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ORIGINAL PAPER

Incorporating Cultural Perspectives into Diabetes Self-Management Programs for East Asian Immigrants: A Mixed-Study Review

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Abstract It is important to understand East Asian immigrants (EAIs)' unique perspectives in managing diabetes in order to provide culturally-competent care. However, it is not known whether EAIs' perspectives are addressed in diabetes self-management interventions developed for EAIs. Therefore, a mixed-study review was conducted to identify EAIs' perspective from qualitative research (n = 9 studies) and to evaluate the components of EAI diabetes self-management interventions (n = 7). Themes from the qualitative synthesis demonstrated that EAIs have unique cultural values and traditional health beliefs while struggling with multi-contextual barriers due to immigration. The evaluation of EAI diabetes self-management interventions revealed that there was a lack of consensus on cultural strategies for EAIs' across the interventions. Addressing language barriers was the only factor consistently integrated in the cultural components of intervention by employing bilingual interventionists. EAIs' perspectives and experiences need to be incorporated in the future diabetes self-management interventions to better provide culturally-competent care.

Keywords East Asian immigrants · Cultural competency · Diabetes mellitus type 2 · Self-management · Mixed-study review

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Introduction

Type 2 diabetes mellitus (T2DM) is an increasing epidemic in Asian immigrants who are living in the US [1]. In particular, East Asian immigrants (EAIs)—including Chinese, Korean, Japanese, and Taiwanese—who share similar health beliefs and cultural norms as defined by United Nations Statistics Division [2], have a high risk of developing T2DM. Chinese immigrants, the largest Asian American subgroup (3.8 million) and one of the fastest growing populations (44 % increase from 2000 to 2010) [3] are twice as likely to develop T2DM (10.9 %) than the non-Hispanic white population (5.9 %), after adjusting for BMI and age [4]. Similar results have been reported in Korean (1.7 million, the fifth largest Asian subgroup and experiencing 47 % growth from 2000 to 2010) and Japanese immigrants (1.3 million, the sixth largest Asian subgroup) [3]; the BMI-and-age adjusted prevalence of diabetes was 12.6 % in Korean and 13.3 % in Japanese [4].

Despite the high risk for T2DM in EAIs, EAIs frequently demonstrate poor diabetes self-management, mostly due to linguistic and cultural barriers [5, 6]. The majority of EAIs (70–78 %) are first-generation [7] who often hold traditional cultural beliefs. In addition, more than half of EAIs report limited English proficiency [8] and difficulty in communication with their health care providers [9]. These cultural and language barriers can not only lead to miscommunication [10], but also negatively influence their health care practices [11]. EAIs sometimes feel that health care providers do not respect or understand their perspectives or lifestyle [10] and in turn, EAIs are often labeled as being "non-adherent" to diabetes self-management recommendations [12].

Given the escalating T2DM epidemic and multiple barriers to obtain diabetes care among EAIs, it is

challenging but important that diabetes self-management programs include the cultural perspectives of EAIs'. Several studies have been conducted to explore EAIs' perspectives on diabetes self-management and EAI-targeted culturally-competent diabetes interventions have been developed and evaluated. However, synthesis of this literature and evaluation of the cultural components of EAI-targeted diabetes intervention has not been reported. Synthesizing this literature has the potential to guide future intervention development and evaluation.

The purpose of this mixed-study review was to identify EAIs' perspectives and experiences with diabetes self-management and to examine if EAIs' perspectives were addressed in diabetes self-management interventions. The specific research questions were:

(1) What are EAIs' health beliefs about diabetes self-management?
(2) What are EAIs' perceptions of factors influencing diabetes self-management?
(3) What are the culturally-competent strategies incorporated in diabetes self-management interventions for EAIs?
(4) How have EAIs' health beliefs and perceptions of factors influencing diabetes self-management been incorporated in diabetes self-management intervention for EAIs?
(5) Which interventions match the strategies derived from EAIs' perspectives and experiences?

Methods

Study Design

This study employed a mixed-study review design [13]. This particular approach integrates qualitative and quantitative findings to answer research questions and is especially useful in "integrating information about both effectiveness and context in intervention research" [14, p. 673]. This study consisted of three phases: synthesis of qualitative findings on EAIs' perspectives and experiences in managing diabetes (Synthesis 1); synthesis of quantitative findings from trials of EAI-targeted culturally competent diabetes intervention (Synthesis 2); and integration of the qualitative and quantitative findings (Synthesis 3).

Search Methods

A broad search was done using key terms to identify the population of the study (e.g. 'Korea', 'Japan', 'Taiwan', and 'Chinese') and terms to identify the focus of the study (e.g. 'type 2 diabetes', and 'self-care'/'self-management'/'prevention'). The databases searched were Medline, CINAHL, and PUBMED. The search was followed the PRISMA guideline [15]. All studies were assessed with the following inclusion criteria: English language, EAI sample, studies on addressing cultural aspects of diabetes self-management, and qualitative study design or (quasi) experimental study design that evaluated an intervention.

Search Outcomes

A total of 667 references were retrieved, 207 duplicated references were eliminated. During reviewing the abstracts, 439 articles were eliminated for not including the target population of EAIs. Additionally, ten articles were eliminated because they were neither qualitative study-design nor experimental study design. We also conducted a hand search by reviewing reference lists and leading authors' publication lists and included five additional articles that met our inclusion criteria. The final sample included 16 articles: nine qualitative articles and seven of quantitative articles. We found that in some cases, especially in qualitative studies, two or more articles were published from the same sample. We treated these articles separately if the research questions and study findings were sufficiently different. The flow of data collection and synthesis process is presented in Fig. 1.

Quality Appraisal

Pluye's [16] scoring system for mixed-study reviews was used to appraise the methodological quality of retained studies. The scoring system provides a total quality score for each retained study, taking into account the study design (qualitative or quantitative). The total quality score can be calculated as a percentage, number of 'yes' responses divided by the number of 'relevant criteria' * 100.

The overall quality of the qualitative studies was moderate: the total scores ranged from 50 to 83 out of 100 and most had clear aims and an appropriate research design. However, no study included the researcher's reflexivity. For quantitative studies, overall quality was weak: the total scores ranged from 33 to 67 out of 100. Only two studies employed randomized controlled trials and even these two studies did not report allocation concealment or blinding.

Data Abstraction and Synthesis

Synthesis 1: Qualitative Studies

A content analysis was used to synthesize the qualitative studies [14]. The first step was extraction of information

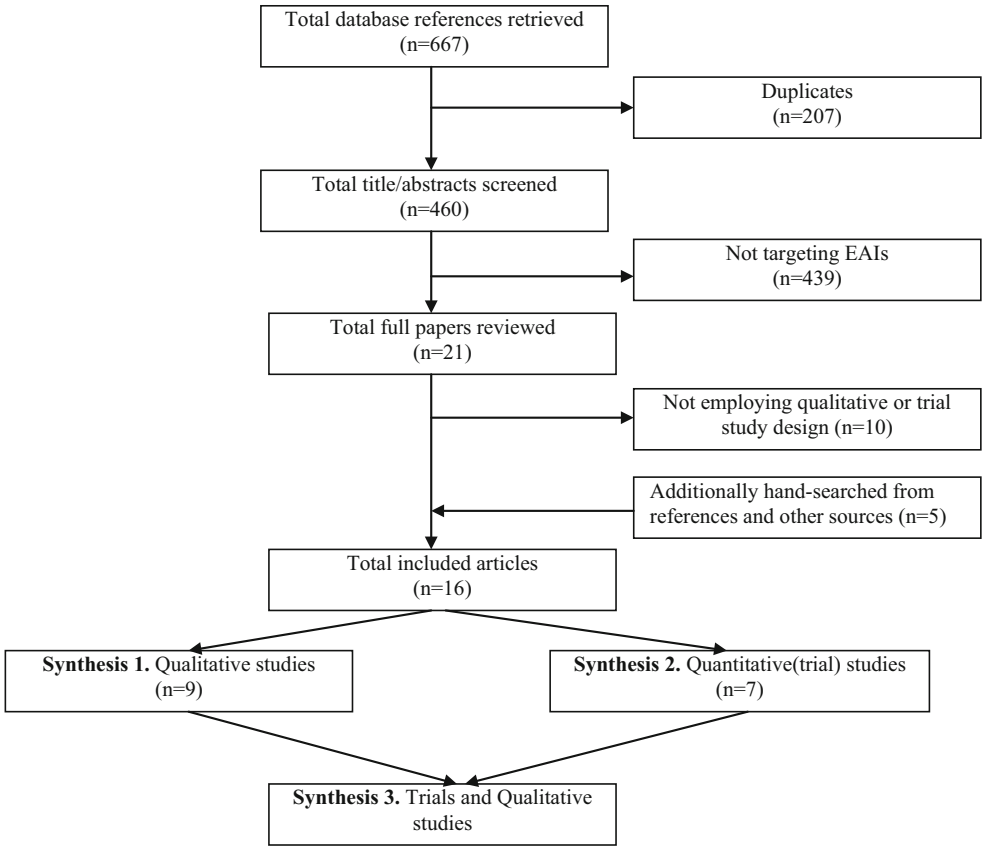

Fig. 1 Flowchart of data collection and synthesis process

from each qualitative study regarding study design, sample characteristics, and study findings. All themes, metaphors, phrases or participant quotes describing EAIs' health beliefs or perceptions were extracted.

After data extraction, data coding categories were initially developed using Tseng et al.'s [17] framework on factors affecting Chinese Americans' diabetes self-management—"Culture: belief system and perception of disease" and "Immigration". Using a line-by-line coding technique, five initial codes were identified that described the theme of culture (i.e., demographics, language, acculturation, accessing health care, and the US environment) and six initial codes described the theme of immigration (i.e., explanatory model for health and disease, model for behavior, traditional views of foods and exercise, social obligation, social stigma, and family factors).

The extracted qualitative data from these initial codes were expanded and re-grouped together to create descriptive categories under the two overarching themes of cultural beliefs and immigration-related challenges affecting diabetes self-management. This analysis was conducted by one author and reviewed and revised in collaboration with the other two authors. Any coding conflicts were resolved by group discussion.

Synthesis 2: Quantitative (Trial) Studies

A different form was used for data abstraction of the quantitative studies. Data on sample characteristics; study design, setting, general program description, cultural strategies, and outcomes (HbA1C, other biomarkers, DM knowledge/behaviors, and quality-of-life) were extracted from each study. After abstracting the data, a qualitative analysis of the textual data (e.g., general intervention description, cultural strategies, and program contents) was conducted to identify cultural components of the interventions. Effect size of each intervention was not calculated because most studies employed a single group pre-post test design.

Synthesis 3: Qualitative and Quantitative Studies

From the qualitative synthesis (synthesis 1), a set of strategies for interventions was identified that reflected EAIs' perspectives and modifiable factors influencing their diabetes self-management. Based on the cultural strategies from the qualitative studies, the interventions were evaluated in terms of how many of the strategies were incorporated into the intervention.

Results

Synthesis 1: Qualitative Studies

A total of nine qualitative studies were reviewed [5, 6, 18–24]. Six studies used an interpretative description method and three studies used phenomenology. Five out of the nine studies were published within 5 years. Sample characteristics of the studies are summarized in Table 1. Sample sizes varied from 12 to 40 participants. Most of the participants were between 55 and 65 years of age (88.9 %) and immigrated into one of three regions, New York City, Northern California, and Baltimore communities where many Asian immigrants reside.

Among the nine studies, six were conducted with Chinese immigrants and three were conducted with Korean immigrants. There were no studies that included Japanese or Taiwanese immigrants. Despite the limited ethnic variability, the findings across the two immigrant populations were similar. The only difference between Korean and Chinese immigrants' perspectives was in the degree of applying yin and yang concepts into their lifestyle. Therefore, we addressed Koreans and Chinese as one unit, unless otherwise noted.

The data analysis identified two overarching themes of cultural beliefs and immigration-related challenges. The detailed structure of themes is presented in Fig. 2.

Cultural Beliefs

Cultural beliefs represented beliefs about health and social relationships, independent of immigration, which negatively or positively influenced EAIs' diabetes self-management. General health beliefs included beliefs about health and illness, medication, food and exercise. Beliefs about social relationships included beliefs/behaviors concerning family dynamics, beliefs about group dynamics, and beliefs about relationships with health care providers (Table 2).

General Health Beliefs

Beliefs About Health and Illness

East Asian immigrants believed that health means having "no symptoms, no diagnosed disease, no prescribed medicine, and no need to see a physician regularly." [5, p. 838]. EAIs perceived that diabetes was not a serious disease because they rarely experienced diabetes symptoms or apparent limitations [[18, p. 317]. Therefore, they did not make lifetime commitments to lifestyle modification, glucose monitoring, medication, or keeping appointments with health care providers [5, 18].

The other major belief of EAIs was the belief that health is obtained by balancing yin and yang [5, 19–21]. Usually, yin represents cold and yang represents hot properties. EAIs believed that diabetes is a status where yin and yang have become imbalanced, in particular, excessive hot status. This belief primarily influenced EAI's approach to medication and food.

Beliefs related to the cause of diabetes also led to feelings of stigma. EAIs considered people with diabetes to be persons unable to control their desires, having excessive appetites, or as being lazy individuals [6, 20]. This stigma hindered disclosure of their illness to others and their request for support in managing their diabetes.

Beliefs About Medication

Both Korean and Chinese immigrants, heavily relied on oriental herbal remedies for diabetes self-management [5, 18–21]. EAIs believed that oriental herbal remedies improved general health and cured disease through balancing yin and yang. In contrast, they believed Western medication was made from unhealthy chemical substances that cause imbalances in yin and yang. They also believed that Western medication treated only symptoms of illness and did not cure the disease. Such beliefs related to Western medicines affected medication non-adherence.

Beliefs About Food

East Asian immigrants categorized food into two groups, 'good' foods (i.e. meat, white rice, and poultry) and 'bad' foods (i.e. raw vegetables, brown rice, and multigrain foods) [5, 20, 22]. 'Good' foods are perceived to be "natural healing agents" [20, p. 776] and should be eaten in abundance to enhance health, life satisfaction, and social bonds [20]. In particular, white rice was thought to be essential for survival and had important cultural significance [5, 18]. Thus, EAIs believed that sufficient 'good' foods, mainly white rice, were essential for diabetes care [5, p. 839].

Chinese immigrants sometimes classified foods as being "cold" (yin) or "hot" (yang) [19, 20]. They believed that it was important to eat cold foods (i.e. tea, herbs) to resolve excessive hotness in the body [18, 20]. These beliefs about food contributed to confusion in interpreting dietary recommendations, which did not consider yin/yang or good/bad foods. Interestingly, even though yin and yang concept was embedded in Korean immigrants' belief about disease [5], the concept was not prevalent in their belief toward specific foods, compared to Chinese immigrants.

Table 1 Characteristics of qualitative studies

Studies	Chun and Chesla [20]	Chesla and Chun [22]	Chesla et al. [19]	Washington and Wang-Letzkus [18]	Chun et al. [23]	Wang et al. [21]	Pistulka et al. [24]	Cha et al. [5]	Nam et al. [16]
Methods	Phenomenology Group interview	Phenomenology Group interview	Interpretive description Couple + group interview	Interpretative description Individual interview	Phenomenology Couple + group interview	Interpretative description Focus group interview	Interpretative description Individual interview	Interpretative description Individual interview	Interpretative description Focus group interview
Sample size	N = 20 (13 patients with T2D and 7 spouses)	N = 20 (13 patients with T2D and 7 spouses)	N = 40 (20 patient-spouse couple)	N = 13	N = 40 (20 patient-spouse couple)	N = 24 (17 well-controlled and 7 poorly-controlled T2D individual)	N = 12	N = 20	N = 23
Country of origin	China	China	China	China	China	China	South Korea	South Korea	South Korea
Geographical location	Northern California	Northern California	San Francisco bay area	Southern California area	San Francisco bay area	New York city	Baltimore	Metropolitan Atlanta	Washington-Baltimore
Age, year (SD)	Pt: 60.9 (7.5) Sp: 59.6 (8.8)	Pt: 60.9 (7.5) Sp: 59.6 (8.8)	62 (9.2)	78 (N/A)	62 (9.2)	P: 56 (N/A) W: 60.6 (N/A)	55.9 (N/A)	64.5 (11.6)	58.5 (7.3)
Gender (women), %	Pt: 30.8 Sp: 42.9	Pt: 30.8 Sp: 42.9	60	45.1	60	P: 57 W: 12	66.7	55.0	39.1
Duration in the U.S., year (SD)	Pt: 14.4 (10.3) Sp: 19.0 (13.1)	Pt: 14.4 (10.3) Sp: 19.0 (13.1)	14.7 (13.6)	15 (N/A)	14.7 (13.6)	P: 13.7 (N/A) W: 16.6 (N/A)	N/A	23.6 (9.7)	25.3 (11.5)
Duration of T2D, year (SD)	6.5 (4.9)	6.5 (4.9)	8.4 (5.9)	9.2 (N/A)	8.4 (5.9)	P: 6.4 (N/A) W: 6.0 (N/A)	8 (N/A)	N/A	12.0 (8.7)

Pt Patient, *Sp* spouse, *N/A* not available, *P* poorly controlled T2D group, *W* well-controlled T2D group

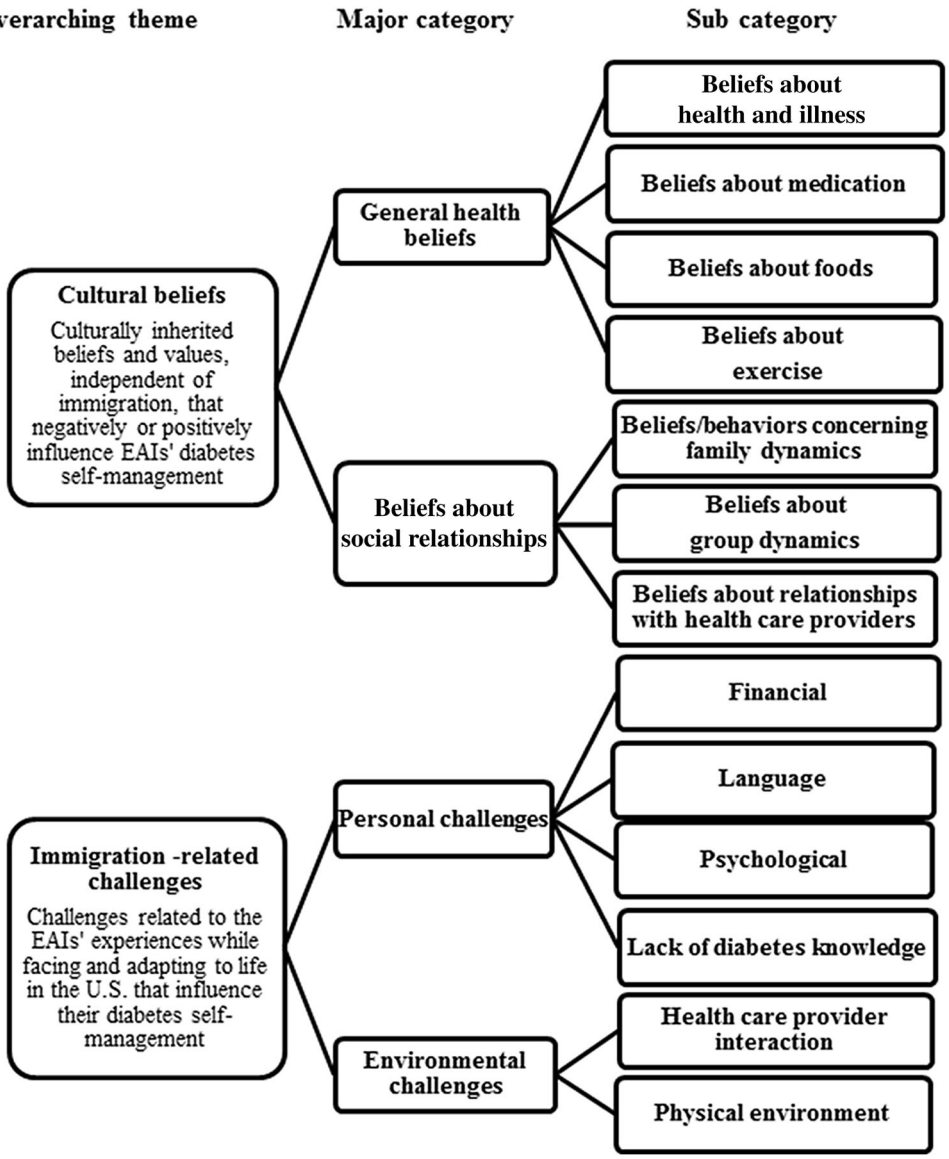

Fig. 2 Structure of major categories and sub-categories

Beliefs About Exercise

Chinese immigrants believed that strenuous exercise, such as weight-lifting, jogging and aerobics, compromised one's health causing bodily imbalances of yin and yang [20]. Consequently, they described preferring light exercise [18, 20]. There was no report on the belief about exercise based on yin and yang concept in Korean immigrants.

Beliefs About Social Relationships

Beliefs/Behaviors Concerning Family Dynamics

East Asian immigrant adults expected families to participate in diabetes management, including diet control, food preparation, and exercise [5, 6, 18, 19, 22, 23]. Therefore, the health beliefs and diabetes knowledge of spouses influenced partner's dietary and medication adherence; however gender differences were reported.

East Asian immigrants believed that women should sacrifice their own needs and act for the benefit of their families and spouses. As a result, wives were expected to prepare diabetes-appropriate food for their husbands with diabetes, whereas husbands were less expected to be involved with their wives' diabetes care. This gender role also hindered women's diabetes self-management by making women feel guilty about preparing diabetes-appropriate food for themselves.

Parent–child relationships also played an important role in diabetes management. Adult children strongly felt responsible to care for their parents [19, 24]. This sense of

Table 2 Cultural beliefs

Major category	Sub-category	Sample of themes
General health beliefs	Beliefs about health and disease	"No symptom, no disease" illness perception
		Emphasis on balancing yin and yang
		Stigma on diabetes patients
	Beliefs about medication	Authority of oriental herbal treatment
		Mistrust of western medication
	Beliefs about foods	Good food versus Bad food
		Food as a natural healing agent
		Belief on abundance of good foods
		Yin food versus Yang food
	Beliefs about exercise	Avoidance of strenuous exercise
Beliefs/behaviors concerning social relationship	Beliefs/behaviors concerning family dynamics	Family engagement in diabetes self-management
		Spouse's health beliefs and knowledge in diabetes self-management
		Husband–wife (men–women) hierarchical relationships
		Parent–child hierarchical relationships
		Family emotional and instrumental support
	Beliefs about group dynamics	Emphasis on group (including family) harmony
		Avoidance of conflict, attention, disclosure
		The meaning of sharing foods/group meals
	Beliefs about relationships with health care providers	Doctor–patient hierarchical relationships

filial piety often enhanced parents' diabetes self-management because they wanted to remain healthy and not be a burden for their children.

Lastly, EAIs reported that instrumental and emotional support from family members influenced diabetes self-management. Instrumental support, such as financial support for housing, transportation assistance, and identification of government subsidies, as well as health care services, enhanced diabetes self-management. Emotional support, such as showing concern and offering reassurance, encouraged EAIs to commit to diabetes self-management by alleviating acculturation demands and stress.

Beliefs About Group Dynamics

East Asian immigrants believed the preservation of group harmony to be more important than individual benefits. Therefore, they did not want to create conflicts or receive attention during social gatherings by rejecting foods [5, 6, 19, 22]. For EAIs, sharing foods had a symbolic significance. Eating alone was meaningless because "meals were sustaining only if shared" [19, p. 1814], whereas, group meals were seen as important events that enhanced social relationships and ties [19, 20]. The importance of group meals and sharing of foods made EAIs reluctant to reject or restrict food for blood glucose control during social gatherings.

Beliefs About Relationships with Health Care Providers

East Asian immigrants expressed strong beliefs about their relationship with health care providers [5, 19, 22]. They believed that they should be deferential and show respect to their health care providers. Therefore, they did not talk back or ask many questions, which may contribute to ineffective communication with their health care providers.

Immigration-Related Challenges

Personal and environmental immigration-related challenges of adapting to life in the US influenced diabetes self-management of EAIs. Four sub-categories of personal challenges were identified: financial, language, psychological, and lack of diabetes knowledge. Two sub-categories of environmental challenges were identified: interaction with health care provider and the physical environment (Table 3).

Personal Challenges

Financial

Many EAIs expressed that their top priority was economic survival and social adaptation rather than diabetes care [5, 6]. Therefore, they could not spend time on their diabetes

Table 3 Immigration-related challenges

Major category	Sub-category	Sample of themes
Personal challenges	Financial	Economic survival-busy life, financial constraint
		Lack of health insurance/inadequate health insurance coverage
		Benefits from medicare/medicaid programs
	Language	Limited English proficiency
	Psychological	Loneliness, isolation, depression, sense of individualism
	Lack of diabetes knowledge	Lack of knowledge on general diabetes management (overview of diabetes, diabetes management)
		Lack of knowledge on culturally sensitive diabetes management (traditional foods and American food choices)
Environmental challenges	Health care provider interaction	Health care provider's bilingual skills, cultural knowledge, emotional support
	Physical environment	Ethnically-homogeneous neighborhoods
		Supportive community resources (free/low cost senior day care, YMCA, gym, park, etc.)
		Favorable natural environment (clean air, weather, etc.)

self-management. EAIs also reported experiencing financial constraints that hindered them from purchasing healthy foods, medicines and supplements. Due to their low-income or self-employment, they frequently reported lacking health insurance which hindered access to diabetes care. Sometimes, benefits from Medicare or Medicaid helped them with their financial situation.

Language

Limited English proficiency was a considerable challenge that inhibited access to health care services [6, 20]. Limited English proficiency led EAIs to avoid communicating with health care providers who do not speak their language. It also created challenges in scheduling medical appointments, purchasing over-the-counter diabetes care products, and attending diabetes education sessions.

Psychological

East Asian immigrants reported frequent feelings of loneliness, isolation and depression as they lived far from friends and family. One participant expressed the experience as "All in all, having left home, there is not as much warmth in the US and the atmosphere is not as festive, not as fun as our mainland China home. The main point is that we have few relatives and friends here." [23, p. 260]. These negative emotions could compromise diabetes self-management [23].

Lack of Diabetes Knowledge

East Asian immigrants frequently expressed lack of knowledge on the disease process and limited understanding about diabetes self-management. They did not know what to eat, how much they should eat, and how to calculate the calories count mostly due to a lack of diabetes education in their native language [5, 18, 23]. EAIs also described a lack of culturally-competent dietary guidelines that not only integrated their traditional recipes, portion sizes and cultural beliefs, but also acceptable American food choices.

Environmental Challenges

Interaction with Health Care Providers

Access to health care providers who spoke the same language and understand their culture facilitated diabetes self-management as this improved communication and resolved conflicts between western medical advice and traditional beliefs. In addition, emotional support from health care providers was viewed as helpful and encouraging [23, p. 258] and could enhance their diabetes self-management.

Physical Environment

Aspects of their local environment that differed from their native countries sometimes facilitated diabetes self-management [5, 23]. EAIs who felt a strong sense of community expressed a positive effect on their well-being as it encouraged them to become more involved with social and physical activities. Additionally, free or low cost community resources such as senior day care, YMCA, gyms or parks encouraged them to engage in exercise. Natural environmental factors such as clean air and mild weather (in California) also affected self-management.

Synthesis 2: Quantitative (Trial) Studies

Description of Quantitative Studies

A total of seven quantitative studies [25–31] were included in this review, two randomized control trials and five pre-post test designs (Table 4). Most of the studies were conducted recently; five out of seven studies were published within 5 years. Sample sizes ranged from 23 to 145. All interventions were provided by bilingual diabetes educators in community settings.

The delivery methods of the intervention were varied: 29 % of interventions (n = 2) provided only education sessions, either individually or in a group, 29 % of interventions provided the combination of education sessions and group activities (n = 2), and 57 % of interventions had various combinations, such as the combination of education sessions/group activities/counseling/telephone calls (n = 3). Mixed results were reported in all outcomes; there was significant improvement in HbA1C (n = 4) and quality of life (n = 3), improvement in diabetes knowledge (n = 4), and improvement in health behaviors (n = 3). The rest of studies reported no significant improvement in HbA1C (n = 2), quality of life (n = 1) and diabetes knowledge (n = 1) or did not measure the outcomes.

Cultural Strategies in the Intervention

Among the seven studies, one research team developed culturally competent strategies (reflecting EAIs' unmet needs and using support group approach rather than individual counseling) [25] based on their prior qualitative studies [19, 23]. Another team reported that they developed culturally tailored intervention by including EAI's yin and yang belief toward food [29], based on some qualitative studies [19, 22, 23]. Another team developed EAI-specific cultural strategies based on previous qualitative studies [31], but they did not specify which studies they referred to and what components were adapted for EAIs. The rest of studies did not mention how they developed EAI-specific cultural components in-detail.

The primary cultural strategies used in diabetes self-management interventions for EAIs were the use of native language in class (100 %) [25–31] and integration of traditional food and recipes in diet guidelines (86 %) [26–31]. Other common cultural strategies were employing group-problem solving strategies (43 %) [25, 29, 31]; addressing cultural myths related to oriental and western medication (43 %) [26, 29, 30] or related to diabetes (29 %) [25, 31]; teaching traditional exercises (43 %) [26, 29, 30]; and addressing group meal challenges (29 %) [25, 31]. Others were incorporating the yin and yang concept and traditional beliefs on diet (only Chinese) [30]; discussing guilt and depression with respect to diabetes [31]; role plays of family conflict scenarios [25]; and provision of community and health care resources [31].

The education sessions included a diabetes overview (i.e. pathology, current research findings, progress, or complications) (86 %) [25, 26, 28–31], the topics of diabetes diet (86 %) [26–31], exercise (71 %) [26, 28–31], medication (56 %) [26, 28–30], stress management (56 %) [25, 29–31], glucose monitoring (43 %) [26, 29, 30], eye and foot care (43 %; n = 3) [26, 29, 30], communication skills (43 %) [25, 28, 31], and other related topics (problem-solving [25, 28], access to health care [31]).

Synthesis 3: Qualitative and Quantitative Studies

Based on the qualitative analysis, 23 culturally-competent strategies to support EAI diabetes self-management were identified (Table 5). The diabetes self-management interventions were then evaluated for their use of these culturally-competent strategies. All interventions employed bilingual health care providers and six out of seven interventions provided dietary recommendations related to traditional foods. However, the majority of interventions did not include many of the strategies to accommodate EAIs' specific perspectives and experiences. For example, three intervention addressed EAIs mistrust of Western medication and preference for traditional medicine, one intervention addressed yin-yang concepts in diet, and one intervention addressed family dynamics.

Discussion

In this review, we have identified that the cultural beliefs and immigration-related challenges of EAIs influence their diabetes self-management in multiple ways. The synthesis of qualitative findings indicate that EAIs' health beliefs and cultural values frequently conflict with Western health beliefs, which can contribute to poor adherence to Western

Table 4 Characteristics of and synthesis of quantitative studies

Studies	Wang and Chan [30]	Kim et al. [28]	Choi and Rush [26]	Ivey et al. [27]	Sun et al. [29]	Chesla et al. [25]	Islam et al. [31]
Study design	Single group pretest–posttest design	Randomized controlled trial-waiting list design	Single group pretest–posttest design	Quasi-experimental design	Single group pretest–posttest design	Delayed-treatment repeated-measures design	Randomized controlled trial
Sample size	N = 33	N = 79	N = 41	N = 92	N = 23	N = 145	N = 48
Country of origin	China	South Korea	South Korea	China	China	China	South Korea
Geographical location	Hawaii	Washington–Baltimore area	Not specific, West coast area	Oakland area	San Francisco area	Northern California	New York City
Age, year (SD)	68.8 (10.1)	56.4 (7.9)	70.3 (8.4)	66.7 (10.7)	52 % aged 70–79	64.5 (9.4)	59.7 (8.1)
Gender (women), %	51.5	44.3	53.7	65	52.2	59	64.3
Duration in the U.S., year (SD)	16.5 (9.3)	53.2 % in US for >20 years	27.0 (9.5)	16.5 (8.9)	N/A	18 (11.9)	22.6 (10.3)
Baseline A1c, % (SD)	7.1 (1.1)	9.3 (1.4)	7.3 (N/A)	7.6 (.7)	7.9 (1.0)	7.2 (1.3)	N/A
Theory	Empowerment model	N/A	N/A	Bodenheimer model	CCM + TRA + SCT	Grey's health coping	N/A
Attrition, %	17.5	4.8	23	N/A	15	18.5	N/A
Intervention description	10 × 1 h group education over 10 weeks	6 × 2 h group education over 6 weeks + monthly telephone counseling over 6 months + home glucose monitoring	2 × 2 h group educations	3 physician visits + 3 dietarian counseling + 3 health-coach phone call over 6 months	12 × 90-min support group sessions + group education over 6 months + bilingual booklet	6 × 2 h group education + discussion + role plays over 6 weeks	6 × 2 h group education + discussions + 10 follow-up phone calls over 6 months

Table 4 continued

Studies	Wang and Chan [30]	Kim et al. [28]	Choi and Rush [26]	Ivey et al. [27]	Sun et al. [29]	Chesla et al. [25]	Islam et al. [31]
Cultural strategy	Chinese language Chinese food example Chinese exercise Pros and cons of oriental and Western medicine Integrating cultural belief (yin and yang concept) into lifestyles Traveling guidelines	Korean language Integration of Korean food/recipes in diet guideline	Korean language Korean food/ recipes examples Korean exercise Discussions of cultural beliefs and diabetes self-management (i.e. oriental medicine)	Chinese language Nutritional counseling on Chinese diet	Chinese language Chinese exercise Chinese food examples Cultural stress management (reciting Chinese poetry) Discussions of cultural myths related to oriental and Western medicine Cultural strategies based on previous qualitative research	Chinese language Collective problem solving strategies with bicultural and indirect communication Discussions of cultural myths about diabetes Group meal challenges Role plays of family scenarios Cultural strategies based on previous qualitative research	Korean language Korean statistics for diabetes Korean food/recipes Discussions of cultural myths about diabetes Group meal challenges Discussions of guilt/depression Community resources Cultural strategies based on previous qualitative research
Outcome							
HbA1c	Significant, No p value	$p < .01$	$p < .01$	$p = .06$	$p < .01$	$p = .42$	N/A
Other biomarkers	BMI, BP, significant, No p value	$p > .05$ for Lipid panel	$p < .01$ for HDL, waist circumference	N/A	N/A	N/A	$p > .1$ for BMI, BP, waist circumstance
DM knowledge	N/A	$p = .01$	$p = .39$	N/A	$p < .01$	$p < .01$	$p = .03$
Quality of life	Significant, No p value	$p < .01$	$p > .05$ for physical/mental health	N/A	N/A	$p < .01$	N/A
DM behaviors	N/A	$p < .01$ for self-care activities	$p < .01$ for foot care	N/A	$p > .05$ for DM practice	N/A	$p = .02$ for eating brown rice

N/A Not available, *CCM* chronic care model, *TRA* theory of reasoned action, *SCT* social cognitive theory, *BMI* body mass index, *BP* blood pressure, *HDL* high density cholesterol, *DM* diabetes mellitus

Table 5 Synthesis of qualitative and quantitative findings

Qualitative findings	Cultural strategies from qualitative synthesis	Evaluation of interventions
Beliefs about health and disease	1. Change their "no symptom, no disease " perception to chronic illness perception	1. No study addressed "no symptom, no disease" perception
	2. Integrating yin and yang concepts in diet and exercise guidelines	2. One study addressed yin-yang concepts in diet
	3. Correcting stigma on diabetes patients and guilty about having diabetes	3. One study addressed their guilty and depression in group discussion
Beliefs about medication	4. Address mistrust for Western medication	4–5. Three studies addressed the mistrust for oriental and Western medication
	5. Explain benefits and the adverse effects of oriental herbal therapy	
Beliefs about foods	6. Correct the belief on the effect of abundance of good foods	6–7. Six studies included dietary education with traditional food examples, but no study informed acceptable American food choices
	7. Develop and delivery of culturally competent diet guidelines-including traditional food, recipes based on their portion size, and acceptable American food choices	
Beliefs about exercise	8. Correct the belief on strenuous exercise	8. Five studies included exercise education but did not address the mistrust on vigorous level of exercise
	9. Recommend traditional exercise like tai-chi	9. Three study educated cultural activities (i.e. Tai-chi, Chi-gong, or Yoga) as an exercise
Beliefs/behaviors concerning family dynamics	10. Participation of family members, especially spouse in the education	10. All studies recruited only patients
	11. Educate and practice communication skills for obtaining family supports and resolving family conflicts	11. One study role-played family conflict scenarios to enhance communication skills with family members
	12. Empower female patients with diabetes	12. No study separately approached or empowered female patients
Beliefs about group dynamics	13. Discuss how to cope with group meal challenge and share one's experience and strategies	13. Two studies addressed the group-meal challenge
Beliefs about relationships with health care providers	14. Educate and practice assertive communication skills with health care providers	14. Two studies included communication skills with health care providers
Financial challenges	15. Educate how to access available free/low cost health care resources	15. One study addressed available these resources
Language challenges	16. Employ bilingual interventionist	16. All studies employed bilingual interventionist
	17. Provide native-language version of workbook	17. Two studies provide native-language workbook
Psychological challenges	18. Educate and practice stress management	18. Six included stress-management or problem-solving in the education
	19. Provide emotional support group activity	19. Three studies were conducted group activity sessions
Lack of diabetes knowledge	20. Provide an overview of diabetes	20. Six included a diabetes overview in the education
	21. Provide diabetes self-management practice	21. Diet (86 %), exercise (71 %), medication (56 %), glucose monitoring (43 %), eye and foot care (43 %) were included in the education
Health care provider interaction	14[a]. Same strategy presented in #14	14[a]. Same results presented in #14
	22. Educate how to request translation/interpreter services during the health care encounters	22. One study addressed the way to access health care but no study informed how to get language services
Physical environment	23. Share/educate community-based recreational, educational, or self-help group resources/ethnic community networks	23. No study included this content in the education or group activity session

[a] Repeated recommendation

medication and treatment guidelines. Moreover, EAIs experience financial, language, and psychological challenges, and lack of diabetes knowledge, which affect access to care and diabetes self-management. Environmental challenges, such as the presence of bilingual health care providers and community resources, also influence EAIs' diabetes self-management.

There was considerable discrepancy between EAIs' perspectives and the cultural strategies employed in diabetes self-management interventions for EAIs. The language

factor was the only factor consistently integrated in interventions by employing bilingual interventionists and using the patients' primary language in the class. From the qualitative synthesis, many other culturally-competent strategies that incorporate EAI beliefs and perspectives into programs were identified. Encouraging family participation in diabetes education may enhance diet, exercise, or other self-management practices for individuals with T2DM. In addition, because many EAIs place a high value on group dynamics, developing a peer-based intervention or organizing a self-help group may be another way to facilitate diabetes support from peers and improve diabetes self-management. In terms of education content, addressing EAIs beliefs about health and illness or their use of oriental herbal remedies, may enhance their adherence with health care providers' advice and self-management behaviors. In particular, for Chinese immigrants, understanding and integrating yin and yang concepts into education about food and exercise may be beneficial to resolve conflicts between Western health beliefs and their traditional health beliefs. Lastly, addressing challenges during group meals, educating EAIs in communication skills, and providing opportunities to practice these skills may enhance the ability of EAIs to be more assertive related to diabetes self-management.

While interventions did not incorporate many culturally relevant strategies, it is noteworthy that more than half of interventions significantly improved diabetes knowledge, health behaviors, and glycemic control. This may indicate that language barriers are critical factors that hinder EAIs' diabetes management, and providing diabetes education and support in EAIs' native language is necessary. It is also possible that interventions included more culturally relevant strategies when delivering the program that were not identified in the manuscript. In addition, the process of developing culturally relevant strategies was reported in only three manuscripts. If the process of intervention development and greater detail on cultural strategies were reported consistently, understanding on the mediators to EAIs' diabetes self-management and metabolic control could be determined.

This review has several limitations. First, there were challenges in determining the optimal fit for some codes related to the process of acculturation. Since the acculturation process occurs along with immigration process [32, p. 1244], these codes were not distinguishable into cultural beliefs or immigration related challenges. In this review, we decided to focus on the attributes of the acculturation process rather than acculturation itself. For example, the code of "change of filial piety" was categorized into cultural belief by focusing on "filial piety" rather than "change". However, this classification does not highlight the characteristics of acculturation process, which also may affect diabetes self-management.

Second, the review included only published journal articles and did not include dissertations or unpublished research. In addition, many quantitative (experimental) studies were conducted with a small sample size and employed a single-group pretest–posttest design which does not guarantee that the change in the outcome variable was caused by the intervention [14]. Thus, results should be interpreted cautiously. Finally, there was limitation in sample diversity. All qualitative and quantitative studies involved Chinese and Korean immigrant participants; they did not include Japanese or Taiwanese immigrants. Additionally, the majority of qualitative studies were conducted with Chinese immigrants and this may bias the qualitative synthesis results—Chinese immigrants' specific health beliefs may be more represented than other EAIs' health belief in this review. Although there are common cultural heritages among EAIs subgroups, the specific health beliefs may be different among EAIs.

Conclusion

This mixed-study review identified EAIs' perspectives and experiences on diabetes self-management and evaluated if EAIs' perspectives were addressed in diabetes self-management interventions. EAIs have unique perceptions of health and illness; beliefs about medication, food, and exercise; and also distinctive cultural values regarding family, group, and patient-provider relationships. Due to immigration, they also have experienced financial constraints, language barriers, psychological distress, lack of diabetes knowledge, lack of culturally-competent health care, and different physical environments from their mother countries. The review reveals that most of current diabetes interventions have limitations in addressing important EAIs' perspectives or needs into their cultural strategies. Addressing EAIs' challenges in T2DM self-management caused by cultural and immigration-related factors, and incorporating their perspectives into diabetes self-management programs is necessary to improve culturally-competent diabetes care for EAIs.

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