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Effects of the First Line Diabetes Care (FiLDCare) self-management education and support project on knowledge, attitudes, perceptions, self-management practices and glycaemic control: a quasi-experimental study conducted in the Northern Philippines

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ABSTRACT

Objectives: To investigate the effects of implementing a context-adapted diabetes self-management education and support (DSME/S) project based on chronic care models in the Philippines, on knowledge, attitudes, self-management practices, adiposity/obesity and glycaemia of people with diabetes.

Design: Prospective quasi-experimental before–after study.

Participants: 203 people with type 2 diabetes mellitus from two local government units in the Northern Philippines fulfilling set criteria.

Outcome measures: Context-adapted DSME/S was given to a cohort of people with diabetes by trained pre-existing local government healthcare personnel. Changes in knowledge, attitudes and self-management practices, body mass index, waist circumference, waist-hip ratio (WHR) and glycosylated haemoglobin (HbA1c) were measured 1 year after full project implementation. Non-parametric and parametric descriptive and inferential statistics including logistic regression analysis were done.

Results: Complete data were collected from 164 participants. Improvements in glycaemia, waist circumference, WHR, knowledge, some attitudes, adherence to medications and exercise, and an increase in fear of diabetes were significant. Reductions in HbA1c, regardless of level of control, were noted in 60.4%. Significant increase in knowledge (p<0.001), positive attitude (p=0.013), perceived ability to control blood glucose (p=0.004) and adherence to medications (p=0.001) were noted among those whose glycaemia improved. Significant differences between the subgroups whose HbA1c improved and those whose HbA1c deteriorated include male gender (p=0.042), shorter duration of diabetes (p=0.001) and increased perceived ability to control blood glucose (p=0.042). Significant correlates to improved glycaemia were male gender (OR=2.655; p=0.034), duration of diabetes >10 years

Strengths and limitations of this study

- This study is one of the few conducted regarding:
- Integrating chronic care with current healthcare activities making use of pre-existing healthcare staff to introduce/improve care for chronic conditions in public first-line health care services of a low-to-middle-income country such as the Philippines; and
- Analysing changes in knowledge, attitudes, perceptions and self-management practices and demonstrating correlations with improving glycaemia.
- Logistic regression analysis identifies significant correlates towards improving glycaemia.
- Comparative analysis of those with improvements in glycaemia against those with deteriorations identifies factors that may have contributed towards blood glucose lowering.
- The absence of a control group limits the strength of this study in attributing the identified significant outcomes solely to the intervention.

(OR=0.214; p=0.003) and fear of diabetes (OR=0.490; p=0.048).

Conclusions: Context-adapted DSME/S introduced in resource-constrained settings and making use of established human resources for health may improve knowledge, attitudes, self-management practices and glycaemia of recipients. Further investigations on addressing fear of diabetes and tailoring DSME/S to females with diabetes and those who have had diabetes for a longer period of time may help improve glycaemia.

INTRODUCTION

It has been shown that early interventions prevent or delay the onset of diabetes

complications and good control of the condition is a key.[1–3] Interventions may involve assuring adequate access to diabetes care, medications, laboratory examinations and the support needed to ensure delivery of health services. Aside from these, a vital role has to be played by the person with diabetes as the condition affects and is affected by daily activities throughout life. People with diabetes must be equipped and supported to manage their condition. The need for self-management education and training for chronic conditions in general and diabetes in particular has long been recognised as an integral part of good quality healthcare,[4 5] and diabetes self-management education and support (DSME/S) is already deemed a right for all concerned.[6] Since more than two decades ago, self-management education has slowly been incorporated into the standards of chronic disease care in high-income countries.[7 8]

The concepts of self-care in general and diabetes self-management in particular are not yet fully embraced in low-to-middle-income countries (LMIC). However, these LMIC also need to utilise all possible opportunities to prevent and control diabetes: DSME/S can be a cost-effective measure that may help control diabetes and prevent its complications in these countries where 70% of the total global current cases of diabetes occur[9] and where it affects men and women at younger ages.[10] The need for such a shift is also a relevant issue in the Philippines, where the leading causes of mortality for the past 10 years have been chronic conditions,[11] but where public health is still generally oriented to acute and infectious diseases.

Previous studies in high-income countries have demonstrated that self-management education programmes designed to increase knowledge and bring about behaviour change are successful in improving glycaemia.[12 13] A number of these studies have explored factors that may be associated with glycaemic control, which may be an effect of the programme (such as increased diabetes knowledge) or not (such as level of education, gender and duration of diabetes), but there is a dearth of publications demonstrating any relationships between changes in glycaemia and specific attitudes and perceptions related to diabetes, especially in LMIC.

Although a number of aspects in the provision of DSME/S require expertise, skills and specialised personnel that LMIC may not have the capacity to supply, there are certain DSME/S activities that can be translated to low resource settings. We hypothesised that integrating certain DSME/S activities in first-line health systems of LMIC can improve knowledge and attitudes of people with diabetes, which may stimulate better self-management practices and improve glycaemia as measured by a decrease in glycosylated haemoglobin (HbA1c).

In the Philippines, we implemented the context-adapted chronic care model-based First Line Diabetes Care (FiLDCare) Project where we organised primary care for diabetes in two local government units. The project focused mainly on primary healthcare providers and people with a chronic condition, concentrating on decision support to the healthcare workers, minor reorganisation of the health service, delivery system redesign and self-care development through DSME/S. The possible effects of the FiLDCare Project DSME/S on the knowledge, attitudes, perceptions, self-management practices, obesity/adiposity and glycaemic control of people with diabetes are explored in this paper.

BACKGROUND
The Philippine public primary healthcare system
Public healthcare in the Philippines was devolved in 1992. The responsibility of providing basic healthcare services for the people was handed down to local government units, specifically municipalities and cities.[14] A decade before healthcare devolution, the country implemented a primary healthcare policy which created a large cadre of community-based health workers locally called barangay (village) health workers (BHW).[15] Organisationally, the BHW fall under the governance of the barangay and are selected to work in their respective areas of residence; functionally, they are under the local government health unit (LGHU). A BHW is assigned approximately 10–20 families, is responsible for dissemination of health information and health promotion activities and conducts other health-related undertakings for any member of the families being attended to. At present, a typical LGHU would be composed of one or more municipal or city health centres and a number of barangay health stations, and would have at least one municipal/city health officer, at least one nurse, several midwives and the BHW.

Routinely, chronic condition-related activities in the LGHU are limited to informative posters on stroke, high blood pressure, diabetes, chronic lung diseases, smoking cessation and the benefits of exercise and a healthy diet. There are also 1-day annual campaigns on specific conditions, healthy lifestyle, tobacco control, etc, as programmed by the Department of Health.[16] Organised care aiming at self-management education and support for chronic conditions is non-existent in most LGHUs. Before the presently reported FiLDCare Project, this was also the case at the study sites.

Diabetes in the Philippines
The Philippines is predicted to be among the 10 countries worldwide with the highest numbers of people with type 2 diabetes mellitus (type 2 DM) by 2030.[17] Based on regular epidemiological surveys conducted by the Philippine Food and Nutrition Research Institute, the prevalence of 'new' type 2 DM as tested by a single fasting blood glucose of ≥7 mmol/L increased from 3.4% in 2003 to 4.8% in 2008, together with an increase in the prevalence of known diabetes from 2.6% to 4%.[18 19] A rise in diabetes complications has also been noted. For renal complications alone, it is seen that 55%

of people with diabetes in the Philippines will eventually develop kidney disease; in 2007, there was an increase of more than 2800 patients with diabetic nephropathy requiring dialysis.[20] The rapidly increasing prevalence of type 2 DM, and the poor control of disease progression and emergence of complications only show that current case management of diabetes mellitus in the Philippines is below optimum.

We previously conducted a cross-sectional Knowledge, Attitudes and Practices (KAP) study on 549 people with diabetes from three different urban and rural sites in the Philippines, exploring and documenting the associations of diabetes knowledge and some attitudes and perceptions with perceived self-efficacy and the self-management practices of adherence to medications, diet and exercise and proper utilisation of healthcare services.[21] A study on the knowledge, attitudes and practices of people with diabetes in a single rural site, which concentrated on characterising the respondents' diabetes knowledge, beliefs in patient autonomy, self-monitoring of blood sugar and frequency of clinical consultations, was published a few years earlier.[22] We were not able to find any publications regarding longitudinal KAP studies conducted on people with diabetes in the Philippines.

METHODOLOGY

This was a prospective quasi-experimental before-after multicentre study involving two purposively selected LGHUs and a cohort of people with diabetes, conducted from May 2011 to February 2013. The intervention was a context-adapted chronic disease care model-based DSME/S. The outcomes of interest were changes in diabetes knowledge, attitudes, perceptions, practices, body mass index (BMI), waist circumference, waist-hip ratio (WHR) and HbA1c levels of the project participants.

Selected LGHU staff including BHW participated in a 32 h training workshop on primary diabetes care and DSME/S, results of which will be discussed elsewhere.

The study sites

Batac (population=53 542 as of 2010[23]) is a non-highly urbanised component city in the island of Luzon composed of 43 barangays with two government health centres and their barangay health stations. Other healthcare services include a tertiary-level Department of Health-operated hospital, a primary-level private hospital, a number of private multispecialty clinics and clinical laboratories and several private drugstores/pharmacies.

Pagudpud (population=21 877 as of 2010[23]), the northernmost settlement in Luzon, is a rural municipality classified to be very low in economic development. Composed of 16 barangays, it only has a basic government health centre and barangay health stations for healthcare. There are no laboratory facilities, nor any private clinics or drugstores/pharmacies.

As in many LMIC, most healthcare expenditures are out-of-pocket.

Inclusion/exclusion criteria

The LGHU staff members were requested to enrol people with diabetes from their localities to the FiLDCare Project. Criteria for inclusion in the FiLDCare Project were: diagnosis of type 2 diabetes, age ≥20 years and willingness to participate in the project. The trained healthcare workers provided primary diabetes care and DSME/S to the project participants.

Data gathered from the project participants were further screened for inclusion in statistical analysis. Inclusion criteria for analysis were: completeness of interview data, preimplementation and postimplementation HbA1c values and preimplementation and postimplementation anthropometric measurements. Exclusion criteria were: pregnancy and a positive medical history of anaemia (sickle cell, iron deficiency), and end-stage renal disease.

Interview of project participants (diabetes knowledge, attitudes, perceptions and practices)

The principal investigator and/or trained field researchers, one of whom was the FiLDCare Project nurse, provided full project information and obtained written informed consent from each of the participants. The researchers conducted one-on-one interviews using a structured questionnaire inquiring on knowledge, attitudes, perceptions and practices and took measurements for the BMI, waist circumference and WHR. They likewise tested for HbA1c making use of *A1CNow* (Bayer HealthCare, Makati City, Philippines), a point-of-care test that conforms to the National Glycohemoglobin Standardization Program protocol. Interviews and measurements were carried out prior to and 1 year after the start of project implementation. Knowledge was tested making use of a 20-question diabetes knowledge test based on the Fitzgerald *et al*[24] Diabetes Knowledge Test and the Garcia *et al*[25] Diabetes Knowledge Questionnaire. Questions on attitudes and perceptions were adapted from the survey questionnaires of the University of Michigan Diabetes Research and Training Center.[26 27] The attitude and perception questions were formulated as statements and made use of a Likert scale for answers, with 1 ('never') as the lowest and 5 ('always') as the highest rating. Negative and positive attitudes were measured separately. A straight statement on fear "I am afraid of my diabetes" was used to assess fear of diabetes. Perceived support needs and support received were directed towards support a person with diabetes needs and receives from family and friends. Questions on perceived support attitudes probed the perceptions of how a person with diabetes is being treated, accepted and supported by family and friends. The internal reliability consistency of these sets of questions was previously tested in our cross-sectional KAP study, with Cronbach's α of 0.72–0.94.[21] Questions on medication adherence inquired on medications prescribed by healthcare providers and if the respondents were taking the right medications at the right dosages at the right time; these were transposed to 'no' or 'yes'

answers and summarised as 'no' if any of the questions were answered with 'no' and 'yes' if all the questions were answered with 'yes'. The question on diet adherence was answerable by 'no', 'sometimes' or 'yes/always'; these answers were transformed to 'not/sometimes adherent' and 'yes/fully adherent'. For exercise, questions were asked on the type of exercise done, frequency and duration; the answers were then transformed to 'no' or 'yes' based on the criteria of doing 150 min of moderate-intensity aerobic physical activity or at least 75 min of vigorous-intensity aerobic physical activity throughout the week.[28] Medical records were reviewed for any comorbid illnesses.

FiLDCare Project DSME/S strategy

One-on-one diabetes self-management education (DSME) was initiated either by the city/municipal health officer or the LGHU nurse, assisted by the principal investigator and/or the FiLDCare Project nurse during consultations at the government health unit. Consultations and the concomitant DSME sessions were done at least once every 3 months. The DSME sessions focused on: information on diabetes and diabetes medications, adoption of self-care behaviour, gaining control over the condition through problem solving skills and goal setting. DSME was conducted in a conversational and interactive manner, embedded in the clinical consultation. Duration of the initial DSME session ranged from 20 to 30 min and the succeeding sessions from 5 to 15 min. Written materials on healthy eating, exercise and glycaemic goals were given out during the sessions. Community-based diabetes self-management support (DSMS) was continued by the BHW and the midwives. DSMS concentrated more on behavioural support with reinforcement of self-management (taking medications, diet, exercise and foot care) and problem solving. DSMS was provided informally through home visits where the BHW would drop by the house of the person with diabetes and introduce pieces of information on diabetes and diabetes care in the conversation. Also, DSMS sessions were conducted in the barangay health stations where the BHW and midwives would be found on specific days two to four times a month and where people with diabetes could go if and when they had any questions or would want to talk to these healthcare workers. DSMS was provided at least once a month. The frequency and duration of DSME/S depended primarily on the demand of the person with diabetes. The DSME/S approach was collaborative and interactive rather than rigidly structured. After the opening DSME where the different aspects for self-management were discussed, the opinion and choices of the person with diabetes on the topics to be tackled in succeeding DSME/S sessions were considered. Active listening skills (introduced in the initial training workshop) were employed.

Statistics

Statistical analyses were performed making use of the statistical package Stata/IC V.11.0.[29] A Wilcoxon signed-rank test was used to compare the preimplementation and postimplementation median values of the outcomes. Test of proportions was used to compare the preimplementation and postimplementation proportions of people adherent to medications, diet and exercise and people with good glycaemic control.

Comparisons of collected demographic data and the changes in measured end points were done using the stratifications 'decreased/unchanged HbA1c' and 'increased HbA1c'; 'in good glycemic control' and 'not in good glycemic control' on both preimplementation and postimplementation determinations; and 'in good glycemic control' on the preimplementation and 'in good glycemic control' on the postimplementation determination. A Mann-Whitney U test was used for the collected demographic data and two independent samples t test was used for the computed changes in the measured outcomes.

Logistic regression analysis was performed using 'decreased/unchanged HbA1c' against 'increased HbA1c' to determine significant correlates in improving glycaemic control. Independent variables were transformed into categorical variables. Bivariate logistic regression was initially performed. An α of 0.1 was used as the cut-off to consider for multivariate logistic regression. Multivariate logistic regression of independent variables with α of 0.05 or less was performed and variables with an α>0.05 were removed in a stepwise fashion. The remaining variables having an α of ≤0.05 were considered statistically significant correlates.

Definitions

Good control of diabetes was defined as having HbA1c ≤7% (≤53 mmol/mol).[30] This cut-off was considered as the optimal level in preimplementation and postimplementation determinations.

For the classification of changes in HbA1c preimplementation and postimplementation, it should be noted that, without any interventions, the natural history of diabetes is deterioration of glycaemic control through time.[31] Unchanged HbA1c levels may thus be viewed as a favourable result. Following this logic, unchanged HbA1c levels were grouped with decreased HbA1c levels against those with increased HbA1c levels.

Postimplementation changes in ratings were determined by subtracting preimplementation ratings from the postimplementation values. No and negative changes were grouped together against positive changes to create categorical variables. Increase was defined as a positive change.

Changes in adherence were classified as 'did not deteriorate/improved' and 'deteriorated/did not improve'. The classification 'did not deteriorate/improved' includes those who reported to be adherent in preimplementation and postimplementation interviews or who reported to be not adherent in the preimplementation interview but became adherent postimplementation. Those who reported to be not adherent in the postimplementation interview were classified 'deteriorated/did not improve'

regardless of adherence reported in the preimplementation interview.

Duration of diabetes was categorised as ≤2, >2–10 and >10 years; education was categorised based on the number of years in school, namely 0–6, 7–10 and >10 years.

RESULTS

A total of 203 people with diabetes were enrolled in the FiLDCare Project; 134 in Batac City and 69 in Pagudpud. Statistical analysis was conducted on data collected from 164 (80.8%) participants, 108 in Batac City and 56 in Pagudpud. Of the 39 participants whose data were not included in the statistical analysis, 5 refused any A1C testing from the outset, 4 died, 8 migrated, 2 refused the postimplementation interview and 20 refused any further A1C testing. None were found to have any of the exclusion criteria for statistical analysis stated. Demographic data of the project participants are listed in table 1.

Baseline results

In the preimplementation phase, 68 (41.5%) of the study participants had good glycaemic control. Statistical analyses of the baseline data did not identify any significant differences between those in 'good glycemic control' and those 'not in good glycemic control' in any of the variables measured during the preimplementation interview.

Postimplementation results

Postimplementation data showed an increase in the number of study participants with good glycaemic control (n=83, 50.6%). However, aside from age (median age, in good control=59, not in good control=55;

Table 1 Demographics of people enrolled in the First Line Diabetes Care (FiLDCare) Project

	Male N=42 (25.6%)	Female N=122 (74.4%)
Age		
Average	57.9	56.5
Median	58.5	57
Range	36–83	27–80
Number of years with diabetes		
Summary statistics		
Average	5	4.7
Median	2.5	2
Range	0.5–28	0.5–22
Distribution (years)		
0.5–2	85 (51.8%)	
>2–10	53 (32.3%)	
>10	26 (15.9%)	
Level of education (number of years in school)		
0–6	43 (26.2%)	
7–10	63 (38.4%)	
>10	58 (35.4%)	

p=0.010), no other significant differences in the end points measured postimplementation were noted among those with 'good glycemic control' against those 'not in good glycemic control'.

Changes in measured end points

A year after full implementation, analysis of the median values showed significant decrease in the HbA1c (p<0.001), waist circumference (p=0.007), WHR (p<0.001) and the 'perceived support received from family and friends' (p<0.001). Significant increases were noted in the correct answers to the knowledge test (p<0.001), the 'perceived ability to control blood glucose' (p=0.036), the 'perceived ability to adhere to diet and exercise' (p=0.022) and the 'fear of diabetes' (p<0.001). Analysis of proportions showed significant increase in people adherent to medications (p=0.001) and adherent to exercise (p<0.001), but a significant decrease in those adherent to diet (p<0.001; table 2).

There was a significant increase (p<0.001) in the proportion of project participants with optimal glycaemic control from 41.5% to 50.6%. Regardless of level of control, HbA1c decreased in 60.4% of the participants (99/164), remained the same in 7.9% (13/164) and increased in 31.7% (52/164). Among those with reduced HbA1c, the average reduction was −1.44 HbA1c percentage points (−15.7 mmol/mol); when combined with those with unchanged HbA1c, the average reduction was −1.3 HbA1c percentage points (−14.2 mmol/mol). Among those with increased HbA1c, the average increase was +1.21 HbA1c percentage points (+13.2 mmol/mol).

Table 3 stratifies the preimplementation and postimplementation HbA1c values of the project participants. Among those who had optimal preimplementation HbA1c levels, HbA1c decreased in 60.3% (41/68), remained the same in 8.8% and increased in 30.9% (21/68). The increase was marked in 5.9% (4/68), reclassifying them to have suboptimal HbA1c levels postimplementation. Among the project participants having suboptimal preimplementation HbA1c levels (>7%/>53 mmol/mol), HbA1c decreased in 60.4% (58/96) with 19.8% achieving good glycaemic control postimplementation. HbA1c remained the same in 7.3% and increased in 32.3% (31/96). The mean average changes were −2.16 HbA1c percentage points (−23.6 mmol/mol) among those whose HbA1c decreased and +1.60 HbA1c percentage points (+17.5 mmol/mol) among those whose HbA1c increased. There were no reported incidences of hypoglycaemia among the study participants.

Analysis of the changes in measured end points based on glycaemic control prior to and 1 year after project implementation showed a higher decrease in HbA1c (p=0.016) and an increase in positive attitude ratings (p=0.006) among those with preimplementation HbA1c >7%. As expected, a decrease in HbA1c was noted among those classified to be 'in good glycemic control' in the postimplementation determination (p=0.033). The decrease in HbA1c among those 'in good glycemic

Table 2 Preimplementation and postimplementation values of measured end points, in medians and proportions

Variable	Overall, n=164 Median values, (binomial interpolation of CIs/IQR) Before implementation	After implementation	p Value Wilcoxon signed-rank test	Change Mean change	Male, n=42 Median values, (binomial interpolation of CIs/IQR) Before implementation	After implementation	p Value Wilcoxon signed-rank test	Change Mean change	Female, n=122 Median values, (binomial interpolation of CIs/IQR) Before implementation	After implementation	p Value Wilcoxon signed-rank test	Change Mean change
HbA1c, % mmol/mol	7.7 (7.2 to 8.2/6.5–10.4) 61 (55 to 56/48–90)	6.9 (6.8 to 7.5/6.2–9.3) 52 (51 to 58/44–78)	<0.001	−0.49 −5.4	7.5 (6.7 to 8.7/6.3–10.7) 58 (50 to 72/45–93)	6.8 (6.2 to 7.7/6.1–8.7) 51 (44 to 61/43–72)	0.001	−0.92 −10.1	7.8 (7.2 to 8.5/6.5–10.4) 62 (55 to 69/48–90)	7.2 (6.8 to 8.0/6.3–9.5) 55 (51 to 64/45–80)	0.057	−0.34 −3.7
BMI, kg/m^2	23.7 (23.1 to 24.1/21.8–26.1)	23.3 (22.6 to 23.8/21.2–25.6)	0.075	−0.40	23.8 (22.8 to 24.7/22.0–25.8)	23.6 (21.9 to 24.7/21.2–25.1)	0.395	−0.37	23.6 (23.0 to 24.0/21.6–26.2)	23.2 (22.4 to 24.1/21.0–25.7)	0.122	−0.41
Waist circumference, in cm	85.0 (83.9 to 86.4/81.0–91.2)	83.0 (82.0 to 85.0/79.0–89.0)	0.007	−1.37	89.0 (84.3 to 91.5/81.0–94)	80.0 (83.0 to 89.9/81.0–94.0)	0.026	−2.09	84.0 (82.8 to 85.2/80.0–88.9)	82.8 (81.0 to 85.0/78.7–88.0)	0.054	−1.13
Waist-hip ratio	0.90 (0.89 to 0.91/0.87–0.95)	0.89 (0.88 to 0.90/0.85–0.92)	<0.001	−0.02	0.93 (0.90 to 0.95/0.89–0.96)	0.91 (0.88 to 0.93/0.87–0.95)	0.025	−0.03	0.90 (0.88 to 0.91/0.86–0.93)	0.88 (0.87 to 0.90/0.85 to 0.92)	0.001	−0.20
Knowledge, % correct answers	60.0 (60.0 to 65.0/50.0–75.0)	67.5 (65.0 to 70.0/60.0–75.0)	<0.001	+7.59	50.0 (50.0 to 64.3/45.0–70.0)	65.0 (60.0 to 70.0/60.0–75.0)	0.006	+9.52	62.5 (60.0 to 65.0/50.0–75.0)	70.0 (65.0 to 70.0/60.0–75.0)	<0.001	+6.93
Perceived fear of diabetes	4.0 to 4.0/2.0–4.0	4.0 to 4.0/3.0–5.0	<0.001	+0.46	2.0 to 4.0/1.0–4.0	3.0 to 4.0/2.0–5.0	0.003	+0.81	4.0 to 4.0/2.4–4.0	4.0 to 4.0/3.0–4.0	0.018	+0.34
Positive attitude	3.4 (3.2 to 3.4/2–8–3.9)	3.4 (3.2 to 3.6/3.0–4.0)	0.071	+0.14	3.2 (2.8 to 3.4/2.6–3.6)	3.4 (3.2 to 4.0/3.2–4.0)	0.025	+0.36	3.4 (3.2 to 3.6/2.8–4.0)	3.4 (3.2 to 3.6/3.0–3.8)	0.479	+0.07
Negative attitude	3.0 (2.8 to 3.4/2.2–4.0)	3.2 (3.0 to 3.4/2.6–3.8)	0.115	+0.15	2.4 (2.0 to 2.8/1.8–3.6)	3.0 (2.8 to 3.2/2.6–3.6)	0.027	+0.42	3.2 (2.8 to 3.6/2.4–4.0)	3.2 (3.0 to 3.5/2.6–3.8)	0.631	+0.06
Attitude towards self-care adherence	3.2 (3.0 to 3.5/2.8–3.8)	3.5 (3.2 to 3.5/3.0–4.0)	0.139	+0.13	3.0 (3.0 to 3.2/2.8–3.5)	3.4 (3.0 to 3.5/2.8–4.0)	0.087	+0.28	3.2 (3.2 to 3.5/2.0–5.0)	3.5 (3.3 to 3.5/3.0–4.0)	0.454	+0.08
Perceived ability to control blood glucose	3.0 (3.0 to 4.0/3.0–4.0)	3.0 (3.0 to 4.0/3.0–5.0)	0.036	+0.24	3.0 (3.0 to 3.0/3.0–4.0)	4.0 (3.0 to 4.0/3.0–4.0)	0.016	+0.43	3.0 (3.0 to 4.0/2.8–4.0)	3.0 (3.0 to 4.0/3.0–5.0)	0.0279	+0.17
Perceived ability to control weight	3.0 (3.0 to 4.0/3.0–4.0)	3.0 (3.0 to 4.0/3.0–4.0)	0.349	+0.12	3.0 (3.0 to 4.0/3.0–4.0)	3.5 (3.0 to 4.0/3.0–4.0)	0.289	+0.021	3.0 (3.0 to 4.0/3.0–4.0)	3.0 (3.0 to 4.0/3.0–4.0)	0.649	+0.08
Perceived ability to adhere to diet and exercise regimens	4.0 (3.0 to 4.0/3.0–5.0)	4.0 (4.0 to 4.0/3.0–5.0)	0.022	+0.26	3.0 (3.0 to 4.0/3.0–4.0)	4.0 (3.0 to 4.0/3.0–5.0)	0.071	+0.35	4.0 (3.0 to 4.0/3.0–5.0)	4.0 (4.0 to 4.0/3.0–5.0)	0.107	+0.23
Perceived ability to handle feelings about diabetes	3.0 (3.0 to 4.0/3.0–4.5)	3.0 (3.0 to 4.0/3.0–4.5)	0.653	−0.01	4.0 (3.0 to 4.0/3.0–4.0)	3.5 (3.0 to 4.0/3.0–5.0)	0.592	+0.17	3.0 (3.0 to 4.0/3.0–4.0)	3.0 (3.0 to 3.3/3.0–4.0)	0.391	−0.07
Perceived support needs	5.0 (4.8 to 5.0/4.2–5)	4.8 (4.2 to 5.0/4.0–5.0)	0.193	+0.02	5.0 (4.7 to 5.0/4.3–5.0)	4.2 (4.0 to 5.0/4.0–5.0)	0.125	−0.13	5.0 (4.8 to 5.0/4.2–5.0)	5.0 (4.3 to 5.0/4.0–5.0)	0.593	+0.007
Perceived support received from family and friends	5.0 (5.0 to 5.0/4.0–5.0)	4.0 (4.0 to 4.0/3.8–4.8)	<0.001	−0.39	5.0 (4.9 to 5.0/4.0–5.0)	4.0 (4.0 to 4.0/3.8–4.3)	0.002	−0.52	5.0 (4.8 to 5.0/4.0–5.0)	4.0 (4.0 to 4.0/3.8–5.0)	<0.001	−0.34

	N (proportion, %)		Test of proportions	Change n (%)	N (proportion, %)		Test of proportions	Change n (%)	N (proportion, %)		Test of proportions	Change n (%)
Proportion adherent to medications	108 (65.9)	134 (81.7)	0.001	+26 (+15.8)	30 (71.4)	34 (81.0)	0.306	+4 (+9.6)	78 (63.9)	100 (82.0)	0.001	+22 (+18.1)
Proportion adherent to exercise regimen	68 (41.5)	110 (67.1)	<0.001	+42 (+25.6)	25 (59.5)	27 (64.3)	0.653	+2 (+4.8)	43 (35.2)	83 (68.0)	<0.001	+40 (+38.2)
Proportion adherent to prescribed diet	99 (60.4)	66 (40.2)	<0.001	−33 (−20.2)	19 (45.2)	14 (33.3)	0.264	−5 (−11.9)	80 (65.6)	52 (42.6)	<0.001	−28 (−23.0)

BMI, body mass index; HbA1c, glycosylated haemoglobin.

Table 3 Stratification of FiLDCare Project participants based on preimplementation and postimplementation levels of glycaemic control

Change in HbA1c	Preimplementation						Total (postimplementation)
	Good control HbA1c ≤7%			Not in good control HbA1c >7%			
	Decreased	Increased	Unchanged	Decreased	Increased	Unchanged	
Postimplementation Good control HbA1c <7%	41	17	6	19			83
Not in good control HbA1c >7%		4		39	31	7	81
Total (preimplementation)	41	21	6	58	31	7	164
	68			96			

FiLDCare, First Line Diabetes Care; HbA1c, glycosylated haemoglobin.

control' postimplementation was significantly higher than the decrease in HbA1c among those 'in good glycemic control' preimplementation (p<0.001). None of the other measured changes in end points showed statistically significant differences according to preimplementation and postimplementation glycaemic control status (table 4).

Wilcoxon signed-rank test showed a significant difference in gender (p=0.042), duration of diabetes (p=0.005) and the change in the 'perceived ability to control blood glucose' (p=0.034) between those with 'decreased/unchanged HbA1c' against 'increased HbA1c'. Results of analysis of the end points based on the changes in HbA1c are listed in table 5. Overall values are presented in table 5. Since logistic regression showed a significant difference in gender associated with improved glycaemia, values were disaggregated by gender as listed in table 6. The main differences between the groups 'increased HbA1c' and 'decreased/unchanged HbA1c' are the significant increase in correct answers to the knowledge test (p<0.001), increased ratings of positive attitude (p=0.013) and 'perceived ability to control blood glucose' (p=0.004), and the increased proportion of people adherent to medication (p=0.001) in favour of those whose glycaemia improved. There is a significant increase in the ratings of fear (p=0.010), positive and negative attitudes (p=0.008; 0.009) and the perceived ability to control blood glucose (p=0.007) among the male participants whose glycaemia improved, which was not observed among the female participants.

Bivariate logistic regression of correlates for improved glycaemia identified the male gender (p=0.049), duration of diabetes >10 years (p=0.001), increased fear of diabetes (p=0.050), increased perceived ability to control blood glucose (p=0.030) and better adherence to diet suitable to diabetes (p=0.049) as having an α of ≤0.1. These were entered in multivariate logistic regression to arrive at the final model composed of the male gender as a positive correlate to improved glycaemia (p=0.034), and duration of diabetes >10 years (p=0.003) and increased fear of diabetes (p=0.048) as strong negative correlates (table 7).

DISCUSSION

Patient education has evolved through the years from merely informing patients regarding their illnesses to involving them in the care of their conditions, especially in chronic cases.[9] In diabetes, usual self-management education activities aim toward providing information on the disease process and its pathophysiology and giving instructions on self-management behaviour, which may cover diet, physical activity, monitoring, medications, risk reduction, problem solving and coping.[32–35] Several published individual articles and meta-analyses of trials evaluating the effectiveness of DSME have demonstrated the efficacy of DSME for people with diabetes, in terms of improvements in glycaemic control, knowledge, self-management behaviour and the psychological and behavioural aspects of self-management. The settings, techniques and types of interventions used in these DSME programmes were diverse and involved a combination of a number of providers that included at least any three of the following: medical specialists, dietitians, psychologists, managers and pharmacists aside from primary care physicians, nurses and the occasional community-based healthcare workers.[13 34–43] No specific structural variations seem to be constantly superior over others.

For the FiLDCare Project, one-on-one collaborative DSME/S sessions were conducted in a clinical and a community setting, and aimed mainly to provide information and basic knowledge on diabetes, and instructions and reminders for diabetes self-management. The project made use of existing LGHU staff and took advantage of the large cadre of BHW (in the Philippines, these community workers are generally highly educated), shifting tasks that were standardisable and required less expertise, so as not to overburden the LGHU physician and nurse. Furthermore, self-care development actively involved the person with diabetes. Actively involving the person with a chronic condition in self-management and decision-making increases the likelihood of adherence to the recommended plan of care.[44]

One year after full project implementation, significant improvements were noted: the participants' level of diabetes-related knowledge, the perceptions of 'ability to

Table 4 Mean change (SD) of measured end points according to preimplementation and postimplementation control of glycaemia

Glycaemic control	Preimplementation (baseline)			Postimplementation			Preimplementation 'in good control' vs postimplementation 'in good control', p value
	In good control (n=68) Mean change (SD)	Not in good control (n=96) Mean change (SD)	p Value Independent samples t test	In good control (n=83) Mean change (SD)	Not in good control (n=81) Mean change (SD)	p Value Independent samples t test	Two independent samples t test
HbA1c, % (mmol/mol)	−0.065 (0.766)	−0.786 (2.367)	0.016	−0.800 (2.116)	−0.167 (1.629)	0.033	<0.001
BMI, kg/m^2	−0.892 (1.812)	−0.181 (3.112)	0.067	−0.702 (2.944)	−0.245 (1.809)	0.234	0.539
Waist circumference, cm	−2.714 (7.888)	−0.706 (5.709)	0.060	−2.317 (7.820)	−0.740 (5.374)	0.135	0.633
WHR	−0.025 (0.110)	+0.016 (0.063)	0.511	−0.028 (0.106)	−0.012 (0.057)	0.215	0.518
Knowledge test rating, %	+7.00 (20.40)	+8.00 (19.00)	0.739	+8.10 (20.68)	+7.00 (18.84)	0.721	0.542
Perceived fear of diabetes	+0.618 (1.630)	+0.354 (1.741)	0.328	+0.542 (1.748)	+0.383 (1.647)	0.549	0.727
Positive attitude	−0.091 (0.872)	+0.308 (0.928)	0.006	+0.039 (0.920)	+0.249 (0.921)	0.144	0.074
Negative attitude	+0.218 (1.085)	+0.106 (1.342)	0.572	+0.161 (1.203)	+0.143 (1.284)	0.925	0.709
Attitude towards self-care adherence	+0.040 (0.911)	+0.918 (0.944)	0.287	+0.069 (0.940)	+0.198 (0.923)	0.379	0.707
Perceived ability to control blood glucose	+0.103 (1.199)	+0.333 (1.359)	0.263	+0.157 (1.204)	+0.321 (1.386)	0.418	0.640
Perceived ability to control weight	−0.015 (1.203)	+0.208 (1.428)	0.295	±0.024 (1.334)	+0.259 (1.340)	0.177	0.781
Perceived ability to adhere to diet and exercise regimens	+0.103 (1.174)	+0.375 (1.394)	0.191	+0.217 (1.279)	+0.309 (1.348)	0.655	0.468
Perceived ability to handle feelings about diabetes	−0.206 (1.451)	+0.135 (1.396)	0.131	−0.120 (1.383)	+0.111 (1.466)	0.300	0.201
Perceived support needs	+0.093 (0.973)	−0.030 (1.155)	0.476	+0.040 (0.925)	+0.002 (1.227)	0.822	0.907
Perceived support received	−0.179 (1.191)	−0.535 (1.236)	0.067	+0.229 (1.194)	+0.549 (1.246)	0.094	0.573
	N (proportion, %)		Test of proportions	N (proportion, %)		Test of proportions	
Adherence to medications (improved/did not deteriorate)	57 (83.8)	77 (80.2)	0.683	71 (85.5)	63 (77.8)	0.229	
Adherence to exercise (improved/did not deteriorate)	47 (69.1)	63 (65.6)	0.736	56 (67.5)	54 (66.7)	1.00	
Adherence to diet (improved/did not deteriorate)	32 (47.1)	34 (35.4)	0.148	38 (45.8)	28 (34.6)	0.155	

BMI, body mass index; HbA1c, glycosylated haemoglobin; WHR, waist-hip ratio.

Table 5 Preimplementation and postimplementation median values of HbA1c, anthropometric measurements, diabetes knowledge, attitudes and perceptions, and proportions of self-care practices stratified according to 'increased HbA1c' and 'decreased or unchanged HbA1c', and p values of comparisons of changes in measured end points among those with 'increased HbA1c' against 'decreased or unchanged HbA1c'

Change in A1C	Increased HbA1c, n=52				Decreased/unchanged HbA1c, n=112				p Value two independent samples t test of mean change, increased HbA1c vs decreased/unchanged HbA1c
	Median Pre	Post	p Value Wilcoxon signed-rank test	Change Mean change	Median Pre	Post	p Value Wilcoxon signed-rank test	Change Mean change	
HbA1c, % (mmol/mol)	7.5 (58)	9.2 (76)	<0.001	+1.21 (+13.2)	7.8 (62)	6.8 (51)	<0.001	-1.3 (-14.2)	<0.001
BMI, kg/m²	24.5	23.3	0.115	-0.72	23.5	23.2	0.281	-0.24	0.379
Waist circumference, cm	85	83	0.006	-2.32	84.5	83.9	0.140	-0.93	0.314
WHR	0.90	0.89	0.028	-0.01	0.90	0.89	0.001	-0.03	0.226
Knowledge test rating, %	65	65	0.060	+4.20	60	70	<0.001	+9.0	0.134
Perceived fear of diabetes	4.0	4.0	0.004	+0.69	4.0	4.0	0.024	+0.35	0.240
Positive attitude	3.3	3.4	0.441	+0.18	3.4	3.4	0.013	+0.13	0.748
Negative attitude	3.0	3.1	0.415	+0.23	3.0	3.2	0.164	+0.12	0.602
Attitude towards self-care adherence	3.1	3.4	0.967	+0.04	3.2	3.5	0.090	+0.17	0.404
Perceived ability to control blood glucose	3.0	3.0	0.516	-0.08	3.0	4.0	0.004	+0.38	0.034
Perceived ability to control weight	3.0	3.5	0.340	+0.17	3.0	3.0	0.618	+0.09	0.711
Perceived ability to adhere to diet and exercise regimens	4.0	4.0	0.006	+0.31	4.0	4.0	0.083	+0.24	0.763
Perceived ability to handle feelings about diabetes	3.5	3.0	0.328	-0.17	3.0	3.0	0.870	+0.07	0.308
Perceived support needs	4.8	5.0	0.978	+0.16	5.0	4.6	0.123	-0.04	0.275
Perceived support received	4.8	4.0	0.035	-0.25	5.0	4.0	<0.001	-0.45	0.342
	N (proportion, %) Pre	Post	Test of proportions	Change n (%)	N (proportion, %) Pre	Post	Test of proportions	Change n (%)	
Adherence to medications	38 (73.1)	42 (80.8)	0.352	+4 (+7.7)	70 (62.5)	92 (82.1)	0.001	+22 (19.6)	
Adherence to exercise regimen	19 (36.5)	33 (63.5)	0.006	+14 (+27.0)	49 (43.8)	77 (68.8)	<0.001	+28 (25.0)	
Adherence to diabetes diet	37 (71.2)	24 (46.2)	0.010	-13 (-25.0)	62 (55.4)	42 (37.5)	0.007	-20 (17.9)	

BMI, body mass index; HbA1c, glycosylated haemoglobin; WHR, waist-hip ratio.

control blood glucose' and 'ability to adhere to diet and exercise regimens' and reported adherence to medications and exercise increased. Adiposity/obesity as measured through the WHR and waist circumference decreased. More than these, glycaemic control of the FiLDCare Project participants significantly improved. However, the fear of diabetes increased and the 'perceived support received from family and friends' decreased, as did reported adherence to diet.

Changes in glycaemia and measures of obesity/adiposity

The effects of DSME/S on clinical end points such as glycaemia and obesity/adiposity have been well documented in the past.[13 14 34–43] These were also observed in our study. Overall, the noted reduction in HbA1c of the FiLDCare Project participants was significant. There was also a significant increase in the proportion of people with optimal glycaemic control. In-depth analysis of the changes in HbA1c levels shows reductions in HbA1c regardless of the level of preimplementation glycaemic control. The proportion of people with reductions in HbA1c, whether among those with optimal or with suboptimal control, approached 60%, with higher reductions in HbA1c levels among those classified to have suboptimal control at baseline. Significant changes in obesity/adiposity were noted through the WHR and the waist circumference measurements, but not through the BMI. These significant reductions in the indirect measures for obesity/adiposity were noted regardless of glycaemic control.

Changes in knowledge, attitudes and perceptions

Akin to aforementioned studies on DSME where changes in knowledge were measured,[12 13] knowledge of the project participants increased. The increase in knowledge may have increased perceptions of self-efficacy. Possessing the essential knowledge about the condition and the care for the condition may increase the level of confidence of people with diabetes in their self-care abilities, that is, ability to control blood glucose and ability to adhere to diet and exercise regimens. Positive feelings of self-efficacy may consequently lead them to perform and adhere to better self-management practices.[45] In our study, this could be construed as an increase in knowledge leading to increased perceived abilities to control blood glucose and to adhere to diet and exercise regimens, leading to an increase in self-reported adherence to medications and exercise of our project participants. The changes in self-reported adherence to diet may have been an effect of the participants having learned of the specific diet they should be adhering to, which they were taught during the DSME/S sessions. The negative change noted could be attributable to their change in perception of what a diet suitable for diabetes consists of rather than a change in eating behaviour, hence the decrease in the number answering 'yes' in the postimplementation interview. Another possible effect of the DSME/S sessions is the

Table 6 Preimplementation and postimplementation median values of HbA1c, anthropometric measurements, diabetes knowledge, attitudes and perceptions, and proportions of self-care practices stratified according to 'increased HbA1c' and 'decreased or unchanged HbA1c' and according to gender

Change in A1c / Gender	Increased HbA1c, n=52								Decreased/unchanged HbA1c, n=112							
	Male, n=8				Female, n=44				Male, n=34				Female, n=78			
	Median		p Value	Change	Median		p Value	Change	Median		p Value	Change	Median		p Value	Change
	Pre	Post	Wilcoxon signed-rank test	Mean change	Pre	Post	Wilcoxon signed-rank test	Mean change	Pre	Post	Wilcoxon signed-rank test	Mean change	Pre	Post	Wilcoxon signed-rank test	Mean change
HbA1c, % (mmol/mol)	6.3 (50)	8.5 (69)	0.012	+1.51 (+16.5)	7.7 (61)	9.2 (77)	<0.001	+1.16 (+12.7)	7.7 (61)	6.6 (49)	<0.001	−1.49 (−16.3)	8.1 (65)	6.8 (51)	<0.001	−1.18 (−12.9)
BMI, kg/m^2	24.6	23.7	0.124	−1.10	24.5	23.0	0.401	−0.66	23.7	23.5	0.986	−0.20	23.4	23.3	0.234	−0.27
Waist circumference, cm	90.2	87.0	0.014	−4.60	84.5	82.0	0.063	−1.91	87.8	86.0	0.188	−1.50	84.0	83.0	0.284	−0.69
WHR	0.95	0.94	0.069	−0.03	0.90	0.88	0.093	−0.11	0.92	0.90	0.106	−0.04	0.90	0.89	0.006	−0.02
Knowledge test rating, %	62.5	60.0	1.00	+3.75	65.0	65.0	0.021	+4.32	55.0	65.0	0.001	+10.88	60.0	70.0	<0.001	+8.40
Perceived fear of diabetes	2.0	3.0	0.107	+1.0	4.0	4.0	0.013	+0.64	2.0	4.0	0.010	+0.76	4.0	4.0	0.311	+0.18
Positive attitude	3.4	3.2	0.725	+0.03	3.2	3.2	0.365	+0.20	3.2	3.8	0.008	+0.44	3.5	3.4	0.842	−0.01
Negative attitude	2.5	2.6	0.726	−0.13	3.0	3.2	0.315	+0.29	2.4	3.2	0.009	+0.55	3.2	3.1	0.893	−0.07
Attitude towards self-care adherence	3.0	2.8	0.831	−0.09	3.2	3.5	0.902	+0.07	3.0	3.5	0.092	+0.37	3.4	3.4	0.420	+0.09
Perceived ability to control blood glucose	3.5	3.0	0.879	−0.12	3.0	3.0	0.547	−0.07	3.0	4.0	0.007	+0.56	3.0	4.0	0.080	+0.31
Perceived ability to control weight	3.5	3.0	0.879	−0.25	3.0	4.0	0.260	+0.25	3.0	4.0	0.198	+0.32	3.0	3.0	0.773	-0.01
Perceived ability to adhere to diet and exercise regimens	3.0	3.0	0.162	+0.50	4.0	4.0	0.263	+0.27	3.0	4.0	0.161	+0.32	4.0	4.0	0.241	+0.21
Perceived ability to handle feelings about diabetes	3.5	3.0	0.611	−0.12	3.5	3.0	0.406	−0.18	4.0	4.0	0.449	+0.24	3.0	3.0	0.694	0
Perceived support needs	5.0	4.7	0.320	−0.29	4.8	5.0	0.716	+0.24	5.0	4.0	0.192	−0.09	5.0	4.9	0.352	−0.02
Perceived support received	5.0	3.8	0.161	−0.85	4.8	4.0	0.172	−0.14	5.0	4.0	0.012	−0.45	5.0	4.0	<0.001	−0.45
	N (proportion, %)		Test of proportions	Change n (%)	N (proportion, %)		Test of proportions	Change n (%)	N (proportion, %)		Test of proportions	Change n (%)	N (proportion, %)		Test of proportions	Change n (%)
Adherence to medications	5 (62.5)	7 (87.5)	0.248	+2 (+25.0)	33 (75.0)	35 (79.6)	0.611	+2 (+4.6)	25 (73.5)	27 (79.4)	0.568	+2 (+5.9)	45 (57.7)	65 (83.3)	<0.001	+20 (+25.6)
Adherence to exercise regimen	5 (62.5)	5 (62.5)	1.00	0	14 (31.8)	28 (63.6)	0.003	+14 (+31.8)	20 (58.8)	22 (64.7)	0.618	+2 (+5.9)	29 (37.2)	55 (70.5)	<0.001	+26 (+33.3)
Adherence to diabetes diet	4 (50.0)	2 (25.0)	0.302	−2 (−25.0)	33 (75.0)	22 (50.0)	0.015	−11 (−25.0)	15 (44.0)	12 (35.3)	0.457	−3 (−8.7)	47 (60.3)	30 (38.5)	0.006	−17 (−21.8)

Table 7 Results of logistic regression analysis of improved glycaemia: Correlates with α≤0.1 identified on bivariate regression analysis of categorical variables and the final model with the significant correlates (α≤0.05) of improved glycaemia identified on multivariate regression

Correlate	OR	p Value	95% CI
Bivariate logistic regression			
Male gender	2.460	0.049	1.020 to 5.633
Duration of diabetes >10 years	0.200	0.001	0.074 to 0.537
Increased fear of diabetes	0.513	0.050	0.264 to 0.999
Increased perceived ability to control blood glucose	2.250	0.030	1.083 to 4.673
Better adherence to diet suitable for diabetes	2.460	0.049	1.000 to 6.036
Multivariate logistic regression (final model)			
Male gender	2.655	0.034	1.078 to 6.537
Duration of diabetes >10 years	0.214	0.003	0.078 to 0.587
Increased fear of diabetes	0.490	0.048	0.242 to 0.994

recognition of things that have to be done for the condition, which could trigger the person to seek for social support in order to accomplish some of these. As the person with the condition learns of the various activities to be undertaken for self-care and self-management, previously perceived adequate support given by family and friends may now be perceived as inadequate, hence the negative change in this rating. Involvement of the family and friends in the DSME/S sessions was limited, and strategies to include the people around the person with diabetes in future DSME/S activities need to be developed further. Multivariate regression analysis identified increased fear as the lone modifiable correlate significantly associated with glycaemic control. In this study, its effect on glycaemia improvement was negative. Although a number of health campaigns have made use of the fear factor, such may not necessarily trigger a positive response; fear may bring about negative self-management behaviour.[46] Fear of diabetes as well as other psychological aspects may have been inadequately addressed in the DSME/S sessions due to the limited training and composition of the healthcare team. Such fear may have negatively influenced self-management behaviour and other known and unknown factors that may have contributed to improved glycaemic control.

The two other correlates significantly associated to improved glycaemia are non-modifiable. Nevertheless, this information may be used in tailoring DSME/S. In our study, the female gender and duration of diabetes of 10 years or more were identified to be negatively correlated to improvements in glycaemia.

Gender
Gender differences in glycaemic control have been studied in the past with women either having equal or poorer but not superior glycaemic control compared with men.[47] [48] This may be partly attributed to differences in glucose metabolism and homoeostasis between sexes.[49] With regard to our study, we noted gender differences comparing some preimplementation and postimplementation attitude and perception ratings.

However, the male population in our sample is not substantial enough to subject this to further and more rigorous statistical analysis. Thus, we can only speculate how, in consonance with the theory of perceived self-efficacy, the increase in knowledge, fear, and positive and negative attitudes in our male population may positively affect perceived self-efficacy to control blood glucose, stimulate positive self-management behaviour and thereby improve glycaemia.

Duration of diabetes
It has been observed that much of the instruction on diabetes care is given to the person when the diagnosis is first made and there may be a need to retrain people who have had diabetes for a number of years so as to maintain better glycaemic control.[50] However, it seems that in spite of DSME/S given to the whole cohort in our study, glycaemia still had the tendency to deteriorate in the subgroup of people with known diabetes for 10 years or more. Other factors undoubtedly influence this negative correlation, aside from the need of retraining in people who have had diabetes for a number of years.

CONCLUSIONS
This research has shown that some basic elements of DSME/S may be introduced making use of pre-existing healthcare personnel and produce favourable results. The provision of context-adapted DSME/S may improve diabetes-related knowledge, some attitudes, perceptions and practices, adiposity/obesity and glycaemia of its recipients. The FiLDCare Project, with some improvements, may be implemented in other areas of the Philippines to find out if it yields comparable, if not better, outcomes. Other LMIC may draw inspiration from this study to apply similar context-adapted measures to implement DSME/S.

Explorations on ways by which to handle psychological aspects in general and address fear of diabetes in particular in resource-constrained settings where a complete professional healthcare team is unavailable would be

useful. Special attention may be needed in designing appropriate DSME/S for the female gender and those who have been known to have diabetes for a number of years. Inclusion of and a more active participation of family and friends as well as other members of the community in DSME/S activities should be considered, as this may help improve the social support that most people with diabetes need.

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