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Review

Randomized controlled trial lifestyle interventions for Asian Americans: A systematic review



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ABSTRACT

Objective. Asian Americans are the fastest-growing race in the United States. However, they are largely under-represented in health research, particularly in lifestyle interventions. A systematic review was conducted to analyze the characteristics and quality of lifestyle intervention literature promoting changes in physical activity (PA), diet, and/or weight management targeting Asian Americans.

Method. A systematic electronic database search identified randomized controlled clinical trials (RCTs), involving lifestyle interventions for Asian Americans, published from 1995 to 2013 conducted in the US. Data extraction was conducted from August through December 2013.

Results. Seven RCTs met the review criteria. Cross-study comparisons were difficult due to diversity in: RCT intervention designs, cultural appropriateness, outcome measures, sample size, and race/ethnic groups. Overall, risk of bias and cultural appropriateness scores were moderate to low. Five out of seven RCTs showed significant between group differences for PA, diet, and weight. In general, sample sizes were small or lacked sufficient power to fully analyze intervention efficacy.

Conclusion. Evidence of the efficacy for lifestyle interventions among Asian Americans was mixed. Recommendations include: more rigorous RCT designs, more objective measures, larger Asian American sample sizes, culturally appropriate interventions, individual tailoring, maintenance phase with support, and providing education and modeling of lifestyle behaviors.

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Introduction

Asian Americans are the fastest-growing racial group in the United States (US Census Bureau, 2013). In 2012, there were approximately 18.9 million Asians living in the US, comprising nearly 6% of the total US population (Pew Social Demographic Trends, 2012). The six largest Asian American populations are: Chinese (3.8 million), Filipinos (3.4 million), Asian Indians (3.2 million), Vietnamese (1.7 million), Koreans (1.7 million), and Japanese (1.3 million). Approximately 74% of Asian American adults are born outside of the US with half possessing limited English proficiency. Although the population of Asian Americans is projected to grow to 34.4 million by 2060, they are largely underrepresented in health research in general, and behavioral lifestyle intervention literature for this group is minimal (Palaniappan et al., 2010).

Physical inactivity and poor diet are independent risk factors for multiple diseases, such as diabetes and cardiovascular disease. Evidence indicates that lifestyle interventions promoting physical activity (PA) and healthy nutrition are effective in mitigating these risk factors, which are prevalent across all racial/ethnic groups (Hooper et al., 2011; Hu et al., 2012; Knowler et al., 2002). Asian Americans tend to be physically inactive and less likely to meet the recommendations of the 2008 National Physical Activity Guidelines, as compared to Whites (Afable-Munsuz et al., 2010; Kandula and Lauderdale, 2005). Limiting saturated fats and carbohydrates (e.g., refined sugar) in the diet have been effective in reducing risks for obesity, diabetes, and cardiovascular disease (CVD) (Malik et al., 2010; Siri-Tarino et al., 2010). However, some Asian American (e.g., South Asian Indians and Filipinos) diets are high in saturated fats (e.g., clarified butter, hydrogenated oils, pork fat, and coconut products) (Centers for Disease Control and Prevention, 2013; Kittler and Sucher, 2008). Furthermore, although the average body mass index (BMI) among Asian Americans is relatively lower compared to other racial/ethnic groups, Asians have a propensity for abdominal adiposity, increasing their risk for type 2 diabetes and CVD at lower BMI cutoff levels (Hu, 2011). Analysis of the California Health Interview Survey (using the World Health Organization Asian BMI cutoff levels) found Asian Americans, particularly Filipinos with the highest prevalence for obesity and type 2 diabetes among all racial/ethnic groups (Jih et al., 2014; WHO, 2004). Thus, Asian Americans face unique health challenges today.

A recent systematic review of lifestyle interventions (related to PA, diet, and weight management) conducted in the US reported that a majority of study samples were comprised primarily of well-educated White Americans (Artinian et al., 2010). Although there are several systematic reviews and/or meta-analysis of lifestyle interventions targeting ethnic minorities, most are focused on African Americans and Hispanics (Glazier et al., 2006; Tussing-Humphreys et al., 2013; Whitt-Glover and Kumanyika, 2009). Furthermore, a cursory review of

lifestyle intervention studies promoting PA, diet, and weight loss/management yielded few, if any studies targeting Asian Americans predating 1995. To the best of our knowledge, there are no systematic reviews and/or meta-analyses that examined the overall effectiveness of published behavioral lifestyle interventions or identified potential strategies to promote PA, healthy diets, or weight loss/management for Asian Americans.

Therefore, the goal of this paper was to systematically review, summarize, and synthesize the characteristics, quality, and key factors related to efficacy of the lifestyle intervention literature that incorporate strategies promoting PA, diet, and/or weight management targeting Asian Americans. Evaluation of overall study quality was based on the Cochrane Collaboration risk of bias criteria. Evaluation of intervention design quality was based in part on the cultural adaptation strategies used to achieve cultural appropriateness. Culturally tailored interventions that are appropriate for racial/ethnic populations are shown to increase the effectiveness and adherence for health behavior change, and support the internal reliability of results (Elder et al., 2009; World Health Organization, 2009). It may be difficult to culturally adapt an intervention if it includes multiple racial/ethnic population samples. Although overlooked by many major systematic reviews, interventions focused on specific racial/ethnic populations should be assessed for cultural appropriateness (Bender and Clark, 2011). Findings from this review will help identify knowledge gaps and aid future lifestyle intervention designs for Asian Americans.

Methods

Search strategy

In collaboration with a professional librarian, a comprehensive literature search was performed on controlled studies involving lifestyle intervention targeting Asian Americans. Five electronic databases were searched including: PubMed, EMBASE, CINAHL, PsycINFO®, and Web of Science®. Three specific lifestyle health behaviors were of interest: physical activity, diet/nutrition, and weight loss/management. For this review, the term “Asian”, per the US Census Bureau (2010) definition refers to individuals, “... having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent” (Hoeffle et al., 2012). Search terms include all Asian groups from these regions. The term “American” was used to distinguish Asian groups residing in (versus outside) the United States. The search included various combinations of the following key words: Asian, American, Chinese, Vietnamese, Filipino, Korean, Japanese, Thai, Malaysian, Taiwanese, Cambodian, Burmese, Indonesian, Laotian, Mongolian, Bhutanese, South Asian, Indian, Bangladeshi, Pakistani, Pacific Islander, physical activity, exercise, leisure activity, diet, nutrition, weight, weight loss/reduction, weight management, intervention, lifestyle behaviors, health promotion, and behavior change. Online Google searches were employed and reference sections of included articles were searched to identify additional articles. See Appendix 1 for detailed search terms and step-by-step procedures.

Inclusion/exclusion criteria

Inclusion criteria

1) Peer reviewed journal articles, published in English between 1995 and August 2013, 2) RCTs conducted in the US, 3) lifestyle interventions that involved, and outcomes that evaluated change, in PA, diet, or weight, 4) RCTs specifically targeting Asian American populations, and 5) adults ≥ 18 years. Since environmental factors influence lifestyle behaviors, Asian Americans living in the US are different from Asians living in other countries (Ball et al., 2006; Marmot and Syme, 1976). Thus, studies were restricted to those conducted in the US. If there was any disagreement about study inclusion/exclusion between two independent reviewers, the reviewers read the full-texts of those studies until consensus was reached. If consensus was not reached, a third reviewer made the final decision.

Exclusion criteria

1) Systematic review, meta-analysis, qualitative, quasi-experimental, cohort, or cross-sectional study design, and 2) unpublished reports or reports published online in abstract, and 3) RCTs including non-Asian and Asian American subjects if no reports were provided on cultural adaptation and individual tailoring appropriate for Asian Americans, or on subgroup analysis of outcomes of interest (PA, diet, or weight) for Asian Americans.

Data extraction

The first reviewer performed data extraction. Two reviewers verified the results. The following data were extracted: 1) RCT characteristics – publication year, setting/location, research question, theoretical framework, design, randomization strategy and scheme, number of groups, and retention rate; 2) sample characteristics – number of patients enrolled in the RCT stratified by group, age, gender, and race/ethnicity; 3) intervention characteristics – design, goal, each arm descriptions, duration, dose, fidelity, delivery mode, and cultural adaptation strategies; 4) outcome characteristics – measures for PA, diet, and weight; and 5) outcomes – change in PA, diet, and weight over time. Whenever possible, missing variables were calculated or estimated from reported data. For trials with multiple published articles (related to the intervention development and design), relevant data was incorporated from Supplementary sources.

Data synthesis

Data syntheses were performed in three ways and displayed in one of the following three tables: 1) Table 1 presents a descriptive summary of the reviewed RCTs including the primary outcomes of interest for this review (PA, diet, and weight); 2) Table 2 presents the description of the interventions and assessment of cultural appropriateness; and 3) Table 3 presents the quality of the RCT designs based upon risk of bias. Finally, a summary of evidence for efficacy is provided. The heterogeneity of the seven reviewed RCT interventions precluded quantitative analyses.

Cultural appropriateness assessment

To assess the cultural appropriateness of the overall intervention design quality for Asian Americans we used a modified version of the Bender and Clark Cultural Adaptation Scoring System (Bender and Clark, 2011). Scoring assessments consist of six cultural adaptation strategies recommended to facilitate cultural appropriateness: 1) Peripheral: use of visual and audio elements (e.g. foods, music, clothing, and pictures); 2) Evidential: use of scientific evidence in educational information related to the target group (e.g., an ethnic group's preference for white rice that increases their risk for diabetes); 3) Constituent-involving: solicitation of knowledge, input, and participation of members from the target community (e.g. use of focus groups or trained community members for intervention implementation); 4) Socio-cultural: incorporation of target group cultural values and norms (e.g., accommodating family oriented or patriarchal preferences); 5) Linguistics: translation of study materials into the culture's own language following accepted guidelines, with consideration for literacy levels and regional differences; and 6) Tailoring: fine-tuning of the intervention (to improve relevancy for one specific person or subgroup). Studies received one point for each of the six cultural adaptation strategies applied to their intervention. Based on total score, each intervention study was ranked for cultural appropriateness as follows: 5 to 6 = high, 3 to 4 = moderate, and 0 to 2 = low.

Risk of bias assessment

To assess the overall RCT study design quality, we modified the evaluation criteria outlined in the Cochrane Collaboration's tool for assessing risk of bias (Higgins et al., 2011). Risk of bias criteria include: 1) sample: did the study target Asian Americans for sufficient power, 2) concealment of allocation: were concealment of allocation methods described, 3) blinding: were investigator and participant blinding procedures described, 4) intention-to-treat: were intention-to-treat analysis methods reported or implemented, 5) retention rate: was retention $\geq 80\%$? For each individual criterion met, the study received a "yes" (+); if not met, a "no" (–). RTC study quality was ranked on a "yes" sum basis: 4 to 5 = high quality; 2 to 3 = moderate quality; and 0 to 1 = low quality. For each reviewed study, two reviewers (MB and JC) independently assessed risk of bias. If consensus was not reached, a third reviewer (YF) resolved the issue.

Results

The study selection process is illustrated in Fig. 1. After duplicate removal, the initial search identified 1794 abstracts. Based on exclusion criteria, abstract reviews excluded 1734 studies. The 69 remaining potentially relevant studies were subject to full-text review. Among these 69 studies, we excluded nine quasi-experimental studies focused on specific Asian American populations (6 single-group design studies without control group and 3 parallel studies without randomization). In addition, three large multi-site RCTs with multiple racial/ethnic population samples including non-Asian populations (e.g., Caucasians, African Americans and Hispanics) and were excluded. Cultural adaptations and individual tailoring, or subgroup analysis of outcomes of interest was not reported for the Asian American subgroups in these three large RCT studies. Following these study exclusions, seven studies were identified for review (Dirige et al., 2013; Han et al., 2010; Islam et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013). Table 1 provides a descriptive summary of reviewed studies including: RCT design characteristics, sample characteristics, intervention characteristics, cultural appropriateness assessment, risk of bias assessment, and evidence of efficacy. Highlighted are the outcomes of interest – PA, diet and weight-loss/management.

RCT design characteristics

Table 1 provides a summary of design characteristics for the seven reviewed RCTs (Bandura, 1989; Bronfenbrenner, 1979; De Abajo et al., 2001; Godin and Shephard, 1985; Pierce et al., 2002; Prochaska and DiClemente, 1983). Three out of seven RCTs identified a theoretical framework to guide the intervention design. Two (Han et al., 2010; Qi et al., 2011) used Bandura's social cognitive learning and self-efficacy theory (Bandura, 1989), and one (Dirige et al., 2013) used the transtheoretical model (Prochaska and DiClemente, 1983).

Three studies were single-site regular RCTs (Han et al., 2010; Liao et al., 2002; Wang et al., 2013). One was a cluster-RCT of community groups (Dirige et al., 2013) and three were pilot-RCTs (Islam et al., 2013; Qi et al., 2011; Sun et al., 1996). Two RCTs were conducted in the Western US – California (Dirige et al., 2013) and Washington (Liao et al., 2002), where over 70% of Asian Americans reside (US Census Bureau, 2010, 2013). Five RCTs were conducted in the eastern US (Pennsylvania, Massachusetts, and New York) (Han et al., 2010; Islam et al., 2013; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013).

One study was a 2-year RCT (Liao et al., 2002). Two RCTs were 15 to 18 months (Dirige et al., 2013; Han et al., 2010), and four ranged from 2 weeks to 6 months (Islam et al., 2013; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013).

Sample characteristics

All seven studies targeted a specific Asian population (Hmong – 1, Japanese – 1, Chinese – 2, Korean – 2, or Filipino – 1) (Dirige et al., 2013; Han et al., 2010; Islam et al., 2013; Liao et al., 2002; Qi et al.,

Table 1

Summary of 7 reviewed RCTs for Asian Americans conducted in the US. Superscript numbers indicate reference for theoretical framework b = (Bandura, 1989) c = (Prochaska and Diclemente, 1983).

Author/year/setting	Research question & theoretical framework	RCT design/# of groups & randomization strategies	Sample size & characteristics	Retention rate N (%) & duration	PA, diet, weight & outcome measures	Outcomes for change in PA, diet, and weight
Studies targeting one specific Asian group Sun et al. (1996), Wisconsin	What are the effects of a Tai Chi Chuan program on physical and mental health for Hmong Americans?	Pilot RCT with 2 groups	N = 20 I: n = 10 C: n = 10 Age 60–64 years = 30%; 65–69 years = 50%; 70–74 years = 20% Female = 70% Hmong immigrants >60 years 100%	N = 20 (100%); 12 weeks	PA: self-report	PA: intervention group increased the frequency of Tai Chi practice more than control group (p < .001)
Liao et al. (2002), Washington	Does diet and exercise improve adiposity in Japanese Americans with IGT to delay or prevent T2DM?	Adaptive RCT with 2 groups	N = 74 I: n = 36 C: n = 38 Age: 55.8 ± 1.8 years Female = 63% Japanese Americans with IGT 100%	N = 58 (78%); 24 months	PA: exercise treadmill test for VO _{2max} Diet: 3-day food diary Weight: weight, height, BMI	PA: at 24 months, intervention group improved VO _{2max} more compared to control group (p = .0002) Diet: intervention group – 79 to 88% met dietary goals of <30% calories from fat and 55–70% consumed <7% from saturated fat Control group 59 to 79% met goals of <30% calories from fat and 77 to 88% consumed <10% from saturated fat Weight: BMI: intervention group reduced weight and BMI more than control (all p < .005). PA: no significant difference between Ia and Ib groups (p > .05), although both groups increased PA (p < .01)
Han et al. (2010), Maryland, Washington DC	Can telephone counseling improve hypertension management in Korean Americans?; self-efficacy ^b and self-help response to chronic illness	Parallel RCT with 2 groups; 3 months of F/U randomization	N = 445 Ia: n = 203 Ib: n = 194 Age: 51.9 ± 5.7 years Female: 52.8% Korean adults 100%	N = 360 (81%); 15 months	PA: self-report	PA: no significant difference between Ia and Ib groups (p > .05), although both groups increased PA (p < .01)
Qi et al. (2011), Pennsylvania	What is the preliminary effectiveness of the SEOPE intervention for OP prevention in Chinese Americans?; social learning and self-efficacy ^b	Pilot RCT with 2 groups; randomization with sealed envelopes	N = 83 I: n = 42 C: n = 41 Age: 64.1 ± 9.5 years	N = 72 (87%); 2 weeks	PA: Yale Physical Activity Survey ³⁸	PA: intervention group increased exercise time and exercise expenditure more than control (p < .05)

Dirige et al. (2013), California	What are the effects of a community-based lifestyle intervention on PA, diet and stages of change for Filipino Americans?; transtheoretical model ^c	Clustered RCT with 2 groups; 18 social organizations	Female = 24% Chinese adults 100% N = 18 org. (individual N = 673) I: n = 9 org (n = 337) C: n = 9 org (n = 336) Age ^a : I: 57.9 ± 17.7 years C: 44.9 ± 15.6 years Female = 62.8% ^a Prediabetic Filipino Americans 100%	N = 528 (78%) I: n = 255 (76%) C: n = 273 (81%); 18 months	PA: Godin-Shepherd Physical Activity Survey ³⁹ Diet: self-report: fat, fruit, and vegetable intake	Intervention group started exercising regularly compared to control group (p < .05) PA: at 18 months, the intervention group was more likely to engage in PA than control group (p = 0.02) Diet: at 18 months, no difference between groups for fruit and vegetable intake (p = 0.16), but intervention group was more likely to eat a low-fat diet than control (p < 0.01)
Islam et al. (2013), New York	What is the impact and feasibility of a CHW intervention to improve health behaviors and promote diabetes prevention for Korean Americans?	Pilot RCT with 2 groups	N = 48 I: n = 25 C: n = 23 Age: 59.7 ± 8.1 years I: 61.0 ± 8.1 years C: 59.5 ± 7.0 years Female = 64.3% Korean immigrants 100%	N = 35 (73%) I: n = 21 C: n = 14; 6 months	PA: self-report Diet: self-report Weight: weight, height, BMI	PA: no significant change in either group (p > .05) Diet: no significant change in either group (p > 0.05), except intervention group increased brown rice intake (p < 0.02) Weight: no significant change in weight, BMI or hip-to-waist ratio in either group (p > 0.05) Intervention group (23.8%) lost more than 3 lb, but control group (47.1%) had no change in weight
Wang et al. (2013), New York	What are the effects of substituting brown rice for white rice on insulin resistance?	Parallel RCT with 2 groups	N = 100 I: n = 49 C: n = 51 Age: I: 50 ± 9 years C: 55 ± 9 years Female = 67% Prediabetic Chinese Americans 100%	N = 58 (58%) I: n = 28 (57%) C: n = 29 (57%); 12 weeks	Diet: 3-day food record for brown rice intake Weight: weight, height, waist circ. BMI	Diet: a brown rice diet was associated with substantial improvements in metabolic risk factors compared to white rice diet for pre-diabetic Chinese Americans (all p < .05) Weight: at 12 weeks only intervention group decreased weight, waist circ., BMI compared to control (all p < .005)

Note: BMI = body mass index (kg/m²), BP = blood pressure, C = control group, CHW = community health worker, circ. = circumference, DPP = Diabetes Prevention Program, I = intervention group, LI = less intensive, MI = more intensive, OP = osteoporosis, org = organizations, PA = physical activity, PI = Pacific Islanders, RCT = randomized controlled trial, SE = standard error, SEOPE = self-efficacy-based OP preventative education, SSB = sugar sweetened beverage, and T2DM = type 2 diabetes mellitus.

^a Represents final sample.

^b (Bandura, 1989) and

^c (Prochaska and Diclemente, 1983).

Table 2
Summary of interventions, cultural adaptation strategies, and cultural appropriateness scores for reviewed RCTs conducted in the US.

Author/year location/race/ethnicity	Intervention duration, goal, description, dose, fidelity and delivery mode	Cultural adaptation strategies & cultural appropriateness total score
Sun et al. (1996), Wisconsin, Hmong = 100%	<p>Duration = 12 weeks</p> <p>Goal – to improve physical and psychological health through Tai Chi practice.</p> <p>I: Tai Chi sessions on movements with mini-lectures on human physiology, common disease in older adults, emotional and mental health, and stress management + daily phone calls.</p> <p>12 week intervention C: encouraged to continue normal physical activity routine. Daily phone contact to confirm compliance.</p> <p>Dose: 2 hr weekly Tai Chi sessions + mini-lecture × 10 weeks</p> <p>Fidelity: used validated and translated instruments in Hmong. Measurement and data collected by researcher and program assistant. No report on who delivered the 10 weekly Tai Chi sessions.</p> <p>Delivery: individual and group</p>	<p>☑ Peripheral – PA Tai Chi Chuan</p> <p>☐ Evidential</p> <p>☐ Constituent-involving</p> <p>☐ Socio-cultural</p> <p>☑ Linguistic – surveys translated and validated for Hmong</p> <p>☑ Tailoring – individual goal-setting</p> <p>Total score = 3</p>
Liao et al. (2002), Washington, Japanese = 100%	<p>Duration = 24 months</p> <p>Goal – to improve adiposity and body fat distribution through diet and PA to reduce diabetes risk in Japanese Americans.</p> <p>I: AHA step 2 diet + endurance exercise + supervised meetings 3×/week for PA and diet support first 6 months. 6 month intervention</p> <p>C: AHA step 1 diet + stretching + supervised meetings 3×/week for PA and diet support first 6 months.</p> <p>Maintenance for both groups: after 6 months told to maintain diet and exercise unsupervised for the next 18 months</p> <p>Dose: 3 meetings/week × 6 months</p> <p>Fidelity: branching treadmill tests performed under physician supervision. Same investigator used standard methods for BMI measurements, Japanese American dieticians consulted on Japanese foods</p> <p>Delivery: individual</p>	<p>☑ Peripheral – choice of cultural foods allowed</p> <p>☐ Evidential</p> <p>☐ Constituent-involving</p> <p>☑ Socio-cultural – Japanese dietician consulted on cultural foods</p> <p>☐ Linguistic</p> <p>☐ Tailoring</p> <p>Total = 2</p>
Han et al. (2010), Maryland, Washington DC, Korean = 100%	<p>Duration = 15 months</p> <p>Goal: describe receptivity of nurse telephone counseling by Korean Americans with hypertension and compare behavioral outcomes by dose of counseling. Self-Help Intervention Program for high blood pressure (SHIP-HBP) care and control in Korean Americans .</p> <p>Ia-MI: in-class HBP education, in-home BP monitoring, and BP monitoring by tele-transmission system, and bi-weekly group telephone counseling.</p> <p>Group counseling sessions: reviewed BP reports, discussed BP control status, HBP management (med adherence, low-salt diet, exercise, smoking and alcohol cessation, BP monitoring and stress management). 15 month intervention</p> <p>Dose: weekly class education × 6 weeks, in-home BP monitoring with a tele-transmission system × 6 weeks, and bi-weekly group telephone counseling sessions × 12 months</p> <p>Ib-LI: mail-based HBP education, in-home BP monitoring by tele-transmission system, and monthly group telephone counseling. Group counseling sessions similar to group Ia above. 15 months intervention</p> <p>Dose: weekly mail-based education materials × 6 weeks, home BP monitoring with tele-transmission system × 6 weeks, and monthly group telephone counseling sessions × 12 months</p> <p>Fidelity: Telephone counseling delivered by bilingual nurses based on the learned resourcefulness model.</p> <p>Delivery: Individual and group</p>	<p>☑ Peripheral – used community locations for meetings</p> <p>☑ Evidential – evidenced-based HBP education for Koreans</p> <p>☑ Constituent-involving – SHIP-HBP is a community-based trial</p> <p>☑ Socio-cultural – community input</p> <p>☑ Linguistic – bilingual nurses and staff implemented intervention</p> <p>☑ Tailoring – group tailored telephone counseling</p> <p>Total = 6</p>
Qi et al. (2011), Pennsylvania, Chinese = 100%	<p>Duration = 2 weeks</p> <p>SEOPE intervention goal: to strengthen self-efficacy and outcome expectations for adopting behaviors to prevention OP.</p> <p>I: 1-hr PowerPoint class + materials on bone health & OP + exercise & screening tool for home use + individual goals & action strategies.</p> <p>2 week intervention</p> <p>C: 1-hr PowerPoint class on brain diseases, cerebrovascular system & Alzheimer's disease</p> <p>Dose: 1-hr/week class education × 2 weeks</p> <p>Fidelity: study measures were forward and back translated into Chinese. Intervention facilitated in Mandarin by nurse researcher using investigator-developed education booklet by the NIH on osteoporosis for Asian women</p> <p>Data collected via face-to-face interviews in Mandarin</p> <p>Delivery: individual and group</p>	<p>☑ Peripheral – conducted in familiar church-based community clinic</p> <p>☑ Evidential – risk factor for OP in Asians given</p> <p>☑ Constituent-involving – used Mandarin speaking staff</p> <p>☑ Socio-cultural – extended family welcome to participate</p> <p>☑ Linguistic – delivered in Mandarin, translated for low-literacy</p> <p>☑ Tailoring – individual goal-setting</p> <p>Total = 6</p>
Dirige et al. (2013), California, Filipinos = 100%	<p>Duration = 18 months</p> <p>Siglang Buhay goal: to improve healthy behaviors and stages of change for Filipino Americans</p> <p>I: Curriculum: 1) intake of 5 or more servings of fruits and vegetables/day, 2) eat a low fat-diet, 3) engage in MVPA for 30 min/day × 5 days/week or more.</p> <p>Curriculum: monthly group education on behavior change skills needed to adopt and maintain healthy eating and regular PA practices + workshops and activities (e.g., healthy cooking, recipe contests, dancing, basketball tournaments).</p> <p>18 month intervention</p> <p>C: monthly cancer education workshops</p> <p>Dose: 5 monthly group education activities/workshops × 18 months</p> <p>Fidelity: intervention delivered by 2–3 health committee members per social organization. Committee member initially attended 14 weekly training sessions</p>	<p>☑ Peripheral – meet at community sites</p> <p>☐ Evidential</p> <p>☑ Constituent-involving – CBPR, community partnerships</p> <p>☑ Socio-cultural – community members trained to facilitate intervention</p> <p>☐ Linguistic</p> <p>☑ Tailoring – group PA preferences</p> <p>Total = 4</p>

Table 2 (continued)

Author/year location/race/ethnicity	Intervention duration, goal, description, dose, fidelity and delivery mode	Cultural adaptation strategies & cultural appropriateness total score
Islam et al. (2013), New York, Korean = 100%	and monthly education session with researchers during the 18-month intervention. Delivery: group Duration = 6 months Project RICE = Reaching Immigrants through Community Empowerment Goal: improve health behaviors and clinical measures for diabetes prevention. I: Curricula: 2 hr group topical sessions × 6 on nutrition, PA, diabetes, cardiovascular disease, stress, family support, and access to health care + FU phone calls × 10. 6 month intervention C: No details provided Dose: Monthly 2-hr group sessions × 6, follow-up phone calls × 10 Fidelity: intervention led by a trained, bilingual Korean American CHW and several program staff. CHW and staff attended 60-hr core-competency-based training + 30 hr of additional training on mental health, motivational interviewing, and other topics. Curriculum adapted from existing materials validated in minority communities. Formative study findings used to add culturally relevant topics/strategies. All materials translated into Korean and reviewed by bi-lingual staff. Delivery: individual and group	<input checked="" type="checkbox"/> Peripheral – ethnic foods and cooking techniques and utensils <input checked="" type="checkbox"/> Evidential – education on risks for diabetes for Koreans <input checked="" type="checkbox"/> Constituent-involving – CBPR, community partnership, focus groups <input checked="" type="checkbox"/> Socio-cultural – trained bilingual CHW facilitated intervention <input checked="" type="checkbox"/> Linguistic – translated materials <input checked="" type="checkbox"/> Tailoring – group PA preferences and discussions on health Total = 6
Wang et al. (2013), New York, Chinese = 100%	Duration = 12 weeks Goal – determine brown rice diet effects to improve insulin resistance in prediabetic Chinese Americans. All participants' total energy requirements estimated to maintain body weight. 12 week intervention Ia: brown rice food supplies to maintain body weight were provided every 4 weeks for 3 months. Encouraged to prepare rice for daily meals with supplies provided and not to change usual patterns of cooking and eating. Dose: every 4 weeks × 3 months received brown rice food supply Ib: white rice and food supplies to maintain body weight were provided every 4 weeks for 3 months. Encouraged to prepare rice for daily meals with supplies provided and not to change usual patterns of cooking and eating. Dose: every 4 weeks × 3 months received white rice food supply Fidelity: nutrient composition of rice measured at Certified Laboratories, Inc. (Plainfield, NY) according to standardized analytical method. No formal report as to who delivered the intervention education and information Delivery: individual	<input type="checkbox"/> Peripheral <input type="checkbox"/> Evidential <input type="checkbox"/> Constituent-involving <input type="checkbox"/> Socio-cultural <input type="checkbox"/> Linguistic <input checked="" type="checkbox"/> Tailoring – individual rice and food supplies to maintain weight Total = 1

Note: AHA = American Heart Association, AHA step 1 diet = 30% total calories as fat, 10% saturated fat, 50% carbohydrate, and <300 mg cholesterol daily, AHA step 2 diet = <30% total calories as fat, 7% saturated fat, 55% carbohydrate, and <200 mg cholesterol daily, BMI = body mass index (kg/m²), BP = blood pressure, CBPR = community-based participatory research, CHW = community health worker, circ. = circumference, C = control, FPG = fasting plasma glucose, FU = follow-up, HPB = high blood pressure, hr = hour, I = intervention, IAF = intra-abdominal fat, LI = less intensive, MI = more intensive, OGTT = oral glucose tolerance test, OP = osteoporosis, PA = physical activity, RCT = randomized controlled trial, SEOPE = self-efficacy-based OP preventative education, T2DM = type 2 diabetes mellitus, and vs. = versus.

2011; Sun et al., 1996; Wang et al., 2013). Sample sizes were generally small and insufficiently powered. For example, four RCTs targeting a specific Asian group had total sample sizes of less than 100 subjects, suggesting limited power (Islam et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996). The mean age for the seven study samples ranged from 40 to 79 years. The overall study weighted mean sample age was approximately 53.1 years. Female sample proportion ranged from 24% to 70%. The overall weighted female sample proportion was 58%.

Intervention characteristics

Intervention design characteristics are presented in Table 2. Intervention designs were diverse in nature. PA, diet, and/or weight loss/management were incorporated into the intervention design in various combinations (i.e., singly, in tandem, or all three lifestyle behaviors). Only the Dirige et al. (2013) objective was focused on health promotion of PA and diet behaviors. Six study objectives were focused on preventing chronic disease. Of the six studies: 1) the Liao et al. (2002)

Table 3
Risk of bias assessment for reviewed RCTs conducted in the US.

Author/year	Sample	Concealment of allocation	Blinding	Intention to treat analysis	Retention rate	Quality score
Studies targeting a single Asian ethnic-group						
Sun et al. (1996)	+	–	–	+	+	3
Liao et al. (2002)	+	–	–	–	–	1
Han et al. (2010)	+	–	–	+	+	3
Qi et al. (2011)	+	+	–	–	+	3
Dirige et al. (2013)	+	–	–	–	–	1
Islam et al. (2013)	+	–	–	–	–	1
Wang et al. (2013)	+	–	–	–	–	1

Note: + = yes and – = no. Sample: samples represent Asians including subgroup analysis (+) and samples represent Asians without subgroup analysis (–); concealment of allocation: described the method used to conceal the allocation sequence (+) and incomplete description (–); blinding: investigator-blinded (+) and no blinding (–); intention to treat analysis: intention to treat analysis was done (+) and intention to treat analysis was not done (–); retention rate: ≥ 80% (+) and <80% (–); and RTC study quality was ranked on a “yes” sum basis: 4 to 5 = high quality, 2 to 3 = moderate quality and 0 to 1 = low quality.

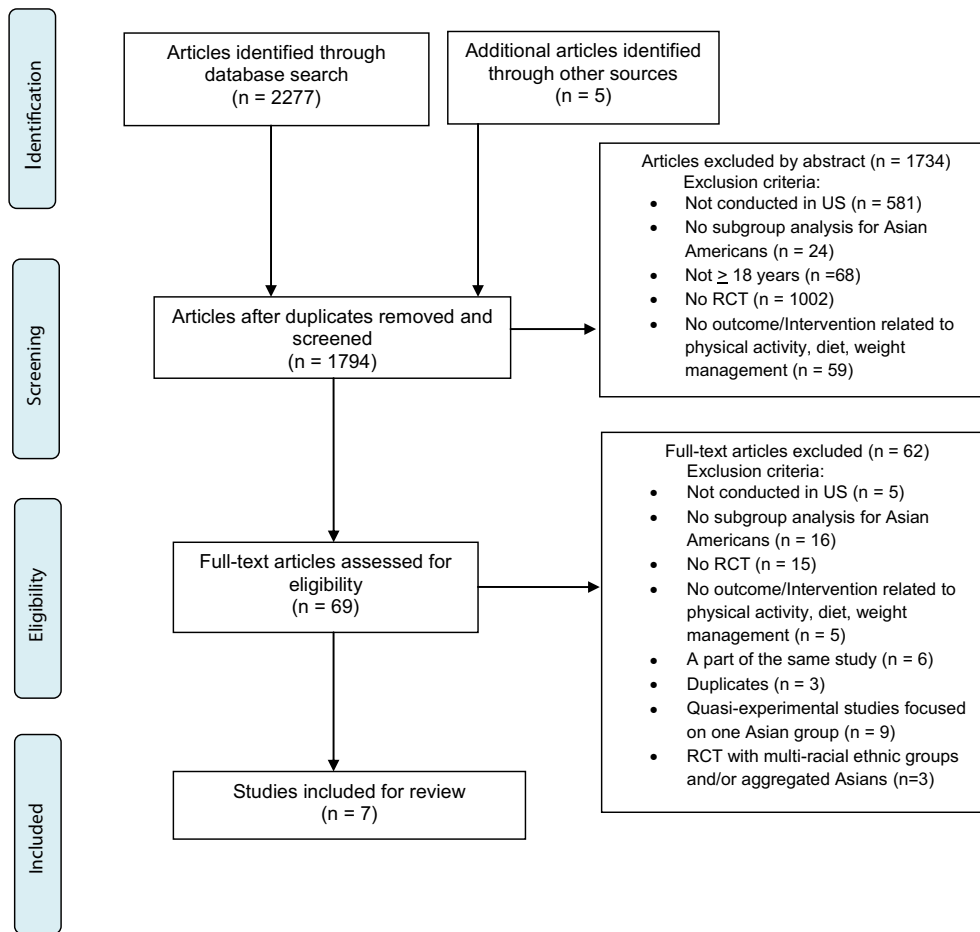


Fig. 1. Flow diagram for study selection process for RCTs of lifestyle interventions related to PA, diet, and weight management for Asian Americans in the US.

and Islam et al. (2013) studies measured change in all three outcomes (PA, diet, and weight) to reduce diabetes risk, 2) the Wang et al. (2013) study measured change in both diet and weight to reduce diabetes risk, and 3) the Sun et al. (1996), Han et al. (2010) and Qi et al. (2011) studies measured change in PA alone to reduce risk of mental illness, hypertension, and osteoporosis respectively.

Out of the seven RCTs, only the Liao et al. (2002) incorporated a maintenance phase in the intervention design. Although support for diet and PA was provided during the 6-month intervention, no support was provided during the 18-month maintenance phase. Significant improvements were seen in the intervention group for PA and weight along with improvements in diet compared to the control.

Cultural appropriateness assessment

Cultural adaptation strategies and assessment for intervention cultural appropriateness are presented in Table 2. Out of the seven intervention designs, three received high scores (5–6 points) (Han et al., 2010; Islam et al., 2013; Qi et al., 2011), two received moderate scores (3–4 points) (Dirige et al., 2013; Sun et al., 1996), and two received low scores (0–2 points) (Liao et al., 2002; Wang et al., 2013). The three high scoring interventions employed all six cultural adaptation strategies (Han et al., 2010; Islam et al., 2013; Qi et al., 2011). Each targeted one specific Asian group (2 – Koreans, 1 – Chinese) focused on individual or group tailoring with community based participatory research (CPBR) methods.

The Sun et al. (1996) and Dirige et al. (2013) interventions both targeted one specific Asian group (Hmong and Filipinos, respectively) and received moderate cultural adaptation scores. Sun et al. (1996)

focused on individual tailoring, whereas Dirige et al. (2013) focused on group tailoring along with CBPR methods. Of the two low scoring interventions (1 to 2 points), Liao et al. (2002) targeted Japanese and Wang et al. (2013) targeted Chinese. None of these studies reported using CBPR methods in their intervention design.

Risk of bias assessment

A risk of bias assessment for reviewed studies is presented in Table 3. None of the seven RCTs received a high-quality assessment score. Three RCT designs received moderate-quality assessments (Han et al., 2010; Qi et al., 2011; Sun et al., 1996), and the remaining four received low-quality assessments (Dirige et al., 2013; Islam et al., 2013; Liao et al., 2002; Wang et al., 2013). Only Sun et al. (1996) and Han et al. (2010) reported or followed intention to treat analysis for outcome measures and only Qi et al. (2011) reported concealment of allocation methods. None of the studies reported blinding procedures.

Three RCTs had high retention rates of $\geq 80\%$ (Han et al., 2010; Qi et al., 2011; Sun et al., 1996) and four RCTs had low retention rates $< 80\%$ (Dirige et al., 2013; Islam et al., 2013; Liao et al., 2002; Wang et al., 2013). All four RCTs with low retention rates also had low-quality assessment scores.

Evidence of efficacy

Primary outcomes of interest for this systematic review included change in PA, diet, and/or weight loss/management and may not represent the primary outcomes of the reviewed RCT studies. Reviewed RCTs measured PA, diet, and weight in various combinations using a variety

of metrics. Except for Liao et al. (2002) that used an exercise treadmill test to assess VO_{2max} (measure for physical fitness) as a proxy for PA, the reviewed studies measured PA (min/day of exercise) and diet (rice, meats, carbohydrates, fat, and/or beverage intake) by self-report. Investigators using calibrated scales objectively measured all weight outcomes.

As presented in Table 1, only the Liao et al. (2002) and Islam et al. (2013) RCTs measured all three outcomes of interest. Six out of seven RCTs measured change in PA. Seven RCTs measured change in diet and only four RCTs measured change in weight. RCTs also used different units of analysis for the target outcomes. For example, the Liao study measured diet via percent fat intake and the Dirige study measured diet via fruit and vegetable intake (Dirige et al., 2013; Han et al., 2010; Islam et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013).

Results for change in outcomes were mixed. Overall, five studies (Dirige et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013) showed a significant improvement in one or more outcomes of interest, while Han et al. (2010) and Islam et al. (2013) studies showed no significant change in any measured outcomes. Compared to their controls, four interventions significantly increased PA ($p < .05$), while two showed no change (Dirige et al., 2013; Han et al., 2010; Islam et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996). One intervention significantly improved diet ($p < .05$), while three did not (Dirige et al., 2013; Islam et al., 2013; Liao et al., 2002; Wang et al., 2013). Finally, two interventions significantly reduced weight and/or BMI compared to control ($p < .05$), and one did not (Islam et al., 2013; Liao et al., 2002; Wang et al., 2013).

Discussion

To the best of our knowledge, there are no systematic reviews and/or meta-analyses that examined the overall effectiveness of published behavioral lifestyle interventions, or identified potential strategies to promote PA, healthy diets, and/or weight loss for Asian Americans. This systemic review reports on seven RCT lifestyle interventions, each focused on one specific Asian American population promoting and measuring change in PA, diet, and/or weight management. Cross-study comparisons were difficult because the reviewed studies were very diverse in design, duration, intervention dose, sample size, race/ethnic groups, cultural appropriateness, maintenance, and retention. Overall, the treatment effect of these seven RCT lifestyle interventions was inconsistent. Intervention between group differences were: 1) significant in four RCTs assessing change in PA, while two showed no differences; 2) significant in two measuring diet change while one showed no difference; and 3) significant in two studies assessing weight change, while one showed no difference (Dirige et al., 2013; Han et al., 2010; Islam et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013).

Overall, study outcomes and intervention design were inconsistent making comparisons and statistically valid conclusions difficult. However, seven RCT intervention design elements may have significantly impacted outcomes. These elements are discussed below along with suggestions for improving intervention effectiveness.

RCT quality

Risk of bias

Overall, the seven reviewed RCTs lacked rigor (Dirige et al., 2013; Han et al., 2010; Islam et al., 2013; Liao et al., 2002; Qi et al., 2011; Sun et al., 1996; Wang et al., 2013). All seven studies did not report on the following three elements: concealment of allocation, blinding, or intention to treat analysis, leading to possible risk of bias from cross-contamination between the intervention and control groups; and possible misinterpretation for intervention effectiveness. Another contributing factor to low-quality RCT design was the small Asian

American sample sizes. Half the RCT sample sizes were ≤ 100 subjects, all from studies targeting individual Asian groups. For example, the Islam et al. (2013) and Sun et al. (1996) pilot studies had small sample sizes (35 and 20 subjects, respectively) and lacked sufficient sample power to statistically assess the efficacy of the intervention effectiveness (Glazier et al., 2006).

To improve the validity of lifestyle intervention outcomes, future studies should consider improving the overall quality of RCTs by rigorously addressing the risk of bias components set forth in Table 3. RCT study designs should: emphasize larger sample sizes with power for analysis, incorporate methods to minimize cross-contamination, and use recommended cultural adaptations strategies to improve retention rates set forth in Table 2 (Bender and Clark, 2011; Higgins et al., 2011).

Self-report versus objective measures

Our findings were consistent with other systematic reviews on lifestyle interventions for mental illness, HIV, and breast cancer screening that also found that most reviewed studies lacked rigor and objective measure design (Cabassa et al., 2010; Darbes et al., 2002; Horton, 2009). Except for Liao et al. (2002) that used an exercise treadmill test to assess VO_{2max} , the reviewed RCTs relied on self-report measures for PA and/or diet, bringing into question the validity of their outcomes and intervention effectiveness. A systematic review comparing studies using self-report for PA versus objective PA measures found that self-reported change in PA tended to overestimate the effectiveness of the PA interventions (Prince et al., 2008). Although the Han et al. (2010) and Islam et al. (2013) studies showed trends towards increased PA and healthy diets, they reported no between-group differences for PA or diet outcomes – concluding, perhaps incorrectly, a lack of intervention effectiveness. This could be due in part to self-report. Therefore, evaluating effective lifestyle interventions are best achieved by using rigorous objective measures.

Cultural appropriateness

Aggregated Asian versus individual Asian populations

In general, current research practice tends to aggregate multiple Asian populations as a single Asian American population (Lu et al., 2012). This is not unique to Asian Americans. Other racial/ethnic groups, such as multiple Latino populations (e.g., El Salvadorians, Puerto Ricans, and Mexican), are also often aggregated into an overall Latino population (Furman et al., 2009).

Evidence indicates that individual Asian American groups (e.g. Chinese, Asian Indians) differ in cultural practices, behaviors, and health risks (Marmot and Syme, 1976; Pew Research Center, 2013). For example, Asian Indian immigrants are more educated and English proficient than Cambodians and Vietnamese (Kittler and Sucher, 2008). The Chinese diet is low in fat and dairy products, and high in cooked vegetables with limited fruit, whereas the South and Southeast Asian diet is high in fat, fried foods, fruits, and vegetables. A recent study found Filipinos and Asian Indians have higher risks for obesity and T2DM compared to other Asian groups (Jih et al., 2014).

A recent meta-analysis (Smith et al., 2011) of reviewed psychotherapy intervention studies for ethnically diverse populations found that the most culturally adapted interventions focusing on one racial/ethnic group showed greater effect sizes than non-culturally adapted interventions that focused on multiple racial/ethnic groups. Thus, culturally relevant lifestyle intervention studies focused on specific Asian populations with considerations for its specific cultural beliefs and practices may be more effective in promoting healthy behavior change, and thereby improving health outcomes.

Cross contamination

Culturally appropriate interventions have been shown to improve intervention effectiveness, engagement, and retention (Bender and Clark, 2011; Kreuter et al., 2003). Three out of five interventions scoring

high or moderate for cultural appropriateness showed significant change in PA (Dirige et al., 2013; Qi et al., 2011; Sun et al., 1996). However, although the Han et al. (2010) and Islam et al. (2013) interventions scored high for cultural appropriateness, results indicated no between group differences in PA, diets, or weight outcomes. Cultural values and recruitment strategies may have influenced these outcomes. As a predominately immigrant monolingual population with low English proficiency, Koreans have closely knit families and communities (Pew Research Center, 2013). The Han et al. (2010) and Islam et al. (2013) studies primarily recruited from Korean community (organization, churches, stores, and events) creating a strong possibility for cross-contamination between intervention and control groups; thus influencing the outcomes and limiting intervention effectiveness. Asian values for family and community should be carefully considered when designing RCT intervention to avoid risk of contamination between groups (Kittler and Sucher, 2008). One option may be to use a cluster RCT design to minimize cross contamination (Higgins et al., 2011).

Individual tailoring

One-on-one individually tailored interventions have been effective in improving health behaviors in diverse race/ethnic groups (Glazier et al., 2006). Independent of overall cultural appropriateness scores, three RCTs that demonstrated significant change in measured outcomes also used individual tailoring (Qi et al., 2011; Sun et al., 1996; Wang et al., 2013). Future intervention studies should consider the benefits of using individual tailoring as well as other cultural adaptation strategies to more effectively influence health behavior change.

Other intervention design elements

Maintenance

Including a maintenance phase in an intervention design provides several benefits. First, it facilitates an objective assessment of intervention effectiveness and adherence to health behavior changes. Second, it may provide continued motivation and reinforcement of targeted health behaviors (Dalle Grave et al., 2011; Middleton et al., 2013). Only the Liao et al. (2002) intervention included a maintenance phase. However, no maintenance support was provided, which may have negatively impacted the intervention effectiveness. Strategies that promote long-term adherence should be incorporated in behavior change interventions. Researchers may want to consider multifaceted intervention and maintenance program elements (e.g. social support, relapse prevention, and self-monitoring) to improve long-term adherence for healthy behavior changes.

Emphasize and model lifestyle behaviors

A recent meta-analysis of interventions to increase PA among healthy adults found interventions that emphasized and modeled PA behaviors had a larger effect size compared to interventions that focused only on improving knowledge, attitudes, or beliefs about PA (Conn et al., 2011). Two reviewed RCTs (Islam et al., 2013; Liao et al., 2002) measured change in all three target-outcomes. The Liao RCT demonstrated intervention effectiveness for PA, diet, and weight, while the Islam Project Rice program did not demonstrate change in any of the outcomes. The Liao intervention provided education for PA and nutrition, and modeled lifestyle behaviors, whereas the Islam Project Rice program only provided education for PA and diet. Providing education and modeling lifestyle behaviors may have been key to the Liao intervention effectiveness compared to the Islam Project Rice program that did not model behaviors. Incorporating education and behavior modeling into lifestyle interventions, in tandem with various maintenance elements described above, may improve intervention effectiveness and long-term adherence to health behavior change.

Strengths and limitation of this review

To our knowledge, this was first paper to systematically review the effectiveness of lifestyle interventions for Asian Americans to help identify knowledge gaps. However, several limitations need to be acknowledged. First, only papers published in English that targeted Asian Americans conducting in the United States were included in this review. Although extensive search efforts may not have identified all relevant studies, the reviewed studies were representative and captured the recent state of current literature. Publication bias of positive trials may have overestimated the effectiveness of lifestyle interventions included in this review. Thus, findings may not be generalizable to Asians living within or outside of the US, or to other racial/ethnic minority groups. Second, the differences in primary outcome measures, relatively small sample sizes, and heterogeneity of the study design prevented us from conducting a meta-analysis or obtaining an overall effect size. Third, our review assessments to determine study quality were limited by the lack of important reported information, such as factors relating to implementation of the intervention, context, and methodological features (e.g. blinding, data collection tools, details on cultural adaptation strategies, etc.).

Despite these limitations, this study has important implications for research and practice. Most systematic reviews of lifestyle interventions among racial/ethnic minorities have been conducted with African Americans and Hispanics, while Asian Americans have largely been overlooked. This review provides one of the first documented efforts to identify the knowledge gap in RCT lifestyle interventions focused on PA, diet, and weight management for Asian Americans.

Conclusions

Asian Americans are the fastest growing race with the largest immigrant populations in the United States. Although various Asian populations suffer disproportionately from a high prevalence of type 2 diabetes, hypertension, and stroke (Hoeffle et al., 2012; Pew Research Center, 2013), there is limited preventive research targeting this population. Our systematic examination of seven RCT studies that found evidence of efficacy for lifestyle interventions among Asian Americans promoting PA, diet, and/or weight loss was mixed, influenced by multiple design factors. Seven factors were identified that may have significantly impacted the outcomes of interest in terms of RCT quality, cultural appropriateness, and other intervention design elements. Recommendations to improve lifestyle interventions for Asian Americans include incorporating: 1) more rigorous RCT designs, 2) more objective measures in place of self-report, 3) larger Asian American sample sizes employing individual Asian groups versus aggregated samples, 4) culturally sensitive intervention designs to avoid cross contamination (as well as improving retention and efficacy), 5) individual tailoring, 6) a maintenance phase with support to improve adherence, and 7) an emphasis on modeling and PA behavior versus knowledge and didactics alone. More RCT lifestyle interventions focused in Asian Americans are needed to identify effective interventions to reduce health disparities in this at-risk population.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ypmed.2014.07.034>.

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