Peer support in Shanghai's Commitment to diabetes and chronic disease self-management: program development, program expansion, and policy

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Abstract

Identifying organizational settings for sustainable, scalable implementation of peer support (PS) is a challenge. Development, initial evaluation, and community expansion of PS for populations with diabetes staged in the context of the Shanghai Integration Model integrating primary and specialty care for diabetes. Development Phase with 9 Community Health Centers (CHCs) leading to Community Expansion Phase with additional 12 communities. Development Phase peer leaders (PLs) co-led meetings on diabetes management, led neighborhood activities, and followed up with individuals and families. Among 1,284 participants, changes in HbA1c, other clinical markers, and diabetes distress were significant (p s from 0.001 to 0.041), pronounced among those with elevated levels, for example, HbA1c reduction from 9.09% to 8.50% among those $\geq 8\%$ at baseline ($p < 0.001$). Ratings of Implementation were associated with reduced HbA1c and diabetes distress and increased neighborhood support. In particular, linking with community resources and utilization of neighborhood Residential Committees were associated with improved HbA1c, indicating the value of PS programs including community resources. Thus, the Community Expansion Phase includes district- and community-level health staff, Community Self Management Groups, and Residential Committees along with CHCs in 12 communities, all of which have implemented activities during the first 6 months. PS programs are feasible and appear to add value among populations with diabetes in community settings such as Shanghai. Recognition by the Shanghai government has included PS as a key strategy for achieving self-management of chronic disease in its 2030 health goals.

Key words

peer support, intersectoral community and clinical, diabetes, implementation

INTRODUCTION

Worldwide, peer support (PS) has reached and delivered services to populations regarding a variety of infectious and chronic diseases [1–3] as well as mental health [4]. Pertinent to the fact that across many settings, large proportions of those with diabetes and other chronic diseases fail to receive basic recommended diabetes care and education, a systematic review showed effectiveness of PS in reaching, engaging, and benefiting those identified

Implications

Practice: Peer support for diabetes management and, more broadly, chronic disease management is feasible and apparently effective when implemented through community as well as clinical settings.

Policy: Following the lead of the Shanghai Municipal Health Commission and based on results such as those reported here, health policies should support ongoing and community- as well as clinic-based peer support for chronic disease management.

Research: Following documentation of feasibility, benefits, and the importance of several aspects of implementation, research should refine measures of implementation and examine specific aspects of implementation to develop key performance indicators that facilitate program standardization as well as flexibility and adaptability.

as “hardly reached” [5]. This includes those affected by disadvantages such as low levels of health literacy and social support [6,7]. The interventions described here also address a number of other factors important in China, including discrimination against those with diabetes and the importance of social cohesion [8,9]. How to stage PS, however, is not clear. Here, we report staging PS for diabetes within the context of a systematic approach to integrating community, specialty, and hospital care.

Chinese national policy

National health policy provides an important context that encourages education and support in chronic disease management. Chinese national reforms initiated in 2009 [10, 11] included an emphasis on primary care, generally offered through community health centers (CHCs) [12] that provide essential public health services free to all

citizens [13], including health education and care for mental illnesses and chronic diseases including diabetes [11]. The Healthy China 2030 blueprint [14] extends these reforms such as through a variety of preventive and capacity reforms, including increasing health literacy and promoting disease prevention and healthy lifestyles, with special emphasis on high-risk populations such as older adults, migrants, and low-income groups. To address these, Healthy China 2030 promotes a shift from disease treatment to health promotion and health management, requiring engagement from all sectors in society.

The program setting: Shanghai and the Shanghai Integration Model

To serve its 240 million residents, Shanghai includes 326 hospitals and 240 CHCs with each CHC serving an average of 100,000 [15]. Its 16 districts range from urban to rural and in population from 654,800 to 5.5 million [15]. The hospitals and CHCs are administered under the Shanghai Municipal Health Commission, the Shanghai Shengkang Hospital Development Center, and District Health Commissions in each of the 16 districts. Districts are subdivided into communities (total of 240), typically each with one CHC and a sub-district health office.

Congruent with national and Shanghai policy, the Shanghai Integration Model (SIM), led by Professor Weiping Jia of the Shanghai Sixth People's Hospital (S6PH), set out to promote integration of primary and specialty care as well as the content of care and public health services, including health education, self management, medications, regular primary care, screening, needed specialty care, and care for complications. Research on the SIM has documented (a) increased numbers reached and screened for complications, (b) improved clinical status (reduced Hemoglobin A1c [HbA1c], blood pressure, and triglycerides), with also (c) reduced unnecessary specialty care [16, 17]. Since 2017, the Shanghai health system has promoted the SIM in all districts.

The integration of care and especially the expansion of the roles of CHCs in chronic care may provide a useful setting for integrating PS into regular care. Reciprocally, PS may facilitate the objectives of the SIM, encouraging appropriate primary as well as specialty care, while helping patients to integrate medical care, healthy lifestyle and self management in their daily lives. Accordingly, the present paper reports development of PS through CHCs under the SIM. This includes a Development Phase with formative evaluation, outcomes, and lessons learned from implementing PS in 9 CHCs. Based on these findings, a Community Expansion Phase extends the program to 12 additional communities and their CHCs.

DEVELOPMENT PHASE: PEER SUPPORT IN 9 CHCS

Ten CHCs were selected according to their having in place the key organizational resources and protocols of the SIM and their willingness to collaborate in the project.

Formative evaluation

From interviews with seven patients with diabetes and eight CHC staff (5 physicians, 1 deputy director, and 2 nurses) from 3 of the 10 CHCs in July–August of 2016, the project team developed the program protocols. Discussion during initial training in February, 2017 led to further refinements of plans for the intervention including, for example, emphasis on group activities co-led by CHC staff and PLs or by PLs alone.

Implementation of peer leader program

From criteria suggested by research staff from the S6PH and Peers for Progress, CHC staff recruited peer leaders based on existing relationships with people in the community. Several CHCs recruited peer leaders who had experience working on prior health projects from Community Self-Management Groups (CSMGs) or from Residential Committees. Across Shanghai, there are approximately 6,000 active CSMGs of residents who share interests in a variety of health issues. Residential Committees are the basic organization of shared community management and shared education and services in China [15]. These work with CSMGs, CHCs, and community health staff to arrange resources, and generally attend to the needs of the neighborhoods and residents they serve.

Initial training in February 2017 spanned two and one-half days and included CHC staff and PLs together. Subsequent, 6-h training in August 2017 included an additional 15 PLs along with those from initial training. Training covered diabetes knowledge, diabetes self-care, communication skills, group skills, program protocols, experience sharing, practical tips, as well as key core messages, group facilitation skills, and helping patients make the transition from discussing problems to taking action using a “Diabetes Action Plan” as a framework. An additional follow-up training for all PLs in June 2018 reviewed PL activities and skills. Separate sessions for CHC staff reviewed their roles in coordinating and supervising PLs within their clinics and communities. Final training outlines and all other intervention materials described in this paper are available at <http://peersforprogress.org/who-we-are/collaborative-projects/shanghai-integration-model/>

In addition to training, research staff provided quarterly consultation individually to each CHC regarding program development and led meetings of CHCs in June and November 2017, and February 2018 to provide opportunity for sharing progress and implementation challenges. WeChat was used for monthly skill enhancement modules for CHC

staff and PLs, for responding to CHC queries and concerns, and sharing among CHCs.

Table 1 describes the services and activities PLs implemented as revised prior to the program's initiation in February 2017 and further revised based on feedback from CHCs, peer leaders, and participants through the course of implementation.

Participants

Across the CHCs participants were recruited through announcements and posters in CHCs, oral invitations from GPs during outpatient visits,

recommendations by PLs living in the same community, recommendations by CSMG leaders or staff working in residential committees, or through quarterly telephone or in-person assessments mandated by government policies for all with diabetes and other chronic diseases. Activities were opened to all with diabetes. Those recruited to evaluation samples (target = 140 per CHC) signed informed consent documents from CHC staff at baseline assessments. All procedures were approved by the committee for the protection of human subjects of the S6PH, 2017-015-(1).

Table 1 | Key Components and Examples of Peer Leader Intervention

Monthly diabetes education classes and activities, led by CHC staff or co-led with PLs

Topics of classes: healthy diet, medication use, insulin use, exercises tips for diabetes patients, complications, lipid control, how to use insulin correctly, balancing mood in self-management

Group discussion of diabetes management

Sessions on diet and nutrition which PLs guided and promoted and which CHC staff facilitated with dietary teaching and analysis and back-up of nutrition knowledge

Informal Community Activities to Encourage Healthy Lifestyles and Diabetes Management

Through these group activities, those with diabetes recognize that they are not alone, share experiences, and affirm their shared identity as having diabetes as an antidote to stigma and shame around the disease

Performance Art (e.g., writing and performing skits, composing songs)

Experience sharing and story telling, model shared experiences

Writing and performing skits including healthy diet, using insulin, exercises

Group discussions of diabetes management, challenges in following diabetes management, ways to address those challenges, feelings about and stressors of diabetes, etc.

Summary report in the form of group newsletter shared with group members to show monthly progress of the group, and diabetes self-management knowledge

Informal Community Activities to Promote a Sense of Community and Support Among Those with Diabetes

Group exercise and dance

One-day outings such as to neighboring cities (Suzhou)

Group food preparation

Free test of diabetes glucose and blood pressure and experience sharing

Jogging together and test finger blood glucose before and after jogging and show the influence of exercises on blood sugar through this activity

Monthly exercises together with the help of an exercises professional as the assistant

Outings such as to parks or neighboring cities, such as a 1-day trip to Suzhou, helping group members bond with one another

WeChat among PLs and participants

Share number of steps per day per person to encourage exercises

Share educational materials and latest health or diabetes-related information filtered and disseminated by CHC staff

Continue discussion after attending diabetes education classes

Promote upcoming classes, meetings, and/or activities

Relationship building and caring, encouragement through WeChat communication

Individual follow up or meetings with those needing or requesting extra support

This was encouraged but not expected of PLs

Individual consulting or conversation led by Peer leaders for better glucose control

Accompanying individual group members who have not had a doctor appointment for a long time to see their CHC doctor

Go to group member's home to express caring, checking whether problems have arisen, making Action Plans, general talking, etc.

PL interactions with families

Encouraging spouses to attend group meetings and activities

PLs conduct home visits to help family members understand the importance of insulin therapy for their loved ones with diabetes.

Collaborations with other resources within neighborhoods

Some PLs were also leaders of existing "Community Self-Management Groups." Some CHCs or PLs had ties to Residential Committees in neighborhoods. Trained lay workers from NGOs in communities were also involved with some programs.

Help from NGO focusing on health promotion in community to organize lectures and activities on diabetes or health in general.

Evaluation

Evaluation included mixed qualitative and quantitative methods to characterize the program across implementation, effectiveness, and lessons learned. CHC records and staff notes characterized implementation across the CHCs. Technical assistance through individual consultation and group meetings provided observations on strengths and weaknesses of different program elements, needed modifications, etc.

Impact indicators from individuals included quantitative clinical and quality-of-life measures gathered from evaluation cohorts of 140 per CHC. Extraction of clinical indicators from CHCs' laboratory data included HbA1c that was the primary endpoint identified in trial registration. Extraction also included anthropometric data, blood pressure, and lipids.

Surveys were drawn from consensus measures for evaluating PS in diabetes, developed by previous Peers for Progress investigators [18] and adapted to Chinese and the present context. These included the PHQ-8 measure of depression [19], the EQ-5D measure of quality of life [20, 21], and a four-item measure of diabetes specific distress drawn from the Diabetes Distress Scale [22]. Neighborhood support for diabetes management was measured by eight items answered on 5-point scales ("Not comfortable at all" to "Completely comfortable"). Sample items included "In the neighborhood where you live, how comfortable are you talking about your diabetes and your feelings with other people that understand the disease?" or "How much do you feel comfortable talking with others when you are feeling stressed or down about your diabetes?" or "How much do you feel that other people in your

neighborhood understand the importance of diabetes management?"

Through the course of consultation with CHCs, research staff recognized substantial variability in level of implementation of the program. In September 2018, 18 months after initial training in February 2017, the two research staff who had consulted actively with CHC staff rated the PL programs according to 11 characteristics as described in Table 2. The two raters achieved initial agreement on 54 of 99 ratings however there were no instances of disagreement by more than 1 point (e.g., 1 and 2, or 2 and 3, but never 1 and 3). After resolving disagreements by consensus, CHCs' scores across all 11 items were averaged (interpolating item 11 to a 3-point scale) to yield a General Implementation score, with possible range of 1–33.

DEVELOPMENT PHASE: IMPLEMENTATION RESULTS

CHC participation

After attending the initial training in February 2017 and beginning baseline data collection, leadership of one CHC decided in September 2017 to withdraw from the project because of a lack of available staff resources. It and data from its participants were dropped from the program and analyses, leaving 9 CHCs that participated in implementation and evaluations.

Training

A total of 74 PLs and 26 CHC staff completed training, 25 staff and 66 PLs in February 2017 and 26 staff, 58 existing PLs, and 10 newly recruited PLs in August 2017.

Table 2 | Means, Ranges, and Standard Deviations of Ratings of CHCs on Each of 11 Characteristics of Implementation of PL Programs

Category and Items	Means	Ranges (SDs)
Peer leader activity		
1. Number of Peer Leaders active: ___ 1–2 ___ 3–5 ___ 6–10 ___ more than 10	2.89	2–4 (0.601)
2. Activities led by Peer Leaders without CHC staff: 1-Poor, 2-Moderate, 3-High	1.67	1–3 (0.707)
3. Contacts of Peer Leaders w/individual patients: 1-Rare, 2-For some Patients, 3-Common	1.56	1–3 (0.726)
CHC engagement		
4. Joint activities of CHC staff with Peer Leaders: 1-Poor, 2-Moderate, 3-High	2.22	1–3 (0.667)
5. Regular supervision of Peer Leaders: 1-Poor, 2-Moderate, 3-High	2.11	2–3 (0.333)
6. Active leadership of CHC leaders: 1-Poor, 2-Moderate, 3-High	1.89	1–3 (0.601)
7. Management plan and organization: 1-Poor, 2-Moderate, 3-High	1.89	1–3 (0.601)
8. Engagement of CHC staff with Project team at Sixth People's Hospital: 1-Poor, 2-Moderate, 3-High	2.00	1–3 (0.707)
9. Use of project funds, resources: 1-Poor, 2-Moderate, 3-High	2.11	1–3 (0.601)
Residential committees		
10. Utilization of Residential Committees or other community resources: 1-Poor, 2-Moderate, 3-High	2.00	1–3 (0.707)
Community links		
11. Enhance diabetes Peer Leader program by building on or linking with other initiatives or pre-existing programs: 1-Poor, 2-Moderate, 3-High	1.67	1–3 (0.707)
Total with item #1 interpolated from 4- to 3-point scale (possible range = 11–33)	21.28	15.25–31 (5.040)

Characteristics of recruitment and retention of PLs

Expectations that PLs need to be individuals with very well-managed diabetes were moderated by observations that good PLs may be individuals with well but not perfectly controlled diabetes [23] or those with experience with diabetes such as through a spouse or friend [24–26]. Among the 74 trained, 60 peer leaders were individuals living with diabetes and 7 were recruited from residential committees. As the program progressed, CHC staff recruited replacements for those unsuited to being PLs. Additional volunteers also assisted informally through helping with community activities, etc. Thus, instead of a fixed cadre of trained PLs implementing specific protocols, the number and activities of PLs varied across the CHCs in response to varying needs and opportunities.

Program revision and quality improvement

Group activities came to focus on group goal-setting while encouraging individualized goals for those who choose them. To supplement those identified by CHC staff, research staff provided additional resources on self-management topics, including, for example, a diabetes patient magazine and two popular books on diabetes edited by one of the present authors, Professor Jia. Additionally, “Patient Insulin Stories” collected from program participants were used to encourage appropriate insulin therapy.

Characteristics of peer support activities implemented

As detailed in Table 1, informal activities led by PLs ranged from weekly to monthly across all CHCs. Interactions included face-to-face informal gathering, phone calls or WeChat, and WeChat groups to provide ongoing support. Additionally, some CHCs worked with CSMGs or Residential Committees to develop outdoor activities (e.g., field trips), and some encouraged PLs and participants to attend activities organized by Residential Committees such as exercise groups.

Ratings of implementation

The distribution of the General Implementation scores for the 9 CHCs bore out the observations that implementation varied across CHCs. With a possible range of 11–33, the 9 CHCs varied widely ranging from 15.25 to 31 with a mean of 21.28 (median = 20.25, standard deviation = 5.04), equivalent to a mean rating on each item of 1.93 on a scale ranging from 1 to 3.

With only 9 CHCs, principal components or similar approaches to relationships among the items were not possible. However, face validity and alpha reliabilities led to the two subscales indicated in Table 2, Peer Leader Activity (mean of items 1–3 = 1.80, standard deviation = 0.59, alpha reliability = 0.909) and CHC Engagement (mean of items 4–9 = 2.04, standard deviation = 0.51,

alpha reliability = 0.921). The two remaining items, “Utilization of Residential Committees ...” (Residential Committees), and “Enhance diabetes Peer Leader program by building on or linking with other initiatives ...” (Community Links) were surprisingly not highly correlated ($r = 0.500$) and so were retained as single items (means = 2.00, 1.67, standard deviations = 0.71, 0.71, respectively), resulting along with General Implementation in five indices of implementation.

Organizational challenges to implementation

As expected, varying ability to prioritize the program, limited staff time, and competing responsibilities were substantial challenges for the CHCs. In general, an important lesson learned is the varied types of organizational support these programs require. Key is (a) the need for clear responsibility for coordination of the PL program within the CHC; (b) understanding that the use of PLs may enhance professionals’ ability to help their patients but does not reduce the demands on their time; (c) help from other members of the staff to allow the health staff to focus more on designing activities, teaching, etc.; (d) assistance to help coordinate and organize activities; (e) performance appraisal; and (f) project staff authority over use of funds for the project.

Multiple management/operational models have emerged from the CHCs for implementing PS programs effectively. Those in which general practitioners were actively involved in nationally mandated public health services and the PL program appeared to be more effective in supporting the program.

Challenges for CHC staff included high existing workloads, lack of confidence in the PS model, difficulty recruiting PL candidates, and competing priorities within the CHCs. Initially, some viewed participation as “compulsory” requiring adherence to protocols without adaptation to local circumstances. In response, further discussions with CHCs emphasized a collaborative, problem solving relationship. Always intended, this clarification was helpful in securing greater cooperation from the CHCs.

DEVELOPMENT PHASE: IMPACTS AMONG PARTICIPANTS

Participant characteristics

With the objective of 140 per CHC, samples included 132 and 135 individuals in 2 CHCs and at least 140 and as many as 155 in the other 7 for a total of 1,284 adults with diabetes. As in baseline measures in Table 3, the sample included 43.1% males. The mean age of 68 reflects both the epidemiology of diabetes and the fact that, in the Chinese settings of CHCs, programs that entail attendance during the day will be most popular among retirees. Mean years with diabetes was 11.79% with 80.6% taking oral medications and 35.4% taking insulin.

Table 3 | Characteristics of Sample

Number of participants	1,284
Mean Age (95% CI)	68.00 (67.59–68.41)
% Male/% female	43.1%/56.9%
Mean years with diabetes (95% CI)	11.79 (11.38–12.20)
Mean BMI (kg/m ²) (95% CI)	25.08 (24.88–25.27)
<26 kg/m ²	64.9%
≥26 kg/m ²	35.1%
Mean HbA1c (95% CI)	7.52% (7.45%–7.60%)
Percentage with HbA1c < 7%	38.1%
7–7.49%	17.6%
7.5–7.99%	13.8%
8–8.99%	16.7%
≥9%	13.9%
Mean SBP (mmHg) (95% CI)	135.94 (135.04–136.84)
Mean DBP (mmHg) (95% CI)	78.41 (77.94–78.89)
TC (mmol/L) (95% CI)	4.95 (4.89–5.01)
TG (mmol/L) (95% CI)	1.72 (1.65–1.79)
HDLc (mmol/L) (95% CI)	1.41 (1.39–1.44)
LDLc (mmol/L) (95% CI)	2.99 (2.94–3.04)
% Taking Oral Rx	80.6%
% Taking Insulin	35.4%
Mean score for EQ5D quality of life (possible range = 1–3; 1 = good quality of life) (95% CI)	1.13 (1.12–1.14)
Mean diabetes distress (possible range = 1–6, 1 = little distress) (95% CI)	1.81 (1.75–1.86)
Mean PHQ depression (possible range = 0–27) (95% CI)	3.22 (2.99–3.46)
Minimal (score = 0–4)	74.2%
Mild (score = 5–9)	18.7%
Moderate (score = 10–14)	4.1%
Moderately severe (score = 15–19)	2.5%
Severe (score = 20–27)	0.5%

Metabolic control was generally good but 30.6% had initial HbA1c values over 8%. Participants reported generally good quality of life, little diabetes distress, and little depression with only 7.1% reporting scores on the PHQ indicative of moderate or clinically significant depression.

Impacts on participants

Table 4 includes key variables at baseline and month 12 for all participants and for those above cut-offs for scores of clinical concern. The primary endpoint was HbA1c which decreased from 7.52 to 7.43% ($p = .013$) across all participants and from 9.09% to 8.50% among those whose baseline values were ≥ 8% ($p < .001$).

In addition to HbA1c, all other variables showed significant improvement over this period with the exception of the EQ5D and PHQ, for which baseline levels indicated good quality of life and little depression. As detailed in the table, breaking out the sample according to cut-offs for clinical concern yielded significant improvements for all variables.

Exploratory, *post hoc* examination of implementation

With the observed appreciable variability in implementation, exploratory, *post hoc* analyses examined

relationships with outcomes both to guide further program development and future planned implementation analyses. Because of the *post hoc* nature of these analyses, they were confined to HbA1c, BMI, diabetes distress, and neighborhood support, sampling respectively from among metabolic control, adiposity, quality of life, and a potential social or community impact. Intraclass correlations of impact measures among the nine sites at baseline ranged from 0.0269 for HbA1c to 0.1737 for diabetes distress. Accordingly, for each implementation variable, we created an orthogonal vector with seven elements (9 *df* at site level, 1 for implementation indicator, 7 for orthogonal vectors) to control for clustering within sites and all other potential site-level confounders, such as CHC characteristics. Multiple linear regression analyses examining effects of the implementation variables on 12-month impact measures including the orthogonal vectors and controlling for baseline levels of impact measures as well as gender, age, education status, and years with diabetes. Table 5 presents the results of these analyses.

As can be seen, the general, 11-item measure of implementation was associated with improved HbA1c, including among those >8% at baseline, and with reduced diabetes distress, including those

Table 4 | Means (95% CI) of Key Variables at Baseline and 12-Month Evaluation for All Participants and Disaggregated for Those with Baseline Values Above Criteria for Clinical Concern

Measure	Baseline mean (95% CI)	12-Month mean (95% CI)	p-Level
HbA1c % (n = 1104)	7.52 (7.44–7.59)	7.43 (7.35–7.51)	.013
Baseline ≥ 8% (n = 332)	9.09 (8.98–9.20)	8.50 (8.33–8.67)	<.001
BMI (kg/m ²) (n = 1,106)	25.12 (24.92–25.32)	24.91 (24.72–25.10)	.001
Baseline ≥ 26 kg/m ² (n = 395)	28.69 (28.44–28.94)	27.86 (27.58–28.14)	<.001
SBP (n = 1103)	135.98 (135.05–136.92)	133.77 (132.94–134.60)	<.001
Baseline ≥ 130 mmHg (n = 764)	142.96 (141.99–143.92)	135.83 (134.83–136.84)	<.001
DBP (n = 1103)	78.53(78.03–79.03)	77.17(76.69–77.65)	<.001
Baseline ≥ 80 mmHg (n = 572)	84.64(84.14–85.13)	79.23(78.52–79.93)	<.001
TC (n = 1102)	4.94(4.87–5.00)	4.80(4.74–4.86)	<.001
Baseline ≥ 4.5 mmol/L (n = 728)	5.50(5.44–5.56)	5.15(5.08–5.22)	<.001
TG (n = 1,104)	1.71(1.64–1.79)	1.72(1.64–1.80)	.859
Baseline ≥ 1.7 mmol/L (n = 397)	2.79(2.63–2.95)	2.47(2.31–2.63)	<.001
HDLc (n = 1105)	1.42(1.39–1.44)	1.36(1.34–1.39)	<.001
Baseline ≤ 1.0 for males, ≤ 1.3 for females (n = 311)	1.07(1.05–1.08)	1.12(1.10–1.15)	<.001
Mean LDLc (n = 1,103)	2.99(2.94–3.04)	2.89(2.84–2.95)	<.001
Baseline ≥ 2.6 mmol/L (n = 725)	3.48(3.43–3.52)	3.19(3.13–3.25)	<.001
Diabetes distress (n = 1,013)	1.80 (1.75–1.86)	1.74 (1.69–1.79)	.041
Baseline mean ≥ 2.0 (n = 390)	2.79 (2.71–2.87)	2.03 (1.94–2.13)	<.001
EQ5D (n = 1017)	1.13 (1.12–1.14)	1.14 (1.12–1.15)	.517
Baseline mean ≥ 1.2 (n = 424)	1.31 (1.30–1.33)	1.18 (1.16–1.21)	<.001
PHQ-8 (n = 1,016)	3.17 (2.93–3.42)	3.07 (2.84–3.30)	.443
Baseline total ≥ 10 (≥ moderate, n = 69)	14.13 (13.24–15.02)	6.33 (5.16–7.51)	<.001

Notes: Paired-*t* test used for continuous variables.

in the top tertile at baseline. Engagement of the CHCs was significantly associated with reductions in HbA1c, BMI, and diabetes distress.

PL Activity was associated with decreased distress and increased neighborhood support. Increases in neighborhood support from baseline were also associated with decreased distress (partial correlation = -0.170 , $p < .001$). PL Activity, however, was not associated with HbA1c, due perhaps to the fact that research staff who rated implementation interacted mostly with CHC staff and had little direct contact with PLs, possibly compromising the validity of the PL Activity ratings.

Community linkages was associated with improved HbA1c. Residential Committees was also associated with improved HbA1c and also decreased distress but with *decreased* neighborhood support.

Table 5 also includes corresponding analyses for those with scores at baseline above criteria for risk or concern, HbA1c > 8%, BMI > 26, and the top tertile of diabetes distress. As can be seen, the relationships for these analyses were generally similar to those for the whole sample.

Five conclusions emerged from the Development Phase:

- A program featuring PS is feasible in the “real world” settings of Shanghai’s CHCs

- The PS program is associated with improved clinical status and reduced diabetes distress, especially among those with initially elevated levels
- Benefits of the PS program are associated with the extent to which it is implemented
- From exploratory evaluations of implementation, different features of the program may have specific effects on different outcomes
- The significant associations of Community Links and Residential Committees with improved HbA1c point to the importance of community organizations and linkages.

COMMUNITY EXPANSION PHASE: FROM CLINIC TO COMMUNITY

Given uneven implementation across CHCs in the Development Phase, the Community Expansion Phase, currently being implemented, has extended responsibility for program coordination and management to communities’ sub-district health staff as well as the district-level health staff responsible for the districts in which the communities are located. As portrayed in Fig. 1, each community’s CHC is engaged in the program but is not responsible for program management. Consistent with this placement of responsibility in the community and also reflecting Developmental Phase findings on the contributions of CSMGs and Residential Committees, the Community Expansion Phase increases

Table 5 | Results of Multiple Regression Analyses Examining Associations of Implementation Indices with Selected Impacts Including Orthogonal Vectors to Control for Clustering Within Sites and Controlling for Gender, Age, Education, and Years with Diabetes as well as Corresponding Baseline Values of Impact Measures

	HbA1c All				BMI All			
	<i>B</i>	<i>B</i> SE	<i>t</i>	<i>p</i>	<i>B</i>	<i>B</i> SE	<i>t</i>	<i>p</i>
General implementation	-0.0151	0.0033	-4.62	<.0001	-0.0104	0.0058	-1.81	.071
PL activity	0.0583	0.0482	1.21	.2267	-0.0975	0.0849	-1.15	.2509
CHC Eng'mt	-0.3257	0.0659	-4.94	<.0001	-0.2978	0.1167	-2.55	.0109
Residential Comm's	-0.2545	0.0529	-4.81	<.0001	0.0395	0.0935	0.42	.6726
Community link	-0.2982	0.0472	-6.31	<.0001	0.1523	0.0832	1.83	.0676
	HbA1c > 8%, <i>n</i> = 350				BMI > 26, <i>n</i> = 432			
General implementation	-0.0231	0.0078	-2.98	.0032	-0.0106	0.0119	-0.89	.372
PL activity	0.0042	0.1164	0.04	.9714	-0.1779	0.1768	-1.01	.3149
CHC Eng'mt	-0.3932	0.1523	-2.58	.0103	-0.2746	0.2394	-1.15	.2522
Residential Comm's	-0.4412	0.1408	-3.13	.0019	-0.2612	0.1830	-1.43	.1543
Community link	-0.5399	0.1186	-4.55	<.0001	0.1864	0.1548	1.2	.2293
	4-Item diabetes distress—all				Neighborhood support—all			
General implementation	-0.0161	0.0023	-6.88	<.0001	0.0055	0.0026	2.12	.0341
PL activity	-0.1521	0.0344	-4.42	<.0001	0.1874	0.0383	4.89	<.0001
CHC Eng'mt	-0.3745	0.0494	-7.58	<.0001	0.0865	0.0520	1.66	.0966
Residential Comm's	-0.0792	0.0379	-2.09	.037	-0.1275	0.0424	-3.01	.0027
Community link	-0.0170	0.0494	-0.34	.7305	-0.0648	0.0369	-1.76	.0792
	4-Item diabetes distress—top tertile, <i>n</i> = 319							
General implementation	-0.0274	0.0059	-4.65	<.0001				
PL activity	-0.0508	0.0930	-0.55	.5856				
CHC Eng'mt	-0.6147	0.1101	-5.59	<.0001				
Residential Comm's	-0.2571	0.0859	-2.99	.003				
Community Link	-0.0767	0.0803	-0.95	.3406				

Results include analyses for all participants (*n* = 1,284) as well as for those above criteria for risk or clinical concern as indicated in the table.

emphasis on involving both CSMGs and Residential Committees to add their capacity to deliver PS for community members. This is also consistent with national and Shanghai policy encouraging health promotion through all sectors of society.

The traditional role of Residential Committees is to be familiar with their neighborhoods, promote available community resources, and assist residents such as through help in finding jobs. Some Residential Committee members also serve as CSMG leaders. The expanded program builds on the traditional role of Residential Committees and extends their capacity to connect high-risk residents (a) to clinical and health screening services in CHCs, and (b) to community activities, such as those organized by CHCs and CSMGs for diabetes education and self management support.

The Community Expansion Phase is conducted in close collaboration with the Department of Health Promotion in the Shanghai Municipal Health Commission. Indeed, it is now part of the Department's development of chronic disease prevention and management programs so that those who would ultimately make decisions about broad adoption are part of the collaborating team. Table 6 presents the roles and responsibilities of key staff and groups in the Community Expansion Phase.

Key curricula elements

To focus the project and in recognition of the multiple, sometimes confusing messages often disseminated about diabetes, the Community Expansion Phase now includes a newly developed curriculum element, "5 Key Messages" that *everyone* should know about diabetes: (a) Healthy Lifestyle, (b) Cooperate with Diagnosis and Treatment, (c) Proactive Management, (d) Peace of Mind, and (e) Seek Support. Through a video, print versions, and emphases in all program activities, the 5 Key Messages are intended to provide individuals with diabetes a sense of coherence in their management and, reflecting a broad, community emphasis, to provide their friends, families, PLs and clinicians key issues on which to focus support.

With the S6PH, the Department of Health Promotion also developed six Diabetes Modules that cover Diabetes prevention, Healthy lifestyle and exercises, Healthy diet, Oral medication and insulin, Blood glucose monitoring, and Prevention and management of complications. CHC staff are responsible for presenting the modules and PLs assist recruiting participants and facilitating discussion.

Additionally, a series of 1–2 page tools address specific topics in diabetes management such as

Table 6 | Responsibilities of Key Staff and Groups in Community Expansion Phase of Peer Support in the Shanghai Integration Model

1. District health staff:	
(a)	Direct overall planning of programs and activities within communities in their districts, in conjunction with those in the communities
(b)	Provide policy support to the district government, regarding budget and staff resources support
(c)	Provide regular trainings to key staff based on training provided by project staff and S6PH regarding project plans and key skills/points for PLs
(d)	Supervise implementation progress
(e)	Coordinate cross-sector collaboration, including CHCs and sub-district health promotion offices
(f)	Integrate resources
(g)	Organize network meetings and experience sharing within the district
2. Sub-district health promotion staff (numbers involved range from 3 to 10 across sub-districts):	
(a)	Help design implementation plans
(b)	Provide policy support regarding human resources, budget and activities
(c)	Coordinate Residential Committees and CSMGs to organize and implement group activities
(d)	Actively invite residents in the communities to attend activities
(e)	Facilitate experience sharing and further dissemination in the communities
(f)	Facilitate completion of recruitment and health examinations in CHCs
3. Community Health Centers (numbers involved range from 7 to 24 staff across sub-districts):	
(a)	Help design the implementation plans of diabetes prevention and control for their community
(b)	Provide professional support for community activities, including teaching in health classes and lectures
(c)	Administer surveys and health examinations
(d)	Promote dissemination of the 5 Key Messages
(e)	Provide health consulting
4. Residential committee:	
(a)	Provide places for activities and logistic support
(b)	Communicate with Residential Committee director to gain support
(c)	Support PLs' work
(d)	Organize group activities and disseminate to the whole community
(e)	Mobilize the community

adaptations of traditional holiday recipes. These tools may (a) stand alone as informational hand-outs, (b) serve as the basis for a group meeting on a topic, or (c) provide PLs structure in counseling individuals. Additionally, stories that portray individuals coping with typical challenges [27] have been developed.

In addition to these curricula elements, a program training and core manual provide instruction on PS principles, keys to success, providing effective support individually and in group activities, engaging family members, building mutual trust, effective communication, supporting insulin management, privacy and confidentiality, “red flags,” back-up and support for PLs, materials and suggestions for organizing group activities, setting a diabetes action plan, and program examples from the 9 CHCs in the Development Phase.

Graded levels of curriculum

To facilitate participation by as many groups as possible, the curriculum is organized around three program levels with the first and second focused on activities that all settings can implement. Level 1 includes distribution of the 5 Key Messages and other basic diabetes messages and activities, and

cooperation with CHCs in arranging presentation of the 6 Diabetes Modules. Thus all CSMGs might connect to the program through distribution of basic materials making the diabetes messages more universal and enhancing a broad sense of support for those with diabetes.

Level 2 includes neighborhood groups and activities led by PLs and intended to provide individuals with diabetes a sense of community and to facilitate healthy lifestyles. Level 3 includes training of selected CSMG members and other PLs to provide individual PS to families and patients who are having problems with their diabetes, including diabetes distress or other emotional problems.

Design and evaluation

In addition to documentation of implementation against performance objectives and structured interviews evaluating program features and factors related to adoption/disseminability [28, 29], evaluation samples of 120 people with diabetes in each CHC will include clinical, behavioral, and quality-of-life measures. These will be compared to samples from four CHCs in communities from the same six districts but not participating in the program.

COMMUNITY EXPANSION PHASE: PROGRESS TO DATE

Table 7 provides examples of a number of PL and related community activities organized according to the three Levels of the program. In particular, improving health literacy and basic knowledge about diabetes among all community residents is a priority for several reasons, including the contributions of misunderstanding to stigma and reduced availability and quality of social support. The 5 Key Messages for all citizens as well as the 6 Diabetes Modules have important roles in this, along with public group activities that increase a sense of community among those with diabetes.

Progress to date and lessons learned include:

- Seventy-seven PLs recruited from CSMGs and patients with diabetes who were encouraged by CHC health staff. Twenty-four PLs, 36 staff completed training in October, 2018; 24 PLs and 42 staff in February 2019, and 36 PLs and 30 staff in June 2019
- Each of the 12 expansion phase communities has developed plans for and executed activities
- Six diabetes modules have been offered a total of 90 times, at least twice in each community, ranging from 4 times in the smallest district to 25.
- Meetings with district and sub-district staff have encouraged them to take greater roles in program leadership rather than relying on CHCs to direct program development
- Buy-in and active support from the district director is crucial amidst competing priorities, limited resources and other challenges.

Video and print media presenting the 5 Key Messages were introduced in August 2019 via CHCs,

CSMGs, and other community groups, activities, and events including those not limited to a focus on diabetes. They have been further distributed through leaflets/brochures, social media (WeChat), group activities, health institutions and other programs. Several district health staff have reported to project staff that they found the 5 Key Messages useful in other chronic disease management projects and that patients found them interesting and easy to understand.

District and sub-district staff have shown capability and creativity in designing and coordinating activities such as through collaborating with a local sport health bureau to teach taichi and healthy exercises, additional trainings to enhance the teaching skills of CHC staff, or adopting a point incentive system one district developed.

Advantages of the broadened base and three-level model

In the Development Phase, CHC programs were offered only during working hours. Expanding the contributing organizations and inclusion of Level 1 activities has opened program implementation to those who may not be interested in extensive engagement in diabetes programs, individuals with prediabetes, those employed full-time, as well as family members or neighborhood residents.

Collaboration for a culture of mutuality

Mutually beneficial exchange is a key part of the expanded program. For example, CSMGs co-operate with CHCs, notably by inviting CHC doctors to lead community classes. CHC health staff also benefit from Residential Committees' support to engage more participants for health screenings,

Table 7 | Template of Key Organization Roles in Cross-Sector Collaboration for Peer Support

General Organizational Resource or Component Necessary for Program Success	Sector(s)	How met in Shanghai
Clinical-Professional Leadership and Credibility	Health Academic	Shanghai Jiao Tong University Affiliated Sixth People's Hospital (S6PH) Jiao Tong University
Major Host or Convening Organization with Broad Resources and Reach in Community and Capacity to Bring Other Organizations Together	Government Health	Health Promotion Department of Shanghai Municipal Health Commission
Training	Government Health	S6PH Health Promotion Department of Shanghai Municipal Health Commission
Program Monitoring, Quality Improvement, Technical Assistance	Government Health	S6PH Health Promotion Department of Shanghai Municipal Health Commission
Local, Neighborhood Direction and Management	Government Health Community	District and Sub-District Health Offices
Local Organizations with Interests Pertinent to Health as Source for Volunteers and Base of Existing Activities	Community Government	Community Self Management Groups Residential Committees
Local Clinical Services	Health	Community Health Centers
Develop and Produce Training Materials, Materials for Participants, Materials to Promote Program, etc.	Government Health	S6PH Health Promotion Department of Shanghai Municipal Health Commission

Fig 1 | General model of cross-sector collaboration and Peer support in expansion phase in 12 communities.

etc. Some district health commissions collaborate with some social health promotion organizations for health promotion.

Together, collaboration among health, government, academic, and community sectors may provide a base for PS activities and key messages across the community to help make support a shared value. Recall that in the 9 CHCs from the Development Phase, ratings of Peer Leader Activity were associated with increases in participants' ratings of the extent of neighborhood support for diabetes management.

CONCLUSION, SCALING UP, STANDARDIZATION, AND ADAPTABILITY

Perhaps the greatest accomplishment of the projects described here is the adoption of the program by the Shanghai Municipal Health Commission. In its 2030 health plan, it has identified self management of chronic diseases as a key priority. Additionally, encouraged by evidence from the present PS program, it has further identified PS as an important strategy for self management.

Scaling up to all 240 communities in Shanghai and eventually to other cities in China raises substantial challenges for standardization. In contrast, standardization is necessary in order to ensure that programs are implemented in the manner intended. In contrast, a program such as this is highly reliant on the initiative of those implementing it. Constraining them with excessive details of program requirements is liable to discourage their engagement and/or encourage perfunctory implementation. Furthermore, variability across communities, even in a single city such as Shanghai, demands that programs be adaptable to their settings and populations. In addressing this challenge it may be helpful to articulate key functions of programs, leaving the specific ways in which those functions are met to local direction, as has been found valuable with *Peers for Progress* in promoting PS [2, 3], and previously the Robert Wood Johnson *Diabetes Initiative* promoting

diabetes self management in diverse primary care and community settings [30]. Table 7 includes a preliminary outline of key functions to be met in developing and implementing programs such as those described here. How they are met may vary as they are adapted to other settings, but the structure of the functions provides a base for standardization.

LIMITATIONS

The limitations of this project and report are generally related to it not being a tightly controlled study but, rather, one in which considerable variability in implementation of a common approach to PS was accommodated. The Developmental Phase lacked controls, although the relationships with implementation indicators generally provided a sort of dose-response relationships between level of implementation and impacts. The variability across settings in program implementation points to the need for further research to examine site characteristics that may influence implementation as well as measures of fidelity that are sufficiently flexible to accommodate inevitable variability across settings and/or populations in broad dissemination [31]. A more general limitation lies in the fact that the CHCs and communities chosen to participate were chosen based on project staff's assessment of their being good candidates for this developmental work. This limits the ability to assume generality of these results to other settings.

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Compliance with Ethical Standards

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