

BMJ Open

A “before-after” study on the effects of the First Line Diabetes Care (FiLDCare) self-management education and support project in the Northern Philippines on project participants’ knowledge, attitudes, perceptions, practices and glycemic control

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-005317
Article Type:	Research
Date Submitted by the Author:	22-Mar-2014
Complete List of Authors:	Ku, Grace Marie; Institute of Tropical Medicine, Public Health; Kegels, Guy; Institute of Tropical Medicine, Public Health
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	Health services research
Keywords:	General diabetes < DIABETES & ENDOCRINOLOGY, EDUCATION & TRAINING (see Medical Education & Training), self-care development, knowledge, attitudes, perceptions, and practices, low-and-middle-income countries

SCHOLARONE™
Manuscripts

1
2
3 A “before-after” study on the effects of the First Line
4
5
6 Diabetes Care (FiLDCare) self-management
7
8
9
10 education and support project in the Northern
11
12
13 Philippines on project participants’ knowledge,
14
15
16 attitudes, perceptions, practices and glycemc
17
18
19
20 control
21
22
23
24
25
26

27 Grace Marie V. Ku, MD, MPH

28 Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium
29 gracemariakumd@yahoo.com
30

31
32
33
34 Guy Kegels, MD, PhD

35 Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium
36 gkegels@itg.be
37
38
39
40
41
42

43 Correspondence to:

44 Grace Marie Ku, MD, MPH
45 Arellano cor Otis Streets, #2 R. Ablan, Sr.
46 Batac City, Ilocos Norte
47 2906 PHILIPPINES
48 gracemariakumd@yahoo.com
49
50
51
52

53 *Keywords: diabetes knowledge, attitudes, perceptions and practices; diabetes self-*
54 *management education and support; low-middle income country (Philippines)*
55

56
57 Word count: 3966
58
59
60

ABSTRACT

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

Primary and secondary outcome measures. Context-adapted DSME/S was given to project participants by trained pre-existing local government healthcare personnel. Changes in KAP, practices, body mass index, waist circumference, waist-hip ratio (WHR) and glycosylated hemoglobin (HbA1c) were measured one year after full project implementation. Wilcoxon’s signed-rank test, test of proportions, Mann-Whitney test and logistic regression analyses were done.

Results. Complete data was collected from 164 participants. Improvements in glycemia, waist circumference, WHR, knowledge, some perceptions and 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 glycemia improved. Significant differences in the subgroup whose HbA1c improved as against those whose HbA1c deteriorated include male gender ($p=0.042$); shorter duration of diabetes ($p=0.001$) and increased

1
2
3 perceived ability to control blood glucose ($p=0.042$). Significant correlates to
4 improved glycemia were male gender ($OR=2.655;p=0.034$), duration of diabetes
5 >10years ($OR=0.214;p=0.003$) and fear of diabetes ($OR=0.490;p=0.048$).
6
7
8
9

10
11 **Conclusion.** Context-adapted DSME/S introduced in resource-constrained settings
12 and making use of established human resources for health may improve knowledge,
13 attitudes, perceptions, practices, and glycemia of recipients. Further investigations on
14 addressing fear of diabetes and tailoring DSME/S to females and those who have
15 had diabetes for a longer period of time may help to indicate ways to further improve
16 glycemia.
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study is one of the few conducted regarding:
 1. Integrating chronic care with current healthcare activities making use of pre-existing healthcare staff to introduce/improve quality of chronic care in public first line health care services of a low-to-middle-income country such as the Philippines; and
 2. Analyzing changes in knowledge, attitudes, perceptions and practices and demonstrating correlations with improving glycemetic control
- Logistic regression analysis identifies significant correlates towards improving glycemia.
- Comparative analysis of those with improvements in glycemia 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.

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 recognized as an integral part of good quality health care[4, 5] and diabetes self-management education and support (DSME/S) is already deemed a right for all concerned.[6] Since more than 2 decades ago, self-management education has slowly been incorporated into 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 utilize all possible opportunities to prevent and control diabetes: DSME/S may 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 public health is still generally oriented to acute and infectious diseases.

Previous studies have demonstrated that self-management education programs designed to increase knowledge and bring about behavior change are more

1
2
3 successful in improving glycaemia[12, 13] but there is a dearth of publications
4
5 demonstrating any relationships between glycaemic control and specific attitudes and
6
7 perceptions related to diabetes.
8
9

10
11 Although a number of aspects in the provision of DSME/S require expertise, skills,
12
13 and specialized personnel that LMIC may not have the capacity to supply, there are
14
15 certain DSME/S activities that can be translated to low resource settings. In the
16
17 Philippines, we implemented the context-adapted chronic care model-based First
18
19 Line Diabetes Care (FiLDCare) Project where we organized primary care for diabetes
20
21 in two local government units. The project focused mainly on primary health care
22
23 providers and the person with chronic condition, concentrating on decision support to
24
25 the healthcare workers, minor re-organization of the health service, delivery system
26
27 re-design and self-care development through DSME/S. The possible effects of the
28
29 FiLDCare Project DSME/S on the knowledge, attitudes, perceptions, practices,
30
31 obesity/adiposity and glycaemic control of people with diabetes are explored in this
32
33 paper.
34
35

36 37 **Background**

38
39 Public health care in the Philippines was devolved in 1992. The responsibility of
40
41 providing basic health care services for the people was handed down to local
42
43 government units, specifically municipalities and cities.[14] A decade before health
44
45 care devolution, the country implemented a primary health care policy which created
46
47 a large cadre of community-based health workers locally called barangay (village)
48
49 health workers (BHW) who are selected to work in their respective areas of residence
50
51 .[15] Organizationally, the BHW fall under the governance of the barangay and are
52
53 selected to work in their respective areas of residence; functionally, they are under
54
55 the local government health units (LGHU). A BHW is assigned approximately 10-20
56
57 families, is responsible for dissemination of health information and health promotion
58
59
60

1
2
3 activities, and conducts other health-related undertakings to any member of the
4 families being attended to. At present, a typical LGHU would be composed of one or
5 more municipal or city health centers and a number of barangay health stations, and
6 would have at least one municipal/city health officer, at least one nurse, several
7 midwives, and the BHW.
8
9
10
11
12

13
14
15 Batac (population=53,542 as of 2010[16]) is a non-highly urbanized component city
16 in the island of Luzon composed of 43 barangays with two government health
17 centers and their barangay health stations. Other health care services include a
18 tertiary-level Department of Health-operated hospital, a primary-level private hospital,
19 a number of private multi-specialty clinics and clinical laboratories, and several
20 private drugstores/pharmacies.
21
22
23
24
25
26
27
28

29 Pagudpud (population=21,877 as of 2010[16]), the northernmost settlement in Luzon,
30 is a rural municipality classified to be very low in economic development. Composed
31 of 16 barangays, it only has a basic government health center and barangay health
32 stations for health care. There are no laboratory facilities, nor any private clinics or
33 drugstores/pharmacies.
34
35
36
37
38
39

40
41
42 As in many LMIC, most healthcare expenditures are out-of-pocket.
43
44
45

46 In these LGHU, the chronic condition-related activities are limited to informative
47 posters on stroke, high blood pressure, diabetes, chronic lung diseases, smoking
48 cessation, and the benefits of exercise and a healthy diet. There are also one-day
49 annual campaigns on specific conditions, healthy lifestyle, tobacco control, etc., as
50 programmed by the Department of Health.[17] Similar to most LGHU in the
51 Philippines, organized care aiming at self-management education and support for
52
53
54
55
56
57
58
59
60

1
2
3 chronic conditions is non-existent in both the Batac City and Pagudpud government
4 health units.
5
6
7

8 9 **METHODOLOGY**

10 This was a prospective quasi-experimental before-after multicenter study involving
11 two purposively selected LGHU and a cohort of people with diabetes, conducted from
12 May 2011 to February 2013. The intervention was a context-adapted chronic disease
13 care model-based DSME/S. The outcomes of interest were changes in diabetes
14 knowledge, attitudes, perceptions, practices, body mass index (BMI), waist
15 circumference, waist-hip ratio (WHR) and glycosylated hemoglobin (HbA1c) levels of
16 the project participants.
17
18
19
20
21
22
23
24

25
26
27 Selected LGHU staff including BHW participated in a 32 hours training workshop on
28 primary diabetes care and DSME/S, results of which will be discussed elsewhere.
29
30
31
32

33 **Inclusion / exclusion criteria**

34 The LGHU staff were requested to enrol people with diabetes from their localities to
35 the FiLDCare Project. Criteria for inclusion in the FiLDCare Project were: diagnosis of
36 type 2 diabetes, age \geq 20 years, and willingness to participate in the project. The
37 trained healthcare workers provided primary diabetes care and DSME/S to the
38 project participants.
39
40
41
42
43
44
45
46
47

48 Data gathered from the project participants were further screened for inclusion in
49 statistical analysis. Inclusion criteria for analysis were: completeness of interview
50 data, pre- and post-implementation HbA1c values and pre- and post-implementation
51 anthropometric measurements. Exclusion criteria were: pregnancy and a positive
52 medical history of anemia (sickle cell, iron deficiency) and end-stage renal disease.
53
54
55
56
57
58
59
60

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

The principal investigator and/or trained field researchers, one of which 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 done prior to and one 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. Diabetes Knowledge Test [18] and the Garcia et al. Diabetes Knowledge Questionnaire [19]. Questions on attitudes and perceptions were adapted from the survey questionnaires of the University of Michigan Diabetes Research and Training Center.[20, 21] 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 measure 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. 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 summarized as “no” if any of the questions were answered with “no” and “yes” if all the questions were answered with

1
2
3 “yes”. The question on diet adherence was answerable by “no”, “sometimes”, or
4
5 “yes/always”; these answers were transformed to “not/sometimes adherent” and
6
7 “yes/fully adherent”. For exercise, questions were asked on the type of exercise
8
9 done, frequency, and duration; the answers were then transformed to “no” or “yes”
10
11 based on the criteria of doing 150 minutes of moderate-intensity aerobic physical
12
13 activity or at least 75 minutes of vigorous-intensity aerobic physical activity
14
15 throughout the week.[22] Medical records were reviewed for any co-morbid illnesses.
16
17

18 19 **FiLDCare Project DSME/S strategy**

20
21 One-on-one diabetes self-management education (DSME) was initiated either by the
22
23 city/municipal health officer or the LGHU nurse, assisted by the principal investigator
24
25 and/or the FiLDCare Project nurse during consultations at the government health
26
27 unit. Consultations and the concomitant DSME sessions were done at least once
28
29 every three months. The DSME sessions focused on: information on diabetes and
30
31 diabetes medications, adoption of self-care behavior, gaining control over the
32
33 condition through problem solving skills, and goal setting. DSME was conducted in a
34
35 conversational and interactive manner, embedded in the clinical consultation.
36
37 Duration of the initial DSME session ranged from 20 to 30 minutes and the
38
39 succeeding sessions from 5 to 15 minutes. Written materials on healthy eating,
40
41 exercise, and glycemic goals were given out during the sessions. Community-based
42
43 diabetes self-management support (DSMS) was continued by the BHW and the
44
45 midwives. DSMS concentrated more on behavioral support with reinforcement of
46
47 self-care (taking medications, diet, exercise and foot care) and problem solving.
48
49 DSMS was provided informally through home visits where the BHW would drop by
50
51 the house of the person with diabetes and introduce pieces of information on
52
53 diabetes and diabetes care in the conversation. Also, DSMS sessions were
54
55 conducted in the barangay health stations where the BHW and midwives would be
56
57 found on specific days two to four times a month and where people with diabetes
58
59
60

1
2
3 could go if and when they had any questions or would want to talk to these
4
5 healthcare workers. DSMS was conducted at least once a month. The frequency and
6
7 duration of DSME/S depended primarily on the demand of the person with diabetes.
8
9 The DSME/S approach was collaborative and interactive rather than rigidly
10
11 structured. After the opening DSME where the different aspects for self-care were
12
13 discussed, the opinion and choices of the person with diabetes on the topics to be
14
15 tackled in succeeding DSME/S sessions were considered. Active listening skills
16
17 (introduced in the initial training workshop) were employed.
18
19

20 21 **Statistics**

22
23 Statistical analyses were done making use of the statistical package Stata/IC version
24
25 11.0.[23] Wilcoxon signed-rank test was used to compare the pre- and post-
26
27 implementation median values of the outcomes. Test of proportions was used to
28
29 compare the pre- and post- implementation proportions of people adherent to
30
31 medications, diet and exercise and people with good glycemic control.
32
33

34
35 Mann-Whitney test was used to compare the differences of the changes of the
36
37 outcomes between “decreased/unchanged HbA1c” and “increased HbA1c”.
38
39

40
41 Logistic regression analysis was done using “decreased/unchanged HbA1c” against
42
43 “increased HbA1c” to determine significant correlates in improving glycemic control.
44
45 Independent variables were transformed into categorical variables. Bivariate logistic
46
47 regression was initially done. An alpha of 0.10 was used as the cut-off to consider for
48
49 multivariate logistic regression. Multivariate logistic regression of independent
50
51 variables with alpha of 0.05 or less was done and variables with an alpha>0.05 were
52
53 removed in a stepwise fashion. The remaining variables having an alpha of ≤ 0.05
54
55 were considered statistically significant correlates.
56
57
58
59
60

Definitions

Good control of diabetes was defined as having HbA1c $\leq 7.0\%$ ($\leq 53\text{mmol/mol}$).^[24]

For the classification of changes in HbA1c pre- and post-implementation, it should be noted that, without any interventions, the natural history of diabetes is deterioration of glycemic control through time.^[25] Unchanged HbA1c levels may thus be viewed as a favorable result. Following this logic, unchanged HbA1c levels were grouped with decreased HbA1c levels against those with increased HbA1c levels.

Post-implementation changes in ratings were determined by subtracting pre-implementation ratings from the post-implementation values. No and negative changes were grouped together against positive changes to create categorical variables. Increase was defined as a positive change.

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

RESULTS

A total of 203 people with diabetes were enrolled to 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, five refused any A1C testing from the outset, four died, eight migrated, two refused post-implementation interview, and 20 refused any further A1C testing. None were found to have any of the exclusion criteria for statistical analysis stated above.

Demographic data of the project participants are listed in Table 1.

1
2
3
4
5 A year after full implementation, analysis of the median values showed significant
6 decrease in the HbA1c ($p<0.001$), waist circumference ($p=0.007$), WHR ($p<0.001$),
7 and the “perceived support received from family and friends” ($p<0.001$). Significant
8 increases were noted in the correct answers to the knowledge test ($p<0.001$), the
9 “perceived ability to control blood glucose” ($p=0.036$), the “perceived ability to adhere
10 to diet and exercise” ($p=0.022$), and the “fear of diabetes” ($p<0.001$). Analysis of
11 proportions showed significant increase in people adherent to medications ($p=0.001$)
12 and adherent to exercise ($p<0.001$), but a significant decrease in those adherent to
13 diet ($p<0.001$) (Table 2).
14
15
16
17
18
19
20
21
22
23
24

25 There was a significant increase ($p=0.014$) in the proportion of project participants
26 with optimal glycaemic control from 37.2% to 50.6%. Regardless of level of control,
27 HbA1c decreased in 60.4% of the participants (99/164), remained the same in 7.9%
28 and increased in 31.7% (58/164). Among those with reduced HbA1c, the average
29 reduction was -1.44 HbA1c percentage points (-15.7 mmol/mol); when combined with
30 those with unchanged HbA1c, the average reduction was -1.3 HbA1c percentage
31 points (-14.2 mmol/mol). Among those with increased HbA1c, the average increase
32 was +1.21 HbA1c percentage points (+13.2 mmol/mol).
33
34
35
36
37
38
39
40
41
42
43

44 Table 3 stratifies the pre- and post-implementation HbA1c values of the project
45 participants. Among those who have optimal pre-implementation HbA1c levels,
46 HbA1c decreased in 60.3% (41/68). HbA1c remained the same in 8.8% and
47 increased in 30.9% (21/68). The increase was marked in 5.9% reclassifying them to
48 have sub-optimal HbA1c levels post-implementation. Among the project participants
49 having sub-optimal pre-implementation HbA1c levels ($>7.0\%$ / $>53\text{mmol/mol}$), HbA1c
50 decreased in 60.4% (58/96) with 19.8% achieving good glycaemic control post-
51 implementation. HbA1c remained the same in 7.3% and increased in 32.3% (31/96).
52
53
54
55
56
57
58
59
60

1
2
3 The mean average changes were -2.16 HbA1c percentage points among those
4 whose HbA1c decreased and +1.60 HbA1c percentage points among those whose
5 HbA1c increased.
6
7
8
9

10
11 Results of analysis of the endpoints based on the changes in HbA1c categorized as
12 “increased” and “decreased/unchanged” are listed in Table 4. Overall values are
13 presented in Table 4a; values disaggregated by gender are listed in Table 4b. The
14 main differences between the groups “increased HbA1c” and “decreased/unchanged
15 HbA1c” are the significant increase in correct answers to the knowledge test
16 (p<0.001), increased ratings of positive attitude (p=0.013) and “perceived ability to
17 control blood glucose” (p=0.004), and the increased proportion of people adherent to
18 medication (p=0.001) in favor of those whose glycemia improved. There is a
19 significant increase in the ratings of fear (p=0.010), positive and negative
20 attitudes(p=0.008; 0.009), and the perceived ability to control blood glucose
21 (p=0.007) among the male participants whose glycemia improved, which was not
22 observed among the female participants. Mann-Whitney test revealed significant
23 difference in gender (p=0.042), duration of diabetes (p=0.001), and the change in the
24 “perceived ability to control blood glucose” (p=0.028) between those with
25 “decreased/unchanged HbA1c” against “increased HbA1c”.
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43

44 Bivariate logistic regression of correlates for improved glycemia identified the male
45 gender (p=0.049), duration of diabetes >10years (p=0.001), increased fear of
46 diabetes (p=0.050), increased perceived ability to control blood glucose (p=0.030),
47 and better adherence to diet suitable to diabetes (p=0.049) as having an alpha of
48 ≤ 0.10 . These were entered in multivariate logistic regression to arrive at the final
49 model composed of the male gender as a positive correlate to improved glycemia
50 (p=0.034), and duration of diabetes >10 years (p=0.003) and increased fear of
51 diabetes (p=0.048) as strong negative correlates (Table 5).
52
53
54
55
56
57
58
59
60

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 to provide information on the disease process and its pathophysiology, and instructions on self-care behaviours which may cover diet, physical activity, monitoring, medications, risk reduction, problem solving, and coping.[26-29] 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 glycemic control, knowledge, selfcare behavior, and the psychological and behavioral aspects of selfcare. The settings, techniques, and types of interventions used in these DSME programs were diverse and involved a combination of a number of providers that included at least any 3 of the following: medical specialists, dietitians, psychologists, managers, and pharmacists aside from primary care physicians, nurses, and the occasional community-based health care workers.[13, 28-37] No specific structural variations seem to be constantly superior over others.

For the FiLDCare Project, one-on-one collaborative DSME/S sessions were conducted both 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-care. 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 standardizable 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

1
2
3 with chronic condition in self-care and decision making increases the likelihood of
4 adherence to the recommended plan of care.[38]
5
6
7

8
9 One year after full project implementation, significant improvements were noted: the
10 participants' level of diabetes-related knowledge, the perceptions of "ability to control
11 blood glucose" and "ability to adhere to diet and exercise regimens", and reported
12 adherence to medications and exercise increased. Adiposity/obesity as measured
13 through the WHR and waist circumference decreased. More than these, glycemic
14 control of the FiLDCare Project participants significantly improved. However, the fear
15 of diabetes increased and the "perceived support received from family and friends"
16 decreased, as did reported adherence to diet.
17
18
19
20
21
22
23
24

25 26 27 **Changes in glycemia and measures of obesity/adiposity**

28
29 The effects of DSME/S on clinical endpoints such as glycemia and obesity/adiposity
30 have been well-documented in the past.[13,14, 28-37] These were also observed in
31 our study. Overall, the noted reduction in HbA1c of the FiLDCare project participants
32 was significant. There was also a significant increase in the proportion of people with
33 optimal glycemic control. In depth analysis of the changes in HbA1c levels shows
34 reductions in HbA1c regardless of the level of pre-implementation glycemic control.
35
36 The proportion of people with reductions in HbA1c, whether among those with
37 optimal or with sub-optimal control, approached 60%, with higher reductions in
38 HbA1c levels among those classified to have sub-optimal control at baseline.
39
40 Significant changes in obesity/adiposity were noted through the WHR and the waist
41 circumference measurements, but not through the BMI. These reductions in the
42 indirect measures for obesity/adiposity were noted regardless of glycemic control.
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 on their abilities to perform self-care, i.e. ability to control blood glucose, ability to adhere to diet and exercise regimen. Positive feelings of self-efficacy may consequently lead them to perform and adhere to better self-care practices.[39] In our study, this could be construed as an increase in knowledge leading to increased perceived ability to control blood glucose and adhere to diet and exercise regimen, 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 diabetic diet consists of rather than a change in eating behavior; hence the decrease in the number answering “yes” in the post-implementation interview. Multivariate regression analysis identified increased fear as the lone modifiable correlate significantly associated with glycemic control. In this study, its effect on glycemia 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-care behavior.[40] 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 health care team. Such fear may have negatively influenced self-care behavior and other known and unknown factors that may have contributed to improved glycemic control.

1
2
3 The two other correlates significantly associated to improved glycemia are non-
4 modifiable. Nevertheless, this information may be used in tailoring DSME/S. In our
5 study, the female gender and those who have had diabetes for 10 years or more
6 were identified to be negatively correlated to improvements in glycemia.
7
8
9
10

11 12 13 14 15 **Gender**

16 Gender differences in glycemic control have been studied in the past with females
17 either having equal or poorer but not a superior glycemic control compared to
18 males.[41, 42] This may be partly attributed to differences in glucose metabolism and
19 homeostasis between sexes.[43] With regard to our study, we noted gender
20 differences in comparing some pre- and post-implementation attitude and perception
21 ratings. However, the male population in our sample is not substantial enough to
22 subject this to further and more rigorous statistical analysis. Thus, we can only
23 speculate how, in consonance with the theory of perceived self-efficacy, the increase
24 in knowledge, fear, and positive and negative attitudes in our male population may
25 positively affect perceived self-efficacy to control blood glucose, stimulate positive
26 self-care behavior, and thereby improve glycemia.
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42

43 **Duration of diabetes**

44 It has been observed that much of the instructions on diabetes care is given to the
45 person when the diagnosis is first made and there may be a need to re-train people
46 who have had diabetes for a number of years so as to maintain better glycemic
47 control.[44] However, it seems that in spite of DSME/S given to the whole cohort in
48 our study, glycemia still had the tendency to deteriorate in the subgroup of people
49 with known diabetes for >10 years. Other factors undoubtedly influence this negative
50
51
52
53
54
55
56
57
58
59
60

1
2
3 correlation, aside from the need of re-training in people who have had diabetes for a
4
5 number of years.
6
7
8
9

10 **Conclusions**

11 This research has shown that some basic elements of DSME/S may be introduced
12 making use of pre-existing health care personnel and produce favorable results. The
13 provision of context-adapted DSME/S may improve diabetes-related knowledge,
14 some attitudes, perceptions and practices, adiposity/obesity, and glycemia of its
15 recipients. The FiLDCare Project may be implemented in other areas of the
16 Philippines to find out if it yields comparable outcomes. Other LMIC may draw
17 inspiration from this study to apply similar context-adapted measures to implement
18 DSME/S.
19
20
21
22
23
24
25
26
27
28
29

30 Explorations on ways by which to handle psychological aspects in general and
31 address fear of diabetes in particular in resource-constrained settings where a
32 complete professional health care team is unavailable would be useful.
33
34
35
36
37

38 Special attention may be needed in designing appropriate DSME/S for the female
39 gender and those who have been known to have diabetes for a number of years
40 now.
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

ACKNOWLEDGEMENTS

We thank the Belgian Directorate for Development Cooperation through the Institute of Tropical Medicine, Antwerp, for funding this research project.

We also thank Joris Menten of the Institute of Tropical Medicine, Antwerp, for the assistance in statistical analysis.

FOOTNOTES

Ethical considerations

This research was approved by the Institutional Review Boards of the University of Antwerp and the Institute of Tropical Medicine in Belgium (Belgian Reg. No. B30020109490), and the Ethics Committee of the Mariano Marcos Memorial Hospital and Medical Center in the Philippines. It was conducted with permission from the governments of the Province of Ilocos Norte, the City of Batac and the Municipality of Pagudpud and their respective health offices.

Conflict of interest statement

Neither of the authors has any financial competing interests regarding this research.

Authors' contributions

GMVK contributed to the design of the research, participated in data collection, did the statistical analysis and drafted the manuscript. GK provided substantial contributions in the concept and design, data analysis, and in the drafting of the manuscript. Both authors read and approved the final manuscript.

References

- 1 Peltonen M, Lindstrom J, Tuomilehto J. Towards the prevention of type 2 diabetes mellitus. In: by Puska P, Vartiainen E, Laatikainen T, Jousilahti P, Paavola M, eds. The North Karelia Project: from North Karelia to national action. Helsinki: Helsinki University Printing House 2009: 231-242.
- 2 The Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the diabetes prevention program outcomes study. *Lancet* 2009;374:1677-1686.
- 3 Perreault L, Kahn SE, Christophi CA, Knowler WC, Hamman RF. Regression from pre-diabetes to normal glucose regulation in the diabetes prevention program. *Diabetes Care* 2009;32:1503-1588.
- 4 World Health Organization. The Ljubljana charter on reforming health care. *BMJ* 1996;312:1664-1665.
- 5 International Diabetes Federation Clinical Guidelines Task Force. Global guideline for type 2 diabetes. Brussels: IDF 2012.
- 6 Standards Revision Committee of the International Diabetes Federation Consultative Section on Diabetes Education. International standards for diabetes education, 3rd ed. Brussels: IDF 2009.
- 7 Funnel MM, Brown TL, Childs BP, Haas LB, Hosey GM, Jensen B, Maryniuk M, Peyrot M, Piette JD, Reader D, Siminerio LM, Weinger K, Weiss MA. National standards for diabetes self-management education. *Diabetes Care* 2011;34:S89-96.
- 8 Dreeben O. Patient education in rehabilitation. London: Jones & Bartlett Publishers International 2010.
- 9 International Diabetes Federation. Diabetes Atlas, 5th ed. Brussels: IDF, 2013.
- 10 World Health Organization. Innovative care for chronic conditions: building blocks for action. Geneva: WHO 2002.

- 1
2
3 11 White paper. Ten leading causes of mortality in the Philippines 1982 - 2006.
4
5 <http://www.doh.gov.ph/node/198.html>. (accessed: 18 March 2014)
6
7
8 12 Norris SK, Engelgau MM, Venkat Narayan KM. Effectiveness of self-
9 management training in type 2 diabetes. *Diabetes Care* 2001;24:561-587.
10
11 13 Norris SL, Nichols PJ, Caspersen CJ, Glasgow RE, Engelgau MM, Jack L Jr,
12 Snyder SS, Carande-Kulis VG, Isham G, Garfield S, Briss P, McCulloch D &
13 the Task Force on Community Prevention Services. Increasing diabetes self-
14 management education in community settings: a systematic review. *Am J Prev*
15 *Med* 2002;22:39-66.
16
17 14 Grundy J, Healy V, Gorgolon L, Sandig E. Overview of devolution of health
18 services in the Philippines. *Rural and Remote (online)* 2003.
19
20 <http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=220>. (accessed: 18
21 March 2014)
22
23 15 Philips DR. Primary healthcare in the Philippines: banking on the barangays?
24 *Soc Sci Med* 1986;23:1105-1117.
25
26 16 Philippine National Statistics Office 2010 Census of Population and
27 Housing.Total Population by Province, City, Municipality, and Barangay as of
28 May 1, 2010, Ilocos Norte.
29
30 [http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos](http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos.pdf)
31 [s.pdf](http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos.pdf). (accessed 18 March 2014)
32
33 17 Annual calendar of activities of the Philippine Department of Health 2014.
34 http://www.doh.gov.ph/annual_calendar.html. (accessed: 18 March 2014)
35
36 18 Fitzgerald JT, Anderson RM, Funnell MM, Barr PA, Hiss RG, Hess GE, Davis
37 WK. The Reliability and Validity of a Brief Diabetes Knowledge Test. *Diabetes*
38 *Care* 1998;21(5):706–710.
39
40 19 Garcia AA, Villagomez ET, Brown SA, Kouzerkanani K, Hanes CL. The Starr
41 County Diabetes Education Study. *Diabetes Care* 2001;24:16-21.
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 20 Anderson RM, Fitzgerald JT, Funnell MM, Grupen LD. The third version of the
4 Diabetes Attitude Scale (DAS-3). *Diabetes Care* 1998;21:1403-1407.
5
6
7 21 Fitzgerald JT, Davis WK, Connell CM, Hess GE, Funnell MM, Hiss RG.
8 Development and validation of the Diabetes Care Profile. *Eval Health Prof*
9 1996;19:209-231.
10
11
12
13 22 World Health Organization. Global recommendations on physical activity for
14 health. Geneva: WHO 2010.
15
16
17 23 Stata/IC 11. Texas: StataCorp LP 2009.
18
19 24 American Diabetes Association. Standards of medical care in diabetes – 2013.
20 *Diabetes Care* 2013;36:S11-60.
21
22
23 25 DeFronzo RA. From the triumvirate to the ominous octet: a new paradigm for
24 the treatment of type 2 diabetes mellitus. *Diabetes* 2009;58:773-795.
25
26
27 26 American Association of Diabetes Educators. Guidelines for the practice of
28 diabetes self-management education and training. Chicago: American
29 Association of Diabetes Educators 2009.
30
31
32
33 27 Eigenmann C, Colagiuri R. Outcomes and indicators for diabetes education – a
34 national consensus position. Canberra: Diabetes Australia 2007.
35
36
37 28 Deakin TA, Cade JE, Williams R, Greenwood DC. Structured patient education:
38 the diabetes X-PERT programme makes a difference. *Diabet Med*
39 2006;23:944-954.
40
41
42
43 29 Davies MJ, Heller S, Skinner TC, Campbell MJ, Carey ME, Cradock S, Dallosso
44 HM, Daly H, Doherty Y, Eaton S, Fox C, Oliver L, Rantell K, Rayman G, Khunti
45 K and on behalf of the Diabetes Education and Self-management Education for
46 Ongoing and Newly Diagnosed Collaborative. Effectiveness of the diabetes
47 education and self-management for ongoing and newly diagnoses
48 (DESMOND) programme for people with newly diagnosed type 2 diabetes:
49 cluster randomised controlled trial. *BMJ* 2008;336:491-495.
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 30 Brown SA, Garcia AA, Kouzekanani K, Hanis CL. Culturally competent
4 diabetes self-management education for Mexican Americans: the Starr County
5 border health initiative. *Diabetes Care* 2002;25:259-268.
6
7
8
9 31 Kulzer B, Hermanns N, Reinecker H, Haak T. Effects of self-management
10 training in type 2 diabetes: a randomized, prospective trial. *Diabet Med*
11 2007;24:415-423.
12
13
14 32 McGowan P. The efficacy of diabetes patient education and self-management
15 education in type 2 diabetes. *Can J Diabetes* 2011;35:46-53.
16
17
18 33 Gary TL, Genkinger JM, Guallar E, Peyrot M, Brancati FL. Meta-analysis of
19 randomized educational and behavioral interventions in type 2 diabetes.
20
21
22
23
24
25 34 Fan L, Sidani S. Effectiveness of diabetes self-management education and
26 intervention elements: a meta-analysis. *Can J Diabetes* 2009;33:18-36.
27
28
29 35 Warsi A, Wang PS, LaValley MP, Avorn J, Solomon DH. Self-management
30 education programs in chronic disease: a systematic review and
31 methodological critique of the literature. *Arch Intern Med* 2004;164:1641-1649.
32
33
34 36 Ko S-H, Song S-R, Kim S-R, Lee J-M, Kim J-S, Shin J-H. Long term effects of
35 a structured intensive diabetes education program (SIDEPE) in patients with
36 type 2 diabetes mellitus – a 4-year follow-up study *Diabet Med* 2007;24:55-62.
37
38
39 37 Salinerio-Fort MA, Carrillo-de Santa Pau E, Arrieta-Blanco FJ, Abanades-
40 Herranz JC, Martin-Madrado C, Rodes-Soldevila B. Effectiveness of PRECEDE
41 model for health education on changes and level of control of HbA1c, blood
42 pressure, lipids, and body mass index in patients with type 2 diabetes mellitus.
43
44
45
46
47
48
49
50
51
52 38 Delamater AM. Improving patient adherence. *Clinical Diabetes* 2006;24:71-7.
53
54 39 Bandura A. Self efficacy: towards a unifying theory of behavioral change.
55
56
57
58
59
60

- 1
2
3 40 Di Battista AM, Hart TA, Greco L, Gloizer J. Type 2 diabetes among
4 adolescents: reduced diabetes self-care caused by social fear and fear of
5 hypoglycemia. *Diabetes Educator* 2009;35:465-475.
6
7
8
9 41 Eriksson BS, Rosenqvist U. Social support and glycemic control in non-insulin
10 dependent diabetes mellitus patients: gender differences. *Women & Health*
11 1993;20:59-70.
12
13 42 Gobl CS, Brannath W, Bozkurt L, Handisurya A, Anderwald C, Luger A, Krebs
14 M, Kautzky-Willer A, Bischof MG. Sex-specific differences in glycemic control
15 and cardiovascular risk factors in older patients with insulin-treated type 2
16 diabetes mellitus. *Gen Med* 2010;7:593-599.
17
18 43 Blaak E. Sex differences in the control of glucose homeostasis. *Curr Opin Clin*
19 *Nutr Metab Care* 2008;11:500-504.
20
21 44 Murata GH, Shah JH, Adam KD, Wendel CS, Bokhari SU, Solvas PA. Factors
22 affecting diabetes knowledge in type 2 diabetes veterans. *Diabetologia*
23 2003;46:1170-1178.
24
25 45 Delamater A. Clinical use of hemoglobin A1c to improve diabetes
26 management. *Clin Diabetes* 2006;24:6-8.
27
28 46 Pawson R, Tilley N. Realistic Evaluation. London: Sage Publications Ltd 1997.
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Demographics of people enrolled in the FiLDCare Project

		Male	Female	
		N=42 (25.6%)	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	0.5 – 2 years	85 (51.8%)	
		>2 – 10 years	53 (32.3%)	
		>10 years	26 (15.9%)	
Level of education (number of years in school)	0-6 years	43 (26.2%)		
	7-10 years	63 (38.4%)		
	>10 years	58 (35.4%)		

Table 2. Pre- and post-implementation values of measured endpoints, in medians and proportions

Variable	Overall, n=164				Male, n=42				Female, n=122			
	Before implementation	After implementation	P value	change	Before implementation	After implementation	P value	change	Before implementation	After implementation	P value	change
	Median values, (binomial interpolation of confidence intervals / interquartile range)	Median values, (binomial interpolation of confidence intervals / interquartile range)	Wilcoxon signed-rank test	Mean change	Median values, (binomial interpolation of confidence intervals / interquartile range)	Median values, (binomial interpolation of confidence intervals / interquartile range)	Wilcoxon signed-rank test	Mean change	Median values, (binomial interpolation of confidence intervals / interquartile range)	Median values, (binomial interpolation of confidence intervals / interquartile range)	Wilcoxon signed-rank test	Mean change
HbA1c, %	7.7 (7.2-8.2 / 6.5-10.4)	6.9 (6.8-7.5 / 6.2-9.3)	<0.001	-0.49	7.5 (6.7-8.7 / 6.3-10.7)	6.8 (6.2-7.7 / 6.1-8.7)	0.001	-0.92	7.8 (7.2-8.5 / 6.5-10.4)	7.2 (6.8-8.0 / 6.3-9.5)	0.057	-0.34
mmol/mol	61 (55-56 / 48-90)	52 (51-58 / 44-78)		-5.4	58 (50-72 / 45-93)	51 (44-61 / 43-72)		-10.1	62 (55-69 / 48-90)	55 (51-64 / 45-80)		-3.7
BMI, kg/m ²	23.7 (23.1-24.1 / 21.8-26.1)	23.3 (22.6-23.8 / 21.2-25.6)	0.075	-0.40	23.8 (22.8-24.7 / 22.0-25.8)	23.6 (21.9-24.7 / 21.2-25.1)	0.395	-0.37	23.6 (23.0-24.0 / 21.6-26.2)	23.2 (22.4-24.1 / 21.0-25.7)	0.122	-0.41
Waist circumference, in cm	85.0 (83.9-86.4 / 81.0-91.2)	83.0 (82.0-85.0 / 79.0-89.0)	0.007	-1.37	89.0 (84.3-91.5 / 81.0-94)	80.0 (83.0-89.9 / 81.0-94.0)	0.026	-2.09	84.0 (82.8-85.2 / 80.0-88.9)	82.8 (81.0-85.0 / 78.7-88.0)	0.054	-1.13
Waist-hip ratio	0.90 (0.89-0.91 / 0.87-0.95)	0.89 (0.88-0.90 / 0.85-0.92)	<0.001	-0.02	0.93 (0.90-0.95 / 0.89-0.96)	0.91 (0.88-0.93 / 0.87-0.95)	0.025	-0.03	0.90 (0.88-0.91 / 0.86-0.93)	0.88 (0.87-0.90 / 0.85-0.92)	0.001	-0.20
Knowledge, % correct answers	60.0 (60.0-65.0 / 50.0-75.0)	67.5 (65.0-70.0 / 60.0-75.0)	<0.001	+7.59	50.0 (50.0-64.3 / 45.0-70.0)	65.0 (60.0-70.0 / 60.0-75.0)	0.006	+9.52	62.5 (60.0-65.0 / 50.0-75.0)	70.0 (65.0-70.0 / 60.0-75.0)	<0.001	+6.93
Perceived fear of diabetes	4.0 (4.0-4.0 / 2.0-4.0)	4.0 (4.0-4.0 / 3.0- 5.0)	<0.001	+0.46	2.0 (2.0-4.0 / 1.0-4.0)	4.0 (3.0-4.0 / 2.0-5.0)	0.003	+0.81	4.0 (4.0-4.0 / 2.4-4.0)	4.0 (4.0-4.0 / 3.0-4.0)	0.018	+0.34
Positive attitude	3.4 (3.2-3.4 / 2.8-3.9)	3.4 (3.2-3.6 / 3.0- 4.0)	0.071	+0.14	3.2 (2.8-3.4 / 2.6-3.6)	3.5 (3.2-4.0 / 3.2-4.0)	0.025	+0.36	3.4 (3.2-3.6 / 2.8-4.0)	3.4 (3.2-3.6 / 3.0-3.8)	0.479	+0.07
Negative attitude	3.0 (2.8-3.4 / 2.2-4.0)	3.2 (3.0-3.4 / 2.6-3.8)	0.115	+0.15	2.4 (2.0-2.8 / 1.8-3.6)	3.0 (2.8-3.2 / 2.6-3.6)	0.027	+0.42	3.2 (2.8-3.6 / 2.4-4.0)	3.2 (3.0-3.5 / 2.6-3.8)	0.631	+0.06

Attitude towards self-care adherence	3.2 (3.0-3.5 / 2.8-3.8)	3.5 (3.2-3.5 / 3.0-4.0)	0.139	+0.13	3.0 (3.0-3.2 / 2.8-3.5)	3.4 (3.0-3.5 / 2.8-4.0)	0.087	+0.28	3.2 (3.2-3.5 / 2.0-5.0)	3.5 (3.3-3.5 / 3.0-4.0)	0.454	+0.08
Perceived ability to control blood glucose	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-5.0)	0.036	+0.24	3.0 (3.0-3.0 / 3.0-4.0)	4.0 (3.0-4.0 / 3.0-4.0)	0.016	+0.43	3.0 (3.0-4.0 / 2.8-4.0)	3.0 (3.0-4.0 / 3.0-5.0)	0.0279	+0.17
Perceived ability to control weight	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.0)	0.349	+0.12	3.0 (3.0-4.0 / 3.0-4.0)	3.5 (3.0-4.0 / 3.0-4.0)	0.289	+0.021	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.0)	0.649	+0.08
Perceived ability to adhere to diet and exercise regimens	4.0 (3.0-4.0 / 3.0-5.0)	4.0 (4.0-4.0 / 3.0-5.0)	0.022	+0.26	3.0 (3.0-4.0 / 3.0-4.0)	4.0 (3.0-4.0 / 3.0-5.0)	0.071	+0.35	4.0 (3.0-4.0 / 3.0-5.0)	4.0 (4.0-4.0 / 3.0-5.0)	0.107	+0.23
Perceived ability to handle feelings about diabetes	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.5)	0.653	-0.01	4.0 (3.0-4.0 / 3.0-4.0)	3.5 (3.0-4.0 / 3.0-5.0)	0.592	+0.17	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-3.3 / 3.0-4.0)	0.391	-0.07
Perceived support needs	5.0 (4.8-5.0 / 4.2-5)	4.8 (4.2-5.0 / 4.0-5.0)	0.193	+0.02	5.0 (4.7-5.0 / 4.3-5.0)	4.2 (4.0-5.0 / 4.0-5.0)	0.125	-0.13	5.0 (4.8-5.0 / 4.2-5.0)	5.0 (4.3-5.0 / 4.0-5.0)	0.593	+0.007
Perceived support received from family & friends	5.0 (5.0-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 3.8-4.8)	<0.001	-0.39	5.0 (4.9-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 3.8-4.3)	0.002	-0.52	5.0 (4.8-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 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%)

Table 3. Stratification of FiLDCare Project Participants based on pre-implementation and post-implementation levels of glycaemic control

		Pre-implementation						Total (post- implementation)
		Good control HbA1c<7%			Not in good control HbA1c>7%			
Change in HbA1c		decreased	increased	unchanged	decreased	increased	unchanged	
Post- implementation	Good control	41	17	6	19			83
	Not in good control		4		39	31	7	81
Total (pre-implementation)		41	21	6	58	31	7	164
		68			96			

Table 4a. Pre-implementation & post-implementation 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 endpoints among those with “Increased HbA1c” against “Decreased or Unchanged HbA1c”

Change in A1C	Increased HbA1c, n=52				Decreased/Unchanged HbA1c, n=112				P value Mann Whitney Test, Increased HbA1c vs Decreased / Unchanged HbA1c
	Pre	Post	P value	Change	Pre	Post	P value	Change	
	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	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/m ²	24.5	23.3	0.115	-0.72	23.5	23.2	0.281	-0.24	0.446
Waist circumference, cm	85	83	0.006	-2.32	84.5	83.9	0.140	-0.93	0.190
WHR	0.90	0.89	0.028	-0.01	0.90	0.89	0.001	-0.03	0.816
Knowledge test rating, %	65	65	0.060	+4.20	60	70	<0.001	+9.0	0.182
Perceived fear of diabetes	4.0	4.0	0.004	+0.69	4.0	4.0	0.024	+0.35	0.165
Positive attitude	3.3	3.4	0.441	+0.18	3.4	3.4	0.013	+0.13	0.787
Negative attitude	3.0	3.1	0.415	+0.23	3.0	3.2	0.164	+0.12	0.896
Attitude towards self- care adherence	3.1	3.4	0.967	+0.04	3.2	3.5	0.090	+0.17	0.379
Perceived ability to control blood glucose	3.0	3.0	0.516	-0.08	3.0	4.0	0.004	+0.38	0.028
Perceived ability to control weight	3.0	3.5	0.340	+0.17	3.0	3.0	0.618	+0.09	0.604
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	0.825
Perceived ability to handle feelings about diabetes	3.5	3.0	0.328	-0.17	3.0	3.0	0.870	+0.07	0.334
Perceived support needs	4.8	5.0	0.978	+0.16	5.0	4.6	0.123	-0.04	0.427
Perceived support received	4.8	4.0	0.035	-0.25	5.0	4.0	<0.001	-0.45	0.372
	N (proportion, %)		Test of proportions	Change n (%)	N (proportion, %)		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%)	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

Table 4b. Pre-implementation & post-implementation 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	Increased HbA1c, n=52								Decreased/Unchanged HbA1c, n=112							
	Male, n=8				Female, n=44				Male, n=34				Female, n=78			
Gender	Pre	Post	P value	Change	Pre	Post	P value	Change	Pre	Post	P value	Change	Pre	Post	P value	Change
	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	Mean change	Median		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 5. Results of logistic regression analysis of improved glycemia: Correlates with $\alpha \leq 0.10$ identified on bivariate regression analysis of categorical variables and the final model with the significant correlates ($\alpha \leq 0.05$) of improved glycemia identified on multivariate regression.

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

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract - YES (b) Provide in the abstract an informative and balanced summary of what was done and what was found - YES
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported - YES
Objectives	3	State specific objectives, including any prespecified hypotheses - YES
Methods		
Study design	4	Present key elements of study design early in the paper - YES
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection - YES
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up - YES <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed – NOT APPLICABLE <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable - YES
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group - YES
Bias	9	Describe any efforts to address potential sources of bias - YES
Study size	10	Explain how the study size was arrived at - YES
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why - YES
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding - YES (b) Describe any methods used to examine subgroups and interactions - YES (c) Explain how missing data were addressed - YES (d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed – NOT APPLICABLE <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses

Continued on next page

Results

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed - YES (b) Give reasons for non-participation at each stage - YES (c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders - YES (b) Indicate number of participants with missing data for each variable of interest – THERE WERE NO MISSING DATA (c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount) - YES
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time - YES <i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included - YES (b) Report category boundaries when continuous variables were categorized - YES (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses - YES

Discussion

Key results	18	Summarise key results with reference to study objectives - YES
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias - YES
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence - YES
Generalisability	21	Discuss the generalisability (external validity) of the study results - YES

Other information

Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based - YES
---------	----	---

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

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

Journal:	<i>BMJ Open</i>
Manuscript ID:	bmjopen-2014-005317.R1
Article Type:	Research
Date Submitted by the Author:	10-Jul-2014
Complete List of Authors:	Ku, Grace Marie; Institute of Tropical Medicine, Public Health; Kegels, Guy; Institute of Tropical Medicine, Public Health
Primary Subject Heading:	Diabetes and endocrinology
Secondary Subject Heading:	Health services research, Diabetes and endocrinology
Keywords:	General diabetes < DIABETES & ENDOCRINOLOGY, EDUCATION & TRAINING (see Medical Education & Training), self-care development, knowledge, attitudes, perceptions, and self-management practices, low-and-middle-income countries

SCHOLARONE™
Manuscripts

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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

Grace Marie V. Ku, MD, MPH

Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium
gracemariekumd@yahoo.com

Guy Kegels, MD, PhD

Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium
gkegels@itg.be

Correspondence to:

Grace Marie Ku, MD, MPH
Arellano cor Otis Streets, #2 R. Ablan, Sr.
Batac City, Ilocos Norte
2906 PHILIPPINES
gracemariekumd@yahoo.com

Keywords: diabetes knowledge, attitudes, perceptions and self-management practices; diabetes self-management education and support; low-middle income country (Philippines)

Word count: 4901

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 glycemia 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 hemoglobin (HbA1c) were measured one year after full project implementation. Non-parametric and parametric descriptive and inferential statistics including logistic regression analysis were done.

Results. Complete data was collected from 164 participants. Improvements in glycemia, waist circumference, WHR, knowledge, some attitudes, and 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 glycemia improved. Significant differences between the subgroup whose HbA1c improved and those whose HbA1c deteriorated include male gender ($p=0.042$); shorter duration of diabetes ($p=0.001$) and increased perceived

1
2
3 ability to control blood glucose ($p=0.042$). Significant correlates to improved glycemia
4
5 were male gender ($OR=2.655;p=0.034$), duration of diabetes >10 years
6
7 ($OR=0.214;p=0.003$) and fear of diabetes ($OR=0.490;p=0.048$).
8
9

10
11 **Conclusion.** Context-adapted DSME/S introduced in resource-constrained settings
12
13 and making use of established human resources for health may improve knowledge,
14
15 attitudes, self-management practices, and glycemia of recipients. Further
16
17 investigations on addressing fear of diabetes and tailoring DSME/S to female
18
19 persons with diabetes and those who have had diabetes for a longer period of time
20
21 may help improve glycemia.
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study is one of the few conducted regarding:
 1. 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
 2. Analyzing changes in knowledge, attitudes, perceptions and self-management practices and demonstrating correlations with improving glycemia
- Logistic regression analysis identifies significant correlates towards improving glycemia.
- Comparative analysis of those with improvements in glycemia 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.

INTRODUCTION

1
2
3
4
5 It has been shown that early interventions prevent or delay the onset of diabetes
6 complications, and good control of the condition is a key.[1-3] Interventions may
7 involve assuring adequate access to diabetes care, medications, laboratory
8 examinations, and the support needed to ensure delivery of health services. Aside
9 from these, a vital role has to be played by the person with diabetes as the condition
10 affects and is affected by daily activities throughout life. People with diabetes must be
11 equipped and supported to manage their condition. The need for self-management
12 education and training for chronic conditions in general and diabetes in particular has
13 long been recognized as an integral part of good quality health care,[4, 5] and
14 diabetes self-management education and support (DSME/S) is already deemed a
15 right for all concerned.[6] Since more than 2 decades ago, self-management
16 education has slowly been incorporated into standards of chronic disease care in
17 high income countries.[7, 8]

18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34 The concepts of self-care in general and diabetes self-management in particular are
35 not yet fully embraced in low-to-middle income countries (LMIC). However, these
36 LMIC also need to utilize all possible opportunities to prevent and control diabetes:
37 DSME/S may be a cost-effective measure that may help control diabetes and prevent
38 its complications in these countries where 70% of the total global current cases of
39 diabetes occur[9] and where it affects men and women at younger ages.[10] The
40 need for such a shift is also a relevant issue in the Philippines where the leading
41 causes of mortality for the past 10 years have been chronic conditions[11] but public
42 health is still generally oriented to acute and infectious diseases.

43
44
45
46
47
48
49
50
51
52
53
54 Previous studies in high-income countries have demonstrated that self-management
55 education programs designed to increase knowledge and bring about behavior
56 change are successful in improving glycemia[12, 13]. A number of these studies
57
58
59
60

1
2
3 have explored factors that may be associated with glycemic control, which may be an
4 effect of the program (such as increased diabetes knowledge) or not (such as level of
5 education, gender and duration of diabetes) but there is a dearth of publications
6 demonstrating any relationships between changes in glycemia and specific attitudes
7 and perceptions related to diabetes, especially in LMIC.
8
9

10
11
12
13
14
15 Although a number of aspects in the provision of DSME/S require expertise, skills,
16 and specialized personnel that LMIC may not have the capacity to supply, there are
17 certain DSME/S activities that can be translated to low resource settings. We
18 hypothesized that integrating certain DSME/S activities in first line health systems of
19 LMIC can improve knowledge and attitudes of people with diabetes, which may
20 stimulate better self-management practices and improve glycemia as measured by a
21 decrease in glycosylated hemoglobin (HbA1c).
22
23
24
25
26
27
28
29

30
31 In the Philippines, we implemented the context-adapted chronic care model-based
32 First Line Diabetes Care (FiLDCare) Project where we organized primary care for
33 diabetes in two local government units. The project focused mainly on primary health
34 care providers and the people with a chronic condition, concentrating on decision
35 support to the healthcare workers, minor re-organization of the health service,
36 delivery system re-design and self-care development through DSME/S. The possible
37 effects of the FiLDCare Project DSME/S on the knowledge, attitudes, perceptions,
38 self-management practices, obesity/adiposity and glycemic control of people with
39 diabetes are explored in this paper.
40
41
42
43
44
45
46
47
48
49

50 51 **Background**

52 ***The Philippine public primary health care system***

53
54
55 Public health care in the Philippines was devolved in 1992. The responsibility of
56 providing basic health care services for the people was handed down to local
57
58
59
60

1
2
3 government units, specifically municipalities and cities.[14] A decade before health
4 care devolution, the country implemented a primary health care policy which created
5 a large cadre of community-based health workers locally called barangay (village)
6 health workers (BHW).[15] Organizationally, the BHW fall under the governance of
7 the barangay and are selected to work in their respective areas of residence;
8 functionally, they are under the local government health units (LGHU). A BHW is
9 assigned approximately 10-20 families, is responsible for dissemination of health
10 information and health promotion activities, and conducts other health-related
11 undertakings to any member of the families being attended to. At present, a typical
12 LGHU would be composed of one or more municipal or city health centers and a
13 number of barangay health stations, and would have at least one municipal/city
14 health officer, at least one nurse, several midwives, and the BHW.
15
16
17
18
19
20
21
22
23
24
25
26
27
28

29 Routinely, chronic condition-related activities in the LGHU are limited to informative
30 posters on stroke, high blood pressure, diabetes, chronic lung diseases, smoking
31 cessation, and the benefits of exercise and a healthy diet. There are also one-day
32 annual campaigns on specific conditions, healthy lifestyle, tobacco control, etc., as
33 programmed by the Department of Health.[16] Organized care aiming at self-
34 management education and support for chronic conditions is non-existent in most
35 LGHU. Before the presently reported FiLDCare project, this was also the case in the
36 study sites.
37
38
39
40
41
42
43
44
45
46
47

48 ***Diabetes in the Philippines***

49 The Philippines is predicted to be among the 10 countries worldwide with the highest
50 numbers of people with diabetes mellitus type 2 (type 2 DM) by 2030.[17] Based on
51 regular epidemiologic surveys conducted by the Philippine Food and Nutrition
52 Research Institute, the prevalence of “new” type 2 DM as tested by a single fasting
53 blood glucose (FBG) of ≥ 7.0 mmol/L increased from 3.4% in 2003 to 4.8% in 2008
54
55
56
57
58
59
60

1
2
3 together with an increase in the prevalence of known diabetes from 2.6% to
4
5 4.0%.[18,19] A rise in diabetes complications has also been noted. For renal
6
7 complications alone, it is seen that 55% of people with diabetes in the Philippines will
8
9 eventually develop kidney disease; in 2007 there was an increase of more than 2800
10
11 diabetic nephropathy patients requiring dialysis.[20] The rapidly increasing
12
13 prevalence of type 2 DM, and the poor control of disease progression and
14
15 emergence of complications only show that current case management of diabetes
16
17 mellitus in the Philippines is below optimum.
18
19
20

21 We previously conducted a cross-sectional KAP study on 549 people with diabetes
22
23 from three different urban and rural sites in the Philippines, exploring and
24
25 documenting the associations of diabetes knowledge and some attitudes and
26
27 perceptions with perceived self-efficacy and the self-management practices of
28
29 adherence to medications, diet and exercise and proper utilization of healthcare
30
31 services.[21] A study on the knowledge, attitudes, and practices of people with
32
33 diabetes in a single rural site, which concentrated on characterizing the respondents'
34
35 diabetes knowledge, beliefs in patient autonomy, self-monitoring of blood sugar, and
36
37 frequency of clinical consultations was published a few years earlier.[22] We were
38
39 not able to find any publications regarding longitudinal KAP studies conducted on
40
41 people with diabetes in the Philippines.
42
43
44
45

46 **METHODOLOGY**

47 This was a prospective quasi-experimental before-after multicenter study involving
48
49 two purposively selected LGHU and a cohort of people with diabetes, conducted from
50
51 May 2011 to February 2013. The intervention was a context-adapted chronic disease
52
53 care model-based DSME/S. The outcomes of interest were changes in diabetes
54
55 knowledge, attitudes, perceptions, practices, body mass index (BMI), waist
56
57 circumference, waist-hip ratio (WHR) and HbA1c levels of the project participants.
58
59
60

1
2
3
4
5 Selected LGHU staff including BHW participated in a 32 hours training workshop on
6 primary diabetes care and DSME/S, results of which will be discussed elsewhere.
7
8
9

10 **The study sites**

11
12 Batac (population=53,542 as of 2010[23]) is a non-highly urbanized component city
13 in the island of Luzon composed of 43 barangays with two government health
14 centers and their barangay health stations. Other health care services include a
15 tertiary-level Department of Health-operated hospital, a primary-level private hospital,
16 a number of private multi-specialty clinics and clinical laboratories, and several
17 private drugstores/pharmacies.
18
19
20
21
22
23
24
25
26

27 Pagudpud (population=21,877 as of 2010[23]), the northernmost settlement in Luzon,
28 is a rural municipality classified to be very low in economic development. Composed
29 of 16 barangays, it only has a basic government health center and barangay health
30 stations for health care. There are no laboratory facilities, nor any private clinics or
31 drugstores/pharmacies.
32
33
34
35
36
37
38
39

40 As in many LMIC, most healthcare expenditures are out-of-pocket.
41
42
43

44 **Inclusion / exclusion criteria**

45
46 The LGHU staff were requested to enrol people with diabetes from their localities to
47 the FiLDCare Project. Criteria for inclusion in the FiLDCare Project were: diagnosis of
48 type 2 diabetes, age \geq 20 years, and willingness to participate in the project. The
49 trained healthcare workers provided primary diabetes care and DSME/S to the
50 project participants.
51
52
53
54
55
56
57
58
59
60

1
2
3 Data gathered from the project participants were further screened for inclusion in
4 statistical analysis. Inclusion criteria for analysis were: completeness of interview
5 data, pre- and post-implementation HbA1c values and pre- and post-implementation
6 anthropometric measurements. Exclusion criteria were: pregnancy and a positive
7 medical history of anemia (sickle cell, iron deficiency), and end-stage renal disease.
8
9
10
11
12
13

14 **Interview of project participants (Diabetes knowledge, attitudes, perceptions** 15 **and practices)** 16

17
18 The principal investigator and/or trained field researchers, one of which was the
19 FiLDCare Project nurse, provided full project information and obtained written
20 informed consent from each of the participants. The researchers conducted one-on-
21 one interviews using a structured questionnaire inquiring on knowledge, attitudes,
22 perceptions and practices and took measurements for the BMI, waist circumference,
23 and WHR. They likewise tested for HbA1c making use of *A1CNow* (Bayer
24 HealthCare, Makati City, Philippines), a point-of-care test that conforms to the
25 National Glycohemoglobin Standardization Program protocol. Interviews and
26 measurements were done prior to and one year after the start of project
27 implementation. Knowledge was tested making use of a 20-question diabetes
28 knowledge test based on the Fitzgerald et al. Diabetes Knowledge Test[24] and the
29 Garcia et al. Diabetes Knowledge Questionnaire[25]. Questions on attitudes and
30 perceptions were adapted from the survey questionnaires of the University of
31 Michigan Diabetes Research and Training Center.[26, 27] The attitude and
32 perception questions were formulated as statements and made use of a Likert scale
33 for answers, with 1 (“never”) as the lowest and 5 (“always”) as the highest rating.
34
35 Negative and positive attitudes were measured separately. A straight statement on
36 fear “I am afraid of my diabetes” was used to assess fear of diabetes. Perceived
37 support needs and support received were directed towards support a person with
38 diabetes needs and receives from family and friends. Questions on perceived
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 support attitudes probed the perceptions of how a person with diabetes is being
4 treated, accepted and supported by family and friends. The internal reliability
5 consistency of these sets of questions were previously tested in our cross-sectional
6 KAP study, with Cronbach's alpha of 0.72-0.94.[21] Questions on medication
7 adherence inquired on medications prescribed by healthcare providers and if the
8 respondents were taking the right medications at the right dosages at the right time;
9 these were transposed to "no" or "yes" answers and summarized as "no" if any of the
10 questions were answered with "no" and "yes" if all the questions were answered with
11 "yes". The question on diet adherence was answerable by "no", "sometimes", or
12 "yes/always"; these answers were transformed to "not/sometimes adherent" and
13 "yes/fully adherent". For exercise, questions were asked on the type of exercise
14 done, frequency, and duration; the answers were then transformed to "no" or "yes"
15 based on the criteria of doing 150 minutes of moderate-intensity aerobic physical
16 activity or at least 75 minutes of vigorous-intensity aerobic physical activity
17 throughout the week.[28] Medical records were reviewed for any co-morbid illnesses.
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35

36 **FiLDCare Project DSME/S strategy**

37 One-on-one diabetes self-management education (DSME) was initiated either by the
38 city/municipal health officer or the LGHU nurse, assisted by the principal investigator
39 and/or the FiLDCare Project nurse during consultations at the government health
40 unit. Consultations and the concomitant DSME sessions were done at least once
41 every three months. The DSME sessions focused on: information on diabetes and
42 diabetes medications, adoption of self-care behavior, gaining control over the
43 condition through problem solving skills, and goal setting. DSME was conducted in a
44 conversational and interactive manner, embedded in the clinical consultation.
45
46 Duration of the initial DSME session ranged from 20 to 30 minutes and the
47 succeeding sessions from 5 to 15 minutes. Written materials on healthy eating,
48 exercise, and glycemic goals were given out during the sessions. Community-based
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 diabetes self-management support (DSMS) was continued by the BHW and the
4
5 midwives. DSMS concentrated more on behavioral support with reinforcement of
6
7 self-management (taking medications, diet, exercise and foot care) and problem
8
9 solving. DSMS was provided informally through home visits where the BHW would
10
11 drop by the house of the person with diabetes and introduce pieces of information on
12
13 diabetes and diabetes care in the conversation. Also, DSMS sessions were
14
15 conducted in the barangay health stations where the BHW and midwives would be
16
17 found on specific days two to four times a month and where people with diabetes
18
19 could go if and when they had any questions or would want to talk to these
20
21 healthcare workers. DSMS was provided at least once a month. The frequency and
22
23 duration of DSME/S depended primarily on the demand of the person with diabetes.
24
25 The DSME/S approach was collaborative and interactive rather than rigidly
26
27 structured. After the opening DSME where the different aspects for self-management
28
29 were discussed, the opinion and choices of the person with diabetes on the topics to
30
31 be tackled in succeeding DSME/S sessions were considered. Active listening skills
32
33 (introduced in the initial training workshop) were employed.
34
35
36
37

38 **Statistics**

39
40 Statistical analyses were done making use of the statistical package Stata/IC version
41
42 11.0.[29] Wilcoxon signed-rank test was used to compare the pre- and post-
43
44 implementation median values of the outcomes. Test of proportions was used to
45
46 compare the pre- and post- implementation proportions of people adherent to
47
48 medications, diet and exercise and people with good glycemic control.
49
50

51
52 Comparisons of collected demographic data and the changes in measured endpoints
53
54 were done using the stratifications “decreased/unchanged HbA1c” and “increased
55
56 HbA1c; “in good glycemic control” and “not in good glycemic control” on both pre-
57
58 and post-implementation determinations; and “in good glycemic control” on the pre-
59
60

1
2
3 implementation and “in good glycemic control” on the post-implementation
4
5 determination. Mann-Whitney test was used for the collected demographic data and
6
7 two independent samples T-test was used for the computed changes in the
8
9 measured outcomes.

10
11
12
13 Logistic regression analysis was done using “decreased/unchanged HbA1c” against
14
15 “increased HbA1c” to determine significant correlates in improving glycemic control.
16
17 Independent variables were transformed into categorical variables. Bivariate logistic
18
19 regression was initially done. An alpha of 0.10 was used as the cut-off to consider for
20
21 multivariate logistic regression. Multivariate logistic regression of independent
22
23 variables with alpha of 0.05 or less was done and variables with an alpha>0.05 were
24
25 removed in a stepwise fashion. The remaining variables having an alpha of ≤ 0.05
26
27 were considered statistically significant correlates.
28
29

30 31 **Definitions**

32
33 Good control of diabetes was defined as having HbA1c $\leq 7.0\%$ ($\leq 53\text{mmol/mol}$).[30]
34
35 This cut-off was considered as the optimal level in both pre-implementation and post-
36
37 implementation determinations.
38
39

40
41 For the classification of changes in HbA1c pre- and post-implementation, it should be
42
43 noted that, without any interventions, the natural history of diabetes is deterioration of
44
45 glycemic control through time.[31] Unchanged HbA1c levels may thus be viewed as a
46
47 favorable result. Following this logic, unchanged HbA1c levels were grouped with
48
49 decreased HbA1c levels against those with increased HbA1c levels.
50
51

52
53 Post-implementation changes in ratings were determined by subtracting pre-
54
55 implementation ratings from the post-implementation values. No and negative
56
57
58
59
60

1
2
3 changes were grouped together against positive changes to create categorical
4
5 variables. Increase was defined as a positive change.
6
7

8
9 Changes in adherence were classified as “did not deteriorate/improved” and
10
11 “deteriorated/did not improve”. The classification “did not deteriorate/improved”
12
13 includes those who reported to be adherent in both pre- and post-implementation
14
15 interviews or who reported to be not adherent in the pre-implementation interview but
16
17 became adherent post-implementation. Those who reported to be not adherent in the
18
19 post-implementation interview were classified “deteriorated/did not improve”
20
21 regardless of adherence reported in the pre-implementation interview.
22
23

24
25 Duration of diabetes was categorized as ≤ 2 years, >2-10 years, and >10years;
26
27 education was categorized based on the number of years in school, namely 0-6
28
29 years, 7-10 years and >10 years.
30
31

32 33 **RESULTS**

34
35 A total of 203 people with diabetes were enrolled to the FiLDCare Project; 134 in
36
37 Batac City and 69 in Pagudpud. Statistical analysis was conducted on data collected
38
39 from 164 (80.8%) participants, 108 in Batac City and 56 in Pagudpud. Of the 39
40
41 participants whose data were not included in the statistical analysis, five refused any
42
43 A1C testing from the outset, four died, eight migrated, two refused post-
44
45 implementation interview, and 20 refused any further A1C testing. None were found
46
47 to have any of the exclusion criteria for statistical analysis stated. Demographic data
48
49 of the project participants are listed in Table 1.
50
51

52 53 **Baseline results**

54
55 In the pre-implementation phase, 68 (41.5%) of the study participants had good
56
57 glycemic control. Statistical analyses of the baseline data did not identify any
58
59
60

1
2
3 significant differences between those in “good glycemic control” and those “not in
4
5 good glycemic control” in any of the variables measured during the pre-
6
7 implementation interview.
8
9

10 11 **Post-implementation results**

12
13 Post-implementation data showed an increase in the number of study participants
14
15 with good glycemic control (n=83, 50.6%). However, aside from age (median age, in
16
17 good control=59, not in good control=55; p=0.010), no other significant differences in
18
19 the endpoints measured post-implementation were noted among those with “good
20
21 glycemic control” against those “not in good glycemic control”.
22
23

24 25 **Changes in measured endpoints**

26
27 A year after full implementation, analysis of the median values showed significant
28
29 decrease in the HbA1c (p<0.001), waist circumference (p=0.007), WHR (p<0.001),
30
31 and the “perceived support received from family and friends” (p<0.001). Significant
32
33 increases were noted in the correct answers to the knowledge test (p<0.001), the
34
35 “perceived ability to control blood glucose” (p=0.036), the “perceived ability to adhere
36
37 to diet and exercise” (p=0.022), and the “fear of diabetes” (p<0.001). Analysis of
38
39 proportions showed significant increase in people adherent to medications (p=0.001)
40
41 and adherent to exercise (p<0.001), but a significant decrease in those adherent to
42
43 diet (p<0.001) (Table 2).
44
45

46
47
48 There was a significant increase (p<0.001) in the proportion of project participants
49
50 with optimal glycemic control from 41.5% to 50.6%. Regardless of level of control,
51
52 HbA1c decreased in 60.4% of the participants (99/164), remained the same in 7.9%
53
54 (13/164) and increased in 31.7% (52/164). Among those with reduced HbA1c, the
55
56 average reduction was -1.44 HbA1c percentage points (-15.7 mmol/mol); when
57
58 combined with those with unchanged HbA1c, the average reduction was -1.3 HbA1c
59
60

1
2
3 percentage points (-14.2 mmol/mol). Among those with increased HbA1c, the
4
5 average increase was +1.21 HbA1c percentage points (+13.2 mmol/mol).
6
7

8
9 Table 3 stratifies the pre- and post-implementation HbA1c values of the project
10
11 participants. Among those who had optimal pre-implementation HbA1c levels, HbA1c
12
13 decreased in 60.3% (41/68), remained the same in 8.8% and increased in 30.9%
14
15 (21/68). The increase was marked in 5.9% (4/68) reclassifying them to have sub-
16
17 optimal HbA1c levels post-implementation. Among the project participants having
18
19 sub-optimal pre-implementation HbA1c levels (>7.0% / >53mmol/mol), HbA1c
20
21 decreased in 60.4% (58/96) with 19.8% achieving good glycaemic control post-
22
23 implementation. HbA1c remained the same in 7.3% and increased in 32.3% (31/96).
24
25 The mean average changes were -2.16 HbA1c percentage points (-23.6mmol/mol)
26
27 among those whose HbA1c decreased and +1.60 HbA1c percentage points
28
29 (+17.5mmol/mol) among those whose HbA1c increased. There were no reported
30
31 incidences of hypoglycemia among the study participants.
32
33

34
35 Analysis of the changes in measured endpoints based on glycaemic control prior to
36
37 and one year after project implementation showed a higher decrease in HbA1c
38
39 ($p=0.016$) and an increase in positive attitude ratings ($p=0.006$) among those with
40
41 pre-implementation HbA1c>7%. As expected, a decrease in HbA1c was noted
42
43 among those classified to be "in good glycaemic control" in the post-implementation
44
45 determination ($p=0.033$). The decrease in HbA1c among those "in good glycaemic
46
47 control" post-implementation was significantly higher than the decrease in HbA1c
48
49 among those "in good glycaemic control" pre-implementation ($p<0.001$). None of the
50
51 other measured changes in endpoints showed statistically significant differences
52
53 according to pre- and post-implementation glycaemic control status (Table 4).
54
55
56
57
58
59
60

1
2
3 Wilcoxon signed-rank test showed a significant difference in gender ($p=0.042$),
4
5 duration of diabetes ($p=0.005$), and the change in the “perceived ability to control
6
7 blood glucose” ($p=0.034$) between those with “decreased/unchanged HbA1c” against
8
9 “increased HbA1c”. Results of analysis of the endpoints based on the changes in
10
11 HbA1c are listed in Table 5. Overall values are presented in Table 5a. Since logistic
12
13 regression showed a significant difference in gender associated with improved
14
15 glycemia, values were disaggregated by gender as listed in Table 5b. The main
16
17 differences between the groups “increased HbA1c” and “decreased/unchanged
18
19 HbA1c” are the significant increase in correct answers to the knowledge test
20
21 ($p<0.001$), increased ratings of positive attitude ($p=0.013$) and “perceived ability to
22
23 control blood glucose” ($p=0.004$), and the increased proportion of people adherent to
24
25 medication ($p=0.001$) in favor of those whose glycemia improved. There is a
26
27 significant increase in the ratings of fear ($p=0.010$), positive and negative
28
29 attitudes ($p=0.008$; 0.009), and the perceived ability to control blood glucose
30
31 ($p=0.007$) among the male participants whose glycemia improved, which was not
32
33 observed among the female participants.
34
35

36
37 Bivariate logistic regression of correlates for improved glycemia identified the male
38
39 gender ($p=0.049$), duration of diabetes >10 years ($p=0.001$), increased fear of
40
41 diabetes ($p=0.050$), increased perceived ability to control blood glucose ($p=0.030$),
42
43 and better adherence to diet suitable to diabetes ($p=0.049$) as having an alpha of
44
45 ≤ 0.10 . These were entered in multivariate logistic regression to arrive at the final
46
47 model composed of the male gender as a positive correlate to improved glycemia
48
49 ($p=0.034$), and duration of diabetes >10 years ($p=0.003$) and increased fear of
50
51 diabetes ($p=0.048$) as strong negative correlates (Table 6).
52
53
54
55
56
57
58
59
60

DISCUSSION

1
2
3
4
5 Patient education has evolved through the years from merely informing patients
6
7 regarding their illnesses to involving them in the care of their conditions, especially in
8
9 chronic cases.[9] In diabetes, usual self-management education activities aim to
10
11 provide information on the disease process and its pathophysiology, and instructions
12
13 on self-management behavior which may cover diet, physical activity, monitoring,
14
15 medications, risk reduction, problem solving, and coping.[32-35] Several published
16
17 individual articles and meta-analyses of trials evaluating the effectiveness of DSME
18
19 have demonstrated the efficacy of DSME for people with diabetes in terms of
20
21 improvements in glycemic control, knowledge, self-management behavior, and the
22
23 psychological and behavioral aspects of self-management. The settings, techniques,
24
25 and types of interventions used in these DSME programs were diverse and involved
26
27 a combination of a number of providers that included at least any 3 of the following:
28
29 medical specialists, dietitians, psychologists, managers, and pharmacists aside from
30
31 primary care physicians, nurses, and the occasional community-based health care
32
33 workers. [13, 34-43] No specific structural variations seem to be constantly superior
34
35 over others.
36
37
38

39 For the FiLDCare Project, one-on-one collaborative DSME/S sessions were
40
41 conducted both in a clinical and a community setting, and aimed mainly to provide
42
43 information and basic knowledge on diabetes, and instructions and reminders for
44
45 diabetes self-management. The project made use of existing LGHU staff and took
46
47 advantage of the large cadre of BHW (In the Philippines, these community workers
48
49 are generally highly educated), shifting tasks that were standardizable and required
50
51 less expertise, so as not to overburden the LGHU physician and nurse. Furthermore,
52
53 selfcare development actively involved the person with diabetes. Actively involving
54
55 the person with chronic condition in self-management and decision making increases
56
57 the likelihood of adherence to the recommended plan of care.[44]
58
59
60

1
2
3
4
5 One year after full project implementation, significant improvements were noted: the
6 participants' level of diabetes-related knowledge, the perceptions of "ability to control
7 blood glucose" and "ability to adhere to diet and exercise regimens", and reported
8 adherence to medications and exercise increased. Adiposity/obesity as measured
9 through the WHR and waist circumference decreased. More than these, glycemic
10 control of the FiLDCare Project participants significantly improved. However, the fear
11 of diabetes increased and the "perceived support received from family and friends"
12 decreased, as did reported adherence to diet.
13
14
15
16
17
18
19
20
21
22

23 **Changes in glycemia and measures of obesity/adiposity**

24 The effects of DSME/S on clinical endpoints such as glycemia and obesity/adiposity
25 have been well-documented in the past.[13,14, 34-43] These were also observed in
26 our study. Overall, the noted reduction in HbA1c of the FiLDCare project participants
27 was significant. There was also a significant increase in the proportion of people with
28 optimal glycemic control. In depth analysis of the changes in HbA1c levels shows
29 reductions in HbA1c regardless of the level of pre-implementation glycemic control.
30 The proportion of people with reductions in HbA1c, whether among those with
31 optimal or with sub-optimal control, approached 60%, with higher reductions in
32 HbA1c levels among those classified to have sub-optimal control at baseline.
33 Significant changes in obesity/adiposity were noted through the WHR and the waist
34 circumference measurements, but not through the BMI. These significant reductions
35 in the indirect measures for obesity/adiposity were noted regardless of glycemic
36 control.
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52

53 **Changes in knowledge, attitudes and perceptions**

54 Akin to aforementioned studies on DSME where changes in knowledge were
55 measured[12, 13], knowledge of the project participants increased. The increase in
56
57
58
59
60

1
2
3 knowledge may have increased perceptions of self-efficacy. Possessing the essential
4
5 knowledge about the condition and the care for the condition may increase the level
6
7 of confidence of people with diabetes in their selfcare abilities, i.e. ability to control
8
9 blood glucose, ability to adhere to diet and exercise regimen. Positive feelings of self-
10
11 efficacy may consequently lead them to perform and adhere to better self-
12
13 management practices.[45] In our study, this could be construed as an increase in
14
15 knowledge leading to increased perceived abilities to control blood glucose and to
16
17 adhere to diet and exercise regimen, leading to an increase in self-reported
18
19 adherence to medications and exercise of our project participants. The changes in
20
21 self-reported adherence to diet may have been an effect of the participants having
22
23 learned of the specific diet they should be adhering to, which they were taught during
24
25 the DSME/S sessions. The negative change noted could be attributable to their
26
27 change in perception of what a diet suitable for diabetes consists of rather than a
28
29 change in eating behavior; hence the decrease in the number answering “yes” in the
30
31 post-implementation interview. Another possible effect of the DSME/S sessions is the
32
33 recognition of things that have to be done for the condition which could trigger the
34
35 person to seek for social support in order to accomplish some of these. As the
36
37 person with the condition learns of the various activities to be undertaken for self-
38
39 care and self-management, previously perceived adequate support given by family
40
41 and friends may now be perceived as inadequate, hence the negative change in this
42
43 rating. Involvement of the family and friends in the DSME/S sessions was limited,
44
45 and strategies to include the people around the person with diabetes in future
46
47 DSME/S activities need to be developed further. Multivariate regression analysis
48
49 identified increased fear as the lone modifiable correlate significantly associated with
50
51 glycemic control. In this study, its effect on glycemia improvement was negative.
52
53 Although a number of health campaigns have made use of the fear factor, such may
54
55 not necessarily trigger a positive response; fear may bring about negative self-
56
57 management behavior.[46] Fear of diabetes as well as other psychological aspects
58
59
60

1
2
3 may have been inadequately addressed in the DSME/S sessions due to the limited
4 training and composition of the health care team. Such fear may have negatively
5 influenced self-management behavior and other known and unknown factors that
6
7 influenced self-management behavior and other known and unknown factors that
8
9 may have contributed to improved glycemic control.
10

11
12
13
14
15 The two other correlates significantly associated to improved glycemia are non-
16 modifiable. Nevertheless, this information may be used in tailoring DSME/S. In our
17 study, the female gender and duration of diabetes of 10 years or more were identified
18 to be negatively correlated to improvements in glycemia.
19
20
21
22
23

24 25 26 27 **Gender**

28
29 Gender differences in glycemic control have been studied in the past with females
30 either having equal or poorer but not a superior glycemic control compared to
31 males.[47, 48] This may be partly attributed to differences in glucose metabolism and
32 homeostasis between sexes.[49] With regard to our study, we noted gender
33 differences comparing some pre- and post-implementation attitude and perception
34 ratings. However, the male population in our sample is not substantial enough to
35 subject this to further and more rigorous statistical analysis. Thus, we can only
36 speculate how, in consonance with the theory of perceived self-efficacy, the increase
37 in knowledge, fear, and positive and negative attitudes in our male population may
38 positively affect perceived self-efficacy to control blood glucose, stimulate positive
39 self-management behavior, and thereby improve glycemia.
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 re-train people who have had diabetes for a number of years so as to maintain better glycemic control.[50] However, it seems that in spite of DSME/S given to the whole cohort in our study, glycemia 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 re-training 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 health care personnel and produce favorable results. The provision of context-adapted DSME/S may improve diabetes-related knowledge, some attitudes, perceptions and practices, adiposity/obesity, and glycemia 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 health care 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 now. Inclusion of and a more active participation of family and friends as well as other

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

For peer review only

ACKNOWLEDGEMENT

We thank Joris Menten of the Institute of Tropical Medicine, Antwerp, for the assistance in statistical analysis.

FOOTNOTES

Reporting guideline

This is a quasi-experimental study and no specific reporting guidelines are listed.

Ethical considerations

This research was approved by the Institutional Review Boards of the University of Antwerp and the Institute of Tropical Medicine in Belgium (Belgian Reg. No. B30020109490), and the Ethics Committee of the Mariano Marcos Memorial Hospital and Medical Center in the Philippines. It was conducted with permission from the governments of the Province of Ilocos Norte, the City of Batac and the Municipality of Pagudpud and their respective health offices.

Authors' contributions

GMVK contributed to the design of the research, participated in data collection, did the statistical analysis and drafted the manuscript. GK provided substantial contributions in the concept and design, data analysis, and in the drafting of the manuscript. Both authors read and approved the final manuscript.

Conflict of interest statement

Neither of the authors has any financial competing interests regarding this research.

Funding statement

This research project was funded by the Belgian Directorate for Development Cooperation through the Institute of Tropical Medicine, Antwerp.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Data sharing statement

Additional data may be obtained by sending an e-mail to
gracemariakumd@yahoo.com.

For peer review only

References

- 1 Peltonen M, Lindstrom J, Tuomilehto J. Towards the prevention of type 2 diabetes mellitus. In: by Puska P, Vartiainen E, Laatikainen T, Jousilahti P, Paavola M, eds. The North Karelia Project: from North Karelia to national action. Helsinki: Helsinki University Printing House 2009: 231-242.
- 2 The Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the diabetes prevention program outcomes study. *Lancet* 2009;374:1677-1686.
- 3 Perreault L, Kahn SE, Christophi CA, et al. Regression from pre-diabetes to normal glucose regulation in the diabetes prevention program. *Diabetes Care* 2009;32:1503-1588.
- 4 World Health Organization. The Ljubljana charter on reforming health care. *BMJ* 1996;312:1664-1665.
- 5 International Diabetes Federation Clinical Guidelines Task Force. Global guideline for type 2 diabetes. Brussels: IDF 2012.
- 6 Standards Revision Committee of the International Diabetes Federation Consultative Section on Diabetes Education. International standards for diabetes education, 3rd ed. Brussels: IDF 2009.
- 7 Funnel MM, Brown TL, Childs BP, et al. National standards for diabetes self-management education. *Diabetes Care* 2011;34:S89-96.
- 8 Dreeben O. Patient education in rehabilitation. London: Jones & Bartlett Publishers International 2010.
- 9 International Diabetes Federation. Diabetes Atlas, 5th ed. Brussels: IDF, 2013.
- 10 World Health Organization. Innovative care for chronic conditions: building blocks for action. Geneva: WHO 2002.
- 11 White paper. Ten leading causes of mortality in the Philippines 1982 - 2006. <http://www.doh.gov.ph/node/198.html>. (accessed: 18 March 2014)

- 1
2
3 12 Norris SK, Engelgau MM, Venkat Narayan KM. Effectiveness of self-
4 management training in type 2 diabetes. *Diabetes Care* 2001;24:561-587.
5
6
7 13 Norris SL, Nichols PJ, Caspersen CJ, et al. The Task Force on Community
8 Prevention Services. Increasing diabetes self-management education in
9 community settings: a systematic review. *Am J Prev Med* 2002;22:39-66.
10
11
12
13 14 Grundy J, Healy V, Gorgolon L, et al. Overview of devolution of health services
14 in the Philippines. *Rural and Remote (online)* 2003.
15
16 <http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=220>. (accessed: 18
17 March 2014)
18
19
20
21 15 Philips DR. Primary healthcare in the Philippines: banking on the barangays?
22 *Soc Sci Med* 1986;23:1105-1117.
23
24
25 16 Annual calendar of activities of the Philippine Department of Health 2014.
26
27 http://www.doh.gov.ph/annual_calendar.html. (accessed: 18 March 2014)
28
29
30 17 Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: estimates for
31 the year 2000 and projections for 2030. *Diabetes Care* 2004;27(5):1047-1053.
32
33
34 18 Philippine Food & Nutrition Research Institute. 6th National Nutrition and Health
35 Survey. Manila: Philippine Food & Nutrition Research Institute. 2003.
36
37
38 19 Philippine Food & Nutrition Research Institute. 7th National Nutrition and Health
39 Survey. Manila: Philippine Food & Nutrition Research Institute. 2008.
40
41
42
43 20 Renal Disease Control Program and the Philippine Society of Nephrologists.
44 Philippine Renal Disease Registry Annual Report. Quezon City: National Kidney
45 and Transplant Institute. 2011.
46
47
48
49 21 Ku GMV & Kegels G. Knowledge, attitudes and perceptions of people with type
50 2 diabetes as related to self-management practices: Results of a cross-
51 sectional study conducted in Luzon, Philippines. *Chronic Illness* 06/2014;
52
53
54
55
56 DOI:10.1177/1742395314538291.
57
58
59
60

- 1
2
3 22 Ardeña GJ, Paz-Pacheco E, Jimeno CA, et al. Knowledge, attitudes and
4 practices of persons with type 2 diabetes in a rural community: phase I of the
5 community-based diabetes self-management education (DSME) Program in
6 San Juan, Batangas, Philippines. *Diabet Res Clin Pract* 2010; 90:160–166.
7
8
9
10
11 23 Philippine National Statistics Office 2010 Census of Population and
12 Housing.Total Population by Province, City, Municipality, and Barangay as of
13 May 1, 2010, Ilocos Norte.
14 [http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos](http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos.pdf)
15 [s.pdf](http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos.pdf). (accessed 18 March 2014)
16
17
18
19
20
21 24 Fitzgerald JT, Anderson RM, Funnell MM et al. The Reliability and Validity of a
22 Brief Diabetes Knowledge Test. *Diabetes Care* 1998;21(5):706–710.
23
24
25 25 Garcia AA, Villagomez ET, Brown SA, et al. The Starr County Diabetes
26 Education Study. *Diabetes Care* 2001;24:16-21.
27
28
29 26 Anderson RM, Fitzgerald JT, Funnell MM, Grupen LD. The third version of the
30 Diabetes Attitude Scale (DAS-3). *Diabetes Care* 1998;21:1403-1407.
31
32
33 27 Fitzgerald JT, Davis WK, Connell CM, et al. Development and validation of the
34 Diabetes Care Profile. *Eval Health Prof* 1996;19:209-231.
35
36
37 28 World Health Organization.Global recommendations on physical activity for
38 health. Geneva: WHO 2010.
39
40
41 29 Stata/IC 11. Texas: StataCorp LP 2009.
42
43
44 30 American Diabetes Association. Standards of medical care in diabetes – 2013.
45 *Diabetes Care* 2013;36:S11-60.
46
47
48 31 DeFronzo RA. From the triumvirate to the ominous octet: a new paradigm for
49 the treatment of type 2 diabetes mellitus. *Diabetes* 2009;58:773-795.
50
51
52 32 American Association of Diabetes Educators. Guidelines for the practice of
53 diabetes self-management education and training. Chicago: American
54 Association of Diabetes Educators 2009.
55
56
57
58
59
60

- 1
2
3 33 Eigenmann C, Colagiuri R. Outcomes and indicators for diabetes education – a
4 national consensus position. Canberra: Diabetes Australia 2007.
5
6
7 34 Deakin TA, Cade JE, Williams R, et al. Structured patient education: the
8 diabetes X-PERT programme makes a difference. *Diabet Med* 2006;23:944-
9 954.
10
11
12
13 35 Davies MJ, Heller S, Skinner TC, et al. and on behalf of the Diabetes Education
14 and Self-management Education for Ongoing and Newly Diagnosed
15 Collaborative. Effectiveness of the diabetes education and self-management
16 for ongoing and newly diagnoses (DESMOND) programme for people with
17 newly diagnosed type 2 diabetes: cluster randomised controlled trial. *BMJ*
18 2008;336:491-495.
19
20
21
22
23
24
25 36 Brown SA, Garcia AA, Kouzekanani K, et al. Culturally competent diabetes
26 self-management education for Mexican Americans: the Starr County border
27 health initiative. *Diabetes Care* 2002;25:259-268.
28
29
30
31 37 Kulzer B, Hermanns N, Reinecker H, et al. Effects of self-management training
32 in type 2 diabetes: a randomized, prospective trial. *Diabet Med* 2007;24:415-
33 423.
34
35
36
37 38 McGowan P. The efficacy of diabetes patient education and self-management
38 education in type 2 diabetes. *Can J Diabetes* 2011;35:46-53.
39
40
41 39 Gary TL, Genkinger JM, Guallar E, et al. Meta-analysis of randomized
42 educational and behavioral interventions in type 2 diabetes. *Diabetes Educator*
43 2003;29:488-501.
44
45
46
47 40 Fan L, Sidani S. Effectiveness of diabetes self-management education and
48 intervention elements: a meta-analysis. *Can J Diabetes* 2009;33:18-36.
49
50
51 41 Warsi A, Wang PS, LaValley MP, et al. Self-management education programs
52 in chronic disease: a systematic review and methodological critique of the
53 literature. *Arch Intern Med* 2004;164:1641-1649.
54
55
56
57
58
59
60

- 1
2
3 42 Ko S-H, Song S-R, Kim S-R, et al. Long term effects of a structured intensive
4 diabetes education program (SIDEPE) in patients with type 2 diabetes mellitus –
5 a 4-year follow-up study *Diabet Med* 2007;24:55-62.
6
7
8
9 43 Salinerio-Fort MA, Carrillo-de Santa Pau E, Arrieta-Blanco FJ, et al.
10 Effectiveness of PRECEDE model for health education on changes and level of
11 control of HbA1c, blood pressure, lipids, and body mass index in patients with
12 type 2 diabetes mellitus. *BMC Public Health* 2011;11: 267.
13
14
15
16
17 44 Delamater AM. Improving patient adherence. *Clinical Diabetes* 2006;24:71-7.
18
19 45 Bandura A. Self efficacy: towards a unifying theory of behavioral change.
20 *Psychol Rev* 1977;84:191-215.
21
22
23 46 Di Battista AM, Hart TA, Greco L, et al. Type 2 diabetes among adolescents:
24 reduced diabetes self-care caused by social fear and fear of hypoglycemia.
25 *Diabetes Educator* 2009;35:465-475.
26
27
28
29 47 Eriksson BS, Rosenqvist U. Social support and glycemic control in non-insulin
30 dependent diabetes mellitus patients: gender differences. *Women & Health*
31 1993;20:59-70.
32
33
34
35 48 Gobl CS, Brannath W, Bozkurt L, et al. Sex-specific differences in glycemic
36 control and cardiovascular risk factors in older patients with insulin-treated type
37 2 diabetes mellitus. *Gen Med* 2010;7:593-599.
38
39
40
41 49 Blaak E. Sex differences in the control of glucose homeostasis. *Curr Opin Clin*
42 *Nutr Metab Care* 2008;11:500-504.
43
44
45
46 50 Murata GH, Shah JH, Adam KD, et al. Factors affecting diabetes knowledge in
47 type 2 diabetes veterans. *Diabetologia* 2003;46:1170-1178.
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Demographics of people enrolled in the FiLDCare Project

		Male	Female	
		N=42 (25.6%)	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	0.5 – 2 years	85 (51.8%)	
		>2 – 10 years	53 (32.3%)	
		>10 years	26 (15.9%)	
Level of education (number of years in school)	0-6 years	43 (26.2%)		
	7-10 years	63 (38.4%)		
	>10 years	58 (35.4%)		

Table 2. Pre- and post-implementation values of measured endpoints, in medians and proportions

Variable	Overall, n=164				Male, n=42				Female, n=122			
	Before implementation	After implementation	P value	change	Before implementation	After implementation	P value	change	Before implementation	After implementation	P value	change
	Median values, (binomial interpolation of confidence intervals / interquartile range)		Wilcoxon signed-rank test	Mean change	Median values, (binomial interpolation of confidence intervals / interquartile range)		Wilcoxon signed-rank test	Mean change	Median values, (binomial interpolation of confidence intervals / interquartile range)		Wilcoxon signed-rank test	Mean change
HbA1c, %	7.7 (7.2-8.2 / 6.5-10.4)	6.9 (6.8-7.5 / 6.2-9.3)	<0.001	-0.49	7.5 (6.7-8.7 / 6.3-10.7)	6.8 (6.2-7.7 / 6.1-8.7)	0.001	-0.92	7.8 (7.2-8.5 / 6.5-10.4)	7.2 (6.8-8.0 / 6.3-9.5)	0.057	-0.34
mmol/mol	61 (55-56 / 48-90)	52 (51-58 / 44-78)		-5.4	58 (50-72 / 45-93)	51 (44-61 / 43-72)		-10.1	62 (55-69 / 48-90)	55 (51-64 / 45-80)		-3.7
BMI, kg/m ²	23.7 (23.1-24.1 / 21.8-26.1)	23.3 (22.6-23.8 / 21.2-25.6)	0.075	-0.40	23.8 (22.8-24.7 / 22.0-25.8)	23.6 (21.9-24.7 / 21.2-25.1)	0.395	-0.37	23.6 (23.0-24.0 / 21.6-26.2)	23.2 (22.4-24.1 / 21.0-25.7)	0.122	-0.41
Waist circumference, in cm	85.0 (83.9-86.4 / 81.0-91.2)	83.0 (82.0-85.0 / 79.0-89.0)	0.007	-1.37	89.0 (84.3-91.5 / 81.0-94)	80.0 (83.0-89.9 / 81.0-94.0)	0.026	-2.09	84.0 (82.8-85.2 / 80.0-88.9)	82.8 (81.0-85.0 / 78.7-88.0)	0.054	-1.13
Waist-hip ratio	0.90 (0.89-0.91 / 0.87-0.95)	0.89 (0.88-0.90 / 0.85-0.92)	<0.001	-0.02	0.93 (0.90-0.95 / 0.89-0.96)	0.91 (0.88-0.93 / 0.87-0.95)	0.025	-0.03	0.90 (0.88-0.91 / 0.86-0.93)	0.88 (0.87-0.90 / 0.85-0.92)	0.001	-0.20
Knowledge, % correct answers	60.0 (60.0-65.0 / 50.0-75.0)	67.5 (65.0-70.0 / 60.0-75.0)	<0.001	+7.59	50.0 (50.0-64.3 / 45.0-70.0)	65.0 (60.0-70.0 / 60.0-75.0)	0.006	+9.52	62.5 (60.0-65.0 / 50.0-75.0)	70.0 (65.0-70.0 / 60.0-75.0)	<0.001	+6.93
Perceived fear of diabetes	4.0 (4.0-4.0 / 2.0-4.0)	4.0 (4.0-4.0 / 3.0-5.0)	<0.001	+0.46	2.0 (2.0-4.0 / 1.0-4.0)	4.0 (3.0-4.0 / 2.0-5.0)	0.003	+0.81	4.0 (4.0-4.0 / 2.4-4.0)	4.0 (4.0-4.0 / 3.0-4.0)	0.018	+0.34
Positive attitude	3.4 (3.2-3.4 / 2.8-3.9)	3.4 (3.2-3.6 / 3.0-4.0)	0.071	+0.14	3.2 (2.8-3.4 / 2.6-3.6)	3.5 (3.2-4.0 / 3.2-4.0)	0.025	+0.36	3.4 (3.2-3.6 / 2.8-4.0)	3.4 (3.2-3.6 / 3.0-3.8)	0.479	+0.07
Negative attitude	3.0 (2.8-3.4 / 2.2-4.0)	3.2 (3.0-3.4 / 2.6-3.8)	0.115	+0.15	2.4 (2.0-2.8 / 1.8-3.6)	3.0 (2.8-3.2 / 2.6-3.6)	0.027	+0.42	3.2 (2.8-3.6 / 2.4-4.0)	3.2 (3.0-3.5 / 2.6-3.8)	0.631	+0.06

Attitude towards self-care adherence	3.2 (3.0-3.5 / 2.8-3.8)	3.5 (3.2-3.5 / 3.0-4.0)	0.139	+0.13	3.0 (3.0-3.2 / 2.8-3.5)	3.4 (3.0-3.5 / 2.8-4.0)	0.087	+0.28	3.2 (3.2-3.5 / 2.0-5.0)	3.5 (3.3-3.5 / 3.0-4.0)	0.454	+0.08
Perceived ability to control blood glucose	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-5.0)	0.036	+0.24	3.0 (3.0-3.0 / 3.0-4.0)	4.0 (3.0-4.0 / 3.0-4.0)	0.016	+0.43	3.0 (3.0-4.0 / 2.8-4.0)	3.0 (3.0-4.0 / 3.0-5.0)	0.0279	+0.17
Perceived ability to control weight	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.0)	0.349	+0.12	3.0 (3.0-4.0 / 3.0-4.0)	3.5 (3.0-4.0 / 3.0-4.0)	0.289	+0.021	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.0)	0.649	+0.08
Perceived ability to adhere to diet and exercise regimens	4.0 (3.0-4.0 / 3.0-5.0)	4.0 (4.0-4.0 / 3.0-5.0)	0.022	+0.26	3.0 (3.0-4.0 / 3.0-4.0)	4.0 (3.0-4.0 / 3.0-5.0)	0.071	+0.35	4.0 (3.0-4.0 / 3.0-5.0)	4.0 (4.0-4.0 / 3.0-5.0)	0.107	+0.23
Perceived ability to handle feelings about diabetes	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.5)	0.653	-0.01	4.0 (3.0-4.0 / 3.0-4.0)	3.5 (3.0-4.0 / 3.0-5.0)	0.592	+0.17	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-3.3 / 3.0-4.0)	0.391	-0.07
Perceived support needs	5.0 (4.8-5.0 / 4.2-5)	4.8 (4.2-5.0 / 4.0-5.0)	0.193	+0.02	5.0 (4.7-5.0 / 4.3-5.0)	4.2 (4.0-5.0 / 4.0-5.0)	0.125	-0.13	5.0 (4.8-5.0 / 4.2-5.0)	5.0 (4.3-5.0 / 4.0-5.0)	0.593	+0.007
Perceived support received from family & friends	5.0 (5.0-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 3.8-4.8)	<0.001	-0.39	5.0 (4.9-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 3.8-4.3)	0.002	-0.52	5.0 (4.8-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 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%)

Table 3. Stratification of FiLDCare Project Participants based on pre-implementation and post-implementation levels of glycemc control

		Pre-implementation						Total (post- implementation)
		Good control HbA1c<7%			Not in good control HbA1c>7%			
Change in HbA1c		decreased	increased	unchanged	decreased	increased	unchanged	
Post- implementation	Good control HbA1c<7%	41	17	6	19			83
	Not in good control HbA1c>7%		4		39	31	7	81
Total (pre-implementation)		41	21	6	58	31	7	164
		68			96			

Table 4. Mean change (SD) of measured endpoints according to pre-implementation and post-implementation control of glycemia

Glycemic control	Pre-implementation (Baseline)			Post-implementation			Pre-implementation "in good control" vs post-implementation "in good control", P value
	In good control (n=68)	Not in good control (n=96)	P value	In good control (n=83)	Not in good control (n=81)	P value	
	Mean change, (SD)	Mean change, (SD)	Independent samples T-test	Mean change, (SD)	Mean change, (SD)	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	

Table 5a. Pre-implementation & post-implementation 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 endpoints 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
	Pre	Post	P value	Change	Pre	Post	P value	Change	
	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	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/m ²	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, %)		Test of proportions	Change n (%)	N (proportion, %)		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%)	

Table 5b. Pre-implementation & post-implementation 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	Increased HbA1c, n=52								Decreased/Unchanged HbA1c, n=112							
	Male, n=8				Female, n=44				Male, n=34				Female, n=78			
Gender	Pre	Post	P value	Change	Pre	Post	P value	Change	Pre	Post	P value	Change	Pre	Post	P value	Change
	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	Mean change	Median		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 6. Results of logistic regression analysis of improved glycemia: Correlates with $\alpha \leq 0.10$ identified on bivariate regression analysis of categorical variables and the final model with the significant correlates ($\alpha \leq 0.05$) of improved glycemia identified on multivariate regression.

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

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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

Grace Marie V. Ku, MD, MPH
Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium
gracemariekumd@yahoo.com

Guy Kegels, MD, PhD
Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium
gkegels@itg.be

Correspondence to:
Grace Marie Ku, MD, MPH
Arellano cor Otis Streets, #2 R. Ablan, Sr.
Batac City, Ilocos Norte
2906 PHILIPPINES
gracemariekumd@yahoo.com

Keywords: diabetes knowledge, attitudes, perceptions and self-management practices; diabetes self-management education and support; low-middle income country (Philippines)

Word count: 4901

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 glycemia 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 hemoglobin (HbA1c) were measured one year after full project implementation. Non-parametric and parametric descriptive and inferential statistics including logistic regression analysis were done.

Results. Complete data was collected from 164 participants. Improvements in glycemia, waist circumference, WHR, knowledge, some attitudes, and 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 glycemia improved. Significant differences between the subgroup whose HbA1c improved and those whose HbA1c deteriorated include male gender ($p=0.042$); shorter duration of diabetes ($p=0.001$) and increased perceived

1
2
3 ability to control blood glucose ($p=0.042$). Significant correlates to improved glycaemia
4
5 were male gender ($OR=2.655;p=0.034$), duration of diabetes >10 years
6
7 ($OR=0.214;p=0.003$) and fear of diabetes ($OR=0.490;p=0.048$).
8
9

10
11 **Conclusion.** Context-adapted DSME/S introduced in resource-constrained settings
12
13 and making use of established human resources for health may improve knowledge,
14
15 attitudes, self-management practices, and glycaemia of recipients. Further
16
17 investigations on addressing fear of diabetes and tailoring DSME/S to female
18
19 persons with diabetes and those who have had diabetes for a longer period of time
20
21 may help improve glycaemia.
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study is one of the few conducted regarding:
 1. 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
 2. Analyzing changes in knowledge, attitudes, perceptions and self-management practices and demonstrating correlations with improving glycemia
- Logistic regression analysis identifies significant correlates towards improving glycemia.
- Comparative analysis of those with improvements in glycemia 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.

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 recognized as an integral part of good quality health care,[4, 5] and diabetes self-management education and support (DSME/S) is already deemed a right for all concerned.[6] Since more than 2 decades ago, self-management education has slowly been incorporated into 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 utilize all possible opportunities to prevent and control diabetes: DSME/S may 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 public health is still generally oriented to acute and infectious diseases.

Previous studies in high-income countries have demonstrated that self-management education programs designed to increase knowledge and bring about behavior change are successful in improving glycemia[12, 13]. **A number of these studies**

1
2
3 have explored factors that may be associated with glycemic control, which may be an
4 effect of the program (such as increased diabetes knowledge) or not (such as level of
5 education, gender and duration of diabetes) but there is a dearth of publications
6 demonstrating any relationships between changes in glycemia and specific attitudes
7 and perceptions related to diabetes, especially in LMIC.
8
9
10
11
12

13
14
15 Although a number of aspects in the provision of DSME/S require expertise, skills,
16 and specialized personnel that LMIC may not have the capacity to supply, there are
17 certain DSME/S activities that can be translated to low resource settings. We
18 hypothesized that integrating certain DSME/S activities in first line health systems of
19 LMIC can improve knowledge and attitudes of people with diabetes, which may
20 stimulate better self-management practices and improve glycemia as measured by a
21 decrease in glycosylated hemoglobin (HbA1c).
22
23
24
25
26
27
28
29
30

31
32 In the Philippines, we implemented the context-adapted chronic care model-based
33 First Line Diabetes Care (FiLDCare) Project where we organized primary care for
34 diabetes in two local government units. The project focused mainly on primary health
35 care providers and the people with a chronic condition, concentrating on decision
36 support to the healthcare workers, minor re-organization of the health service,
37 delivery system re-design and self-care development through DSME/S. The possible
38 effects of the FiLDCare Project DSME/S on the knowledge, attitudes, perceptions,
39 self-management practices, obesity/adiposity and glycemic control of people with
40 diabetes are explored in this paper.
41
42
43
44
45
46
47
48
49
50

51 **Background**

52 ***The Philippine public primary health care system***

53
54
55 Public health care in the Philippines was devolved in 1992. The responsibility of
56 providing basic health care services for the people was handed down to local
57
58
59
60

1
2
3 government units, specifically municipalities and cities.[14] A decade before health
4 care devolution, the country implemented a primary health care policy which created
5 a large cadre of community-based health workers locally called barangay (village)
6 health workers (BHW).[15] Organizationally, the BHW fall under the governance of
7 the barangay and are selected to work in their respective areas of residence;
8 functionally, they are under the local government health units (LGHU). A BHW is
9 assigned approximately 10-20 families, is responsible for dissemination of health
10 information and health promotion activities, and conducts other health-related
11 undertakings to any member of the families being attended to. At present, a typical
12 LGHU would be composed of one or more municipal or city health centers and a
13 number of barangay health stations, and would have at least one municipal/city
14 health officer, at least one nurse, several midwives, and the BHW.

15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30 Routinely, chronic condition-related activities in the LGHU are limited to informative
31 posters on stroke, high blood pressure, diabetes, chronic lung diseases, smoking
32 cessation, and the benefits of exercise and a healthy diet. There are also one-day
33 annual campaigns on specific conditions, healthy lifestyle, tobacco control, etc., as
34 programmed by the Department of Health.[16] Organized care aiming at self-
35 management education and support for chronic conditions is non-existent in most
36 LGHU. Before the presently reported FiLDCare project, this was also the case in the
37 study sites.

38 ***Diabetes in the Philippines***

39
40
41
42
43
44
45
46
47
48
49
50 The Philippines is predicted to be among the 10 countries worldwide with the highest
51 numbers of people with diabetes mellitus type 2 (type 2 DM) by 2030.[17] Based on
52 regular epidemiologic surveys conducted by the Philippine Food and Nutrition
53 Research Institute, the prevalence of “new” type 2 DM as tested by a single fasting
54 blood glucose (FBG) of ≥ 7.0 mmol/L increased from 3.4% in 2003 to 4.8% in 2008

1
2
3 together with an increase in the prevalence of known diabetes from 2.6% to
4 4.0%.[18,19] A rise in diabetes complications has also been noted. For renal
5 complications alone, it is seen that 55% of people with diabetes in the Philippines will
6 eventually develop kidney disease; in 2007 there was an increase of more than 2800
7 diabetic nephropathy patients requiring dialysis.[20] The rapidly increasing
8 prevalence of type 2 DM, and the poor control of disease progression and
9 emergence of complications only show that current case management of diabetes
10 mellitus in the Philippines is below optimum.
11
12
13
14
15
16
17
18
19
20

21 We previously conducted a cross-sectional KAP study on 549 people with diabetes
22 from three different urban and rural sites in the Philippines, exploring and
23 documenting the associations of diabetes knowledge and some attitudes and
24 perceptions with perceived self-efficacy and the self-management practices of
25 adherence to medications, diet and exercise and proper utilization of healthcare
26 services.[21] A study on the knowledge, attitudes, and practices of people with
27 diabetes in a single rural site, which concentrated on characterizing the respondents'
28 diabetes knowledge, beliefs in patient autonomy, self-monitoring of blood sugar, and
29 frequency of clinical consultations was published a few years earlier.[22] We were
30 not able to find any publications regarding longitudinal KAP studies conducted on
31 people with diabetes in the Philippines.
32
33
34
35
36
37
38
39
40
41
42
43
44
45

46 **METHODOLOGY**

47 This was a prospective quasi-experimental before-after multicenter study involving
48 two purposively selected LGHU and a cohort of people with diabetes, conducted from
49 May 2011 to February 2013. The intervention was a context-adapted chronic disease
50 care model-based DSME/S. The outcomes of interest were changes in diabetes
51 knowledge, attitudes, perceptions, practices, body mass index (BMI), waist
52 circumference, waist-hip ratio (WHR) and HbA1c levels of the project participants.
53
54
55
56
57
58
59
60

1
2
3
4
5 Selected LGHU staff including BHW participated in a 32 hours training workshop on
6 primary diabetes care and DSME/S, results of which will be discussed elsewhere.
7
8
9

10 **The study sites**

11 Batac (population=53,542 as of 2010[23]) is a non-highly urbanized component city
12 in the island of Luzon composed of 43 barangays with two government health
13 centers and their barangay health stations. Other health care services include a
14 tertiary-level Department of Health-operated hospital, a primary-level private hospital,
15 a number of private multi-specialty clinics and clinical laboratories, and several
16 private drugstores/pharmacies.
17
18
19
20
21
22
23
24
25
26

27 Pagudpud (population=21,877 as of 2010[23]), the northernmost settlement in Luzon,
28 is a rural municipality classified to be very low in economic development. Composed
29 of 16 barangays, it only has a basic government health center and barangay health
30 stations for health care. There are no laboratory facilities, nor any private clinics or
31 drugstores/pharmacies.
32
33
34
35
36
37
38
39

40 As in many LMIC, most healthcare expenditures are out-of-pocket.
41
42
43

44 **Inclusion / exclusion criteria**

45 The LGHU staff were requested to enrol people with diabetes from their localities to
46 the FiLDCare Project. Criteria for inclusion in the FiLDCare Project were: diagnosis of
47 type 2 diabetes, age \geq 20 years, and willingness to participate in the project. The
48 trained healthcare workers provided primary diabetes care and DSME/S to the
49 project participants.
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Data gathered from the project participants were further screened for inclusion in
4 statistical analysis. Inclusion criteria for analysis were: completeness of interview
5 data, pre- and post-implementation HbA1c values and pre- and post-implementation
6 anthropometric measurements. Exclusion criteria were: pregnancy and a positive
7 medical history of anemia (sickle cell, iron deficiency), and end-stage renal disease.
8
9
10
11
12
13

14 **Interview of project participants (Diabetes knowledge, attitudes, perceptions** 15 **and practices)** 16

17
18 The principal investigator and/or trained field researchers, one of which was the
19 FiLDCare Project nurse, provided full project information and obtained written
20 informed consent from each of the participants. The researchers conducted one-on-
21 one interviews using a structured questionnaire inquiring on knowledge, attitudes,
22 perceptions and practices and took measurements for the BMI, waist circumference,
23 and WHR. They likewise tested for HbA1c making use of *A1CNow* (Bayer
24 HealthCare, Makati City, Philippines), a point-of-care test that conforms to the
25 National Glycohemoglobin Standardization Program protocol. Interviews and
26 measurements were done prior to and one year after the start of project
27 implementation. Knowledge was tested making use of a 20-question diabetes
28 knowledge test based on the Fitzgerald et al. Diabetes Knowledge Test[24] and the
29 Garcia et al. Diabetes Knowledge Questionnaire[25]. Questions on attitudes and
30 perceptions were adapted from the survey questionnaires of the University of
31 Michigan Diabetes Research and Training Center.[26, 27] The attitude and
32 perception questions were formulated as statements and made use of a Likert scale
33 for answers, with 1 (“never”) as the lowest and 5 (“always”) as the highest rating.
34
35 Negative and positive attitudes were measured separately. A straight statement on
36 fear “I am afraid of my diabetes” was used to assess fear of diabetes. Perceived
37 support needs and support received were directed towards support a person with
38 diabetes needs and receives from family and friends. Questions on perceived
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 support attitudes probed the perceptions of how a person with diabetes is being
4 treated, accepted and supported by family and friends. The internal reliability
5 consistency of these sets of questions were previously tested in our cross-sectional
6 KAP study, with Cronbach's alpha of 0.72-0.94.[21] Questions on medication
7 adherence inquired on medications prescribed by healthcare providers and if the
8 respondents were taking the right medications at the right dosages at the right time;
9 these were transposed to "no" or "yes" answers and summarized as "no" if any of the
10 questions were answered with "no" and "yes" if all the questions were answered with
11 "yes". The question on diet adherence was answerable by "no", "sometimes", or
12 "yes/always"; these answers were transformed to "not/sometimes adherent" and
13 "yes/fully adherent". For exercise, questions were asked on the type of exercise
14 done, frequency, and duration; the answers were then transformed to "no" or "yes"
15 based on the criteria of doing 150 minutes of moderate-intensity aerobic physical
16 activity or at least 75 minutes of vigorous-intensity aerobic physical activity
17 throughout the week.[28] Medical records were reviewed for any co-morbid illnesses.
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35

36 **FiLDCare Project DSME/S strategy**

37 One-on-one diabetes self-management education (DSME) was initiated either by the
38 city/municipal health officer or the LGHU nurse, assisted by the principal investigator
39 and/or the FiLDCare Project nurse during consultations at the government health
40 unit. Consultations and the concomitant DSME sessions were done at least once
41 every three months. The DSME sessions focused on: information on diabetes and
42 diabetes medications, adoption of self-care behavior, gaining control over the
43 condition through problem solving skills, and goal setting. DSME was conducted in a
44 conversational and interactive manner, embedded in the clinical consultation.
45
46 Duration of the initial DSME session ranged from 20 to 30 minutes and the
47 succeeding sessions from 5 to 15 minutes. Written materials on healthy eating,
48 exercise, and glycemic goals were given out during the sessions. Community-based
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 diabetes self-management support (DSMS) was continued by the BHW and the
4 midwives. DSMS concentrated more on behavioral support with reinforcement of
5 **self-management** (taking medications, diet, exercise and foot care) and problem
6
7 solving. DSMS was provided informally through home visits where the BHW would
8
9 drop by the house of the person with diabetes and introduce pieces of information on
10
11 diabetes and diabetes care in the conversation. Also, DSMS sessions were
12
13 conducted in the barangay health stations where the BHW and midwives would be
14
15 found on specific days two to four times a month and where people with diabetes
16
17 could go if and when they had any questions or would want to talk to these
18
19 healthcare workers. DSMS was provided at least once a month. The frequency and
20
21 duration of DSME/S depended primarily on the demand of the person with diabetes.
22
23 The DSME/S approach was collaborative and interactive rather than rigidly
24
25 structured. After the opening DSME where the different aspects for **self-management**
26
27 were discussed, the opinion and choices of the person with diabetes on the topics to
28
29 be tackled in succeeding DSME/S sessions were considered. Active listening skills
30
31 (introduced in the initial training workshop) were employed.
32
33
34
35
36
37

38 **Statistics**

39
40 Statistical analyses were done making use of the statistical package Stata/IC version
41
42 11.0.[29] Wilcoxon signed-rank test was used to compare the pre- and post-
43
44 implementation median values of the outcomes. Test of proportions was used to
45
46 compare the pre- and post- implementation proportions of people adherent to
47
48 medications, diet and exercise and people with good glycemic control.
49
50

51
52 **Comparisons of collected demographic data and the changes in measured endpoints**
53
54 **were done using the stratifications “decreased/unchanged HbA1c” and “increased**
55
56 **HbA1c; “in good glycemic control” and “not in good glycemic control” on both pre-**
57
58 **and post-implementation determinations; and “in good glycemic control” on the pre-**
59
60

1
2
3 implementation and “in good glycemic control” on the post-implementation
4
5 determination. Mann-Whitney test was used for the collected demographic data and
6
7 two independent samples T-test was used for the computed changes in the
8
9 measured outcomes.
10

11
12
13 Logistic regression analysis was done using “decreased/unchanged HbA1c” against
14
15 “increased HbA1c” to determine significant correlates in improving glycemic control.
16
17 Independent variables were transformed into categorical variables. Bivariate logistic
18
19 regression was initially done. An alpha of 0.10 was used as the cut-off to consider for
20
21 multivariate logistic regression. Multivariate logistic regression of independent
22
23 variables with alpha of 0.05 or less was done and variables with an alpha>0.05 were
24
25 removed in a stepwise fashion. The remaining variables having an alpha of ≤ 0.05
26
27 were considered statistically significant correlates.
28
29
30

31 Definitions

32
33 Good control of diabetes was defined as having HbA1c $\leq 7.0\%$ ($\leq 53\text{mmol/mol}$).[30]
34
35 This cut-off was considered as the optimal level in both pre-implementation and post-
36
37 implementation determinations.
38
39

40
41 For the classification of changes in HbA1c pre- and post-implementation, it should be
42
43 noted that, without any interventions, the natural history of diabetes is deterioration of
44
45 glycemic control through time.[31] Unchanged HbA1c levels may thus be viewed as a
46
47 favorable result. Following this logic, unchanged HbA1c levels were grouped with
48
49 decreased HbA1c levels against those with increased HbA1c levels.
50

51
52
53 Post-implementation changes in ratings were determined by subtracting pre-
54
55 implementation ratings from the post-implementation values. No and negative
56
57
58
59
60

1
2
3 changes were grouped together against positive changes to create categorical
4
5 variables. Increase was defined as a positive change.
6
7

8
9 **Changes in adherence were classified as “did not deteriorate/improved” and**
10
11 **“deteriorated/did not improve”. The classification “did not deteriorate/improved”**
12
13 **includes those who reported to be adherent in both pre- and post-implementation**
14
15 **interviews or who reported to be not adherent in the pre-implementation interview but**
16
17 **became adherent post-implementation. Those who reported to be not adherent in the**
18
19 **post-implementation interview were classified “deteriorated/did not improve”**
20
21 **regardless of adherence reported in the pre-implementation interview.**
22
23

24
25 Duration of diabetes was categorized as ≤ 2 years, >2-10 years, and >10years;
26
27 education was categorized based on the number of years in school, namely 0-6
28
29 years, 7-10 years and >10 years.
30
31

32 33 **RESULTS**

34
35 A total of 203 people with diabetes were enrolled to the FiLDCare Project; 134 in
36
37 Batac City and 69 in Pagudpud. Statistical analysis was conducted on data collected
38
39 from 164 (80.8%) participants, 108 in Batac City and 56 in Pagudpud. Of the 39
40
41 participants whose data were not included in the statistical analysis, five refused any
42
43 A1C testing from the outset, four died, eight migrated, two refused post-
44
45 implementation interview, and 20 refused any further A1C testing. None were found
46
47 to have any of the exclusion criteria for statistical analysis stated. Demographic data
48
49 of the project participants are listed in Table 1.
50
51

52 53 **Baseline results**

54
55 **In the pre-implementation phase, 68 (41.5%) of the study participants had good**
56
57 **glycemic control. Statistical analyses of the baseline data did not identify any**
58
59
60

1
2
3 significant differences between those in “good glyceemic control” and those “not in
4 good glyceemic control” in any of the variables measured during the pre-
5 implementation interview.
6
7
8
9

10 11 **Post-implementation results**

12
13 Post-implementation data showed an increase in the number of study participants
14 with good glyceemic control (n=83, 50.6%). However, aside from age (median age, in
15 good control=59, not in good control=55; p=0.010), no other significant differences in
16 the endpoints measured post-implementation were noted among those with “good
17 glyceemic control” against those “not in good glyceemic control”.
18
19
20
21
22
23

24 25 **Changes in measured endpoints**

26
27 A year after full implementation, analysis of the median values showed significant
28 decrease in the HbA1c (p<0.001), waist circumference (p=0.007), WHR (p<0.001),
29 and the “perceived support received from family and friends” (p<0.001). Significant
30 increases were noted in the correct answers to the knowledge test (p<0.001), the
31 “perceived ability to control blood glucose” (p=0.036), the “perceived ability to adhere
32 to diet and exercise” (p=0.022), and the “fear of diabetes” (p<0.001). Analysis of
33 proportions showed significant increase in people adherent to medications (p=0.001)
34 and adherent to exercise (p<0.001), but a significant decrease in those adherent to
35 diet (p<0.001) (Table 2).
36
37
38
39
40
41
42
43
44
45
46
47

48 There was a significant increase (p<0.001) in the proportion of project participants
49 with optimal glyceemic control from 41.5% to 50.6%. Regardless of level of control,
50 HbA1c decreased in 60.4% of the participants (99/164), remained the same in 7.9%
51 (13/164) and increased in 31.7% (52/164). Among those with reduced HbA1c, the
52 average reduction was -1.44 HbA1c percentage points (-15.7 mmol/mol); when
53 combined with those with unchanged HbA1c, the average reduction was -1.3 HbA1c
54
55
56
57
58
59
60

1
2
3 percentage points (-14.2 mmol/mol). Among those with increased HbA1c, the
4
5 average increase was +1.21 HbA1c percentage points (+13.2 mmol/mol).
6
7

8
9 Table 3 stratifies the pre- and post-implementation HbA1c values of the project
10
11 participants. Among those who had optimal pre-implementation HbA1c levels, HbA1c
12
13 decreased in 60.3% (41/68), remained the same in 8.8% and increased in 30.9%
14
15 (21/68). The increase was marked in 5.9% (4/68) reclassifying them to have sub-
16
17 optimal HbA1c levels post-implementation. Among the project participants having
18
19 sub-optimal pre-implementation HbA1c levels (>7.0% / >53mmol/mol), HbA1c
20
21 decreased in 60.4% (58/96) with 19.8% achieving good glycemetic control post-
22
23 implementation. HbA1c remained the same in 7.3% and increased in 32.3% (31/96).
24
25 The mean average changes were -2.16 HbA1c percentage points (-23.6mmol/mol)
26
27 among those whose HbA1c decreased and +1.60 HbA1c percentage points
28
29 (+17.5mmol/mol) among those whose HbA1c increased. **There were no reported**
30
31 **incidences of hypoglycemia among the study participants.**
32
33
34

35
36 **Analysis of the changes in measured endpoints based on glycemetic control prior to**
37
38 **and one year after project implementation showed a higher decrease in HbA1c**
39
40 **(p=0.016) and an increase in positive attitude ratings (p=0.006) among those with**
41
42 **pre-implementation HbA1c>7%. As expected, a decrease in HbA1c was noted**
43
44 **among those classified to be "in good glycemetic control" in the post-implementation**
45
46 **determination (p=0.033). The decrease in HbA1c among those "in good glycemetic**
47
48 **control" post-implementation was significantly higher than the decrease in HbA1c**
49
50 **among those "in good glycemetic control" pre-implementation (p<0.001). None of the**
51
52 **other measured changes in endpoints showed statistically significant differences**
53
54 **according to pre- and post-implementation glycemetic control status (Table 4).**
55
56
57
58
59
60

1
2
3 Wilcoxon signed-rank test showed a significant difference in gender ($p=0.042$),
4
5 duration of diabetes ($p=0.005$), and the change in the “perceived ability to control
6
7 blood glucose” ($p=0.034$) between those with “decreased/unchanged HbA1c” against
8
9 “increased HbA1c”. Results of analysis of the endpoints based on the changes in
10
11 HbA1c are listed in Table 5. Overall values are presented in Table 5a. Since logistic
12
13 regression showed a significant difference in gender associated with improved
14
15 glycemia, values were disaggregated by gender as listed in Table 5b. The main
16
17 differences between the groups “increased HbA1c” and “decreased/unchanged
18
19 HbA1c” are the significant increase in correct answers to the knowledge test
20
21 ($p<0.001$), increased ratings of positive attitude ($p=0.013$) and “perceived ability to
22
23 control blood glucose” ($p=0.004$), and the increased proportion of people adherent to
24
25 medication ($p=0.001$) in favor of those whose glycemia improved. There is a
26
27 significant increase in the ratings of fear ($p=0.010$), positive and negative
28
29 attitudes ($p=0.008$; 0.009), and the perceived ability to control blood glucose
30
31 ($p=0.007$) among the male participants whose glycemia improved, which was not
32
33 observed among the female participants.
34
35

36
37 Bivariate logistic regression of correlates for improved glycemia identified the male
38
39 gender ($p=0.049$), duration of diabetes >10 years ($p=0.001$), increased fear of
40
41 diabetes ($p=0.050$), increased perceived ability to control blood glucose ($p=0.030$),
42
43 and better adherence to diet suitable to diabetes ($p=0.049$) as having an alpha of
44
45 ≤ 0.10 . These were entered in multivariate logistic regression to arrive at the final
46
47 model composed of the male gender as a positive correlate to improved glycemia
48
49 ($p=0.034$), and duration of diabetes >10 years ($p=0.003$) and increased fear of
50
51 diabetes ($p=0.048$) as strong negative correlates (Table 6).
52
53
54
55
56
57
58
59
60

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 to provide information on the disease process and its pathophysiology, and instructions on self-management behavior 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 glycemic control, knowledge, self-management behavior, and the psychological and behavioral aspects of self-management. The settings, techniques, and types of interventions used in these DSME programs were diverse and involved a combination of a number of providers that included at least any 3 of the following: medical specialists, dietitians, psychologists, managers, and pharmacists aside from primary care physicians, nurses, and the occasional community-based health care 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 both 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 standardizable and required less expertise, so as not to overburden the LGHU physician and nurse. Furthermore, selfcare development actively involved the person with diabetes. Actively involving the person with chronic condition in self-management and decision making increases the likelihood of adherence to the recommended plan of care.[44]

1
2
3
4
5 One year after full project implementation, significant improvements were noted: the
6 participants' level of diabetes-related knowledge, the perceptions of "ability to control
7 blood glucose" and "ability to adhere to diet and exercise regimens", and reported
8 adherence to medications and exercise increased. Adiposity/obesity as measured
9 through the WHR and waist circumference decreased. More than these, glycemic
10 control of the FiLDCare Project participants significantly improved. However, the fear
11 of diabetes increased and the "perceived support received from family and friends"
12 decreased, as did reported adherence to diet.
13
14
15
16
17
18
19
20
21
22

23 **Changes in glycemia and measures of obesity/adiposity**

24 The effects of DSME/S on clinical endpoints such as glycemia and obesity/adiposity
25 have been well-documented in the past.[13,14, 34-43] These were also observed in
26 our study. Overall, the noted reduction in HbA1c of the FiLDCare project participants
27 was significant. There was also a significant increase in the proportion of people with
28 optimal glycemic control. In depth analysis of the changes in HbA1c levels shows
29 reductions in HbA1c regardless of the level of pre-implementation glycemic control.
30 The proportion of people with reductions in HbA1c, whether among those with
31 optimal or with sub-optimal control, approached 60%, with higher reductions in
32 HbA1c levels among those classified to have sub-optimal control at baseline.
33 Significant changes in obesity/adiposity were noted through the WHR and the waist
34 circumference measurements, but not through the BMI. These significant reductions
35 in the indirect measures for obesity/adiposity were noted regardless of glycemic
36 control.
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52

53 **Changes in knowledge, attitudes and perceptions**

54 Akin to aforementioned studies on DSME where changes in knowledge were
55 measured[12, 13], knowledge of the project participants increased. The increase in
56
57
58
59
60

1
2
3 knowledge may have increased perceptions of self-efficacy. Possessing the essential
4
5 knowledge about the condition and the care for the condition may increase the level
6
7 of confidence of people with diabetes in their selfcare abilities, i.e. ability to control
8
9 blood glucose, ability to adhere to diet and exercise regimen. Positive feelings of self-
10
11 efficacy may consequently lead them to perform and adhere to better self-
12
13 management practices.[45] In our study, this could be construed as an increase in
14
15 knowledge leading to increased perceived abilities to control blood glucose and to
16
17 adhere to diet and exercise regimen, leading to an increase in self-reported
18
19 adherence to medications and exercise of our project participants. The changes in
20
21 self-reported adherence to diet may have been an effect of the participants having
22
23 learned of the specific diet they should be adhering to, which they were taught during
24
25 the DSME/S sessions. The negative change noted could be attributable to their
26
27 change in perception of what a diet suitable for diabetes consists of rather than a
28
29 change in eating behavior; hence the decrease in the number answering “yes” in the
30
31 post-implementation interview. Another possible effect of the DSME/S sessions is the
32
33 recognition of things that have to be done for the condition which could trigger the
34
35 person to seek for social support in order to accomplish some of these. As the
36
37 person with the condition learns of the various activities to be undertaken for self-
38
39 care and self-management, previously perceived adequate support given by family
40
41 and friends may now be perceived as inadequate, hence the negative change in this
42
43 rating. Involvement of the family and friends in the DSME/S sessions was limited,
44
45 and strategies to include the people around the person with diabetes in future
46
47 DSME/S activities need to be developed further. Multivariate regression analysis
48
49 identified increased fear as the lone modifiable correlate significantly associated with
50
51 glycemic control. In this study, its effect on glycemia improvement was negative.
52
53 Although a number of health campaigns have made use of the fear factor, such may
54
55 not necessarily trigger a positive response; fear may bring about negative self-
56
57 management behavior.[46] Fear of diabetes as well as other psychological aspects
58
59
60

1
2
3 may have been inadequately addressed in the DSME/S sessions due to the limited
4 training and composition of the health care team. Such fear may have negatively
5 influenced self-management behavior and other known and unknown factors that
6
7
8
9 may have contributed to improved glycemic control.
10

11
12
13
14
15 The two other correlates significantly associated to improved glycemia are non-
16 modifiable. Nevertheless, this information may be used in tailoring DSME/S. In our
17 study, the female gender and duration of diabetes of 10 years or more were identified
18 to be negatively correlated to improvements in glycemia.
19
20
21
22
23

24 25 26 27 **Gender**

28
29 Gender differences in glycemic control have been studied in the past with females
30 either having equal or poorer but not a superior glycemic control compared to
31 males.[47, 48] This may be partly attributed to differences in glucose metabolism and
32 homeostasis between sexes.[49] With regard to our study, we noted gender
33 differences comparing some pre- and post-implementation attitude and perception
34 ratings. However, the male population in our sample is not substantial enough to
35 subject this to further and more rigorous statistical analysis. Thus, we can only
36 speculate how, in consonance with the theory of perceived self-efficacy, the increase
37 in knowledge, fear, and positive and negative attitudes in our male population may
38 positively affect perceived self-efficacy to control blood glucose, stimulate positive
39 self-management behavior, and thereby improve glycemia.
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 re-train people who have had diabetes for a number of years so as to maintain better glycemic control.[50] However, it seems that in spite of DSME/S given to the whole cohort in our study, glycemia 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 re-training 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 health care personnel and produce favorable results. The provision of context-adapted DSME/S may improve diabetes-related knowledge, some attitudes, perceptions and practices, adiposity/obesity, and glycemia 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 health care 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 now.

Inclusion of and a more active participation of family and friends as well as other

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

For peer review only

ACKNOWLEDGEMENT

We thank Joris Menten of the Institute of Tropical Medicine, Antwerp, for the assistance in statistical analysis.

FOOTNOTES

Reporting guideline

This is a quasi-experimental study and no specific reporting guidelines are listed.

Ethical considerations

This research was approved by the Institutional Review Boards of the University of Antwerp and the Institute of Tropical Medicine in Belgium (Belgian Reg. No. B30020109490), and the Ethics Committee of the Mariano Marcos Memorial Hospital and Medical Center in the Philippines. It was conducted with permission from the governments of the Province of Ilocos Norte, the City of Batac and the Municipality of Pagudpud and their respective health offices.

Authors' contributions

GMVK contributed to the design of the research, participated in data collection, did the statistical analysis and drafted the manuscript. GK provided substantial contributions in the concept and design, data analysis, and in the drafting of the manuscript. Both authors read and approved the final manuscript.

Conflict of interest statement

Neither of the authors has any financial competing interests regarding this research.

Funding statement

This research project was funded by the Belgian Directorate for Development Cooperation through the Institute of Tropical Medicine, Antwerp.

Data sharing statement

Data collected on healthcare workers' training on the provision of primary diabetes care with emphasis on self-care development and the project participants' patients' assessment of chronic illness care (PACIC) will be presented and discussed elsewhere.

Additional data may be obtained by sending an e-mail to the corresponding author.

For peer review only

References

- 1 Peltonen M, Lindstrom J, Tuomilehto J. Towards the prevention of type 2 diabetes mellitus. In: by Puska P, Vartiainen E, Laatikainen T, Jousilahti P, Paavola M, eds. The North Karelia Project: from North Karelia to national action. Helsinki: Helsinki University Printing House 2009: 231-242.
- 2 The Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the diabetes prevention program outcomes study. *Lancet* 2009;374:1677-1686.
- 3 Perreault L, Kahn SE, Christophi CA, Knowler WC, Hamman RF. Regression from pre-diabetes to normal glucose regulation in the diabetes prevention program. *Diabetes Care* 2009;32:1503-1588.
- 4 World Health Organization. The Ljubljana charter on reforming health care. *BMJ* 1996;312:1664-1665.
- 5 International Diabetes Federation Clinical Guidelines Task Force. Global guideline for type 2 diabetes. Brussels: IDF 2012.
- 6 Standards Revision Committee of the International Diabetes Federation Consultative Section on Diabetes Education. International standards for diabetes education, 3rd ed. Brussels: IDF 2009.
- 7 Funnel MM, Brown TL, Childs BP, Haas LB, Hosey GM, Jensen B, Maryniuk M, Peyrot M, Piette JD, Reader D, Siminerio LM, Weinger K, Weiss MA. National standards for diabetes self-management education. *Diabetes Care* 2011;34:S89-96.
- 8 Dreeben O. Patient education in rehabilitation. London: Jones & Bartlett Publishers International 2010.
- 9 International Diabetes Federation. Diabetes Atlas, 5th ed. Brussels: IDF, 2013.
- 10 World Health Organization. Innovative care for chronic conditions: building blocks for action. Geneva: WHO 2002.

- 1
2
3 11 White paper. Ten leading causes of mortality in the Philippines 1982 - 2006.
4
5 <http://www.doh.gov.ph/node/198.html>. (accessed: 18 March 2014)
6
7
8 12 Norris SK, Engelgau MM, Venkat Narayan KM. Effectiveness of self-
9 management training in type 2 diabetes. *Diabetes Care* 2001;24:561-587.
10
11 13 Norris SL, Nichols PJ, Caspersen CJ, Glasgow RE, Engelgau MM, Jack L Jr,
12 Snyder SS, Carande-Kulis VG, Isham G, Garfield S, Briss P, McCulloch D &
13 the Task Force on Community Prevention Services. Increasing diabetes self-
14 management education in community settings: a systematic review. *Am J Prev*
15 *Med* 2002;22:39-66.
16
17 14 Grundy J, Healy V, Gorgolon L, Sandig E. Overview of devolution of health
18 services in the Philippines. *Rural and Remote (online)* 2003.
19 <http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=220>. (accessed: 18
20 March 2014)
21
22 15 Philips DR. Primary healthcare in the Philippines: banking on the barangays?
23 *Soc Sci Med* 1986;23:1105-1117.
24
25 16 Annual calendar of activities of the Philippine Department of Health 2014.
26 http://www.doh.gov.ph/annual_calendar.html. (accessed: 18 March 2014)
27
28 17 Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes:
29 estimates for the year 2000 and projections for 2030. *Diabetes Care*
30 *2004;27(5):1047-1053*.
31
32 18 Philippine Food & Nutrition Research Institute. 6th National Nutrition and Health
33 Survey. Manila: Philippine Food & Nutrition Research Institute. 2003.
34
35 19 Philippine Food & Nutrition Research Institute. 7th National Nutrition and Health
36 Survey. Manila: Philippine Food & Nutrition Research Institute. 2008.
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 20 Renal Disease Control Program and the Philippine Society of Nephrologists.
4 Philippine Renal Disease Registry Annual Report. Quezon City:National Kidney
5 and Transplant Institute. 2011.
6
7
8
9
10 21 Ku GMV & Kegels G. Knowledge, attitudes and perceptions of people with type
11 2 diabetes as related to self-management practices: Results of a cross-
12 sectional study conducted in Luzon, Philippines. *Chronic Illness* 06/2014;
13 DOI:10.1177/1742395314538291.
14
15
16
17 22 Ardeña GJ, Paz-Pacheco E, Jimeno CA, et al. Knowledge, attitudes and
18 practices of persons with type 2 diabetes in a rural community: phase I of the
19 community-based diabetes self-management education (DSME) Program in
20 San Juan, Batangas, Philippines. *Diabet Res Clin Pract* 2010; 90:160–166.
21
22
23
24 23 Philippine National Statistics Office 2010 Census of Population and
25 Housing.Total Population by Province, City, Municipality, and Barangay as of
26 May 1, 2010, Ilocos Norte.
27
28 <http://www.census.gov.ph/sites/default/files/attachments/hsd/pressrelease/llocos.pdf>.
29 (accessed 18 March 2014)
30
31
32
33
34 24 Fitzgerald JT, Anderson RM, Funnell MM, Barr PA, Hiss RG, Hess GE, Davis
35 WK. The Reliability and Validity of a Brief Diabetes Knowledge Test. *Diabetes*
36 *Care* 1998;21(5):706–710.
37
38
39 25 Garcia AA, Villagomez ET, Brown SA, Kouzerkanani K, Hanes CL. The Starr
40 County Diabetes Education Study. *Diabetes Care* 2001;24:16-21.
41
42
43
44 26 Anderson RM, Fitzgerald JT, Funnell MM, Grupen LD. The third version of the
45 Diabetes Attitude Scale (DAS-3). *Diabetes Care* 1998;21:1403-1407.
46
47
48
49 27 Fitzgerald JT, Davis WK, Connell CM, Hess GE, Funnell MM, Hiss RG.
50 Development and validation of the Diabetes Care Profile. *Eval Health Prof*
51 1996;19:209-231.
52
53
54
55
56
57
58
59
60

- 1
2
3 28 World Health Organization. Global recommendations on physical activity for
4 health. Geneva: WHO 2010.
5
6
7 29 Stata/IC 11. Texas: StataCorp LP 2009.
8
9 30 American Diabetes Association. Standards of medical care in diabetes – 2013.
10
11 *Diabetes Care* 2013;36:S11-60.
12
13 31 DeFronzo RA. From the triumvirate to the ominous octet: a new paradigm for
14 the treatment of type 2 diabetes mellitus. *Diabetes* 2009;58:773-795.
15
16
17 32 American Association of Diabetes Educators. Guidelines for the practice of
18 diabetes self-management education and training. Chicago: American
19 Association of Diabetes Educators 2009.
20
21
22
23 33 Eigenmann C, Colagiuri R. Outcomes and indicators for diabetes education – a
24 national consensus position. Canberra: Diabetes Australia 2007.
25
26
27 34 Deakin TA, Cade JE, Williams R, Greenwood DC. Structured patient education:
28 the diabetes X-PERT programme makes a difference. *Diabet Med*
29 2006;23:944-954.
30
31
32
33 35 Davies MJ, Heller S, Skinner TC, Campbell MJ, Carey ME, Cradock S, Dalloso
34 HM, Daly H, Doherty Y, Eaton S, Fox C, Oliver L, Rantell K, Rayman G, Khunti
35 K and on behalf of the Diabetes Education and Self-management Education for
36 Ongoing and Newly Diagnosed Collaborative. Effectiveness of the diabetes
37 education and self-management for ongoing and newly diagnoses
38 (DESMOND) programme for people with newly diagnosed type 2 diabetes:
39 cluster randomised controlled trial. *BMJ* 2008;336:491-495.
40
41
42
43
44
45
46
47 36 Brown SA, Garcia AA, Kouzekanani K, Hanis CL. Culturally competent
48 diabetes self-management education for Mexican Americans: the Starr County
49 border health initiative. *Diabetes Care* 2002;25:259-268.
50
51
52
53
54 37 Kulzer B, Hermanns N, Reinecker H, Haak T. Effects of self-management
55 training in type 2 diabetes: a randomized, prospective trial. *Diabet Med*
56 2007;24:415-423.
57
58
59
60

- 1
2
3 38 McGowan P. The efficacy of diabetes patient education and self-management
4 education in type 2 diabetes. *Can J Diabetes* 2011;35:46-53.
5
6
7 39 Gary TL, Genkinger JM, Guallar E, Peyrot M, Brancati FL. Meta-analysis of
8 randomized educational and behavioral interventions in type 2 diabetes.
9
10 *Diabetes Educator* 2003;29:488-501.
11
12
13 40 Fan L, Sidani S. Effectiveness of diabetes self-management education and
14 intervention elements: a meta-analysis. *Can J Diabetes* 2009;33:18-36.
15
16
17 41 Warsi A, Wang PS, LaValley MP, Avorn J, Solomon DH. Self-management
18 education programs in chronic disease: a systematic review and
19
20 methodological critique of the literature. *Arch Intern Med* 2004;164:1641-1649.
21
22
23 42 Ko S-H, Song S-R, Kim S-R, Lee J-M, Kim J-S, Shin J-H. Long term effects of
24 a structured intensive diabetes education program (SIDEPE) in patients with
25
26 type 2 diabetes mellitus – a 4-year follow-up study *Diabet Med* 2007;24:55-62.
27
28
29 43 Salinerio-Fort MA, Carrillo-de Santa Pau E, Arrieta-Blanco FJ, Abanades-
30
31 Herranz JC, Martin-Madrado C, Rodes-Soldevila B. Effectiveness of PRECEDE
32
33 model for health education on changes and level of control of HbA1c, blood
34
35 pressure, lipids, and body mass index in patients with type 2 diabetes mellitus.
36
37 *BMC Public Health* 2011;11: 267.
38
39
40 44 Delamater AM. Improving patient adherence. *Clinical Diabetes* 2006;24:71-7.
41
42 45 Bandura A. Self efficacy: towards a unifying theory of behavioral change.
43
44 *Psychol Rev* 1977;84:191-215.
45
46 46 Di Battista AM, Hart TA, Greco L, Gloizer J. Type 2 diabetes among
47
48 adolescents: reduced diabetes self-care caused by social fear and fear of
49
50 hypoglycemia. *Diabetes Educator* 2009;35:465-475.
51
52 47 Eriksson BS, Rosenqvist U. Social support and glycemic control in non-insulin
53
54 dependent diabetes mellitus patients: gender differences. *Women & Health*
55
56 1993;20:59-70.
57
58
59
60

- 1
2
3 48 Gobl CS, Brannath W, Bozkurt L, Handisurya A, Anderwald C, Luger A, Krebs
4 M, Kautzky-Willer A, Bischof MG. Sex-specific differences in glycemic control
5 and cardiovascular risk factors in older patients with insulin-treated type 2
6 diabetes mellitus. *Gend Med* 2010;7:593-599.
7
8
9
10
11 49 Blaak E. Sex differences in the control of glucose homeostasis. *Curr Opin Clin*
12 *Nutr Metab Care* 2008;11:500-504.
13
14
15 50 Murata GH, Shah JH, Adam KD, Wendel CS, Bokhari SU, Solvas PA. Factors
16 affecting diabetes knowledge in type 2 diabetes veterans. *Diabetologia*
17 2003;46:1170-1178.
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Demographics of people enrolled in the FiLDCare Project

		Male	Female	
		N=42 (25.6%)	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	0.5 – 2 years	85 (51.8%)	
		>2 – 10 years	53 (32.3%)	
		>10 years	26 (15.9%)	
Level of education (number of years in school)	0-6 years	43 (26.2%)		
	7-10 years	63 (38.4%)		
	>10 years	58 (35.4%)		

Table 2. Pre- and post-implementation values of measured endpoints, in medians and proportions

Variable	Overall, n=164				Male, n=42				Female, n=122			
	Before implementation	After implementation	P value	change	Before implementation	After implementation	P value	change	Before implementation	After implementation	P value	change
	Median values, (binomial interpolation of confidence intervals / interquartile range)		Wilcoxon signed-rank test	Mean change	Median values, (binomial interpolation of confidence intervals / interquartile range)		Wilcoxon signed-rank test	Mean change	Median values, (binomial interpolation of confidence intervals / interquartile range)		Wilcoxon signed-rank test	Mean change
HbA1c, %	7.7 (7.2-8.2 / 6.5-10.4)	6.9 (6.8-7.5 / 6.2-9.3)	<0.001	-0.49	7.5 (6.7-8.7 / 6.3-10.7)	6.8 (6.2-7.7 / 6.1-8.7)	0.001	-0.92	7.8 (7.2-8.5 / 6.5-10.4)	7.2 (6.8-8.0 / 6.3-9.5)	0.057	-0.34
mmol/mol	61 (55-56 / 48-90)	52 (51-58 / 44-78)		-5.4	58 (50-72 / 45-93)	51 (44-61 / 43-72)		-10.1	62 (55-69 / 48-90)	55 (51-64 / 45-80)		-3.7
BMI, kg/m ²	23.7 (23.1-24.1 / 21.8-26.1)	23.3 (22.6-23.8 / 21.2-25.6)	0.075	-0.40	23.8 (22.8-24.7 / 22.0-25.8)	23.6 (21.9-24.7 / 21.2-25.1)	0.395	-0.37	23.6 (23.0-24.0 / 21.6-26.2)	23.2 (22.4-24.1 / 21.0-25.7)	0.122	-0.41
Waist circumference, in cm	85.0 (83.9-86.4 / 81.0-91.2)	83.0 (82.0-85.0 / 79.0-89.0)	0.007	-1.37	89.0 (84.3-91.5 / 81.0-94)	80.0 (83.0-89.9 / 81.0-94.0)	0.026	-2.09	84.0 (82.8-85.2 / 80.0-88.9)	82.8 (81.0-85.0 / 78.7-88.0)	0.054	-1.13
Waist-hip ratio	0.90 (0.89-0.91 / 0.87-0.95)	0.89 (0.88-0.90 / 0.85-0.92)	<0.001	-0.02	0.93 (0.90-0.95 / 0.89-0.96)	0.91 (0.88-0.93 / 0.87-0.95)	0.025	-0.03	0.90 (0.88-0.91 / 0.86-0.93)	0.88 (0.87-0.90 / 0.85-0.92)	0.001	-0.20
Knowledge, % correct answers	60.0 (60.0-65.0 / 50.0-75.0)	67.5 (65.0-70.0 / 60.0-75.0)	<0.001	+7.59	50.0 (50.0-64.3 / 45.0-70.0)	65.0 (60.0-70.0 / 60.0-75.0)	0.006	+9.52	62.5 (60.0-65.0 / 50.0-75.0)	70.0 (65.0-70.0 / 60.0-75.0)	<0.001	+6.93
Perceived fear of diabetes	4.0 (4.0-4.0 / 2.0-4.0)	4.0 (4.0-4.0 / 3.0-5.0)	<0.001	+0.46	2.0 (2.0-4.0 / 1.0-4.0)	4.0 (3.0-4.0 / 2.0-5.0)	0.003	+0.81	4.0 (4.0-4.0 / 2.4-4.0)	4.0 (4.0-4.0 / 3.0-4.0)	0.018	+0.34
Positive attitude	3.4 (3.2-3.4 / 2.8-3.9)	3.4 (3.2-3.6 / 3.0-4.0)	0.071	+0.14	3.2 (2.8-3.4 / 2.6-3.6)	3.5 (3.2-4.0 / 3.2-4.0)	0.025	+0.36	3.4 (3.2-3.6 / 2.8-4.0)	3.4 (3.2-3.6 / 3.0-3.8)	0.479	+0.07
Negative attitude	3.0 (2.8-3.4 / 2.2-4.0)	3.2 (3.0-3.4 / 2.6-3.8)	0.115	+0.15	2.4 (2.0-2.8 / 1.8-3.6)	3.0 (2.8-3.2 / 2.6-3.6)	0.027	+0.42	3.2 (2.8-3.6 / 2.4-4.0)	3.2 (3.0-3.5 / 2.6-3.8)	0.631	+0.06

Attitude towards self-care adherence	3.2 (3.0-3.5 / 2.8-3.8)	3.5 (3.2-3.5 / 3.0-4.0)	0.139	+0.13	3.0 (3.0-3.2 / 2.8-3.5)	3.4 (3.0-3.5 / 2.8-4.0)	0.087	+0.28	3.2 (3.2-3.5 / 2.0-5.0)	3.5 (3.3-3.5 / 3.0-4.0)	0.454	+0.08
Perceived ability to control blood glucose	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-5.0)	0.036	+0.24	3.0 (3.0-3.0 / 3.0-4.0)	4.0 (3.0-4.0 / 3.0-4.0)	0.016	+0.43	3.0 (3.0-4.0 / 2.8-4.0)	3.0 (3.0-4.0 / 3.0-5.0)	0.0279	+0.17
Perceived ability to control weight	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.0)	0.349	+0.12	3.0 (3.0-4.0 / 3.0-4.0)	3.5 (3.0-4.0 / 3.0-4.0)	0.289	+0.021	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.0)	0.649	+0.08
Perceived ability to adhere to diet and exercise regimens	4.0 (3.0-4.0 / 3.0-5.0)	4.0 (4.0-4.0 / 3.0-5.0)	0.022	+0.26	3.0 (3.0-4.0 / 3.0-4.0)	4.0 (3.0-4.0 / 3.0-5.0)	0.071	+0.35	4.0 (3.0-4.0 / 3.0-5.0)	4.0 (4.0-4.0 / 3.0-5.0)	0.107	+0.23
Perceived ability to handle feelings about diabetes	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-4.0 / 3.0-4.5)	0.653	-0.01	4.0 (3.0-4.0 / 3.0-4.0)	3.5 (3.0-4.0 / 3.0-5.0)	0.592	+0.17	3.0 (3.0-4.0 / 3.0-4.0)	3.0 (3.0-3.3 / 3.0-4.0)	0.391	-0.07
Perceived support needs	5.0 (4.8-5.0 / 4.2-5)	4.8 (4.2-5.0 / 4.0-5.0)	0.193	+0.02	5.0 (4.7-5.0 / 4.3-5.0)	4.2 (4.0-5.0 / 4.0-5.0)	0.125	-0.13	5.0 (4.8-5.0 / 4.2-5.0)	5.0 (4.3-5.0 / 4.0-5.0)	0.593	+0.007
Perceived support received from family & friends	5.0 (5.0-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 3.8-4.8)	<0.001	-0.39	5.0 (4.9-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 3.8-4.3)	0.002	-0.52	5.0 (4.8-5.0 / 4.0-5.0)	4.0 (4.0-4.0 / 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%)

Table 3. Stratification of FiLDCare Project Participants based on pre-implementation and post-implementation levels of glycemic control

		Pre-implementation						Total (post- implementation)
		Good control HbA1c<7%			Not in good control HbA1c>7%			
Change in HbA1c		decreased	increased	unchanged	decreased	increased	unchanged	
Post- implementation	Good control HbA1c<7%	41	17	6	19			83
	Not in good control HbA1c>7%		4		39	31	7	81
Total (pre-implementation)		41	21	6	58	31	7	164
		68			96			

Table 4. Mean change (SD) of measured endpoints according to pre-implementation and post-implementation control of glycemia

Glycemic control	Pre-implementation (Baseline)			Post-implementation			Pre-implementation "in good control" vs post-implementation "in good control", P value
	In good control (n=68)	Not in good control (n=96)	P value	In good control (n=83)	Not in good control (n=81)	P value	
	Mean change, (SD)	Mean change, (SD)	Independent samples T-test	Mean change, (SD)	Mean change, (SD)	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	

Table 5a. Pre-implementation & post-implementation 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 endpoints 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
	Pre	Post	P value	Change	Pre	Post	P value	Change	
	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	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/m ²	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, %)		Test of proportions	Change n (%)	N (proportion, %)		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%)	

Table 5b. Pre-implementation & post-implementation 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	Increased HbA1c, n=52								Decreased/Unchanged HbA1c, n=112							
	Male, n=8				Female, n=44				Male, n=34				Female, n=78			
Gender	Pre	Post	P value	Change	Pre	Post	P value	Change	Pre	Post	P value	Change	Pre	Post	P value	Change
	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	Mean change	Median		Wilcoxon signed-rank test	Mean change	Median		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 6. Results of logistic regression analysis of improved glycemia: Correlates with $\alpha \leq 0.10$ identified on bivariate regression analysis of categorical variables and the final model with the significant correlates ($\alpha \leq 0.05$) of improved glycemia identified on multivariate regression.

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