. 和其他不吸烟的同龄人比，您觉得您得肺癌的风险：		
肺癌筛查益处感知量表 说明：以下是一些关于肺部扫描的陈述。请从**强烈反对**到**强烈同意**的选项中选择一项。		
选项：1 强烈反对　**2** 反对　3 同意　**4** 强烈同意		
1. 进行肺部扫描能帮助早点发现肺癌。		
2. 进行肺部扫描会降低死于肺癌的机率。		
3. 进行肺部扫描能降低我对肺癌的担忧。		
4. 进行肺部扫描会帮助我计划未来。		
5. 进行肺部扫描能让我的家人不用那么担心。		
6. 进行肺部扫描会让我感到安心。		
肺癌筛查障碍感知量表 说明：以下是人们给出的推迟做肺部扫描的一些原因。请从**强烈反对**到**强烈同意**的选项中选择一项。		

选项：1 强烈反对 **2** 反对 3 同意 **4** 强烈同意		
1. 我可能会推迟做肺部扫描，因为我担心会发现问题。		
2. 我可能会推迟做肺部扫描，因为我没有时间。		
3. 我可能会推迟做肺部扫描，因为我没有固定的医护人员。		
4. 我可能会推迟做肺部扫描，因为我家里没有人得过肺癌。		
5. 我可能会推迟做肺部扫描，因为费用会是个问题。		
6. 我可能会推迟做肺部扫描，因为我没有任何肺部问题或症状。		
7. 我可能会推迟做肺部扫描，因为交通会是个问题。		
8. 我可能会推迟做肺部扫描，因为我害怕肺部扫描会损伤我的肺。		
9. 我可能会推迟做肺部扫描，因为我和医院或者医护人员有过不愉快的经历。		
10. 我可能会推迟做肺部扫描，因为我对这个检查了解得不够。		
11. 我可能会推迟做肺部扫描，因为我觉得我年龄太大而不能从肺癌筛查中受益。		
12. 我可能会推迟做肺部扫描，因为我是吸烟者.		
13. 我可能会推迟做肺部扫描，因为如果我肺部有问题，我宁愿不要知道。		
14. 我可能会推迟做肺部扫描，因为我不相信结果能告诉我有没有得肺癌。		
15. 我可能会推迟做肺部扫描，因为我担心自己吸烟而受到社会排斥。		
16. 我可能会推迟做肺部扫描，因为我担心会因吸烟而受到指责。		
17. 我可能会推迟做肺部扫描，因为我担心如果诊断出肺癌而受到社会排斥。		
18. 我可能会推迟做肺部扫描，因为这样做不值得。		
19. 我可能会推迟做肺部扫描，因为我不信任医疗系统。		
20. 我可能会推迟做肺部扫描，因为我相信进行肺部扫描不能改变死于肺癌的命运。		
肺癌筛查自我效能量表 说明：以下是一些关于您安排和完成肺部扫描能力的信心的陈述。请从**完全没有把握**到**很有把握**的选项中选择一项。		
选项：1 完全没有把握 **2** 没有太大把握 3 有一些把握 4 很有把握		
1. 您对自己能成功预约肺部扫描有多大信心？ 并请说明无法成功预约肺部扫描的原因：________________________________		
2. 您对自己能安排时间去做肺部扫描有多大信心？		

3. 您对安排来回诊所/医院做肺部扫描的交通工具有多大信心？		
4. 您对于充分获取有关肺部扫描的信息有多大信心？		
5. 如果需要费用，您有多大把握能自行支付肺部扫描的费用？		
6. 即使您担心检查结果，您有多大把握去做肺部扫描？		
7. 即使您不知道检查步骤，您有多大把握去做肺部扫描？		
8. 即使您对检查过程感到焦虑，您有多大把握去做肺部扫描？		
9. 即使您对结果感到焦虑，您有多大把握去做肺部扫描?		
10. 对于能够和医生讨论肺部扫描，您有多大信心？ 并请说明没有信心和医生讨论肺部扫描的原因：________________________________		
肺癌严重度感知量表 说明：以下是关于患肺癌的一些陈述。请从**强烈反对**到**强烈同意**的选项中选择一项。		
选项：1 强烈反对 **2** 反对 3 同意 **4** 强烈同意		
1. 我想到肺癌就心跳加快。		
2. 我害怕想起肺癌。		
3. 如果某人得了肺癌，他/她所经历的和肺癌有关的问题会持续很长一段时间。		
4. 如果某人得了肺癌，疾病会威胁到他/她和家人的关系。		
5. 如果某人得了肺癌，他/她的整个人生会发生改变。		
6. 如果某人得了肺癌，他/她将活不过 5 年。		
肺癌筛查行动线索量表 说明：以下是一些关于进行肺部扫描的陈述。请从**强烈反对**到**强烈同意**的选项中选择一项。		
选项：1 强烈反对 **2** 反对 3 同意 **4** 强烈同意		
1. 如果医生建议，我会去做肺部扫描。		
2. 如果我的朋友或者家人建议，我会去做肺部扫描。		
3. 如果大众媒体（电台或电视）建议，我会去做肺部扫描。		
4. 如果我有肺癌的症状，我会去做肺部扫描。		
5. 我会去做肺部扫描，因为我担心我的健康。		
6. 如果我有家人或者熟人患有肺癌，我会去做肺部扫描。		

Appendix G

Table 1. Sample Questions for Reviewing the Scale in the Cognitive Interview

Type of Cognitive Probe	Example
Comprehension/Interpretation	What does the term '…' mean to you?
理解/解释	"…" 对您来说意味着什么？
Paraphrasing	Can you repeat the question I just asked in your own words?
改写	您能用自己的话重复刚才我问您的那个问题吗？
Confidence judgment	How sure are you that you ….?
判断信心	您有多确定…?
Recall	How do you remember that you …?
回忆	您记得您…?
	How did you come up with your answer?
	您是怎样得出答案的？
Specific	Why do you say that …?
具体	您为什么说…?
General	Was that easy or hard to answer?
常规	回答这个问题是容易还是难呢？
	I noticed that you hesitated. Tell me what you were thinking.
	我注意到您有些犹豫。告诉我您刚在想什么。
	Your response to this question indicates that ...Tell me more.
	您对这个问题的回答表明…再告诉我一些。

Appendix H

Table 2. Activities and Outcomes Related to the Instrument Adaptation

Activity	Outcome
Comprehensive literature review	English version 1
Forward translation	Chinese version 1
Backward translation	English version 2 & Chinese version 2
Expert review	English version 3 & Chinese version 3
Cognitive interview with participants	English version 4 & Chinese version 4

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Chapter 5. Manuscript One

Cross-cultural Instrument Adaptation and Validation of Health Beliefs about Cancer Screening: A Methodological Systematic Review

Fang Lei, MSN, MPH, RN; Wei-Ti Chen, PhD, FAAN, CNM, RN;

Mary-Lynn Brecht, PhD; Zuo-Feng Zhang, MD, PhD; Eunice Lee, PhD, FAAN, RN

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Abstract

Background: The uptake of cancer screening was significantly associated with participants' health beliefs about cancer screening. Although scales measuring health beliefs about cancer screening are developed and available, the scales developed for the general population in the U.S. may lack cultural appropriateness, which could potentially compromise the reliability and validity of the scale when used in different ethnic groups or populations.

Objective: This systematic review aims to summarize, analyze, and compare the methods used in the cross-cultural instrument adaptation and validation processes of health beliefs about cancer screening.

Methods: A systematic review design with narrative methods was used. Electronic databases, including PubMed, Google Scholar, CINAHL®, and PsycINFO were searched.

Results: A total of 18 articles were eligible. Results showed 1) the translation methods included committee translation and back-translation which was further refined by using professional translators, using professional interpreters and/or involving the first author, using bilingual individuals, and involving bilingual investigators, 2) the modification methods included embedded and afterward modification, and 3) the validation methods included testing construct validity, internal consistency reliability, item-total subscale correlations, test-retest reliability, content validity, predictive validity, and face validity.

Conclusions: Using appropriate methods to adapt and validate instruments to make them culturally fitted to target populations is essential for cross-cultural research.

Implications for Practice: To adequately measure health beliefs about cancer screening in another population by using appropriately translated, modified, and validated instruments can

potentially increase the uptake rate of cancer screening and eventually decrease the mortality rate of cancer among target population.

Keywords: Cancer screening; instrument; health beliefs; adaptation; validation; systematic review

Cross-cultural Instrument Adaptation and Validation of Health Beliefs about Cancer Screening: A Methodological Systematic Review

Introduction

Cancer is a major public health problem in the world.[1] According to estimates from the World Health Organization (WHO) [2] and American Cancer Society,[3] cancer is the second leading cause of death globally [2] and in the U.S. [3] WHO estimated that 9.6 million deaths resulted from cancer, or one in six deaths was due to cancer in 2018.[2] In the 21st century, cancer ranks as the leading cause of death and the single most important barrier to longevity in every country of the world.[4] As people live longer, detecting cancer early is an urgent issue.[4]

Cancer screening is an effective method to detect cancer at an early stage prior to the onset of symptoms when cancer treatment is most effective. [5] From 1990 to 2015, overall cancer mortality has decreased by 25% in the U. S., [5] possibly due to the high-quality cancer screening as well as improved uptakes of cancer screenings. [5]

Previous research showed that the uptake rate of cancer screening was significantly associated with people's health belief about cancer screening. [6] Beliefs and attitudes about cancer screening, such as mistrust of cancer screening and healthcare system, beliefs toward cancer screening process or illness, and fatalism beliefs, are important factors influencing high-risk population's participation in cancer screening. [7-11] Among minority ethnic groups, traditional cultural values, and health beliefs about concepts of preventive health, fear of cancer screening, belief that cancer screening is unnecessary unless one is ill, misconceptions concerning one's susceptibility to cancer, and stigmatization may also deter high risk populations from getting cancer screening. [6]

To explain cancer-related health protective behaviors, several scales measuring health beliefs and preventive screening practices were developed based on the Health Belief Model. [12, 13] The Health Belief Model is a social cognition model focusing on health behavior change. [14] It originated from psychological science, [15] and was developed in the 1950s by Rosenstock, Hochbaum, Kegeles, and Leventhal, four social psychologists at the United States Public Health Service Organization. [16, 17] For the decades, scales developed based on the Health Belief Model have been widely used for various types of cancer screening such as breast, cervical, colorectal, and lung cancer. [12, 13] Constructs measured in these scales include 1) perceived susceptibility, 2) perceived severity, 3) perceived benefits, 4) perceived barriers, 5) self-efficacy, and 6) cues to action. [12, 13] Although these constructs differ slightly among ethnicities because of distinct social-cultural values and beliefs (e.g., sexual behavior, fatalism, and concepts of preventive health), [18, 19] most conceptual aspects are consistent. [6]

Cultural-specific health beliefs about cancer screening among various ethnic groups can lead to racial/ethnic differences in cancer screening. [20] Although scales measuring cancer-related health beliefs are available, [12, 13] the ones developed and validated for the general population in the U.S. may lack cultural appropriateness, which could compromise the reliability and validity of the scale when used in different ethnic groups or populations. As cultural influences on constructs could differ by race group, [20] instruments measuring Caucasians in the U.S. might not be applicable to other race groups. When an instrument is not culturally sensitive, cultural adaptation of the existing scale is suggested. [21] If the constructs or items overlap and differ slightly in populations with a different cultural background, scale adaptation is more appropriate and practical than development of new scales. [21]

Adaptation of an existing instrument to be used in a target population is a cost-efficient and time-saving choice in cross-cultural research. [22] According to Chang and Chau, [22] the best method of measuring a construct is developing a research instrument from the perspective of the population, but this is rarely feasible because of cost and time constraints. Therefore, the most practical choice could be using an instrument that has already been developed. [22] Making optimal use of existing knowledge by building on the work of others and translating and modifying the target and validated instruments could be a more efficient method to minimize the cost of instrument development, make research results comparable from different studies, and facilitate exchange of information between researchers. [23]

An important consideration for the adaptation and validation of cross-cultural instruments is equivalency between the original and translated instruments. Reaching conceptual, item, semantic, operational, measurement, and cultural equivalence is essential for ensuring the reliability and validity of translated instruments. [24] To increase equivalency between the original and translated instruments, appropriate translation, modification, and validation methods are important and deserve further investigation. The purpose of this methodological systematic review was to summarize, analyze, and compare the methods of adaptation and validation of instruments measuring health beliefs about cancer screening for populations with different cultural backgrounds. Findings from this study could provide evidence and guidance for naive cross-cultural researchers to adapt and validate an existing instrument to be used in their research population.

Methods

Search strategy

Electronic databases, including PubMed, Google Scholar, CINAHL®, and PsycINFO were searched. Key words including constructs about instrument adaptation and validation, health belief, and cancer screening were applied. Detailed key words from each construct included 1) *instrument adaptation*: instrument modification, modify, revise, adapt, adaptation, refinement, refine; 2) *health belief*: perception, attitude, belief, perspective; and 3) *cancer screening*: cancer, screening, prevent, prevention. Inclusion and exclusion criteria were applied. The inclusion criteria for the articles were 1) peer-reviewed articles; 2) related to the instrument adaptation and validation of health beliefs about cancer screening; and 3) published in English language (which could be read by the authors). The exclusion criteria were 1) informal articles (e.g., commentary, letter to editor, conference abstract), 2) not an instrument adaptation and validation study, and 3) did not include constructs from the Health Belief Model.

After the articles were identified, the titles and the abstracts of the articles were read for further inclusion and exclusion. Articles listed in the references of the included articles were searched for further inclusion. Information on the purpose, sample, setting, methods, results, and discussion parts of the included articles were extracted and entered into the table of evidence. Results in the study were reported by following the PRISMA approach. [25]

Results

Searching findings

Initially, 1,312 articles were identified after applying key words searching and inclusion criteria restriction. After removing duplicates and assessing the titles and abstracts of the articles, 1,292 articles were excluded because the studies were 1) not related to the health beliefs about cancer screening, 2) not related to the cultural adaptation and validation of the instrument, or 3) not formal articles (e.g., comments, conference abstracts, letter to editors). After assessing the full text of the articles, one additional article was further excluded because it was related to cultural beliefs of cancer screening instead of health beliefs of cancer screening. Finally, 18 eligible articles were included in this methodological review (Figure). [26-43]

Data evaluation

Methodological rigor of the included articles was evaluated using Bowling's checklist (Table 1). [44] This tool facilitated the systematic appraisal of studies regarding clarity of aims, objectives, methods and appropriate analysis of data. Bowling's checklist [44] provided a comprehensive checklist of 20 evaluation criteria rather than a scoring system to assess the quality of studies. All the 18 quantitative studies had limitations; for example, none of the articles discussed generalizability of findings to other populations. To be included in a systematic review, 11 to 17 items out of the 20 items on the checklist should be met to be considered fair in quality. [44] As all the 18 studies met the requirement, none of the studies was excluded after data evaluation.

Study characteristics

All the 18 studies (in Table 2) were cross-sectional. The sample size of the studies ranged from 15 [34] to 656. [38] Convenience sampling [26, 29, 31, 32, 34, 38, 43] and random sampling [27, 28, 36, 37, 39] methods were the recruitment methods most-commonly used. Most of the participants in the studies were recruited from hospitals or schools/universities. [27, 29, 30-32, 36-38] The most frequently adapted instrument in the studies was Champion's Health Belief Model Scales. [16] Sixteen studies focused on health beliefs about breast cancer screening and breast self-examination. One study examined health beliefs about colorectal cancer screening, [33] and one was about health beliefs around cervical cancer screening. [27] All of the studies used the Health Belief Model to guide their studies.

Adaptation of existing instrument

To adapt an instrument to use in another population, translation and modification are necessary. The methods used in the translation and modification processes included back-translation and committee translation, embedded modification and afterward modification.

Translation methods

During the translation process, language barriers and cultural differences should be considered. [45] Among these 18 studies, the translation method most-commonly used (n = 17) was back-translation, which included the use of a panel of experts, translators, or interpreters to translate the instrument from the original language to the target language, then back-translate it to the original language. [46, 47]

Back-translation method. The back-translation method included two steps, forward translation (translating the instrument from the original language to the target language) and backward translation (translating the translated instrument from the target language to the original language). Most of the studies involved one to three translation persons in both steps. The translators in both steps translated the instrument independently. However, one study included ten translation persons in the forward translation step. [30] The ten translators who were bilingual in Turkish and English were familiar with the concepts underlying the instrument. They independently translated the original version of the instrument into Turkish.

According to the types of personnel involved in the translation process, the back-translation used in the reviewed articles was done by professional translators, professional interpreters and/or the first author, bilingual individuals, or bilingual investigators.

Using professional translators. In seven studies, professional translators were involved in the translation work for the instrument. [28, 29, 31, 34, 39, 41, 43]

Using professional interpreters and/or involving the first author. The professional interpreters were persons who had an educational background in the field of the instrument, were familiar with the instrument, or knowledgeable about the instrument. Usually, the professional interpreters were bilingual health care providers, such as nurses or physicians. [26, 35]

Using bilingual individuals. In six studies, bilingual university staff and speakers, or other non-health care system individuals translated the instrument. [27, 30, 32, 37, 38, 41]

Involving bilingual investigators. In these studies, [36, 40] the instruments were translated and back-translated separately by different bilingual investigators.

Committee translation method. In the study conducted by Lee and Lee, [33] three bilingual translators who were fluent in both Korean and English formed the translation committee. The primary investigator drafted initial items in English for the health belief scales from existing instruments and added items from searched studies. The committee translated the English version of the health belief scales into Korean. After that, the primary investigator and translation committee members reviewed the modified instruments to check for discrepancies as well as for unclear or awkward sentences in translation. [33]

Modification methods

The modification process of the instruments varied which could happen at different stages of the translation process. According to the stage of the modification in the translation process, the modification process was categorized as embedded modification or afterward modification.

Embedded modification. Embedded modification is a process conducted between forward and backward translation. It was less commonly used [26, 30, 31, 36, 40] compared to afterward modification. In the study conducted by Kharameh et al., [31] the instrument used for the breast cancer screening was adapted to be used in colorectal cancer screening. The modification was made after the forward translation and before the back translation. In another study conducted by Gozum and Aydin, [26] the original instrument was translated to the target language by two translators. The forward-translated instrument was given to six bilingual health professional judges (two gynecology nursing professors and four public health nursing professors). The judges worked independently and reported their views on the scale. Their views were collected on a single form. The opinions were largely similar with each other. Only minor wording differences were noted. The two translators who forward translated the instrument agreed on the modifications, and the translated scale was revised accordingly. After that, the modified instrument was given to another bilingual medical doctor for the backward translation. [26]

In another study conducted by Karayurt and Dramalı, [30] the forward-translated instrument was given to 10 bilingual health professional experts (four nursing faculty members, two surgical oncology professors, a medical oncology professor, a psychology professor, and two psychologists). The judges suggested minor changes in wording, and the translated instrument was revised accordingly. After that, the translated tool was then back translated into English by a bilingual person. [30] The same procedure was used in the studies conducted by Mikhail and

Petro-Nustas [36] as well as Tsangari and Petro-Nustas. [40] The number of professional judges in these two studies ranged from three to six. The judges also validated the content validity of the forward-translated instrument and determined the translated instrument was culturally appropriate.

Afterward modification. The afterward modification happened after the forward and backward translation. Among the 18 studies included in this methodological review, 13 studies used the afterward modification method. [27-29, 32-35, 37-39, 41-43] Three reviewing methods, including individual participants review (n = 3 to 10), focus group review (n = 4 to 6), and expert review (n = 3 to 12) were used in the afterward modification process.

In the study conducted by Dewi, [43] the authors added items representing two dimensions (cues to action and self-efficacy) and removed the motivation dimension in the scales after the forward and backward translation procedures. [43] They did so to update the scales to be consistent with the revision of the Health Belief Model, which included cues to action and self-efficacy. [43] In another study conducted by Guvenc et al., [27] after the instrument was forward and backward translated, four items adapted from other scales were added to the perceived barriers subscale by the authors. These four items were thought to be appropriate to Turkish culture: cost, fatalism, preference for female healthcare professionals, and distance from the health center. Then, the revised instrument was given to four bilingual healthcare professionals (two gynecological oncologists and two nursing university staff members) to review. Minor changes in wording were suggested and the instrument was revised accordingly. [27]

In another study [28] aimed to translate Champion's Health Belief Model Scale and validate it in Iranian women with a family history of breast cancer, the forward- and backward-translated instrument was given to 13 experts and a survey was done with 30 women who had history of breast cancer in their family, and four focus groups were conducted with 43 women to check the instrument's cultural equivalency. Two groups of ten women with breast cancer and two groups of 11 women with a family history of breast cancer participated in the focus groups. Items were added to or eliminated from the translated instrument per experts' suggestions and participants' discussions to make the scale culturally appropriate. [28] Another study [29] aimed to adapt and validate the Spanish version of Champion's Health Belief Model Scale for mammograms that was used among Mexican women. Focus group interviews and expert evaluation were held to check the forward- and backward-translated instruments' adequacy, compatibility, and relevance. After the evaluation, some items were removed for redundancy. Minor changes in wording were made. Per experts' suggestions, items concerning risk factors for breast cancer in the perceived susceptibility subscale were added. Furthermore, the pretest of the instrument also leaded to an amendment in the response options of the instrument. [29] The response options were amended as follows: 4 = "yes," 3 = "I think so," 2 = "I don't think so," and 1 = "no." Similar afterward modification methods were used in other studies.

Validation methods

The validation process is to validate the instrument for the target population, which is usually measured by the validity and reliability. In the 18 articles included in this methodological review, SPSS software was used for data analysis. For example, construct validity and internal consistency reliability were the most frequently used analysis methods. Other frequently used tests were test-retest reliability and item-total subscale correlations. Some of the studies also used the analysis of content validity, face validity, and predictive validity. More details about the validation methods are presented below.

Construct validity. All the 18 studies tested the revised instruments' construct validity. Among the 18 studies, four studies used the confirmatory factor analysis, [28, 40, 41] seven studies used principal component analysis, [26, 32, 35, 37- 39, 42] and two used exploratory factor analysis. [29, 36] For the other studies, two studies used both exploratory factor analysis and principal component analysis, [27, 31] one study used both confirmatory factor analysis and principal component analysis, [30] one study used both exploratory factor analysis and confirmatory factor analysis, [33] and one study used Pearson correlation between the original and revised versions of the instrument. [34] In the analysis, some items were deleted due to a low factor loading of less than 0.3, [26, 27] such as the items in the perceived barriers subscale; "fear of finding out you have cancer," "your husband's opinion," "shame," and "pain". [29] Results from all the studies showed a good model fit and adequate explanation of the final structural model.

Internal consistency reliability. All the 18 studies tested the instruments' internal consistency reliability. The internal consistency reliability was measured using Cronbach's alpha coefficient. Usually, Cronbach's alpha coefficient was set at 0.70. When Cronbach's alpha coefficient was larger than 0.70, the instrument's reliability was considered satisfactory. Results from all 18 studies included in this methodological review showed a satisfactory Cronbach's alpha coefficient larger than 0.70.

Item-total subscale correlations. Of the 18 studies, 11 studies tested the item-total subscale correlations. [27, 29-32, 35, 37-39, 41, 42] Usually, the item-total subscale correlation was set at 0.3. When the correlation between an item and the total subscale score was larger than 0.3, the item-total subscale correlation was considered satisfactory. In the analysis, some items were deleted due to a low item-total subscale correlation of less than 0.3. For example, one item in the study conducted by Guvenc et al., [27] "If I have a smear test regularly and the result is good, I don't need to worry too much about cervical cancer," was deleted because of low correlation between the item and subscale scores ($r = 0.17$).

Test-retest reliability. The test-retest reliability was used to test the instruments' reliability across time. Eight of the 18 studies tested the instruments' test-retest reliability. [27, 28, 30, 31, 34, 35, 41, 42] The retest sample size ranged from 10 [42] to 96. [30] The interval between the test and retest time was 12 [41] to 31 days. [27] Most of the studies retested the instruments two weeks after the first test time. [27, 31, 34, 35, 42] Pearson correlation test (inter-class correlation) [28, 34, 42] was the method most-commonly used to compare the test-retest scores for each dimension. Usually, the test-retest correlation coefficient criterion was set at 0.6. [28, 35] The test-retest reliability was considered satisfactory when the test-retest correlation coefficient was larger than 0.6. [48-50] Data analysis results showed the test-retest reliability from all the reviewed studies using it was larger than 0.6, ranging from 0.79 to 0.99.

Content validity. One of the 18 studies reported the content validity of the revised instrument. [43] The content validity was measured by the content validity index, which was evaluated through expert panel discussion. Also, the expert panel assessed and commented on the suitability, reasonability, logical sequence, conciseness, and comprehensiveness of the items.[43]

Predictive validity. Three of the 18 studies included in this study tested the predictive validity of the revised instruments [30, 36, 40] using multiple regression [30, 36, 40] and Pearson correlations for data analysis. [36, 40] The frequency of practice of screening in the past year [30, 36, 40] and the intended frequency of screening in the next year were used as dependent variables. [36, 40] In the study conducted by Karayurt and Dramalı, [30] results showed that there was a positive relationship between the frequency of breast screening examination practice and confidence, benefits, health motivation, susceptibility, and severity and a negative relation between the frequency of breast screening examination practice and barriers. Women with low scores on the barriers reported higher frequency of breast screening examination practice. Likewise, women with high scores on confidence, benefits, health motivation, susceptibility, and severity reported higher frequency of breast screening examination in the last year. [30] However, in the study conducted by Mikhail and Petro-Nustas, [36] different results were reported in the frequency of breast screening examination practice and related factors. For the breast screening examination practice in the last year, results showed it was positively associated with susceptibility, benefits, confidence, and motivation and negatively associated with severity and barriers, indicating that women with low scores on the barriers and severity reported higher frequency of breast screening examination practice in the past 12 months. [36] Inconsistent findings were also found in the study conducted by Tsangari and Petro-Nustas. [40] Results showed that barriers and confidence predicted the frequency of breast screening examination practice both in the past and in the next year, while no significant association was found between the breast screening examination practice and four other factors (susceptibility, motivation, benefits, and severity). [40]

Face validity. One of the 18 studies estimated the face validity of the revised instrument. [49] In the study, the face validity was evaluated to ensure clarity and comprehensibility of the items, to highlight inappropriate items or response options, and to identify and test translation alternatives and modifications. [34] A focus group was conducted with a convenience sample of asymptomatic women (n = 6) in the pilot test phase. [34] The researcher read the translated text aloud to the participants. The face validity of the instrument was measured by a 5-point Likert scale. The face validity test resulted in a removal of two items in the adapted instrument, because they were found to confuse the women and raise anxiety in responders. [34]

Discussion

This review summarized the methodologies used in the cross-cultural instrument adaptation and validation processes. Cross-cultural instrument adaptation included three steps: translation, modification, and validation. Translation is essential when a study's goal is to reference a construct across cultures. [30] To translate an instrument, the language barriers and cultural differences should be considered. [26, 51] Also, the investigators must have knowledge of the instrument-evaluated disease and the related customs, beliefs, and practices of the target population. [26]

Translating a questionnaire for multicultural research requires more than just word conversion. Direct translation of a validated instrument may not result in a culturally equivalent version in the other languages. [52] The word-by-word translation can result in incomprehensible meaning in the target language. Therefore, changes and adaptation of the items in the source language may be necessary to achieve conceptual equivalence in the target language.

Although there have been no consistent criteria established for translation of research instruments, the translation method most-commonly used in the literature was back-translation, which included the use of a panel of experts and interpreters to translate the items from the source language to the target language and then back-translate from target language to the language of origin. [46, 47] The translators and back-translators worked independently and then reviewed the translation together. [46] The main goal of back-translation was to ensure that items in the two languages had equivalent meanings. Compared to the committee translation method, back-translation method included forward and backward translation processes, which may require more time and staff to complete, but could ensure the equivalency between the two versions.

To increase the equivalency of the items between the translated and original instruments, ideally, measurement of the concepts should be done from the perspective of the culture under investigation. [35] A bilingual/bicultural team with researchers indigenous to the culture was the optimal choice. It allowed for collaborative decision making about the concepts addressed in the instrument. [35] Also, to make the translated instrument culturally appropriate, researchers must use words that are preferred and commonly used by the target population. If appropriate attention is not given to the choice of words, the translation may be meaningless to the participants from the target population and accurate responses might not be obtained. [53] Furthermore, in some studies, professional translators translated the instrument. Although the professional work has the same linguistical meaning as the original version, the targeted group may not understand certain words or phrases in the translations if they are too technical. Therefore, to judge the equivalency and cultural relevance of the translation, it is recommended that the translation be examined by participants representative of the target population or focus group participants who are bilingual and/or typical of the target population. [41, 54, 55]

Modification is the second step in the cross-cultural instrument adaptation process. It is an essential step to reach the cultural equivalency of the instrument. According to Medina-Shepherd and Kleier, [35] the validity of studies using translated instruments without the process of modification may be problematic. As the translation methodology progressed, more attention should be given to the modification of instruments. The researcher’s emphasis should place on procedures for determining equivalence between the primary and secondary language of the instrument. [35]

Compared to the embedded modification, afterward modification appears to have more strength because both the forward-translated and backward-translated versions of instruments can be checked by the expert panel and focus group judges. It was the most frequently used modification method in the reviewed literature. It can ensure the language and cultural equivalence of the translated and original versions of instruments, thus increase the reliability of the instrument.

Validation is the last step in the cross-cultural adaptation process. After completing the translation and modification of the research instrument, researchers should do psychometric testing on the instrument. Translation and modification may change the internal structure of the instruments and require that validity and reliability be established for the revised instrument. According to Nunnally, [37] the target-language version should be tested as a new instrument. The translated version will be considered equivalent to the original tool if its reliability and validity are found to be similar with those of the source language instrument. [36]

Construct validity was one of the most frequently used validation tests in the reviewed literature. Construct validity was often tested by confirmatory factor analysis, exploratory factor analysis, and principal component analysis. Confirmatory factor analysis is used when the researcher understands the constructs that underlie the data. [56] It is more powerful than exploratory factor analysis because it allows for explicit hypothesis testing by allowing testing of the "goodness-of-fit" of the predetermined number of factors and factor structure. [56] Other validation tests frequently used in the literature were internal consistency reliability, item-total subscale correlation, content validity, and predictive validity. To ensure validity and reliability of the translated instrument, construct validity and internal consistency reliability are the most necessary tests should be done in the data analysis process.

To ensure cultural equivalency of the translated and original versions of the instrument, appropriate adaptation and validation methods are essential. Cross-cultural adaptation is not just about translation, but also about considering the conceptual, item, semantic and operational equivalences between the source and target-language versions. [57] Selecting appropriate translators who have relevant experience with the research topic, engaging professional judges in the modification process, and validating the psychometric properties of the translated instrument before putting it into usage will add to the equivalency between the translated and original instrument in measuring health beliefs on cancer screening utilization.

Limitations

This methodological review has some limitations. First, only articles written in English were reviewed, which might have restricted our findings and biased the data as well. Excluding languages other than English may introduce a language bias and lead to erroneous conclusions. 58 Articles written in other languages than English may include different findings on the adaptation and validation methods used in the cross-cultural research. Given that 92.50% of scientific literature is written in English, 59 the impact on our findings might be minimal. Second, data in this study were synthesized using a narrative method rather than a meta-analysis method. For that reason, our findings cannot be used to recommend the optimal strategies for adapting and validating instruments used in the cross-cultural research. Third, this study mainly focused on the adaptation of existing instruments for different language groups, factors which may impact small groups of people within the same race, such as education levels, occupations, and residence in different geographical locations were not discussed in this study. It may limit the generalizability of the findings to be applied in different small groups and require further studies to explore the factors that impact the adaptation and validation of instruments in different groups within a specific race.

Conclusions

This review summarized the methods that were commonly used in the instrument adaptation and validation processes of cross-cultural research. It provided evidence and guidance for the cross-cultural researchers seeking to measure health beliefs about cancer screening across diverse ethnic populations. Instrument adaptation and validation are two essential processes in cross-cultural research. Using an appropriate method to translate, modify, and validate the instrument can help to reach the conceptual, item, semantic, operational, measurement, and cultural equivalence between the original and translated instruments. In the literature, back-translation and afterward-modification were most frequently used for translating existing instruments to another language. Validity was most frequently established by using the construct validity, content validity, face validity and predictive validity; and reliability was most frequently established by using the internal consistency reliability, test-retest reliability, and item-total subscale correlation when instruments were translated. Considering there is no gold standard for the cross-cultural instrument adaptation and validation, careful consideration should be given when choosing appropriate methods to adapt and validate instruments to make them culturally fitted to the target populations. Future research focusing on the selection of appropriate instrument adaptation and validation methods needs to be done to guide researchers and to add new scientific evidence to cross-cultural research.

Appendix A

Table 1. Critical Appraisal of Literature

Criteria	Yes	No
Quantitative studies critical appraisal checklist [34]		
1. Aims and objectives clearly stated	18	0
2. Hypothesis/research questions clearly specified	10	8
3. Dependent and independent variables clearly stated	3	15
4. Variables adequately operationalized	14	4
5. Design adequately described	12	6
6. Method appropriate	18	0
7. Instruments used tested for reliability and validity	18	0
8. Source of sample, inclusion/exclusion, response rates described	14	4
9. Statistical errors discussed	4	14
10. Ethical considerations	13	5
11. Was the study piloted	15	3
12. Statistically analysis appropriate	18	0
13. Results reported and clear	18	0
14. Results reported related to hypothesis and literature	18	0
15. Limitations reported	13	5

16. Conclusions do not go beyond limit of data and results	18	0
17. Findings able to be generalized	0	18
18. Implications discussed	18	0
19. Existing conflict of interest with sponsor	0	18
20. Data available for scrutiny and reanalysis	0	18

Appendix B

Table 2. Study Characteristics for the Articles Included in the Methodological Review

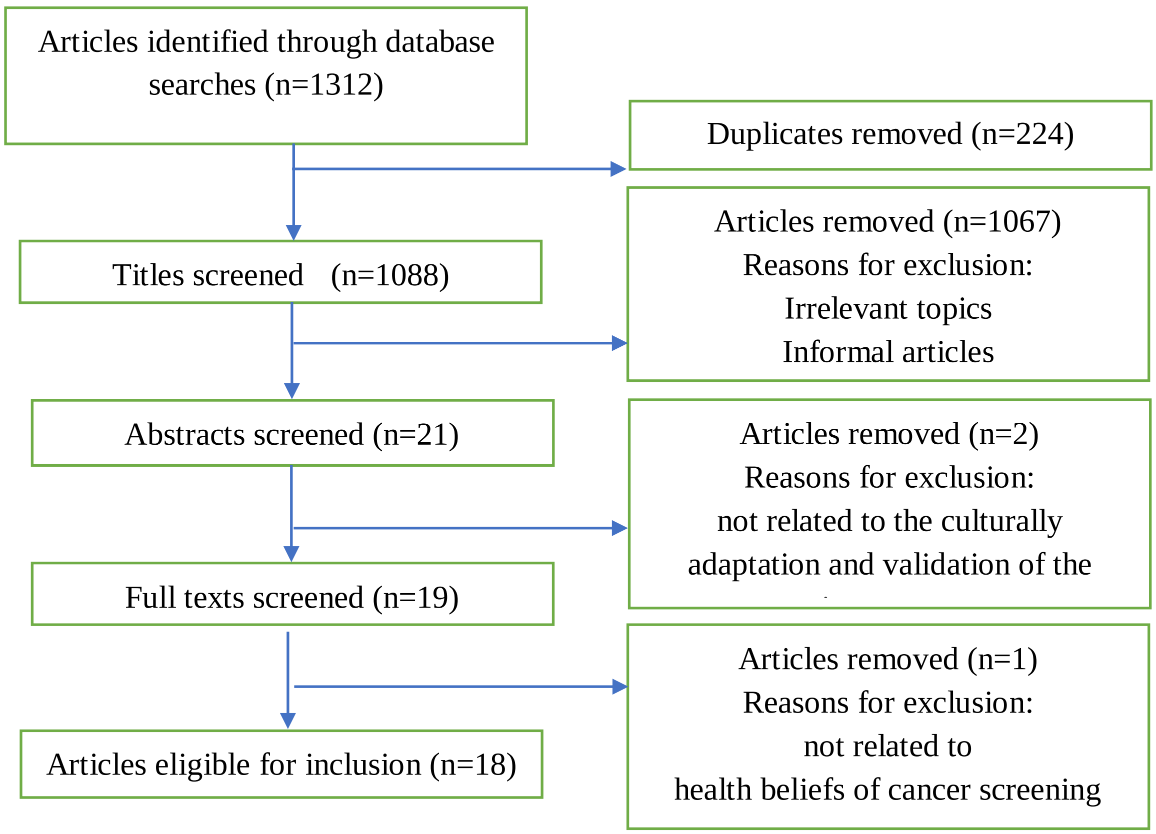
Citation	Setting	Translation method	Modification method	Validation method
Gozum & Aydin, 2004[26]	Turkey	• back-translation • using professional interpreters and/or involving the first author	• embedded modification	• construct validity • internal consistency reliability • item-total subscale correlations
Guvenc et al., 2011[27]	Turkey	• back-translation • using bilingual individuals	• afterward modification	• construct validity • internal consistency reliability • test-retest reliability
Hashemian et al., 2013[28]	Iran	• back-translation • using professional translators	• afterward modification	• construct validity • internal consistency reliability • test-retest reliability
Juárez-García et al., 2019[29]	Mexico	• back-translation • using professional translators	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations
Karayurt & Dramalı, 2007[30]	Turkey	• back-translation • using bilingual individuals	• embedded modification	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability • predictive validity
Kharameh et al., 2014[31]	Iran	• back-translation • using professional translators	• embedded modification	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability
Lee et al., 2002[32]	South Korea	• back-translation • using bilingual individuals	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations
Lee & Lee, 2015[33]	United States (Korean	• Committee translation	• afterward modification	• construct validity • internal consistency reliability

	Americans)			
Marmarà et al., 2017[34]	Malta	• back-translation • using professional translators	• afterward modification	• construct validity • internal consistency reliability • test-retest reliability • face validity
Medina-Shepherd & Kleier, 2010[35]	United States (Hispanic women)	• back-translation • using professional interpreters and/or involving the first author	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability.
Mikhail & Petro-Nustas, 2001[36]	Jordan	• back-translation • involving bilingual investigators	• embedded modification	• construct validity • internal consistency reliability • predictive validity
Parsa et al., 2008[37]	Malaysia	• back-translation • using bilingual individuals	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations
Secginli & Nahcivan, 2004[38]	Turkey	• back-translation • using bilingual individuals	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations
Taymoori & Berry, 2009[39]	Iran	• back-translation • using professional translators	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations
Tsangari & Petro-Nustas, 2012[40]	Cyprus	• back-translation • involving bilingual investigators	• embedded modification	• construct validity • internal consistency reliability • predictive validity
Yilmaz & Sayin, 2013[41]	Turkey	• back-translation • using professional translators	• afterward modification	• construct validity • internal consistency reliability • item-total subscale correlations • test-retest reliability
Zelviene & Bogusevicius, 2007[42]	Kaunas	• back-translation • using bilingual individuals	• afterward modification	• construct validity • internal consistency reliability • item-total subscale

				correlations
Dewi, 2018[43]	Indonesia	• back-translation • using professional translators	• afterward modification	• test-retest reliability • construct validity • internal consistency reliability • content validity

Appendix C

Figure. PRISMA Flow Chart Documenting the Study Selection Process



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Chapter 6: Manuscript Two

Beliefs and Attitudes toward Lung Cancer Screening among Chinese American High-risk Smokers: Interviews Based on Health Belief Model

Fang Lei, MSN, MPH, RN; Wei-Ti Chen, PhD, FAAN, CNM, RN;

Mary-Lynn Brecht, PhD; Zuo-Feng Zhang, MD, PhD; Eunice Lee, PhD, FAAN, RN

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Abstract

Background: The prevalence of smoking and lung cancer are high among Chinese Americans; however, the uptake rate of lung cancer screening is relatively low among this population. Lung cancer screening behavior is closely related to health beliefs of lung cancer screening. This study aims to explore beliefs and attitude of lung cancer screening with low dose computed tomography among Chinese American high-risk smokers.

Methods: Guided by the Health Belief Model, semi-structured individual interviews were conducted with Chinese American high-risk smokers via phone. Additional questionnaires on demographic information, history of smoking and lung cancer screening were collected via email or phone before the interview, depending on participants' preference. Content analysis was used to extract meaningful and significant themes in the dataset. Constant comparison analysis and process coding were used to categorize and code data.

Results: Data saturation was reached after interviewing nine participants. Chinese American high-risk smokers perceived a low susceptibility of lung cancer, since they believed various protective factors of lung cancer (e.g., doing exercise, healthy diet, etc.) reduced their risk of getting lung cancer. All the participants perceived a high severity of lung cancer. They acknowledged lung cancer would have a huge impact on their life. Perceived benefits of lung cancer screening were accurate in most aspects although minor confusions were still noticed among this population. Perceived barriers varied on participants', physicians', and institutional levels. High-risk Chinese American smokers had little confidence to screening lung cancer. Cues to action for them to screening lung cancer included recommendations from health care providers, support from family members and friends, and information shared on Chinese-based social media.

Conclusions: Misconceptions and barriers to screening lung cancer existed widely among Chinese American high-risk smokers. Intervention programs and clinical practice should be implemented to increase lung cancer screening among this population. Promotion of smoking cessation and lung cancer screening among Chinese Americans should be proceeded together through shared decision-making conversations; mental health support should be provided to counter the effect of fatalism and negative emotion among this population; and support should be obtained from high-risk Chinese American smokers' family members, friends, and health care providers.

Keywords: Lung cancer screening; Chinese Americans; Health beliefs; smokers; high risk; lung cancer

Beliefs and Attitudes toward Lung Cancer Screening among Chinese American High-risk Smokers: Interviews Based on Health Belief Model

Background

Lung Cancer Mortality and Survival Rates

Lung cancer is the leading cause of cancer deaths in Chinese Americans [1]. Among all Asian American subgroups, Chinese Americans have the highest mortality rate of lung cancer [2]. As the second and fourth most common cancer among U.S. Chinese men and women, respectively, lung cancer accounted for approximately 30% of all cancer-related deaths in Chinese Americans [1]. In the US, the five-year survival rate of lung cancer is 15% for males and 21% for females [3]. Patients with lung cancer have one of the lowest five-year survival rates (18.6%) compared to other types of cancer in the U.S., such as colorectal (64.5%), breast (89.6%) and prostate (98.2%) cancer. Only 16% of lung cancers are diagnosed at a localized stage, for which the five-year survival rate is 55% [3]. As the diagnosed time prolongs, the five-year survival rate for lung cancer patients drops to 4% when lung cancer is diagnosed at a late stage (stage IV) [3], and more than half of patients with late-stage lung cancer die within a year after diagnosis [3].

Lung Cancer and Lung Cancer Screening

Lung cancer screening with low dose computed tomography (CT) is an effective secondary prevention method for lung cancer [4]. Screening for individuals at high risk for lung cancer has the potential to improve lung cancer survival by finding the disease at an earlier stage when it is more likely to be curable through surgical intervention and other therapeutic treatments. It has been reported that about eight million Americans qualify as high-risk individuals for lung cancer and are recommended to receive annual screening with low dose CT scans [5]. If half of these high-risk individuals were screened, over 12,000 lung cancer deaths could be prevented [5]. Lung cancer screening with low dose CT has been proved to reduce the mortality rate of lung cancer by 20%, compared to the standard chest X-ray, among current or former smokers who had smoked at least 30 pack-year (smoked one pack of cigarettes per day for 30 years) or had quit smoking within the past 15 years [4, 6]. Since 2013, the United States Preventive Services Task Force (USPSTF) and other organizations have issued guidelines for the early detection of lung cancer with yearly low dose CT among high-risk population [7]. Screening lung cancer with low dose CT was covered both by the private and public health insurances for the high-risk population (adults aged 50 to 80 years who have a 20 pack-year smoking history and currently smoke or have quit within the past 15 years) [8].

Uptake Rate of Lung Cancer Screening

Although the supportive landscape has changed, uptake rates of lung cancer screening with low dose CT remain low after the USPSTF guideline was published [9, 10]. The percentage of eligible population who had received lung cancer screening with low dose CT just increased from 3.3% in 2010 to 3.9% in 2015 among U.S. population [11]. Reports about the uptake rates of lung cancer screening among minority populations were lacking. Although the uptake rate of lung cancer screening with low dose CT among Chinese Americans was not reported in the literature, a recent study showed 22% of the elderly Chinese men in Chicago met the eligibility criteria of the USPSTF low dose CT screening [12].

Health Beliefs and Behaviors of Lung Cancer Screening

Previous studies indicated that health beliefs of lung cancer screening were significantly associated with the uptake of lung cancer screening. Reports showed people who were significantly more likely to have a low dose CT screening had several common health beliefs toward lung cancer screening [13]. In a cross-sectional survey study among 338 older smokers (aged older than 55 years) with a smoking history more than 30 pack-year, the results showed the participants who were more likely to say they would get screened if they perceived a high risk for lung cancer, were not afraid of CT scans, believed low dose CT screening results were accurate and detecting lung cancer earlier would more likely improve lung cancer prognosis [13]. Several other studies also indicated that cultural factors such as beliefs and attitudes about lung cancer screening process or illness, knowledge, mistrust of healthcare system, and fatalistic beliefs were related to high-risk population’s participation in lung cancer screening programs [14-18], especially among minorities (e.g., Blacks and Hispanics) [19].

Health Belief Model

The interview questions in this study were developed based on the Health Belief Model (HBM) (Fig. 1). The HBM is a social cognition model focusing on health behavior change [20]. It originated from psychological science [21], and was developed in the 1950s by Rosenstock, Hochbaum, Kegeles, and Leventhal, four social psychologists at the United States Public Health

Service Organization [22]. Amendments to the model were made in the late 1980s to incorporate emerging evidence about the role of self-efficacy in decision-making and health behavior [23].

The HBM is one of the most frequently used theories in health promotion, disease prevention, and health education [21]. It was initially developed to explore the reasons of the widespread failure of tuberculosis screening programs. Later, it was used for predicting and explaining health-related behaviors, especially for the utilization of health services [24]. The HBM has been used in several studies to explore participants' belief, attitude, and behaviors about various types of cancer screening [25-27]. It has been tested and proved to be a valid theory to explore participants' beliefs and attitude toward health services utilization.

The key concepts of HBM are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action [23]. 1) Perceived susceptibility is individuals' subjective beliefs on the risk of getting a disease [23], which refers to how strongly people believe that they are susceptible to the disease [23]. 2) Perceived severity is personal evaluation of the seriousness of the consequences related to a disease, which refers to individuals' perception on whether the disease will have serious effects on their lives if they contract it [23]. 3) Perceived benefit is people' s assessment of the value to take the advised action to reduce risks or seriousness of diseases [23]. 4) Perceived barriers are people's belief about the negatively valued aspects of taking actions, which are the obstacles to the behavior change [23]. 5) Self-efficacy refers to individuals' own confidence in personal ability to successfully take action to achieve outcomes by responding to unfamiliar or difficult situations and dealing with any associated setbacks or obstacles [23]. 6) Cues to action refers to the strategies used to activate one's readiness to take actions [23].

Health Belief Model and Screening Behaviors among Chinese Americans

The HBM has been used in several studies among Chinese American populations to explore their screening behaviors. One quantitative study based on the HBM conducted with 125 Asian American women in southeastern Michigan showed that Chinese women were five times more likely than others to identify ‘‘do not need mammogram if I feel ok’’ and ‘‘waiting time is too long’’ as perceived barriers for screening mammogram (OR = 5.450, 95% CI =1.643, 18.081, and OR = 5.070, 95% CI =1.674, 15.351, respectively), controlling for income [28]. Another qualitative study conducted in 14 in-depth interviews and 4 focus groups with 39 low-income Chinese immigrants in New York City showed a strong influence of Chinese culture on Chinese immigrants' health beliefs toward breast, cervical, and prostate cancer, and their cancers screening behaviors. Based on the HBM, common misconceptions about the causes of cancer included: excessive sexual activities, having a certain blood type, cancer being "contagious", and women ignoring their reproductive or natural functions by using birth control or not breastfeeding [29]. Although these studies provided some information on Chinese Americans' beliefs and attitude toward cancer screening, however, date is limited. In addition, up to date, to our knowledge, no study has explored Chinese American high-risk smokers' attitude and beliefs toward lung cancer screening with low dose CT. Given a high mortality rate and a low screening rate of lung cancer among Chinese American population, exploring their health beliefs toward their utilization of screening is necessary. By filling this gap, a better understanding toward Chinese American high-risk smokers' attitude and beliefs of lung cancer screening could be reached.

Methods

Aim and Significance of the Study

The purpose of this study was to explore beliefs and attitude toward lung cancer screening with low dose CT among Chinese American high-risk smokers. Findings from this study can help health care providers getting more insight into Chinese Americans' health behaviors of screening lung cancer. By knowing Chinese Americans' health beliefs toward lung cancer screening, culturally tailored intervention programs could be designed to help to increase the uptake rate of lung cancer screening among Chinese Americans.

Design and Ethical Consideration

This qualitative study was guided by the semi-structured interview guide which was developed based on the Health Belief Model. In-depth individual phone interviews were conducted with the participants and recorded by digital recorder. This study was approved by the university Institution of Research Board (IRB). Due to the minor risk of the study design, written informed consent was waived by the university IRB. However, study information sheet was distributed to the participants via email or phone to inform their rights in the study. In addition, participants' privacy and confidentiality were strictly protected in the study by following the research ethical rules enacted by university IRB. Each participant was assigned a study number to protect their personal information from accidental disclosure, and no information was identifiable.

Setting, Inclusion and Exclusion Criteria

The inclusion criteria for the participants to be included in this study were: 1) Aged 50 to 80 years old, 2) residing in the United States and self-identified as descendants of Chinese, 3) current smokers or quit smoking in the past 15 years, with a smoking history over 20 package-year, 4) can speak Cantonese or Mandarin, and 5) can read Chinese at 6^{th} grade level. Exclusion criterion for the participants was having been diagnosis with lung cancer. The sample size of this study was determined by data saturation toward the study aim.

Recruitment and Data Collection

Participants in this study were recruited using the purposive and snowball sampling methods. English and Chinese version flyers including information on the purpose of the study, inclusion and exclusion criteria, and the primary investigator's contact information were posted on a popular website (https://www.chineseinla.com) among Chinese Americans. After the participants contacted the primary investigator, they were screened by the eligibility to participate in the study through phone, and a follow up formal interview were scheduled with the participants. Before the interviews, a questionnaire package was sent to the participants to fill out. Some participants were not able to fill out the questionnaires by themselves. Following their requests, the questions were asked, and the questionnaires were filled out item by item in the individual interviews by the primary investigator. The individual interviews were conducted in Chinese by the primary investigator, recorded by the digital recorder, translated to English, and stored in a passworded encrypted laptop. For reimbursing the participants' time and effort in this study, a 25-dollar and

5-dollar amazon gift card was sent to the participants and referrals, respectively, through email after the interviews were completed.

Instruments

The semi-structured interview guide (Table 1) included questions asking about participants' beliefs and attitude toward lung cancer screening. Further, a questionnaire was developed to collect 1) the demographic information, including questions asking about participants' age, gender, marital status, number of children, education level, income, insurance status, religious status, age when moved to the US, residence years in the US, occupation, and language or dialect; and 2) the smoking and lung cancer screening history, including participants' smoking amount, frequency, length, intention and confidence to quitting smoking/screening lung cancer, family history of lung cancer, and lung cancer screening history.

All the instruments used in this study were developed based on the literature search and back-and-forth discussions among authors of this study. The instruments were developed in English initially, reviewed by all authors of this study, further revised, and translated to Chinese by the primary investigator. The translated Chinese version of instruments were reviewed and revised again, which aims to achieve cultural clarity and make the instruments easy understandable.

Data Analysis

Data collected in this study was analyzed using the content analysis method. Constant comparison analysis was conducted to extract emerging subthemes and main themes in the content. Four coding phases including initial, focused, axial, and theoretical coding were conducted through constant comparison of the content. In the initial coding phase, line by line coding was done manually using the process coding method. Then a cross-transcription comparison was conducted in the focused coding phase to identify the most frequent and significant codes. The codes were linked to subcategories, properties and dimensions in the axial coding phase, and main categories for themes were identified in the final theoretical coding phase. During the data analysis process, field notes and memos were taken to facilitate data analysis. The analysis was done by the primary investigator and reviewed by the second author of this study. Themes emerged from the data analysis were further reviewed and verified by other authors of this study to ensure the trustworthiness and consistency of the findings.

Results

Participants' Characteristics

After interviewing nine participants, data reached "theoretical saturation" for the study purpose. No new information emerged regarding the main themes extracted from the interviews. For the nine individual interviews with participants, each interview time ranged from 30 to 60 minutes, with a mean interview time at 48 minutes. Six of the nine participants quit smoking in the past 15 years, and three of them were current smokers. Among the current smokers, all of them planned to quit after six months. In a scale ranging from 1 to 10, mean scores for the importance to them to quit smoking and screening lung cancer are 7.7 and 7.4, respectively (1=not at all important, 10=extremely important); and 4.7 and 8.1 for their confidence to quit smoking and screening lung cancer, respectively (1=not at all confident, 10=extremely confident). More demographic characteristics can be found in Table 2.

Qualitative Results

Based on the Health Belief Model, high-risk Chinese American smokers' health beliefs toward lung cancer screening with low dose CT were reported by the categories of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (Table 3).

Perceived Susceptibility

When asked about who was at a high risk of lung cancer, all participants acknowledged that smokers were susceptible to lung cancer. They also mentioned secondhand smokers, smokers with alcohol use, and the person who had a family history of lung cancer could have a high risk of lung cancer. Although all participants were able to identify the risk factors of lung cancer, some confusions around the risk of lung cancer were still noticed. While some participants can correctly identify the environment factor which led to lung cancer (e.g., dusty, and smoky working environment), some participants thought bad mood can cause lung cancer. In addition, most of the participants thought smoking did not definitely lead to lung cancer. They gave evidence by the smokers who they know but didn't get lung cancer and non-smokers who were diagnosed with lung cancer to support their opinions.

Most the participants thought their personal risk of lung cancer was low. Only one participant thought he was possible to get lung cancer, and one participant thought everyone's risk for lung cancer was the same. The participants attributed their low risk of lung cancer to their regular work and life schedule, family history (without lung cancer history), healthy behaviors (quitting smoking in the past 15 years, not drinking, doing exercise, and healthy diet), good health status (no problems or symptoms of their lungs), and environmental factors (good air quality, and good work and life environment). One participant stated getting old made him worried and scared about his lung cancer risk.

Perceived Severity

All the participants acknowledged lung cancer would have a huge impact on their life. Most of them mentioned lung cancer could cause personal health problems (e.g., discomfort when breathing, short of breath, short of life, fatigue and easy to get tired, and death), with one participant thinking that lung cancer patients were discriminated by others because lung cancer could transmit to others. Also, they stated lung cancer could cause family problems and impact social interaction with others. All the participants reported lung cancer brought emotional distress/despair/frustration/fear to them and their family members. They also mentioned the heavy financial burden brought by lung cancer treatment, with one participant emphasizing that being a household head diagnosed with lung cancer brought a disaster to the whole family.

Perceived Benefits

All the participants realized the benefits of lung cancer screening with low dose CT. All of them agreed lung cancer screening can help them to detect and treat lung cancer earlier. Most of them thought screening can help to prevent lung cancer. Some participants stated screening lung cancer could tell them their current lung status, help with emotion management (not so worried about the smoking history, and make people ease) and raise smokers' concern about their health. They thought a bad lung situation would help smokers to quit smoking, and screening could increase smokers' perceived risk and severity toward lung cancer.

Perceived Barriers

Barriers to screening lung cancer were noticed from participants' personal factors, physicians' factors, and institutional factors. Participants' personal factors hindering their lung cancer screening behaviors included emotional factor, lack of knowledge about lung cancer screening, financial factor, physical barriers, incorrect health maintenance beliefs and behaviors, fatalism beliefs, and language barrier. Most of the participants reported being scared/worried about a lung cancer diagnosis would hinder them to screen lung cancer. One participant reported that she was not willing to bother doctors and she thought lung cancer would be result of her fault. One participant pointed out that the discrimination/stigma/shame around screening was a reason for smokers to opt out screening.

Results showed that all the participants lacked knowledge about lung cancer screening: They never heard about the lung cancer screening with low dose CT before, neither of them did lung cancer screening previously. Most of the participants thought knowledge of lung cancer screening was a factor impacting lung cancer screening behaviors. Some participants described their confusion around the procedures of lung cancer screening, including not knowing whether lung cancer is painful or not, thinking radiation from screening is harmful to people, etc. Some participants expressed their confusions about the performance of lung cancer screening, including mixing up screening with clinical trial exams and medicine treatment, and mixing up low dose CT lung cancer screening with normal CT scan for diagnosing lung cancer among symptomatic patients. One participant pointed out that he did not know whether he had a high risk for lung cancer or not. Upon further discussions with the participants, all of them attributed the insufficient information on lung cancer screening to their lack of knowledge on screening with low dose CT.

Barriers related to financial and physical factors were noticed in the interviews. Some of the participants pointed out financial cost was a reason for smokers' opting out lung cancer screening. They thought screening was not worthy given money was cost. Further, some participants reported physical barriers such as transportation, time conflict (need to ask a leave from work to go to screening), and time consuming (need to wait for a long time before the appointment time and need to go to different places to see doctors and do exams) would hinder them to screening lung cancer.

Incorrect health maintenance beliefs and behaviors also hindered the high-risk Chinese American participants' lung cancer screening behaviors. All the participants reported a good health (without problems or symptoms of their lungs) was a reason for their not thinking about screening lung cancer. One participant mentioned his father's diagnosis with lung cancer due to not getting further screening since the nodule in his lung didn't change. One participant pointed out his friends being diagnosed with lung cancer due to their not caring about their lung symptoms and mistakenly believing their symptoms would get better with time went by. Some participants agreed that they did not think about screening actively. They mentioned a common problem related to smokers' screening behavior---take the chance if no symptoms occur. One participant said that she tended to take medicines by herself to treat health problems without seeing doctor or doing exams.

Furthermore, fatalism beliefs and language barrier were acknowledged barriers for the high-risk Chinese American participants' to screening lung cancer. When talking about perceptions toward lung cancer, all the participants tended to use the second-personal pronoun ("you") to explain everything, instead of using the first-personal pronoun (e.g., I will get lung cancer if …). One participant mentioned twice in his conversation that lung cancer was determined by genes or DNA, and one participant believed Jesus arranged everything no matter screening was done or not. Most of the participants mentioned communication with doctors in English language is a difficulty for them to access health care service. They tended to choose Chinese-speaking doctors for treating their health problems.

Four physician-related factors emerged as barriers to screening for lung cancer: neglect of prevention, time limitation, possible lack of knowledge about lung cancer screening, and possible ambiguous obligation. When talking about the reasons for not having a discussion with doctors about lung cancer screening, all the participants mentioned that they had never received a recommendation about lung cancer screening from their doctors. Some participants emphasized doctors did little about disease prevention. One participant mentioned doctors did not take lung cancer screening seriously (thought lung cancer screening was not important). The findings clearly suggest physicians who provided care to Chinese Americans tended not to recommend lung cancer screening to their patients. Further, some participants mentioned the consultation time was not enough when seeing doctor, and the doctor was too busy to tell patients about other information. One participant reported feeling awkward to discuss with doctors about disease prevention due to doctor's lack of time. Lastly, some participants talked about their confusions about the responsibility of ordering lung cancer screening by doctors. They wondered whether it is their family doctors' or the expertise doctors' responsibility to order the screening since none of them did that for them previously.

The participants also mentioned the institutional factors which hindered their screening behaviors. All the participants though the education of lung cancer screening was insufficient. Some participants pointed out lack of attention about lung cancer screening from health care system was a reason for their not screening lung cancer. Some participants complained the inconvenience to go to different places to see doctors and do exams, and they pointed out the appointment time interval was too long for seeing doctor or receiving physical exams.

Self-efficacy

When asked about where and how to screen lung cancer, even though some participants had the experience of receiving CT previously due to diseases, most of the participants were not confident about where to receive the low dose CT test and how to get it. Some participants thought only family doctors could order the screening. One participant thought doing a CT was comfortable and the procedure was convenient. When asked about their confidence to schedule the appointment for screening, most of the participants depended on their family doctor to schedule the appointment. One participant reported she needed help from her daughter to arrange the appointment. Regarding their confidence to discuss results of lung cancer screening with their doctors, most of the participants were confident to accept the results of screening. Some participants were not willing to know the results or accept a bad result of lung cancer screening. One participant mentioned his confusion toward the results of CT exam by talking about his father's diagnosis with lung cancer although his doing lung CT exams several times. Even though confusions about the results of lung cancer screening presented, all of them acknowledged feeling frustrated about getting a bad result from screening.

Following discussions about their confidence to treat lung cancer after a positive result from screening, most of the participants expressed their confidence to follow doctor's instruction on the treatment. One participant stated that she would only be willing to treat if the status of lung cancer was not serious, and she thought treatment of a late-stage lung cancer was not worthy. The other participant pointed out that he would only see doctor if the result of screening was not so bad; if lung cancer was diagnosed at a late stage and the prognosis was not good, he would wait to death and not treat, with a hope that he would die quickly since he believed Jesus would arrange his life.

Cues to Action

When talking about getting information on lung cancer screening, all the participants did not know lung cancer screening was performed using low dose CT, although some of them received CT exam before. Most of the participants did not know how to get information to screen lung cancer. Some of them thought getting information from hospital or doctors, consulting others, or by family members' help. Although some of the participants thought internet could make information more accessible to smokers, one of them agreed she did not like to search information online, neither did she know how to search information through websites, and another participant pointed out he preferred simple and easy understandable text information with pictures.

Regarding the triggers for smokers to decide to screen for lung cancer, all the participants agreed having symptoms or problems with lungs would trigger smokers' wiliness to screen. Some of the participants thought being old was a reason for them to receive screening. One participant emphasized the importance to aware the harm of smoking and the risky smoking amount for the smokers to screening lung cancer. For the external cues to action, all the participants thought doctors' recommendation to screen was very important. In addition, family members' suggestions and social media's information were important to their screening behaviors. Some participants thought smokers would take screening seriously if it was a normal regular exam, and they suggested the request and discussion of screening with doctors could be done by smokers actively.

Discussion

This qualitative study explored Chinese American high-risk smokers' perceptions and beliefs toward lung cancer screening with low dose CT based on the HBM. This is one of the first studies focusing on Chinese Americans' perceptions of lung cancer screening. Findings from this study could benefit both health care providers and high-risk Chinese American smokers by helping them to identify the barriers and facilitators for lung cancer screening, thus sensitive intervention programs could be designed and implemented to increase the uptake rate of lung cancer screening among Chinese Americans.

In the study, although all participants were able to identify the risk factors of lung cancer, some confusions around the risk of lung cancer were also noticed. The relationship between smoking and lung cancer was not clear among the participants. Witnessed by the evidence from smokers who did not get lung cancer and non-smokers who did get lung cancer, most participants thought their risk of lung cancer was not definitely high. Furthermore, by underlining other protective factors to health, such as a regular work and life schedule, quitting smoking in the past 15 years, not drinking, doing exercise and so on, the participants further refused their risk of lung cancer, although they smoked more than 20 package-year previously.

This should be an important point to initiate in-depth conversations about lung cancer screening with Chinese Americans at high-risk for lung cancer. Health education focusing on the aggressive factors and defensive factors of lung cancer should be taught to the high-risk smokers. Explanations about the relationship of smoking and lung cancer should be delivered to the smokers to raise their awareness toward their risk of lung cancer. Knowledge about smoking's consequence on lung cancer should be clarified by mentioning other risk factors such as secondhand smoking and polluted air, which may lead to non-smokers to get lung cancer [30]. In addition, smokers not getting lung cancer should be clarified with the fact that multiple diseases could be caused by smoking (e.g., cardiovascular diseases, stroke, diabetes, and other sites of cancers, etc.) [31];

smokers may not be able to develop or discover lung cancer prior to the other kinds of diseases' symptoms occur.

Given the low survival rate of lung cancer, all the participants agreed lung cancer would have a huge impact on their life, from the aspects of health, emotion, finance and social interactions with the family members and someone else. Although most of the participants were able to identify the consequences caused by lung cancer disease, understanding toward the cause of lung cancer and the consequence mentioned by one participant was inaccurate. Thinking lung cancer was a contagious disease and it could transmit to others made the participant thought a lung cancer diagnosis could bring discrimination/stigma/shame to the smokers. Going from this, additional health education on the pathology of lung cancer should be delivered to the high-risk smokers. It was necessary to let smokers know that more than 60 known carcinogens had been detected in cigarette smoke [32]. All the carcinogens played a crucial role in tumorigenesis [32], which active smokers' DNA that evoked genetic mutations and epigenetic reprogramming [32], and eventually leaded to the uncontrollable cell mutation. Clarification should be made on the non-contagious characteristic of lung cancer. Instead of bacteria or virus which could be contagious, the auto-cellular variation caused by the carcinogens in cigarette smoke should be emphasized on the reason for lung cancer, thus the perception toward the consequence of transmitting lung cancer disease to others and feeling discriminated/stigmatized/shame from others could be changed.

Regarding the perceived benefits of lung cancer screening, although all the participants agreed that screening lung cancer could help to detect and treat lung cancer earlier, a misunderstanding of the benefits of lung cancer was noticed in the individual conversations with four participants who thought screening can help to prevent lung cancer. Although lung cancer screening with low dose CT is a secondary prevention method for lung cancer, by screening with low dose CT, lung cancer can be detected and treated at an earlier stage before the appearance of signs or symptoms [33]; however, screening cannot change the fact that lung cancer is developing or occurred. Smoking cessation is the optimal method for smokers to prevent lung cancer. As the primary prevention method for lung cancer, smoking cessation is found to be cost effective both yielding immediate and long-term benefits on the health of lung cancer patients, including decreased risk of disease, increased survival time, decreased postoperative complications, increased efficacy of chemotherapy, decreased radiation therapy complications, and improved quality of life [34]. Thus, when a conversation about lung cancer screening is initiated with high-risk smokers, emphasis should be put both on the screening and smoking cessation. In addition, some participants realized the benefits of screening lung cancer on smoking cessation. They stated that screening lung cancer could raise smokers' concern about their heath and increase their perceived risk and severity toward lung cancer. Particularly, a bad lung situation would help smokers to quit smoking, which is also supported by the evidence that three of the participants in this study quit smoking in the past 15 years due to their fear of the "black and messy lungs" in the chest image exam.

In the study, barriers to screening lung cancer existed on participants', physicians', and institutional levels. Efforts should be put to help high-risk smokers to overcome those barriers.

Promotion programs focusing on the propaganda of lung cancer screening related knowledge should be implemented both among physicians and high-risk smokers. Attention should be raised to help physicians and high-risk smokers to realize their roles in preventing lung cancer. Information on the free cost, low radiation and performing procedures should be delivered to the eligible high-risk smokers to ease their fear/worry/shame toward screening lung cancer. Flexible and convenient screening schedules with mandarin language services should be provided to help Chinese American high-risk smokers to get access to the services. Health education on disease prevention and health promotion should be delivered both to high-risk smokers and their significant others. Emotional care such as encouraging high-risk smokers to talk about what they were going through, to be strong, to maintain a positive environment and normalcy, and to use spirituality as a source of strength to help them change their negative fatalism attitude to a positive one [35].

When talking about self-efficacy of screening lung cancer, most of the participants were not confident enough. They needed help with screening either from health care providers or family members. In addition, 33% of the participants (n=3) were not ready to deal with the result from screening, and all the participants endorsed an emotional change upon getting a lung cancer diagnosis. Furthermore, negative expectation of the treatment and confusion around the result of screening were also noticed in the study. To increase high-risk smokers' self-efficacy to screening lung cancer, one-on-one shared decision-making conversations should be initiated to help them better understand the benefits and harms of screening lung cancer [36]. Explanations around the false negative and false positive results of screening and the possible consequences (e.g., missing detection of lung cancer, and following-up invasive procedures such as diagnostic needle biopsy, bronchoscopy, and thoracic surgery, etc.) should be informed to the high-risk smokers [37]. Also, mental health support following screening should be prepared to help this vulnerable population get through their life change. When it is necessary, palliative care should be provided by patients' request after a comprehensive evaluation of patients' quality of life and the disease progress.

Regarding the cues to action, disseminating information on lung cancer screening is an important external cue which could change high-risk smokers' attitude toward lung cancer screening. Clarification on the low dose of CT and the difference between screening and normal CT for diagnosis should be provided to help high-risk smokers differentiate the concepts of screening and diagnosis. Easy understandable culturally sensitive Chinese text information flyers or pamphlets with pictures should be designed and distributed to high-risk smokers. Support from health care providers (by giving recommendation), family members, relatives, and friends (by providing suggestions), and social media (by increasing awareness and sharing knowledge) should be maintained to remind eligible high-risk smokers to screening lung cancer annually. When it is necessary, an active request by eligible high-risk smokers to screening lung cancer could be combined to the physicians' recommendation of lung cancer screening. Working along both with high-risk smokers and physicians could ensure an increasing uptake rate of lung cancer screening among Chinese American smokers.

Limitation

This study has some limitations. First, although we intended to recruit Chinese American high-risk smokers across the United States, most of the participants (n=8) participated in this study resided in the Los Angeles area; thus, some of our findings may be not relevant to the high-risk Chinese American smokers who reside in other areas. However, given the cultural elements are mostly in common across Chinese Americans residing in different areas within the United States, findings of this study could still mirror some issues related to Chinese American high-risk smokers' health beliefs toward lung cancer screening and provide useful information to increase their awareness to screening lung cancer. Secondly, same as other qualitative studies, participants' recall-bias and self-reflection may bring bias to the study. By recalling their past experiences and answering questions from their personal perceptions, individual's opinion may deviate the results of the study. However, by triangulating and constant comprising the significant and meaningful themes emerged in the transcripts, bias brought up by individual participant could be reduced to an acceptable level.

Future Directions for Research and Practice

Findings from this study indicate several directions for future research and clinical practice. First, culturally sensitive Chinese language education programs which focus on lung cancer screening need to be implemented among high-risk smokers and health care facilities. Health education tools such as flyers and pamphlets should be disseminated among this population to help them increase their knowledge level of lung cancer screening. Second, one-on-one pre-screening shared decision-making conversation and post-screening mental health support should be implemented in the clinical practice. Involving high-risk smokers' family members and friends in the screening process could help to promote and remind high-risk smokers to screening lung cancer. Third, smoking cessation education and lung cancer screening promotion should go hand in hand among current high-risk smokers. Without quitting smoking, by screening lung cancer solely, current high-risk smokers' risk of getting lung cancer is still at the high level. Supporting methods for quitting smoking such as language sensitive quitting smoking line and nicotine patch should be informed and promoted among current high-risk smokers.

Conclusions

Guided by the Health Belief Model, high-risk Chinese American Smokers' health beliefs toward lung cancer screening with low dose CT was explored in this study. Findings from this study enable us to understand Chinese Americans' lung cancer screening behaviors and suggest various strategies to increase lung cancer screening among this population. Given the prevalent smoking rate but low uptake rate of lung cancer screening among this population, we suggested that smoking cessation and lung cancer screening should be emphasized together for this population in the shared decision-making conversations with health care professionals; mental support should be provided to counter the effect of fatalism and negative emotion in this population; and support should be obtained from high-risk Chinese American smokers' family members and friends. By using the HBM, targeted interventions could be designed and utilized more efficiently to deal with the barriers to screening lung cancer among this population, and eventually increase their self-efficacy to screening lung cancer.

List of abbreviations

CT: Computed tomography

USPSTF: United States Preventive Services Task Force

HBM: Health Belief Model

IRB: Institution of Research Board

Declarations

Ethics approval and consent to participate: The study was approved by the Institution of Research Board (IRB) at University of California, Los Angeles. Although the written informed consent was waived by the university IRB, content on the study information sheet was informed to the participants and their privacy/confidentiality are both protected. All methods in this study were carried out in accordance with relevant guidelines and regulations.

Consent for publication: Not Applicable.

Availability of data and materials: The qualitative datasets generated and/or analyzed during the current study are not publicly available due to the data containing information that could compromise research participant privacy/consent but are available from the corresponding author on reasonable request, and subject to approval from the institution of research board at the University of California, Los Angeles.

Authors' contributions: FL is the principal investigator for the study. Conceptualization, methodology, writing—original draft preparation, FL; writing—review and editing, FL, WTC, MLB, ZFZ, and EL.

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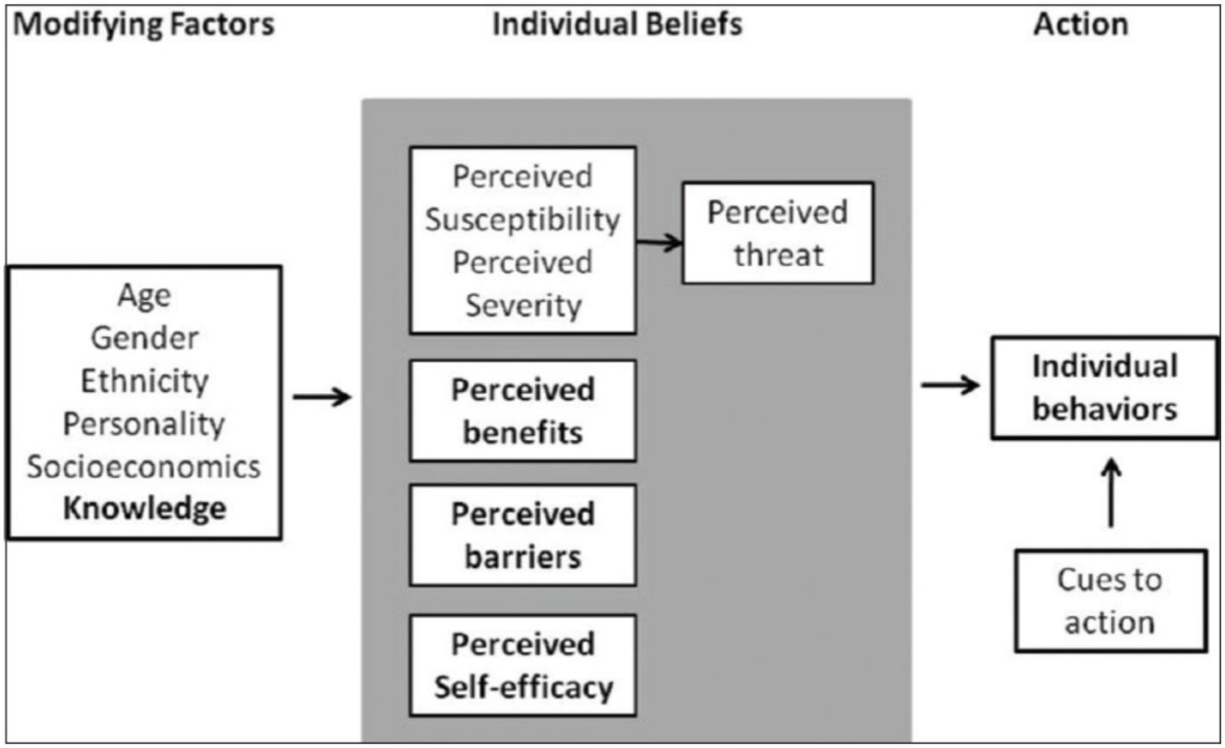
Appendix A

Fig. 1. Health Belief Model



Appendix B

Table 1. Semi-structured Interview Guide

- **Entry question**

1. When you hear “lung cancer” or “lung cancer screening”, what comes to your mind?

- **Perceived susceptibility**

2. Who get lung cancer? Do you think that you will get lung cancer? Why do you think like that?

- **Perceived severity**

3. Do you know anybody who get lung cancer?

PROBE: (If yes,) How does that impact their life? What if it happened in your case?
(If no,) What impact do you think it will be on a person’s life, if he/she diagnosed with lung cancer? Why do you think like that?

- **Perceived benefits**

4. Did your doctor or other health care providers discuss lung cancer or recommend lung cancer screening with/to you?

PROBE: (If yes,) How do you/they benefit from screening lung cancer?
(If no,) What benefits do you think a smoker can get from screening lung cancer? Why do you think like this?

- **Perceived barriers**

5. Further probe questions for question 4.

PROBE: (If yes,) Tell me more about the difficulties that you/they encountered or what you think could be improved in the screening processes.
(If no,) What could be reasons for you not having a lung cancer screening? What help do you think is necessary for you to obtain lung cancer screening?

6. What do you think may prevent a smoker from screening lung cancer? Why do you think so?

- **Self-efficacy**

7. Do you know where and how to screen lung cancer?

PROBE: (If yes,) Tell me more about the places and procedures for screening lung cancer.
(If no,) What could be done to make that information more accessible to smokers like you?

8. Are you confident to schedule an appointment for screening lung cancer by yourself, if it is necessary?

PROBE: (If yes,) Tell me more about the processes to schedule the appointment.
(If no,) What could be done by you or health care providers to make it feasible?

9. Are you confident to discuss results of lung cancer screening with your doctor?

PROBE: (If yes,) Tell me more about your interpretation of the screening results.
(If no,) What could be improved to make it feasible?

- **Cues to action**

10. Did you get any information on lung cancer screening before?

PROBE: (If yes,) Where did you get the information? How do you feel when you got that information?

(If no,) Who do you want to get the information from? What do you like to know most?

11. What could trigger a smoker to decide to screen lung cancer? Why do you think so?

- **Ending Question**

12. Is there anything that you think I should know about your perceptions or experiences about lung cancer or screening?

Appendix C

Table 2. Sample Characteristics

Item	Category	N (%)
Age (y)	50-78	Mean age: 60.9y
Gender	Female	1
	Male	8
Marital status	Married	7
	Divorced	2
Number of children	1 Child	6
	2 Children	3
Education level	Less than high school diploma	1
	Some college	1
	Bachelor's degree	6
	Master's degree	1
Annual income	Less than $20000	1
	$20000-44999	5
	$45000-139999	3
Insurance status	Medical or Medicare	3
	Company's insurance	6
Religious status	Catholic	4
	None	5
Age when moved to the US (y)	33-60	Mean age: 42.9
Residence years (y)	3-30	Mean: 18
Occupation	Export sale	1
	Tourist	2
	Hotel management	1
	Fast food service	1
	Uber eat driver	1
	No/Retired	3
Language or dialect	Mandarin	9, with at least one other dialect
Smoking status	Quit smoking in the past 15 years	6
	Smoking regularly, 1 package/day	2
	Smoking regularly, 0.5 package/day	1

Panning to quit	After 6 months	3
	NA	6
Importance to quit	6-10	Mean 7.7
	NA	6
Confidence to quit	3-6	Mean 4.7
	NA	6
Length of smoking	More than 10 years	8
	7-10 years	1
Family history of lung cancer	Yes	1
	No	8
Lung cancer screening history	No	9
Intention to screening lung cancer	Per doctor's recommendation	2
	After 6 months	4
	No	3
Importance to screening lung cancer	3-10	Mean 7.4
Confidence to screening lung cancer	3-10	Mean 8.1

Appendix D

Table 3. Example Quotes and Codes for Each Category

Concept	Example Quote	Example Code
Perceived susceptibility	"Angry, in bad mood, easy to have cancers. Some people smoke for a whole life, but they don't have cancer. Some people don't smoke but they still have lung cancer." (Participant 2, female, 63y)	• Feeling bad mood can cause lung cancer • Refusing the relationship between smoking and lung cancer • Giving evidence by smokers not having lung cancer and non-smokers having lung cancer
	"I don't think my risk is high. Because currently I am living at a house. The air quality is good. Few people live nearby. I retired and I don't go to factory to work. I don't smoke now, and my friends don't smoke. People live nearby don't smoke too. So, I don't concern about it." (Participant 9, male, 78y)	• Thinking his risk of lung cancer is low • Thinking good air quality and quitting smoking put him at a low risk of lung cancer
Perceived severity	"First, you are not normal. Second, you are not healthy. Third, if you interact with your friends, you cannot stay too closely when you talk. Other people will also dislike you. Your disease can transmit to others. I think the bacteria will transmit to other. I don't know whether the bacteria of lung cancer can be passed through sputum. But I think it is not good because you cough frequently." (Participant 9, male, 78y)	• Thinking lung cancer impact both personal health and interaction with others • Thinking lung cancer patients are discriminated by others • Thinking lung cancer can transmit to others • Thinking lung cancer is caused by bacteria • Thinking cough is not good • Being confused about whether lung cancer can be transmitted through sputum
Perceived benefits	"Know early and prevent early. No, it is not that know early and prevent early. It is… know early and treat early. I think smoking is very common in Asian	• Pointing out screening lung cancer helps to detect and treat lung cancer early • Thinking screening is good for

	population. If lung cancer screening is a regular test, it is a good thing for smokers. If lung cancer is screened regularly, it can facilitate (their health) and raise their awareness toward the risk brought by lung cancer. Only if they screen lung cancer, they will know the severity of lung cancer." (Participant 3, male, 50y)	smokers • Thinking screening can increase smokers' perceived susceptibility of lung cancer • Thinking lung cancer screening can increase smokers' perceived severity of lung cancer • Thinking regular lung cancer screening can raise smokers' concern about their health
	"Because if we want to prevent lung cancer, we need to do the test. We can know our lung function after the test. Although I quit smoking for a long time, screening can tell me how my lungs currently function." (Participant 5, male, 57y)	• Thinking screening is necessary for prevent lung cancer • Thinking screening can tell him his current lung status
	"Screening lung cancer can tell you what your lungs look like now. If smokers do the test, I think the situation is definitely not good. If the situation is not good, they need to quit smoking as soon as possible. In order to live for a longer time, they need to quit smoking." (Participant 5, male, 57y)	• Thinking screening lung cancer can tell current lung status • Thinking a bad lung situation helps smokers to quit smoking
Perceived barriers	"I didn't do it before. I don't know whether it is painful. It seems that it needs to inject something, right? Contract agent, right?" (Participant 4, male, 58y)	• Having no experience about screening lung cancer • Confusing about screening's procedure • Not knowing whether lung screening is painful or not • Thinking contract agent could be used for the screening
	"I will follow Jesus' arrangement. Also, I heard lots of diseases are determined by genes or DNA. If I have lung cancer, I	• Believing in Jesus's arrangement • Thinking lung cancer is determined by genes or DNA

	will accept my fate." (Participant 8, male, 51y)	• Accepting fate
	"For disease prevention, I feel… if you are very sick, they will treat you. If you can tolerate the symptoms by yourself, they will not treat you… There is very little work the doctor does for disease prevention." (Participant 8, male, 51y)	• Thinking doctors only treat very sick patients • Thinking doctors did little about disease prevention
	"The time interval for the appointment is very long. Maybe I will use other methods, e.g., go to see urgent care, or buy some medicine to overcome it. I feel it is very inconvenient. Furthermore, they see patients too fast. They don't have time to listen to your complaint. I feel I don't have time to tell them all my concern. They also don't have time to tell you what you need to prevent and how you need to prevent." (Participant 8, male, 51y)	• Thinking seeing doctor in the US is very inconvenient • Complaining about doctors' fast speed in seeing patients • Not having enough time to tell doctor his concern and discuss with doctor about disease prevention
	"…What you said just now that my doctor didn't tell me, is it possible that this is the responsibility of expertise physicians? So, they don't know?" (Participant 8, male, 51y)	• Being confused by the responsibility of ordering lung cancer screening between family doctor and expertise physician
	"Chinese people are conservative. Chinese people care about their face, and they are shy. They don't want others to know their problems. If you make them convenient and keep their privacy, or they can do the screening without other knowing… If you let them do the exam publicly, they will feel shame and they will not accept it on purpose. If you have some methods to help them to do the	• Pointing out shame and stigma from screening can prevent smokers from screening lung cancer • Thinking screening should be offered privately • Thinking convenience is a factor impacting the screening behavior • Mentioning the financial cost of screening

	exam conveniently without costing money and shading shame on them, I think they are willing to do the exam." (Participant 9, male, 78y)	
Self-efficacy	"If I need to make the appointment for the screening, I will let my daughter help me to find the place to schedule." (Participant 2, female, 63y)	• Needing daughter's help with scheduling appointment for screening
	"For every test, what I wish to see is that the doctor would not tell me the result of the test. If the doctor doesn't tell me the result, it means nothing wrong." (Participant 3, male, 50y)	• Not willing to know the results of tests • Thinking no news is good news
	"I felt if you have no diseases or symptoms, if you require to do the X-ray or CT, the doctor will not let you do. So, I am not confident to see my doctor and tell him, 'I have no discomfort of my lungs. I want to screen lung cancer with low dose CT.' The doctor will ask me, 'What discomfort do you have?' For me, they will only let you do the CT when you don't feel well." (Participant 8, male, 51y)	• Thinking doctor will not order screening if patients do not have symptoms • Not feeling confident to suggest his doctor to order lung cancer screening for him if he has no symptoms
Cues to action	"…So first it is the introduction by social media, second family members' advice, and doctor's suggestions and command. Of course, we can also tell the doctor, 'There is the lung cancer screening test. Can we do the screening? Whether I can make an appointment for it?' We can ask doctors' actively." (Participant 3, male, 50y)	• Thinking social media, family members' suggestions and doctors' advice are important for screening • Thinking smokers can also request screening actively

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Chapter 7. Manuscript Three

Cross-cultural adaptation of Lung Cancer Screening Health Belief Scale: A methodological study

Fang Lei, PhD©, MSN, MPH, RN; Wei-Ti Chen, PhD, FAAN, CNM, RN; Mary-Lynn Brecht, PhD; Zuo-Feng Zhang, MD, PhD; Ying Zheng, MD, DPH; Yuhe Hu, DNP, AGPCNP-BC, RN; Tuzhen Xu, PhD©, MSN, RN; Siqian Wang, PhD©, BSN, RN; Eunice Lee, PhD, FAAN, RN

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Abstract

Background and Purpose

The purpose of this study was to report the process of adapting the existing Lung Cancer Screening Health Belief Scale to be used in Chinese Americans.

Methods

Guided by Flaherty et al.'s cross-cultural equivalency model, the methodology used in the adaptation process consists of four steps, including preliminary modification after comprehensive literature review, forward and backward translation, expert review, and cognitive interviews among participants.

Results

The modified culturally fitted Lung Cancer Screening Health Belief Scale included 57 items and 6 sub-scales, which was proved highly reliable and valid through the expert review and participants' review.

Conclusions

This study provided an example for novice cross-cultural researcher to adapt an instrument to be used in another population with different language. Further research is needed to work out a standard guideline for cross-cultural instrument adaptation.

Key words

Lung cancer screening, health belief, cross-cultural, adaptation, methodology

Cross-cultural adaptation of Lung Cancer Screening Health Belief Scale:
A methodological study

Introduction

Lung cancer is the leading cause of cancer deaths in Chinese Americans (Gomez et al., 2015). It is the second and fourth most common cancer among U.S. Chinese men and women, respectively (Gomez et al., 2015). While there is no well-established study reporting the survival rate of lung cancer among Chinese Americans, it is reported that only 16% of lung cancers are diagnosed at a localized stage in the U.S. population, for which the five-year survival rate is 55% (McCarthy, 2014). As the time to diagnosis prolongs, the five-year survival rate for lung cancer patients drops to 4% when lung cancer is diagnosed at a late stage (stage IV) (McCarthy, 2014).

Lung cancer screening with low dose computed tomography increases the possibility of detecting lung cancer at an earlier stage, leading to a 20% reduction of the lung cancer mortality, compared to screening by X-ray (Tota et al., 2014). However, the uptake rate of lung cancer screening with low dose computed tomography has been low among U.S. population, which was 3.3% in 2010 and 3.9% in 2015 (Jemal & Fedewa, 2017), and lacking report among Chinese Americans.

Previous studies indicated that health beliefs about lung cancer screening were significantly associated with the uptake of lung cancer screening. Reports showed people who had a low dose computed tomography scan were significantly more likely to hold several common health beliefs toward lung cancer screening (Cataldo, 2016). Participants who were more likely to undergo screening for lung cancer would perceive a high risk for lung cancer, were not afraid of computed tomography scans, believed low dose computed tomography screening results were accurate and detecting lung cancer earlier would be more likely to improve lung cancer prognosis (Cataldo, 2016). Several other studies also indicated that cultural factors such as beliefs and attitudes about lung cancer screening process or illness, knowledge, mistrust of the healthcare system, and fatalistic beliefs were related to high-risk population's participation in lung cancer screening programs (Carter-Harris, Brandzel et al., 2017; Carter-Harris, Ceppa, et al., 2017; Duong et al., 2017; Gressard et al., 2017; Jonnalagadda et al., 2012; Tanner et al., 2013). Most of these studies were done based on the Health Belief Model, which is a social cognitive model focusing on health behavior change (Ajzen, 1997).

The Health Belief Model has six key concepts, including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (Ajzen, 1997). Perceived susceptibility is individuals' subjective beliefs on the risk of getting lung cancer. Perceived severity is personal evaluation of the seriousness of the consequences related to lung cancer. Perceived benefits is people' s assessment of the value to take the advised action to reduce risks or seriousness of lung cancer. Perceived barriers is people's belief about the obstacle to screening lung cancer. Self-efficacy refers to individuals' own confidence in personal ability to successfully screening lung cancer to decrease their risk of getting lung cancer. Cues to action refers to the strategies used to activate one's readiness to screening lung cancer (Glanz, Rimer & Viswanath, 2008).

Health beliefs toward lung cancer screening may be associated with lung cancer screening behaviors among minority population (Carter-Harris, Brandzel et al., 2017; Carter-Harris, Ceppa, et al., 2017; Duong et al., 2017; Gressard et al., 2017; Jonnalagadda et al., 2012; Tanner et al., 2013). Chinese cultural beliefs (e.g., fatalism and perceived low health literacy as a barrier to screening lung cancer) may particularly explain a low uptake rate of lung cancer screening in Chinese Americans. However, up to date, to our knowledge, no culturally adapted instrument on lung cancer screening health belief was available to be used for lung cancer screening education and intervention programs among Chinese Americans.

Using an efficient and effective instrument to evaluate high-risk Chinese Americans' health beliefs toward lung cancer screening can provide data which can help to design tailored lung cancer screening programs to increase the uptake rate of lung cancer screening and potentially decrease the mortality rate of lung cancer among this population. Although a previous study (Carter-Harris, Slaven et al., 2017) provided an appropriate instrument (CVI=0.88 to 0.92, Cronbach's alpha=0.80 to 0.92, SRMR=0.074) to investigate health beliefs about lung cancer screening among U.S. general population, scales that were developed for western cultures did not include constructs (e.g., fatalism, some culturally specific perceived barriers such as language barriers) which were fitted to the eastern culture (Thompson, 2009). The instrument was developed and tested in English and has not been culturally adapted for the Chinese American population. Some cultural beliefs related to the Chinese Americans' cancer screening behaviors, e.g., fatalism, perceived language barriers, and perceived cues to action from physicians, which were found in the literature were lacking in the original scales. When existing instruments have different content or constructs, development of new scales is necessary. However, if the content or constructs overlap but are slightly different, scale adaptation or refinement is appropriate (Van de Vijver & Leung, 1997).

Existing studies of lung cancer screening showed that even though several differences were observed in ethnical minority versus non-ethnical minority participants' health beliefs about lung cancer and screening (Jonnalagadda et al., 2012), health belief constructs (e.g., barriers) overlap somewhat among minority versus non-minority populations (Carter-Harris, Brandzel et al., 2017; Carter-Harris, Ceppa, et al., 2017; Cataldo, 2016; Duong et al., 2017;

Gressard et al., 2017; Tanner et al., 2013), such as lacking of knowledge toward lung cancer screening, practical barriers and patients' misunderstanding of the out-of-pocket cost (Carter-Harris, Brandzel et al., 2017).

Adapting and validating an existing instrument to be used in a different population is beneficial. It could assist researchers to accurately measure high-risk smokers' health beliefs toward lung cancer screening. It could be a cost efficient and time-saving choice for cross-cultural research (Chang & Chau, 1999; Li et al., 2001; de Paula Lima et al., 2005). The cross-cultural instrument adaptation includes two necessary steps, which are instrument translation and instrument modification (Chang et al., 1999). Adapting an instrument to be used in another culture is not only simply translating the instrument to another language. Since the cultural background varies among different population groups, modifying the instrument to meet the cultural equivalence is essential for ensuring the reliability and validity of translated instruments (Stewart et al., 2012). According to Flaherty et al., a five-stage equivalence should be met to maintain the integrity of the translated instrument: 1) semantic equivalence: to ensure that the meaning of each item remains conceptually and idiomatically the same; 2) content equivalence: to ensure that the content of each item in the instrument has consistent cultural relevance; 3) technical equivalence: to ensure that the methods of data collection (interviews, observation, or self-report) elicit comparable data; 4) criterion equivalence: to establish the normative interpretation of the variable; and 5) conceptual equivalence: to ensure that the same theoretical construct is being measured in each culture (Flaherty et al., 1988).

Based on Flaherty et al.'s cross-cultural equivalency model, the Lung Cancer Screening Health Belief Scale was adapted to be used in Chinese Americans in this study. The purpose of the study was to report the process of adapting the existing Lung Cancer Screening Health Belief

Scale to be used in Chinese Americans. This methodological study will provide evidence and guidance for novice cross-cultural researchers and helps them to get more insights into the cross-cultural instrument modification process.

Methods

Existing instrument

The Lung Cancer Screening Health Belief Scale was developed based on the Health Belief Model in the 1950s by Rosenstock, Hochbaum, Kegeles, and Leventhal, four social psychologists at the United States Public Health Service Organization (Carpenter, 2010; Glanz, Rimer, & Viswanath, 2008). It is composed of 35 items in four subscales, including three items for the Perceived Risks of Lung Cancer Subscale, six items for the Perceived Benefits of Lung Cancer Screening Subscale, 17 items for the Perceived Barriers of Lung Cancer Screening Subscale, and nine items for the Self-efficacy Subscale (Carter-Harris, Slaven, et al., 2017). The Perceived Risks, Perceived Benefits, and Perceived Barriers Subscales use four-point Likert-style responses with items ranging from strongly disagree to strongly agree (strongly disagree=1, strongly agree=4). The Self-efficacy Subscale uses four-point Likert-style responses with items ranging from not at all confident to very confident (not at all confident=1, very confident=4). The scale has been tested among 497 long-term smokers. The Psychometric testing showed the scale was valid and reliable (Carter-Harris, Slaven, et al., 2017).

Processes of revising the instrument

First step: Preliminary modification after comprehensive literature review

Procedures. Permission for using the Lung Cancer Screening Health Belief Scale for translation, modification, and application had been obtained from the first author of the Lung

Cancer Screening Health Belief Scale (October 1, 2018) (Carter-Harriers et al., 2017). A comprehensive literature review about the health beliefs of lung cancer screening among Asians/Asian Americans (including Chinese Americans) and U.S. population was conducted. Findings were categorized by the constructs of Health Belief Model. Results showed all the six constructs in Health Belief Model were significantly associated with participants' uptake of lung cancer screening.

Preliminary modification outcome. According to the findings from the literature review (Kwok & Sullivan, 2006), wordings of the original items such as "It is likely that I will get lung cancer sometime in my lifetime" was modified by the first author to "It is likely that the smokers who smoke as much as I will get lung cancer sometime in his/her lifetime." Rather than the first-person statement, the item was revised to the third person due to the fatalism of the smokers.

In addition to revising the item, to reflect the constructs included in the Health Belief Model and results from the comprehensive literature review, two subscales were added into the original Lung Cancer Screening Health Belief Scales. The items to be added to the Perceived Severity of Lung Cancer Subscale derived from the existed scale measuring perceived severity of breast cancer. Items in the Perceived Severity Subscale of Champion's Health Belief Model Scale were revised and adapted to fit the context of lung cancer screening among Chinese Americans. The Perceived Severity Subscale of Champion's Health Belief Model Scale (Champion, 1993) has seven items. All items are scored on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Severity Subscale has demonstrated good reliability with Cronbach's alpha of 0.80 (Champion, 1993). All the seven items were revised and added to the scale. Items such as "The thought of breast cancer scares me" were revised to "The thought of lung cancer scares me" by fitting the lung cancer screening context. In addition, items such as

“Breast cancer would threaten my relationship with my husband” were revised to “Lung cancer would threaten my relationship with my family members” to address an expanded impact of lung cancer among family members.

Items evaluating cues to action of lung cancer screening were added to the original scale based on existed scale measuring cues-to-action of colorectal cancer screening (Lee, 2019). The Cues-to-action of Colorectal Cancer Screening Subscale has six items. All items are scored on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Lee, 2019). It demonstrated good reliability with Cronbach’s alpha of 0.80 (Lee, 2019). All the six items were revised and added to the scale. Items measuring external cues to action such as “If a doctor recommends colorectal cancer screening, I will have it” as well as internal cues to action such as “If I have symptoms of colorectal cancer, I will have it” (Lee, 2019) were revised to “If a doctor recommends lung cancer screening, I will have it” and “If I have symptoms of lung cancer, I will have it” by fitting the lung cancer screening context.

A table were created with all the reworded, added, and deleted items of the subscales. Rationales for the rewordings as well as added and deleted items were included in the table as well. The table developed by the first author were reviewed and approved by other authors of this study (Drs. Lee, Chen, Brecht, and Zhang). An initially modified Lung Cancer Screening Health Belief Scale (English version 1) were generated after the process.

Second step: Forward and backward translation

Procedures. The initially modified Lung Cancer Screening Health Belief Scale items (English version 1) were translated forward, from English to Chinese version independently by the first author of the study and a bilingual DNP nurse. Both of them are bilingual in Chinese and English. The two versions of the translated scales were compared for any discrepancies between them. Intensive discussions were held to reach consistency between the two translated versions. The unresolved discrepancies were included in a table and further discussed with other authors of this study. An initial Chinese version of Lung Cancer Screening Health Belief Scale were obtained (Chinese version 1) after reaching the consistency between the first author and the bilingual researcher.

Two bilingual nurses (Mrs. Xu and Wang) engaged in the backward translation into English process. Both of them had a medical working background, a PhD education background and had some prior work experience with the scale translation. They independently back translated the Chinese version 1 of Lung Cancer Screening Health Belief Scale to the original language (English). The two versions of back-translated Lung Cancer Screening Health Belief Scale were compared for any discrepancies by the two bilingual nurses. Discussions were held by them until consistency of the items were reached. The first author compared the back-translated Lung Cancer Screening Health Belief Scale and modified English version 1 of Lung Cancer Screening Health Belief Scale to check the clarity of the items. Discussions were held with all the other authors of this study for reaching consistency between the two versions. Necessary modification to the scales were made upon the recommendations of the other authors of this study. An initially modified Lung Cancer Screening Health Belief Scale (English version 2 and Chinese version 2) were generated after the process.

Forward and backward translation outcome. During the forward and backward translation of the scale, some major inconsistencies were noticed in the process: 1) Translations about the options for the items were inconsistent. One translator translated the options “not at all confident, not too confident, somewhat confident, very confident” to the Chinese phrases which were close to the daily life language (完全没有把握，没有太大把握，有一些把握，很有把握),

while the other translator translated it to the Chinese phrases which were close to the original options (一点都不自信，不太自信，有点自信，非常自信).After discussions among the research team members, the translation which was close to the daily life language was kept, since it was more likely to be accepted by participants. 2) Forward translations about some items in the scale were inconsistent, e.g., one item in the Perceived Benefits of Lung Cancer Screening Subscale, “Having a lung scan will help me not worry as much about lung cancer” was translated verbatim to Chinese phrase (进行肺部扫描帮助我不那么担心肺癌) by one translator, while the other translator translated it to the Chinese phrase which was easier to be understood (进行肺部扫描会减少我对肺癌的担心). Upon discussions among the research team members, the translation was further modified to a version (进行肺部扫描能让我不那么担心肺癌) which was close to the aforementioned translation, to make it align with the original scale. 3) Inconsistencies between the forward and backward translation versions were noticed, such as translations about the item “How confident are you that you can discuss the lung scan with your doctor?” In the forward translation version of the scale, the Chinese phrase which meant results (结果) was added into the Chinese version scale to make the meanings of the item clearer and easier understandable, upon discussion between the two forward translators and among the research team members. However, after the backward translation, meaning of the item was limited to discussion with doctors about results only, which narrowed down the meaning of the item. So, the Chinese phrase which meant results was deleted at last upon further discussions among the translators and research team members.

Third step: Expert review

Both versions of the Chinese Lung Cancer Screening Health Belief Scale (English and Chinese version 2) were given to five bilingual experts to review via email. The experts have specialized expertise in the areas of cancer nursing or cross-cultural research. The experts included cancer nursing care experts, instrument refinement experts, and the cancer research experts who know Chinese culture well.

Procedures. After obtaining agreement to review the instruments from the experts, the first author sent expert review form and content validity scale to the experts. The experts provided comments to the modified Lung Cancer Screening Health Belief Scale (English version 2 and Chinese version 2) and determined the clarity, relevance, and translation equivalency of the two-language version tools. Follow-up emails regarding the reviewing materials were sent one week after the initial emails for those who did not return the form. Upon receiving all the comments from the experts, a comprehensive evaluation of the comments was conducted. Suggestions from the experts' comments were discussed among the first author and the other authors of this study (Drs. Lee, Chen, Brecht, and Zhang). In addition, the item-level content validity index (I-CVI) and the scale-level content validity index/universal agreement (S-CVI/UA) were calculated. A table were created with the synthesized information on the experts' suggestions, comments and potential modifications for the items which had a low I-CVI and low S-CVI/UA. Agreed-on recommendations among the authors were applied to revise the modified Lung Cancer Screening Health Belief Scale (English version 2 and Chinese version 2).

Expert Review Form. The expert review form was designed by the first author to collect experts' comments to the initially modified Lung Cancer Screening Health Belief Scale to reach content equivalency. It was developed by comprehensive literature review focusing on the cross-cultural instrument adaptation. It was a quantitative data collection method regarding experts' ratings to the items using criteria from the content validity scale. It also collected qualitative data regarding experts' comments to the items in the initially modified Lung Cancer

Screening Health Belief Scales. Instructions to fill the form was given at the beginning of the form. A table including expert's name, review time, rating to the clarity, relevance, translation equivalency as well as comments to each item was provided.

Content Validity Scale. The Content Validity Scale used in this study is to evaluate the extent to which the Lung Cancer Screening Health Belief Scale represent all facets of the health beliefs toward lung cancer screening (Pennington, 2003). It was revised from the content validity scale used in another study (Rodrigues et al., 2017) by following the recommendations from Polit and Beck (2006). The Content Validity Scale is a four-point Likert scale with items rated from 1 to 4. It includes three items with one each measuring the clarity, relevance, and translation equivalency levels of the measured scale. Using the Content Validity Scale, the experts rated the semantic equivalence of the items in the initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) to the meaning of the items in the modified English version (English version 2) with responses ranging from not appropriate to very appropriate (different meaning =1, exactly the same =4). The experts also rated the clarity of the initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) and the included items with responses ranging from not easy to understand to very easy to understand (not clear =1, Item is clear =4). The relevance of the items in the initially modified Chinese Lung Cancer Screening Health Belief Scale (Chinese version 2) to the overall scale context was also rated by the experts with responses ranging from not relevant to very relevant (not relevant=1, very relevant=4). The items were ultimately modified based on experts' review and approved by the other authors of this study (Drs. Lee, Chen, Brecht, and Zhang). The English version 3 and Chinese version 3 of Lung Cancer Screening Health Belief Scale were generated after the process.

Data analysis. The quantitative data generated from the expert review was analyzed using I-CVI (item-level content validity index), S-CVI/UA (scale level content validity index/universal agreement) and content validity coefficient (CVCt). The I-CVI is computed as the number of experts giving a rating 3 or 4 to the relevancy of each item, divided by the total number of experts (Lynn, 1986). Judgment on each item should be made as follows: If the I-CVI is higher than 0.79, the item is appropriate. If it is between 0.70 and 0.79, it needs revision. If it is less than 0.70, it is eliminated (Abdollahpour et al., 2010). The S-CVI is defined as the proportion of total items judged content valid or the proportion of items on an instrument that achieved a rating of 3 or 4 by the content experts (Lynn, 1986). For calculating the S-CVI/UA, the scale is dichotomized by combining values 3 and 4 as relevant and 2 and 1 as not relevant for each item (Lynn, 1986). Then, the number of items considered relevant by all the judges (or number of items with CVI equal to 1, with the items rated either by 3 or 4 out of 4) is divided by the total number of items. It was proposed the S-CVI/UA should be larger than 0.8 for new instruments (Davis, 1992). The CVCt is calculated by subtracting the mean Pei (MPei) from the mean CVCi (MCVCi). The MCVCi was calculated by the grade given to each item divided by the maximum grade. The MPei is calculated by dividing the number of evaluating judges from one. After calculations, a CVCt between 0.7 and 0.8 was considered as an acceptable level (Balbinotti, Benetti, & Terra, 2007; Silveira et al., 2018).

Content validity, clarity, and translation equivalent scores. Results showed the I-CVI for each item ranged from 0.8 to 1, which was at the acceptable level above 0.79. The S-CVI/UA ranged from 0.75 to 1, with an unacceptable S-CVI/UA on the Perceived Barriers of Lung Cancer Screening Subscale (S-CVI/UA=0.75). Items from the Perceived Barriers of Lung Cancer Screening Subscale were further modified upon the expert review suggestions, to make it reach the acceptable level of 0.8 on the S-CVI/UA. Average clarity scores for individual items ranged from 3.2 to 4 out of 4, with 35 items (64.8%) considered clear (rated as 4 out of 4). Mean scores for the clarity of the subscales ranged from 3.84 to 3.97 out of 4. The CVCt for clarity ranged from 0.76 to 0.79, which was at an acceptable level. Average translation equivalent scores for individual items ranged from 3.4 to 4 out of 4, with 31 items (57.4%) considered exactly the same (rated as 4 out of 4). Mean scores for the translation equivalent of the subscales ranged from 3.86 to 3.96 out of 4 (Table 1). The CVCt for translation equivalent ranged from 0.77 to 0.79, which was at an acceptable level.

Content modification. Content of the scale was modified according to the experts' recommendation using several modification strategies: 1) Changing wording. This stargate was used to make the item in the scale more culturally adapted, e.g., Changed the second person "you" in Chinese (你) to another word with respectful meaning in Chinese (您); Or to make the meaning of the response option more accurate, e.g., Changed the word in the response option "agree" (赞同, means approve, consent, which meaning is deeper and broader than the later one) to another word meaning "agree" (同意, means agree, consent); or to make the sentence easier readable, e.g., one item in the Perceived Benefits of Lung Cancer Screening Subscale, "Having a lung scan will help me not worry as much about lung cancer" (进行肺部扫描能让我不那么担心肺癌)was changed to "Having a lung scan can decrease my worry about lung cancer" (进行肺部扫描能降低我对肺癌的担忧). The same modification was also made for another item in the Perceived Barriers for Lung Cancer Screening Subscale. 2) Adding extra explanations to the items to make the meaning clearer, e.g., one Item in the Perceived Barriers to Lung Cancer Screening Subscale, "How confident are you that you can make an appointment to have a lung scan?" was added by a fill-in-the-blank option to make the reasons clearer: "Please describe your reasons about not confident to make an appointment to have a lung scan. (请说明无法成功预约肺部扫描的原因). 3) Changing/Combing the two sections in the sentence to one section to make the sentence easier readable, e.g., one item in the Self-efficacy for Lung Cancer Screening Subscale, “How confident are you that you can make an appointment to have a lung scan? (对于预约肺部扫描，您有多大把握？), which was originally translated to two sections, and then was combined to one section (您对自己能成功预约肺部扫描有多大信心？). The same modification was also made for the other 20 items in the Perceived Barriers for Lung Cancer Screening Subscale. 4) Deleting redundant item to make the scale concise, e.g., we deleted one of the two items in the Perceived Severity for Lung Cancer Subscale, which are redundant in their meanings. “The thought of lung cancer scares me” was deleted (想到肺癌我就害怕), since it had a similar meaning to “I am afraid to think about lung cancer” (我害怕想起肺癌).

Forth step: Cognitive interview

The cognitive individual interviews were conducted to assess Chinese Americans’ health beliefs toward lung cancer screening, to examine cultural differences with the US population on the health beliefs to screening lung cancer, and to make the scales culturally appropriate for Chinese Americans. The individual interviews were conducted with nine Chinese American smokers, which included two components: a discussion of health beliefs toward lung cancer screening and a review of the Lung Cancer Screening Health Belief Scale (Chinese version 3).

Sample. Using a combination of convenience and chain referral sampling (multiple snowballs) methods, nine Chinese American high-risk smokers were recruited by the posters posted on a popular Chinese website (https://www.chineseinla.com/). Inclusion criteria for the participants were aged 50 to 80 years old, self-identified as descendants of Chinese, currently living in the United States, current smokers or quit smoking in the past 15 years, smoked at least 20 pack-year cigarettes (smoked one pack of cigarettes every day for 20 years), can speak Chinese (either Cantonese or Mandarin) and read Chinese. The exclusion criterion for the participants was having been previously diagnosed with lung cancer. To reflect gender constitution of smoking prevalence among Chinese American population, eight males and one female were recruited in this process.

Recruitment. The recruitment posters were distributed online. The purpose of the study, inclusion and exclusion criteria, reimbursement amount, and the first author's phone number as well as email address were listed in the posters. When a Chinese American who was interested in participating in the study contacted the first author via telephone or email, s/he were screened for the eligibility by answering the screening questions over the phone, text message, or through email. The eligible participants could choose either to be interviewed through online chat app or via telephone, depending on the participant's preference. Due to a minimal risk of the study, the written informed consent was waived by the university IRB office. Before the interview, the first author sent the information sheet, the expert reviewed and adapted Lung Cancer Screening Health Belief Scale (Chinese version 3), and a self-administrated questionnaire package including the sociodemographic information questionnaire, smoking and lung cancer screening history questionnaire, as well as Suinn-Lew Self-identity Acculturation Scale to the participants through online chat app or email.

Cognitive interview procedure. All the nine participants were interviewed individually via telephone, using the cognitive interview technique. The cognitive interview technique is an evidence-based, qualitative method specifically designed to investigate whether a survey question (attitudinal, behavioral, or factual) fulfills its intended purpose (Willis & Artino, 2013). A semi-structured interview guide based on the Health Belief Model was developed by the research team to guide the interview. Questions related to the health beliefs of lung cancer screening (e.g., “What benefits do you think a smoker can get from screening lung cancer?”) were asked and recorded by a digital recorder. Themes emerging in the interviews were considered for modifying the adapted Chinese Lung Cancer Screening Health Belief Scale. The first author asked the participants to answer the Chinese version 3 of Lung Cancer Screening Health Belief Scale first. After the participants finished answering the scale, the first author discussed the scale item by item using the think-aloud interviewing and verbal probing techniques. The cognitive interviews were recorded by the digital recorder. A $25 Amazon gift card was emailed to the participants after the interviews, for compensating their time in the interviews.

Data analysis. The qualitative data collected from the interviews were analyzed by content analysis methods. Main content of the semi-structured interviews was transcribed verbatim to Chinese language by the first author and the research assistant. Themes emerged in the qualitative data were categorized and summarized to help the adaptation of the Chinese Lung Cancer Screening Health Belief Scale. Discrepancies between translations were discussed between the first author and the research assistant to reach consistency. Combing the participants’ suggestions and themes emerged in the individual interviews, the expert-reviewed-and-adapted Chinese Lung Cancer Screening Health Belief Scale items were further modified. Potentially added items from the emerged themes as well as suggested modifications to the instrument were discussed by the first author and Drs. Lee, Chen, Brecht, and Zhang. Necessary discussions were held to reach the consistency on a final version (English version 4) that could be used for the validation test. The modifications made by the other authors of this study were reflected in the Chinese version 4. A flowchart with the activities and outcomes for the instrument adaptation can be found in figure 1.

Suggested modification from participate review. The expert reviewed and modified Lung Cancer Screening Health Belief Scale was further reviewed by participants from target population to reach semantic and content equivalency. To make the meanings of the items accurate and culturally adapted, suggestions from the participants to modify the scale included: 1) To change "It is likely that someone who smoked about as much and as long as I have would get lung cancer in the next ten years" to "It is likely that someone who smoked about as much and as long as I have would get lung cancer in the future", since the participants thought there was no scientistic basis to say it for sure that high-risk smokers would die in 10 years, which led them to disagree this statement. But they did believe that they had higher risk of getting lung cancer in the future. 2) To change ""I might put off having a lung scan" (我可能会推迟做肺部扫描) to "I am hesitating to have screening for lung cancer" (我犹豫做肺部扫描), since two out of the nine participants thought they would not put off the lung scan. They were willing to screen immediately after recommended by doctors, so they "disagree" with the statement "I might put off having a lung scan" in the items. 3) To change "I might put off having a lung scan because I am a smoker" to "…because I am/was a smoker", because two out of the nine participants thought this item was not applicable since they quit smoking already. So, the word "was" was added to the item to include this situation to make the item applicable. 4) To change the item "If someone developed lung cancer, he/she would not live longer than 5 years" to "If someone developed late-stage lung cancer, …", because two out of the nine participants thought there was no scientistic basis to say it for sure that lung cancer patients would die in 5 years.

Suggested modification from semi-structured interviews. The emerged themes from the semi-structured interviews were further checked with the research team members and added to the modified scale to make the scale culturally adapted. The items related to the emerged themes which were added to the scale included: 1) “Having a lung scan will help me to know whether I have any lung problems (进行肺部扫描能帮助我了解我是否有肺部疾病)” in the Perceived Benefits of Lung Cancer Screening Subscale; 2) “I am hesitating to have screening for lung cancer because I have poor English communication skills (我犹豫做肺部扫描，因为我的英语交流能力不太好)”in the Perceived Barriers to Lung Cancer Screening Subscale; 3) “If someone had lung cancer, it would be a burden to his/her financial status (如果某人得了肺癌，疾病会给他/她带来经济负担) in the Perceived Severity for Lung Cancer Subscale; 4) “If someone had lung cancer, it would impact his/her social interactions with others (如果某人得了肺癌，疾病将会影响他/她和别人的社会交往) in the Perceived Severity for Lung Cancer Subscale; 5) “If someone had lung cancer, it would bring discrimination to him/her (如果某人得了肺癌，疾病会使他/她受到歧视) in the Perceived Severity for Lung Cancer Subscale.

Results

The modified scale was composed of 57 items in six subscales, including four items for the Perceived Risks of Lung Cancer Subscale, seven items for the Perceived Benefits of Lung Cancer Screening Subscale, 21 items for the Perceived Barriers of Lung Cancer Screening Subscale, 10 items for the Self-efficacy Subscale, 9 items for the Perceived Severity for Lung Cancer Scale, and 6 items for the Cues to Action of Lung Cancer Screening Scale. The Perceived risks, Perceived barriers, Perceived benefits, Perceived Severity, and Cues to Action Subscales use four-point Likert-style responses with items ranging from strongly disagree to strongly agree (strongly disagree=1, strongly agree=4). The Self-efficacy Subscale uses four-point Likert-style responses with items ranging from not at all confident to very confident (not at all confident=1, very confident=4). A detailed final English and Chinese versions of the Lung Cancer Screening Health Belief Scale could be found in the supplemental documents attached to this article. In this article, we only reported the processes of translation and modification of the instrument, results about the validation of the adapted instrument were reported elsewhere in our other manuscripts.

Discussion

This methodological study provided a detailed procedure and guidance on the process of cross-cultural instrument modification. The methodology reported in this study could help novice cross-cultural researchers to get more insights into the cross-cultural instrument adaptation and provided a feasible approach to increase the validity and reliability of the adapted instrument.

Results from this study showed a reliable adaptation process consisted of four steps, with each step resulting in written documentation via the adaptation log: 1) preliminary modification after comprehensive literature review; 2) forward and backward translation: included forward-translation from 2 or more forward-translations, synthesis and resolution of discrepancies between/among forward-translators, backward-translation from 2 or more backward-translations, independent review of back-translation vs source document, revision and iterative development related to discrepancies, and consolidation of all translation and review activity into a single instrument appropriate for expert review; 3) expert review: included evaluation of content validity and construction of a pre-final instrument according to the results from expert review; and (4) cognitive interviews with participants: included obtaining a final instrument according to participants' suggestions on the instrument and themes emerged from cognitive interviews. Through this 4-step process, the translated instrument is checked both by the experts and participants, which ensures the adapted instrument's accuracy and cultural equivalency, thus is reliable to be tested among target population.

Results from this study showed that the literal translation method may have some issues for the cross-cultural instrument adaptation. Although a literal translation method could keep the meaning of the original items intact, however, translations using this method may bring difficulties for the participants to understand. Thus, a semantic translation method might be a better solution because it keeps the meaning of the original items but also make the meaning accurate and easy to read. In addition, several factors related to the target population and the instrument administration should be considered in the instrument modification process. Participants' characteristics, such as health literacy level, age, gender (Hall et al., 2018), education level, and some of their cultural perceptions related to fatalism or masculism should be taken account in the adaptation process. Also, the administration elements of the instrument, such as questionnaire format, instructions, mode of administration, and measurement methods should be considered when adapting the instrument (Hall et al., 2018). Depending on the target populations' characteristics and the administration elements of the adapted instrument, necessary changes should be made to make the instrument culturally adapted. Lastly, a cognitive interview with participants is necessary to make the instrument fully adapted to the target population. The cognitive interview techniques include concurrent think-aloud protocols, verbal probes, hybrid approaches, etc. (Ryan et al., 2012). The think-aloud protocol asks participants to provide the description of what they are thinking as they respond to an item (the think-aloud protocol) or just after responding to the item (Tourangeau et al., 2000). The verbal probing technique asks prob questions about participants' thinking rather than just recording what they spontaneously report (Blair & Presser, 1993). The hybrid approaches use verbal probing technique in conjunction with the think-aloud method (Beatty & Willis, 2007; Blair

& Brick, 2009). By using these approaches, Chinese American smokers' perceptions toward lung cancer screening was further explored and recorded for adapting the instrument. Also, the semi-structured interviews which were conducted among the target participants further helped to understand their health beliefs toward lung cancer screening and make the adaptation closer to the culture under investigation.

Limitations

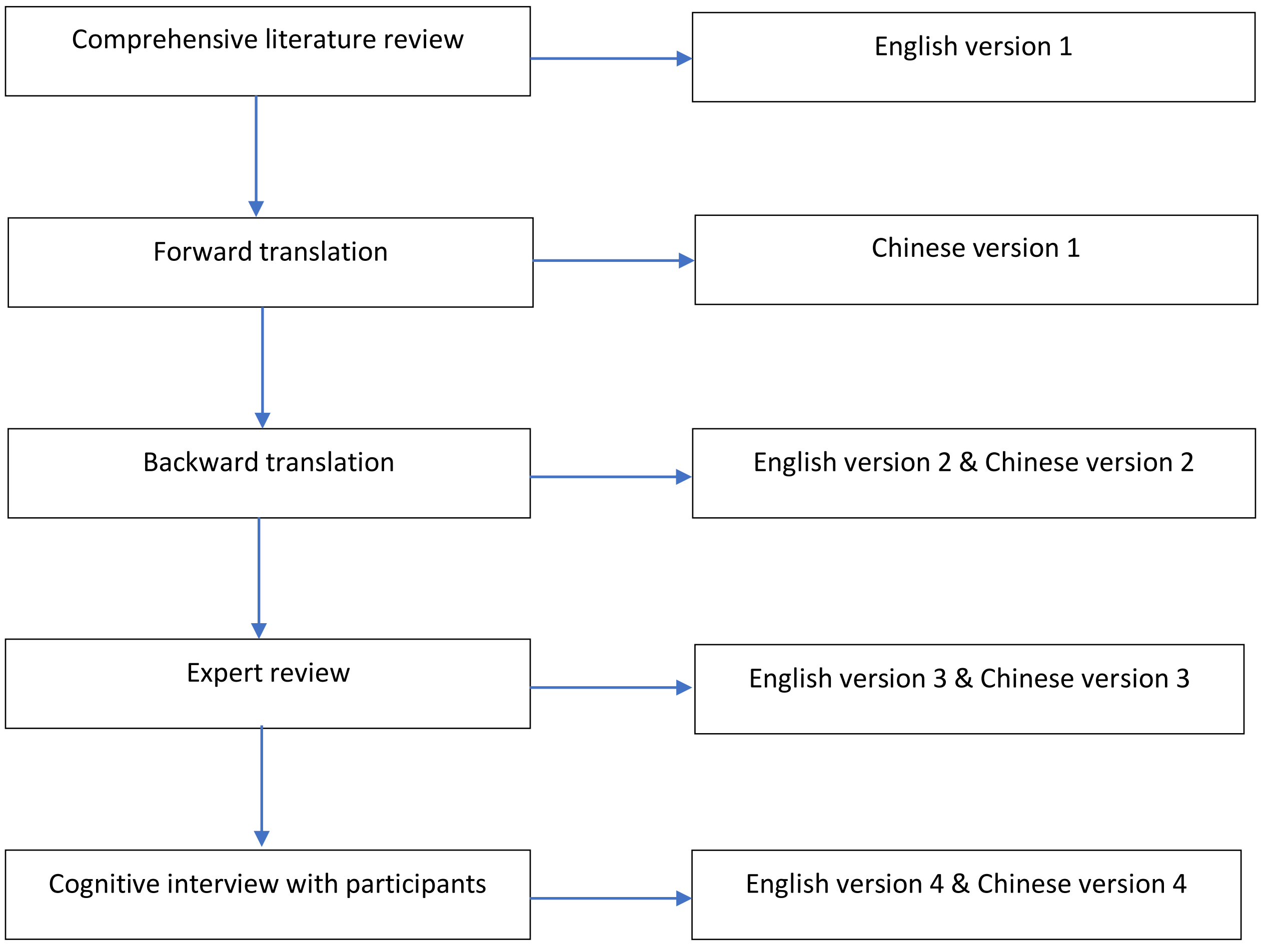
This study has some limitations. First, most of the participants participated in the cognitive interviews resided in Los Angeles due to the recruitment flyers were only posted on the Los Angeles based website, which may bring selection bias toward the results of cognitive review. However, since California has the second largest population of Chinese Americans, and Los Angeles is one of the largest cities in California which has approximately 10% of Chinese Americans in the U.S. (Torre, et al., 2016), potential selection bias might be minimal. Second, it took one year to finish the process of forward and backward translation, expert review, and cognitive interviews. Although the methodology presented in this study for cross-culturally adapting an instrument to be used in another culture is highly reliable and valid, the length of time for completing the adaptation process may not be feasible for some researchers who aim to finish the adaptation process quickly. Third, although the modified scale was proved highly content valid through the expert review and participants' review, a formal test in the target population is still needed in order to verify the scale's reliability and further validity. A test on the scale's internal consistency reliability, construct validity, and criterion-related validity is necessary.

Conclusions

This study reported a reliable methodology for cross-culturally adapting an instrument to be used in another culture. The 4-step adaptation process included preliminary modification after comprehensive interview, forward and backward translation, expert review, and cognitive interviews. The methodology was proved highly reliable and valid. This study provided an example for novice cross-cultural researchers to adapt an instrument in English to be used in Chinese Americans in Chinese. Future research is needed to work out a standard guideline for cross-cultural instrument adaptation. A cost-efficient and time-saving methodology to adapt instruments cross-culturally should be worked out to help cross-cultural researchers better prepared for the instrument adaptation and validation research projects.

Appendix A

Fig. 1. Flowchart about the Instrument Adaptation



Appendix B

Table 1. Total Scale Level Content Validity Indices and Clarity, Translation Equivalent Mean Scores for Lung Cancer Screening Health Belief Subscales

Scale	**Total Content Validity Index (Relevance)**	**Clarity Mean Scores (1-4)**	**CVCt Clarity**	**Translation Equivalent Mean Scores (1-4)**	**CVCt Translation Equivalent**
Perceived Risk of Lung Cancer Subscale	1	3.96	0.79	3.96	0.79
Perceived Benefits of Lung Cancer Screening Subscale	1	3.9	0.78	3.93	0.78
Perceived Barriers to Lung Cancer Screening Subscale	0.75*	3.91	0.78	3.88	0.77
Self-Efficacy for Lung Cancer Screening Subscale	1	3.84	0.76	3.86	0.77
Perceived Severity for Lung Cancer Subscale	1	3.86	0.77	3.86	0.77
Cues to Action for Lung Cancer Screening Subscale	1	3.97	0.79	3.93	0.78

* The Perceived Barriers to Lung Cancer Screening Subscale was further revised since the S-CVI/UA is lower than 0.8.

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Chapter 8. Future directions

In this study, we adapted the Lung Cancer Screening Health Belief Scale to be used in Chinese Americans. For the directions of future studies, a formal validation of the scale should be conducted in Chinese American smokers to establish its construct and criterion-related validity and reliability. Also, qualitative and intervention studies could be conducted based on the findings revealed in this study.

Establishment of the Scale's Psychometric Properties

To further test the psychometric properties of Chinese Lung Cancer Screening Health Belief Scale, a survey with a larger sample size should be conducted in the target population. Validation tests to establish the modified instrument's construct validity, criterion-related validity, and internal consistency reliability will be conducted. A cross-sectional online survey using the sociodemographic information questionnaire (Appendix A), smoking and lung cancer screening history questionnaire (Appendix B), Suinn-Lew Self-identity Acculturation Scale (Appendix C), and the adapted Chinese Lung Cancer Screening Health Belief Scale will be administrated.

Inclusion criteria for the sample population will be: Chinese American high-risk smokers who identified themselves as Chinese Americans and born in China, aged 50 to 80 years old, current smokers, or quit smoking in the past 15 years, with a smoking history of 20 pack-year at least, and can read Chinese. The exclusion criterion will be having been previously diagnosed with lung cancer. The target sample size for the study will be 280. It was calculated by the power analysis using G-power.

The SPSS 28.0 software and SPSS Amos software will be used to analyze data. The construct validity will be tested using the confirmatory factor analysis. Descriptive analysis such as mean with standard deviation and median with range will be used to describe the differences on perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and cues to action between the screened and non-screened groups. Statistical analysis with the Cronbach's alpha coefficient will be used to test the internal consistency reliability.

Secondary data analysis study

A secondary analysis based on the data from the validation test of the Chinese Lung Cancer Screening Health Belief Scale in Chinese Americans could be done to investigate the facilitators and barriers for Chinese American long-term smokers to screening lung cancer and to examine relationships between facilitators and barriers with their lung cancer screening behaviors. Logistic regressions and descriptive analysis including percentages and means with standard deviations will be conducted using SPSS software. Independent variables will include smoking history, acculturation levels, etc. Dependent variables will include intention to screening lung cancer and history of lung cancer screening.

Qualitative interview study

Based on the findings from this study, a qualitative interview study which aims to explore physicians' perspectives and experiences of recommending lung cancer screening to their Chinese American smoker clients could be conducted. The semi-structured individual interviews will be conducted in person. Content analysis using comparison analysis and process coding will be used. Themes related to physicians' perspectives and experiences of recommending lung cancer screening to their Chinese American smoker clients will be summarized and categorized.

Intervention study

A pilot randomized control study which aims to improve lung cancer screening among Chinese American heavy smokers could be conducted. Participants will be randomized to intervention and control groups. Participants in the intervention group will take part in health education workshops about lung cancer screening. Participants in the control group will have delayed health education workshops about lung cancer screening at 6 months later than the intervention is implemented in the intervention group. Outcome for the study is the uptake rate of lung cancer screening among Chinese American heavy smoker participants at 6- and 12-month post intervention.

Conclusions

The directions for the future studies discussed in this chapter are examples of studies which could be implemented to improve lung cancer screening uptake rates among Chinese Americans. More detailed plans and comprehensive literature review still need to be conducted before putting these projects into implementation.

The validated Chinese version Lung Cancer Screening Health Belief Scale can provide healthcare providers a tool to evaluate Chinese American high-risk smokers' health belief toward lung cancer. It can also help healthcare providers to understand the facilitators and barriers for Chinese American smokers to screening lung cancer. In addition, the qualitative interview among physicians who have work experience with their Chinese American smoker clients can help health care promoters to understand the facilitators and barriers for physicians to recommend lung cancer screening to their Chinese American smoker clients. Furthermore, the pilot intervention study can help to increase the knowledge level of lung cancer screening among

Chinese American high-risk smokers and potentially increase the lung cancer screening rate among this population.

In summary, this study reported the methodology used in the cross-cultural instrument adaptation process. The methodology could be applied to adapt instruments in other areas. The future directions of research proposed in this study can potentially benefit high-risk Chinese American smokers and decrease the lung cancer mortality rates among this population.

Appendix A

Sociodemographic Information Questionnaire

Instruction: Please provide a response for each of the following question:

1. What is your age (y)? _______________

2. What is you gender?

   Female O

   Male O

   Others O

3. What is your marital status?

   Single O

   Married O

   Separated O

   Divorced O

   Widowed O

4. How many children do you have?

   0 O

   1 O

   2 O

   3+ O

5. What is your education level?

   Less than High School Diploma O

   High School O

   Some College O

   Bachelor's degree O

Graduate Degree O

6. What is your household annual income?

Less than $20,000 O

$20,000 to $44,999 O

$45,000 to $139,999 O

$140,000 to $149,999 O

$150,000 to $199,999 O

Greater than $200,000 O

7. What is your health insurance status?

Have no insurance O

Private insurance O

Government insurance (Medical or Medicare) O

Company's insurance O

8. What is your religion?

Catholic O

Protestant O

Eastern Religion (e.g. Buddhism) O

Other religion O

None O

9. What was your age when you moved to the U.S.? _____________

10. How many years have you lived in the U.S.? _____________

11. Do you work currently?

No O

Yes O (please identify your occupation ___________)

12. What language or dialect do you use most frequently? ________

Appendix B

Smoking and Lung Cancer Screening History Questionnaire

1. Do you smoke currently?

Yes, on a regular basis. O (Please identify how many packs per day ____________)

Yes, sometimes. O (please identify the frequency ______ and how many packs per day _____)

Not anymore, I quit in the past 15 years. O

2. If you smoke currently, please complete the following 3 questions:

1) Are you planning to quit smoking?

Within the next month O

Within the next 2-6 months O

Sometime after 6 months O

I am not planning to quit O

2) On a scale of 1 to 10, how IMPORTANT is it for you to quit smoking?

1 2 3 4 5 6 7 8 9 10

(Not at all important) (Extremely important)

3) On a scale of 1 to 10, how CONFIDENT are you to quit smoking?

1 2 3 4 5 6 7 8 9 10

(Not at all confident) (Extremely confident)

3. How long have you smoked?

Less than 1-year O

1-3 years O

4-6 years O

7-10 years O

More than 10 years O

4. Is/Was there anybody in your family diagnosed with lung cancer?

Yes O

No O

5. Have you received lung cancer screening with low dose computed tomography before?

Yes O (If yes, please identify the last time you received it. Year: ________).

No O

6. Please complete the following 3 questions:

1) Are you planning to receive lung cancer screening with low dose computed tomography?

Within the next month O

Within the next 2-6 months O

Sometime after 6 months O

I am not planning to receive it O

2) On a scale of 1 to 10, how IMPORTANT is it for you to receive the lung cancer screening with low dose computed tomography?

1 2 3 4 5 6 7 8 9 10

(Not at all important) (Extremely important)

3) On a scale of 1 to 10, how CONFIDENT are you to receive the lung cancer screening with low dose computed tomography?

1 2 3 4 5 6 7 8 9 10

(Not at all confident) (Extremely confident)

Appendix C

Asian Self-identity Acculturation Scale

INSTRUCTIONS: The following questions are to collect information about the background of Asians who live in United States and their behaviors, which may be related to your cultural identity. Choose the one answer which best describes you.

1. What language can you speak?

1. Asian only (for example, Chinese, Japanese, Korean, Vietnamese, etc.)
2. Mostly Asian, some English
3. Asian and English about equally well
4. Mostly English, some Asian
5. Only English

2. What language do you prefer?

1. Asian only (for example, Chinese, Japanese, Korean, Vietnamese, etc.)
2. Mostly Asian, some English
3. Asian and English about equally well (bilingual)
4. Mostly English, some Asian
5. Only English

3. How do you identify yourself?

1. Chinese, Taiwanese, Japanese, Korean etc.
2. Asian

3. Asian-American
4. Chinese-American, Japanese-American, Korean-American, etc.
5. American

4. Which identification does (did) your father use?

1. Chinese, Taiwanese, Japanese, Korean etc.
2. Asian
3. Asian-American
4. Chinese-American, Japanese-American, Korean-American, etc.
5. American

5. Which identification does (did) your mother use?

1. Chinese, Taiwanese, Japanese, Korean etc.
2. Asian
3. Asian-American
4. Chinese-American, Japanese-American, Korean-American, etc.
5. American

6. What was the ethnic origin of the friends and peers you had, as a child up to age 6?

1. Almost all Asians, Asian-Americans.
2. Mostly Asians, Asian-Americans.
3. About equally Asian groups, Anglo groups, African Americans, and Hispanics
4. Mostly Anglos, African Americans, Hispanics, or other non-Asians
5. Almost all Anglos, African Americans, Hispanics, or other non-Asians

7. What was the ethnic origin of the friends and peers you had, as a child from 6 to 18?

1. Almost all Asians, Asian-Americans.
2. Mostly Asians, Asian-Americans.
3. About equally Asian groups, Anglo groups, and African Americans.
4. Mostly Anglos, African Americans, Hispanics, or other non-Asians
5. Almost all Anglos, African Americans, Hispanics, or other non-Asians

8. Whom do you now associate with in the community?

1. Almost all Asians, Asian-Americans.
2. Mostly Asians, Asian-Americans.
3. About equally Asian groups, Anglo groups, African Americans, and Hispanics
4. Mostly Anglos, African Americans, Hispanics, or other non-Asians
5. Almost all Anglos, African Americans, Hispanics, or other non-Asians

9. If you could pick, whom would you prefer to associate with in the community?

1. Almost all Asians, Asian-Americans.
2. Mostly Asians, Asian-Americans.
3. About equally Asian groups, Anglo groups, African Americans, and Hispanics
4. Mostly Anglos, African Americans, Hispanics, or other non-Asians
5. Almost all Anglos, African Americans, Hispanics, or other non-Asians

10. What is your music preference?

1. Only Asian music (for example, Chinese, Japanese, Korean, Vietnamese, etc.)
2. Mostly Asian
3. Equally Asian and English

4. Mostly English
5. English only

11. What is your movie preference?

1. Asian-language movies only
2. Asian-language movies mostly
3. Equally Asian/English English-language movies
4. Mostly English-language movies only
5. English-language movies only

12. Where were you born? ______________________________ Please specify

12-1. In terms of being in the United States, circle the generation that best applies to you:

1. 1st Generation = I was born in Asia or other
2. 2nd Generation = I was born in U.S., either parent was born in Asia or other
3. 3rd Generation = I was born in U.S., both parents were born in U.S, and all grandparents born in Asia or other
4. 4th Generation = I was born in U.S., both parents were born in U.S, and at least one Grandparent born in Asia or other and one grandparent born in U.S.
5. 5th Generation = I was born in U.S.; both parents were born in U.S., and all grandparents also born in U.S.
6. Don't know what generation best fits since I lack some information.

13. Where were you raised?

1. In Asia only
2. Mostly in Asia, some in U.S.

3. Equally in Asia and U.S.
4. Mostly in U.S., some in Asia
5. In U.S. only

14. What contact have you had with Asia?

1. Raised one year or more in Asia
2. Lived for less than one year in Asia
3. Occasional visits to Asia
4. Occasional communications (letters, phone calls, etc.) with people in Asia
5. No exposure or communications with people in Asia

15. What is your food preference at home?

1. Exclusively Asian food
2. Mostly Asian food, some American
3. About equally Asian and American
4. Mostly American food
5. Exclusively American food

16. What is your food preference in restaurants?

1. Exclusively Asian food
2. Mostly Asian food, some American
3. About equally Asian and American
4. Mostly American food
5. Exclusively American food

17. What language do you read?

1. Read only an Asian language
2. Read an Asian language better than English
3. Read both Asian and English equally well
4. Read English better than an Asian language
5. Read only English

18. What language do you write?

1. Write only an Asian language
2. Write an Asian language better than English
3. Write both Asian and English equally well
4. Write English better than an Asian language
5. Write only English

19. If you consider yourself a member of the Asian group (Oriental, Asian, Asian-American, Chinese-American, etc., whatever term you prefer), how much pride do you have in this Group?

1. Extremely proud
2. Moderately proud
3. Little pride
4. No pride but do not feel negative toward group
5. No pride but do feel negative toward group

20. How would you rate yourself?

1. Very Asian

2. Mostly Asian
3. Bicultural
4. Mostly Westernized
5. Very Westernized

21. Do you participate in Asian occasions, holidays, traditions, etc.?
    1. Nearly all
    2. Most of them
    3. Some of them
    4. A few of them
    5. None at all

22. Rate yourself on how much you believe in Asian values (e.g., about marriage, families, education, work):
    1. Strongly believe
    2. Moderately believe
    3. Believe a little
    4. Mostly not believe
    5. Do not believe at all

23. Rate yourself on how much you believe in American (Western) values:
    1. Do not believe at all
    2. Mostly not believe
    3. Believe a little
    4. Moderately believe

5. Strongly believe

24. Rate yourself on how well you fit when with other Asians of the same ethnicity

1. Fit very well
2. Moderately fit
3. Fit a little
4. Moderately do not fit
5. Do not fit

25. Rate yourself on how well you fit when with other Americans who are non-Asian

1. Do not fit
2. Moderately do not fit
3. Fit a little
4. Moderately fit
5. Fit very well

26. There are many different ways in which people think of themselves. Which ONE of the following most closely describes how you view yourself?

1. I consider myself basically an Asian person (e.g., Chinese, Japanese, Korean, Vietnamese, etc.). Even though I live and work in America, I still view myself basically as an Asian person.
2. I consider myself as an Asian-American, although deep down I always know I am an Asian.
3. I consider myself as an Asian-American. I have both Asian and American characteristics, and I view myself as a blend of both.

4. I consider myself as an Asian-American, although deep down, I view myself as an American first.
5. I consider myself basically as an American. Even though I have an Asian background and characteristics, I still view myself basically as an American.

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