The global, health care, and social value of community-based late-life depression care

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Abstract

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Despite its impact on health, health care, and costs of care, depression remains under-recognized and treated among older adults, in particular those underserved due to poverty, racism, and other social disadvantages. Traditional clinic-based mental health care is inadequate for addressing social determinants of mental health (e.g. economic deprivation, discrimination). One model for improving equity in access to late-life depression care is the Program to Encourage Active, Rewarding Lives (PEARLS). PEARLS aligns with global mental health recommendations to integrate quality care into accessible community-based organizations via trusted providers that reach underserved populations. Though PEARLS was developed with and by such organizations and has shown clinical effectiveness, it has not been widely adopted.

The field of implementation science aims to close research-to-practice gaps so that evidence-based programs (EBPs) like PEARLS have the greatest public health impact. Research is needed to move beyond effectiveness in reducing depression to evaluate what matters to multiple partners - older persons, providers, organizations, and policymakers. What we know about barriers to EBP uptake offers clues for closing this research-to-practice gap. First, EBPs need to be adapted to local resource-constrained contexts in and outside the U.S. to reduce rather than exacerbate health inequities. For PEARLS, this means adapting the model for resource-constrained older persons and the community-based organizations that serve them. Second, EBPs need to show potential cost savings (e.g., through lower health care utilization), as improvement in health alone is often insufficient for PEARLS adoption or sustainability. Third, EBPs must address what matters now for both EBP participants and providers; for PEARLS and in COVID-19 context, what matter now is social isolation and loneliness ("social connectedness").

This dissertation brings together three studies to better understand PEARLS' value by evaluating its global, health care, and social impact to promote older-adult health equity. Aim 1 uses a concurrent mixed-methods design to evaluate whether and how PEARLS improves social connectedness among older social service recipients living with depression and in poverty in five U.S. areas. Aim 2 applies quasi-experimental methods to existing administrative data on older social service recipients to assess PEARLS potential cost savings from reduced health care utilization (hospitalizations and nursing home stays). Aim 3 uses a multiple-case study design to evaluate PEARLS implementation with two resource-constrained cultural contexts: community health workers to support older U.S. Latinos, and newly trained social workers to support Cambodians living with diabetes.

This dissertation integrates health services research, implementation science, global mental health, and health equity frameworks and methods to demonstrate the value of evidence-based depression care to improve the lives of underserved older populations.

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This dissertation is dedicated to my Dad who modeled how research can build community and make a difference, one step at a time.

Table of Contents

Chapter 1. Introduction

Importance of late life depression: Depression is a significant public health issue affecting one in four adults and now the leading cause of disability.[1] Among older persons, depression impairs function and quality of life, leads to worse health outcomes, and increases risk of preventable deaths including suicide.[2] Older persons with depression use more health care[3–5] and enter nursing homes earlier.[6] These institutionalizations are devastating across the board as older persons prefer aging in place, and costs of health and social care continue to rise without improvement in health outcomes.[7–9]

Disparities in access to quality late-life depression care. Despite depression's impact on people, society, and systems, and the existence of effective depression care models, there is a depression treatment gap around the world. Half of older adults do not receive adequate or appropriate treatment.[10] Socially marginalized older persons have greater disparities in depression outcomes. Older persons living in poverty have higher burden of depression, worse access to care, and are less likely to benefit from pharmacological or psychotherapy treatment.[11] Older persons of color have less access to sufficient care despite recent rises in both recognition and treatment rates,[12–14] and those with limited English proficiency are similarly disadvantaged.[15] Rural communities face worse access to late-life depression care due to both attitudinal and structural barriers.[16,17] Older persons with intersecting identities further increase their mental health burden.[15]

Recommendations for improving equity in access to mental health care. The global mental health (GMH) field has emerged to address mental health inequities in resource-constrained settings around the world.[18] International bodies[1,19] call for closing the mental health treatment gap by building capacity among non-specialist workers to deliver community-based interventions. This task-shifting and task-sharing can improve access to quality mental health care by expanding availability of self- and community-based care in settings with limited access, workforce gaps, and stigma towards specialty mental health care.[20,21] Community-based care can also address negative social determinants of health like poor housing and food insecurity.[22] While GMH research was initially focused in resource-constrained settings outside the U.S. ("low- and middle-income countries"), a global-to-local frame is now called for to improve equity in access to appropriate, high-quality mental health care in resource-constrained contexts in high-income countries (HICs).[23,24]

Community-based collaborative care models (CCM) to reach marginalized older persons. CCM build capacity among non-mental health providers to provide effective team-based care.[25] The model was initially developed for highly-resourced clinical settings[26,27] and evidence is emerging in resource-constrained settings.[28–30] PEARLS is a home/community-based CCM created in partnership with social service organizations in Seattle, US (Fig 1). Existing front-line workers are trained to actively screen for depression; offer brief psychosocial interventions[31,32] for self-management, support, and psychoeducation; and coordinate with primary and mental health care as needed. Clinical supervisors provide ongoing consultation and training for non-specialists to provide quality depression care. Based on the Chronic Care Model,[22] PEARLS empowers older persons to manage depression, and often other chronic conditions, using existing resources, new skills, and better care linkages. Older person's financial, physical, and cultural barriers to care can be reduced by offering preferred non-pharmacological care[16] in their

homes.[28] PEARLS' focus on marginalized older persons can also improve health equity[33] through organizations that address social determinants of health.[29,30,34]

Implementation science to improve access to PEARLS in diverse resource-constrained settings. Though PEARLS was created with community partners and is effective at reducing depression,[17] uptake has been limited. This know-do gap is a focus for implementation science (IS) – a research and practice approach to understand what, why, and how interventions work in "real world" settings and evaluate ways to improve them.[35,36] Several known barriers to community-based EBP uptake may help explain why this gap persists. First, depression EBPs may not be demanded by older persons or providers given other priorities or continued stigma against mental illness and treatment-seeking.[40] It may be more appropriate to address lack of social connectedness like social isolation and loneliness (a depression risk factor[37] and symptom in some contexts)[38] that are important to multiple partners.[39] Second, EBPs are seen as too costly (a bar clinical care is now held to under health care reform's quadruple aim)[40] necessitating the importance of examining potential cost benefits. Third, EBPs have long been perceived as top-down, academic models that are not appropriate for nor can be adapted for diverse, resource-constrained contexts such as for persons who speak languages other than English. However, IS has shifted from a dichotomy between fidelity to vs adaptations of the original EBP model, to recognition that not adapting to local context reduces EBPs success.[35,36,39]

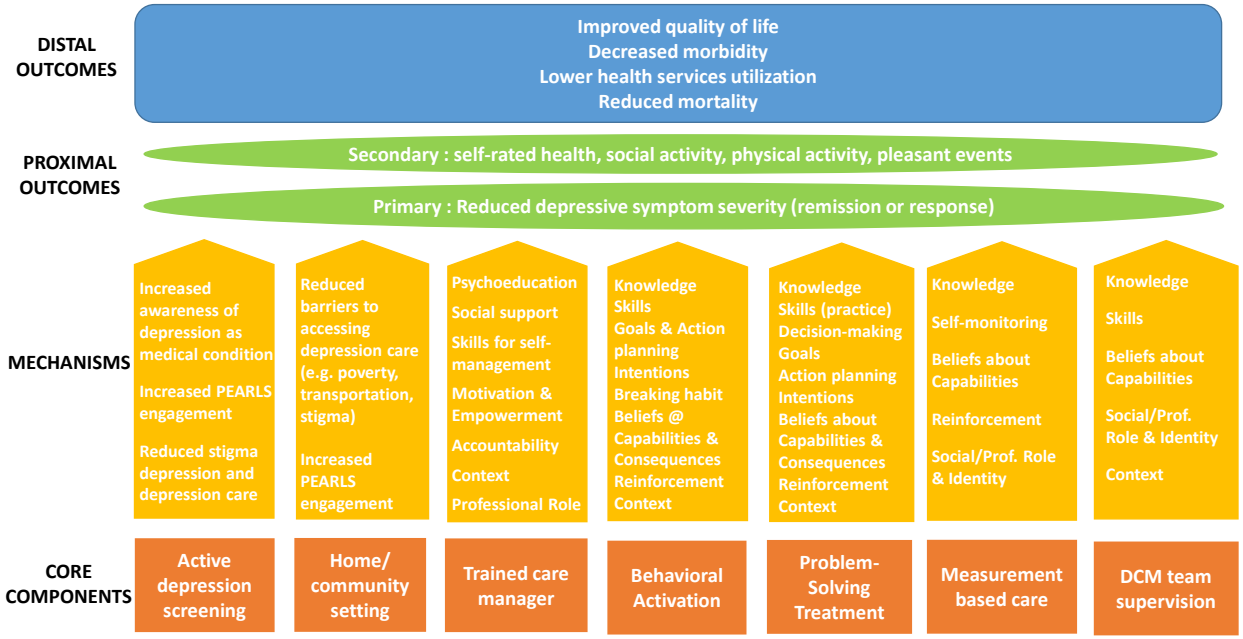


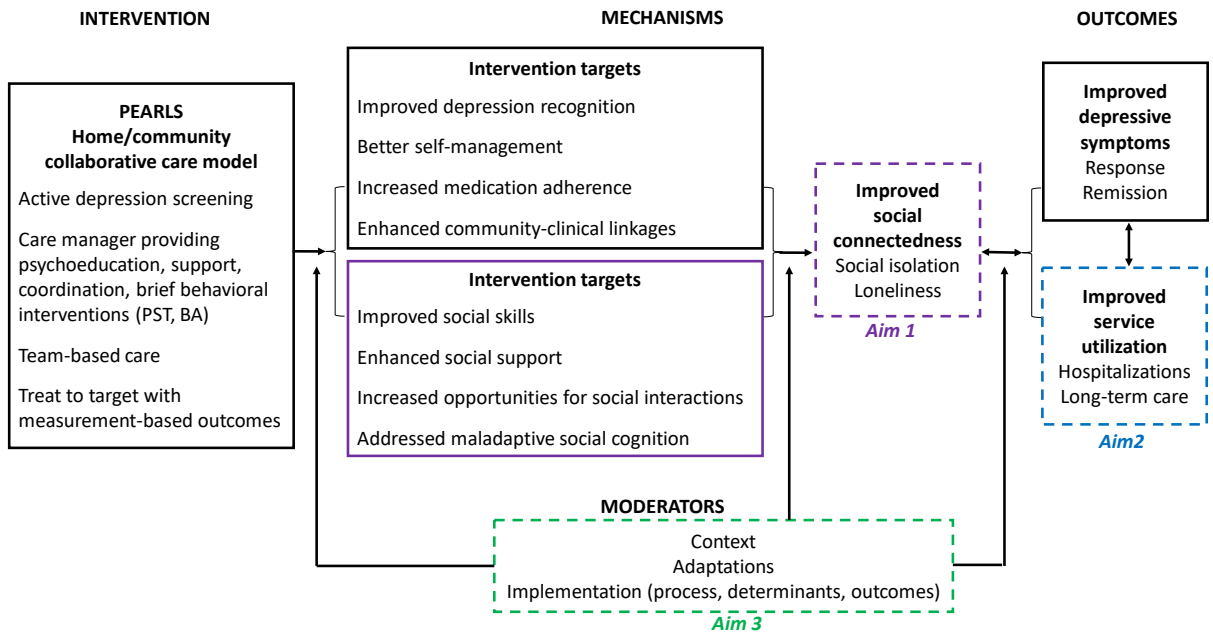
Figure 1. PEARLS conceptual model

DCM = Depression care management

This dissertation brings together three studies of PEARLS global, health care, and social value to improve equity in access to care. Aim 1 expands PEARLS evidence base to assess whether and how PEARLS can improve social connectedness–a related and important issue for older persons and care systems that may be more significant for older persons, providers, organizations, and policymakers–and for which less is known about effective interventions.[41,75] Aim 2 looks at whether PEARLS may reduce costly health care utilizations for older marginalized populations. We need evidence on potential cost savings (e.g. through fewer hospitalizations and nursing home stays) to make the business case for payers to reimburse and organizations to adopt PEARLS in today's health care reform climate of improving access and quality while reducing costs.[40,41] Aim 3 can improve understanding of where, when, what, how and why EBP adaptations[42] happen to better fit resource-constrained contexts, how adapted PEARLS is delivered, and what other changes are needed.[45,46,43] This study can guide PEARLS delivery in very low resource settings with different cultural contexts than PEARLS original research, and offer important global-to-local learnings to improve PEARLS delivery.[44] Our long-term goal is to improve health and well-being for underserved older populations by reducing inequities in access to quality depression care.

Figure 2 expands PEARLS program theory into a conceptual model about how the proposed dissertation research will improve understanding of PEARLS social (Aim 1), health care (Aim 2), and global value (Aim 3).

Conceptual model of PEARLS potential social, health care, and global value.



Chapter 2. Aim 1 paper

Improving Social Connectedness Among Older Adults Living with Depression and Experiencing Poverty: A Convergent Mixed-Methods PEARLS Evaluation

Abstract

Background and Objectives

Social disconnectedness has emerged as a public health epidemic, with the COVID-19 pandemic highlighting the impact on older adults. We evaluated whether and how an evidence-based program designed to address depression via community-based social service organizations (CBOs) (the Program to Encourage Active, Rewarding Lives (PEARLS)) can improve social connectedness among depressed older adults experiencing poverty.

Research Design and Methods

We partnered with 15 CBOs in five U.S. states, purposively sampling for diverse settings, practitioners, and populations. We used concurrent mixed methods: baseline, post and 6-month follow-up social connectedness assessments (DSSI-10, PROMIS-SI-6, UCLA-3; N=280), and semi-structured interviews (N=29 participants; 38 providers) with PEARLS participants and providers. Analyses include descriptive statistics, paired t-tests, regression; thematic analysis; integration and joint displays to compare quantitative and qualitative findings.

Results

PEARLS participants were mean(SD) age 73(9), 78% female, 44% Black, Indigenous, or other People of Color (BIPOC), 61% lived alone and/or were unpartnered. Findings from baseline-post survey analysis indicate improved social connectedness across measures ($p < 0.001$); this was maintained but attenuated 6-months following the active intervention for DSSI-10 and PROMIS-SI-6. Interviews suggest several mechanisms of action (enhanced social skills, social support, opportunities for social interactions, reduced maladaptive social cognition). While CBOs connected older adults to resources to address social needs, contextual barriers to improving social connectedness persisted.

Discussion and Implications

Findings suggest PEARLS can improve social connectedness among older adults who are underserved. Adaptations to intervention and implementation are posited, with multi-level approaches needed to address structural determinants of disconnect.

Background and Objectives

Lack of social connectedness is now recognized as a public health epidemic given its huge health and cost burden. “Social connectedness” encompasses multiple ways a person can be or feel connected –one’s relationships and roles with others (structural), social support or lack thereof (functional), and positive or negative qualities of one’s relationships or the support (quality). [94] A recent analysis of the 2011 National Aging and Health Retirement Study [95] found that one in four community-dwelling older adults were socially isolated, and 43% were lonely. Those who carry greater risks for social disconnect include older adults who are BIPOC, living in poverty, in rural areas, who live alone, are unpaid caregivers, and/or are LGBTQ+. [96]. COVID-19’s sheltering-at-home and distancing created even more urgency for addressing social disconnect. (Berridge et al., 2020)

Social disconnectedness increases the risk of poor health, depression, heart disease, stroke, cognitive and functional decline, and hospitalizations and readmission among older adults [99]. Lack of social contacts is associated with $6.7 billion in additional Medicare spending annually. [100] While the risk for early death due to social disconnectedness is on par with high blood pressure, physical inactivity, obesity, or smoking 15 cigarettes a day--health issues that have been foci of public health interventions for the last several decades [101]--little is known about how to effectively improve social connectedness among older populations who are underserved. Public health interventions must prioritize these populations to narrow rather than widen inequities in access to quality care and health outcomes. [33] Since people can be or feel socially disconnected for various reasons, effective interventions must be tailored to the preferences, values, and circumstances of diverse participants. [102]

The Program to Encourage Active, Rewarding Lives (PEARLS), an evidence-based program for late-life depression [58], offers potential for improving social connectedness among older adults experiencing poverty. PEARLS aligns with the established active ingredients of social connectedness interventions – the program was designed to reach socially isolated older adults via community-based social services organizations (CBOs) and is theory-driven; it also engages older persons as active program participants to understand the nature of their disconnection and co-create personalized solutions including accessing additional supports and services. [103] PEARLS may improve social connectedness through known mechanisms of action - improving social skills, enhancing social support, increasing opportunities for social interactions, and addressing maladaptive social cognition. [104] As a proven intervention for lowering depression, PEARLS addresses both a risk factor for low social connectedness [38] and a qualitative symptom of depression. [37] Lastly, PEARLS may reduce inequities in social connectedness as it is delivered by social service CBOs that reach communities underserved by clinical care, employing providers who understand the local context and can address social determinants of health. [34]

Given this state of research and practice, we embarked on an evaluation to understand whether and how PEARLS can improve social connectedness among older adults living with depression and experiencing poverty in the U.S.

Research Design and Methods

Design and setting

We used a pragmatic paradigm that values diverse approaches and both quantitative and qualitative data to answer research questions in practice settings. [105] A concurrent mixed-methods design (Figure 1) gives equal weight to quantitative and qualitative data [106] to "give voice to participants as well as report statistical trends (p.73)." [107] This study was exempt from UW IRB review.

PEARLS is offered by community-based social service organizations (CBOs) offering supports in older adults' homes and communities to help those in poverty age in place and maintain quality of life and independence. We used maximum variation purposive sampling [108] to select 15 PEARLS programs in five U.S. states (WA, TX, NY, MD, FL) with diverse older populations (e.g., race/ethnicity, language, rurality) and settings (e.g., provider and organization attributes; year of PEARLS adoption).

Intervention

PEARLS is an evidence-based late-life depression program [58] created in partnership with CBOs. CBO staff are trained as PEARLS coaches to actively screen for depression; offer brief psychosocial interventions (Problem-Solving Treatment (PST) [31] and Behavioral Activation (BA) (Jacobson et al., 1996)) for self-management, support, and psychoeducation; and to coordinate with health care. PEARLS is 6-8 in-person or tele-sessions over 4-5 months plus brief follow-up phone calls. As described previously, a depression program like PEARLS may address social connectedness through known intervention targets and core components. For example, BA may increase meaningful and accessible social activities, and PST may address barriers to social connectedness such as poor-quality relationships, lack of transportation, and health issues. PEARLS was unchanged for this evaluation, except adding a social connectedness assessment during enrollment. During study meetings, CBOs shared this assessment functioned as intervention, helping providers and participants understand the nature of disconnection and areas for focus.

Quantitative data collection and analysis

Sampling

Incoming PEARLS participants were invited to complete social connectedness assessments at enrollment. PEARLS targets older adults (age >/=50) experiencing poverty with clinically significant depressive symptoms (PHQ-9 >/= 6 or 10). Persons with significant cognitive impairment or functionally impairing substance abuse or severe mental illness are ineligible. We aimed to recruit 200 participants for sufficient power (0.80) to detect longitudinal changes in social connectedness, which yields a 20% probability of not detecting an actual difference in outcome.

Data Collection

CBOs collected participant data between January 2018-September 2019 during in-person PEARLS enrollment ("baseline"). Our study team collected post-PEARLS data by phone at

program completion 6 months after enrollment ("post") and at 12-months after enrollment ("follow-up"), between June 2018-October 2020. Although it is not optimal to collect data using different modalities, having trusted providers do initial data collection was key for engaging communities who are underserved [109]. We also trained both CBO and study survey administrators to strengthen validity and reliability. Participants received $20 per assessment.

We used a multi-scale assessment of social connectedness (Duke Social Support Index (DSSI-10) [110], Patient-Reported Outcomes Measurement Information System-Social Isolation (PROMIS-SI-6) [111], UCLA Loneliness Scale (UCLA-3) (Hughes et al., 2004)) to capture different social connectedness constructs [94]. We also collected sociodemographic and health participant data to understand factors (NASEM, 2020; Schwarzbach et al., 2014) associated with change in social connectedness including pandemic onset. A brief online survey of PEARLS providers (both managers and coaches) gathered data on socio-demographics, mechanisms and core components.

Data analysis

We used REDCap [116] for data management and Stata 15.1 [117] for analysis. Our three social connectedness scales had good construct and convergent validity, (Edwards et al., 2017) and reliability (Terwee et al., 2007). We reverse-coded scales to facilitate interpretation; higher scores indicated more social connectedness. We ran descriptive statistics to summarize sample characteristics and provider data. We used paired t-tests to statistically test for change in social connectedness over time, and Cohen's d effect sizes for magnitude of change. Unadjusted and adjusted regression models identified factors associated with change. Bonferroni correction adjusted p-values (0.05/3=0.017) for paired t-tests and regression.

Qualitative data collection and analysis

Sampling

We used maximum variation sampling to identify PEARLS participants with diverse attributes that increase social disconnectedness burden. Participants completed a 30-60-minute phone interview after post-PEARLS assessment. All providers enrolling at least 10 PEARLS participants and managers were invited to participate in interviews. Our initial analysis sample was 20 participants and 12 providers with stopping criterion at 3 [118]. While saturation can be reached at 12 [118,119]. we recruited additional participants for various perspectives (e.g., Latinos from different countries).

Data collection

The semi-structured, participant interview guide asked open-ended questions to understand whether and how PEARLS worked as a social connectedness intervention. This provided qualitative data about effectiveness, mechanisms, and moderators. Group provider interviews included similar topics. Interviews were conducted in English and Spanish by trained research staff, audio-recorded, and transcribed for analysis. Post-interview reflective memos [119] documented emerging learnings, non-verbals, lingering questions, and researcher assumptions and bias.

Data analysis

Data was tracked using REDCap, then managed and analyzed with Dedoose (Dedoose, 2021). We employed thematic analysis [121] to understand how the data fit together, highlight similarities and differences across participants, and generate unanticipated insights: We read transcripts and memos to familiarize ourselves with the data and to create brief narratives [119]. We created codes to describe what we interpreted in the text as important (Gale, 2013), and to organize data for systematic comparison, using deductive codes from research questions and theory, and inductive codes from emergent themes. [122] We used constant comparison methods with two researchers double-coding transcripts to discuss, define and refine codes, then coding independently and discussing areas of disagreement. Post-coding analytic memos noted how codes related to each other and mapped to research questions (Ravitch, 2015). We created interpretation memos (Gale, 2013) using coded data to offer possible explanations for what was happening in the data. These included summary of findings, key distinctions, counterexamples, and further points for consideration. Memos had illustrative quotes to keep original meanings and feel of the interviewee's words to "show, not tell." Methods aligned with well-established trustworthiness criteria for rigor in analyses [123].

Mixed methods integration

We merged data sources to better understand how PEARLS impacts social connectedness [124]. We used joint display tables [125] and compared quantitative and qualitative results side-by-side to see where findings converged, diverged, or expanded [107].

Results

Participants

Quantitative

Our final analytic sample included 280 older PEARLS participants who completed study assessments at PEARLS enrollment (baseline) (74%, 854/1,149), 6-months post–enrollment (post) (68%, 320/472 completers) and 12-months following enrollment (follow-up) (87% 280/320). Participants were on average 73 years old, 79% female, and 44% BIPOC (21% Black, 19% Latino, and 4% Asian or American Indian/Alaskan Native) (Table 1). Most were experiencing poverty (81%) or found it hard to pay for basic needs (71%). On average, participants had four chronic conditions and moderate depression severity (PHQ-9 mean(SD) 12.6(4.9)); 65% reported poor self-rated health. The majority were socially isolated according to common metrics-61% live alone and 80% are unpartnered. PEARLS participants reported lower social connectedness than overall older adult populations on the DSSI-10, PROMIS-SI-6, and UCLA-3.

Qualitative

We conducted 29 interviews with survey participants post-PEARLS assessment. Interview participants had comparable demographics to the survey population (Table 2) with a mean(SD) age of 68.2(7.8), three-quarters (75.9%) female, and almost half (45%) BIPOC. 55.2% lived alone and the mean(SD) household size of those who lived with others was 3.4(1.4). Nearly

76% experienced financial hardship and 86.2% were not partnered. Participants had on average 5 (2.1) chronic conditions and had similar baseline depression and social connectedness as the overall study population. Supplemental Figure 1 offers several narratives to illustrate older adults' experiences of social connectedness and PEARLS.

Thirty-eight PEARLS providers participated in ten group interviews. Providers were primarily age 40-60 (37%) or 60 and above (42%), 87% female, and 58% identified as BIPOC (29% Black, 16% Latino, 5% American Indian or Alaskan Native, 3% Asian, and 13% as a race not specified) (Table 2). Half identified social work as their field; other fields included mental health, public health, aging, and medicine. Two-thirds were PEARLS coaches (interventionists) and one-third were program managers supervising PEARLS coaches. Coaches delivered PEARLS both part-time (68%) and full-time (32%) and ranged in years of program experience.

Findings from all data sources are organized around overarching research questions: A. Does PEARLS improve social connectedness? (*effectiveness*), B. How does PEARLS improve social connectedness? (*mechanisms*), and C. Under what conditions does PEARLS improve social connectedness? (*moderators*)

A. Does PEARLS improve social connectedness? (*effectiveness*)

Quantitative

Effectiveness. When compared to baseline, PEARLS participants were more socially connected at 6–months after enrollment when active PEARLS sessions ended, and at 12-months after enrollment (Table 3). At 6 months, the mean (SD) change in social connectedness was 1.2(3.9) for DSSI-10, 2.2(6.2) for PROMIS-SI-6, and 0.5(2.2) for UCLA-3, with all three scales showing statistically significant change over time ($p<0.001$). At 12–months (6 months after PEARLS active intervention), participants maintained improvements from baseline social connectedness. These changes were statistically significant for the DSSI-10 ($p<0.001$) and PROMIS-SI-6 ($p=0.009$), while the UCLA-3 did not meet statistical significance ($p=0.023$) using the Bonferroni correction for multiple testing (p-value adjusted from $p<0.05$ to $p=0.017$). Cohen's d effect sizes were small for both 6-month (DSSI-10: 0.28, PROMIS-SI-6: 0.35, UCLA-3: 0.21) and 12-month change (DSSI-10: 0.28, PROMIS-SI-6: 0.17, UCLA-3: 0.15), suggesting the magnitude of change in perceived isolation and loneliness were attenuated six months following working PEARLS sessions. Sensitivity analyses of DSSI-10 subscales suggest improvements were driven by higher satisfaction with social support, rather than by increases in social network size or social interactions.

Factors associated with effectiveness at 12 months. Factors associated with effectiveness at 6-months are reported elsewhere [126]. Looking at improvements in social connectedness from baseline to 12-months (6 months following active intervention), some factors associated with improvements stayed the same (e.g., Latinos had smaller DSSI-SI improvements (B=-0.91, p=0.012)) (Supplemental Table 1). Some factors were different: at 12-months, women were more likely than men to maintain improvements in social connectedness (DSSI-SI, PROMI-6 and UCLA-3); whites were more likely than BIPOC adults to maintain improvements in social isolation (DSSI-SI); persons who were not partnered were more connected compared to persons who were partnered (DSSI-SI); persons who had visited the

doctor in the past 3 months were more likely than those who had not to improve perceived isolation and loneliness; and persons with more chronic conditions (DSSI-SS, PROMIS-SI-6), arthritis (DSSI-SS, DSSI-10), digestive disorder (PROMIS-SI-6, UCLA-3), kidney disease (UCLA-3), or stroke (DSSI-SS, DSSI-10, PROMIS-SI-6) had greater improvements in social connectedness. Adjusted regression models found only differences by gender and doctor's visits maintained statistical significance for loneliness, and gender and Latinos for DSSI_SI.

Depression and social connectedness. At 6-months, improvements in depression remission, response and severity were associated with better social connectedness. [126] We did not collect PHQ-9s at 12-months due to concerns about discussing suicide when study participants were no longer connected to PEARLS. However, at 12-months, participants with clinically significant depression (PHQ-9>/=10) when they began PEARLS, were more likely than those with baseline minor depression to improve perceived isolation (B=3.4, p<0.001) and loneliness (B=0.93, p=0.004).

COVID-19 context. While 6-month improvements in perceived isolation and loneliness remained consistent after pandemic onset, participants who completed PEARLS after March 1, 2020 had smaller overall improvements in the DSSI-10. Sensitivity analysis suggest while statistically significant improvements in satisfaction with social support remained steady, there were decreases in social interactions. This is not surprising given shelter-at-home and physical distancing guidelines during the pandemic. Likewise at 12-months, participants whose assessments were collected during the pandemic (63%) maintained statistically significant improvements (P<0.001) in satisfaction with social support (DSSI-SS) and had no change in social network size and social interactions (DSSI-SI).

B. How does PEARLS improve social connectedness? (*mechanisms*)

Quantitative

In a brief post-interview survey, PEARLS providers (N=38) reported that the most common mechanisms for action were increasing opportunities for social interaction (87%), enhancing social support (82%), and reducing negative thoughts about self-worth and how others perceive them (76%). Improving social skills was less commonly endorsed (47%) as a mechanism for action by providers.

Qualitative

Supplemental Table 2 illustrates the mechanisms by which participation in PEARLS influenced older adults' social connectedness.

Enhancing Social Support: PEARLS coaches gave emotional, instrumental, and informational support to older adults. Both participants and providers shared how participants feeling respected, cared for, heard, and trusted by their coach was foundational to moving out of their "*doom and gloom.*" "*Just listening is big*" (Org 1, Provider 1, rural). Since many older adults feel a burden to loved ones and have difficulty asking for help, it was easier to get support from a coach without feeling negative self-worth and guilt. Talking out loud at PEARLS sessions rather than just thinking about things; using PST and BA tools to "*get out and walk even when don't feel like it*" (NY688); and receiving tangible aid (e.g., paying an electricity bill, or

accessing a self-monitoring blood pressure machine or transportation), further enhanced support participants were not getting from their social network. Support was particularly impactful during COVID-19 lockdown: "*especially right now PEARLS is very, very important for all the elderly people, even more so I feel than before, because they're really grateful that there's somebody who's calling them.*" (Organization 7, Provider 1, urban/suburban)

PEARLS also enhanced social support for participants by re-engaging with their social networks. "Family" meant different things – one 65-year-old Black female participant shared "*I like church because it's a family*" (FL219); others got support from friends and neighbors who they talk to, socialize with, and get groceries and transportation. For some participants, social support from family didn't change over the course of PEARLS but their perspectives on it did – for example, accepting the disconnect between the relationships they have and those they want, feeling less burdened by familial conflict, or finding other avenues for support rather than focusing on dysfunctional or poor-quality relationships. This is illustrated by one 73-year-old married White woman (FL142) who had lost an adult child and weathered challenges after her husband's car accident led to job loss and depression: "*not every day is peaches and cream, but it's much better than it was*."

Some participants shared how important it was to have a coach from a similar cultural background to enhance support through shared values and respect. Spanish-speaking PEARLS participants appreciated having a bilingual, bicultural coach, recognizing they could not participate if PEARLS were only in English. Both participants and providers highlighted the social skills that a good PEARLS coach brought to the program, recognizing everyone cannot provide strong social support. A few participants did not connect with their coach due to their lack of experience, poor communication and engagement, and other coach attributes.

Increasing Opportunities for Social Interaction: Throughout PEARLS, older adults became aware they were isolated or lonely and why they were feeling this way, which pointed towards ways to increase opportunities for social interaction. For example, an older Black widow had lost her husband and siblings within the past year, and didn't feel she could talk to her adult children about it. She learned that being disconnected was not a normal part of aging and she could foster different connections with her kids, or reach out for social interactions from others in her life. Coaches worked with participants to apply PST to set realistic goals to be more social – PEARLS person-centeredness meant older adults knew what was best for increasing social interactions. Learning to weigh the pros and cons of possible solutions helped older adults get unstuck and move forward. It was up to them to carry out action plans between sessions, which some were able to do, and some were not due to various obstacles outside their control (e.g., a bad pain day, fatigue from COPD, lack of transportation). BA offered a road map for planning accessible and meaningful social activities, often with people already in their network. Doing more helped counter feelings of disconnect, which reinforced more social opportunities.

For many older adults, the pandemic exacerbated existing disconnection and created additional disconnection. During COVID, coaches shared personal anecdotes with participants to build rapport, normalize isolation and provide examples on how to reconnect in new ways. Some participants recognized their lack of social connectedness through social media and news, and

seeing other people cope helped participants realize the impact of isolation. In some cases, participants were not able to plan social interactions as they were severely constrained by lockdown policies—so PEARLS served as their social activity. When this occurred, coaches encouraged them to "*focus more on, say, pleasant activities and physical activities' because the social part is very hard right now for them to do.*" (Org 3, Provider 1, urban/suburban)

Reducing Maladaptive Social Cognition: PEARLS participants and providers described different ways that PEARLS helped reduce negative thoughts about self-worth and how other people perceive them, which contribute to disconnect and depression. Providers reflected how the PEARLS worksheet helped build confidence among older adults to tackle life's problems – i.e., PST to identify attainable steps to achieving their goals; being person-centered and using the confidence scale to open their eyes to their self-worth; planning activities via BA and recognizing they were self-neglecting. Furthermore, participants' felt heard by their PEARLS coach and focused on important and enjoyable things rather than worrying about others. As one 61-year-old White male living alone shared, "*I felt like I accomplished something and did things for myself on my own, not for other people"* (MD142).

Furthermore, accepting what one cannot change was key for older adults for whom aging came with great loss—of roles and relationships, function and ability, value and worth. During PEARLS, participants moved from "*it's not the same as it used to be*" to recognizing "*it's a whole different ball game*." Taking care of others rather than oneself was common for female participants, who shared how accepting life circumstances and returning to activities they enjoyed, rather than being immobilized by things beyond their control, was essential for improving social connectedness. For instance, one 73-year-old Black woman (TX006) shared challenges with her adult son who struggled with substance use and lived in and out of the house. Over the course of PEARLS, she grew to accept the difficult living situation (having her son be homeless was out of the question), was able to "*get up and move more"* in her house, and cleaned up her bedroom for her great-grandkids to come spend the night which helped her "*feel better about myself*."

Improving Social Skills: Though this mechanism did not come up as often as others, both participants and providers shared how PEARLS helped improve older adults' ability to communicate more effectively by "*more or less brushing up on social skills*" (FL 331, 57-year-old rural White woman) to better connect. Participants may have stopped calling and reaching out because they felt like a burden, and that their kids or friends were too busy with their own lives. There may also be trauma from their own upbringing, child rearing, and not having the relationships they wanted with adult children at this stage in their lives. With PEARLS, participants learned how to open-up or "*curve their tongue*" to improve social connectedness.

C. Under what conditions does PEARLS improve social connectedness? (*moderators*)

Quantitative

PEARLS participants who improved their depression were white, not Latino, widowed, lived with fewer people, had seen a doctor in last 3 months, had a stroke history, less caregiving hours, or did not have a pet, were more likely to improve social connectedness post-PEARLS. Participants who were female, white, unpartnered, had visited the doctor, or had more chronic

conditions were more likely to maintain improvements in social connectedness at 6-month follow-up.

Qualitative

Both participants and providers shared multi-level barriers to social connectedness which impact PEARLS effectiveness by moderating the previously described pre-conditions. Structurally, many participants had limited access to resources, a fundamental cause of health inequities—as one 79-year-old rural White widow living alone stated, "*it's hell bein' poor*" (MD049). Living in poverty means older adults are constantly "*figuring out how they're going to pay for their expenses*" (Org 5, Provider 2, urban/suburban), which limits resources for nurturing social connections like financial resources for transportation or movies, or emotional resources to manage dysfunctional relationships with family. Neighborhood-level challenges included limited opportunities for social connections, lack of access to public transportation, and disconnect with neighbors in areas with income inequality (e.g., rural areas with second homes on the water next to trailer homes). For some participants, not living close to family meant they didn't feel connected—as one 62-year-old Puerto Rican woman living alone shared, *"I'm not close because I live far"* (FL245).

Interpersonal and individual barriers to social connectedness were described in previous sections, such as challenging dynamics with and neglect from adult children, and low energy and pain from comorbid depression, health and social issues which made older adults "*more prone to wanting to shut down*." This could lead to lack of motivation or willingness to change, preferring to only connect with people like them which limited social connectedness when those people were not accessible. PEARLS provided some tools for self-advocacy and utilizing community resources for additional support to address some individual and interpersonal barriers to social connectedness; but, policy, environmental, and systems interventions are needed to tackle structural and neighborhood determinants of program effectiveness.

Integration

Table 4 shows illustrative quotes for the four mechanisms for action by which PEARLS participants improved or did not improve social connectedness and depression. This joint display table shows patterns between the assessment and interview data to generate ideas about how PEARLS may improve social connectedness among older adults with depression, and what other supports are needed.

Integrating findings suggests older adults who reduced depression and <u>enhanced social support</u> had people in their lives they could connect with, improved how they were connecting, and felt more connected even if they faced mobility limitations or family lived far away. For older adults who did not improve depression, they may still have felt like a burden or lacked connections with family. Participants who improved depression but not connectedness may have become less depressed through supports and services yet did not address underlying disconnect or have lasting connectedness. Older adults who improved depression and <u>increased opportunities for social interaction</u> used PST and BA to break down larger problems and resume doing meaningful things or create a new normal. For participants who did not improve their depression, opportunities for social engagement may have been limited by lack of income.

Participants who reduced maladaptive social cognition and depression shared how their coach helped them focus on themselves rather than others, move beyond the negative to the positive, and accept what they cannot change, all of which helped them connect with others. Older adults who did not improve their depression but reduced negative thoughts may have had less acceptance about aging and or their depression interfered with their ability to carry out action plans. For participants who improved on neither, changing negative self-talk may not have been enough for impact. Lastly, for older adults who improved social skills and depression, PEARLS may have helped them move beyond their problems to reach out, whether by adjusting communication with adult children, or engaging with grandchildren despite health limitations. For those who did not improve depression, social skills may have still improved but not enough to counter other life challenges.

Figure 2 brings together learnings on effectiveness, mechanisms and moderators, illustrating potential causal pathways by which PEARLS participants can improve social connectedness. Reading from left to right, PEARLS' ability to activate the four mechanisms is moderated by multi-level barriers and how the intervention is delivered. Coach attributes, having a social network to strengthen, and COVID-19, were pre-conditions for whether mechanisms were ever activated. These same preconditions and moderators influenced whether the four mechanisms translated into more social connectedness. Several proximal outcomes, or early indications PEARLS works as intended, include affective (e.g., less emotional distress); cognitive (e.g., higher self-efficacy, acceptance of reality, awareness of disconnect); and behavioral (increasing social, physical, and pleasant activities, self-care and disease management) outcomes, with reducing depression touching all proximal outcomes.

Discussion and Implications

Study results suggest that PEARLS, an evidence-based depression program, can improve social connectedness among older adults experiencing poverty. After active intervention, participants significantly reduced loneliness and perceived isolation, and improved social interactions and satisfaction with social supports. These improvements persisted but were attenuated over time and during COVID, especially for objective measures of social isolation, suggesting improvements were not only due to active intervention. On the one hand, these findings are surprising given that coaches did not adapt PEARLS to address social connectedness, beyond incorporating social connectedness measures into their enrollment assessment. On the other hand, PEARLS incorporates core functions of interventions that reduce social isolation and loneliness (Dickens et al., 2011; NASEM, 2020), so some improvement in social connectedness was hypothesized.

Our findings support PEARLS operates through four established mechanisms for action to reduce social isolation or loneliness for diverse older adults. Furthermore, PEARLS addressed both depression and social disconnect, conditions that reinforce each other. While participants overall became more socially connected after PEARLS, for whom, why, and how this connection happened varied. We found several preconditions for PEARLS to improve social connectedness or moderate effectiveness. For instance, the social support from their coach helped older adults feel trusted and heard, which facilitated awareness, acceptance, and behavioral changes using the

PST and BA tools (rather than coaches doing for them). While 12-month follow-up findings suggest social connectedness is improved beyond coach support, participants often describe their coach first when asked about PEARLS. This participant-coach relationship is essential when working with marginalized older adults where engagement is a key ingredient for social validity and outcomes. [127]

As a social determinant of health, social disconnectedness and the ability to activate mechanisms for action is influenced by contextual issues faced by older adults such as living in poverty, including poor transportation and social capital, greater neighborhood deprivation, crime, and segregation. [95] In the U.S., growing older often comes with stressful life changes such as functional decline, loss of purpose, change in roles, networks, and living situation, and ageism and other systematic inequities [128]. PEARLS participants and coaches sometimes came up with ingenious ways around these barriers or ways to accept them, and sometimes not. Further research and practice should embed PEARLS within multi-level interventions that address social, cultural, environmental barriers to being or feeling connected.

In the pandemic context, social disconnectedness increased among some older adults [129,130]. Older BIPOC adults, in poverty, with complex health needs, living alone, or with disabilities were hardest hit [131]. There was an incredible strain on social service staff and CBOs, working tirelessly to provide food, COVID-19 information and vaccines, and other services. The past few years also brought social challenges beyond COVID–a combative presidential election, police violence and continued racial injustice against Black and Brown communities, wildfires and other extreme weather—that influenced PEARLS engagement, delivery and effectiveness. While PEARLS helped older adults manage collective and individual losses and stresses by creating a "new normal" during COVID-19, social distancing may have reduced social connectedness and diminished PEARLS impact. The pandemic did, however, present opportunities to provide PEARLS by phone or videoconferencing, suggesting "telePEARLS" is acceptable, feasible and effective.

Strengths and Limitations

This evaluation addressed several critiques of previous research, including unclear or interchanging definitions of social isolation and loneliness, small sample sizes, and lack of follow-up (NASEM, 2020). We also aligned with recent recommendations to address health equity [132], engaging CBOs and the older adults they reach who are often left out of research studies so findings would be applicable and accessible. Mixed methods allowed for quantitatively evaluating PEARLS effectiveness as a social connectedness intervention, while qualitatively describing the mechanisms and moderators that offer opportunities to improve impact. Participant interviews centered stories of resilience and loss, while providers offered nuanced perspectives across participants rather than a self-selected group. Comparing findings generated several hypotheses about how PEARLS improves social connectedness to guide future research and practice.

This study brings several limitations. As a single group design without a comparison group or randomization, one cannot make causal inferences that PEARLS alone led to better social connectedness. While we found support for the four mechanisms for action for improving

social connectedness, future experimental or quasi-experiment research would limit threats to internal validity. Our sample only included older adults living with depression, which limits applicability to those who are disconnected but without clinically significant depressive symptoms. Furthermore, LGBTQ+ older adults and those living in rural areas were underrepresented, and by receipt of social services our sample is less isolated than persons not connected to CBOs.

Conclusion

This evaluation suggests PEARLS can be effective at increasing social connectedness among older adults who have been traditionally underserved. With social isolation and loneliness a leading cause of morbidity and mortality, we provide a path for marginalized older adults and the CBOs that engage them to strengthen these connections. Future research, policy and practice must tackle identified barriers to delivery and impact.

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TABLES AND FIGURES

Figure 1. Convergent mixed methods evaluation design and methods

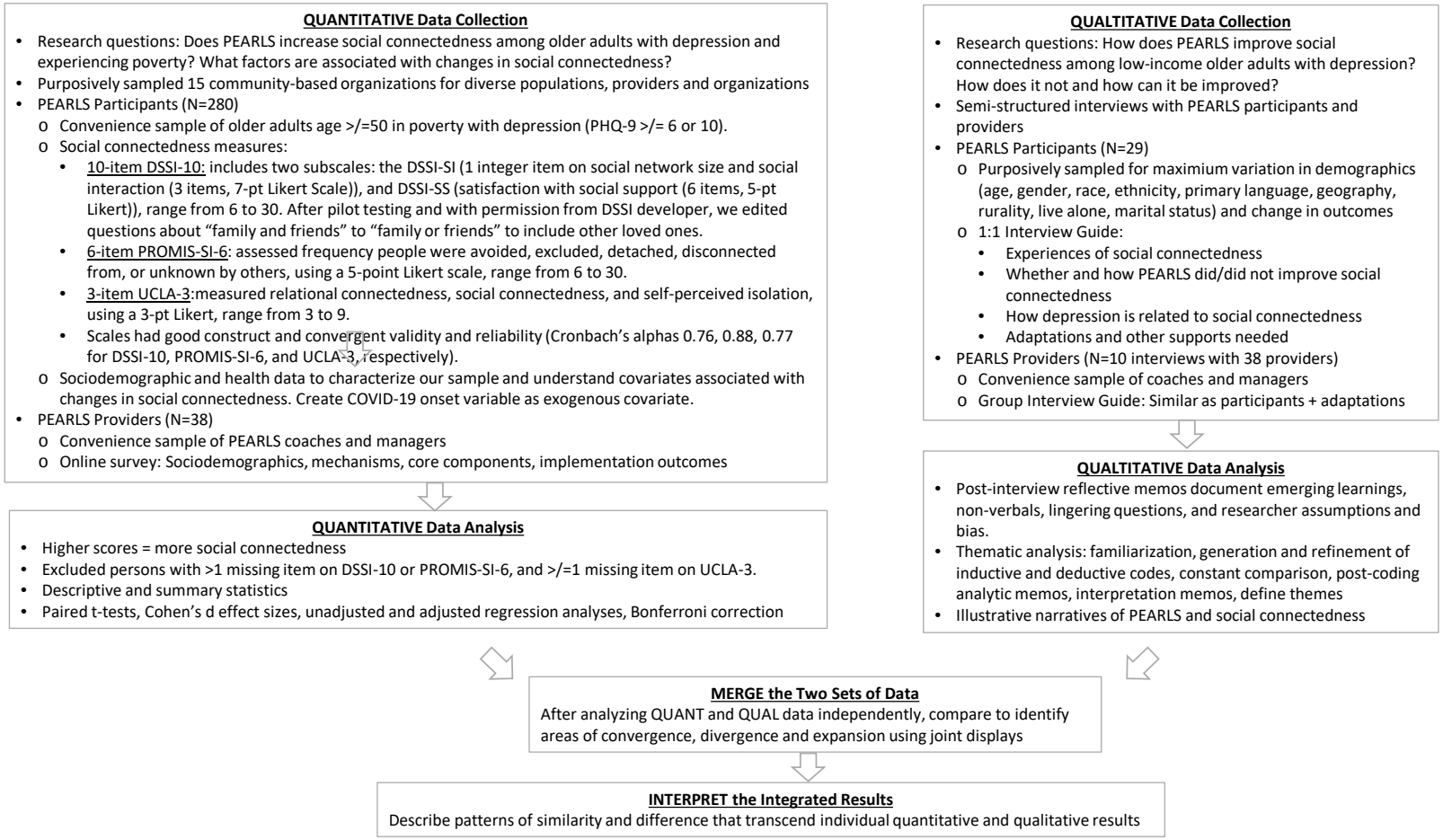

Figure 2. Integrating quantitative and qualitative findings to evaluate whether, how and under what conditions PEARLS works to improve social connectedness among low-income older adults with depression.

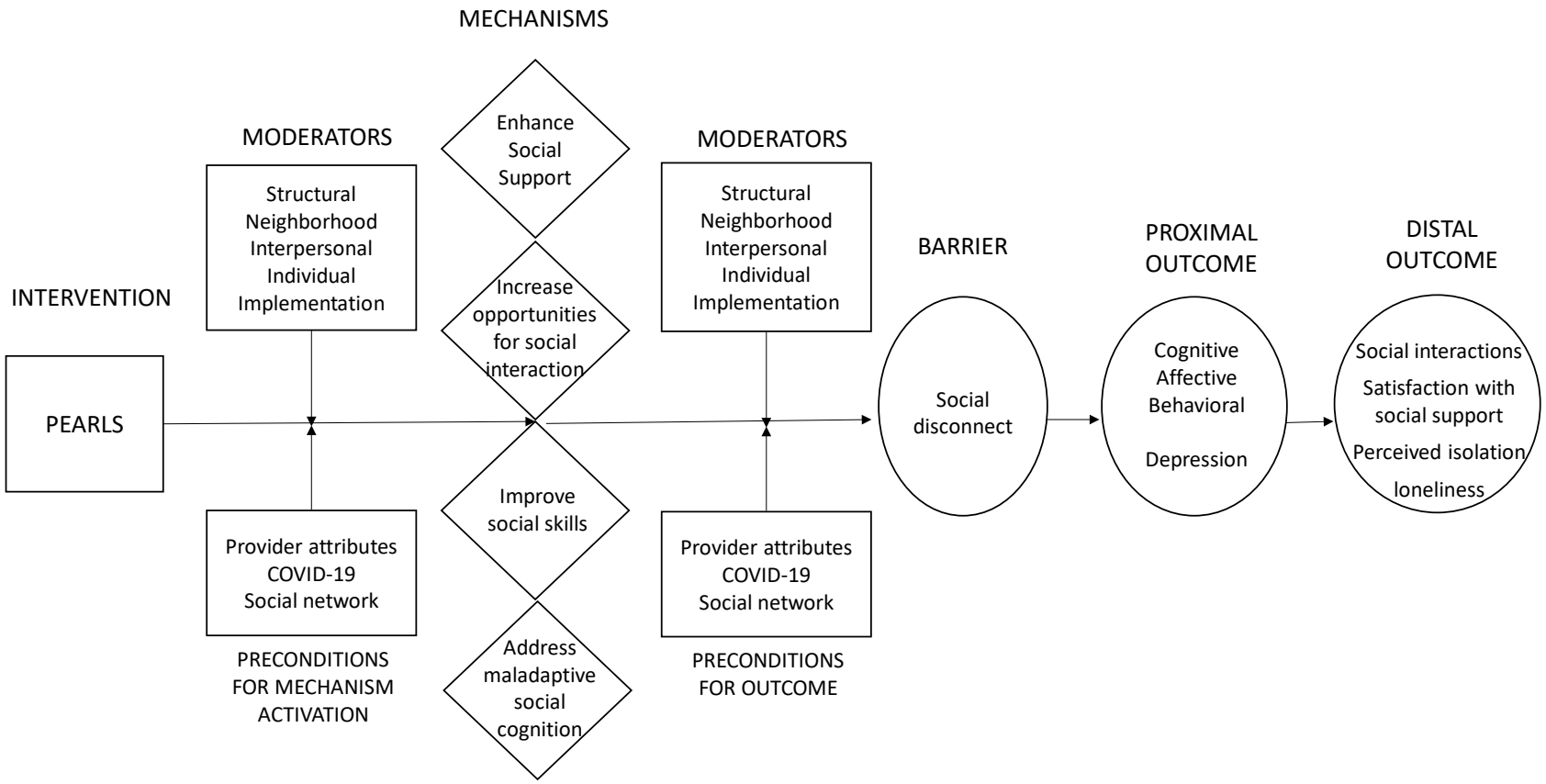

TABLE 1. PEARLS Participant Demographics for quantitative arm (N=280)

	%	n		%	n
Age *(Mean SD)* (range 50 – 93)	*71.8*	*9.5*	**< 250% Federal Poverty Level**	82.4	169
Female	81.5	185	**Basic needs (food, housing, heating)**		
			Somewhat hard to pay for basics	40.1	97
Race and Ethnicity			Very hard to pay for basics	30.2	73
White	58.0	129			
Black	21.3	47	**Occupation** - % not working/retired [d]	94.2	212
Latino [a]	16.2	36			
Other [b]	4.5	10	**Caregiving** in last 12 months	33.5	76
			Care for adults with dementia	40.9	29
LGBTQ	7.1	16	Live with care partner	48.0	36
			Paid for caregiving	7.9	6
Rural (RUCA zip)	7.2	20			
			Poor/fair self-rated health	57.4	159
Relationship status					
Married/Partnered	21.2	48	**Chronic conditions**		
Widowed	27.3	62	*Mean (SD)* chronic conditions	*4.2*	*2.0*
Divorced or Separated	31.7	72	>/=2 chronic conditions (“multiple”)	92.8	257
Single (Never Married/Partnered)	19.8	45	5 or more chronic conditions	54.2	150
Living status			Lung disease (e.g. asthma)	30.0	68
Live alone	60.6	137	Joint problems (e.g. arthritis)	72.7	165
Live with spouse/partner	16.9	47	Diabetes	34.5	78
Live with other family or friends	20.5	57	Digestive problems (e.g. ulcer)	36.6	83
			Heart problems (e.g. angina, CHF)	37.9	86
Live with pets	44.2	99	Hypertension	58.4	132
Education			Stroke	22.0	50
High school graduate/GED or less	36.6	83	Mental health conditions [e]	77.2	173
Some college	36.6	74			
College grad or grad school	30.8	70	*Mean (SD)* PHQ-9 depression score	*12.7*	*5.1*
			PHQ-9 >/= 10	74.8	206
Income [c]					
< $30,000 (household size = 1)	86.1	118	**Access to health care**		
< $40,000 (household size = 2)	57.7	30	Hospitalized in the last 3 months	31.8	88
			Did not see PCP in the last 3 mo.	16.6	46

N (%) unless otherwise noted. *Mean (SD) in italics*. CHF=Congestive Heart Failure. GED=General Educational Development. LGBTQ+ = Lesbian, Gay, Bisexual, Transgender, Queer, and other sexual identities. PCP=Primary Care Provider.PHQ-9=Patient Health Questionnaire. RUCA=Rural Urban Commuting Area. SD=Standard Deviation. [a] Latino includes 36% Puerto Rican, 14% Dominican, 14% Latino countries in North, Central, South America, 36% country of origin not specified. [b] Other Race/Ethnicity includes people who identified as Asian, American Indian/Alaskan Native, Native Hawaiian, or Jewish. [c] Denominator is different as participants were asked one item based on household size. [d] Includes persons not working due to disabilities or retired. [e] While all have clinically significant depressive symptoms, some do not have official diagnosis.

TABLE 2. PEARLS Participant and Provider Demographics for qualitative arm (N=29)

PARTICIPANTS	%	n	PROVIDERS	%	n
Age *(Mean SD)* (range 52-82)	*68.2 (7.8)*		**Age**		
			18-39	21	8
Female	75.9	22	40-59	37	14
			60 or above	42	16
Race and Ethnicity					
White	51.7	15	**Female**	87	33
Black	27.6	8			
Latino [a]	17.2	5	**Race and Ethnicity**		
Other [b]	6.8	2	White	58	22
			Black	29	11
Relationship status			Latino	16	6
Married/Partnered	13.8	4	American Indian/Alaskan Native	5	2
Widowed	20.7	6	Asian	3	1
Divorced	31.0	9	Native Hawaiian/Pacific Islander	5	2
Separated	3.4	1			
Single (Never Married/Partnered)	31.0	9	**Education**		
			Bachelor's or some college	29	11
LGBTQ	6.9	2			
			Time spent doing PEARLS		
Rural (RUCA zip)	6.9	2	8 hours or less	29	11
			9-16 hours per week	26	10
Living alone	55.2	16	17-24 hours per week	3	1
			25-32 hours per week	10	4
Caregiving in last 12 months	37.9	11	40 hours per week	32	12
Chronic conditions *(Mean SD)*	*4.9 (2.1)*		**Experience with PEARLS**	45	17
			Less than 1 year	13	5
Baseline PHQ-9 depression (*Mean SD*)	*13.3 (4.6)*		1-3 years	34	13
			4-6 years	45	17
Somewhat or very hard to pay for basic needs	75.9		7 years or more	8	3

N (%) unless otherwise noted. *Mean (SD) in italics*. PHQ-9=Patient Health Questionnaire. RUCA=Rural Urban Commuting Area. [a] Latino includes 60% Puerto Rican, 40% Dominican. 3 participants (10%) did interviews in Spanish. [b] Other Race/Ethnicity includes American Indian/ Alaskan Native or Jewish.

TABLE 3. Magnitude of social connectedness at PEARLS at pre, post (6-months), and follow-up (12-months).

	Mean (SD)										
Outcome	**Baseline**	**6-Month**	**12-Month**	**6-mo change**	***t***	***df***	***p*** [a]	**12-mo change**	***t***	***df***	**p** [a]
Social interaction and satisfaction with social support (DSSI-10)	21.2 (4.2)	22.4 (4.2)	22.2 (4.1)	1.2 (3.9)	5.2	312	<0.001	1.0 (4.1)	4.2	280	<0.001
Perceived social isolation (PROMIS-SI)	20.1 (6.5)	22.6 (6.2)	21.1 (6.4)	2.2 (6.2)	6.3	310	<0.001	1.0 (6.3)	2.6	274	0.009
Loneliness (UCLA)	6.1 (2.2)	6.6 (2.1)	6.4 (2.1)	0.5 (2.2)	3.7	301	0.002	0.3 (2.2)	2.3	272	0.023

DSSI-10: Duke Social Support Index (10-item) (range 10-30); PROMIS-SI: PROMIS Social Isolation scale (range 6-30); UCLA: UCLA Loneliness 3-Item Scale (range 3-9). Higher score=more connected. [a] Probability values for differences between pre- vs 6-mo and vs 12-mo measures using paired t-tests.

Table 4. Joint display table of improvements in social connectedness (quantitative) by mechanisms for action (qualitative).

	Improved social connectedness**				**Did not improve**
Mechanisms	Social isolation	Satisfaction social support	Perceived isolation	Loneliness	
Interview sample	34.5% (10/29)	51.7% (15/29)	72.4% (21/29)	62.1% (18/29)	17.2% (5/29)
Improved depression?*	70.0% (7/10)	46.7% (7/15)	47.6% (10/21)	55.6% (10/18)	0.0% (0/6)
Enhance social support	Don't get around like used to but have people to talk to in building	Coach being from similar cultural background → more open → better care and outcomes	Improve quality of relationships with friends – as became less depressed, ranted less about ex	Don't live close to family Feel less lonely even though socially isolated	*No interview participants met this criteria*
Increase opportunities for social interaction	Made plans in advance so had something to look forward to	Used PST and BA to restart activities used to enjoy	Use PST steps to go out in public and have something to do that chose myself	Used PST and BA to break down complex issues into smaller pieces to tackle	
Reduce maladaptive social cognition	Accepting being alone with not much going on they like doing (only bar scene for dancing)	PEARLS coach helped her focus on getting it together instead of talking about everyone else	Helped move me from dwelling on stuff to being on a more positive path	Feel more connected to grandkids, even though I have to be alone most of the time since covid	
Improve social skills	Helped me deal with adult kids by learning to think before talking	Alone due to homebound/ health issues -> took risks and connect with grandkids	Reach out and find something else to do beside looking at my problems	Coach let her speak but moved along rather than dwelling on all that stuff	
Did not improve	30.0% (3/10)	53.3% (8/15)	52.4% (11/21)	44.4% (8/18)	100.0% (6/6)
Enhance social support	Would like to be more connected with family but they are busy with their lives	Doesn't get out but the phone is my friend, and thank God for neighbors who bring supplies	The person (PEARLS coach) who comes to see you makes or breaks it. Listening + counseling = support.	Hard to depend on other people when used to being independent + don't want to feel like a burden	Came to home and got things like food that couldn't afford
Increase opportunities for social interaction	Isolated geographically, with limited transportation options	Try to get out and do things that wasn't doing before but hard without car	Reconnected with church family.	Set goals to start getting connected out of the house again (baby steps)	Strong spirituality but hard to attend church to be around others
Reduce maladaptive social cognition	Life wonderful when younger, more difficult with aging even though married.	Having someone listen made me feel less ashamed	Became calmer after talking with coach and moving around the house.	Planning doesn't always lead to doing, depression can get in the way.	PEARLS provided direction, motivation, and accountability to knock out the negative.
Improve social skills	PEARLS direction helped connect instead of feeling no one understands me	Opened up and talked more than used to, but have had a pretty rough year	Did not have choices in past → coach support for goals and solutions	Helped me know myself and learn how to connect with others	Felt more connected with everybody. Isolated → appreciate quiet home in woods.

Depression improvement = response (>/= 50% decrease btw pre and post PHQ-9), or remission (PHQ-9<5). Social isolation=DSSI-SI, Satisfaction=DSSI-SS, Perceived isolation=PROMIS, Loneliness=UCLA

SUPPLEMENTAL MATERIAL

Supplemental Figure 1. Narratives of social connectedness among low-income older adults living with depression.*

Alicia is a 62 Black divorced woman who lives alone in the city. She is slowed down by both her renal disease and medications. She became isolated and depressed after her son was killed, and each year anniversary she disconnects. Doing PEARLS with a Black coach who understood her culture helped her get back on track – connecting with her grandkids, and managing her diet and weight so she didn't have to spend so much time at dialysis. She is frustrated she hasn't been able to return to the Y water aerobics as it takes so much energy to go early via Access van and there is no elevator for her to get down to pool. (WA072)	Angelica is a 72 year-old Spanish-speaking Dominican woman living in an large urban area. It is hard for her to connect as she living with multiple health issues including heart disease, a stroke that impaired her speech, and a bad knee that led to a recent fall. She is close to her older mother but it is hard for her to come visit as the apartment is not accessible with her wheelchair. Angelica lives with her sister who wants her out of her apartment because she can not pay rent. She both is and feels disconnected even with family around. (NY688)
Mary is a 79- year-old White widow living alone in a rural area. She faces barriers to mobility– she has trouble walking because her leg bothers her real bad, and she cannot afford a new car after her car died so she needs people to pick up to go out in community. Her grandchild comes over and helps including when her spouse was dying – she would love to see her more but she works and is busy. She would like to be doing more but given these challenges she typically sits on her butt and watches TV. (MD049)	David is a 61-year old married White man. For the last 20 years he has been caregiving for his wife who is living with dementia which has strained the connection he feels from his relationship. Becoming depressed and being a full time caregiver led him to feel isolated. Through PEARLS, he realized how dark and angry he had become. Having someone to talk to and reflect back to him what he was saying and how we was acting, plus making the effort to resume taking Prozac, has helped him feel both far less depressed and isolated. (TX001)

*Names changed to protect privacy.

Supplementary Table 1. Baseline to 12-month change in social connectedness by sociodemographic characteristics. (N=280)

	DSSI-SI		DSSI-SS		DSSI-10		PROMIS-SI-6		UCLA-3	
Unadjusted regression [a]	B	95% CI	B	95% CI	B	95% CI	B	95% CI	B	95% CI
Age *(continuous)*	-.003	-.029-.023	.031	-.011-.074	.030	-.024-.084	-.019	-.111-.072	-.017	-.047-.014
Female	.696*	.021-1.37	.513	-.608-1.63	1.33	-.084-2.75	2.58*	.223-4.94	.841*	.061-1.62
White	.573*	.045-1.10	-.280	-1.16-.596	.214	-.897-1.33	.677	-1.17-2.53	.294	-.329-.918
Latino	-.901*	-1.61- -.206	-.689	-1.88-.501	-1.42	-2.91-.066	-.581	-3.06-1.90	-.425	-1.26-.408
LGBTQ+	.586	-.393-1.56	.864	-.755-2.48	1.43	-.617-3.48	.120	-3.27-3.51	.461	-.671-1.59
Unpartnered	.502	-.157-1.16	1.05	-.034-2.13	1.66**	.294-3.02	.998	-1.29-3.28	-.056	-.822-.710
Some college or more	.222	-.320-.766	-.636	-1.52-.251	-.535	-1.66-.591	-1.15	-3.03-.724	.171	-.462-.803
No pets	-.107	-.641-.429	.237	-.641-1.12	.094	-1.02-1.21	.839	-1.02-2.70	.041	-.585-.667
PHQ-9 *(continuous)*	.056*	.007-.105	.028	-.055-.111	.096	-.007-.199	.165	-.002-.333	.036	-.022-.094
Live alone	.027	-.515-.568	.817	-.067-1.70	.766	-.355-1.89	-1.29	-3.16-.574	-.312	-.950-.301
Low-income <250% FPL	-.320	-.950-.310	1.12	-.075-2.32	.705	-.814-2.22	.308	-2.16-2.78	-.130	-.965-.705
Somewhat/hard to pay for basic needs	.015	-.528-.558	.690	-.228-1.61	.735	-.412-1.88	1.21	-.605-3.02	.529	-.087-1.15
Caregiver	.047	-.514-.609	.003	-.914-.920	.030	-1.13-1.19	.535	-1.41-2.47	-.062	-.711-.587
Doctor's visit in past 3 mo.	.401	-.238-1.04	.981	-.100-2.06	1.17	-.170-2.51	2.33*	.162-4.49	1.12**	.384-1.86
# of chronic conditions *(continuous)*	.012	-.119-.143	.245*	.034-.457	.258	-.012-.528	.480*	.029-.930	.118	-.033-.270
Asthma	.130	-.443-.703	-.036	-.976-.904	.037	-1.16-1.23	.599	-1.39-2.59	-.233	-.901-.435
Arthritis	.052	-.542-.646	1.16*	.203-2.11	1.23*	-.010-2.45	1.20	-.846-3.24	-.015	-.701-.671
Cancer	.243	-.567-1.05	-.719	-2.06-.621	-.609	-2.13-1.10	.935	-1.88-3.75	.534	-.406-1.47
Diabetes	-.211	-.767-.346	.885	-.019-1.79	.612	-.543-1.77	1.10	-.825-3.02	-.062	-.712-.587
Digestive Dx	.070	-.475-.616	.655	-.234-1.54	.667	-.463-1.80	2.79**	.942-4.64	.757*	.131-1.38
Heart Dx	.111	-.430-.652	.031	-.854-.916	.120	-1.00-1.24	1.04	-.829-2.91	.361	-.266-.987
Hypertension	.051	-.487-.588	.300	-.578-1.18	.375	-.739-1.49	-.890	-2.75-.968	-.078	-.702-.547
Kidney Dx	-.320	-.981-.341	.351	-.727-1.43	.013	-1.36-1.38	1.38	-.882-3.64	.806*	.048-1.56
Neurological Dx	.577	-.170-1.32	-.074	-1.31-1.17	.773	-.775-2.32	.046	-2.56-2.65	.547	-.333-1.43
Stroke	.444	-.188-1.08	1.14*	.098-2.18	1.68**	.378-2.99	2.87**	.712-5.03	.690	-.043-1.42
Adjusted regression models [b]										
Female	.610*	.004-1.22							0.678*	.027-1.33
Latino	-.999**	-1.70--.300								
Doctor's visits in past 3 months									0.829**	0.172-1.49

*= significant p-value <0.05, **=significant p-value <0.017. B=regression coefficient; FPL=Federal Poverty Level; PHQ-9 = Patient Health Questionnaire 9-item. [a] Unadjusted regression models are compared to male, BIPOC, partnered, high school/GED or less, living with pets, living with others, not low-income, not hard to pay for basic needs, not a caregiver, not visiting doctor in last three months, or lack of specific chronic conditions (CCs), unless listed as continuous in which case reference is each additional unit increase in age years, PHQ-9, number of CCs. [b.] For adjusted regressions, covariates who were statistically significant (SS) in unadjusted regressions models were fit into one model for each outcome. Only SS associations are reported in this table, all other associations for UCLA-3 and for the other outcome measures were NS.

Supplementary Table 2. How PEARLS can work to improve social connectedness for older adults (mechanisms for action)

Mechanism	Participant perspectives	Provider perspectives
Enhance social support	<u>Emotional support from PEARLS coach</u> *Somebody you could **talk to about anything**.* FL331, 57 year old White female, urban/suburban ***I'm in the same culture** as [PEARLS coach]. That made it really nice because she understood a lot of stuff. Man, **she was right there with me….it made me feel like I had a sister who was her**. I was very open. **It made me very open to her and therefore she could help me better**.* TX030, 62 year old Black woman living alone <u>Instrumental support from PEARLS coach</u> *It was nice to have **someone look out for you** and notice you, she brought curry powder for a recipe.* MD142, 61 year old White male living alone, urban/suburban <u>Appraisal support from PEARLS coach</u> *Well, they're very willing to help people. And they ask the right questions. They don't always get the right answers but they always **ask the right questions**…And they come and talk to me [at my house].* MD049, 79 year old White widow living alone, rural <u>Which led to emotional and instrumental support from social network</u> Friends: *They call me four or five times a week and we talk. **And if I have a problem, they help me solve it because these are people I will trust and talk to**. Now, since I don't have anybody else to talk to about my problems, **these are the people I will depend on**.* NY501, 82 year old White man living alone, urban Church: *I thought it was only God that I needed, and yes, that is important, but one of the things, if you know the Bible, is **people need to fellowship together**. **You need to be around other people** who have similar interests or feelings about God. **And it helps me know God even better** in my life.* MD087, 67 year old Black woman living alone, urban Neighbors: *I live alone. I've had falls in the past. I mean, I do have my next-door neighbors. Thank God for them, because **if it wasn't for them, I wouldn't have anything here, as far as supplies**.* MD142, 61 year old White man living alone, urban/suburban	<u>Emotional support from PEARLS coach</u> *I always start my sessions with 'let's have something to drink and toast.' **It has to be positive. Once we've done with all the venting and the negative, I say, 'take a breath.** And let's take on a positive hat of role here, and…Let's deal with the present. What can we do to feel better? Do you want, joy, peace? **Let's create that because we can be kind of our own superheroes**.* Org 6, Provider 1, urban/suburban <u>Instrumental support from coach & community</u> *We're kind of doing baby steps and **connecting them to other programs** or other types of resources on the phone if they're unable to go out into their community. **We're that first step to them socializing with others**.* Org 4, Provider 1, urban/suburban <u>Which led to emotional and instrumental support from social network</u> *I [encouraged my client to] move on from where she was stuck [and] to get out more. She lived with a husband who helped her a lot in terms of getting out. **He started to play a more active role** and being able to do that. She actually got to the point where **she really engaged at church in the way that she did before her decline**.* Org 5, Provider 1, urban/suburban

Mechanism	Participant perspectives	Provider perspectives
Increase opportunities for social interaction	<u>Awareness about being isolated</u> ***Just losing my husband after so many years. I see, I didn't have nobody to talk to 'cause if I said something about it to the kids, you know, they'd be saying things like just be quiet about it. They didn't say be quiet but you know that's what they are thinking. So, I didn't have nobody to talk*** *to…I had three sisters and three brothers and the last one left in January and he left in June. And the one that left in January, we talked every day 3 to 4 times a day. So, I didn't have, I didn't have nobody to talk to, nobody to communicate with. I was kind of strung out a little bit.* TX004, 81 year-old Black widower, urban/suburban <u>Use PST and BA to tackle social problems and be and feel more social</u> ***Getting out more, doing more, because I was kind of to myself... getting out more, reaching out more to... talking about things more…That was encouraging. It was steps, baby steps, but we finally got there****….It's kind of like, you know how to swim, but then you've been away for a long time and then somebody say hey, you got to put your breaths, and do this and do that, kind of coach you back into it... redirecting you back on the right steps.* FL219, 65 year-old Black woman, urban/suburban ***You have to do some positive things enough times that it knocks out the negative****. And if you don't have ways to do that or ways to keep you on track or following through with that, like PEARLS does, you're kind of lost in this world with feeling like ah, nobody understands me, you know, like, boo-hoo type thing, you know. And so* ***you need to be around some people that can give you the directions like PEARLS does****.* WA088, 79-year old White woman, urban/suburban ***I just never really put myself out there to other people****. Not only I had to depression, but a trust issue. So the more I let my guard down a little bit, the better my depression got. Because things turned out not to be a dooming type of situation. Like I said,* ***I've made friends in my building. So there's a closeness between some of the people here now****. I got to the point where people would knock on my door. 'Are you okay? We didn't see you at lunch today.' Or I would go see other people who were going through stuff. And I'd say, 'What's going on? Are you okay? You didn't come to the meeting…..****I actually ended up joining the resident activity committee*** *here.* MD087, 67-year old Black woman living alone, urban/suburban <u>Reconnect with social network</u> *We talked about and I planned was just to* ***go to church and be around people again because I used to be a really outgoing person, and I was everywhere and talking to everybody, and all of the sudden it was like I didn't want to talk to nobody or be around nobody****.* TX008, 65 year old Black and American Indian woman, urban/suburban	<u>Awareness about being isolated</u> *[Participants have told me] '****I had not realized how I had isolated myself so much but talking it through with you, I realize I'm really, really isolated****.' So just that realization of how much they had changed and were in this little bubble that they hadn't realized.* Org 2, Provider 1, urban/suburban <u>Use PST and BA to tackle social problems and be and feel more social</u> *I think* ***for the most part people can't see the forest for the trees, they're so overwhelmed by what they're going through.*** *That's why* ***we pick apart their issue****. And say,* ***what do you want to start with let's get little victories, baby steps****.* Org 1, Provider 1, rural *When I sat down to do the problem list, [it] would be the client's job to do the problem… to get an older adult to say hello to somebody who may be speaking Spanish in the elevator, in their building.* ***That takes a leap for them. Some are willing and some aren't.*** Org 10, Provider 2, urban/suburban <u>Reconnect with social network</u> *"They don't realize that they could still connect with their friends…some of my clients are sitting at home and feeling lonely. It really, really helps them to realize that* ***they don't have to be alone****."* Org 7, Provider 1, urban/suburban

Mechanism	Participant perspectives	Provider perspectives
Reduce maladaptive social cognition (Negative thoughts about self-worth and how others perceive you)	<u>Realize their value and improve self-esteem</u> *She just **helped me bring my self-esteem back up. To believe in myself again. Like I said before, stop worrying about other people and worry about myself sometimes**. Sometimes she told me I probably needed to have some me time and stop worrying about all my grandkids as much as I do….I gradually learned to just back off. Like I said a few minutes ago whatever I could change I'd change it or whatever I can't, I don't. I leave it alone and go on. I can't do nothing about it. I pray about it. That's it…..**I came back to being myself and enjoying things some, and I enjoyed talking to young people**. They'd ask me questions about things in their life. I enjoyed doing that. **Now, I can talk to them without feeling like I'm down and out and I don't know what I'm talking about**.* TX008, 65 year old Black and American Indian woman, urban/suburban <u>Gain acceptance and focus on positive</u> *It was a very positive experience. She gave me great advice. And she didn't want to, **she let me speak and didn't dwell on any of that stuff.** She moved right along and **put me on a path that was, other than the negative path that I was thinking.*** FL157, 74 year old White male living alone, urban/suburban *I used to feel isolated but after talking, visiting with [PEARLS coach] and going through the PEARLS, **I feel a little bit more connected with everybody**. I just say, all right, **I'll go back in my woods and be nice and quiet than have all this noise and drama during the day and at night**.* FL 331, 57-year old White woman, rural	<u>Realize their value and improve self-esteem</u> *I think we're planting seeds in people's minds. [Participants] may not be ready because timing is everything… [one of my participants] was able to take that idea [and apply it later] … **she felt empowered**.* Org 7, Provider 2, urban/suburban <u>Gain acceptance and focus on positive</u> *Not just the PHQ-9, but the program itself just day to day, it has really given [my client] an opportunity to make a decision to **rethink her choices for opportunities and how she can handle life**.* -Org 8, Provider 1, rural *Our position is **not to be their friend and jump on the bandwagon of 'poor pitiful I can't believe they're doing this to you.' Because they want that, and that's not what PEARLS is all about**. You have to guard against that I have found*. -Org 1, Provider 1, rural

Mechanism	Participant perspectives	Provider perspectives
Improve social skills	<u>Communicate more effectively</u> *"Learning how to curve my tongue was one of my big issues during the counseling….And it's been an issue with me all my life, you know, because I always said once I got out from under my mother's household then I was never going to shut up. And I followed through pretty much with that, but at the same time my mouth has gotten me in some pretty predicaments. So learning to control it.* ***Everybody has an opinion but not everybody wants yours****.* ***So I think it [PEARLS] has made quite an impact on my, on how I deal with people****. You know, I have to learn to think before I open my mouth. Think about what I want to say and the way I say it….Because* ***that's hard when you're still with your children, because you want to always be the parent and always be right and that's not, that nary the case these days****."* WA086, 71 year old White widower living with adult children, urban/suburban *They say* ***I've more opened up and talk a lot more than I usually do****. I've had a pretty rough year. I got the double amputation now. I've lost my left leg in 2016. And then I lost my foot in January below the knee and then it turned out to be above the knee. I'm going through that right now. Trying to get that stump healed up so I can get my prosthetic. I told my grandbaby, I said, told him, I said me and you will be walking about the same time. I talk to my grandson like he knows exactly what I'm talking about…. he's just laughs….I think it was, I think PEARLS works, you just got to connect.* ***You got to find out where you connect and learn how to connect us. That's what it is. It's to help people and get to know yourself too…just more or less brush up on my social skills, learn to open up****.* FL 331, 57-year old White woman, rural	<u>Communicate more effectively</u> ***She and her daughter had these issues about the daughter always wanting to blame her for making her feel guilty****. The client was moving, and she was a little hesitant about asking her daughter to come and help her. I said, 'that's what we do as families, we reach out we lean on each other.' And [my client] said, 'we're going to argue the whole time.' I said, 'when she walks in the door, if she starts, give it a moment and say, 'Honey, I'm so happy that you're here.' The daughter came, was two hours late and told [the client], 'I'm late, it's over, you want me to go, you don't want me to stay here.' [My client] said,* ***'Honey, it is so good that you're here. We have all this unpacking to do; you can help me organize and look how lovely you are.'*** *They then had a wonderful time unpacking; they were able to put pictures on the wall.* Org 6, Provider 1, urban/suburban

Chapter 3. Aim 2 paper

Can a home-based collaborative care model reduce health services utilization for low-income older adults living with depression and co-occurring chronic conditions? A quasi-experimental study.

Abstract

Purpose: Depression remains a major public health issue for older adults, increasing risk of costly health services utilization. While home-based collaborative care models (CCM) like PEARLS have been shown to effectively treat depression in low-income older adults living with multiple chronic conditions, their economic impact is unclear. We conducted a quasi-experimental study to estimate PEARLS effect on health service utilization among low-income older adults.

Methods: Our secondary data analysis merged de-identified PEARLS program data (N=1,106), home and community-based services (HCBS) administrative data (N=16,096), and Medicaid claims and encounters data (N= 164) from 2011–2016 in Washington State. We used nearest neighbor propensity matching to create a comparison group of social service recipients similar to PEARLS participants on key determinants of utilization guided by Andersen's Model. Primary outcomes were inpatient hospitalizations, emergency room (ER) visits, and nursing home days; secondary outcomes were long-term supports and services (LTSS), mortality, depression and health. We used an event study difference-in-difference (DID) approach to compare outcomes.

Results: Our final dataset included 164 older adults (74% female, 39% people of color, mean PHQ-9 12.2). One-year post-enrollment, PEARLS participants had statistically significant improvements in inpatient hospitalizations (69 fewer hospitalizations per 1,000 member months, $p=0.02$) and 37 fewer nursing home days ($p<.01$) than comparison group participants; there were no significant improvements in ER visits. PEARLS participants also experienced lower mortality.

Conclusions: This study shows the potential value of home-based CCM for participants, organizations and policymakers. Future research is needed to examine potential cost savings.

Introduction

Late-life depression carries a huge economic burden for people, providers, and society. It is associated with higher health services utilization: older adults use more acute health care (Katon et al., 2003; Manning & Wells, 1992; Simon et al., 1995) and enter nursing homes earlier [6]. Reasons for increased utilization include depression's association with symptoms that require medical care (e.g. pain), non-adherence to medical care for physical chronic conditions [45], and decline in physical capacity and ability to participate in activities of daily living [46]. Older adults living in poverty have higher rates of depression [47] and are more likely to have functional limitations and multiple chronic conditions which lead to increased health services utilization [48–50]. For low-income older adults living with depression, increased utilization suggests inadequate access to routine mental health and primary care. Overutilization of costly yet often undesired or preventable services also suggests increased burden of health and social issues like limited access to resources, disabilities, and other chronic stresses, and reflect upstream socioeconomic conditions that are fundamental causes of health inequities [51]. Increased health services utilization among older adults with depression also disrupts lives and continuity of care and has a financial impact on patients, providers and payers [52]. Institutionalizations due to depression are devastating as older adults strongly prefer to age in place, and costs of care continue to rise without improvement in health outcomes [8,9,53].

Home-based collaborative care models (CCM) yield significant reductions in late-life depression symptoms, but their effects on health services utilization are unclear due to limited research and mixed findings. Some studies have found reductions in health services utilization: a study of interprofessional nurse- or social worker-led depression care management for older home care clients in Ontario, Canada found reduced inpatient hospitalizations [54], while a geriatric home treatment model delivered via a community-based organization in Graz, Austria found fewer admissions to nursing homes [55]. Other studies have been less clear – a three-month, nurse-delivered integrated telehealth intervention (I-TEAM) to improve chronic illness and comorbid depression in a home healthcare setting in the U.S. found significantly fewer ER visits but not significantly fewer days in the hospital 12 months after enrollment [56]. A similar 12-week home health nursing intervention (Depression CAREPATH) found no significant changes in number of nursing home visits or length of stays. [57] A study of PEARLS, a six-month depression care management model delivered via home and community-based services, found trend-level differences between PEARLS intervention group participants (N=72) and usual care group participants (N=66), with 22% of the intervention group having any hospitalizations six months post-enrollment versus 34% in the control group; however, this difference was not statistically significant at traditional levels ($p = .07$) [58]. Knowing whether home-based CCM reduces costly health services utilization is important for policy and practice. Key questions about how to improve access, quality, and cost of health care (i.e. the "Triple Aim") can be answered by looking at health care utilization data [59,60]. This evidence is also needed to support the delivery and financing of home-based CCMs that reach low-income older adults living with multiple chronic conditions who are underserved by traditional clinical care.

To fill this gap, we evaluated the impact of PEARLS on costly health service utilizations in Washington State using routine administrative data and Medicaid claims data. These claims data reflect costly services that home- and-community-based services are working to prevent. Our specific research questions are: What is the effect of PEARLS on inpatient hospitalizations, ER visits, and nursing home days? We hypothesize that PEARLS participants will have lower service utilization than persons who have not participated in PEARLS. Establishing PEARLS's potential cost benefit by reducing health care utilization is important to demonstrate the value [61] of home-based collaborative care delivered via social service community-based organizations to policymakers and payers to increase adoption for public health impact [62] and equity [41].

Methods

Design

Our community-academic research center partnered with local aging services providers and state aging and social services policymakers to conduct this study. We used a quasi-experimental study design using existing data to answer important policy and practice questions in a real-world context [63]. We followed the STROBE checklist for observational studies [64] and a checklist for classifying quasi-experimental studies that evaluate the effects of health interventions [65]. Our study was determined exempt as program evaluation and quality improvement by the Washington State Institutional Review Board.

Intervention: PEARLS

Collaborative care models (CCM) include task shifting and sharing by a trained care manager who actively screens for depression to improve recognition; provides brief, evidence-based psychosocial interventions (Problem-Solving Treatment [66], Behavioral Activation [32] for self-management, psychoeducation and support; coordinates care with primary care providers; and engages mental health specialty care including prescription of antidepressants as needed. The Program to Encourage Active, Rewarding Lives (PEARLS) is an evidence-based CCM developed with social service organizations. Home- and community-based CCM models are important for reaching vulnerable populations whose lack of access to clinical care settings represents a significant barrier to treatment. By being delivered via social service organizations, PEARLS can improve access to depression care by aligning with older persons' preferences for non-pharmacological treatment delivered by trusted providers in their community [67–69], reaching marginalized populations with physical, financial, and cultural barriers to accessing clinical care [70], and addressing upstream social determinants of health like affordable housing and food security [22,71,72].

Population and Data Sources

We analyzed secondary data, combining data from three existing Washington State administrative and claims data sources from 2011 to 2016.

1) The PEARLS dataset included all PEARLS enrollees during the study time period. Older social service participants are eligible for PEARLS if they are age 50 and above with clinically significant depression (Patient Health Questionnaire (PHQ-9>/=6) [73], no cognitive impairment (6-Item Memory Cognition Screen >/= 3) [74], English or Tagalog-speaking, and agree to enroll in PEARLS. We added Medicaid IDs to this dataset to allow merging with administrative and claims data. PEARLS was only offered in King County, WA during the study period; as such these data are for King County only. The county represents 29% of WA State population and includes both metropolitan Seattle as well as suburban and rural areas. This dataset was used to identify the intervention group.

2) The Comprehensive Assessment Reporting Evaluation (CARE) administrative dataset included all persons who receive home- and community-based services (HCBS) in Washington State. Older persons living in poverty and who meet functional eligibility criteria based on needs for assistance with activities of daily living or daily skilled care needs are eligible for HCBS to support aging in place. The CARE tool is used by case managers annually (or more often if needed) to evaluate client function and eligibility for services and to create a plan of care. All HCBS recipients are screened for depression in CARE using the PHQ-9; if they live in King County, a PHQ-9 >/=6 would make them eligible for PEARLS. This dataset was used to create the study comparison group and to provide demographic data for all participants.

3) Medicaid claims and encounters data includes both paid claims (Fee-For-Service (FFS)) and managed care encounter data. In Washington State, Medicaid (AppleHealth) was available for WA residents living below 100% Federal Poverty Level (FPL) for a single-person household from 2011-2013, and was expanded to 138% FPL from 2014-2016. Individuals in need of assistance with activities of daily living are able to access Medicaid if living below 300% of FPL and have limited assets. Some older adults living in poverty are dually eligible ("duals)" and receive both Medicaid and Medicare if they are age 65 and over; we only had access to Medicaid data for this study. This dataset provides our outcomes of interest for the study.

Study group matching

We used R [75] to create the analytic dataset, merging PEARLS data with claims data using Medicaid IDs, then merging the combined data with CARE data. To reduce the potential impact of selection bias, we used nearest neighbor propensity matching (1:1) to create a comparison group of CARE recipients similar to PEARLS participants on key determinants of utilization. Andersen's Behavioral Model of Health Services Use [76,77] suggests that health services utilization is driven by older adult characteristics, which are in turn influenced by the environment (health care system and other external factors). For our study, these older adult characteristics include *predisposing* attributes that increase likelihood of use (age, sex, race, ethnicity, marital status, primary language); *enabling* resources that affect one's ability to access resources (e.g., number of Medicare and Medicaid enrollment months, enrollment year, acute health care and long term care utilization in prior years); and *need* for services (e.g., self-reported

health, chronic conditions, body mass index (BMI), and function as measured by activities of daily living (ADLs)) (Figure 1). We did exact matching on depression diagnosis from claims and CARE data given the focus on evaluating a depression care program.

For older adults in the intervention group (PEARLS), an "index month" was defined as the month of enrollment. For older adults in the comparison group (CARE), the index month refers to the selected time point when their baseline experiences closely matched an intervention group member. Both intervention and comparison group participants were required to have at least one month of full-benefit Medicaid eligibility in both the pre-period (12 months before the index month) and post-period (12 months beginning with the index month).

Figure 2 shows the process for creating the analytic dataset. Starting with the PEARLS dataset, there were 1,106 PEARLS enrollees during 2011-2016. Of those, 411 (37%) did not have a valid Medicaid ID and were dropped because they could not be matched with the outcomes of interest, 216 (20%) were missing key covariates required for matching, 191 (17%) did not complete the PEARLS program, and 93 (8%) were missing CARE data. This yielded 195 PEARLS participants. After we restricted the treatment group to those with a CARE assessment in the 12-month pre- and post-period, the treatment group dropped to 82 participants. For the comparison group, we started with the 16,096 HCBS recipients in King, Snohomish, and Pierce counties in the CARE dataset to create a "matching frame" of months of service associated with Medicaid clients who had similar characteristics but did not enroll in PEARLS using nearest neighbor propensity matching (N=82). These three urban counties represent half of the Washington State population and were selected for similar demographics and access to care characteristics. The final dataset was restricted to 164 older persons with complete CARE assessments during the 12-month pre- and post-periods, so that the intervention and comparison groups were most alike in their propensity to use services.

Outcomes

The claims dataset provides our primary outcomes of interest: 1) acute health services utilization (changes in the number of ER visits per 1,000 member months (MM); changes in the number of inpatient hospitalizations per 1,000 MM) and skilled nursing facility utilization (difference in the number of nursing home days). The unit of analysis is the sum of days over 12 member months. These utilization measures are a proxy for cost since cost data was not available for research use. We also examined several secondary outcomes: the probability of death, change in depression score from pre- to post-period, and the probability of having poor (deteriorated) self-rated health in the 12-month post-period.

Analysis

We used SAS version 9.4 for data analysis. We used an event study difference-in-difference (DID) approach [78] to compare health services and nursing home utilization for PEARLS participants in King County with persons eligible for PEARLS who live outside the

county and are thus unable to participate in PEARLS. DID uses existing longitudinal data to estimate the treatment effect on the treated (the causal effect for PEARLS enrollees) (Figure 3). Using DID to examine changes in utilization overcomes a major flaw of the pre-post design by comparing difference in outcomes between the PEARLS group and a comparison group not exposed to PEARLS but similar demographically and in utilization. An event study DID designs allows for causal inference when program delivery and thus its effects are staggered. [79] For this study, our comparison group matched on baseline characteristics were given pseudo-enrollment dates (index month) that corresponded to the intervention groups' dates of PEARLS enrollment.

We used linear regression to compare change in inpatient hospitalizations, ER visits, and nursing home days for PEARLS participants compared to the matched comparison beneficiaries who did not receive PEARLS. Using pooled OLS regression is commonly used for panel data analysis and does not typically require tests for normality or homoskedasticity. The regression coefficient measured the difference in primary outcomes between 12 months before PEARLS enrollment and 12 months after completion of the 6-month program (or equivalent index dates for comparison group). Given the small sample size of the final dataset, we adjusted for only unbalanced covariates (variables with an absolute standardized differences greater than 0.2 after matching) in the regression model to control for the residual differences between treatment and comparison groups for ER visits; as such we did not account for mortality in the analysis since it did not meet this criteria. For the secondary outcomes, we used logistic regression to compare the odds of death and odds of experiencing poor/deteriorated self-rated health of those older persons who received PEARLS and the odds of persons who did not. We used linear regression to compare changes in depression and LTSSS services score between PEARLS participants and non-participants.

Results

Participants

In our analytic sample, participants were age 50-59 (18.3%), 60-69 (43.9%), 70-79 (20.1%) and 80 and above (17.7%) (Table 1). Three-fourths identified as female (74%) and 39% as a person of color (24% African American, 8% Latino, 5% Asian or Pacific Islander, and 3% American Indian or Alaskan Native). The mean baseline PHQ-9 was 12.2, suggesting moderate depression severity. Many participants were managing multiple chronic conditions – over three in four had cardiovascular disease, more than half had diabetes and/or renal disease, over one in three had gastrointestinal, nervous, and/or pulmonary disease, and one in six had a substance use disorder.

Our analytic sample was comparable to our overall PEARLS dataset (N= 1,106) with similar age breakdown, a greater proportion of women (74% in the analytic sample vs 61% in the full dataset), and similar baseline depression severity (mean (SD) PHQ-9 12.1 (5.2)). The main difference was a much smaller proportion of Asian older adults in our analytic dataset rather than the full PEARLS dataset from 2011-2016 given that some of these older Asian immigrants were not eligible for Medicaid or HCBS used for our outcomes and comparison group.

PEARLS and comparison group participants had an average ADL score of 10.3 and 10.5, respectively, with 0 indicating total independence and 28 indicating total dependence in all seven activities (bed mobility, transfer, locomotion, dressing, eating, toilet use, and personal hygiene). At baseline, PEARLS and comparison group participants had a mean 53 and 49 inpatient hospitalizations and 100 and 136 ER visits, per 1000 member months, respectively. On average, participants had ten in-home Long-Term Services and Supports (LTSS) months and two to four nursing home days prior to the intervention. We found no significant differences in demographics and utilization between the intervention and comparison group, suggesting the matched comparison worked as expected.

Primary outcomes: Health services utilization

We found a statistically significant reduction in the number of inpatient hospitalizations for PEARLS participants vs the comparison group of HCBS clients who did not receive PEARLS ($p = .022$). Specifically, the intervention group had on average 69 fewer inpatient hospitalizations per 1,000 member months than comparison group participants (Table 2). This is considerably fewer hospitalizations than the pre-treatment mean of 53 and 49 inpatient hospitalizations per 1,000 member months for PEARLS participants and matched controls, respectively. PEARLS participants also had significantly fewer nursing home days (-37 days, $p < .001$) over the 12-month period, with baseline mean nursing home days 4.4 for PEARLS participants and 2.0 for the comparison group. While PEARLS participants reported 300 fewer ER visits per 1000 member months, no statistically significant difference were noted for the intervention vs. control group participants.

Secondary outcomes: LTSS Services, Mortality, Health, Depression

PEARLS participants were significantly less likely to die during the follow-up period (OR 0.11, $p < .001$). They also used on average 1.19 fewer community residential care months (e.g., adult family home or assisted living facilities), decreasing from a mean of 0.15 service months during the 12-months pre-PEARLS enrollment, and 3.85 more in-home LTSS service months, increasing from an average of 9.6 in-home service months during the pre-treatment period. There were no significant differences in depression or self-rated poor or deteriorated health between PEARLS participants and comparison group.

Discussion

Our study found that a home-based collaborative care model reduces health services utilization for low-income older adults living with depression. PEARLS participants had significantly fewer inpatient hospitalizations, nursing home days, and community residential long term supports and services (LTSS) care months, than home and community service recipients who did not participate in PEARLS and who had similar sociodemographics, health status, and prior service use. The effect of 69 fewer inpatient hospitalizations for PEARLS participants compared to non-PEARLS participants was particularly large as there were on

average fewer than 60 hospitalizations per 1,000 member months during the pre-intervention period. Our findings are comparable to a recent study of telePST for low-income older adults who are homebound and receiving home-delivered meals; finding statistically significant differences in inpatient hospitalizations but not ER visits when compared to supportive calls [80]

Participating in PEARLS also appeared to lower one's likelihood of dying, a novel finding as mortality has not been assessed in previous PEARLS studies (though suicidal ideation was found to be reduced for PEARLS participants living with both epilepsy and depression in an earlier RCT) [81]. We did not find any significant effect on ER visits, suggesting that PEARLS did not impact the use of outpatient hospital care. This may be because participating in PEARLS did not address underlying access to care issues even while it prevented more costly institutionalizations.

Surprisingly, we did not see any significant PEARLS effect on depression or self-rated health. This may also be a measurement issue or timing issue, as the PEARLS effectiveness studies and practice data collects data on depression and self-rated health immediately following the six to eight in-person sessions, while the HCBS annual assessment data (CARE) that we used for secondary outcomes is collected annually (up to 6 months after active PEARLS intervention ended). So it may be that the CARE depression score for PEARLS participants is no longer reduced as the active intervention has not been delivered for a half a year.

The underlying mechanism through which PEARLS reduced health services utilization is unclear if there is no long-term effect on depression or self-rated health. It could be that short-term decreases in depression, as found in the earlier effectiveness studies [58], can lead to decreases in utilization. PEARLS participants did report significantly more in-home LTSS service months [49], which is to be expected as PEARLS may activate older adults to connect to caregiving, home health aides, and other personal care. It may be that this additional in-home support was the mechanism for reducing more costly outcomes like hospitalizations, nursing home days, and mortality. Other studies provide indirect support for this hypothesis – for example, one study of older public housing residents in Rochester, NY (the majority of whom were Black and lived alone) found that depressed persons not receiving mental health care were more likely to use acute health services, as well as face severe life events and complex medical illness [48]. Further study is needed to examine whether access to quality care is how home-based collaborative care models reduce health services utilization.

More research is also needed to evaluate whether PEARLS can impact two other elements of the quadruple aim for health care reform [40] – costs of care and provider satisfaction. While health services utilization can be a proxy for provider costs based on what is billed for in claims data, it may not reflect the actual cost to patients, families, and policymakers. A person's out-of-pocket cost as well as over- or under-coverage of services is not reflected by how much is billed in claims [60]. Further study can also improve our understanding of the mechanisms by which PEARLS can reduce health services utilization, such as improved self-efficacy, chronic disease and pain management, sleep quality, physical activity, social connectedness, and linkages

to health and social care. We also recognize that our study is exploratory – indicating that PEARLS participants have less health services utilization than similar older adults who do not participate in PEARLS – and was never intended to be able to show causality; prospective experimental studies would establish whether PEARLS reduced health services utilization.

Strengths and limitations

The strengths of this study are the use of pragmatic methods so that findings are relevant to policy- and decision-makers. We partnered with state and local social service agencies to do engage key partners needed for change [43,82], focusing on PEARLS possible return-on-investment beyond clinical effectiveness [61]. We used quasi-experimental design and methods to using observation data that tries to account for change due to other factors than the intervention, and an intuitive interpretation of findings [83]. The advantage of working with administrative data is that it is relatively inexpensive to access and analyze compared to the time consuming process of getting and abstracting patient medical records [60,84]. Previous research has shown high concordance between medical records and administrative data, suggesting administrative data reflects the actual care that patients are receiving [85]. Routine data can yield more externally valid findings for resource-constrained contexts than more internally valid yet expensive and time-consuming experimental designs that do not guide program delivery outside research contexts [86,87].

Using administrative data for health services research brings several limitations. This data is created for reimbursement rather than research, which means absence or presence of a claim may not mean absence or presence of a condition. We cannot tell whether the health services utilizations are preventable, unnecessary or needed (e.g., an older person living with dementia needing the comprehensive clinical care provided by a nursing home, or the short-term rehabilitation provided by a nursing home following a fall), so some of these services may be appropriate given the older adults' care needs. Using claims data also comes with selection bias, in which there may be systematic differences between PEARLS and non-PEARLS participants that drive observed differences in health services utilization between the two groups (and not participation in PEARLS itself, which we are trying to evaluate with this analysis) [83]. Claims data also only includes data for insured populations and for insured care, which limits our understanding of changes in utilization or types of utilization for more vulnerable uninsured PEARLS participants [84]. Administrative data also may have quality issues, as criteria for patient eligibility, covered services, and other measurements may vary over time given differences in Medicaid policies. Furthermore, for this analysis, we were limited by having to exclude a large number of PEARLS participants who lacked HCBS or Medicaid coverage and thus could not be linked to this administrative data. Excluding uninsured populations may have overestimated PEARLS effect as these populations use fewer costly health services than insured populations. [88]

We tried to address these issues in several ways. First, our study partner was able to identify whether the claim was for a unique health service utilization as they have access to claim numbers as part of their state quality improvement role. Second, we used propensity score

matching to try and minimize threats to internal validity from selection bias, recognizing that we can only match our PEARLS participant and comparison groups on observed characteristics that are measured in available data. We also restricted our intervention group to PEARLS completers only to capture PEARLS effect rather than an intent-to-treat analysis. Third, we restricted our analysis to 2011 and on (rather than 2007 when the PEARLS program first started routinely collecting and archiving participant data) given the many changes to Medicaid in 2010 that would make it hard to link data for 2011 and beyond. Finally, we applied several health services research recommendations for using claims data [60]: adjusting for available patient characteristics that may influence health care utilization, using a 12-month follow-up period to account for seasonal trends in acute care utilization, and including length of follow-up as a covariate in our regression model so persons with more or less measurement time do not misleadingly appear to have more or less utilization.

Furthermore, there were several limitations to our analytic methods. While pooled OLS regression is typically used for analyzing panel data sets and does not require tests for normality, we did not confirm the normal distribution of our outcomes. We did not take mortality into account as a covariate in our analysis given our small sample size and decision to only adjust for unbalanced covariates. As such, our utilization results may be an underestimate since our comparison group has fewer months of time to use services with their higher mortality rate. We reported outcomes as per 1000 member months to try and addressing this issue. That said, our utilization may be biased upwards given that end of life care is typically quite intense for older adults with multiple chronic conditions [89] and living in poverty [90]. Future analyses should truncate utilization to one to three months prior to death to avoid counting this expensive and extensive end-of-life care. Lastly, it should be noted that the regression coefficient of interest, or the event-study DID estimator, reflects a net difference between the change in outcome from the post-period to the pre-period between the intervention and comparison groups. This means that it may in fact be that PEARLS participants did not experience a reduction in hospitalizations or nursing home days, only lower utilization relative to the comparison group. The comparison group could have experienced increasing hospitalizations and nursing home days during the 12-month post-intervention period. However, the interpretation is still that PEARLS may have reduced health services utilization relative to not receiving the PEARLS intervention during the year following enrollment.

Implications for Policy and Practice

Recent payment reform models such as the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) may provide an opportunity for home and community-based services to be reimbursed for home-based CCM programs that address late-life depression. MACRA provides a mechanism for health systems to contract outside the health system with social service agencies, so that they can better reach older persons where they are and improve their access to care, quality of care, and subsequent cost outcomes [91]. Home-based CCM models may add value to value-based payment efforts by providing quality, accessible care to older adults who are frail and homebound. MACRA incentivizes health systems to contract with CBOs to help them to

achieve their treatment targets. Home-based CCM models align well with these external quality improvement efforts since they dovetail with recommendations for depression screening, referral and treatment. For example, the Healthcare Effectiveness and Data Information Set (HEDIS) [92] requires regular screening using the PHQ-9, referral to treatment if screening is positive, and significantly improved depression symptoms six months after treatment begins, which a home-based CCM model like PEARLS has evidence in studies and in practice to provide for some older populations.

This study suggests that home-based collaborative care models like PEARLS yield lower costly health services utilization, and as such should be covered by national, state, and local policies. One might follow a similar model as has been done for clinic-based CCM – since 2008, Washington State has supported the Mental Health Integration Program (MHIP), an ongoing, publicly funded CCM implementation in a diverse network of community health clinics serving over 35,000 individuals to date (Vannoy, 2011), and Medicare now has established CPT codes for providers to be reimbursed for collaborative care (CMS, 2017). In addition, these models can be reimbursed through the HCBS Medicaid waiver programs as is done in Washington State. Shared savings models are needed since more than half of our study population are dually eligible for Medicare and Medicaid; this means that more than half of the potential cost savings from PEARLS may be accrued at the federal – rather than the state – level. The successful Health Homes program in Washington State and other states provides one shared savings model for states to receive the benefit from investing in PEARLS [93].

Improving the quality and coordination of care for high-need, high-cost populations is a crucial component for addressing health care disparities among marginalized populations. The Affordable Care Act (ACA) was passed in 2010 to reform our health care system towards the larger goal for better health, better health care, and better value. Home-based collaborative care models like PEARLS are designed to support independent living for older persons living with chronic conditions, disability, or other limitations, and to reduce their hospitalization and nursing home use (Ell, 2007). New policies are urgently needed to support home- and community-based programs that overcome persistent inequities and address contextual issues related to depressive symptoms by providing access to trusted, accessible providers for improved recognition and treatment of late-life depression (Gitlin, 2013).

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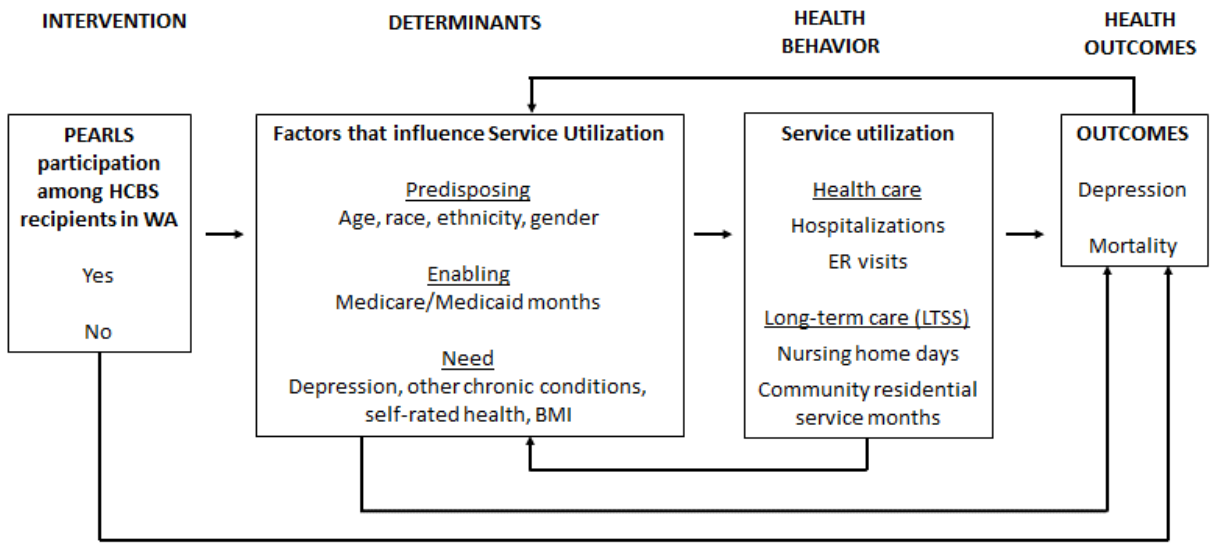
TABLES and FIGURES

Figure 1. Adapted Andersen Model of Health Services Utilization for PEARLS Evaluation in Washington State*



Abbreviations: BMI = body mass index; ER = emergency room; HCBS = home- and community-based services; LTSS = long-term services and supports; WA = Washington State

* adapted from Andersen's Behavioral Model of Health Services Use (Andersen, 1995; Babitsch, 2012)

Figure 2. Flow chart for creating the propensity matched dataset for analysis.

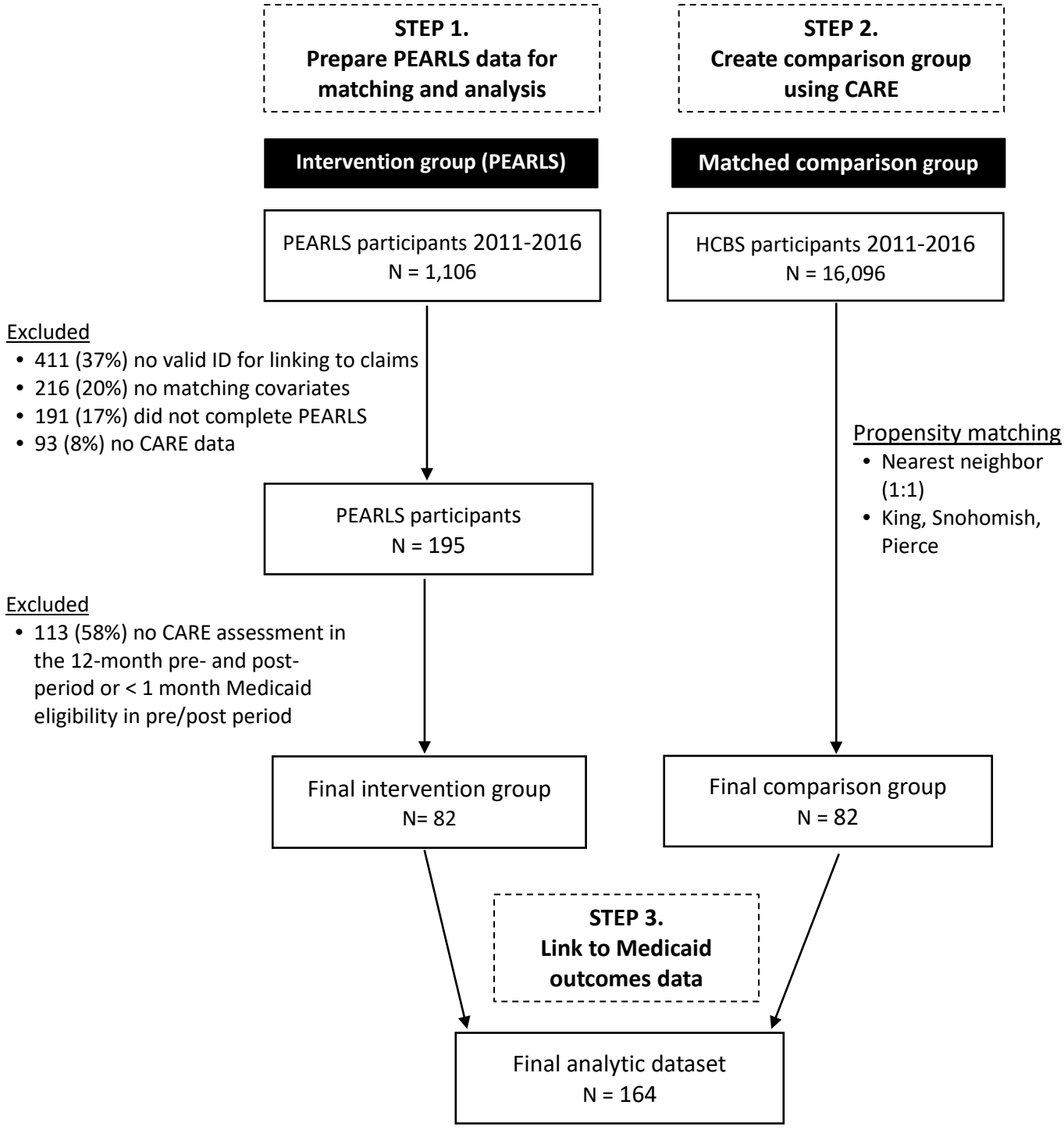


Figure 3. Event Study Difference in Difference (DiD) Approach for PEARLS Evaluation

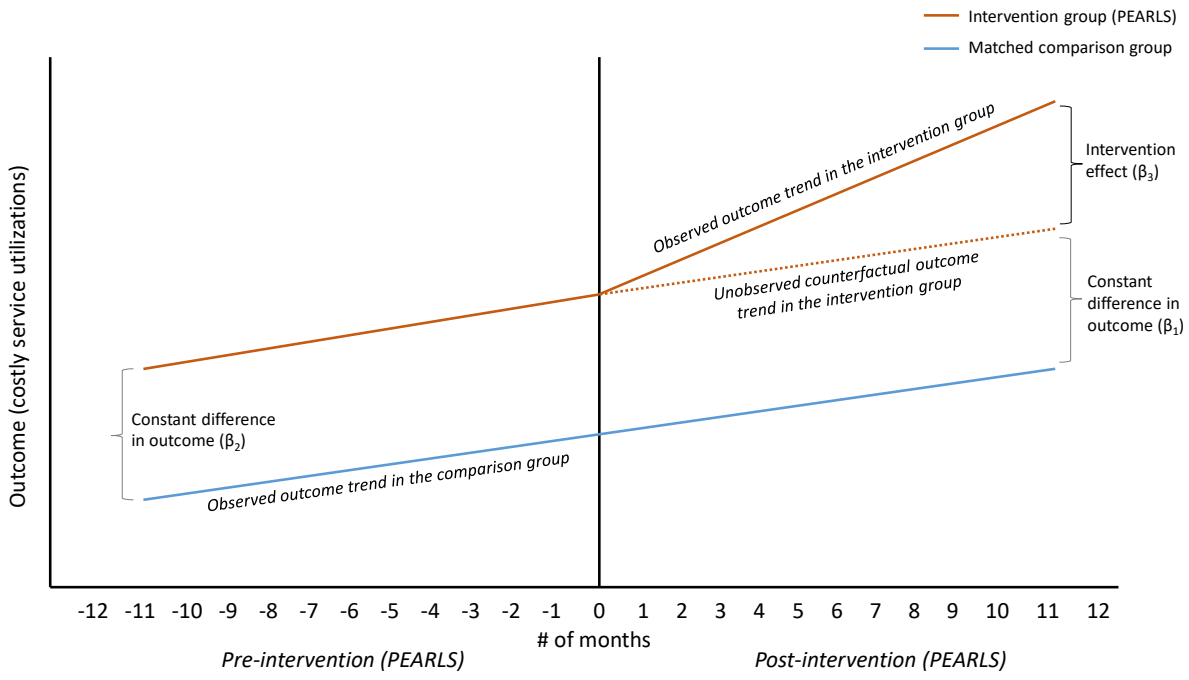


Table 1. Participant characteristics during the pre-intervention period (N = 164).

	Intervention group N = 82	Comparison group N = 82
Age		
Age 50 - 59	14 (17)	16 (20)
Age 60 - 69	37 (45)	35 (42)
Age 70 - 79	18 (22)	15 (18)
Age 80 and above	13 (16)	16 (20)
Gender		
Female	60 (73)	62 (75)
Male	22 (27)	20 (25)
Race/ethnicity		
White	49 (60)	48 (59)
African American	20 (24)	21 (25)
Latino	6 (7)	7 (9)
American Indian/Alaskan Native	2 (3)	2 (3)
Asian/Pacific Islander	5 (6)	4 (5)
PHQ-9 Depression (Mean (SD))	12.2	12.2
Comorbidities		
Cardiovascular	67 (82)	63 (77)
Diabetes	47 (57)	48 (58)
Gastrointestinal	33 (40)	34 (42)
Nervous system	30 (37)	34 (42)
Pulmonary	34 (42)	41 (50)
Renal	41 (50)	45 (55)
Substance use	9 (11)	9 (11)
ADL Score	10.3	10.5
Medicare/Medicaid enrollment		
Medicaid months	11.1	11.5
Dual months	9.4	9.3
Health care utilization		
Inpatient hospitalizations (per 1000 MM)	53	49
ED visits (per 1000 MM)	100	136
LTSS utilization		
In-home service months	9.6	10.2
Nursing home days	4.4	2.0
Residential service months	0.15	0.21

Unless otherwise specified data are reported as N (%). ADL=Activities of Daily Living, ED=Emergency department, LTSS=Long-Term Services and Supports, MM=member months enrolled in Medicaid, Medicare or both.

Table 2. Difference in health services utilization and secondary outcomes for PEARLS participants compared to matched comparison group of social service recipients.

	Main analysis N=164	
Primary outcomes (health service utilization)	**Coefficient [a]**	**p-value**
Number of inpatient hospitalizations (per 1000 MM)	-69.34	*0.0215*
Number of ER visits (per 1000 MM)	-302.57	0.2969
Number of nursing home days	-37.29	*0.0004*
Secondary outcomes	**Coefficient**	**p-value**
Depression score	0.35	0.7374
Number of in-home service months (LTSS)	3.85	*<0.0001*
Number of community residential service months (LTSS)	-1.19	*0.001*
	Odds Ratio (OR)	**p-value**
12-month all-cause mortality	0.11	*0.0006*
Self-reported deteriorated health	0.60	0.1121
Self-reported poor health	0.95	0.8707

Statistically significant p-values are shown in *italics*. As a sensitivity analysis, the comparison group was further restricted to persons with a depression diagnosis in the 12-month pre-period. ER = Emergency room. LTSS = Long Term Supports and Services. MM = member months.

[a] The coefficient measures the difference in the outcome between the treatment and comparison group.

Chapter 4. Aim 3 paper

Evaluating the implementation of the collaborative care model in two cultural contexts: A comparative case study to improve equitable access to quality depression care in resource-constrained settings.

Abstract

Background: Only 1 in 10 and 1 in 27 persons receiving adequate mental health care in high- and low-and-middle-income countries, respectively. Implementation science was established to close this gap between what we know and what we do. However, if what we know is only from highly resourced settings, then our field may exacerbate rather than eliminate health inequities. This comparative case study illustrates learnings from the successful and unsuccessful delivery of an evidence-based depression program can be in two cultural contexts underserved by quality depression care.

Methods: Our case definition is community-academic partnerships to build capacity for the collaborative care model (CCM) for older U.S. Latinos (El Sol) and Cambodians with diabetes (Preah Kossamak) between 2018 and 2020. CCM aligns with global mental health recommendations for task shifting to community providers that reach populations who are underserved, address social needs, and link to clinical care. We selected two instrumental cases that reflect successful/unsuccessful CCM delivery. We conducted secondary analysis of process and outcome data using deductive thematic analysis with implementation science frameworks to evaluate adaptations, determinants, and implementation outcomes.

Results: The case study used multiple data sources which included 58 partners who were involved in delivering CCM. Acceptability was high in both settings given lack of access to quality care, whereas feasibility, fidelity and service penetration were higher at El Sol. This appears to be driven by how the team worked together (CFIR's Implementation Process and Inner Setting determinants). Specifically, El Sol built on the strengths of community health workers/promotores for successful collaborative care through collective efficacy and a strong team culture, whereas Preah Kossamak was hindered by a hierarchical setting and culture. Both settings made ongoing adaptations to CCM to better align with their culture and operations, though adaptations were insufficient as an implementation strategy for health equity in Preah Kossomak due to too many non-modifiable contextual factors.

Conclusions: Case studies are helpful for building evidence on equitable CCM implementation with, for, and in delivery contexts and cultural contexts that are underrepresented in implementation science research. This study suggests adapting CCM with, for and in resource-constrained settings using equitable implementation processes can address contextual determinants to reduce depression inequities. Exploratory findings offer a roadmap for policy and practice and set the stage for future hybrid effectiveness-implementation trials.

BACKGROUND

Depression is a significant public health issue that affects one in four adults and is now the leading cause of disability.(1) Among older persons and persons living with co-occurring chronic conditions, depression impairs function and quality of life, leads to worse health outcomes, and increases risk of preventable deaths including suicide.(2,3) Despite depression's impact and the existence of effective care models, the mental health care gap persists. [While traditionally defined as a "treatment gap", we use the term "care gap" to move beyond pharmacological clinical treatment to reach people who are underserved and to target upstream social and health needs that create disproportionate burden.(4)] Overall, 1 in 10 adults in high-income countries (HICs) and 1 in 27 adults in low-and-middle-income countries (LMICs) do not receive adequate or appropriate care.(5) These disparities are worse for populations who have been historically underserved, such as Black, Indigenous, and Other People of color (BIPOC),(6–8) people who speak languages other than English,(9) and people who live in poverty.(10) These populations face a higher depression burden due to worse access to quality care and poorer health outcomes.

The global mental health field(11) and international bodies(1,12) have called for closing this care gap by building capacity among non-specialist workers to deliver participant-driven interventions in community and other accessible settings. This task -shifting and -sharing can improve access to quality care by expanding care to people and places with poor access, workforce gaps, and stigma towards specialty mental health care,(13,14) while addressing social determinants of health like poor housing and food insecurity.(5) The collaborative care model (CCM)(15,16) offers one proven strategy for increasing access to depression care while maintaining quality, employing team- and measurement-based care through trained front-line providers that better serve both individual preferences and population health.(17) However, much research to build the evidence base for CCMs has been done primarily in highly-resourced, clinical settings.(18) This means that even as implementation science works to close the know-do gap, the evidence accumulated may not apply and may, in fact, worsen inequities in depression burden.

As such, we conducted a comparative case study to understand how CCM worked and did not work in two resource-constrained, cultural contexts underserved by quality depression care. This study brings together two evaluations of CCM delivery with older U.S. Latinos and with Cambodians living with diabetes. These evaluations explored three questions: 1) what adaptations were made to CCM intervention and implementation strategies to fit to local context, and how and why were these adaptations made; 2) what were the contextual determinants of CCM implementation success and challenges; and 3) whether CCM was acceptable, feasible, and done with fidelity? (implementation outcomes) While there are multiple definitions of global health, three cross-cutting principles across definitions are health for all (for all people worldwide), health by all (by a representative range of partners and actors) and health in all (multisectoral efforts to increase health, with special attention to social determinants of health).(19) Our hope is that turning a critical eye can provide a roadmap de-colonizing global

mental health implementation science towards its goal to reduce inequities that the field was initially designed to address.

METHODS

Design

This study employed a multiple-case study design. Case studies are appropriate for answering how and why, practical research questions about current events within real-world contexts where it is not appropriate to control behavior.(20) This design allowed for a more in-depth exploration of CCM implementation from the perspectives of multi-disciplinary practitioners delivering a new program.(21) A multiple-case design was selected to understand the commonalities and variation offered by different cases, using a social constructivist approach to guide case definition, selection, methods, and interpretation.(22) In this approach, cases are developed in relationship between the researcher and informants, with the goal being to understand meanings, contexts, and processes from different perspectives (both individual and shared social meanings).(23),(24) We used Hyett's checklist(25) for case study quality for both methods and reporting. This project was reviewed and approved by the University of Washington Institutional Review Board and the Cambodian National Ethics Committee for Health Research.

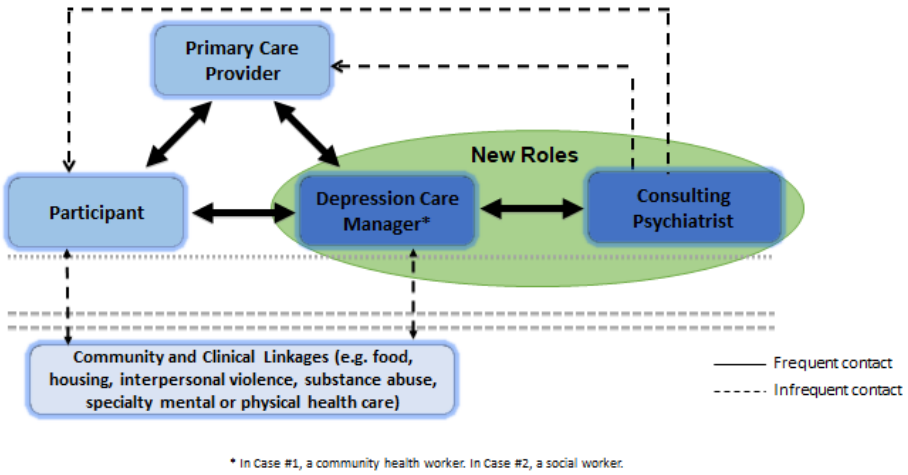
Intervention

The collaborative care model (CCM) was developed to improve depression recognition and treatment, using task -shifting and -sharing to build capacity among non-mental health providers to offer quality, team-based care.(26) (Figure 1) Based on the Chronic Care Model,(27) CCM emphasizes practical, supportive, evidence-based care with active participants and community-clinical linkages. Existing front-line workers are trained to routinely screen for depression; offer brief psychosocial interventions (Problem-Solving Treatment (PST) and Behavioral Activation (BA))(28,29) for self-management, support, and psychoeducation; and coordinate with primary and mental health care as needed. Participants are empowered to manage depression, and often other chronic conditions, using existing resources, new skills, and better care linkages. Clinical supervisors provide ongoing consultation and training for non-specialists to provide quality depression care. The model was initially developed for highly-resourced clinical settings(15,30) and evidence of its effectiveness is emerging in resource-constrained settings(31) in Vietnam,(32) Nepal and India.(17) CCM aligns with global mental health recommendations to close the mental health care gap through: a) training community and non-clinical mental health providers to reach marginalized populations with physical, financial and cultural barriers to accessing care;(33) b) addressing social determinants of mental health (e.g. economic deprivation);(5,34,35) and c) aligning with people's preferences for non-pharmacological treatment delivered by trusted community providers.(33,36,37),(38)

Furthermore, CCM has the potential to improve access to quality depression care by aligning with cultural beliefs, norms and values, and addressing multi-level barriers and to care for older U.S. Latinos and for Cambodians living with diabetes.(39) Training bilingual/bicultural providers can convey that depression care can be culturally relevant as well as financially and

physically accessible for older U.S. Latinos and Cambodians in rural settings. Using the PHQ-9 as a regular tool at each CCM session may also help address stigma about depression. The nine items teach CCM participants what depression is and isn't, helping convey that depression is not "normal" but a treatable illness. The PHQ-9 also helps participants focus on symptoms that interfere with their lives (including less stigmatizing somatic symptoms like sleep and fatigue) without requiring participants to buy into a biomedical model or label of depression. In addition, CCMs psychosocial interventions, PST and BA, focus on the "here and now"--this may help older Latinos move forward from the "dashed hopes or misplaced expectations" from migration to re-frame or re-interpret family support in a way that avoids blame or distress.(40) It may also help alleviate Cambodians concerns about divulging family secrets or too much focus on a difficult past. CCM's person-centeredness means care can support with cultural beliefs, norms, and values, such as preserving Latinos and Cambodians sense of dignity and respect, as well as fit with preference to not disrupt social harmony or networks (the participant only shares what they are comfortable sharing in participant-driven care models like CCM). Lastly, teaching self-care and problem-solving approaches, focusing on modifiable risk factors and moderators for poor health outcomes and access to care, and connecting to other supports as needed can yield depression care that can address participants' complex health and social needs while tapping into clients own resources and power.(40)

Figure 1. Collaborative care model ***(adapted from UW AIMS Center, 2017)***



Setting and Participants

Our case definition was community-academic partnerships from 2018-2020 to build capacity for evidence-based depression care in two resource-constrained settings that are different than the original cultural context in which CCM was developed. We selected two instrumental cases – one typical of successful CCM implementation and one typical of unsuccessful delivery - to compare and contrast whether and how CCM works in two cultural contexts with shared and

distinct values and settings. We used Kohrt and colleagues(5) recommendations for mapping community-based behavioral health care to generate the case descriptions (Table 1).

U.S.: We partnered with El Sol Neighborhood Educational Center, a social service organization that trains community health workers (CHWs) and promotores de salud to improve access to and quality of care for underserved communities in the Inland Empire, California. El Sol prioritizes reaching mono-lingual Spanish speakers, immigrants, and residents with limited English proficiency (LEP). Two CHWs were trained to deliver CCM to older adults in their homes. The depression care management team included the CHWs, CBO's program manager, licensed mental health therapist, and a psychiatric consultant. CCM participants were primarily Spanish-speaking Mexican-American immigrants who had lived in the U.S. for over ten years. They were living with multiple chronic conditions and had poor access to quality health care. PEARLS participant engagement occurred through healthy aging presentations at low-income housing, social service, and health care organizations. Participants received fresh fruit and vegetable boxes and completed brief depression screening to assess for eligibility.

Cambodia: We collaborated with Preah Kossamak Diabetes Center, a public care facility in Phnom Penh, Cambodia. As with many LMICs, this center serves persons living in both the urban capital and outlying rural areas. Four social workers from Royal University of Phnom Penh's Department of Social Work were trained to deliver CCM within the center and via home and phone visits. The collaborative care team included social workers, social work manager, and Preah Kossamak nurses, doctors, and psychiatrists, and the UW team (social worker, psychiatrist, doctor, coach). CCM participants were persons living with both depression and diabetes who attended the center at least monthly for diabetes care. As public care recipients, most were living in poverty in rural areas with limited access to care. Participant engagement occurred during PHQ-2 screening by center nursing staff after assessing blood pressure, glucose, height and weight. Those with elevated depression screening were referred to social workers to assess for eligibility and to enroll in the program.

Table 1. Case descriptions.

	El Sol Neighborhood Educational Center	Preah Kossamak Diabetes Center
Why	Poor access to culturally and linguistically appropriate, quality depression care for older Latinos in the U.S.	Poor access to culturally and linguistically appropriate, quality depression care in Cambodia including for persons living with diabetes
What	CCM + social needs + chronic care management	CCM + social needs + diabetes care management
Where	Older adults' homes in southern California	Public diabetes center & phone/ home in Phnom Penh and rural provinces
Who	• CCM care manager=community health workers • Clinical supervision=psychiatric assistant + LCSW	• CCM care manager = social workers (new to clinic) • Clinical supervision = PK doctors and UW team
How	• Engagement via education + screening + food access at low-income senior housing and CBOs • Training and practice coaching	• Engagement via clinic intake adding PHQ-2 to blood pressure and glucose screening • Training and practice coaching

Adapted from Kohrt and colleagues(5) *recommendations for mapping community-based behavioral health care.*

Data sources

Case studies require multiple sources of data;(41) for this study we used routine process and outcome data from several sources (Table 2). These included qualitative data on adaptations, determinants, and implementation outcomes: transcripts, testimonials, and notes from semi-structured interviews with CCM participants and providers (CCM care managers program manager, clinical supervisor, CCM team clinicians, administrators); and implementation documents such as monthly technical assistance/coaching calls and sustainability planning notes with the CCM implementation team and external practice coaches, intervention materials, notes from clinical supervision calls, internal planning documents, and evaluation reports. Quantitative data was from electronic data registry (Care Management Tracking System (CMTS) in Case #1 and Patient Charting System (PCS) in Case #2): Patient Health Questionnaire (PHQ-9) (42) screening and assessment data on depression severity; and process data on screening, enrollment, completion, and average number of home and phone sessions for implementation fidelity. The PHQ-9 has been validated among Latinos (43) and we recently completed a validation study (unpublished GIF report) with Cambodians that aligns with key recommendations for cross-cultural adaptations and measure validation in LMICs in settings in which the instrument was not initially developed. (44)

Theoretical Frameworks

Table 2 delineates the different theoretical frameworks applied to each case study. We used established implementation science frameworks (MADI, FRAME) to describe not just what adaptations were made to CCM content, context, training, evaluation and implementation strategies, but also how and why these adaptations were made. [Note that in FRAME, "context" refers to modifications made to the way CCM is delivered]. We also included several cultural adaptation frameworks to understand how CCM was modified with, for, and in two different cultural contexts than the original model: for older U.S. Latinos, and for Cambodians living with diabetes.

We used CFIR adapted for LMICs to describe contextual determinants of successful and unsuccessful CCM implementation. Here, "context" refers to the different levels or domains of factors within which CCM is embedded and that influences CCM and its delivery. We focused on six domains of determinants: characteristics of the intervention, the individuals involved in intervention delivery, the implementation process, the inner setting of the delivery organization, the outer setting of the delivery organization, and characteristics of the system.(45) We applied the Implementation Outcomes Framework to explore whether CCM was acceptable, feasible, and done with fidelity. These are early-stage implementation outcomes that are important for improving the social validity of evidence-based interventions adapted for different cultural contexts (46,47). We assessed these implementation outcomes from the perspective of CCM participants, care managers, and other partners in each setting.

Data Analysis

We used deductive thematic analysis for the individual case study analysis to evaluate the adaptations, determinants, and implementation outcomes for CCM delivery in two diverse

cultural contexts in resource-constrained settings. [Note: Individual case studies are reported in-depth in other manuscripts; this paper focuses on the comparative case study]. Briefly, thematic analysis consisted of six iterative phases to yield a rich, complex interpretation of the data: familiarization, generating codes, searching for, reviewing, defining and naming themes, and producing the report.(53) We used the rapid framework method(54) to organize data by code, data source and stakeholder, and generate initial themes, categorizing data by adaptations, determinants and implementation outcomes for each case. The comparative case study then examined similarities, differences, and patterns in the single-case explanations to understand how different contextual factors influenced successful and unsuccessful CCM delivery.(55–57) The first author (LS) led analysis, with input from internal and external implementation, coaching and evaluation team members on codebook development and refinement; describing, refining and summarizing key themes; and interpretation of findings and implications. Several co-authors (SH, AG) reviewed coded data and interpretations of findings, discussing areas of disagreement until consensus was reached.

Table 2. Theoretical frameworks.

Construct	Framework	Description
Adaptations [a]	Model for Adaptation Design and Impact (MADI)(48) expanded Framework for Reporting Adaptations and Modifications to Evidence-based interventions (FRAME) (49)	• what adaptations were made • who participated in adaptation decision-making • for whom the adaptation was made • when the adaptation occurred during the implementation process • why, how, and under what circumstances adaptations were made
	Cultural Influences on Mental Health framework(39) Heuristic framework for cultural adaptations of interventions(47)	• culture influences meanings and norms about both depression and depression care through symptom expression; assessment and diagnosis; coping styles and help seeking; and treatment preferences • partner with delivery organizations to specify when and how to do cultural adaptations
Determinants	Consolidated Framework for Implementation Research (CFIR) (50) adapted for LMIC (51)	Facilitators and barriers to CCM delivery in six areas: • intervention characteristics • inner setting • outer setting • characteristics of individuals • implementation process • system of care
Implementation Outcomes	Implementation Outcomes Framework (52)	From the perspective of CCM participant, providers, and other partners • acceptability (satisfaction) • feasibility (actual fit) • fidelity (faithfulness to core functions)

[a.] Adaptations to CCM model, both intervention and implementation strategies, including cultural adaptations to improve both engagement in care and depression outcomes.

We used recommended strategies from Lincoln and Guba (58) to strengthen the trustworthiness of our research: prolonged engagement, triangulation, peer debriefing, and member checking to enhance the fit between our stakeholder's views and how researchers present them (*credibility*); use of thick descriptions for both research and practice audiences to assess *transferability*; documentation of the research process (*dependability*); and use of audit trails and a reflexivity journal for *confirmability*. Many of these approaches align with recommended comparative case study tactics to minimize measurement error (56,59,60): using multiple sources of evidence for construct validity, performing pattern matching using established implementation science frameworks and models for internal validity, and using a case study checklist and organizing the evidence in a case study database for reliability.

RESULTS

Table 3 and 4 offer details about the data sources and study participants included in this research.

Table 3. Data sources (N=110). [a]

Data source	El Sol Neighborhood Educational Center (N=78 data sources)	Preah Kossamak Diabetes Center (N=32 data sources)
Interviews	• Participants (N=8) • Providers (N=8)	• Participants (N=4) • Providers (N=14)
Implementation documents	• Notes from technical assistance/coaching and sustainability planning calls with the CCM implementation team and external practice coaches • Intervention materials • Notes from clinical supervision calls • Planning documents • Evaluation reports	• Notes from technical assistance/coaching and sustainability planning calls with the CCM implementation team and external practice coaches • Intervention materials • Notes from clinical supervision calls • Planning documents • Evaluation reports
Other materials	Progress reports	Value stream mapping
Electronic data registry	N=159 CCM participants • PHQ-9 screening and assessment • CCM enrollment and completion • Number and mode of CCM sessions	N=2,990 patients screened • PHQ-2 screening and PHQ-9 assessment • CCM enrollment and completion • Number and mode of CCM sessions

[a.] *All data were qualitative except PHQ-9 data from the electronic data records.*

Table 4. Participant characteristics (N=58).

Data source	El Sol Neighborhood Educational Center (N=28)	Preah Kossamak Diabetes Center (N=30)
Participant	8	4
Care Manager	3	5
Clinician*	2	8
Leadership	1	1
Practice coach	3	3
EBP Participant	8	4
Interventionist	3	5

**For El Sol, psychiatric assistant and LMFT. For Preah Kossamak, nurses, diabetes doctors and psychiatrists.*

Implementation outcomes

The first research question asked, "Was CCM acceptable, feasible, and done with fidelity, and how do these implementation outcomes compare and contrast in Cambodia and the U.S?" There was high acceptability for CCM across both settings, largely driven by the lack of mental health care in both contexts and participants, providers and organizations recognizing that CCM could fill this need. Participants appreciated how care was delivered where they were (in the home, clinic, or by phone) and that it was person-centered to addressed current stressors like challenges with family members, poor sleeping, or concerns about chronic health issues. However, participants were also used to care providers being experts that drove care, so this took some getting used to over multiple sessions (which Preah Kossamak didn't have with their participants). Providers saw the value of training community health workers and social workers to do CCM as they have more time to deliver care and part of their role is to connect people to supports and services to address social needs that contribute to distress. While participant's improvements in their health and well-being enhanced CCM's acceptability, there was poorer acceptability when the participant did not engage in care (e.g., keep follow-up appointments, complete action plans) or when there were too many stressors that CCM could not address. This points to the need for multi-level interventions that can address family, community, and structural barriers to depression and depression care. Organizations saw CCM as acceptable since it was an evidence-based model of care, was being promoted by funding organizations, and was promoted as a model that could be integrated into their existing setting.

That said, other early-stage implementation outcomes differed between cases. For El Sol, CCM was feasible for their community-based organization as they were already providing culturally and linguistically appropriate care through community health workers to reach older Latinos in their homes. While Preah Kossamak was reaching underserved Cambodians at their regular diabetes clinic appointments, not providing care where participants lived meant they were limited in how often and when they could provide care (even though home and phone-based care was an option, it was difficult for both participants and practitioners given the lack of infrastructure outside the clinic for providing such care). While in El Sol, CCM was able to be adapted into current organizational workflows, staffing and processes that centered CHWs, Preah Kossamak required a new workforce (social workers) to be embedded into a hierarchical clinical setting.

Likewise, El Sol had high fidelity to delivering the CCM model across core components, while Preah Kossamak had low fidelity with inconsistent screening for depression, infrequent use of Behavioral Activation or Problem-Solving Treatment, and lack of team-based care. While both cases has similar training, coaching, clinical supervision, and electronic data registries, El Sol's equitable implementation processes allowed the CCM team to better utilize these implementation strategies to support more successful program delivery and ultimately effectiveness. El Sol also had much more regular coaching and clinical supervision with both external and internal practitioners which may have further facilitated higher fidelity to the CCM model.

Determinants

The next research question asked, "What are the contextual determinants of CCM implementation, and how do these compare and contrast in Cambodia and in the U.S?" Table 6 illustrates which contextual determinants were present in each case and whether they helped (+) or hindered (-) CCM delivery. The two settings were largely similar on Intervention Characteristics determinants, highlighting CCM's relative advantage, adaptability, trialability and perceived sustainability as facilitators of implementation success, and complexity and perceived costs as barriers. El Sol and Preah Kossamak were also comparable in Outer Setting determinants, with CCM aligning well with external policies that value outcomes (quality of services) over volume (quantity of services); support CHW and social work workforces to reach underserved populations and address social determinants of health; and recommend integrating NCD and mental health care to improve access to mental health care. In both settings, community characteristics both helped and hindered CCM delivery. On the one hand, the lack of culturally and linguistically appropriate depression care meant that CCM filled a gap in services, while on the other hand, structural inequities like poverty, violence, and stigma impeded CCM engagement, delivery, and impact. Furthermore, both settings shared similar Systems determinants; notably, the external funding agent priorities and systems architecture that values clinical care and CCM over other care models, and lack of resource continuity hindered CCM delivery and sustainability despite CCMs strategic policy alignment with task shifting to improve access to care for populations who are underserved.

The most striking differences between the two cases are seen in the Inner Setting and Implementation Process, suggesting these determinants may drive successful vs unsuccessful CCM delivery. With regard to the Inner Setting, both El Sol and Preah Kossamak valued having Community Health Workers and Social Workers, respectively, as care managers as their expertise and professional background made them well-suited to offer structured behavioral counseling while addressing social needs. However, El Sol had several Inner Setting determinants that facilitated delivering a team-based care model like CCM that were not present at Preah Kossamak. First, El Sol's CCM delivery team brought collective efficacy - the shared belief in their ability to carry out activities and meet their common goals for CCM implementation. Working together to deliver CCM built their confidence to provide better depression care for older Latinos with complex health and social needs. El Sol also brought strong team characteristics that included team members with diverse disciplines and professional backgrounds, an all-Latino team with strong trust and experience with their community, collaboration and consultation built into regular internal and external supervision, willingness to go above and beyond to support their community, and clarity in each of their roles and responsibilities. By contrast, although Preah Kossmak had an interdisciplinary CCM implementation team, they lacked a shared belief in their ability to delivery CCM well by working together. Furthermore, Preah Kossamak's team duplicated efforts by continuing to prefer that doctors and psychiatrist do some mental health assessment and care that was to be task shifted to social workers.

Table 6. Contextual determinants of CCM delivery.

		El Sol Neighborhood Educational Center		Preah Kossamak Diabetes Center
Determinant [a]	**Salience**	**Evidence**	**Salience**	**Evidence**
Intervention characteristics				
Relative advantage	++	Lack of culturally and linguistically appropriate and accessible depression care	++	Lack of culturally and linguistically appropriate and accessible mental health care
	++	Home-based care optimal for engagement		Diabetes-based CCM care is only feasible setting and offers opportunity for both MH and NCD outcomes
Complexity	-	CCM requires specific structure, duration, scope	-	CCM requires specific structure, duration, scope
Adaptability	++	Adapted CCM for older Spanish-speaking Latinos	+	Adapted CCM for older Khmer-speaking Cambodians
Trialability	+	Real-time adaptations before and during delivery	+	Real-time adaptations before and during delivery
Perceived sustainability	++	Evidence-based model using PHQ-9 → potential for health payor coverage	+	Evidence-based model with potential for international NGO or national MOH coverage
Cost	-	While cost of CCM delivery covered by grant, could not be sustained within existing CBO budget	-	Though new SW staff were covered, other staff see CCM as more time rather than task-shifted time
Inner setting				
Culture	++	CHW and CBO norms, values, mission alignment	-	Hierarchical culture hindered CCM champions changing practice
	++	Strong rapport and relationships with older Latinos		
Implementation climate	+	Share power and ideas for ongoing quality improvement	-	Time, turf and trust issues within diabetes clinic team and between mental health clinic team
	-	Time, trust and turf issues between CBO and clinic	-	External coaching insufficient to integrate learnings into clinic workflow due to lack of compatibility
Team characteristics	++	CHWs have close understanding and trust with community to provide care and address social needs	+	SW seen as valuable coordinator with skills and time to address social needs and provider counseling
	++	Strong buy-in to CCM, experience with community, go above and beyond, clarity in roles and responsibilities	-	Other team members (doctors, psychiatrists) duplicated assessment and treatment
Collective efficacy	++	Interdisciplinary team with diverse backgrounds and expertise is needed to come together and help older Latino adults with complex health and social needs	+	SW complement medical providers for holistic health
			-	Doctors and psychiatrists duplicated assessment and treatment; nurses did not have capacity for screening
Available resources	++	Short-term grant -> funding for staff to deliver CCM	+	Funding for SW initiated CCM pilot with existing staff
	-	CBO doesn't have billing infrastructure to sustain CCM	-	Lack of funding for sustaining CCM
Leadership engagement	++	Commitment and involvement pre- and during delivery	++	Commitment from leadership pre- and during delivery
			-	Leadership support did not trickle down to practice change

Determinant [a]	El Sol Neighborhood Educational Center		Preah Kossamak Diabetes Center	
	Salience	Evidence	Salience	Evidence
Outer setting				
Community characteristics	+	Lack of culturally and linguistically appropriate and accessible depression care created demand	+	Lack of culturally and linguistically appropriate and accessible depression care created demand
	-	Stigma and elder abuse hindered engagement	-	Stigma hindered engagement in care or follow-up
	-	Structural inequities impeded delivery and engagement	-	Structural inequities impeded delivery and engagement
External incentives	+	Grant funding → allocate time and resources to CCM delivery (vs. one more thing for resource-scare CBO)	-	Funding followed patient rather than shared funding -> disincentive for team-based care
External policy	+	ACA accountable care (value over volume) and CHW workforce recognized federally and statewide	+	NCD and MH international and national policies support CCM (integrated care) for NCDs and MH
Systems				
Strategic policy alignment	+	Task-shifting and sharing to community-based providers to improve access for underserved	+	NCD and MH international and national policies support CCM (integrated care) for NCDs and MH
			-	SW not yet recognized by government civil service system so required in public health care settings
External funding agent priorities	+	Facilitated integrating CCM into CHW/CBO to reduce disparities in access to depression care and outcomes	+	Facilitated integrating CCM into CHW/CBO to reduce disparities in access to depression care and outcomes
	-	Requirement for clinic-community collaboration forced partnership vs organic, truly integrated	-	External funding and delivery meant integration was top-down rather than bottom-up
Systems architecture	-	Clinical care still considered gold standard for mental health care for financing and delivery mechanisms	-	Mental health care still something provided by mental health clinicians, with better care outside public clinics
Resource continuity	-	Lack of continuity when short-term grant funded	-	Lack of continuity when short-term grant funded
Process				
Reflection	++	Clinical supervision and practice coaching provided regular opportunities for reflection	-	Power dynamics, language, and cultural norms hindered reflection at coaching and supervision
Evaluation	++	Regular data registry review to adjust care as needed	-	Barriers to using data registry made it less of a tool
Engagement	++	Team engaged both independently and as team	-	Mixed engagement from CCM team; largely external driven
Shared decision-making	++	Regular clinical supervision and practice coaching offered platform for shared decision-making about adaptations and team-based care	-	External coaching and clinical supervision aimed for shared decision-making; both in and outside meetings, decision-making was top-down

[a]=Organized by the six domains from the Consolidated Framework for Implementation Research for Low- and Middle-Income Countries.(51) + = facilitator, - = barrier
ACA=Affordable Care Act; CBO=community-based organization; CCM=collaborative care model; CHW=community health worker; MH=Mental Health; MOH=Ministry of Health; NA=Not Applicable; NCD=Non-Communicable Diseases; NGO=Non-Governmental Organization; PHQ-9=9-item Patient Health Questionnaire; SW=social worker

Furthermore, for El Sol, the culture of community health workers already integrated into a community-based social service organization aligned with collaborative care, whereas for Preah Kossamak, the hierarchical culture of the setting made it hard for new social workers and clinician champions to change practice. Although both settings had time, turf and trust issues that interfered with delivery, El Sol had an implementation climate that shared power and ideas, Preah Kossamak's lacked such a climate. Lastly, available resources and leadership engagement facilitated CCM delivery for both settings, though did not trickle down into practice change for the more hierarchical clinic setting.

Regarding the Implementation Process domain, both settings engaged in evaluation before and during CCM implementation. Pre-implementation, this included establishing project goals, team training, setting up a data management system, and adapting intervention and implementation materials for each context. During implementation, each setting made further adaptations, such as adjusting clinical supervision to focus on complex cases and providing self-care for care managers after difficult cases. However, evaluation did not lead to similar outcomes, likely due to the other implementation process factors at play. Specifically, El Sol's strong team, collective efficacy, and culture of community health work, meant that reflection, engagement, and shared decision-making were baked into the implementation strategies for CCM delivery. For Preah Kossamak, the hierarchical organizational structure, lack of buy-in across different providers and clinics, and inability to substantively change policies and procedures did not leave any room for power sharing, ongoing reflecting and learning, or engaging to make even a CCM pilot successful.

Adaptations

The final research question asked, "What adaptions were made to CCM to fit to local context, and how and why were these adaptations made? How do these adaptations compare and contrast in Cambodia and in the U.S?" Adaptations were made to CCM content, context, and implementation strategies. For content, care managers embedded tools for managing co-occurring chronic conditions (e.g., physical activity, diet, medication management) and stress (e.g., meditation, relaxation, breathing). Both settings also addressed social needs that drive depression onset, result from depressive symptoms, and interfere with remission from depressive symptoms. El Sol was better situated to make referrals or address these directly through CCM sessions given their role as CHWs in a CBO. Preah Kossamak could connect diabetes patients to services outside the clinic but had less ability to follow-up with patients. Both settings also complemented PST and BA with additional tools to address sleep hygiene and stress management using breathing, relaxation, and other culturally appropriate strategies.

Contextual adaptations have been described above and mainly concerned personnel and setting. For implementation strategies, each setting employed similar strategies that are commonly used with collaborative care (training, coaching, clinical supervision, data registry); however, they were operationalized differently given the different structure of each setting and team as well as more funding available for El Sol's implementation than at Preah Kossamak. For El Sol, the CCM coaches, manager, and LCSW participated in a two-day, in-person training, followed by

regular practice coaching delivered weekly, then biweekly, then monthly. Clinical supervision was provided weekly, focused on several challenging cases rather than reviews of all cases. The data registry was required by the funders and as such used regularly to monitor and track client progress. For Preah Kossamak, the team members participated in a 3-hour, in-person training then follow-up hybrid training sessions on specific CCM components (e.g. PHQ-9, PST). Practice coaching was delivered weekly then monthly over the CCM delivery period, and clinical supervision was done weekly then monthly. All CCM team members were trained on using the data registry, though it was not used consistently for monitoring and tracking.

Throughout CCM planning and delivery, both organizations made content and contextual adaptations; however, El Sol made more adaptations before and during implementation than Preah Kossamak. Furthermore, while both teams collaborated with internal and external partners to make adaptations, the El Sol team made more fidelity-consistent adaptations whereas the Preah Kossamak team sometimes had adaptations that were reactive and fidelity-inconsistent. For example, while both settings expanded CCM client session content to support stress management, chronic disease self-management, stigma reduction, and addressing social needs, El Sol continued to teach PST or BA at each session whereas sometimes Preah Kossamak did not teach one of these tools each session. Another instance is that at Preah Kossamak, the doctors would often provide duplicate depression assessment and care rather than complement the assessment and care being provided by social workers. Findings suggest that these differences were due to having more funding to support project implementation, a more empowered care delivery team, and a less hierarchical organization.

While some content and contextual adaptations were operational to align with the resource-constrained setting, others were cultural to better fit CCM to the priority population underserved by depression care. Operationally, comparing the two cases reveals how similar CCM functions were executed in different forms with varying success. For example, El Sol embedded depression screening into outreach to low-income senior housing facilities where they offered healthy aging presentations and fresh fruit and vegetables. The screening could be done privately given potential stigma or embedded in presentations as part of education about emotional health. These screenings were able to be scheduled because of trusting relationships that CHWs had in the community. Instead of integrating screening into regular workflow, the CHWs did screening quarterly so that they could focus their efforts on outreach and engagement rather than having to balance home visits. Preah Kossamak also aimed to embed screening into routine workflow. At the diabetes center (as in other Cambodian facilities), patients come early in the morning to get a number to be seen that day, rather than having scheduled appointments. Depression screening via the PHQ-2 was embedded into the routine screening that nurses would do in a private room as patients were intake for the day, along with blood pressure and blood glucose screening. Although this plan for screening was determined in consultation with the CCM team, the nurses were swamped from 8am-9am as the patients for the day did their intake, and the room was not particularly private with multiple providers and patients at once. As such, screening was inconsistent: not all patients got screened, and not all those with a score of >/= 3 were referred to the social worker for further assessment and engagement or referral.

The cultural adaptations were largely surface adaptations to improve how depression is talked about and provide care that aligned with preferences and values (e.g., breathing and relaxation exercises). While for El Sol, this was sufficient as CHWs acted as cultural brokers to improve CCMs cultural relevance among older Spanish-speaking Latino adults, surface-level cultural adaptations were insufficient for Preah Kossamak as they did not include explanatory models of illness. For example, "thinking too much" is a common cultural idiom of distress – while behavioral interventions like PST and BA may help reduce this, incorporating this into assessment, communication, and care may strengthen the social validity of CCM.
Future efforts to adapt CCM for different cultural contexts will benefit from recommendations from the cultural adaptations literature for implementation science to make culture visible and explicit in the implementation process, use cultural adaptation frameworks to identify what and how EBP content, delivery and context of practice needs to be adapted, and expand the contextual lens.(61) Lastly, it should be noted that some adaptations were both operational and cultural. For instance, complementing training with ongoing coaching was key for both building capacity among a workforce with lower education as well as aligning with cultural values of community.

Discussion

This comparative case study evaluated the implementation of the collaborative care model to improve access to quality depression care in two diverse cultural contexts than where the model was initially developed: with older U.S. Latinos via a community health worker/promotora-delivered, home-based program, and with Cambodians living with diabetes through newly established social workers in a clinical setting. For implementation outcomes, acceptability was high in both settings given lack of access to quality care, whereas feasibility, fidelity and service penetration were higher in the El Sol setting. It appears that inner setting and implementation process determinants that captured how the CCM team worked together drove these observed differences in implementation outcomes. Specifically, El Sol built on the strengths of community health workers/promotores for successful collaborative care through collective efficacy and a strong team culture, whereas Preah Kossamak was hindered by a hierarchical setting and culture. Both settings made operational and surface-level cultural adaptations to try and address these determinants. While these adaptations aligned and amplified contextual facilitators at El Sol, adaptations were insufficient as an implementation strategy for health equity(62) (improving access to depression care for underserved populations) in Preah Kossamak as they did not sufficiently counter or modify the non-modifiable contextual barriers that influenced unsuccessful delivery.

Learnings have the potential to expand existing implementation science frameworks for improving health equity. Recent calls for the integration of health equity and implementation science call for focusing on reach from the beginning (62) which is what these settings set out to do. Reach was an essential first step given that people of color including those who speak languages other than English are underrepresented in mental health intervention and

implementation studies.(63) In both study settings, adults were made vulnerable by their isolation, poverty, history of trauma, and living with multiple chronic conditions, as well as stigma about depression and depression care. Improving mental health equity means engaging vulnerable populations in research and doing these studies in settings where these populations are served and live. Without this, we will continue to try and implement evidence-based programs that we don't even know if they will work, which is at best inefficient and at worst unequitable and unethical. Our findings align with RE-AIM's(64) recognition of reach as an important but not comprehensive step. A recent paper by Kerkhoff and colleagues(65) identifies the need to engage all key partners from the beginning, address performance gaps as they arise, and addressing systemic barriers like racism and power for reach to translate into action. While El Sol was able to address these first two steps, neither settings tackled the structural inequities that perpetuate both depression burden and the mental health care gap.

The collaborative care model is a solution developed in the global north that is now being applied to the global south. This model centers task shifting and sharing to non-traditional mental health providers like the community health workers/promotores (CHWs/Ps) and social workers in this case study. While this research described the value of training these providers to better reach underserved communities given their training in engagement, addressing of stigma, trauma and social needs that drive depression outcomes and care, and workforce shortage realities, our findings also point to the reality that one can only do task-shifting and sharing with explicit attention to power. It appeared that training trusted CHWs/Ps in homes was more successful then delivering care by new social workers in a clinical setting not just due to time, trust and turf issues but due to power. The success of El Sol, in which power was shared across the CCM team and expertise, was centered in CHWs/Ps with longstanding community and organization ties, contrasted with the usual global health model of external academic partners from highly resourced settings as experts. As such, co-developing and creating models for supervision (66) is an essential implementation strategy so that planning for sustainability is part of capacity building.

While previous models of global health research valued the implementation of some care over no care, this investment in unsustainable time and resources has the potential to do more harm than good. To truly decolonize global health, we must build care models with, in and for communities. This starts with "integrating local knowledge, indigenizing of assessments and solutions, and following the lead of the affected communities in the assessment of their problems and the appropriate application of medical and public health evidence to their situations."(67) Anti-racist and anti-oppressive approaches are needed to truly achieve the promises of mental health equity. Recent articles on integrating implementation science and anti-racism offer specific strategies for doing anti-racist D&I research (68),(69). For example, they call for moving beyond community engagement and organizational context from nouns to verbs, structuring research and practice for more equitable sharing of resources and meaningful inclusion, and interrogating how racism manifests in the norms, policies and institutions we are trying to impact. Absent of anti-racist lens, our efforts will fall short of dismantling the structural racism that drives inequities in mental health care and outcomes.

This comparative case study further reminded us that *how* we do global mental health research is as important if not more important than the intervention that is chosen. The successes of El Sol provides a roadmap for what is needed to do equitable implementation, modelling "reverse innovation" – learning how to improve PEARLS from resource-constrained contexts that innovate to make programs work efficiently and sustainably,(70) centering communities to promote health equity. Absent of this strong collective efficacy organically in the organization, frameworks such as the Collaborative Intervention Planning Framework,(71) that operationalize community-based participatory ethics and intervention mapping methods, lets community drive intervention selection rather than funders/experts. As we started with leadership and CCM experts at both settings, user-centered design approaches would better identify needed cultural adaptations (e.g., limitations of problem solving as western and individualistic).

This case study also affirmed that "culture counts" in mental health care(72) as it influences whether and how people seek help, engage in health behaviors, communicate with providers, and how care is delivered.(39) Psychoeducation about depression helped address misconceptions that this was a normal part of life,(73) and PST and BA appeared to align with Latinos and Cambodians cultural preferences for focusing on the here and now, only sharing what they were comfortable with, and self-sufficiency, and connecting to other services and supports aligns with holistic worldviews. However, the PHQ-9 did not capture cultural idioms of distress, and as such may be limited by not aligning with explanatory models of illness or monitoring change over time. In contexts like Preah Kossamak, deep adaptations to CCM may be needed that better integrate cultural influences of health to improve both the social validity and delivery of CCM. It may also be that team-based models like CCM are not appropriate for hierarchical organizational cultures like those in Cambodia; as such other depression care models may be more appropriate both culturally and operationally.

Trauma-informed practices is another key piece of anti-racist CCM delivery given both older Latinos and Cambodians trauma history. The stressful and traumatic experiences of migration and relocation and scattering of the family structure, membership and relationships can shape a person's thinking, feelings, values, and behaviors over time and impact their family over generations.(74–76) Likewise, a majority of older Cambodians have experienced trauma from the violence, brutality, and starvation, of the Khmer Rouge rule and pre- and post-civil wars during which one-third of the population perished.(77) Transdiagnostic models like the Common Elements Treatment Approach (CETA)(78) address not only depression but also trauma through "talking about difficult memories" and "living exposure" (facing innocuous triggers and reminders in one's environment).(78,79) Dr. Ngo's, Lam, and Nguyen's Livelihood Integration for Effective Depression (LIFE-DM) project is including $150 microfinance loans and repacking CCM care as a life and family-focused program to better engage Vietnamese women living in poverty.

Comparative case studies provide an opportunity to understand and explain how context affects CCM implementation success or failure, so that we can better tailor the intervention to specific

contexts (55) as well as modifying implementation strategies and/or the context (80) to achieve better health outcomes. Furthermore, this design was helpful for building evidence on equitable CCM implementation with, for and in delivery and cultural contexts that are underrepresented in implementation science research. That said, we ran into some of the limitations of this design. While we selected cases strategically, when we realized how different the cases were, it was too late to gather different cases or appropriate data (59). In addition, resource constraints and amount of time needed for research became a limitation as it was more important to prioritize practice. (81)

Conclusions

Given the underrepresentation of people of color who speak languages other than English in mental health intervention and implementation studies, it is essential that research be done with, in and for these communities to see if these programs will work and can work in these contexts. This study helped to address some of the dangerous assumptions from earlier research to eliminate mental health inequities: that all is needed are cultural adaptations for BIPOC and LEP communities, focus on effectiveness rather than implementation, and that one-size-fits-all will improve access to quality care for everyone, overlooking the contextual factors that drive mental health and mental health care in marginalized communities.(82) Indeed, the CFIR and other implementation science models inclusion of the intervention itself as only one piece for successful delivery reminds us that other tools are needed to solve the know-do gap puzzle. Learnings from this study amplify the importance of how we work over what we do in implementation science research and practice to truly eliminate health inequities.

List of abbreviations
CCM: Collaborative care model
CFIR: Consolidated Framework for Implementation Research
CHW: Community Health Workers/promotores
EBP: Evidence-based programs/practices
FRAME: Framework for Reporting Adaptations and Modifications Expanded
HIC: High-income countries
IOF: Implementation Outcomes Framework
LCSW: Licensed clinical social worker
LMIC: Low- and middle-income countries
MADI: Model for Adaptation Design and Impact
NCD: Non-communicable diseases
PHQ-9: 9-item Patient Health Questionnaire
SW: Social Worker

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Chapter 5. Conclusion

This dissertation includes three applied research studies to better understand the social, health care, and global value of community-based depression care, and in turn present several implications for policy and practice going forward.

Aim 1 suggests that in addition to impacting depression outcomes, PEARLS can improve social connectedness among low-income older adults. Specifically, after active intervention, participants significantly reduced their loneliness and perceived isolation, and improved their social interactions and satisfaction with social supports. These improvements persisted but were attenuated over time and during COVID especially for objective measures of social isolation. Findings also support PEARLS operating through four established mechanisms for action to reduce social isolation or loneliness: enhancing social support, improving opportunities for social interaction, reducing negative thoughts, and improving social skills.

Documenting PEARLS potential impact on improving social connectedness has already expanded how PEARLS is disseminated and implemented across the country. Social isolation and loneliness appear to be less stigmatizing then depression, in particular after two years of a pandemic in which everyone experienced the negative impacts from physically and socially distancing from one another.[133] Being or feeling disconnected may also be less stigmatizing as a qualitative symptom of depression experienced by people outside a Western, individualized context.[134] As such, PEARLS providers have begun using isolation as a way to engage older adults in care as well as include brief social connectedness measures in their intake to better understand the nature of a participant's disconnection and co-design personalized solutions using problem-solving treatment and behavioral activation, aligning with evidence on core functions of social connectedness interventions.[135]

Study findings about mechanisms by which PEARLS may improve social connectedness and moderators that can amplify or dampen these mechanisms can further guide future practice by elucidating areas to work on to address both depression and disconnection. For example, integrated findings suggest that older adults who did not improve depression but improved social connectedness may have still felt like a burden. As such, practice can be tailored to work on minimizing maladaptive social cognition or doing activities that increase self-esteem and value might help to strengthen PEARLS effectiveness.

Lastly, both COVID-19 and social isolation being recognized as a costly social determinant of health has brought additional funding for community-based social service organizations to deliver supports and services such as PEARLS given this emerging evidence on improving social connectedness. For instance, the American Rescue Plan funds have been used for organizations to purchase tablets and hotspots so that older adults could connect not just with PEARLS providers but with family, friends and loved ones and other telehealth care. Health care organizations are now routinely screening for social determinants such as isolation and need community and home-based services and supports to refer to, providing another pathway for both PEARLS referrals and reimbursement. In 2023, we will apply to have PEARLS recognized by a new registry of innovations to address social disconnection (EngAGED, National Resource Center for Engaging Older Adults, https://www.engagingolderadults.org/); these registries help build awareness about tools like PEARLS that reach marginalized older adults and are often used to determine which programs are funded. We are also applying for funding in early 2023 to develop training modules to translate PEARLS Connect findings into practice tools.

Aim 2 demonstrated that PEARLS participants had significantly fewer inpatient hospitalizations, nursing home stays, and community residential long term supports and services (LTSS) care months than home and community service recipients who did not participate in PEARLS and who had similar sociodemographics, health status and service use. Participating in PEARLS also appeared to lower one's likelihood of dying. These are significant impacts on older adults' quality of life, health, and costs of care that add to the limited economic evidence on home and community-based collaborative care models.

As part of health care reform, health payers are increasingly being called upon to improve the value of rather than volume of care for all patients and in particular populations who have been traditionally underserved by health care. Improving the quality and coordination of care for high-need, high-cost populations is also a crucial component for addressing health care disparities among vulnerable populations. Older adults use of acute and intensive health care like inpatient hospitalizations and nursing homes may indicate problems with preventable or manageable chronic conditions or upstream social economic conditions that are fundamental causes of health inequities.[136] In this pandemic context, increased hospitalizations may also reflect older adults delaying care for chronic conditions due to concerns about COVID-19 risk as well as increased demand for services as conditions like dementia and mental illness due to isolation.[98] Further research could examine whether PEARLS improved management of both physical and mental chronic conditions as a mechanism to reduce costly health care utilization, which would be of interest to payers looking to achieve the quadruple aim.[40]

It has been well-established that older adults use more acute health care, with older adults accounting for an ever-growing percentage of acute hospital care.[137] While some of this increased health care utilization among low-income older adults with depression can be attributed to complex health needs, functional limitations, and self-rated health, this is also driven by social and economic inequities that increase hospitalization risk even after adjusting for co-morbid health conditions.[51] Increased use of health care among this population is a big problem as it disrupts lives and continuity of care and has a financial impact on patients, providers and payers.[52] For example, preventable hospitalizations (hospital admissions that can possibly be avoided with better management of chronic conditions or treatment of acute conditions) cost $25 billion per year.[138] These hospitalizations disproportionately impact older persons, especially the 80% that live with a chronic condition.[139] Factors contributing to increased hospitalizations include financial barriers to care (even among CMS insured older populations) and lack of continuity of care.[140] While we don't know whether PEARLS impact on inpatient hospitalizations included preventable hospitalizations, nor the mechanisms by which these hospitalizations were reduced, Aim 2's findings are motivating for payers looking to lower costs for older adults living with multiple chronic conditions.

Furthermore, most funding is still spent on institutionalized care then home and community-based care to support independent living of older adults – e.g., a recent estimate found the U.S. spent $90 billion of $125 billon LTC funds on nursing home care. If PEARLS can save nursing home days, it would behoove payers to shift more funding to HCBS providers to deliver PEARLS to older adults to minimize costly days in nursing home care. This also aligns with older adults' preferences to age in place rather than in institutions, as well as preferences for non-pharmacological care. Health payers currently cover the costs of anti-depressant Rx, that 1 in 5 older adults (and 1 in 4 women) take and is on the rise 65% from 1999 – 2014.[141]

Aim 3 illustrated how PEARLS was adapted and implemented in two different resource-constrained, cultural contexts than that in which it was originally developed. This comparative case study described PEARLS successful delivery via CHWs to engage older U.S. Latinos in southern California, and PEARLS unsuccessful delivery with Cambodians living with diabetes in Phnom Penh. Inner setting and implementation process determinants appeared to drive PEARLS feasibility, fidelity, and ultimately clinical outcomes, highlighting the importance of embedding PEARLS into a collaborative team with community trust to engage populations underserved by mental health care. This study also suggests that while adaptations are an important implementation strategy for health equity, they are insufficient to address non-modifiable contextual factors that impede program delivery. Lastly, acceptability may need to be modified as an implementation outcome in resource-constrained contexts with poor access to mental health care as high acceptability may not translated into successful implementation.

This study has important implications for policy and practice. For the health services workforce, the shortage of clinicians to support mental health has been recognized nationally[142] and globally.[143] The U.S. case demonstrated that community health workers can be essential partners in PEARLS delivery for older Latino immigrants; though some CHWs had been trained to do PEARLS in Florida in the past, this is the first study demonstrating how adding PEARLS to promotoras core competencies can improve engagement and outcomes (both depression and addressing social needs). This paper also suggests that building capacity for front-line social service providers to deliver depression care isn't sufficient in and of itself for improving access – implementation strategies beyond "train and hope" [144] are needed to integrate depression care into resource-constrained settings that reach populations who have been underserved by clinical care. How implementation happens is as essential for health equity as what is being delivered – in the U.S. case, PEARLS was embedded in a CBO and CHW context with long-standing trust in the community and collaboration as their work culture and climate. This aligns with recent calls for implementation science to integrate health equity [145,146] and anti-racism [147,148] into their research and practice for equitable D&I – relationships, trust, engagement, connection and reciprocity are as important for reducing depression inequities as selecting, adapting and delivering an evidence-based program like PEARLS. Macro-level strategies are also needed to address drivers of unequal depression burden that a 1:1 intervention like PEARLS can't address.

We are currently applying learnings to projects with both case study partners. The U.S. site has applied for state funding from the CalGrows Innovation Fund: Growing a Resilient, Outstanding Workforce in the Home and Community to address gaps in supporting the direct care workforce that is disproportionately made up of Black, Latino, Indigenous, and Asian/ Pacific Islander woman, many of whom are immigrants in low-income households. This project would scale their local CHW capacity building and training to include PEARLS and other practices for healthy aging, utilizing the coaching and supervision strategies co-developed during their PEARLS implementation. In Cambodia, we are partnering with two community health centers, several NGOs, and the government (Ministry of Health and provincial health district) to apply lessons learned in two rural provinces to integrate collaborative care into their current practices. This project will differ from the case study in that it will be built from the ground up - building capacity with existing health care, social work, and village health workers to strengthen linkages between the community and clinical settings with supervision and coaching provided by the social work department at a Cambodian university – while planning for sustainability with regional support from the provincial operating district who can now make decisions about funding and delivery mechanisms under Cambodia's new de-centralized policymaking.

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