

Invisible Users in Digital Health: A Scoping Review of Digital Interventions to Promote Physical Activity Among CALD Women

Yilin Ke
Faculty of Engineering and Design
University of Auckland
Auckland, New Zealand
yilin.ke@auckland.ac.nz

Yun Suen Pai
Inclusive Reality Lab, School of
Computer Science
University of Auckland
Auckland, New Zealand
yun.suen.pai@auckland.ac.nz

Burkhard Wünsche
Computer Science
University of Auckland
Auckland, New Zealand
bwue001@aucklanduni.ac.nz

Angus Donald Campbell
School of Design
Hong Kong Polytechnic University
Hong Kong, China
angus.campbell@polyu.edu.hk

Mairi Gunn
Faculty of Engineering and Design
University of Auckland
Auckland, New Zealand
mairi.gunn@auckland.ac.nz

Abstract

Digital health has strong potential for promoting physical activity (PA), yet interventions often fail to sustain engagement among culturally and linguistically diverse (CALD) women. Prior reviews focus on short-term efficacy or surface-level localisation, while a design-oriented synthesis of deep cultural adaptation and long-term strategies remain limited. This scoping review systematically screened 1968 records, analysed 18 studies and identified a critical design paradox: techno-solutionist systems overlook social and cultural barriers, while social-support features often fail in low-activity social networks. To address this gap, we propose the Culturally Embedded Interaction Framework, integrating five dimensions: culturally-grounded measurement, multi-modal interaction, contextual and temporal adaptability, embedded social weaving, and theory-guided cultural adaptation. The framework advances beyond accessibility-focused approaches by mapping behavioural theory to design mechanisms that support sustained and culturally plural participation. We provide actionable design principles to help HCI researchers and practitioners move from one-size-fits-all models toward adaptive, theory-informed, and culturally sustaining design.

CCS Concepts

• **Human-centered computing** → **Interaction design theory, concepts and paradigms**; • **Social and professional topics** → **Cultural characteristics**.

Keywords

digital interventions, physical activity, culturally and linguistically diverse (CALD) women, social support, culturally tailored design, scoping review

ACM Reference Format:

Yilin Ke, Yun Suen Pai, Burkhard Wünsche, Angus Donald Campbell, and Mairi Gunn. 2026. Invisible Users in Digital Health: A Scoping Review of Digital Interventions to Promote Physical Activity Among CALD Women. In *Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems (CHI '26)*, April 13–17, 2026, Barcelona, Spain. ACM, New York, NY, USA, 33 pages. <https://doi.org/10.1145/3772318.3791392>

1 Introduction

Digital health technologies (DHTs) are increasingly used to promote health equity and address persistent public health challenges, particularly in PA promotion. Mobile and immersive platforms promise personalised, boundary-less support that can transcend traditional barriers of time, place, and access [17, 37, 40, 50, 52, 54, 71]. For women's health, such technologies have shown potential to increase empowerment and support a range of specific health outcomes [36, 46, 63]. However, from an HCI perspective, this promise is compromised by design misalignments rooted in a techno-solutionist approach that treats cultural and gendered needs as secondary. Poorly designed interventions not only limit women's ability to benefit from DHTs but may also exacerbate inequities by embedding cultural and gender blind spots into technical systems [7, 26, 33, 99].

These challenges are particularly acute for women from CALD backgrounds [82], who experience disproportionately high rates of inactivity-related chronic disease [12, 18, 38, 78]. CALD populations are typically defined as individuals from non-English-speaking backgrounds who identify with non-dominant cultural groups in host countries, excluding Indigenous populations who are not recent migrants [30, 65, 75, 82]. For this population, digital health often fails to deliver on its promise. The technology itself may function, but it is built upon design principles that exclude these users by default.

A central reason lies in the dominance of the surface-localisation paradigm [11, 47], which reduces cultural adaptation to technical translation, cosmetic interface changes, or language substitution. This paradigm exemplifies a broader techno-solutionist mindset prevalent in digital health design [5, 67], where complex socio-cultural challenges, such as family responsibilities, gendered norms,



This work is licensed under a Creative Commons Attribution 4.0 International License. *CHI '26, Barcelona, Spain*

© 2026 Copyright held by the owner/author(s).
ACM ISBN 979-8-4007-2278-3/26/04
<https://doi.org/10.1145/3772318.3791392>

community ties, and culturally specific motivations, are reframed as problems solvable through algorithms or interface polish [75, 82].

The limitations of this paradigm become evident when considering how users actually engage with digital systems over time. An influential longitudinal study by Johansson et al. [45] demonstrated that sustained attendance at cultural events is a significant predictor of long-term self-reported health, suggesting that cultural stimulation functions as a “perishable commodity” requiring continual replenishment. Designs rooted in the surface-localisation paradigm privilege short-term usability at the expense of sustained cultural engagement. This mismatch not only drives low participation but also reinforces the very health disparities, such as elevated risks of diabetes and cardiovascular disease [12, 18, 38, 50], that these technologies intend to address. Such neglect has left CALD women structurally invisible within digital health.

Prior reviews in HCI and digital health have examined technology interventions for structurally marginalised populations. Stowell et al. [96] conducted a systematic review of mHealth interventions targeting vulnerable groups, including individuals of low socioeconomic status and racial/ethnic minorities, and found limited gender, cultural, and contextual tailoring, relying heavily on short-term usability metrics rather than examining how experiences evolve over time. Extending this critique, Kouaho and Epstein [48] further argue that wearable and personal informatics interventions overwhelmingly centre on dominant, higher socioeconomic status populations, embedding design assumptions about financial stability, device access, and normative health behaviours that marginalise culturally diverse or resource-constrained groups. Complementing this, Saksono and Parker [90] introduce a socio-cognitive lens emphasising community relationships and social factors in supporting health behaviour, revealing that existing tools often prioritise individualised behaviour change over socially enabled support. However, these HCI reviews remain largely high-level: they provide critical perspectives and call for greater equity but do not engage deeply with the context of a specific vulnerable group, nor do they translate their critiques into operational design guidance.

By contrast, public health research has examined CALD women more directly, documenting the socio-cultural barriers they face in PA participation [18, 19, 93], systematically reviewed intervention effectiveness [29, 75] and highlighted the promise of community-based interventions [14, 65, 103]. However, these reviews tend to be more outcome- and efficacy-oriented, and provide minimal insight into the design mechanisms that facilitate or hinder engagement.

Although these prior reviews provide critical equity-centred analytical lenses and recognise cultural tailoring as essential, a substantial gap remains in how cultural factors are operationalised in design. Existing scholarship rarely examines how cultural or gendered factors can be translated into actionable design paradigms, feature-level decisions, or theory-informed interaction patterns. This absence of implementation-focused guidance leaves a significant disconnect between recognising inequity and designing systems capable of addressing it.

To bridge this gap, we shift the lens from whether interventions work to how their underlying design mechanisms support or undermine engagement. This scoping review systematically examines how digital PA interventions are designed or fail to design for CALD

women. Following the PRISMA-ScR methodology [97], we systematically reviewed 18 studies and applied a critical interpretive lens to uncover the dominant design paradigms and their conceptual shortcomings, which limit the cultural and gender responsiveness of digital PA interventions. Our investigation is guided by three research questions:

- RQ1: What design paradigms currently dominate the development of digital PA interventions for CALD women?
- RQ2: What specific design shortcomings undermine their potential for sustained engagement?
- RQ3: How can HCI principles be applied to generate more culturally sustaining designs?

Our analysis reveals a core design paradox: techno-solutionist features routinely ignore relational contexts, while pro-social features prove structurally fragile in low-activity networks. To move beyond this paradox, we introduce the Culturally Embedded Interaction Framework, a five-dimensional model spanning culturally grounded measurement, multimodal interaction, embedded social weaving, theory-informed adaptation, and contextual and temporal adaptability. Importantly, this framework was inductively derived from a systematic analysis of the 18 intervention studies, translating empirical patterns into a structured set of dimensions for culturally embedded interaction. For the HCI community, this paper makes two contributions. First, we offer a critical synthesis of design assumptions in digital health interventions, showing how they preconfigure cultural and gender exclusion. Second, we contribute the Culturally Embedded Interaction Framework, which translates behavioural theory into culturally sustaining interaction patterns for CALD women. These contributions move the field beyond accessibility-centric translation toward design approaches that can better support future genuine co-design efforts [79] and foregrounds cultural pluralism and sustained engagement.

2 METHOD

To address our research questions on the design paradigms, socio-technical shortcomings, and culturally sustaining strategies of digital PA interventions for CALD women, we conducted a scoping review [2, 55, 81, 97]. This methodology aligns with our objective to critically examine not merely if interventions work, but how they are conceived, built, and ultimately succeed or fail in their cultural contexts.

Similar to a systematic review, a scoping review examines how research is conducted, summarises the primary focus and findings, identifies conceptual and empirical gaps, and highlights opportunities for future research [15]. Unlike a systematic review, however, a scoping review does not require pre-registration or formal quality appraisal of individual studies [68]. Instead, it emphasises inclusivity across study designs and level of methodological quality, ensuring that early-stage feasibility trials, qualitative studies, and pilot projects are captured alongside randomised controlled trials. This approach is essential for our purposes, as it enables us to synthesise and map the range of design practices in digital health rather than prematurely narrowing the evidence base to a small set of clinically validated interventions.

To ensure transparency and rigour, we adhered to the PRISMA Extension for Scoping Reviews (PRISMA-ScR) [97]. In the remaining subsections, we discuss each of these steps in further detail: (1) literature search strategy; (2) study screening, selection, and eligibility criteria; (3) data charting and analysis; and (4) overview of the Studies.

2.1 Literature search strategy

The literature search was conducted in two stages: an initial search (10 May 2025) and an update (14 May 2025). We conducted a systematic search of five major electronic databases: PubMed and Scopus were chosen for biomedical and public health literature, ACM Digital Library and IEEE Xplore for computer science and human-computer interaction research, and Web of Science for multidisciplinary coverage. To address potential delays in database indexing and ensure that we captured relevant digital health research, we supplemented the database search with targeted searches of JMIR Publications, a leading publisher in the digital health domain. To further maximise coverage, we also conducted manual search of citation snowballing and targeted author searches on Google Scholar. These methods continued until no new eligible studies were identified, following established systematic review methodology [43].

Our search strategy was developed through an iterative process of testing and calibration. We initially performed multiple preliminary searches using broad combinations of keywords related to four core conceptual domains: (1) CALD populations (e.g., “immigrant”, “refugee”, “ethnic minority”), (2) women (e.g., “women”, “female”), (3) digital interventions (e.g., “mHealth”, “app”, “wearable”, “virtual reality”), and (4) physical activity (e.g., “physical activity”, “exercise”, “exergame”).

Through several iterations, we refined the strategy to optimise sensitivity and specificity, finalising the search string for each database. The search was temporally bounded to the period from 2015 to 2025, a decade that marks the mainstream adoption of mobile, wearable, and web-based health technologies, to capture the evolution of modern digital health interventions. The complete, reproducible search syntax for all databases is provided in Appendix A.

2.2 Paper Screening, Selection, and Eligibility Criteria

The study selection process followed three phases: (1) title and abstract screening, (2) full-text review, and (3) resolution of conflicts through consensus. The first author conducted the initial title and abstract screening of all identified records using Rayyan¹ software, an online systematic review tool designed to manage large-scale screening processes [76, 98]. Rayyan supported the organisation of records, but all final inclusion and exclusion decisions were made manually by the authors. To ensure rigour, the eligibility criteria were iteratively refined in consultation with the co-authors before progressing to full-text review.

The criteria were designed to capture emerging digital health interventions (2015-2025) that addressed PA promotion for CALD women in English-speaking contexts, with an emphasis on culturally informed design rather than clinical rehabilitation. They were

organised across five dimensions: population, digital type, target behaviour, study design, and timeframe.

Inclusion Criteria (IC):

- IC1 (Population): Adult CALD women residing in Anglo-phone countries, where CALD is defined as immigrants, refugees, first-generation (or second-generation with a non-English household language) individuals.
- IC2 (Digital Type): Digital interventions (e.g., apps, wearables, virtual reality/augmented reality) designed to promote physical activity.
- IC3 (Target Behaviour): Studies reporting on physical activity-related outcomes.
- IC4 (Study Design): Empirical research employing quantitative, qualitative, or mixed-methods designs, published in English in peer-reviewed venues.
- IC5 (Timeframe): Studies published between 2015 and 2025.

Exclusion Criteria (EC):

- EC1 (Population): Studies that did not include women; did not include individuals from CALD, immigrant, or ethnic minority backgrounds; or focused exclusively on clinical populations (e.g., cancer rehabilitation, diabetes management), pregnant women, men-only cohorts, children, or adolescents.
- EC2 (Intervention Type): Interventions that did not incorporate any digital or technology-based components, including those delivered entirely face-to-face or through community-based programs without a digital aspect.
- EC3 (Intervention Scope): Digital tools or technologies that were not designed to promote physical activity or exercise, or that were used solely for data collection or monitoring purposes without an integrated behavioural intervention component.
- EC4 (Intervention Focus): Studies where the primary target was disease management or clinical rehabilitation (e.g., cancer rehabilitation, diabetes control, cardiovascular disease recovery) rather than the general promotion of physical activity in healthy or preventive contexts.
- EC5 (Study Design): Non-empirical publications (e.g., reviews, protocols, commentaries, theoretical papers) or studies not published in English.

This process yielded 30 articles for full-text review, which were independently evaluated by two authors. Decisions were recorded in a shared spreadsheet to systematically capture disagreements, which were then resolved through discussion until consensus was reached (Appendix B). Ultimately, 18 studies met all inclusion criteria and comprised the final synthesis corpus. To minimise the risk of missing eligible studies, we also applied manual snowballing and author website checks, which identified four additional publications [10, 57, 60, 64], associated with a multi-phase intervention project (Seamos Activas II). We included mixed-gender CALD samples when women were part of the cohort and the intervention targeted PA. In such cases, we coded design features and engagement outcomes, but did not compute women-only effects unless stratified results were reported. The complete process is illustrated in the PRISMA flow diagram (Figure 1).

¹Rayyan official website <https://www.rayyan.ai>

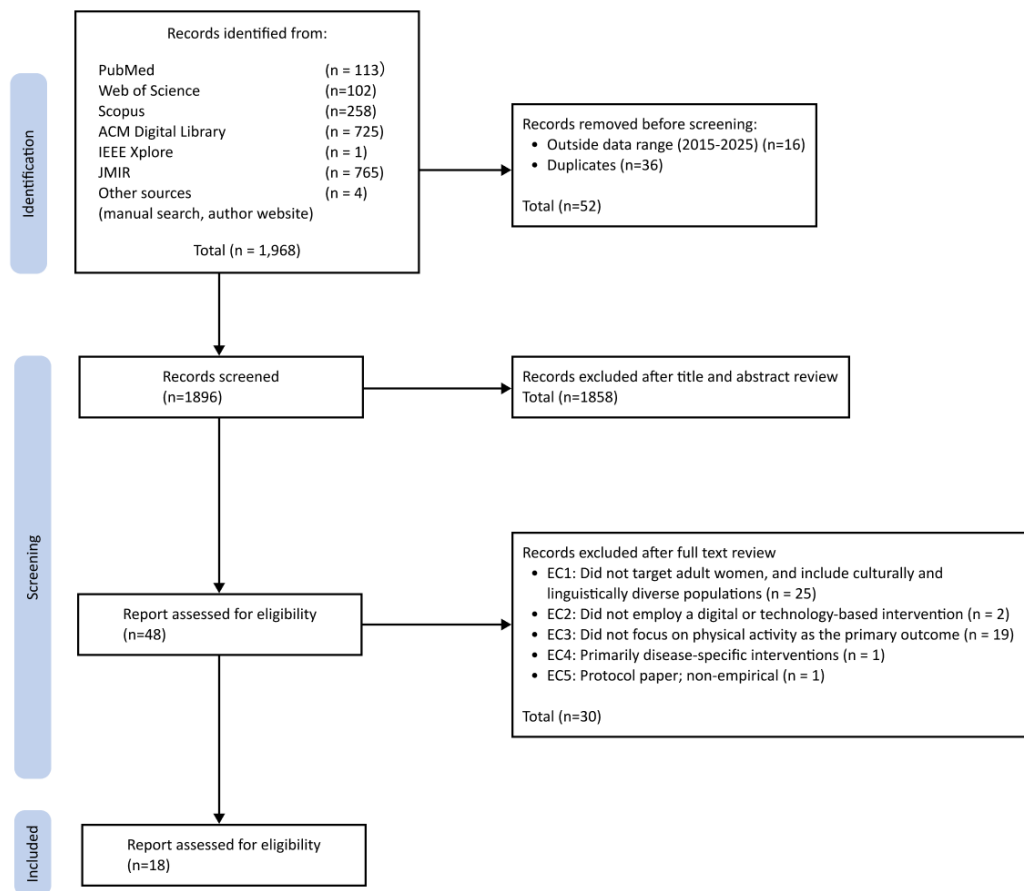


Figure 1: PRISMA flow diagram of the literature search in this study

2.3 Data Charting and Analysis

Data charting was performed to systematically extract and organise key information from the 18 included studies, creating a structured foundation for subsequent analysis. For each study, we documented: (1) bibliographic details (authors, publication year, country of study); (2) methodological attributes (study design, target population characteristics, sample size); and (3) intervention characteristics (digital platform or technology type, specific behavioural strategies employed, cultural adaptation approaches, theoretical frameworks guiding design, physical activity measurement methods, and retention or engagement features). We additionally extracted reported implementation barriers and facilitators, as well as quantitative and qualitative outcomes related to participation and engagement.

Our analytical approach employed a multi-stage process specifically designed to address each research question systematically. The process began with conventional thematic analysis techniques [16] involving iterative coding of extracted data to identify both convergent patterns and divergent findings across studies. Following this process, we coded and categorised the extracted data, and these codes were subsequently organised into higher-order thematic categories explicitly aligned with our three research questions:

For RQ1 (design paradigms), we conducted inductive analysis [3] of design rationales and feature sets to identify and characterise predominant design approaches in the literature.

For RQ2 (design shortcomings), we performed convergent synthesis [41] of articles' limitations of efficacy-engagement disparities to identify structural weaknesses.

For RQ3 (culturally sustaining designs), we employed an interpretive-generative approach [106], identifying positive indicators (elements associated with higher acceptability or retention) to derive design principles and assemble our conceptual framework.

We conducted the mapping of feature frequencies and distributions (e.g., delivery modes, cultural adaptation techniques) to provide additional context for our findings. This mixed-methods approach enabled a comprehensive examination of both the strengths and limitations of current digital approaches, particularly in terms of their capacity to sustain long-term engagement among CALD women.

2.4 Overview of the Studies

The 18 studies reviewed primarily targeted women from culturally and linguistically diverse backgrounds residing in the United States.

A majority focused on Latina women (n=14), while a smaller subset centred on Korean American women (n=3) or on midlife Chinese American women (n=1). Only one study engaged a broader sample of multiethnic Asian subgroups, including Chinese-, Tagalog-, and Vietnamese-speaking women (Table 1). The summary of included studies is shown in Appendix C.

Methodologically, the studies spanned diverse research traditions, ranging from randomised controlled trials (RCTs) to formative qualitative inquiry, capturing both exploratory and confirmatory stages of digital intervention development (Table 2). RCTs (n=11) were the most prevalent, including large-scale interventions such as Seamos Activas II and Pasos Hacia La Salud. Pilot and feasibility studies (n=4) evaluated the short-term usability and acceptability of app-based or technology-enhanced interventions. While these offered rich insights into design challenges, their small sample sizes limited broader applicability. Mixed-methods approaches (n=2) integrated quantitative outcomes with qualitative user feedback, enriching evaluation but remaining resource-intensive. In addition, a formative qualitative study (n=1) adopted a user-centred lens to explore emotional, cultural, and contextual factors shaping PA experiences, highlighting the value of early-stage participatory design in culturally sensitive health interventions.

In terms of intended health outcomes, 17 of the 18 studies framed PA as a preventive measure against chronic conditions disproportionately affecting CALD women, such as type 2 diabetes, hypertension, obesity, and cardiovascular disease [61, 86]. This biomedical rationale reflects a dominant orientation across the literature. Only one study centred on psychological well-being, aiming to reduce stress and enhance mood through movement-based engagement.

Table 1: Target population and number of studies

Target Population	Number of Studies
Latina Women	14 [8–10, 23, 33, 51, 57–60, 64, 89]
Korean American Women	3 [21, 22, 92]
Chinese American Women	1 [21]
Multi-Asian Women	1 [71]

Table 2: Methodology and number of studies

Methodology	Number of Studies
Randomized Controlled Trials (RCTs)	11 [10, 22–24, 51, 57–60, 100]
Pilot / Feasibility Studies	4 [9, 71, 89, 92]
Mixed-Methods Approaches	3 [21, 64]
Formative Qualitative Studies	1 [8]

3 RESULTS

The scoping review synthesises evidence from 18 studies to critically examine the design paradigms underpinning digital PA interventions for CALD women. Our analysis moves beyond efficacy reporting to uncover the assumptions and recurring shortcomings in how these technologies are conceived and built (Appendix D).

The findings are structured to directly address our research questions, first revealing the dominant design paradigms (RQ1), then critiquing their inherent limitations (RQ2), and finally identifying seeds for more culturally sustaining approaches (RQ3) (Figure 2).

3.1 Paradigms of Cultural Tailoring: From Surface-Level Accommodation to Socio-Cultural Embedding

To address RQ1, we examined how the 18 studies incorporated cultural considerations into the design, content, and delivery of digital PA interventions. Our analysis identified recurring patterns in the types of cultural tailoring used, which we synthesised into two core paradigms (Figure 3): (1) a dominant surface-level tailoring paradigm focused on reducing barriers to accessing digital interventions [8, 21–23, 34, 64, 71, 89, 92], and (2) an emerging deep socio-cultural embedding paradigm, focused on integrating the intervention into the cultural fabric of users' lives [9, 10, 24, 51, 57–60, 100].

3.1.1 Interface-Level Adaptations for Digital Accessibility (n=9/18). Across the review corpus, the prevailing approach to cultural adaptation aligned with Resnicow et al.'s [88] notion of surface-level tailoring, where cultural and linguistic differences were positioned primarily as access barriers rather than as sociocultural structures shaping motivation, identity, or behaviour. Three recurring interface-level strategies defined this paradigm:

- (1) **Linguistic Translation:** Interventions relied on direct translation of text messages, educational content, or website interfaces into participants' primary languages to improve comprehension [8, 21–23, 34, 64, 71, 89, 92].
- (2) **Interface Simplification:** Several studies reduced textual load and readability demands by lowering reading levels, using low-text, visually enhanced, simplified user interfaces to accommodate low health literacy or limited digital skills [8, 34, 71].
- (3) **Channel Localisation:** Interventions often delivered reminders, prompts, and ongoing support through communication channels already embedded in participants' everyday practices, such as SMS, email, or familiar messaging platforms [22, 23, 34, 71, 89, 92].

Across the reviewed studies, such strategies consistently improved accessibility and ease of use. Examples include multilingual systems supported by forward translation and low reading-level messages. Some also incorporated culturally recognisable imagery or voice-to-text features to reduce entry barriers for users with limited digital experience [8, 34, 71]. Korean American interventions similarly integrated culturally familiar communication platforms such as KakaoTalk² (widely used mobile messaging in South Korea) and Naver BAND³ (a group communication app), and recruitment was supported by a community advisory board to strengthen cultural relevance and accessibility [22].

However, the primary outcome of these adaptations was access, not sustained cultural engagement. Success was predominantly evaluated through short-term, technology-legible metrics such as weekly steps, MVPA minutes, and system-use frequency

²KakaoTalk official service page: <https://www.kakaocorp.com/page/>.

³BAND official site: <https://www.band.us/ko>.

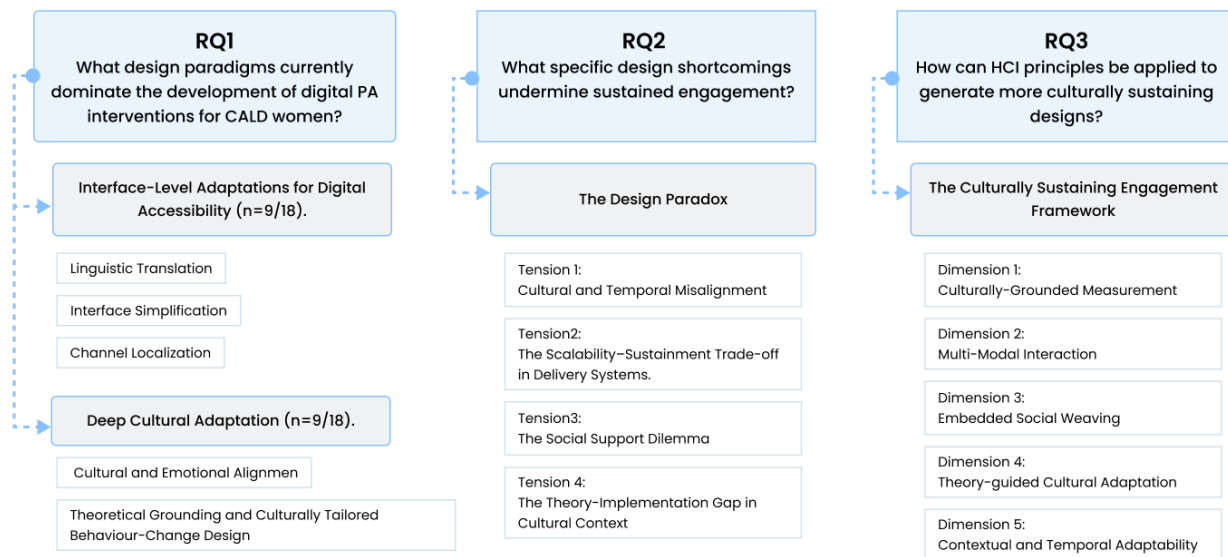


Figure 2: Overview of the study: from design paradigms (RQ1) to tensions (RQ2) to the Culturally Embedded Interaction Framework (RQ3).

[51, 57, 58]. This pattern aligns with broader critiques in the literature, which suggest that interface-level adaptations can improve initial uptake but are often insufficient for sustaining long-term, culturally situated engagement [70, 94]. The reliance on technology-centric metrics further reflects what Morozov terms a techno-solutionist approach, which reduces complex socio-cultural practices to algorithmically-processable data points [66]. Overall, these adaptations addressed barriers to access rather than embedding cultural values, practices, or motivations into the core behavioural or interactional architecture of the intervention.

3.1.2 Deep Cultural Adaptation (3 intervention programs; 9 publications). A minority of interventions are represented by three major multi-phase programs: Pasos Hacia La Salud I [9, 58, 59], Pasos Hacia La Salud II [24, 51, 100], and Seamos Activas II [10, 57, 60], documented across nine publications that have moved beyond the paradigm of surface accessibility. These interventions grounded their behavioural framing, examples, and delivery strategies in Latina women’s cultural values, relational identities, and daily lived experiences. Two primary strategies characterised this paradigm:

(1) *Cultural and Emotional Alignment.* Content and communication were designed to resonate with deeply held cultural values and lived realities. Across reviewed studies of the Pasos Hacia La Salud (I/II) and Seamos Activas II programs, cultural adaptation was reflected in the consistent use of Spanish-language delivery and the integration of behavioural examples grounded in Latina women’s daily relational and caregiving contexts. Intervention manuals, feedback messages, and activity suggestions frequently framed physical activity through family-oriented routines [24, 58, 59, 100]. Furthermore, several studies document the use of bicultural and bilingual staff and moderated online forums as a documented feature to facilitate culturally and emotionally appropriate communication

[24, 59, 100]. These choices supported cultural resonance in both content delivery and interpersonal communication, creating an emotionally supportive context aligned with participants’ lived experiences.

(2) *Theoretical Grounding and Culturally Tailored Behaviour-Change Content.* Across the three Latina-focused intervention programmes, behaviour-change theories were primarily adapted through cultural framing rather than structural reconfiguration [9, 10, 24, 51, 57–60, 100]. The primary method of adaptation involved aligning Social Cognitive Theory (SCT) [4] or the Transtheoretical Model (TTM) [83] constructs with culturally salient values and daily circumstances through the use of examples, narratives, and counselling strategies.

A prominent example is the framing of social support through family cohesion, the cultural norm that emphasises collective responsibility and emotional interdependence. In Pasos Hacia La Salud [9, 24, 51, 58, 59, 100] and Seamos Activas II [10, 57, 60], strategies to increase self-efficacy were intentionally embedded in family-centred activity planning, such as dancing with children, walking with extended relatives, or setting shared weekly goals with partners. These strategies aligned SCT constructs with culturally familiar family routines.

A second pattern of deep adaptation involved tailoring SCT constructs related to perceived barriers and environmental constraints. Interventions provided concrete, context-sensitive behavioural solutions, such as walking in groups during daylight hours, selecting indoor or community-centre routes, or integrating PA into childcare and household routines [9, 58].

Finally, the corpus shows that TTM’s stage-based tailoring was also applied in culturally specific ways [83]. Rather than offering uniform stage-matched recommendations, manuals and feedback

algorithms in Pasos I/II [9, 24, 51, 58, 59, 100] incorporated participants' daily schedules and caregiving routines.

Within these programmes, PA was reframed not merely as an individual health behaviour but as an activity that could enhance caregiving capacity, reduce family burden, and strengthen emotional resilience, aligning motivational pathways with Latina women's relational identities and cultural obligations.

Although nine publications were classified as examples of deep cultural adaptation, they largely report on three closely related intervention programmes: Seamos Activas II [10, 57, 60] and Pasos Hacia La Salud I/II [9, 24, 51, 58, 59, 100]. At the programme level, these interventions demonstrate clear deep cultural adaptation: they are grounded in formative work with Latina women, delivered in Spanish, and explicitly address structural and cultural barriers [9, 24, 57–60]. However, when examined at the level of digital design and interaction features, only a small subset of features, such as family-shared website log-ins or providing separate pedometers for family members, embed cultural values directly into the interaction structure itself [9].

In response to RQ1, our review reveals that digital PA interventions for CALD women are predominantly characterised by a surface-level cultural adaptation paradigm. Most interventions translate content into the target language, simplify wording, and deliver it through familiar channels rather than redesigning the underlying interaction logic or social roles. Although nine publications in our sample qualify as examples of deep cultural adaptation, they mainly represent three closely related Latina programmes (Pasos Hacia La Salud I/II and Seamos Activas II) that share a common, culturally grounded behaviour-change design at the programmes level [9, 10, 24, 57–60, 100], with cultural specificity embedded more in the content and examples than in radically reimagined interaction features.

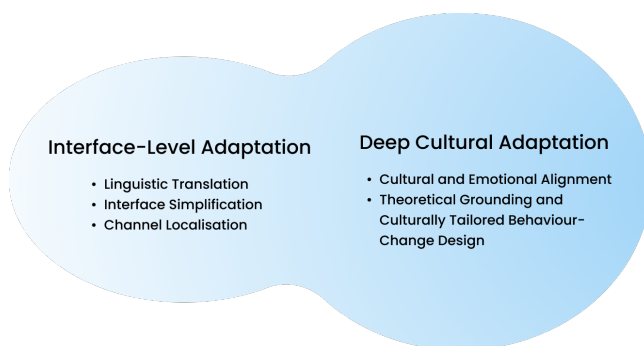


Figure 3: Cultural tailoring strategies: from surface-level accommodation to deep socio-cultural embedding.

3.2 The Design Paradox: Layered Tensions Constraining Engagement

The dominance of the superficially tailored paradigm revealed in Section 3.1 not only leads to ineffective design outcomes but also prevents sustained engagement from the beginning. Our analysis

of RQ2 indicates that this structural imbalance generates four interconnected design tensions (Figure 4) that collectively constrain long-term engagement.

3.2.1 Tension 1: Cultural and Temporal Misalignment (n=4). Across four studies in our corpus, a recurring tension emerged between how digital interventions were conceptualised and delivered and how CALD women understood health, time, and everyday life [21, 22, 34, 89]. One form of misalignment concerned terminology and conceptual framing. In a pilot study with Chinese and Korean American midlife women, cultural conflicts emerged around the use of terms such as “midlife” and “depression,” which carried stigma [21]. In addition, participants' interpretations of what counted as physical activity often diverged from the examples and categories embedded in intervention materials, while inconsistencies in linguistic translation further undermined comprehension and engagement [21].

A second form of misalignment concerned friction in everyday interaction with digital tools. In a rural Hispanic context, participants noted that MyFitnessPal did not include common Latino foods, required burdensome portion entries, and faced syncing failures, which collectively reduced motivation and usability [89]. Similarly, in a user-design study of bilingual conversational coaches, the impersonal and culturally irrelevant tone of system feedback posed an additional challenge. Participants who are monolingual Spanish speakers identified mismatches in tone and phrasing, impersonal responses, and the absence of family-inclusive features, indicating that the feedback style did not fully align with their communication expectations or cultural norms around support [34].

Across these studies, recurring cultural misalignments manifested as confusion, frustration, and reduced willingness to continue using the tools, and were described by participants as key barriers to acceptability and sustained use [21, 34, 89]. The resulting friction is not an accidental defect but an inevitable product of a paradigm that prioritises technological efficiency over interaction design rooted in cultural foundations.

3.2.2 Tension 2: The Scalability–Sustainment Trade-off in Delivery Systems. The reviewed interventions reveal a structural tension in the design of socio-technical health systems: digital configurations that scale well often fail to sustain engagement, while models that provide sustained, culturally grounded support are difficult to scale. We synthesise the 18 studies into four delivery archetypes that illustrate this scalability-sustainment trade-off.

(1) Model 1: Digital-only Programmes (n=8). These interventions delivered PA support entirely via web or mobile channels. Two patterns were observed: (i) web-based, language-localised portals offering tailored content, self-monitoring, feedback, and sometimes discussion forums [8, 9, 51, 58, 59]; and (ii) mobile health apps, often linked with wearable devices such as Fitbit and automated SMS reminders to support adherence [22, 34, 71]. While these models enabled broad reach and low-cost delivery, they consistently faced challenges due to high attrition and low long-term engagement. Across these studies, engagement tended to decline over time, with particularly low participation among women who entered the interventions as completely inactive [58, 59], who remained the most difficult to reach even when interactive features were enhanced.

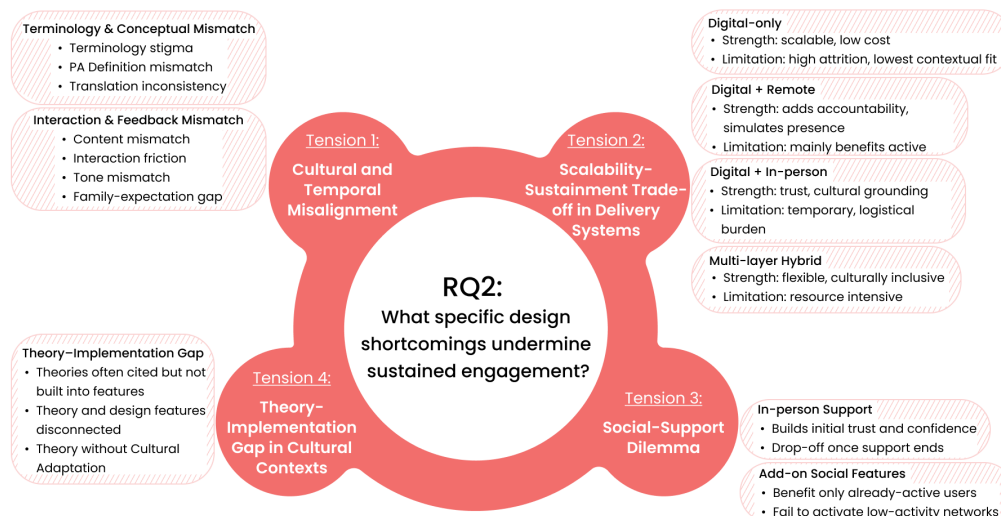


Figure 4: Four systemic design tensions identified in response to RQ2, illustrating cultural-temporal misalignment, scalability-sustainment trade-offs, fragile social support, and the theory-implementation gap in cultural contexts.

(2) *Model 2: Digital + Remote Support (n=6)*. Digital components were paired with remote asynchronous human support, such as automated SMS for tips or weekly reporting, telephone coaching or check-ins, email feedback, online forums [21–24, 60, 100]. Across these interventions, remote contact was used to simulate social presence, provide accountability, and troubleshoot barriers. However, their effectiveness is highly contingent on participants’ pre-existing social capital or network structures and digital communication habits [22, 60]. The engagement data revealed a participation divide. Remote-support features primarily benefited women who were already more active or socially connected, whereas those with weaker or more isolated networks gained limited benefit [22].

(3) *Model 3: Digital + In-Person Support (n=1)*. Only one study combined digital tools with structured in-person sessions. In Rowland et al. [89], participants used Fitbit and MyFitnessPal for digital self-monitoring while also attending face-to-face sessions that provided technical assistance, bilingual coaching, and motivational guidance. These in-person components played a central role in onboarding and early engagement, helping participants interpret digital feedback and troubleshoot device-app issues [89]. Adherence data showed that self-monitoring declined when the in-person contact was reduced, and the study reported logistical barriers, including travel time, scheduling difficulties, and staff demand, that constrained scalability [89].

(4) *Model 4: Hybrid Multi-Layer (n=4)*. Four interventions combined digital tools with both virtual and in-person support. For example, Shin et al. [92] implemented a programme that integrated multiple layers of human interaction, requiring bi-weekly face-to-face education sessions and monthly small-group walking groups alongside the delivery of weekly reminder text messages and Fitbit tracking to reinforce daily engagement. While these touchpoints offered structure and accountability, some participants experienced

pressure and discomfort when discussing adherence [92]. Mendoza-Vasconez et al. combined commercial smartphone apps with an in-person training session to personalise app use, followed by a brief telephone check-in to address technical or behavioural barriers during the maintenance phase [64]. The Seamos Activas II trial further exemplified this hybrid configuration: computer-tailored print materials and automated text messages were integrated with health-coach goal-setting visits and scheduled coaching calls, as described in the design and outcome papers [10, 57]. Across these studies, hybrid delivery offered flexibility to accommodate varying levels of digital literacy and provided culturally grounded support through human facilitation [10, 57, 64]. At the same time, the combination of digital and interpersonal touchpoints highlighted cultural nuances in accountability, showing that while some participants benefited from layered support, others experienced increased social pressure in face-to-face contexts [92].

3.2.3 Tension 3: The Social Support Dilemma. Social and peer support are widely recognised as critical in sustaining PA across the included studies [22, 23, 60], especially for CALD women who face intersecting barriers of social isolation, linguistic exclusion, and limited cultural alignment in mainstream health programs [21, 22, 89]. Interventions provided support either virtually, through online peer groups, conversational agents, or web-based coaching [21–23, 34] or through hybrid models that paired digital tools with face-to-face encounters [89, 92]. Across the corpus a core design paradox emerged: digitally added social features rarely activate low-activity networks [21, 22], while in-person support offers only temporary gains and fails to sustain engagement once removed [23].

(1) *Fragility of Add-On Social Features (n=4)*. Across four studies, social features embedded as add-ons, including online discussion boards, email coaching, peer groups, and conversational agents, showed limited or uneven engagement. These components were most frequently used by participants who were already active or

socially connected, while women with lower baseline activity or weaker social networks engaged less with them.

In Pasos Hacia La Salud, an online message board was provided to enhance peer support; however, usage data revealed minimal visitation, and the feature did not contribute meaningfully to overall engagement with the programmes [51, 58, 59]. Similarly, in a web-based intervention for Chinese and Korean American midlife women, online discussion and email-based coaching attracted little participation despite being framed as culturally supportive mechanisms [21]. Choi et al. [22] further observed that peer-based online groups meaningfully benefited only the most active participants, while women with weaker offline networks, often the intended priority population, derived little benefit.

Conversational-agent-based support exhibited similar limitations. Spanish-speaking women described chatbots as repetitive, technically unstable, and low in social presence, raising concerns about novelty loss and diminishing interpersonal relevance over time [34].

Taken together, these findings indicate that digitally added social features rarely succeed in activating low-activity or socially isolated networks; instead, they often reinforce existing engagement inequalities by primarily serving women who are already active or digitally confident.

(2) *The limitation of In-Person Support (n=3)*. Across three interventions that incorporated face-to-face elements, in-person support functioned effectively as an initial scaffold but did not translate into sustained engagement once the contact decreased [89, 92]. In Rowland et al.'s research, bilingual staff assisted with onboarding and troubleshooting, producing short-term increases in engagement. Yet adherence declined steadily over 12 weeks, rising only during face-to-face visits, [89].

A second limitation concerned the way social components intersected with cultural norms and structural responsibilities. In Shin et al. [92], family and work obligations, shaped by traditional gendered expectations, often took precedence over participation in walking groups and scheduled educational sessions. Family members did not consistently encourage physical activity, and the immediate social environment often functioned as a competing demand rather than a supportive mechanism.

A similar pattern was evident in Chee et al. [21], where weekly one-on-one email coaching was intended to provide accountability, but engagement remained low. Participants were described as “already overwhelmed” by the programme’s demands, and the authors noted that social desirability pressures during progress checks may have discouraged responses. In this context, coaching contacts were perceived as burdensome rather than motivating.

Thus, these findings show that the addition of in-person or direct social touchpoints does not automatically enhance engagement. When implemented as frequent progress checks or intermittent support visits, such mechanisms may introduce logistical pressure, cultural tension, or emotional workload that undermines their intended function. Sustained engagement therefore appears to require support structures that are continuous, culturally aligned, and compatible with participants’ everyday responsibilities.

3.2.4 Tension 4: The Theory-Implementation Gap in Cultural Context. Across the 18 studies, behaviour change theories, primarily

SCT and TTM, were widely referenced and consistently used to guide personalised behavioural tailoring. However, their application remained concentrated at the level of individualised content (goal setting, self-monitoring, stage-matched feedback), rather than informing culturally responsive interaction structures or system logic. In practice, theoretical constructs were adapted linguistically or narratively, but rarely reconfigured to reflect cultural norms, family roles, or everyday constraints.

(1) *Theories Driving Behavioural Tailoring*. Ten Latina-focused trials explicitly cited SCT, typically combined with TTM, using these theories to power expert systems, tailoring algorithms, or motivational scripts [9, 10, 24, 51, 57–60, 64, 100]. Five additional studies implemented SCT-related components, such as self-monitoring or feedback, without naming the theory explicitly [21–23, 89, 92]. These constructs were operationalised through standard behaviour-change mechanics. Pasos Hacia La Salud I used an expert system to generate tailored reports on activity levels, goals, and perceived barriers [58]. Enhanced versions (Pasos II; Seamos Activas II) added web-based logs, progress graphs, and interactive SMS reporting to support ongoing self-monitoring [10, 57]. Commercial tools such as Fitbit and MyFitnessPal automated self-monitoring in studies with Korean American and rural Hispanic adults [89, 92].

Additionally, TTM was referenced in 11 studies [9, 10, 22, 24, 51, 57–60, 64, 100]. In the Latina programmes, TTM stages of change were used to structure intervention tailoring: baseline and follow-up stage assessments informed the frequency, intensity, and type of materials delivered [9, 10, 57–60, 64]. In contrast, in the Korean American pilot, TTM was used to describe participant readiness for activity and to determine eligibility but was not integrated into digital tailoring [22].

(2) *Behaviour Change Theories Used Without Systematic Cultural Adaptation*. Despite extensive behavioural tailoring, SCT and TTM were seldom embedded into culturally specific interaction structures. For example, SCT’s social support construct was often implemented through generic prompts to seek encouragement from others, or via anonymous message boards, rather than through mechanisms explicitly aligned with family norms. In Pasos Hacia La Salud, the use of the online message board was low and not associated with higher MVPA [9]. Similarly, in technology-enhanced programmes for Korean American adults, multi-source support strategies did not produce significant changes in perceived support from family or friends [92].

Cultural interpretations of PA further constrained theoretical alignment. In formative work with Chinese and Korean American midlife women, participants viewed many daily activities as already “sufficient,” creating misalignment with MVPA-oriented goal-setting frameworks; stigma linked to labels such as “midlife” reduced willingness to enrol or remain engaged [21]. App-based interventions for multiethnic Asian adults emphasised language matching and culturally familiar examples for usability, yet retained generic self-monitoring and goal-setting mechanisms [71].

Only a minority of studies have demonstrated the effective translation of theory through socio-technical systems that embed theoretical constructs within culturally responsive interaction loops. The Seamos Activas II series [10, 57, 60] systematically mapped SCT and TTM constructs into tailored text messaging, motivational

interviewing, and contextual feedback, demonstrating that even automated low-burden, theory-driven interaction features, such as individualised goal setting and personalised feedback, significantly predicted sustained MVPA at 12-month follow-up [57].

Overall, across the corpus, behaviour-change theories were applied consistently, but primarily to support personalised behavioural content rather than culturally adaptive interaction design.

In direct response to RQ2 (What specific design shortcomings undermine sustained engagement?), our analysis identifies four systemic tensions in the design of digital PA interventions for CALD women: (Tension 1) cultural and temporal misalignment, (Tension 2) the scalability-sustainment trade-off in delivery systems, (Tension 3) the social-support dilemma, and (Tension 4) the theory-implementation gap in cultural context. These shortcomings do not exist in isolation but are interdependent, collectively constraining the capacity of current digital interventions to support sustained, culturally situated engagement.

3.3 Toward a Culturally Embedded Interaction Framework

Our analysis of the 18 interventions revealed a dispersed set of HCI-relevant strategies, spanning multimodal delivery, cultural usability, social embedding, theory-informed tailoring, and temporal adaptability, that recurred across the reviewed studies. To address RQ3 (How can HCI principles be applied to generate more culturally sustaining designs?), we integrated these empirical patterns through a three-step synthesis process, culminating in the identification of five core design dimensions.

Step 1: Extraction HCI-relevant design strategies across interventions. We first systematically extracted concrete design practices that were explicitly reported to enhance engagement, acceptability, or cultural relevance. This yielded a catalogue of recurrent strategies, including: prioritising cultural usability through low-text, visual-first interfaces [8, 9, 21, 71]; employing multimodal interaction across SMS, web, apps, and wearables to meet diverse user needs [9, 23, 71, 89, 92]; structuring social support through promotoras, bilingual coaches, or familiar platforms [8, 21, 22, 34, 89]; and implementing theory-driven tailoring combined with maintenance scaffolds such as stage-matched messages and adaptive feedback [9, 10, 24, 51, 57, 58, 60, 64, 100].

Step 2: Mapping strategies to design tensions. We then analysed how these strategies corresponded to the four design tensions in Section 3.2. For instance, the cultural-temporal misfit (T1) can be addressed through dimensions of culturally grounded measurement and theory-informed cultural adaptation, implemented via orientations such as localising language and imagery, embedding culturally familiar channels, and avoiding stigmatising labels [9, 21, 71, 92]. Strategies responding to the scalability-sustainment trade-off (T2) frequently focused on reducing interaction burden, leading to orientations such as minimising manual logging and lowering technical barriers [23, 51, 57, 71, 89]. Culturally embedded relational structures, such as promotoras or culturally familiar social platforms, responded to the social-support dilemma (T3) by providing trusted, culturally legible pathways for connection [8, 22, 34, 89]. Finally, culturally framed theory implementation and stage-tailored

maintenance phases addressed the tension of behaviour-change theories being used without systematic cultural adaptation (T4) [10, 21, 24, 57, 60, 64, 92, 100].

Step 3: Integrating mapped strategies into a five-dimension design model. Through an iterative process of clustering the mapped strategies based on thematic similarity and their shared focus on interaction design, five distinct dimensions consistently emerged: Culturally-Grounded Measurement, Multi-Modal Interaction, Embedded Social Weaving, Theory-Guided Cultural Adaptation, and Contextual and Temporal Adaptability. This mapping, detailed in Table 3, illustrates how each dimension integrates multiple strategies and addresses specific tensions.

3.4 The Framework Dimensions

The framework (Figure 5) consists of five interconnected dimensions. It is not a static checklist but a dynamic system where culture guides design and is reinforced through ongoing engagement. All examples in this subsection are drawn directly from the 18 interventions in our review corpus.

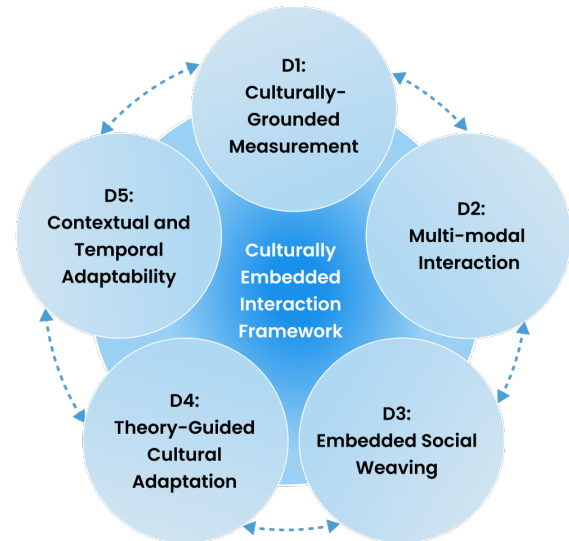


Figure 5: Proposed Culturally Embedded Interaction Framework: consisting of five interconnected dimensions: culturally-grounded measurement, multi-modal interaction, embedded social weaving, theory-guided cultural adaptation, and contextual and temporal adaptability. The framework illustrates how culture functions as a dynamic driver of digital PA intervention design, continuously shaping and reinforcing sustained engagement.

Dimension 1: Culturally-Grounded Measurement. This dimension advocates for measurement practices that extend beyond device-based metrics to incorporate culturally or psychosocially relevant indicators. For example, trials with Korean American women combined wearable-derived walking data with self-efficacy and perceived social support, documenting that increases in activity did

not consistently correlate with higher felt encouragement from family or friends, a nuance invisible to step counts alone [22, 92]. App-based programmes for Chinese-, Tagalog-, and Vietnamese-speaking adults integrated Fitbit steps with multilingual education modules and participant feedback on feasibility and cultural fit, foregrounding whether content felt usable and relevant in daily life [71]. Work with rural Hispanic adults similarly triangulated technology logs with usability and reports of cultural mismatch, such as the absence of a Latino food database [89]. Formative and pilot studies with Chinese and Korean midlife women documented how labels like “midlife” and mental-health framing affected acceptability, underscoring the need to measure stigma, role expectations, and family obligations alongside PA behaviour [21]. In addition, conversational-agent work with English- and Spanish-speaking women elicited qualitative indicators such as warmth, empathy, and family inclusivity that function as cultural performance metrics for “humanness” in coaching, not captured by devices [34]. These empirical examples reinforce Lupton et al.’s observation that quantitative data alone are insufficient to represent the complexity of lived experience and the body [53]. Collectively, these studies illustrate a measurement repertoire that couples objective PA with culturally salient constructs, thereby expanding the criteria for evaluating effectiveness.

Dimension 2: Multi-Modal Interaction. Evidence indicated a recurrent pattern of employing multiple communication channels to accommodate diverse literacy levels, device access, and communication practices. Several design-phase studies with Latino communities reported that low-text, visual-first interfaces, such as images, icons, and short videos, were easier to understand and more motivating than text-heavy screens [8]. In a bilingual chatbot study, Spanish-speaking women expressed preferences for simplified conversational flows and voice-to-text input, indicating the usefulness of audio-based interaction in reducing literacy demands [34]. Among rural Hispanic adults, participants recommended voice guidance, streamlined flows, and fewer manual entries when app and device complexity hindered continued use [89].

Multi-channel programs that paired apps with short, readable text messages and brief videos were used to improve reach and reinforcement. An intervention for multi-Asian-language speakers coupled culturally adapted app content with daily SMS nudges [71]. Similarly, Spanish-language website interventions integrated SMS reminders to sustain engagement [9, 51, 57]. Randomised trials with Latino adults demonstrated the combined use of text messaging and wearables, where low-reading-level SMS prompts supported day-to-day activity tracking [23, 57].

Dimension 3: Embedded Social Weaving. Across the reviewed studies, social connection was implemented through culturally familiar and trusted relational structures rather than generic community features. Several interventions incorporated culturally matched intermediaries, such as promotoras, bilingual coaches, or community advisory boards, which facilitated participant engagement and lowered access barriers [8, 21, 89].

Studies showed differential engagement based on social platform design. Korean American women who actively used a familiar social app showed higher activity than low-engagers, though access alone was insufficient to ensure social support [22]. Conversely, when

“social” features are inadequately designed, such as message boards, non-customisable chats, or lacking peer pathways, participants were observed to disengage or request clearer, culturally resonant connection methods [9, 34, 71].

Multiple trials further documented that increases in PA did not consistently correlate with increased perceived support from friends or family, and that rigid, evaluative check-ins sometimes negatively affected engagement [21, 92]. Overall, the evidence suggests that effectively supporting CALD women digitally involves weaving intervention features into the fabric of existing, trusted community structures, rather than deploying standalone social tools.

Dimension 4: Theory-guided Cultural Adaptation. Across the reviewed studies, behavioural theories such as the TTM and SCT were frequently referenced, but their translation into concrete design features varied substantially. For instance, in Seamos Activas II, the intervention drew on both the TTM and SCT. TTM informed the stage-tailored print and text-message content, while SCT informed the use of goal-setting, self-monitoring, and feedback, which together helped sustain activity levels up to 12 months [57, 60]. Other interventions, however, invoked theory primarily on a conceptual level with limited corresponding feature-level implementation [10].

Evidence indicated that cultural framing influenced the application of theory-driven techniques. Research with Korean American women found goal-setting and self-monitoring to be more effective when delivered through a familiar social platform [22]. Latina participants reported greater motivation when prompts and feedback referenced family roles or collective values, rather than solely individual progress [34, 89]. Similarly, app-based interventions for multiethnic Asian groups indicated that language matching and culturally specific exercise examples were essential for enabling participants to enact SCT-derived strategies [71]. These studies demonstrate that theory-informed design is most effective when adapted to cultural contexts.

Dimension 5: Contextual and Temporal Adaptability. Across several interventions, engagement patterns were influenced by temporal and contextual factors documented in the studies. Cultural calendars affected participation flows: recruitment, program delivery, and user engagement decreased around major cultural holidays such as Lunar New Year and U.S. Thanksgiving [21]. Research also revealed episodic engagement patterns, where participation frequently peaked following scheduled contacts and declined during interim periods [21, 89].

Several interventions employed either rhythm-based or real-time support approaches. In a Korean online community program, weekly challenges and feed updates were associated with consistent platform use [22]. In Seamos Activas II, stage-tailored text messages, brief check-ins, and periodic feedback reports contributed to supporting activity levels over a 6-month period [57, 60]. Correlational analyses linked platform activity duration to behavioural outcomes, with higher and sustained use of intervention websites predicting greater levels of moderate to vigorous PA [51]. Maintenance-focused pilots further documented that low-burden supports, such as automated feedback loops and occasional tailored prompts, were associated with continued activity after program

completion [60, 64]. These studies show how temporal patterns, routine alignment, and culturally shaped schedules influenced ongoing engagement.

Our analysis of 18 digital PA interventions reveals a field characterised by two cultural design paradigms and four systemic tensions. The inductive synthesis of strategies across this corpus yielded five interconnected dimensions, establishing an empirically grounded foundation for understanding culturally embedded interaction design in digital health.

4 DISCUSSION

To our knowledge, this is the first scoping review to critically examine how digital technologies have been designed to enhance and sustain PA among women from CALD backgrounds. Our synthesis reveals both the promise of existing interventions and their persistent shortcomings. In this section, we revisit our three research questions and articulate how our findings extend knowledge in HCI.

4.1 The Paradox of Cultural Design in Digital Health

In addressing RQ1 and RQ2, our findings reveal a structural design paradox that undercuts long-term engagement in digital PA interventions for CALD women. On one hand, techno-solutionist features, automated reminders, algorithmic tailoring, and simplified interfaces, treat culture primarily as an access problem and overlook the relational, cultural, and temporal contexts shaping everyday PA practices [10, 21, 58, 71, 89, 92]. On the other hand, pro-social features intended to foster motivation frequently collapse in low-activity or socially isolated networks, benefiting only those who are already active or digitally confident [22, 34, 51, 92]. These patterns reveal that disengagement is not incidental but systemic, rooted in universalist design logics that privilege efficiency over cultural and social ecologies [6, 44].

From Surface-Level Localisation to Cultural Reductionism. Although cultural tailoring is widely acknowledged across interventions, its implementation is overwhelmingly constrained to surface-level localisation through translation, simplified readability, familiar messaging channels. This approach fails to embed deeper cultural values, relational norms, or communication styles into the interaction architecture itself [8, 9, 22, 23, 34, 51, 57–60, 64, 71, 92, 100]. Even when studies incorporated cultural brokers such as promotoras, bilingual coaches, and community advisory boards, who played important roles in ensuring cultural resonance during recruitment or initial content development [8, 21, 22, 71, 89]; their role was typically confined to the initial phases, such as recruitment or content development. Consequently, their deep cultural expertise was not translated into the system's ongoing interaction logic, leaving culturally grounded relational mechanisms absent from its core behavior. This disconnect reflects what Resnicow et al. describe as surface-structure adaptation, reducing cultural practices to aesthetic markers while leaving underlying relational and motivational logics untouched [88].

Limitations of Techno-Solutionist and Social Features. Efficiency-driven features such as automated reminders or algorithmic personalisation were widely deployed but did not account for the relational and motivational factors identified in the corpus [57, 71, 89].

Conversely, “add-on” social features, such as online forums or chat-based encouragement, assume that digital connectivity can activate otherwise dormant social networks. Our synthesis demonstrates the opposite: these features disproportionately serve individuals who are already socially resourced or physically active, while those with weaker networks, often the primary target of interventions, receive limited benefit [22, 34, 51]. This ineffective layering of social features exposes a second critical flaw: the failure to account for the culturally variable nature of social support itself. Family involvement likewise produced divergent effects across cultural groups: it functioned as reinforcement in some contexts, such as Latina women who welcomed family-oriented framing [58, 64], but acted as a burden or source of pressure for others, including Korean American women who preferred independent or private modes of engagement [21, 92]. The resulting pattern is clear: neither automated technical features nor generic social add-ons meaningfully map onto the relational infrastructures that mediate CALD women's daily lives.

Cultural Embedding and Maintenance. A related pattern concerns the temporal dimension of cultural design. Culture and maintenance were often treated as secondary or optional components, rather than as structuring principles that inform how support should evolve and adapt over time. This explains the recurrent finding of steep declines in engagement after an initial active phase, even when early behavioural gains are achieved [10, 51, 89, 92].

By contrast, the few studies that embedded cultural logic into their temporal structure demonstrated sustained impact. For example, interventions that used stage-tailored prompts and periodic feedback reports within a culturally coherent narrative showed adherence extending to 12 or even 24 months [60, 100]. Lightweight, culturally-framed automated prompts similarly supported engagement beyond the formal intervention period [57, 64]. These divergent outcomes reveal a fundamental insight: long-term engagement failures are not a problem of reminder dosage, but of temporal-cultural misalignment. Successful maintenance requires designing follow-up support so that cultural logics, relational structures, and daily rhythms are woven into the fabric of ongoing interaction, not appended as an afterthought.

Limitations of Human-Centred and Participatory Approaches in Existing Interventions. The prevalent pattern of surface-level cultural adaptation can be attributed, in part, to fundamental limitations in how human-centred and participatory principles are translated into practice. A critical observation is that none of the reviewed studies explicitly situated their methodology within established frameworks of Human-Centred Design (HCD) [101], User-Centred Design (UCD) [56], or Participatory Design [84]. Our classification, therefore, reflects the methods that appeared, such as cognitive interviewing, usability testing, advisory consultation, or co-design workshops. This distinction reveals a structural gap in the current digital health landscape: while many interventions conduct user-informed formative research, few extend these insights into the

Table 3: Mapping design tensions to framework dimensions

Design Tension	Framework Dimension(s)	Design Orientation
T1 Cultural-Temporal Misfit	D1: Culturally-Grounded Measurement D4: Theory-Informed Cultural Adaptation	Localise language and imagery [8–10, 21, 22, 24, 51, 57–60, 64, 100] Use culturally familiar channels [8–10, 21, 22, 24, 33, 51, 57, 58, 71, 89, 100] Avoid stigmatising labels [21] Make content culturally concrete [22, 33, 71, 89] Keep text simple / visual-first [8–10, 23, 33, 57, 58, 71, 89]
T2 Scalability-Sustainment Trade-off	D2: Multi-Modal Interaction D5: Contextual and Temporal Adaptability	Offer multi-modal access [10, 22, 23, 57, 71, 89] Lower technical barriers [8, 21–23, 33, 71, 89] Minimize manual logging [9, 24, 51, 58, 60, 89]
T3 Fragile Social Support	D3 Embedded Social Weaving	Embed culturally matched communities [22, 33, 71, 92] Leverage trusted community brokers [8–10, 21, 22, 24, 51, 57, 58, 60, 89, 100]
T4 Theory-Implementation Gap	D4: Theory-Informed Cultural Adaptation	Embed SCT/TTM into design features [10, 22–24, 51, 57, 58, 60, 64, 89, 100] Sustain with “light-touch” scaffolds [10, 24, 51, 57, 58, 60, 64, 92] Co-design cultural transcreation [8, 21, 22, 34, 71, 89]

iterative co-creation of interaction features, social mechanisms, or long-term maintenance structures.

UCD or HCD methods were most visible during early formative research. Studies such as Seamos Activas II and Pasos Hacia La Salud employed focus groups, cognitive interviews, and literacy assessments to establish linguistic clarity, identify cultural barriers, and ensure content comprehensibility [10, 58]. Similarly, studies with Asian and Hispanic populations employed usability interviews to develop low-text interfaces and culturally resonant content [8, 71]. While these activities reflect the core UCD or HCD principle of understanding user context, their impact remained constrained. The design changes they prompted largely focused on improving content readability and surface-level usability, failing to inform the deeper interaction logic or behavioural scaffolding that characterises sustained engagement [51, 57].

Participatory approaches were present but limited in scope, primarily through advisory structures rather than direct co-design. Korean American and rural Hispanic interventions engaged community advisory boards to review recruitment materials, communication tone, and delivery channels [22, 89]. While these forms of stakeholder engagement shaped programme framing and cultural positioning, they did not translate into the systematic co-creation of digital features or behavioural scaffolding. Only one study extended Participatory Design into the design of interaction behaviour by conducting co-design workshops [34].

Overall, while user or human-centred and participatory methods generated important cultural and contextual insights during formative phases, these insights seldom informed the design of sustained, interaction-level mechanisms. This disconnect highlights a key opportunity for HCI: to integrate user-centred and participatory processes throughout the research and design lifecycle, ensuring that cultural understanding not only shapes content but is also structurally embedded in how digital systems behave over time.

4.2 Culturally Embedded Interaction Framework: A Design Framework for Sustained Participation

In response to the structural paradox revealed in our review, where techno-solutionist features overlook cultural and relational contexts, while social features collapse in low-activity networks, we propose the Culturally Embedded Interaction Framework. This framework represents more than a checklist; it proposes a fundamental reorientation for digital health design: from achieving short-term, cross-cultural accessibility to fostering long-term, culturally sustainable participation.

Consistent with HCI traditions that position frameworks as interventions into design practice rather than descriptive summaries [6, 31], the framework integrates empirical evidence with culturally situated design theory to guide both analysis and generative design. It serves a dual, critical function: as an analytical lens to diagnose the systemic failures of surface-localization, and as a generative guide for creating new, culturally resonant designs. It is structured around five interdependent dimensions that address the shortcomings of the dominant surface-localisation paradigm, as detailed in Table 4.

The framework moves beyond treating culture as a barrier to be translated, and instead operationalises cultural logics as generative resources for interaction design. For instance, drawing on evidence from long-term trials [60, 100] on the importance of sustained support, the framework argues for designing long-term socio-technical infrastructures [1] that integrated continuous support, adaptation, and integration into everyday practice. This shift is achieved through dimensions of contextual and temporal adaptability (D5), which prioritise continuity and resilience [13, 25, 105] and Embedded Social Weaving (D3), which establishes durable, culturally grounded relational structures to sustain engagement over time.

The framework provides distinct entry points for diverse stakeholders engaged in designing and delivering culturally grounded digital health systems. For researchers, it offers a structured, culturally adjusted lens for identifying challenges, mismatches, and support expectations in early formative work, and for examining

Table 4: Framework dimensions and their purposes

Dimension	Purpose
D1: Culturally-Grounded Measurement	To ensure tracking and feedback resonate with culturally specific values and definitions of health and activity.
D2: Multi-Modal Interaction	To meet users across their preferred channels and literacy levels, ensuring the intervention fits seamlessly into their daily practices.
D3: Embedded Social Weaving	To architect bridging social capital by actively designing opportunities for new, meaningful connections to form, rather than relying on pre-existing networks.
D4: Theory-Guided Cultural Adaptation	To transcreate behavioural theory by deeply re-engineering motivational constructs to align with cultural worldviews, moving beyond superficial translation.
D5: Contextual and Temporal Adaptability	To design for life's rhythm by creating interventions that are fluid and long-term.

how behaviour-change theories operate across different cultural contexts [6, 28, 44, 104]. It can guide sampling strategies and the development of culturally sensitive interview and survey protocols, foregrounding whose voices and value systems are centred in the design process [31, 84]. The framework also supports systematic evaluation of emerging intervention concepts against its five dimensions, helping researchers diagnose why prior interventions struggled and design studies with stronger cultural validity and more interpretable outcomes [13, 28, 94].

For designers, the framework translates empirical insights into actionable design requirements throughout the lifecycle, from requirements gathering to prototyping and iteration, extending long-standing commitments to situated and value-sensitive design [6, 28, 31]. The framework also provides criteria for evaluating design alternatives, such as whether interaction models reflect collectivist orientations, temporal rhythms, or culturally familiar communication patterns, helping designers move beyond surface localisation toward deeper cultural embedding [74]. For community health workers and cultural brokers, the framework clarifies how their relational expertise can shape the system's social fabric and maintenance patterns, moving their role beyond recruitment toward co-creating culturally grounded socio-technical infrastructures. This

aligns with HCI work that highlights the importance of intermediaries in sustaining engagement within complex social systems [27, 44].

4.3 Future Validation of the Framework

Although the framework is grounded empirically in 18 interventions, its validity must be established through situated enactment rather than universal generalisation [49]. Following HCI traditions that position frameworks as forms of intermediate-level knowledge [42], the Culturally Embedded Interaction Framework should be evaluated by its usefulness in guiding reflection, shaping design decisions, surfacing cultural tensions, and supporting richer explanations of engagement. Future validation should prioritise contextual, socio-technical inquiry over metric-driven evaluation.

Future work can pursue several complementary pathways that align with Research through Design [106], Research-Informed Design [80], and established framework-refinement practices in HCI [84, 101]. First, participatory and co-design studies can use the framework as a structuring device within Research-Informed Design processes. Building on established HCI traditions of participatory design or community based participatory research with marginalised communities [49, 85], facilitators can incorporate the five dimensions into activities such as card sorting, scenario building, journey mapping, and speculative prototyping. Working with CALD women, family members, and cultural brokers, these sessions can examine whether the dimensions effectively support participants in articulating cultural needs, relational responsibilities, emotional barriers, and temporal rhythms that are often flattened in conventional requirements-gathering or behaviour-change surveys. Within a Research-Informed Design workflow [80], the framework becomes a generative scaffold: it shapes design conversations, focuses the interpretation of qualitative insights, and orients ideation toward culturally embedded interaction mechanisms.

Second, the framework can be applied as a heuristic and analytic lens within Research through Design cycles [106] for evaluating existing or newly developed digital interventions [72]. In this evaluative mode, the five dimensions provide high-level prompts that draw evaluators' attention to cultural mechanisms often overlooked in conventional assessments of digital health systems and can help identify where culturally embedded interaction is present, partial, or absent, and how such gaps may help explain patterns of uptake, appropriation, or attrition. As a pathway for future validation, the framework can be applied when reviewing existing PA technologies or evaluating early design concepts to see whether it reveals cultural blind spots or mismatches that would otherwise be missed.

Third, longitudinal qualitative studies can examine how designs informed by the framework sustain engagement over time [13, 45, 105]. Integrating the framework into a full Research through Design cycle involves using it to guide prototype development, deploying these prototypes in real-world contexts, and iteratively refining both the artefacts and the framework itself as misalignments emerge between expected and observed practices [106]. As a concrete validation pathway, the framework could be applied to guide the design of a small prototype or a revised feature, which is then deployed for several weeks with CALD women. By following participants' evolving interactions, reflections, and adaptations

across this period, researchers can assess whether elements derived from the five dimensions influence durability of use, perceived cultural fit, or ongoing motivation.

Given the situated and heterogeneous nature of cultural practices, validation should rely on context-specific deployments rather than attempts at universal generalisation [11, 27, 28, 88].

4.4 Recommendations: Design Implications for HCI Research

The Culturally Embedded Interaction Framework provides a theoretical strategy for resolving the design paradox. Here, we translate its five dimensions into four core design implications, actionable guiding principles for researchers and practitioners to create design choices for digital PA interventions targeting CALD women (Appendix E).

Implication 1: Design for Temporal Fluidity and Long-Term Maintenance. The framework calls for a shift from designing time-bounded interventions toward creating socio-technical infrastructures that can accommodate the fluctuating temporalities of users' lives. This reframing positions maintenance not as a post-intervention add-on but as an organising principle that shapes how a system evolves with users over months or years.

Digital interventions require embedding ongoing low-burden, long-term scaffolding mechanisms such as stage-tailored messages, adaptive feedback loops, and periodic check-ins that sustain motivation without overwhelming users. This perspective foregrounds the idea that long-term engagement is sustained not through escalating demands but through infrastructures that remain present, adaptable, and culturally resonant over time.

For HCI research, this implies treating temporality itself as a core design material, one that requires attention to the durability, adaptability, and cultural pacing of digital systems, rather than their short-term behavioural effects.

Implication 2: Embed Behavioural Theory into Interaction Features. Across the reviewed studies, behavioural theories such as SCT and TTM were frequently cited, but they rarely shaped the actual interaction design. In most interventions, theory served as a conceptual justification rather than a driver of specific features, resulting in limited cultural relevance and weak long-term engagement. Here, interaction features refer to the concrete system behaviours, such as prompts, feedback loops, goal-setting mechanisms, or social reinforcement pathways, through which users experience and enact behaviour-change processes.

For HCI, this signals the need to shift from referencing theory to translating theory into culturally aligned interaction patterns. Constructs such as readiness, self-efficacy, social reinforcement, and habit formation cannot be implemented as universal mechanisms; they must be adapted to the cultural contexts in which behaviour change unfolds. For example, confidence may be individually framed in some populations yet relationally or collectively constructed in others; likewise, the motivational force of goals or feedback depends on how responsibility, obligation, and encouragement are culturally understood.

This reorientation positions theory as a practical design resource rather than a static citation, enabling digital PA systems to support

behaviour change that is both theoretically grounded and culturally resonant.

Implication 3: Rethink the Role of Social Support. Evidence from the corpus indicates that presuming the existence of supportive, high-activity networks leads to fragile social features that fail in low-energy social contexts [22, 92]. This pattern echoes prior HCI evidence showing that social features, such as sharing or social comparison, do not motivate all users uniformly; while they can support already engaged individuals, others experience pressure or reduced motivation, highlighting the need for personalised rather than generic social mechanisms [62, 69].

By contrast, studies that engaged trusted intermediaries, such as promotoras, bilingual coaches, or community advisory boards, demonstrated stronger cultural resonance and acceptability [10, 71, 89]. In these programmes, social support was not assumed to emerge organically from peer networks but was deliberately mediated through actors who understood participants' language, cultural norms, and everyday constraints.

For HCI, these findings suggest that social support should transition from a supplemental feature to a crucial layer of digital systems. Embedding mechanisms that activate family participation, integrate culturally trusted mediators, and provide alternatives when networks are inactive can ensure that support is both sustainable and culturally resonant.

Implication 4: Design for cultural pluralism, not cultural generalisation. Recent evidence highlights that cultural adaptation in DHIs should be viewed as an iterative, resource-intensive process that requires a clear definition of the focal cultural group from the outset [73]. Our corpus reinforces this point: while family involvement strengthened PA engagement among Latina women [57, 64], it acted as a barrier for Korean women who were already overburdened by caregiving duties [22, 92]. Chinese and multiethnic Asian participants, in contrast, emphasised the importance of community trust, contextual usability, and culturally appropriate delivery channels [21, 71].

These divergent patterns highlight that cultural adaptation cannot be assumed or generalised; it should be co-constructed and co-designed with users. Culturally sensitive DHIs require continuous user involvement, careful prioritisation of relevant features, and participatory methods that embed lived experiences into design from the very beginning. Without such approaches, interventions risk reinforcing the very inequities they aim to address.

5 Limitations and Future Works

This scoping review followed the PRISMA-ScR guidelines [97] to systematically map and synthesise the landscape of digital PA interventions for culturally and linguistically diverse women. While this methodological approach ensured rigour and transparency, the interpretation of our findings must be contextualised within the inherent constraints of the available literature.

The most significant limitation lies in the geographical and cultural narrowness of the existing evidence base. The majority of included studies were conducted in the United States and focused on a limited number of cultural groups, predominantly Latina women. Consequently, our synthesis and the design paradox it identifies are

inherently shaped by the experiences of specific ethnic minorities within a particular national context. The generalisability of our framework to CALD women in other English-speaking countries requires further empirical validation and cannot be assumed.

Furthermore, although our inclusive scope captured a diversity of study designs and digital modalities, the variety of the 18-study corpus limited opportunities for systematic comparison or meta-analysis. Most studies demonstrated efficacy in short-term activity metrics (e.g., daily steps, MVPA) but offered limited evidence concerning sustained engagement or profound cultural adaptation. This observation aligns with our core critique of surface-level localisation: the literature itself frequently lacks the granular design detail necessary to isolate the active ingredients of success beyond a conceptual level.

These limitations define an opportunity for future HCI research. First, there is a critical need to validate and refine the proposed framework across more diverse geographical and cultural contexts to establish its broader utility and boundaries. Second, the field should prioritise longitudinal, theory-driven research that explicitly centres sustained engagement as a primary outcome and provides detailed accounts of how cultural adaptation is translated into concrete interaction design decisions. Finally, rather than pursuing over-generalised solutions, we call for researchers to adopt participatory [39, 84] and co-design approaches [77, 95] that prioritise cultural specificity and contextual depth. Methods such as cultural transcreation workshops [70], scenario-based prototyping [20], and interactive walkthroughs can help translate abstract design principles into situated, culturally resonant strategies. These approaches enable stakeholders to collaboratively map cultural values, social roles, and behavioural motivators into concrete digital interaction patterns [102]. This pathway prioritises depth, long-term sustainability, and cultural resonance over scalability alone, thereby offering a more robust and equitable direction for digital health design.

Looking ahead, this commitment to deep cultural embedding invites a critical examination of emerging technologies, particularly artificial intelligence (AI), which is often promoted for its scalability and personalization capabilities [35, 87]. While AI holds potential for delivering adaptive, highly tailored interventions, these capabilities raise significant ethical considerations [32, 91], including data privacy, algorithmic bias, cultural misclassification, and digital surveillance for marginalised populations. Therefore, any future research in this vein must be coupled with rigorous ethical frameworks and participatory design to ensure equity and trust.

6 Conclusion

This scoping review has identified a fundamental design paradox at the heart of digital PA interventions for CALD women: technosolutionist features tend to ignore complex socio-cultural contexts, while pro-social features often fail in low-activity networks. We have argued that this paradox is a structural outcome of a dominant surface-localisation paradigm that reduces culture to a set of barriers to be overcome. In response, we contributed the Culturally Embedded Interaction Framework, a mid-range design framework comprising five dimensions to guide the creation of socio-technical systems that support long-term cultural pluralism. By translating

this framework into actionable design implications, we provide HCI researchers and practitioners with a principled path to move beyond one-size-fits-all accessibility and toward genuinely sustaining, equitable, and culturally resonant design.

Acknowledgments

Generative AI tools were used at the paragraph level to improve the readability of text originally envisioned and written by the authors. All content, arguments, and conclusions are the authors' own, and the authors take full responsibility for the final manuscript. This work is partially supported by the University of Auckland Faculty of Science Research Development Fund Grant Number 3731533.

References

- [1] José Abdelnour-Nocera and Torkil Clemmensen. 2018. Theorizing about socio-technical approaches to HCI. In *IFIP Working Conference on Human Work Interaction Design*. Springer, 242–262.
- [2] Hilary Arksey and Lisa O'malley. 2005. Scoping studies: towards a methodological framework. *International journal of social research methodology* 8, 1 (2005), 19–32.
- [3] Theophilus Azungah. 2018. Qualitative research: deductive and inductive approaches to data analysis. *Qualitative research journal* 18, 4 (2018), 383–400.
- [4] Albert Bandura. 1991. Social cognitive theory of self-regulation. *Organizational behavior and human decision processes* 50, 2 (1991), 248–287.
- [5] Jeffrey Bardzell and Shaowen Bardzell. 2013. What is "critical" about critical design?. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 3297–3306.
- [6] Shaowen Bardzell. 2010. Feminist HCI: taking stock and outlining an agenda for design. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 1301–1310.
- [7] Cynthia M Baseman, Seka M Dembure, and Rosa I Arriaga. 2025. "We Have to Be Advocates for Ourselves": A Social-Ecological Approach to Mobile Health Design with Black Older Adults Living with Diabetes. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*. 1–17.
- [8] Melinda S. Bender, Suzanna Martinez, and Christine Kennedy. 2016. Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinos: A Qualitative Study. *Journal of Transcultural Nursing* 27, 4 (July 2016), 420–428. doi:10.1177/1043659614565249
- [9] Tanya J. Benitez, Andrea L. Cherrington, Rodney P. Joseph, Colleen Keller, Bess Marcus, Karen Meneses, Becky Marquez, and Dorothy Pekmezi. 2015. Using Web-Based Technology to Promote Physical Activity in Latinas: Results of the Muévete Alabama Pilot Study. *CIN: Computers, Informatics, Nursing* 33, 7 (July 2015), 315–324. doi:10.1097/cin.0000000000000162
- [10] Tanya J. Benitez, Shira I. Dunsiger, Dori J. Pekmezi, Britta A. Larsen, Andrea S. Mendoza-Vasconez, Sarah E. Linke, Beth C. Bock, Kim M. Gans, Sheri J. Hartman, and Bess H. Marcus. 2020. Design and Rationale for a Randomized Trial of a Theory- and Technology- Enhanced Physical Activity Intervention for Latinas: The Seamos Activas II Study. *Contemporary clinical trials* 96 (Sept. 2020), 106081. doi:10.1016/j.cct.2020.106081
- [11] Guillermo Bernal, María I Jiménez-Chafey, and Melanie M Domenech Rodríguez. 2009. Cultural adaptation of treatments: A resource for considering culture in evidence-based practice. *Professional Psychology: Research and Practice* 40, 4 (2009), 361.
- [12] Debra L Blackwell, Jacqueline W Lucas, and Tainya C Clarke. 2014. Summary health statistics for US adults: national health interview survey, 2012. *Vital and health statistics. Series 10, Data from the National Health Survey* 260 (2014), 1–161.
- [13] Eli Blevis. 2007. Sustainable interaction design: invention & disposal, renewal & reuse. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. 503–512.
- [14] Ilse Bignault, HEND Saab, Hanan Youssef, Heba Baddah, Klara Giourgas, and Lisa Woodland. 2023. "It is definitely a good program for everyone from every community": a qualitative study of community partner perspectives on the culturally and linguistically diverse (CALD) mindfulness program. *International Journal of Environmental Research and Public Health* 20, 16 (2023), 6608.
- [15] Peter Bragge, Ornella Clavisi, Tari Turner, Emma Tavender, Alex Collie, and Russell L Gruen. 2011. The global evidence mapping initiative: scoping research in broad topic areas. *BMC medical research methodology* 11, 1 (2011), 92.
- [16] Virginia Braun and Victoria Clarke. 2006. Using Thematic Analysis in Psychology. *Qualitative Research in Psychology* 3, 2 (Jan. 2006), 77–101. doi:10.1191/1478088706qp063oa

- [17] Ferran Calabuig-Moreno, María Huertas González-Serrano, Javier Fombona, and Marta García-Tascón. 2020. The emergence of technology in physical education: A general bibliometric analysis with a focus on virtual and augmented reality. *Sustainability* 12, 7 (2020), 2728.
- [18] Cristina M Caperchione, Gregory S Kolt, and W Kerry Mummery. 2013. Examining physical activity service provision to culturally and linguistically diverse (CALD) communities in Australia: a qualitative evaluation. *PLoS one* 8, 4 (2013), e62777.
- [19] Cristina M Caperchione, Gregory S Kolt, Rebeka Tennent, and W Kerry Mummery. 2011. Physical activity behaviours of Culturally and Linguistically Diverse (CALD) women living in Australia: a qualitative study of socio-cultural influences. *BMC public health* 11, 1 (2011), 26.
- [20] John M Carroll. 1997. Scenario-based design. In *Handbook of human-computer interaction*. Elsevier, 383–406.
- [21] Wonshik Chee, Sangmi Kim, Tsung-Lan Chu, Hsiu-Min Tsai, Xiaopeng Ji, Jingwen Zhang, Eunice Chee, and Eun-Ok Im. 2016. Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study. *Journal of Medical Internet Research* 18, 11 (Nov. 2016), e303. doi:10.2196/jmir.6454
- [22] JiWon Choi, Nah-Mee Shin, Bruce Cooper, Jane Jih, and Tsoh Janice. 2021. A Pilot Study to Promote Active Living among Physically Inactive Korean American Women. *Journal of Community Health Nursing* 38, 1 (2021), 24–37. doi:10.1080/07370016.2021.1869420
- [23] Tracie C. Collins, Liuqiang Lu, M. Gabriela Valverde, M. Ximena Silva, and Deborah Parra-Medina. 2019. Efficacy of a Multi-Component Intervention to Promote Physical Activity among Latino Adults: A Randomized Controlled Trial. *Preventive Medicine Reports* 16 (Dec. 2019), 100965. doi:10.1016/j.pmedr.2019.100965
- [24] Lauren Connell Bohlen, Shira I Dunsiger, Tayla Von Ash, Britta A Larsen, Dori Pekmezi, Becky Marquez, Tanya J Benitez, Andrea Mendoza-Vasconez, Sheri J Hartman, David M Williams, and Bess H Marcus. 2024. Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial. *Journal of Medical Internet Research* 26 (June 2024), e51708. doi:10.2196/51708
- [25] Carl DiSalvo, Phoebe Sengers, and Hrönn Brynjarsdóttir. 2010. Mapping the landscape of sustainable HCI. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 1975–1984.
- [26] Israel Júnior Borges do Nascimento, Hebatullah Mohamed Abdulazeem, Ishanka Weerasekera, Jodie Marquez, Lenny T Vasanthan, Genevieve Deeken, Rosemary Morgan, Heang-Lee Tan, Isabel Yordi Aguirre, Lasse Østeengaard, et al. 2025. Transforming women's health, empowerment, and gender equality with digital health: evidence-based policy and practice. *The Lancet Digital Health* (2025).
- [27] Lynn Dombrowski, Ellie Harmon, and Sarah Fox. 2016. Social justice-oriented interaction design: Outlining key design strategies and commitments. In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems*. 656–671.
- [28] Paul Dourish. 2006. Implications for design. In *Proceedings of the SIGCHI conference on Human Factors in computing systems*. 541–550.
- [29] Aymen El Masri, Gregory S Kolt, and Emma S George. 2022. Physical activity interventions among culturally and linguistically diverse populations: a systematic review. *Ethnicity & Health* 27, 1 (2022), 40–60.
- [30] Sarah Elshahat, Tina Moffat, Mahira Morshed, Haneen Alkhalaf, Keon Madani, Aya Mohamed, Naya Nadeem, Sara Emira, K. Bruce Newbold, and Michael Donnelly. 2023. A Scoping Review of the Relationship Between Physical Activity and Mental Health Among Immigrants in Western Countries: An Integrated Bio-Psycho-Socio-Cultural Lens. *Journal of Immigrant and Minority Health* 25, 5 (Oct. 2023), 1137–1151. doi:10.1007/s10903-023-01518-w
- [31] Daniel Fallman. 2003. Design-oriented human-computer interaction. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. 225–232.
- [32] Dariush D Farhud and Shaghayegh Zokaei. 2021. Ethical issues of artificial intelligence in medicine and healthcare. *Iranian journal of public health* 50, 11 (2021), i.
- [33] Caroline A Figueroa, Tiffany Luo, Adrian Aguilera, and Courtney R Lyles. 2021. The need for feminist intersectionality in digital health. *The Lancet Digital Health* 3, 8 (2021), e526–e533.
- [34] Caroline A. Figueroa, Tiffany C. Luo, Andrea Jacobo, Alan Munoz, Minx Manuel, David Chan, John Canny, and Adrian Aguilera. 2021. Conversational Physical Activity Coaches for Spanish and English Speaking Women: A User Design Study. *Frontiers in Digital Health* 3 (Oct. 2021). doi:10.3389/fdgh.2021.747153
- [35] Rushiraj Gadhvi, Soham Petkar, Priyansh Pankaj Kumar Desai, Shreyas Ramachandran, and Siddharth Siddharth. 2025. AdaptAI: A Personalized Solution to Sense Your Stress, Fix Your Mess, and Boost Productivity. In *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*. 1–12.
- [36] Sophie Grimme, Susanna Marie Spoerl, Susanne Boll, and Marion Koelle. 2024. My data, my choice, my insights: women's requirements when collecting, interpreting and sharing their personal health data. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems*. 1–18.
- [37] Marco Hafner, Jack Pollard, and Christian Van Stolk. 2020. Incentives and physical activity: An assessment of the association between Vitality's Active Rewards with Apple Watch benefit and sustained physical activity improvements. *RAND Health Quarterly* 9, 1 (2020), 4.
- [38] Benjamin H Han, Tina Sadarangani, Laura C Wyatt, Jennifer M Zanowski, Simona C Kwon, Chau Trinh-Shevrin, Linda Lee, and Nadia S Islam. 2016. Correlates of Physical Activity Among Middle-Aged and Older Korean Americans at Risk for Diabetes. *Journal of Nursing Scholarship* 48, 1 (2016), 48–57.
- [39] Christina Harrington, Sheena Erete, and Anne Marie Piper. 2019. Deconstructing community-based collaborative design: Towards more equitable participatory design engagements. *Proceedings of the ACM on human-computer interaction* 3, CSCW (2019), 1–25.
- [40] Gayanika Hettiarachchi Senarath, Pari Delir Haghghi, Denise O'Connor, David Snowdon, and Velandai Srikanth. 2022. Planning digital health interventions: Digital collection of patient-reported measures from older adults. In *Proceedings of the 2022 Australasian Computer Science Week (Brisbane, Australia) (ACSW '22)*. Association for Computing Machinery, New York, NY, USA, 250–253. doi:10.1145/3511616.3513126
- [41] Quan Nha Hong, Pierre Pluye, Mathieu Bujold, and Maggy Wassef. 2017. Convergent and sequential synthesis designs: implications for conducting and reporting systematic reviews of qualitative and quantitative evidence. *Systematic reviews* 6, 1 (2017), 61.
- [42] Kristina Höök and Jonas Löwgren. 2012. Strong concepts: Intermediate-level knowledge in interaction design research. *ACM Transactions on Computer-Human Interaction (TOCHI)* 19, 3 (2012), 1–18.
- [43] Tanya Horsley, Orvie Dingwall, and Margaret Sampson. 2011. Checking reference lists to find additional studies for systematic reviews. *Cochrane database of systematic reviews* 8 (2011).
- [44] Lilly Irani, Janet Vertesi, Paul Dourish, Kavita Philip, and Rebecca E Grinter. 2010. Postcolonial computing: a lens on design and development. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 1311–1320.
- [45] Sven Erik Johansson, Boinkum Benson Konlaan, and Lars Olov Bygren. 2001. Sustaining habits of attending cultural events and maintenance of health: a longitudinal study. *Health promotion international* 16, 3 (2001), 229–234.
- [46] Os Keyes, Burren Peil, Rua M Williams, and Katta Spiel. 2020. Reimagining (women's) health: HCI, gender and essentialised embodiment. *ACM Transactions on Computer-Human Interaction (TOCHI)* 27, 4 (2020), 1–42.
- [47] Young Yun Kim. 2017. Cross-cultural adaptation. *Oxford research encyclopedia of communication* (2017).
- [48] Whitney-Jocelyn Kouaho and Daniel A. Epstein. 2024. Socioeconomic Class in Physical Activity Wearables Research and Design. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems (Honolulu, HI, USA) (CHI '24)*. Association for Computing Machinery, New York, NY, USA, Article 873, 15 pages. doi:10.1145/3613904.3642789
- [49] Calvin A Liang, Sean A Munson, and Julie A Kientz. 2021. Embracing four tensions in human-computer interaction research with marginalized people. *ACM Transactions on Computer-Human Interaction (TOCHI)* 28, 2 (2021), 1–47.
- [50] Renny Lindberg, Jungryul Seo, and Teemu H Laine. 2016. Enhancing physical education with exergames and wearable technology. *IEEE transactions on learning technologies* 9, 4 (2016), 328–341.
- [51] Sarah E. Linke, Shira I. Dunsiger, Kim M. Gans, Sheri J. Hartman, Dori Pekmezi, Britta A. Larsen, Andrea S. Mendoza-Vasconez, and Bess H. Marcus. 2019. Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas: Randomized Controlled Trial. *Journal of Medical Internet Research* 21, 7 (July 2019), e13063. doi:10.2196/13063
- [52] Cristina Lugones-Sanchez, Jose I Recio-Rodriguez, Cristina Agudo-Conde, Irene Repiso-Gento, Esther G Adalia, José Ignacio Ramirez-Manent, Maria Antonia Sanchez-Calavera, Emiliano Rodriguez-Sanchez, Manuel A Gomez-Marcos, Luis Garcia-Ortiz, et al. 2022. Long-term effectiveness of a smartphone app combined with a smart band on weight loss, physical activity, and caloric intake in a population with overweight and obesity (evident 3 study): randomized controlled trial. *Journal of medical Internet research* 24, 2 (2022), e30416.
- [53] Deborah Lupton. 2015. Quantified sex: a critical analysis of sexual and reproductive self-tracking using apps. *Culture, health & sexuality* 17, 4 (2015), 440–453.
- [54] Ben D Ma, Sai Leung Ng, Tim Schwanen, John Zacharias, Mudi Zhou, Ichiro Kawachi, and Guibo Sun. 2018. Pokémon GO and physical activity in Asia: multilevel study. *Journal of medical Internet research* 20, 6 (2018), e217.
- [55] Susanne Mak and Aliko Thomas. 2022. Steps for conducting a scoping review. *Journal of graduate medical education* 14, 5 (2022), 565–567.
- [56] Ji-Ye Mao, Karel Vredenburg, Paul W Smith, and Tom Carey. 2005. The state of user-centered design practice. *Commun. ACM* 48, 3 (2005), 105–109.
- [57] Bess H. Marcus, Shira Dunsiger, Dorothy Pekmezi, Tanya Benitez, Britta Larsen, and Dawn Meyer. 2022. Physical Activity Outcomes from a Randomized Trial of a Theory- and Technology-Enhanced Intervention for Latinas: The Seamos Activas II Study. *Journal of Behavioral Medicine* 45, 1 (Feb. 2022), 1–13. doi:10.1007/s10865-021-00246-6

- [58] Bess H Marcus, Sheri J Hartman, Britta A Larsen, Dori Pekmezi, Shira I Dunsiger, Sarah Linke, Becky Marquez, Kim M Gans, Beth C Bock, Andrea S Mendoza-Vasconez, et al. 2016. Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas. *International Journal of Behavioral Nutrition and Physical Activity* 13, 1 (2016), 62.
- [59] Bess H. Marcus, Sheri J. Hartman, Dori Pekmezi, Shira I. Dunsiger, Sarah Linke, Becky Marquez, Kim M. Gans, Beth C. Bock, Britta A. Larsen, and Carlos Rojas. 2015. Using Interactive Internet Technology to Promote Physical Activity in Latinas: Rationale, Design, and Baseline Findings of Pasos Hacia La Salud. *Contemporary clinical trials* 44 (Sept. 2015), 149–158. doi:10.1016/j.cct.2015.08.004
- [60] Bess H. Marcus, Britta A. Larsen, Sarah E. Linke, Sheri J. Hartman, Dori Pekmezi, Tanya Benitez, James Sallis, Andrea S. Mendoza-Vasconez, and Shira I. Dunsiger. 2021. Long-Term Physical Activity Outcomes in the Seamos Activas II Trial. *Preventive Medicine Reports* 24 (Dec. 2021), 101628. doi:10.1016/j.pmedr.2021.101628
- [61] Kanchan Marcus, Madhan Balasubramanian, Stephanie Short, and Woosung Sohn. 2022. Culturally and linguistically diverse (CALD): terminology and standards in reducing healthcare inequalities. *Australian and New Zealand Journal of Public Health* 46, 1 (2022), 7–9.
- [62] Elaine Massung, David Coyle, Kirsten F Cater, Marc Jay, and Chris Preist. 2013. Using crowdsourcing to support pro-environmental community activism. In *Proceedings of the SIGCHI Conference on human factors in Computing systems*. 371–380.
- [63] Simon C Mathews, Michael J McShea, Casey L Hanley, Alan Ravitz, Alain B Labrique, and Adam B Cohen. 2019. Digital health: a path to validation. *NPJ digital medicine* 2, 1 (2019), 38.
- [64] Andrea S. Mendoza-Vasconez, Esther Solis Becerra, Nathaniel Badii, Noe. Crespo, Samantha. Hurst, Britta. Larsen, Bess H. Marcus, and Elva M. Arredondo. 2022. Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study. *Translational journal of the American College of Sports Medicine* 7, 1 (2022), e000188. doi:10.1249/tjx.0000000000000188
- [65] Jed Montayre, Stephen Neville, Ihaka Dunn, Jagamaya Shrestha-Ranjit, and Valerie Wright-St. Clair. 2020. What Makes Community-based Physical Activity Programs for Culturally and Linguistically Diverse Older Adults Effective? A Systematic Review. *Australasian Journal on Ageing* 39, 4 (Dec. 2020), 331–340. doi:10.1111/ajag.12815
- [66] Evgeny Morozov. 2013. To save everything, click here: The folly of technological solutionism. PublicAffairs.
- [67] Evgeny Morozov. 2014. To save everything, click here: the folly of technological solutionism. *J. Inf. Policy* 4, 2014 (2014), 173–175.
- [68] Zachary Munn, Micah DJ Peters, Cindy Stern, Catalin Tufanaru, Alexa McArthur, and Edoardo Aromataris. 2018. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC medical research methodology* 18, 1 (2018), 143.
- [69] Sean A Munson and Sunny Consolvo. 2012. Exploring goal-setting, rewards, self-monitoring, and sharing to motivate physical activity. In *2012 6th international conference on pervasive computing technologies for healthcare (pervasivehealth) and workshops*. IEEE, 25–32.
- [70] Aila Naderbagi, Victoria Loblay, Iqthyer Uddin Md Zahed, Mahalakshmi Ekambareshwar, Adam Poulsen, Yun JC Song, Laura Ospina-Pinillos, Michael Krausz, Mostafa Mamdouh Kamel, Ian B Hickie, et al. 2024. Cultural and contextual adaptation of digital health interventions: narrative review. *Journal of medical Internet research* 26 (2024), e55130.
- [71] Antony Nguyen, Filmer Yu, Linda G Park, Yoshimi Fukuoka, Ching Wong, Ginny Gildengorin, Tung T Nguyen, Janice Y Tsoh, and Jane Jih. 2024. An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans: Single-Arm Intervention Study. *JMIR Formative Research* 8 (June 2024), e56373. doi:10.2196/56373
- [72] Jakob Nielsen. 1995. How to conduct a heuristic evaluation. *Nielsen Norman Group* 1, 1 (1995), 8.
- [73] Vasileios Nittas, Paola Daniore, Sarah J Chavez, and Tyler B Wray. 2024. Challenges in implementing cultural adaptations of digital health interventions. *Communications medicine* 4, 1 (2024), 7.
- [74] Laleh Nourian, Vinaya Hanumant Naikar, Kristen Shinohara, and Garreth W Tigwell. 2025. Investigating the Intersection of Cultural Design Preferences and Web Accessibility Guidelines with Designers from the Global South. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*. 1–19.
- [75] Téa O'Driscoll, Lauren Kate Banting, Erika Borkoles, Rochelle Eime, and Remco Polman. 2014. A Systematic Literature Review of Sport and Physical Activity Participation in Culturally and Linguistically Diverse (CALD) Migrant Populations. *Journal of Immigrant and Minority Health* 16, 3 (June 2014), 515–530. doi:10.1007/s10903-013-9857-x
- [76] Mourad Ouzzani, Hossam Hammady, Zbys Fedorowicz, and Ahmed Elmagarmid. 2016. Rayyan—a web and mobile app for systematic reviews. *Systematic reviews* 5, 1 (2016), 210.
- [77] Siiri Paananen. 2024. Co-Designing Interactive Technologies for Cultural Heritage Contexts - Creating and Evaluating Interactive Museum Experiences. In *Proceedings of the International Conference on Mobile and Ubiquitous Multimedia (MUM '24)*. Association for Computing Machinery, New York, NY, USA, 549–551. doi:10.1145/3701571.3703597
- [78] Latha P Palaniappan, Eric C Wong, Jessica J Shin, Stephen P Fortmann, and Diane S Lauderdale. 2011. Asian Americans have greater prevalence of metabolic syndrome despite lower body mass index. *International journal of obesity* 35, 3 (2011), 393–400.
- [79] Chrysanthi Papoutsis, Joseph Wherton, Sara Shaw, Clare Morrison, and Trisha Greenhalgh. 2021. Putting the social back into sociotechnical: case studies of co-design in digital health. *Journal of the American Medical Informatics Association* 28, 2 (2021), 284–293.
- [80] Erin Peavey and Kiley B Vander Wyst. 2017. Evidence-based design and research-informed design: What's the difference? Conceptual definitions and comparative analysis. *HERD: Health Environments Research & Design Journal* 10, 5 (2017), 143–156.
- [81] Micah DJ Peters, Casey Marnie, Heather Colquhoun, Chantelle M Garritty, Susanne Hempel, Tanya Horsley, Etienne V Langlois, Erin Lillie, Kelly K O'Brien, et al. 2021. Scoping reviews: reinforcing and advancing the methodology and application. *Systematic reviews* 10, 1 (2021), 263.
- [82] Thi Thu Le Pham, Janneke Berecki-Gisolf, Angela Clapperton, Kerry S. O'Brien, Sara Liu, and Katharine Gibson. 2021. Definitions of Culturally and Linguistically Diverse (CALD): A Literature Review of Epidemiological Research in Australia. *International Journal of Environmental Research and Public Health* 18, 2 (Jan. 2021), 737. doi:10.3390/ijerph18020737
- [83] James O Prochaska and Wayne F Velicer. 1997. The transtheoretical model of health behavior change. *American journal of health promotion* 12, 1 (1997), 38–48.
- [84] Xiang Qi and Junnan Yu. 2025. Participatory Design in Human-Computer Interaction: Cases, Characteristics, and Lessons. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*. Association for Computing Machinery, New York, NY, USA, Article 804, 26 pages. doi:10.1145/3706598.3713436
- [85] Robert Racadio, Emma J Rose, and Beth E Kolkko. 2014. Research at the margin: participatory design and community based participatory research. In *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts-Volume 2*. 49–52.
- [86] Reshmy Radhamony, Wendy M Cross, Louise Townsin, and Biswajit Banik. 2023. Perspectives of culturally and linguistically diverse (CALD) community members regarding mental health services: A qualitative analysis. *Journal of psychiatric and mental health nursing* 30, 4 (2023), 850–864.
- [87] Omid Rafieian and Hema Yoganarasimhan. 2023. AI and personalization. *Artificial intelligence in marketing* (2023), 77–102.
- [88] Ken Resnicow, Tom Baranowski, Jasjit S Ahluwalia, and Ronald L Braithwaite. 1999. Cultural sensitivity in public health: defined and demystified. *Ethnicity & disease* 9, 1 (1999), 10–21.
- [89] Sheri Rowland, Athena K Ramos, Natalia Trinidad, Sophia Quintero, Rebecca Johnson Beller, Leeza Struwe, and Bunny Pozehl. 2022. Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults: Descriptive Study. *JMIR Formative Research* 6, 12 (Dec. 2022), e40379. doi:10.2196/40379
- [90] Herman Saksono and Andrea G Parker. 2024. Socio-cognitive framework for personal informatics: A preliminary framework for socially-enabled health technologies. *ACM Transactions on Computer-Human Interaction* 31, 3 (2024), 1–41.
- [91] Marshall Schminke, Maureen L Ambrose, and Terry W Noel. 1997. The effect of ethical frameworks on perceptions of organizational justice. *Academy of Management Journal* 40, 5 (1997), 1190–1207.
- [92] Chanam Shin, Kyeung Mi Oh, Moonju Lee, Kyungeh An, and Jeongha Sim. 2022. A Technology-Enhanced Physical Activity Intervention: A Feasibility Study. *Clinical Nursing Research* 31, 7 (Sept. 2022), 1219–1224. doi:10.1177/10547738221102272
- [93] Robyn Smith, Ramón Spaaij, and Brent McDonald. 2019. Migrant integration and cultural capital in the context of sport and physical activity: A systematic review. *Journal of international migration and integration* 20, 3 (2019), 851–868.
- [94] Kerstin Spanhel, Sumeyye Balci, Felicitas Feldhahn, Juergen Bengel, Harald Baumeister, and Lasse B Sander. 2021. Cultural adaptation of internet- and mobile-based interventions for mental disorders: a systematic review. *NPJ digital medicine* 4, 1 (2021), 128.
- [95] Marc Steen, Menno Manschot, and Nicole De Koning. 2011. Benefits of co-design in service design projects. *International journal of design* 5, 2 (2011).
- [96] Elizabeth Stowell, Mercedes C Lyson, Herman Saksono, Renée C Wurth, Holly Jimison, Misha Pavel, and Andrea G Parker. 2018. Designing and evaluating mHealth interventions for vulnerable populations: A systematic review. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–17.

- [97] Andrea C Tricco, Erin Lillie, Wasifa Zarin, Kelly K O'Brien, Heather Colquhoun, Danielle Levac, David Moher, Micah DJ Peters, Tanya Horsley, Laura Weeks, et al. 2018. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of internal medicine* 169, 7 (2018), 467–473.
- [98] Amir Valizadeh, Mana Moassefi, Amin Nakhostin-Ansari, Seyed Hossein Hosseini Asl, Mehrnush Saghab Torbati, Reyhaneh Aghajani, Zahra Maleki Ghorbani, and Shahriar Faghani. 2022. Abstract screening using the automated tool Rayyan: results of effectiveness in three diagnostic test accuracy systematic reviews. *BMC Medical Research Methodology* 22, 1 (2022), 160.
- [99] JAGM Van Dijk. 2008. The digital divide in Europe. *The handbook of Internet politics* (2008).
- [100] Tayla von Ash, Shira I. Dunsiger, David M. Williams, Britta A. Larsen, Lauren Connell Bohlen, Dori Pekmezi, Andrea S. Mendoza-Vasconez, Tanya J. Benitez, Beth C. Bock, Sheri J. Hartman, Becky Marquez, and Bess H. Marcus. 2024. Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas. *American Journal of Preventive Medicine* 67, 2 (Aug. 2024), 220–230. doi:10.1016/j.amepre.2024.03.006
- [101] Alex Waddell, Joshua Paolo Seguin, Ling Wu, Peta Stragalinos, Joe Wherton, Jessica L Watterson, Christopher Owen Prawira, Patrick Olivier, Victoria Manning, Dan Lubman, et al. 2024. Leveraging implementation science in human-centred design for digital health. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems*. 1–17.
- [102] Eliza Watson, Hannah Gulline, Stephen M Jane, Anne Woollett, and Darshini Aytton. 2025. Improving participation of culturally and linguistically diverse participants in clinical trials: an expert consultation. *Trials* 26, 1 (2025), 1–7.
- [103] Fern J. Webb, Lori Bilello, Joan Vaccaro, Ross Jones, Donna Neff, and Trudy Gailard. 2024. Community Engagement Strategies for Population Health Research with Culturally Diverse Adults. *Journal of Medicine, Surgery, and Public Health* 2 (April 2024), 100037. doi:10.1016/j.glmedi.2023.100037
- [104] Xuecong Xu, Xiang Yan, and Tawanna R Dillahunt. 2019. Reaching hard-to-reach populations: An analysis of survey recruitment methods. In *Companion Publication of the 2019 Conference on Computer Supported Cooperative Work and Social Computing*. 428–432.
- [105] Rayoung Yang, Mark W Newman, and Jodi Forlizzi. 2014. Making sustainability sustainable: challenges in the design of eco-interaction technologies. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 823–832.
- [106] John Zimmerman, Jodi Forlizzi, and Shelley Evenson. 2007. Research through design as a method for interaction design research in HCI. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. 493–502.

A Appendix A: The final search queries in the syntax of each database

Database	Query
PubMed	(((("immigrant" OR "migrant" OR "foreign-born" OR "newcomer" OR "asylum-seeking" OR "refugee" OR "CALD" OR "ethnic minority" OR "minority women" OR "racial minority" OR "international college student" OR "overseas student" OR "Asian" OR "East Asian" OR "South Asian" OR "Chinese American" OR "Asian immigrant" OR "first-generation immigrant" OR "culturally diverse" OR "ethnic women") AND ("women" OR "female")) AND ("digital intervention" OR "mobile health" OR "mHealth" OR "eHealth" OR "wearable" OR "app" OR "mobile application" OR "technology-based" OR "virtual reality" OR "augmented reality" OR "mixed reality" OR "extended reality" OR "XR" OR "digital health" OR "virtual environment" OR "gamified intervention" OR "digital game" OR "serious game")) AND ("physical activity" OR "exercise" OR "exercise participation" OR "active lifestyle" OR "fitness" OR "fitness engagement" OR "sport participation" OR "exergame" OR "physical activity socialization" OR "exergaming" OR "exercise game" OR "movement-based game" OR "sports game" OR "active play")
Scopus	TITLE-ABS-KEY (("immigrant" OR "migrant" OR "refugee" OR "CALD" OR "ethnic minority" OR "culturally diverse" OR "Asian" OR "East Asian" OR "South Asian" OR "Chinese" OR "Asian immigrant" OR "first-generation")) AND TITLE-ABS-KEY (("women" OR "female")) AND TITLE-ABS-KEY (("digital intervention" OR "mobile health" OR "mHealth" OR "eHealth" OR "wearable" OR "app" OR "mobile application" OR "digital health" OR "virtual reality" OR "augmented reality" OR "serious game" OR "exergame")) AND TITLE-ABS-KEY (("physical activity" OR "exercise" OR "fitness" OR "sport" OR "active lifestyle"))
Web of Science Core Collection	(((("immigrant" OR "migrant" OR "foreign-born" OR "newcomer" OR "asylum-seeking" OR "refugee" OR "CALD" OR "ethnic minority" OR "minority women" OR "racial minority" OR "international college student" OR "overseas student" OR "East Asian" OR "South Asian" OR "Chinese American" OR "Asian immigrant" OR "first-generation immigrant" OR "culturally diverse" OR "ethnic women") AND ("women" OR "female") AND ("digital intervention" OR "mobile health" OR "mHealth" OR "eHealth" OR "wearable" OR "app" OR "mobile application" OR "technology-based" OR "virtual reality" OR "augmented reality" OR "mixed reality" OR "extended reality" OR "XR" OR "digital health" OR "virtual environment" OR "gamified intervention" OR "digital game" OR "serious game") AND ("physical activity" OR "exercise" OR "exercise participation" OR "active lifestyle" OR "fitness" OR "fitness engagement" OR "sport participation" OR "exergame" OR "physical activity socialization" OR "exergaming" OR "exercise game" OR "movement-based game" OR "sports game" OR "active play"))
ACM Digital Library	[[All: "immigrant"] OR [All: "migrant"] OR [All: "foreign-born"] OR [All: "newcomer"] OR [All: "asylum-seeking"] OR [All: "refugee"] OR [All: "cauld"] OR [All: "ethnic minority"] OR [All: "minority women"] OR [All: "racial minority"] OR [All: "international college student"] OR [All: "overseas student"] OR [All: "asian"] OR [All: "east asian"] OR [All: "south asian"] OR [All: "chinese american"] OR [All: "asian immigrant"] OR [All: "first-generation immigrant"] OR [All: "culturally diverse"] OR [All: "ethnic women"]] AND [[All: "women"] OR [All: "female"]] AND [[All: "digital intervention"] OR [All: "mobile health"] OR [All: "mhealth"] OR [All: "ehealth"] OR [All: "wearable"] OR [All: "app"] OR [All: "mobile application"] OR [All: "technology-based"] OR [All: "virtual reality"] OR [All: "augmented reality"] OR [All: "mixed reality"] OR [All: "extended reality"] OR [All: "xr"] OR [All: "digital health"] OR [All: "virtual environment"] OR [All: "gamified intervention"] OR [All: "digital game"] OR [All: "serious game"]] AND [[All: "physical activity"] OR [All: "exercise"] OR [All: "exercise participation"] OR [All: "active lifestyle"] OR [All: "fitness"] OR [All: "fitness engagement"] OR [All: "sport participation"] OR [All: "exergame"] OR [All: "physical activity socialization"] OR [All: "exergaming"] OR [All: "exercise game"] OR [All: "movement-based game"] OR [All: "sports game"] OR [All: "active play"]]
IEEE Xplore Digital Library	("All Metadata": "immigrant" OR "All Metadata": "migrant" OR "All Metadata": "foreign-born" OR "All Metadata": "newcomer" OR "All Metadata": "asylum-seeking" OR "All Metadata": "refugee" OR "All Metadata": "CALD" OR "All Metadata": "ethnic minority" OR "All Metadata": "minority women" OR "All Metadata": "racial minority" OR "All Metadata": "international college student" OR "All Metadata": "overseas student" OR "All Metadata": "Asian" OR "All Metadata": "East Asian" OR "All Metadata": "South Asian" OR "All Metadata": "Chinese American" OR "All Metadata": "Asian immigrant" OR "All Metadata": "first-generation immigrant" OR "All Metadata": "culturally diverse" OR "All Metadata": "ethnic women") AND ("All Metadata": "women" OR "All Metadata": "female") AND ("All Metadata": "digital intervention" OR "All Metadata": "mobile health" OR "All Metadata": "mHealth" OR "All Metadata": "eHealth" OR "All Metadata": "wearable" OR "All Metadata": "app" OR "All Metadata": "mobile application" OR "All Metadata": "technology-based" OR "All Metadata": "virtual reality" OR "All Metadata": "augmented reality" OR "All Metadata": "mixed reality" OR "All Metadata": "extended reality" OR "All Metadata": "XR" OR "All Metadata": "digital health" OR "All Metadata": "virtual environment" OR "All Metadata": "gamified intervention" OR "All Metadata": "digital game" OR "All Metadata": "serious game") AND ("All Metadata": "physical activity" OR "All Metadata": "exercise" OR "All Metadata": "exercise participation" OR "All Metadata": "active lifestyle" OR "All Metadata": "fitness" OR "All Metadata": "fitness engagement" OR "All Metadata": "sport participation" OR "All Metadata": "exergame" OR "All Metadata": "physical activity socialization" OR "All Metadata": "exergaming" OR "All Metadata": "exercise game" OR "All Metadata": "movement-based game" OR "All Metadata": "sports game" OR "All Metadata": "active play")

B Appendix B: Characteristics of excluded studies

No.	Article	Reason for Exclusion	EC Category
1	"I Don't Need a Goal": Attitudes and Practices in Fitness Tracking beyond WEIRD User Groups	Not a PA-promoting digital intervention; examines tracking attitudes/practices only Not focused on CALD women in English-speaking contexts	EC3: Intervention Scope
2	"It's Great to Exercise Together on Zoom!": Understanding the Practices and Challenges of Live Stream Group Fitness Classes	Not a PA-promoting digital intervention; observational study of practices/challenges rather than an intervention; CALD women not a focal population	EC3: Intervention Scope
3	Access to health services among culturally and linguistically diverse populations in the Australian universal health care system: issues and challenges	Not a PA-promoting digital intervention; focuses on health-services access rather than physical activity	EC3: Intervention Scope EC2: Intervention Type
4	An Electronic Wellness Program to Improve Diet and Exercise in College Students: A Pilot Study	Digital intervention present but not CALD-women specific.	EC1: Population
5	Apps for IMproving FITness and Increasing Physical Activity Among Young People: The AIMFIT Pragmatic Randomized Controlled Trial	General youth sample; not women-focused; not CALD-focused	EC1: Population
6	Be Our Guest: Intercultural Heritage Exchange through Augmented Reality (AR)	AR learning/engagement study; no PA outcomes; no women/CALD focal subgroup	EC1: Population EC3: Intervention Scope
7	Better Supporting Human Aspects in Mobile eHealth Apps: Development and Validation of Enhanced Guidelines	Not a physical-activity-promoting digital intervention; not focused on adult CALD women	EC1: Population EC3: Intervention Scope
8	Breaking Barriers in Mobile Game Development	Not a physical-activity-promoting digital intervention; not focused on adult CALD women	EC1: Population EC3: Intervention Scope
9	Designing Leaderboards for Gamification: Perceived Differences Based on User Ranking, Application Domain, and Personality Traits	Generic gamification research; no PA outcomes; no CALD-women focus	EC1: Population EC3: Intervention Scope
10	Effect of Values and Technology Use on Exercise: Implications for Personalized Behavior Change Interventions	No intervention component; no CALD-women focus	EC1: Population EC3: Intervention Scope
11	Enhancing Psychosocial Constructs Associated with Technology-Based Physical Activity: A Randomized Trial Among African American Women	Participants are native-born, English-dominant racial minorities with no evidence of migration or refugee background and no non-English household language	EC1: Population
12	EquityWare: Co-Designing Wearables With And For Low Income Communities In The U.S.	Not a physical-activity-promoting digital intervention; population not specifically adult CALD women	EC1: Population EC3: Intervention Scope
13	Facilitators, motivations, and barriers to physical activity among Chinese American women	Not a PA-promoting digital intervention; examines facilitators/barriers rather than testing an intervention	EC3: Intervention Scope
14	From Solo to Social: Exploring the Dynamics of Player Cooperation in a Co-located Cooperative Exergame	Not a PA-promoting digital intervention; exploratory gameplay study rather than an intervention; not focused on adult CALD women	EC1: Population EC3: Intervention Scope
15	GPTCoach: Towards LLM-Based Physical Activity Coaching	Useful HCI context on LLM coaching; not CALD-women-focused	EC1: Population
16	Home-based walking intervention for middle-aged migrant women using 360-degree virtual videos and a wearable activity tracker: A mixed-methods pilot study	Study conducted outside Anglophone settings; participants do not meet the review's operational definition of CALD	EC1: Population
17	Just Dance: The Effects of Exergame Feedback and Controller Use on Physical Activity and Psychological Outcomes	Not a PA-promoting intervention for the target population; observational/experimental gameplay study rather than a designed PA program for adult CALD women	EC1: Population EC3: Intervention Scope
18	Media format matters: users' perceptions of physical versus digital games	Not a physical-activity-promoting digital intervention; not focused on adult CALD women	EC1: Population EC3: Intervention Scope
19	Physical and Augmented Reality based Playful Activities for Refresher Training of ASHA Workers in India	Training-focused AR system; no CALD-women target; no PA engagement/adherence outcomes	EC1: Population EC3: Intervention Scope
20	Ratings and experiences in using a mobile application to increase physical activity among university students: implications for future design	Population not aligned with review focus: not adult CALD wome	EC1: Population
21	Seek and Reflect: A Mobile Scavenger Hunt to Develop Community Engagement	Not a physical-activity-promoting digital intervention; focuses on community engagement/reflection rather than PA; not focused on adult CALD women	EC1: Population EC3: Intervention Scope
22	Smartphone apps to improve fitness and increase physical activity among young people: protocol of the Apps for IMproving FITness (AIMFIT) randomized controlled trial	General youth sample; not CALD-women focused; protocol paper without intervention results	EC1: Population EC5: Study Design
23	Social Virtual Reality as a Mental Health Tool: How People Use VRChat to Support Social Connectedness and Wellbeing	Not a physical-activity-promoting digital intervention; primary focus on mental health/social connectedness rather than PA	EC3: Intervention Scope EC4: Intervention Focus
24	Socio-Cultural Determinants of Physical Activity among Latin American Immigrant Women in Alberta, Canada	Not a digital, PA-promoting intervention; focuses on barriers/facilitators rather than testing an intervention	EC2: Intervention Type
25	Socioeconomic Class in Physical Activity Wearables Research and Design	Not a physical-activity-promoting digital intervention; not focused on adult CALD women	EC1: Population EC3: Intervention Scope
26	StepsBooster-S: A Culturally Tailored Step-Based Persuasive Application for Promoting Physical Activity	Conducted outside Anglophone immigrant contexts; participants are not CALD women living in English-speaking countries;	EC1: Population
27	That's the way I (dis-)like it! - Effect of Gamer Types and Competitiveness in VR Exergaming	Not a PA-promoting digital intervention for the target population	EC1: Population EC3: Intervention Scope

28	The Jade Gateway to Exergaming: How Socio-Cultural Factors Shape Exergaming Among East Asian Older Adults	Conducted outside Anglophone immigrant contexts; not a PA-promoting digital intervention; not focused on CALD women	EC1: Population EC3: Intervention Scope
29	A Mixed Methods Study on Engagement and Satisfaction with a Digitally-Enhanced Pilot Intervention Among African American and Hispanic Women	Sample does not demonstrate CALD/NESB status: participants were required to read and speak English; no evidence of non-English household language or migration/refugee background	EC1: Population
30	A Remote Health Coaching, Text-Based Walking Program in Ethnic Minority Primary Care Patients With Overweight and Obesity: Feasibility and Acceptability Pilot Study	Sample required English-speaking participants and "comfortable communicating in English"	EC1: Population

C Appendix C: Summary of Characteristics of Included Studies

	Summary of Included Studies	References				
		Authors/Publication Year/Titles	Relevant Interpretation			
			<table border="1"> <thead> <tr> <th>Research Location</th> <th>Population</th> </tr> </thead> </table>	Research Location	Population	
Research Location	Population					
Target Populations	Focus Populations: Focus populations: Women from Asian CALD backgrounds in the United States, with a particular emphasis on Korean American midlife women (n=4)	Choi 2021 <i>A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</i>	San Francisco Bay Area, California, United States	Physically inactive Korean American women, aged 40–69 years.		
		Chee 2016 <i>Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</i>	United States	Chinese and Korean American midlife women (typically aged 40–60 years), in good health, with internet access, and without current or prior medical or cardiovascular conditions.		
		Shin 2022 <i>A Technology-Enhanced Physical Activity Intervention: A Feasibility Study</i>	United States	Midlife Korean American women.		
		Nguyen 2024 <i>An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans</i>	San Francisco Bay Area, California, United States	Nineteen physically underactive Asian American adults (aged 25–70 years), of whom 88% (n = 11) were female; participants spoke Chinese (Mandarin/Cantonese), Tagalog, or Vietnamese.		
	Focus populations: Women from CALD backgrounds in the United States, with a predominant focus on Latina populations, particularly Spanish-speaking women (n=14)	Rowland 2022 <i>Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</i>	A rural agricultural region in Florida, United States	Seventy Hispanic/Latino adults (aged 19–65 years), both men and women, with the majority being female.		
		Figuerola 2021 <i>Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study</i>	Northern California, United States	Twenty-six low-income women (aged 18–65 years) residing in the United States, including 16 Spanish-speaking and 10 English-speaking participants, all physically inactive and from underserved communities.		
		Bender 2016 <i>Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinos: A Qualitative Study</i>	California, United States	Spanish-speaking Latino adults.		
		Collins 2019 <i>Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial</i>	Wichita, Kansas, United States	Latino adults.		
		Benitez 2021 <i>Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study</i>	San Diego County, California, United States	Latina women (aged 18–65 years), physically underactive (<60 minutes of MVPA per week).		
		Marcus 2022 <i>Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study</i>	San Diego County, California, United States	Underactive Latina women (aged 18–65 years), Spanish-speaking; approximately 89% were of Mexican/Mexican-American background.		
		Marcus 2021 <i>Long-term physical activity outcomes in the Seamos Activas II trial</i>	San Diego County, California, United States	Underactive Latina women (aged 18–65 years), Spanish-speaking.		
		Mendoza-Vasconez 2022 <i>Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study</i>	San Diego County, California, United States	Latina women.		
		Benitez 2016 <i>Using web-based technology to promote physical activity in Latinas: Results of the Muévete Alabama pilot study</i>	San Diego County, California, United States	Spanish-speaking Latina women who were physically underactive.		
		Marcus 2015 <i>Using interactive internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud</i>	San Diego County, California, United States	Spanish-speaking Latina women who were physically underactive.		
		Marcus 2016 <i>Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas</i>	San Diego County, California, United States	Underactive Spanish-speaking Latina women, primarily of Mexican/Mexican-American background.		
		Linke 2019 <i>Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas</i>	San Diego County, California, United States	Spanish-speaking Latina women (aged 18–65 years), physically inactive (<60 minutes of MVPA per week).		
		Bohlen 2024 <i>Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial</i>	Providence, Rhode Island, United States	Spanish-speaking Latina women.		
		Ash 2025 <i>Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas</i>	Providence, Rhode Island, United States	Spanish-speaking Latina women (aged 18–65 years) who were physically inactive (<150 minutes of MVPA per week).		
		Study Design	Randomized Controlled Trials (RCTs)	Choi 2021 <i>A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</i>	In a pilot controlled trial, 40 women were randomized to WALK-regular or WALK-plus.	
				Collins 2019 <i>Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial</i>	This study conducted a one-year, NIH funded, randomized, investigator-blinded clinical trial in a cohort of Latino adults at risk for CVD.	
Benitez 2020 <i>Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study</i>	Seamos Activas II is a 6-month randomized controlled trial comparing two PA intervention conditions in Latina women					
Marcus 2022 <i>Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study</i>	Seamos Activas II was a 6-month randomized controlled trial					
Marcus 2021 <i>Long-term physical activity outcomes in the Seamos Activas II trial</i>	Seamos Activas II was a 6-month randomized controlled trial with a maintenance phase from 6 to 12 months that compared two PA interventions for Latina women:					
Marcus 2016 <i>Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas</i>	The Pasos Hacia La Salud study (N = 205) was a randomized controlled trial of a 6-month					
Marcus 2015 <i>Using interactive internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud</i>	The Pasos Hacia La Salud study (N=218) is a randomized controlled trial of a 6-month					
Linke 2019 <i>Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas</i>	The Pasos Hacia La Salud study was a randomized controlled trial of an internet-based PA intervention versus a wellness contact control in Latinas					
Bohlen 2024 <i>Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial</i>	This 6-month randomized controlled trial					
Ash 2024 <i>Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas</i>	The research team conducted a superiority randomized controlled trial (RCT)					
Feasibility study	Shin 2022 <i>A Technology-Enhanced Physical Activity Intervention: A Feasibility Study</i>		A Feasibility Study: Using a single-group, pre-posttest design, this study evaluated feasibility and acceptability of a technology-enhanced physical activity intervention			
	Nguyen 2024 <i>An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans</i>		This was a single-arm, 5-week (1-week run-in period and 4-week intervention period), pilot interventional study			
	Benitez 2016 <i>Using web-based technology to promote physical activity in Latinas: Results of the Muévete Alabama pilot study</i>		In this pilot study, Muévete Alabama, a single-arm pre-posttest design was utilized to assess the feasibility and acceptability of this Spanish language and individually tailored physical activity website for Latinas.			
	Rowland 2022 <i>Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</i>		A descriptive study using quantitative and qualitative methods was used to evaluate the feasibility, usability, and acceptability of delivering a 12-week mHealth self-management intervention.			
mixed-methods research design	Chee 2016 <i>Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</i>		Pilot mixed-methods study with usability testing, expert review, and a preliminary randomized controlled trial (RCT) among Chinese and Korean American midlife women.			
	Mendoza-Vasconez 2022 <i>Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study</i>		This study used a convergent mixed-methods research design, incorporating quantitative and qualitative methods in parallel.			

Summary of Included Studies		References			
	Authors/Publication Year/Titles		Relevant Interpretation		
Qualitative Studies	Bender 2016 Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinos: A Qualitative Study		A qualitative exploratory study using focus groups and in-depth interviews		
Goals for improve physical activity	Chronic Disease Prevention and Risk Reduction	Choi 2021 A Pilot Study to Promote Active Living among Physically Inactive Korean American Women	Reduce the risk of Metabolic syndrome (MetS)		
		Nguyen 2024 An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans	Reduce the risk of Metabolic syndrome (MetS), prevent and moderate chronic diseases		
		Rowland 2022 Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults	support the self-management of chronic health conditions like hypertension and diabetes		
		Figueroa 2021 Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study	Improve physical activity and other health related aspects		
		Chee 2016 Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study	Prevent the progression of metabolic syndrome and related chronic diseases by fostering sustainable physical activity habits among midlife women, a population at elevated risk due to high inactivity levels.		
		Bender 2016 Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinos: A Qualitative Study	Improve leisure-time physical activity among Latinos to reduce obesity and obesity-related diseases, while supporting health literacy and healthier lifestyle behaviors such as increased PA and reduced sedentary behavior.		
		Shin 2022 A Technology-Enhanced Physical Activity Intervention: A Feasibility Study	Reduce cardiometabolic disease (CMD) risks among midlife Korean American adults by promoting physical activity (PA), which can prevent one in ten premature deaths, improve healthy aging, and lower associated healthcare costs.		
		Collins 2019 Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial	Address cardiovascular disease (CVD) risks among Latinos by targeting highly prevalent factors such as type 2 diabetes, hyperlipidemia, and physical inactivity, which together exacerbate vulnerability to poor cardiometabolic outcomes.		
		Benitez 2020 Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study	Emphasize the importance of maintaining healthy PA levels among Latinas in the U.S., who face disproportionately higher risks—being 70% more likely to develop diabetes and 20% more likely to be obese than non-Latina White women—yet only 44% meet national PA guidelines compared with 55% of non-Latina White women		
		Marcus 2022 Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study	Address the urgent need to improve PA among Latina women, who report disproportionately high and increasing prevalence of obesity and diabetes, conditions strongly associated with inactivity, placing them at elevated risk for long-term cardiometabolic disease and health inequities.		
		Marcus 2021 Long-term physical activity outcomes in the Seamos Activas II trial	Address the disproportionate prevalence of lifestyle-related health conditions among Latinas in the U.S., including diabetes, stroke, and obesity, by promoting sustained physical activity engagement as a key preventive strategy.		
		Mendoza-Vasconez 2022 Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study	Address disproportionately low activity rates, improve long-term health outcomes		
		Benitez 2016 Using web-based technology to promote physical activity in Latinas: Results of the Muévete Alabama pilot study	Reduce the risk of type 2 diabetes and obesity through sustained engagement in physical activity.		
		Benitez 2016 Using interactive internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud	Prevent the onset of multiple chronic conditions, including cardiovascular disease, type 2 diabetes, and hypertension, by sustaining regular physical activity.		
		Marcus 2016 Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas	Prevent the onset of multiple chronic conditions, including cardiovascular disease, type 2 diabetes, and hypertension, by sustaining regular physical activity.		
		Linke 2019 Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas	Prevent the onset of multiple chronic conditions, including cardiovascular disease, type 2 diabetes, and hypertension, by sustaining regular physical activity.		
		Bohlen 2024 Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial	Reduce the likelihood of developing type 2 diabetes and hypertension, conditions projected to affect more than half of Latina women.		
		Enhance psychological well-being by improving mood	Ash 2024 Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas		Emphasize the importance of aerobic activity for U.S. Latinas, who are less physically active than non-Hispanic White women. Regular physical activity can prevent and control chronic health conditions, support healthy weight management, and enhance psychological well-being by improving mood.

D Appendix D: Thematic Synthesis of Included Studies.pdf

Thematic Synthesis	No	Summary of Included Studies	References			
			Authors/Publication Year/Titles	Relevant Interpretation		
1. Surface level-cultural adaptation	Interface-Centered Adaptations for Digital Accessibility (n=9)	Collins 2019 <i>Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial</i>	Surface-level cultural adaptation This intervention is not culturally tailored in a deep, structural, or culturally grounded way. It uses linguistic translation and message tailoring by stage of change, but it does not redesign the digital intervention based on Latino cultural values, beliefs, social norms, or lived experiences. Content Tailoring Based on Readiness: Messages were tailored to the participant's PACE score (stage of readiness). This is a behavioral theory-based adaptation, not necessarily a cultural one. Motivational Interviewing (MI): MI is a general counseling approach that is client-centered and can be culturally flexible, but the study does not describe how MI was specifically adapted for Latino cultural values (e.g., familismo, respeto, personalismo).			
		Mendoza-Vasquez 2022 <i>Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study</i>	Surface-Level The WALK program for Korean American women involved surface-level cultural and linguistic adaptation—Korean-language materials, recruitment through Korean community networks, use of popular Korean messaging platforms (KakaoTalk, NAVER BAND), and input from a Korean Community Advisory Board—but did not substantially redesign behavior-change strategies or digital features based on Korean American cultural values, gender norms, or immigration-related experiences.	Tested Spanish-language app features (goal setting, reminders, tracking) to support maintenance; addressed usability and digital literacy but did not incorporate deeper cultural or emotional tailoring.		
		Choi 2021 <i>A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</i>	Surface-Level The research was primarily surface-level, consisting of language translation, simplified text, and language-concordant staff facilitation. The app's behavioral strategies, user interaction logic, goal progression, and digital features were directly inherited from the original English-language program without structural modification to reflect cultural values, norms, or motivational patterns of Chinese-, Vietnamese-, or Filipino-speaking Asian Americans. • Translated the app into Traditional Chinese, Tagalog, and Vietnamese • Used bilingual / bicultural staff to check reading level (fourth-grade level) • Conducted forward translation + review • Conducted pretesting with 4 bicultural/bilingual community members • Made language-equivalence and clarity adjustments • Provided in-language text messages, reminders			
		Rowland 2022 <i>Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</i>	Surface-Level This user-design study developed a bilingual PA chatbot prototype and used co-creation with low-income English- and Spanish-speaking women to explore preferences around language, privacy, digital literacy, and family inclusion. However, the implemented conversational flows remained generic (values, goals, barriers) and were not yet structurally redesigned around Latina cultural values or social roles. We therefore classified the current intervention as surface-level cultural adaptation, with a strong culturally informed design process aimed at enabling deeper adaptation in future versions. • Features that directly encode family involvement (e.g., messaging kids/partners, shared goals) - it's a future wish from participants, not implemented yet. • This research provides great user-centred and culturally aware processes, but the article mostly reports preferences and design recommendations, not a fully implemented, culture-embedded chatbot.			
		Nguyen 2024 <i>An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans</i>	Surface-Level Although this web-based PA program for Chinese and Korean American midlife women used multiple languages (English/Chinese/Korean), bilingual staff, and culturally sensitive recruitment/communication strategies, the underlying intervention structure (forums, education modules, email coaching) and digital features were not fundamentally redesigned based on Chinese/Korean American cultural values or lived experiences; therefore we classified it as surface-level rather than deep cultural adaptation.			
		Chee 2016 <i>Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</i>	Surface-Level This study is a formative qualitative exploration that identifies culturally relevant imagery for a future Latino mHealth app. However, it does not yet translate cultural insights into the intervention architecture, behaviour-change mechanisms, or digital interaction design. Therefore, although culturally sensitive at the visual level, it should be classified as surface-level cultural adaptation.			
		Bender 2016 <i>Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinas: A Qualitative Study</i>	Surface-level cultural adaptation "Cultural tailoring" here is operationalised mainly as Korean-language materials and bilingual delivery, plus Fitbit self-monitoring + SMS reminders. The digital mechanism itself is not culturally redesigned.			
		Shin 2022 <i>A Technology-Enhanced Physical Activity Intervention: A Feasibility Study</i>	Deep Cultural Adaptation. The study integrates SCT and TTM not just theoretically, but functionally, using tailored materials based on participants' self-efficacy, social support needs, stage of change, and preferences. They started with print-based materials, then added interactive texts, goal-setting calls, and location-based resources. The study explicitly states that the intervention was developed following extensive qualitative research with Latinas to identify culturally relevant barriers to physical activity. The intervention uses the SCT and the TTM. While the theories are universal, their application here is tailored to key social mechanisms in the Latino community, such as leveraging family social support for PA.			
		2. Deep social-cultural adaptation	Beyond Translation: (1) Cultural and Emotional Alignment; (2) Community Involvement through Cultural Brokers; (3) Culturally Grounded Behaviour Change Design.	Benitez 2020 <i>Design and rationale for a randomized trial of a theory- and technology-enhanced physical activity intervention for Latinas: The Seamos Activas II study</i> Seamos Activas II - 1	Deep Cultural Adaptation. The study integrates SCT and TTM not just theoretically, but functionally, using tailored materials based on participants' self-efficacy, social support needs, stage of change, and preferences. They started with print-based materials, then added interactive texts, goal-setting calls, and location-based resources. The study explicitly states that the intervention was developed following extensive qualitative research with Latinas to identify culturally relevant barriers to physical activity. The intervention uses the SCT and the TTM. While the theories are universal, their application here is tailored to key social mechanisms in the Latino community, such as leveraging family social support for PA.	
				Marcus 2022 <i>Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study</i> Seamos Activas II - 2	Deep Cultural Adaptation. Seamos Activas II builds on the deeply culturally and linguistically adapted Seamos Saludables program, originally developed through formative work with Latinas and tailored to Latina-specific barriers such as caregiving roles and neighborhood safety, while adding technology-enhanced components (SCT-based text messages and local PA maps). We therefore classified the overall intervention as deep-level cultural adaptation, with the new digital enhancements primarily adding theory-based support rather than additional deep cultural redesign. • Program level: deep cultural adaptation (Spanish, Latina-specific barriers, formative work, culturally tailored print content). • New digital pieces (texts, mapping): mainly theory-driven, context-sensitive, but not strongly re-engineered around culture, more surface-to-moderate on the digital side.	
Marcus 2021 <i>Long-term physical activity outcomes in the Seamos Activas II trial</i> Seamos Activas II - 3 - Maintenance phase	Deep Cultural Adaptation. 1. Adaptation Through Formative Research (Deep Level Foundation) Both the Original and Enhanced versions of the PA intervention were programs that were "culturally adapted for Latinas using formative research". 2. Deep Adaptation in the Digital Design and Technology Enhancements Mitigation of Environmental Barriers: The web-based or remote delivery format (used in prior studies like Muévete Alabama and Pasos Hacia La Salud) was a deep structural choice made specifically to "overcome barriers common in face-to-face interventions" such as lack of transportation, childcare, and family responsibilities. 3. Targeting Culturally Relevant Constructs: The technology was used to implement theory in a culturally informed way. The Enhanced Intervention targeted specific Social Cognitive Theory (SCT) constructs (social support, enjoyment, and outcome expectancies), which were identified through feedback from Latinas as critical for achieving the highest PA increases. The text messages were specifically designed to support these constructs through goal setting and self-monitoring.					
Benitez 2016 <i>Using web-based technology to promote physical activity in Latinas: Results of the Muévete Alabama pilot study</i> Pilot study of Pasos Hacia La Salud study - 1	Deep Cultural Adaptation. The intervention was culturally and linguistically adapted. This included translation/back translation of all materials. Extensive formative research was conducted, including six focus groups on PA barriers and a subsequent round of focus groups (n=19) specifically addressing internet usage among Latinas to inform intervention refinement. The web-based format itself was a deep adaptation designed to overcome barriers like lack of transportation, childcare duties, and fear of immigration authorities prevalent in this population, particularly in Alabama.					
Marcus 2015 <i>Using interactive Internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud</i> Pasos Hacia La Salud - 2	Deep Cultural Adaptation. The program was "culturally and linguistically adapted" for the target population through "extensive formative research". This research included focus groups with Latinas to understand their Internet use behaviours and PA needs. Content was designed to address gender-specific roles and responsibilities (e.g., caregiving and home management) that interfere with PA. The intervention was delivered in Spanish based on participant preference.					
Marcus 2016 <i>Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas</i> Pasos Hacia La Salud - 3	Deep Cultural Adaptation. Recurring Theme: Contextual Adaptation via Formative Research. The deep adaptation was driven by formative research and the need to overcome specific contextual barriers identified in the target population. The development team conducted a series of focus groups with Latinas specifically regarding their Internet use behaviours (why, when, and how often they use the web, and types of sites they visit). This information was then used to build the web-based version of the intervention. The digital, home-based nature of the intervention itself serves as a deep adaptation because it directly mitigates key barriers frequently cited by Latinas for participating in traditional face-to-face interventions, such as limited transportation and childcare duties.					
Linke 2019 <i>Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas</i> Pasos Hacia La Salud II - 1	Deep Cultural Adaptation. Tailoring based on Psychosocial Factors (Theoretical Adaptation): The core of the intervention involved tailoring and personalization of messages based on theoretical constructs derived from the Transtheoretical Model (TTM) and Social Cognitive Theory (SCT). This tailoring addressed psychosocial and environmental factors affecting PA. For example, higher website engagement was positively associated with greater self-efficacy and social support (specifically, the rewards and punishment subscale) at 6 months. The success of tailoring suggests that the theoretically derived messages were culturally and individually relevant."					

Thematic Synthesis	No	Summary of Included Studies	References	
			Authors/Publication Year/Titles	Relevant Interpretation
Cultural and Temporal Mismatches		<p>Bohlen 2024 Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial</p> <p>Pasos Hacia La Salud II-2</p>	<p>Deep Cultural Adaptation.</p> <p>Pasos Hacia La Salud II is built on a Spanish-language intervention developed through formative research with Latina women, with materials that address Latina-specific barriers (e.g., caregiving, safety, time constraints). At the program level, it represents deep cultural adaptation.</p> <p>The digital delivery (web platform, text messaging, and gamified engagement features) is culturally informed but not fully re-engineered around cultural logics. The website and text messages are Spanish-language and incorporate Latina-relevant examples (e.g., dancing) and community contexts, yet the underlying interaction structure.</p>	
			<p>Ash 2024 Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas</p> <p>Pasos Hacia La Salud II-3</p>	<p>Deep Cultural Adaptation.</p> <p>The website includes Spanish-language, stage-matched manuals and tailored feedback and tips for overcoming barriers, with examples such as childcare responsibilities, neighbourhood safety, and lack of transport—issues highlighted in earlier Latina-focused work.</p> <p>The intervention is highly tailored (e.g., to TTM stage, to self-efficacy), but tailoring is a universal behavioral strategy. The content of the tips, text messages, and manuals, while in Spanish, is not described as being specifically designed around core Latino cultural values like familismo.</p>
			<p>Chee 2016 Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</p>	<p>Explicit cultural conflict surfaced around the labels “midlife” and “depression” (stigma), plus divergent lay definitions of physical activity; translation asymmetries further undermined cultural fit.</p>
		<p>Rowland 2022 Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</p>	<p>MyFitnessPal lacked common Latino foods and required burdensome portion entry; device/app syncing failures further undermined motivation.</p>	
			<p>Figueroa 2021 Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study</p>	<p>cultural mismatch in tone/phrasing and impersonal chatbot responses; participants, especially monolingual Spanish speakers wanted family-inclusive features and stronger personalisation.</p>
Configurations of Technology Enhanced Delivery	1	Digital-Only Programs	<p>Nguyen 2024 An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans</p>	<p>Digital only Mobile health (mHealth) intervention using a smartphone app + Fitbit + SMS reminders</p>
			<p>Bender 2016 Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinas: A Qualitative Study</p>	<p>Visual, low-text mobile app prototype for health promotion</p>
			<p>Benitez 2016 Using web-based technology to promote physical activity in Latinas: Results of the Muévete Alabama pilot study</p>	<p>Digital-Only Interventions Internet-based, theory-driven, culturally adapted intervention</p>
			<p>Marcus 2015 Using interactive Internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud</p>	<p>Digital-Only Interventions Internet-based, theory-driven, individually tailored, culturally adapted program</p>
			<p>Marcus 2016 Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas</p>	<p>Digital-Only Interventions Intervention group: Tailored Internet program (Spanish-language), weekly updates, individualised content (tips, feedback, PA strategies)</p>
			<p>Figueroa 2021 Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study</p>	<p>Hybrid / Multi-component Intervention: Digital + Virtual Social Support (non-human) User-centred, SMS-based conversational physical activity intervention using a chatbot designed to coach and motivate participants through personalised, culturally tailored messages.</p>
			<p>Choi 2021 A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</p>	<p>WALK-regular - Digital only (for tracking and self-monitoring) - Fitbit, Fitbit app, weekly self-monitoring sheets</p>
	2	Hybrid Intervention: Digital Interventions with Remote Social Support	<p>Linke 2019 Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas</p>	<p>Digital-Only Interventions Intervention: Individually tailored, culturally adapted Internet PA program</p>
			<p>Marcus 2021 Long-term physical activity outcomes in the Seamos Activas II trial</p>	<p>Automated SMS (tips, weekly goal-setting & reporting with auto-feedback); individualized PA-location mapping; remote phone check-ins</p>
			<p>Bohlen 2024 Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial</p>	<p>Website + text messages, phone calls, gamification features (points system, badges, medals, progress tracking, incentives).</p>
			<p>Chee 2016 Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</p>	<p>Web-based culturally tailored physical activity intervention including: Educational modules (on physical activity, menopause, and depression), Weekly discussion forums one-on-one email coaching.</p>
			<p>Choi 2021 A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</p>	<p>WALK-plus: Digital with remote support - Fitbit, Fitbit app, weekly self-monitoring sheets, plus remote feedback and reinforcement via NAVER BAND online social community.</p>
			<p>Collins 2019 Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial</p>	<p>Hybrid / Multi-component Intervention: Digital + Remote Social Support Fitbit devices, smartphone apps, and SMS text messages, with motivational interviewing phone calls.</p>
			<p>Ash 2025 Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas</p>	<p>Enhanced Web + Text + Coaching Intervention weekly text messages, extra phone calls, gamification (points, medals, incentives), audio manuals, and more social support via the discussion board.</p>
			<p>Rowland 2022 Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</p>	<p>Hybrid / Multi-component Intervention: Digital + In-Person Human Support Mobile health intervention using the MyFitnessPal app + Bluetooth-enabled smart scale + SMS reminders + Tech support visit.</p>
			<p>Shin 2022 A Technology-Enhanced Physical Activity Intervention: A Feasibility Study</p>	<p>Hybrid / Multi-component Intervention: Digital + In-Person Human Support Participants were given a Fitbit Charge 2 and instructed to wear it on a nondominant hand throughout the entire 12-week intervention period + Weekly reminder text messages were sent to participants during the entire 12-week intervention period + Six weekly, face-to-face, individual or small group (two to three people) education sessions were conducted during the first 4 weeks of the intervention + Monthly small group (two to three people) free style walking sessions followed during the next 8 weeks of the intervention.</p>
4	Hybrid Intervention: Digital Interventions with Remote and In-Person Social Support	<p>Mendoza-Vasconez 2022 Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study</p>	<p>App-enhanced maintenance group: at the start of the 3-month maintenance, they are taught in a ~1-hour session how to use two commercial smartphone apps (Fitbit, Nike Training Club), and staff help them download and personalise the apps (goals, etc.). They then use the apps on their own for 3 months. A scheduled phone call at 1 week allows questions about using the apps; no further structured coaching.</p>	
		<p>Marcus 2022 Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study</p>	<p>Digital components + Same baseline and 6-month goal-setting sessions with staff as the Original arm. + Same month-1 telephone call plus additional telephone calls at months 2 and 3 to encourage use of the text messages and address barriers</p>	
		<p>Benitez 2020 Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study</p>	<p>Hybrid / Multi-component Intervention: Digital + Virtual Human Support The core enhancement was the use of interactive text-messaging to increase interactivity and accountability + Yes. Original 1-month call plus additional phone calls at 2, 3, and 9 months to support engagement, especially with the texting component. + Goal-setting session with trained staff at baseline (start of intervention) and 6-month visit.</p>	
Role of Social Support	1	Virtual Social Support	<p>Choi 2021 A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</p>	<p>The study's intervention leveraged culturally familiar virtual platforms (KakaoTalk, Naver BAND) to build online peer groups. These facilitated role modeling and accountability when participants engaged actively, but women embedded in low-activity offline networks reported limited reinforcement.</p>
			<p>Figueroa 2021 Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study</p>	<p>A bilingual conversational agent (chatbot) provided personalised encouragement and PA coaching via SMS.</p>
			<p>Chee 2016 Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</p>	<p>The program embedded social/peer support via Facebook to prompt discussion, weekly goal-setting, and emotional support. Yet the forum architecture (latest-post surfacing) fragmented threads across staggered cohorts, impeding cumulative conversations.</p>
	2	In person Social Support	<p>Benitez 2020 Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study</p>	<p>The study combined interactive SMS, personalised feedback, and remote counselling with culturally tailored print materials. This approach strengthened self-efficacy and accountability, but baseline data showed persistently low levels of friend support.</p>
			<p>Rowland 2022 Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</p>	<p>The study paired MyFitnessPal and smart devices with in-person technical support visits. These human touchpoints were critical in overcoming digital literacy barriers, enhancing trust. However, effects were often temporary, as adherence declined once in-person support was withdrawn.</p>
			<p>Chee 2016 Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Midlife Women: A Pilot Study</p>	<p>Response to individual coaching was low; participants felt judged/pressured by progress checks and avoided one-on-one contact, while overall participation burden (weekly postings, multiple modules) further dampened engagement.</p>
			<p>Shin 2022 A Technology-Enhanced Physical Activity Intervention: A Feasibility Study</p>	<p>This study integrated face-to-face group sessions with digital reminders, which fostered belonging and improved PA and cardiometabolic outcomes. However, perceived family and friend support remained largely unchanged.</p>
			<p>Rowland 2022 Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</p>	
			<p>Collins 2019 Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial</p>	
			<p>Benitez 2020 Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study</p>	

Thematic Synthesis	No	Summary of Included Studies	References	
			Authors/Publication Year/Titles	Relevant Interpretation
Integration of Behaviour Change Theories and Mechanisms	1	Explicit Theory-Driven:	Marcus 2022 Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study	Translational Model (TTM); Social Cognitive Theory (SCT)
			Marcus 2021 Long-term physical activity outcomes in the Seamos Activas II trial	
			Mendoza-Visconez 2022 Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study	
			Benitez 2016 Using web-based technology to promote physical activity in Latinas: Results of the Múvete Alabama pilot study	
			Marcus 2016 Using interactive Internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud	
			Marcus 2016 Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas	
			Linke 2019 Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas	
			Bohlen 2024 Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial	
			Ash 2024 Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas	
			2	
	Nguyen 2024 An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans	No formal theoretical framework was used. Focuses on translation and feasibility of an app-based intervention; theory is not explicitly framed around SCT or TTM.		
	Figuerola 2021 Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study	No formal theory explicitly cited, but design grounded in behavioral reinforcement principles, self-efficacy concepts, and user-centered design (UCD) methodology. Grounded in motivational interviewing principles (open questions, reflective listening, affirmations) to shape coach dialogue; SCT/TTM are not presented as primary frameworks.		
	Bender 2016 Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinas: A Qualitative Study	No formal theory explicitly cited.		
	Logn-time intervention	Seamos Activas II	Benitez 2020 Design and rationale for a randomized trial of a theory- and technology- enhanced physical activity intervention for Latinas: The Seamos Activas II study	The first article presented the design and rationale of the trial, outlining its theoretical foundations in Social Cognitive Theory and the Translational Model, and describing the six-month randomized controlled design with an additional maintenance phase.
Marcus 2022 Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study			The second reported the 6-month outcomes, demonstrating that technology-enhanced strategies significantly increased moderate-to-vigorous physical activity (MVPA) and step counts among Latina women during the first six months.	
Marcus 2021 Long-term physical activity outcomes in the Seamos Activas II trial			The third extended this analysis to the maintenance period, showing that women in the intervention arm sustained higher levels of PA than controls at 12 months, although engagement declined over time, highlighting challenges in long-term adherence.	
Mendoza-Visconez 2022 Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study			This was not part of the original RCT maintenance phase. Instead, it was a separate 3-month follow-on feasibility study, recruiting participants who had already completed Seamos Activas II.	
Pasos Hacia La Salud I and II: focused on scalability and long-term digital engagement (e.g., website use, SMS response, sustainability of activity).				
Pasos Hacia La Salud I: established feasibility and effectiveness.		Benitez 2016 Using web-based technology to promote physical activity in Latinas: Results of the Múvete Alabama pilot study	The goals of the current study were to examine the feasibility and acceptability of using interactive Internet technology to promote physical activity among Latinas in Alabama. Served as a precursor to Pasos I.	
		Marcus 2015 Using interactive Internet technology to promote physical activity in Latinas: Rationale, design, and baseline findings of Pasos Hacia La Salud	Presented study rationale, cultural tailoring, and baseline participant data. Established the framework for testing internet-delivered PA interventions.	
		Marcus 2016 Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas	Reported efficacy of an internet-delivered PA intervention, showing improvements in MVPA and step counts. Provided rigorous outcome evidence.	
Pasos Hacia La Salud II: refined theory, technology, and sustainability focus.		Linke 2019 Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas	Greater engagement with the website, especially logging activity, setting goals, and reading tips, was significantly associated with higher MVPA; this shows that engagement is a critical mechanism of digital intervention success.	
		Bohlen 2024 Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial	Both groups improved PA at 6 months; no overall between-group difference. However, among low-active women (some baseline PA), the enhanced intervention was significantly more effective (higher MVPA, more meeting guidelines). No benefit observed among inactive women at 6 months.	
Ash 2024 Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas		At 18 and 24 months, the enhanced arm showed higher MVPA (both self-report and accelerometer) than the original; effect moderated by baseline activity (low-active benefited earlier, inactive women benefited by 24 months).		

E Appendix E: Summary of Recommendations from Included Studies

Topics	Recommendation	References			
		Authors/Publication Year/Titles	Key Outcomes of the Intervention	Research Insights	Future Research Directions
Cultural and Linguistic Adaptation for Accessibility	Prioritizing language accuracy, cultural sensitivity, effective recruitment and retention strategies, and realistic implementation planning to ensure feasibility and sustainability.	Chae 2016 <i>Practical Issues in Developing a Culturally Tailored Physical Activity Promotion Program for Chinese and Korean American Middle Women: A Pilot Study</i>	1. Low response, interest, and retention – dropout rate of ~30%; participants found the program burdensome and reimbursement insufficient. 2. Recruitment and retention barriers – inadequate incentives, time burden, and perceived judgment during coaching reduced engagement.	1. Bilingualism can lead to some degree of deviance in translated meanings. 2. Cultural sensitivity was essential in developing and implementing the culturally tailored Web-based intervention. 3. Another culture-related issue was the women's own perception of their level of physical activity.	Future research should address cultural attitudes: explore and integrate group-specific cultural perspectives (e.g., aging, stigma around depression) into program design.
	Designing culturally relevant, visually accessible, and low-text digital tools to overcome literacy barriers and promote sustained physical activity	Bender 2016 <i>Designing a Culturally Appropriate Visually Enhanced Low-Text Mobile Health App Promoting Physical Activity for Latinas: A Qualitative Study</i>	1. Both promoters and healthcare providers (HCPs) supported the idea of a visually enhanced low-text (VELT) mHealth app as an alternative to text-heavy materials.	1. Low health literacy is a barrier, many Latino clients struggle with text-based health information, pointing to the need for visual, simple, and culturally tailored communication. 2. Cultural values like familismo (family cohesion) strongly shape what types of visuals and activities resonate. 3. Reliable and diverse visuals (different ages, body types, family roles) can improve engagement and motivation. 4. Providers face systemic barriers (limited consultation time, lack of appropriate materials) that digital tools could help address.	Future research should develop and test culturally adapted VELT mHealth apps that combine visuals, simple text, and culturally meaningful activities. Such tools have the potential to improve health literacy, support behavior change, and reduce health disparities among populations with low literacy skills.
	Designing culturally and linguistically adapted, theory-driven internet interventions that reduce barriers, enhance personalization, and clarify PA maintenance for long-term sustainability.	Benitez 2016 <i>Using Interactive Internet Technology to Promote Physical Activity in Latinas: Rationale, Design, and Baseline Findings of Pasos Hacia La Salud</i>	1. Cultural and linguistic tailoring: The intervention was adapted to Spanish language and Latina cultural norms, including gender roles and caregiving barriers. 2. Theory-driven design: Grounded in Social Cognitive Theory (SCT) and the Transtheoretical Model (TTM), incorporating stage-matched tailoring, self-monitoring, goal-setting, and feedback. 3. Low baseline PA and psychosocial readiness: Most participants were in contemplation/preparation stages, with very low MVPA, low self-efficacy, and limited social support, highlighting the high-need context.	1. Tailored interventions such as this have shown efficacy over non-tailored interventions. 2. Convenience matters: Web-based access aligned well with Latinas' family and caregiving responsibilities, reducing barriers like childcare and transportation. 3. Role of acculturation and gender norms: Latina women's cultural responsibilities (e.g., marianismo, family caretaking) were central barriers shaping PA adoption.	Future interventions should continue to leverage culturally and linguistically tailored, theory-based digital strategies while addressing key barriers such as low self-efficacy, limited social support, and measurement challenges. Enhancing personalization, integrating more interactive features, and exploring the role of mobile technologies as success improvers could strengthen long-term engagement. Importantly, developing standardized approaches to measure and define PA maintenance will be critical for evaluating sustainability across diverse Latina populations.
Personalization and Adaptive Design	Advancing digital health interventions that are personalized and culturally relevant to sustain engagement in underserved populations.	Figueroa 2021 <i>Conversational Physical Activity Coaches for Spanish- and English-Speaking Women: A User Design Study</i>	1. Low-income Spanish- and English-speaking women are interested in using chatbots to improve their physical activity and general health and feel supported by these tools. 2. Chatbots were perceived as acceptable, but long-term engagement risks were noted.	1. Digital literacy, app familiarity, and privacy are major concerns that will be addressed for adoption. 2. Co-creation with the target group and collaboration with community partners will improve usability and effectiveness. 3. Engagement may wane if chatbot functions and recommendations remain static, leading to boredom.	Future research should design and test culturally tailored, adaptive chatbot interventions that prioritize personalization, safety, and equity, while integrating social and family-based support to sustain engagement in low-income bilingual populations.
	Designing adaptive, theory-based digital platforms that sustain engagement through personalized feedback, dynamic content	Linke 2019 <i>Association Between Physical Activity Intervention Website Use and Physical Activity Levels Among Spanish-Speaking Latinas</i>	1. Higher engagement linked to better PA outcomes: More log-ins and time spent on the website predicted significantly higher MVPA at 12 months (both objectively and self-reported).	1. Online community increased intervention adherence, and those who had little support at baseline used and benefited more from this feature compared with those who already had a supportive social network. 2. Engagement and declines over time: Website use peaked early and dropped during maintenance, mirroring other digital health interventions. 3. Feature-specific engagement matters: Goal-setting, personalized feedback, and progress reports drove behavior change more than social support/message boards. 4. Usability challenges: Features like MapMyWalk were both valued and difficult to use, revealing a tension between functionality and accessibility.	Future interventions should prioritize sustained engagement strategies by making digital features more adaptive, dynamic, and user-friendly over time. Design should emphasize high-impact features (goal-setting, personalized feedback, progress tracking) while simplifying navigation and reducing digital burden.
	Expanding culturally tailored mobile apps with social features and healthcare linkages to sustain PA engagement	Nguyen 2024 <i>An App-Based Physical Activity Intervention in Community-Dwelling Chinese-, Tagalog-, and Vietnamese-Speaking Americans</i>	1. Demonstrated high feasibility and acceptability of a culturally tailored, multilingual app-based PA program. 2. Participants reported positive experiences, including an increased motivation to walk and the enjoyment of being able to monitor their physical activity.	1. This study builds on prior evidence from a culturally adapted, multicomponent intervention for Filipino-Americans with type 2 diabetes, which demonstrated feasibility and potential efficacy. 2. By extending this work to Chinese-, Tagalog-, and Vietnamese-speaking communities, it highlights the need for multilingual tailoring to engage diverse Asian American subgroups.	Future work should integrate customizable options, add social features (eg, social comparisons and challenges), and incorporate communication with health care clinicians, which may be beneficial to increase adherence to the intervention components.
	Advancing stage-sensitive, theory-driven digital interventions with tailored intensity to support both initiation and maintenance of PA.	Bohlen 2024 <i>Six-Month Outcomes of a Theory- and Technology-Enhanced Physical Activity Intervention for Latina Women (Pasos Hacia La Salud II): Randomized Controlled Trial</i>	1. For low-active Latina women, the enhanced intervention was more effective at increasing PA. 2. Inactive women saw no extra benefit: For women who were completely inactive at baseline, enhanced features did not provide additional gains over the original program. 3. Additional tailored intervention enhancements may be necessary to increase PA for inactive Latina women.	1. Baseline activity moderated effects: Intervention effectiveness varied by stage of readiness—low-active participants benefited most. 2. Enhancements supported engagement: Added text messages, dynamic features, and extra phone calls, strengthened SCT constructs (self-efficacy, enjoyment, social support). 3. Challenge with inactive participants: Additional strategies are required to help completely inactive women initiate activity.	Future work should focus on stage-sensitive intervention designs, providing more intensive motivational and behavioral support for completely inactive women, while leveraging lighter enhancements for low-active participants. Exploring mobile apps, push notifications, and wearables may improve engagement and initiation. To ensure comparability across studies, researchers should also work toward defining and standardizing physical activity maintenance as a long-term outcome.
Structured and Equitable Social Support	Leveraging culturally tailored and socially supportive digital platforms to promote scalable and sustainable physical activity engagement	Choi 2021 <i>A Pilot Study to Promote Active Living among Physically Inactive Korean American Women</i>	1. Increased self-efficacy for exercise knowledge 2. Improved perceived social encouragement and use of the physical environment 3. Reduced perceived barriers to exercise 4. Reduced mental distress	1. Women who were more active in the online social community already walked more at the start and this higher level of activity persisted. 2. Women who engaged less in the community consistently walked less, suggesting they may need extra encouragement or support. 3. Having reliable role models may be especially important for physically inactive women to start and maintain physical activity.	Future work should test whether online social communities improve both adoption and long-term maintenance of physical activity. Studies ought to run longer with clear follow-ups, and replace resource-heavy one-on-one onboarding with a group session plus brief remote check-ins and tailored text messages to boost scalability.
	Designing multi-component, culturally tailored interventions that combine accessible digital tools with personalized human support to reduce disparities and sustaining physical activity among underserved populations.	Collins 2019 <i>Efficacy of a multi-component intervention to promote physical activity among Latino adults: A randomized controlled trial</i>	1. For both groups, there was a statistically significant within-group increase in aerobic and strength training exercise behaviors. 2. There were no significant differences between groups at three months in quality of life or exercise behavior scores.	1. Multi-component design works: Combining text messaging (stage-tailored encouragement) with motivational interviewing (MI) phone calls created a stronger boost in steps compared to handouts alone. 2. Human contact is valued: Participants rated MI phone calls slightly higher than text messages, showing the value of brief but personal interaction.	Future studies should test this multicomponent model in larger and longer trials to determine sustained effects. Expanding the intensity or personalization of motivational interviewing, while keeping text messages culturally and linguistically tailored, may further enhance engagement. Designs should also address health literacy and education differences to ensure equitable impact.
	Developing culturally and linguistically adapted, theory-driven digital interventions that embed structured and equitable social support mechanisms to sustain physical activity.	Benitez 2016 <i>Using web-based technology to promote physical activity in Latinas: Results of the Muévete Alabama pilot study</i>	1. Increase in PA: Self-reported MVPA increased significantly from 12.5 min/week at baseline to 67.5 min/week after one month. 2. Psychosocial improvements: Significant gains in self-efficacy, cognitive processes of change, and behavioral processes of change. 3. Stages of change progression: Nearly half (45.8%) of participants advanced at least one stage of readiness for PA. 4. High feasibility and satisfaction: Retention was strong (88%), and all participants who completed feedback reported gaining knowledge, motivation, and satisfaction with the program.	1. The culturally and linguistically adapted, theory-driven (Social Cognitive Theory and the Transtheoretical Model) Internet-based physical activity intervention for Latina adults produced significant increases in self-reported moderate-to-vigorous intensity PA, processes of change, and self-efficacy for physical activity. 2. The intervention allowed participants to select their own support partner (friend/family) to share the website and pedometer. * This worked only if women already had supportive social networks. * For those with weak or absent networks, this strategy created a barrier, which may explain the lack of significant increases in perceived social support.	Future interventions should strengthen cultural tailoring, family integration, and digital usability to further support PA adoption among Latinas. Importantly, future research should also explore standardized definitions of PA maintenance and integrate objective and self-report measures to assess sustainability over time. In addition, future interventions should move beyond relying solely on participants' existing social networks and instead provide structured or facilitated opportunities to connect with peers or assigned partners. Embedding social matching, group-based activities, or community health worker facilitation into digital interventions could ensure that even women with limited social networks receive meaningful social support.
Reinforcing long-term PA maintenance through theory-driven, technology-enhanced strategies that sustain newly formed habits with minimal but continuous support.		Marcus 2021 <i>Long-term physical activity outcomes in the Seamos Activas II trial</i>	1. Gains in PA at six months were maintained at 12 months for both interventions. 2. Enhancements (theory, texting) can help high risk populations meet PA guidelines. 3. Participants in the Enhanced arm were more likely to meet PA guidelines (≥150 min/week of MVPA) at 12 months, suggesting low-touch and low-burden theoretical and technological enhancements may help Latinas to continue meeting PA guidelines during the maintenance phase of PA interventions.	1. Evidence-based behavior change tools work: Even minimal "maintenance phase" contact (low-touch texts, brief phone call) helped participants sustain PA. 2. Theoretical and technological enhancements matter: Targeting SCT constructs (self-efficacy, enjoyment, social support, outcome expectancies) supported better adherence to guidelines. 3. Cultural subgroup differences: Mexican-American participants in San Diego showed stronger outcomes than Dominican/Cuban groups in the prior Seamos Saludables study, suggesting cultural context shapes efficacy. 4. Long-term PA maintenance is rare but achievable: Few Latina-focused trials measure 12-month outcomes, making this evidence particularly valuable.	Future interventions should continue to use evidence-based behavior change tools during the maintenance phase to reinforce habits, even with minimal contact. Integrating theoretical frameworks and technological enhancements can further support Latinas in sustaining PA and consistently meeting guidelines over the long term.
	Designing culturally relevant, user-friendly digital supports that sustain physical activity habits while advancing consensus on what constitutes PA maintenance.	Mendoza-Vasconez 2022 <i>Regular and App-enhanced Maintenance of Physical Activity among Latinas: A Feasibility Study</i>	1. Sustained PA gains overall: MVPA dropped after the 12-month intervention but remained much higher than pre-intervention levels (163 min/week vs. 17 min/week at baseline). 2. Enhanced maintenance group: Reported a smaller decline in MVPA compared to the regular group (-29 vs. -85 minutes/week), though not statistically significant.	1. Our results highlight the need for a consensus and an individualized definition of PA maintenance. 2. App feasibility and acceptability: Commercial apps (Fitbit, Nike) were moderately used and valued for self-monitoring, visual appeal, and overcoming barriers (e.g., weather). 3. Information reduces reliance on apps: Some women maintained PA without apps, suggesting that once habits are internalized, digital prompts become less essential. 4. Barriers: Lack of tech skills, frustration with log-ins, and apps not offering culturally relevant activities (like Zumba) reduced engagement.	Future interventions should move beyond simply adding apps and instead design flexible, culturally resonant, and user-friendly digital supports that enhance long-term PA maintenance. This includes offering a variety of app options that align with participants' cultural preferences (e.g., activities like Zumba or dancing), simplifying usability to overcome digital literacy barriers, and integrating apps earlier in interventions to support habit formation. Importantly, to advance the field, it is necessary to reach a consensus on what constitutes physical activity maintenance, so that future interventions can be designed, evaluated, and compared more effectively.
Long-Term Maintenance and Habit Reinforcement	Integrating lifestyle components, reinforcing self-efficacy, and embedding family/peer support are essential for sustaining physical activity in CALD women	Shin 2022 <i>A Technology-Enhanced Physical Activity Intervention: A Feasibility Study</i>	1. High feasibility and acceptability: 100% retention, 93% adherence, and 88.4% satisfaction demonstrated strong engagement and acceptability. 2. Behavioral improvements: Significant increases in self-efficacy, moderate PA, and daily step counts. 3. Health outcomes: Significant improvements in BMI and systolic blood pressure; reductions in prediabetes rates. 4. Many participants only discovered prediabetes or hypertension risks during the study	1. Self-efficacy is central: Gains in confidence strongly correlated with increased PA, reinforcing its importance as a behavioral driver. 2. Technology plus personal contact matters: Combining Fitbit self-monitoring with text reminders and small group support created a motivational synergy. 3. Social support is complex: Despite intervention efforts, family and friend support did not significantly increase—possibly due to competing family demands in midlife. 4. Health risks were under-recognized: About 21% of participants learned they had prediabetes or hypertension for the first time, highlighting limited healthcare access and awareness in this population.	Future interventions should combine physical activity with other lifestyle factors such as diet, while also strengthening social support through family or peer involvement. Reinforcing self-efficacy with achievable goals and providing longer-term follow-up will be key to sustaining engagement and improving health outcomes.

Topics	Recommendation	References			
		Authors/Publication Year/Titles	Key Outcomes of the Intervention	Research Insights	Future Research Directions
	Developing culturally tailored strategies to reduce attrition and sustain long-term engagement in mHealth interventions	Rowland 2022 <i>Feasibility, Usability and Acceptability of a mHealth Intervention to Reduce Cardiovascular Risk in Rural Hispanic Adults</i>	1. Among those who received mHealth support in the intervention group, the usability of the MyFitnessPal app and smart scale to self-monitor daily steps, weight, and calorie intake was high and increased over time.	1. The intervention group received in-person visits with a bilingual nurse practitioner and a technology support person, which may have facilitated the development of self-monitoring skills (weight, calorie intake, and physical activity). 2. mHealth can be leveraged to promote public health and help patients self-manage cardiovascular risk factors, particularly in the absence or limited supply of health care providers in rural communities.	Future research should evaluate and support participants' baseline technology skill level; provide training if needed, and use a phone call or SMS text message follow-ups as a strategy to minimize attrition. In addition, future studies should develop and test culturally tailored strategies to reduce attrition and sustain long-term engagement with mHealth interventions among Hispanic/Latino adults.
Theory-Driven and Multi-Channel Enhancement	Enhancing culturally tailored interventions with interactive digital supports to build accountability, enjoyment, and social support for sustaining physical activity.	Benitez 2020 <i>Design and rationale for a randomized trial of a theory- and technology-enhanced physical activity intervention for Latinas: The Seamos Activas II study</i>	1. Participants were highly inactive: At baseline, objectively measured MVPA was very low (~34-46 min/week), with self-reported MVPA near zero for most. 2. Low psychosocial readiness: Most women were in precontemplation or contemplation stages of change, with generally low self-efficacy and reliance on cognitive (not behavioral) processes of change.	1. Theory refinement: More rigorous targeting of Social Cognitive Theory constructs (e.g., enjoyment, outcome expectations, social support) may be critical to promoting PA. 2. Interactivity matters: Participant feedback from prior studies highlighted the need for greater accountability and immediacy, leading to the integration of interactive texting. 3. Family and friend support as mediators: Evidence from earlier trials suggested that family/friend support mediated sustained PA, the new design built in more opportunities to leverage this support.	Future studies should address interactivity and accountability through text messaging, and more rigorously targeting theoretical constructs may be key to helping Latinas achieve nationally recommended PA levels and thereby reducing health disparities.
	Enhancing theory-driven, multi-channel digital interventions with tailored intensity to sustain physical activity and clarify definitions of PA maintenance	Marcus 2016 <i>Pasos Hacia La Salud: a randomized controlled trial of an internet-delivered physical activity intervention for Latinas</i>	1. Internet-delivered, individually tailored intervention achieved even larger increases in physical activity than the print-based version 2. Baseline PA moderated effects: Low-active participants benefited earlier (by 12-18 months), while completely inactive participants only showed benefits by 24 months. 3. High retention: 81% of participants completed the 24-month follow-up, showing the feasibility of long-term technology-based interventions.	1. Enhancements worked: Adding text messaging, gamification features, persuasive elements (rewards, reminders), and extra support extended PA gains beyond one year. 2. Stage of readiness matters: Inactive women needed longer to benefit, reflecting Trans-theoretical Model stages (precontemplation vs. preparation/action). 3. Technology integration helps: Combining website + text messaging increased engagement and sustained usage, compared with website-only approaches. 4. Theory-driven foundation: SCT and TTM guided tailoring, self-monitoring, and stage-matched feedback, reinforcing the value of theory-based design.	Future interventions should refine multi-channel, theory-driven digital strategies that combine web, text, and gamified features to sustain long-term PA. Design should account for differences in baseline readiness by providing more intensive early-stage support for inactive participants and lighter-touch reinforcement for low-active women. Importantly, advancing the field will require consensus on what constitutes PA maintenance, so outcomes can be consistently defined and compared across studies.
	Scaling culturally tailored, theory-driven, technology-enhanced interventions to sustain physical activity and reduce health disparities.	Marcus 2022 <i>Physical activity outcomes from a randomized trial of a theory- and technology-enhanced intervention for Latinas: the Seamos Activas II study</i>	1. Increased PA across both arms: Both the Original and Enhanced interventions significantly increased MVPA at 6 months (accelerometer and self-report). 2. Higher odds of meeting guidelines: 57% of Enhanced group vs. 44% of Original group met national aerobic PA guidelines at 6 months	1. Theory + technology boosts outcomes: Adding SCT-focused tailoring and text messaging improved accountability and enjoyment, helping more Latinas achieve PA guidelines. 2. Home-based, low-burden interventions are effective: Delivering interventions by mail + texts reduced barriers like transportation and caregiving demands.	Future studies should test the scalability of home-based, culturally tailored, and technology-enhanced PA programs in diverse Latina subgroups. Longer-term follow-ups are needed to evaluate sustained adherence and cardiometabolic outcomes. Research should also explore tailoring interventions to different cultural contexts and family norms, while refining digital tools to address both behavioral support and equity in access.
	Refining stage-sensitive, theory-driven digital interventions with adaptive personalization.	Ash 2024 <i>Pasos Hacia La Salud II: A Superiority RCT Utilizing Technology to Promote Physical Activity in Latinas</i>	1. Both groups improved MVPA: Both the original and enhanced interventions led to sustained increases in MVPA over 24 months. 2. Baseline PA moderated outcomes: Low-active participants benefited earlier (12-18 months), while completely inactive women showed significant gains only by 24 months. 3. High retention: 81% of participants completed the 24-month follow-up, demonstrating the feasibility of long-term digital delivery.	1. Enhancements worked: Adding text messaging, gamification (tokens, medals), persuasive elements (reminders, rewards), and staff-facilitated social support improved engagement and outcomes. 2. Stage of readiness matters: Inactive participants required more time and intensity to see benefits, while low-active participants responded sooner. 3. Theory-driven + technology integration: SCT and TTM underpinned tailoring, stage-matched feedback, and motivational strategies, confirming the value of theory-based design. 4. Persuasive technology potential: Combining website + text messaging created multiple "touch points" that sustained adherence better than static content alone.	Future work should refine stage-sensitive, theory-driven, multi-channel interventions that deliver differentiated support for inactive and low-active women. Incorporating adaptive personalization, sustained engagement strategies (gamification, reminders, rewards), and broader technology integration can help reinforce long-term PA maintenance. Importantly, future research should also work toward establishing consensus on how PA maintenance is defined and measured to allow consistency across trials.