

# Improving diabetes control in the community: a nurse managed intervention model in a multidisciplinary clinic

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## KEYWORDS

Nurse, chronic disease care interventions, disease manager, diabetes, primary care, multidisciplinary clinic

## ABSTRACT

### Objective

To assess diabetes management and control measures in a central multidisciplinary primary care clinic, conducted by a nurse.

### Design

A cross sectional study.

### Setting

Central, multidisciplinary, primary care clinic.

### Subjects

Randomly selected 100 people with diabetes.

### Interventions

People with diabetes with suspected non-optimal glucose control (HbA1c > 7%), were invited to the clinic nurse to discuss optimal personal diabetes control, treatment and follow up. All were provided the necessary referrals to consultants and were called in for follow up visits, and received telephone reminders. All interventions were made according to the current American Diabetes Association Standards of Medical Practice recommendations.

### Main outcome measures

Retrospective data were collected. Data included demographics and diabetes control measures (e.g. HbA1c, LDL, blood pressure, ophthalmologic examination etc.). Data was collected for three x 6 months periods: 1) six months before the nurse visit; 2) six months following the first nurse visit (the intervention); and 3) for patients who were followed up for at least one year after the intervention, the last six months of follow-up.

### Results

With a median follow up of 25 months, HbA1c, LDL and systolic blood pressure levels dropped significantly from before starting the clinic through the intervention and remained low in the last half year of follow up. GP, Ophthalmologist and Dietician visits increased significantly during the study. Non-significant trends were observed with total and diabetes-related hospitalisations decreased, foot examination rates increased and mild weight loss.

### Conclusion

Multidisciplinary intervention managed by a nurse, improve diabetes management and control measures. Observed changes persisted after the intervention period.

## INTRODUCTION

The treatment of chronic disease such as Diabetes Mellitus (DM) is not a simple task for the staff in the Primary Care clinic. A number of models have been created to improve quality of care and counseling chronic patients utilising either physicians only, or in a physician-nurse combination. Bodenheimer et al (2002) surveyed the results of research that studied intervention based on a model of treatment of chronic disease in people with diabetes. Most (32 out of 39 studies) found a positive effect on the process or in at least one result in people with diabetes. In addition, 18 of 27 studies that examined treatment cost in three chronic diseases (diabetes, hypertension, and heart disease) found a drop in costs or health services usage. Studies that compared nurse care manager to primary care physicians showed equivalent or even better results in diabetes control (Watts and Lucatorto 2014).

Many studies have attempted to identify and characterise the management of chronic diseases, and the role of case managers as certified educators in such a program (e.g. baseline assessment, economic analyses, guidelines implementation, educational interventions and outcomes assessment) (Watts and Sood 2016; Jones 2015; Aliha et al 2013; Huston 2001). These studies have also shown that telephone follow-up by a nurse leads to metabolic parameters improvement and better adherence to treatment recommendations in people with diabetes. Changes in the management of chronic diseases have opened up the opportunity for significant professional development for nurses working with chronic patients (Brown et al 2016; Chamberlain-Webber 2004). In evaluating the nurse's contribution to the management of chronic diseases, it was found that nurses have the ability to develop professionally in the field of managing care in the health system; work with other professionals including the primary care physicians; to implement and maintain the process in a multidisciplinary team (Kim 2016; Forbes and While 2009; Watts et al 2009; Witter 2005) and partnership with the patient's close family circle with home assessment, education and support and facilitate access to community resources (Aliotta et al 2008).

It was found that nurses have a major effect when counseling patients on self-management of their disease, particularly when combined with the proactive care management model (Watts and Sood 2016; Aliha et al 2013; Washburn and Hornberger 2008; Hainsworth 2005) and decision-making support. The effect was both on diabetes control (glucose and HbA1c) and on patient adherence to disease management (visits, self-monitoring, and adherence to treatment).

Berra et al (2011) have shown that nurses' structured personal supervision, based on guidelines, can significantly contribute to lowering cardiovascular morbidity and mortality. Other studies have shown that care management delivered by a nurse or team of nurses' increases use of health services for people with diabetes and improved short-term quality of care measurements. However, long-term effects on DM control have not been studied (Wilson et al 2005; Loveman et al 2003). Comparison of care provided by a physician alone and care provided by a physician – nurse combined, showed a greater contribution with combined team work in chronic illnesses (Litaker et al 2003), in treatment of Type 2 Diabetes patients (Luzio et al 2007; Stevenson et al 2001) and in patients with hypertension and Type 2 Diabetes (Gross et al 2009; Hendrix and Wojciechowski 2005). Furthermore, an organised systemic plan utilising a multi-disciplinary team was shown to lower the number of hospitalisations and improve follow up rates and balance of blood glucose, HbA1c and blood pressure results (Domurat 1999). However, the overall results from research of disease management by nurses' have not been published (Watts et al 2009) except for long term HbA1c (Watts and Sood 2016).

Maccabi Healthcare Services is the second largest health maintenance organization (HMO) in Israel, insuring about 2,000,000 patients. All medical follow up and care are performed through a common computerised medical file used by all the Maccabi health care staff.

In Maccabi Healthcare Services, some clinics function with a multidisciplinary team including primary care physician, nurse, social worker, pharmacist, physical exercise consultant and other medical specialists. These clinics care for chronic disease patients and can perform specific interventions for predefined populations. The clinic nurse leads the intervention process and manages the care according to the model of chronic disease management, which combines patient education and follow-ups of both medical (direct disease measures and medications) and process (self-monitoring, staff visits and scheduling). Over the last years, an emphasis has been put on care and control of DM, watching specific parameters that enable follow up and evaluation of patient disease control. This study allows us to examine the efficacy of diabetes care management by a nurse in a multidisciplinary clinic.

## METHOD

The purpose of this study was to assess diabetes management and overall control measures in a central primary care clinic, conducted by a nurse. The study used a retrospective, cross sectional design.

In Maccabi Health Services, Sharon District, a multidisciplinary team clinic has been active since November 2008. The clinic cares for about 10,000 patients, 800 of whom have diabetes. People with diabetes receive specific interventions according to a predetermined protocol and the clinic nurse performs the treatment management. All medical data regarding patients (clinic visits, medications, lab results, etc.) are in the medical file, and the research was carried out by systematic data retrieval from the central medical database. The intervention procedure consisted on identifying people with diabetes with non-optimal control (HbA1c > 7% or personal goal as set by the physician), inviting them to come and see the clinic nurse (who has specialty training in diabetes), either by direct summoning by the nurse or by referral from the patient's physician. Patients received personal guidance regarding the disease, the importance of treatment and control, avoiding complications, explanations on self-management and empowerment, correct use of blood glucose meter and home sphygmomanometers, and were provided referrals to consultants and the necessary providers for continued care and follow up (ophthalmologist, dietician, social worker, physical exercise counselor etc.). During the intervention, the patients were called in for follow up visits, and received telephone reminders and counseling to monitor themselves according to the accepted recommendations. All interventions (management, follow ups and goals) were made according to the current American Diabetes Association Standards of Medical Practice recommendations and were personalised by the diabetes consultant. The multidisciplinary process was conducted and managed by the clinic nurse.

The sample was a convenience sample. In accordance with the research protocol, the first 100 eligible patients to visit the clinic during the study period, who had been diagnosed at least one year before the intervention were selected.

We collected, directly from the medical records, demographics and diabetes control measurements (cholesterol and HbA1c levels, urinalysis for microalbumin/creatinine ratio, blood pressure and weight measurements taken by the trained study nurse, eye and feet exams and the clinic staff follow-up) at three points in time at 6 month intervals each (figure 1).

"Time 0", the initial start of the study, was defined individually per patient according to the patient's first nurse visit (the beginning of the intervention). The time periods were defined as (figure 1):

1. The six-month interval starting one year before the intervention until six months before the intervention. This baseline period was selected to establish the patient's baseline rather than the immediate pre-intervention status that might be argued as affecting the recent patient compliance (the actual summoning for the study, for example).

2. The six-month interval after the initial clinic nurse visit (the intervention period).

3. We also collected data from the last six-month period as follow-up, where available, for patients whose intervention period started over one year before gathering the data. For each time period, the last measurement was recorded for each variable.

In addition, we collected data from the last blood tests before the intervention period (pre-visit 1). In order to create uniformity, the measurement taken was the last performed in each time period.

The research was approved by the institutional research committee and by the institutional review board (IRB).

We used descriptive statistics to evaluate the different variables, and compared the results of the baseline, intervention and follow up by a paired student T test for continuous variables and chi square for the categorical variables. The data was collected and analysed anonymously using SPSS version 16.

## FINDINGS

Our research collected data on 100 people with diabetes who were randomly selected from all the people with diabetes in the clinic. Fifty-two percent were male. The average age was 63.1 ( $\pm 11.92$ ) years, with a median age of 63 years. For every patient medical data was collected for each of the three defined periods as well as an additional pre-visit. Median follow up (for period 3) was 25 months. Patient data during the study periods is presented in table 1. For the various measurements, comparisons were made between baseline period and the pre-intervention visit, and the measurements in intervention and follow-up periods. HbA1c averages before the intervention were  $8.31\% \pm 1.86$  mg%, during the intervention were  $7.19 \pm 1.11$ , and in the final six months of follow up  $7.22\% \pm 1.41$  ( $p < 0.01$ ). LDL levels were  $105.45 \pm 3.88$ ,  $90.99 \pm 29.16$ , and  $90.74 \pm 25.85$  respectively ( $p < 0.05$ ). Systolic Blood pressure levels also dropped from  $140.06 \pm 18.85$  to  $134.33 \pm 16.08$  and  $134.8 \pm 19.15$  respectively ( $p < 0.01$ ). A weight loss was also observed.

**Table 1: baseline and follow-up**

	period 1 (-1 - ½) yr n=82		pre-visit 1 n=100		period 2 (0 - ½)yr n=97		period 3 # last ½yr n=94	
	average	median	average	median	average	median	average	median
LDL-Cholesterol**	98.33 ± 33.52	92	105.45 ± 36.88	99	90.99 ± 29.16	89	90.74 ± 25.85	84.5
HbA1c*	7.74 ± 1.66	7.25	8.31 ± 1.86	7.7	7.19 ± 1.11	6.95	7.22 ± 1.41	6.9
microalbumin/ albumin ratio (U)	40.91 ± 68.26	10			45.19 ± 82.13	10	45.68 ± 82.74	12
systolic Blood pressure**	147.51 ± 24.18	142	140.06 ± 18.85	135	134.33 ± 16.08	130	134.9 ± 19.15	129
weight	87.48 ± 18.99	84.3	86.07 ± 14.35	84.5	85.89 ± 15.04	83	84.6 ± 13.6	83.8
BMI	33.11 ± 6.71	31.74	31.56 ± 4.9	31.05	31.52 ± 5.16	31.02	31.5 ± 4.9	31.01
foot examination**	26%				94%		66%	
phone reminders/ visits (n)	<0.1				1.69 ± 2.53	1	1.06 ± 1.87	0
nurse visits (n)	none				2.7 ± 1.91	2	0.85 ± 1.54	0
dietician visits (n)	0.26 ± 0.76	0			1.17 ± 1.29	1	0.35 ± 0.91	0
physician visits (n)**	5.57 ± 4.58	5			8.78 ± 4.98	7	7.68 ± 5.11	7
ophthalmologist visits**	48%				92%			
hospitalisations (DM related)	0.04 ± 0.24	0			0.01 ± 0.1	0	0.01 ± 0.01	0
hospitalisations (all cause)	0.06 ± 0.28	0			0.03 ± 0.17	0	0.07 ± 0.36	0

\* p<0.05

\*\* p<0.01

# median follow up (period 3) 25 months

The rate of preventive foot examinations increased from 26% to 94% during the intervention and increased to 66% in the final follow up period ( $p < 0.01$ ).

The number of dietician visits increased during the study (N.S.), as did the rate of ophthalmologist ( $p < 0.01$ ) and family physician visits ( $p < 0.01$ ). Conversely, the rate of both all cause and diabetes related hospitalisations dropped. Approximately half of the patients were referred to a dietician during the Intervention period (53%). Of those who actually consulted a dietician, average HbA1c values dropped from  $8.62\% \pm 2.08$  to  $7.28\% \pm 1.32$  ( $p < 0.01$ ).

Of those referred to a dietician, but did not go a similar drop was found, with HbA1c levels dropping from  $8.49\% \pm 1.74$  to  $7.26\% \pm 0.94$  ( $p < 0.01$ ). There was not a significant difference found between dietician attendees and non-attendees.

According to accepted clinical guidelines for diabetes, a yearly visit to the ophthalmologist is recommended. Almost half of the patients (48%) fulfilled this recommendation in the year preceding the intervention period. Of these, at the end of intervention and follow up periods, 94.64% and 76.79% respectively visited the ophthalmologist. Patients who were noncompliant with this measure in the past were instructed to see the ophthalmologist, and an appointment was made for them. Of these, at end of intervention and follow up periods, 88.64% and 54.55% respectively visited an ophthalmologist during the year.

Comparably, clinical guidelines for diabetes recommend a yearly foot examination. This examination is done and recorded in the medical records by the nurse, at least once a year, for every person with diabetes who visits the clinic. Twenty six percent of the patients had a recorded foot examination in their medical records during the baseline period. Of these, 84.6% had a recorded foot exam by end of the intervention period, and 73.1% by end of the follow up period. Conversely, of those whose foot examination was not recorded during baseline period, 96% completed the examination during period 2, and 62.2% during period 3.

Some of the intervention patients also participated in a support group workshop for diabetes, in addition to the intervention process. On comparing these two subgroups, no significant difference was found in HbA1c and Blood pressure levels between these groups.

## DISCUSSION

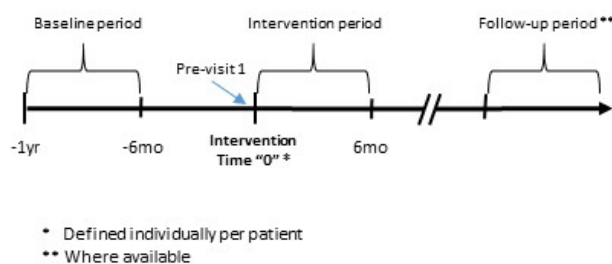
The control of diabetes in people with diabetes is one of the significant tasks confronting the health care staff. Cooperation between the staff members can contribute to both the quality of care and result in better diabetes control markers. Various studies have examined the role of the disease care manager (Watts and Sood 2016; Jones 2015; Watts and Lucatorto 2014; Aliha et al 2013). Our study examined the utility of diabetes care management by a nurse in a multidisciplinary urban clinic.

In our study, people with diabetes in the clinic who were either not achieving optimal control markers or who had not been performing the recommended follow up for diabetes were proactively invited to come and see the diabetes disease control nurse. During the intervention, the patients were given personal counseling that included knowledge about the disease and were empowered regarding disease control. The counseling was made according to the patients' needs and optimal disease care and follow up targets, and included clinic visits, counseling sessions and telephone supportive talks. We collected data on 100 randomly selected people with diabetes at three 6 months intervals with a median follow up of 25 months (figure 1).

A significant improvement was observed following the intervention, through the follow up period in LDL cholesterol, HbA1c and systolic blood pressure. We also found a lasting improvement in annual eye exams and annual foot exams as well as a drop in diabetes-related and non-diabetes-related hospitalisations and an

increase in dietician visits. The lasting changes we observed in the follow up period represent the maintenance of the control achieved in the intervention period by the patients themselves and show success in patient empowerment. These results are consistent with the literature of chronic disease management by a team manager; however, it also shows the effectiveness of the nurse as the disease manager.

**Figure 1:**  
**3 defined study periods**



One should note the improvement of systolic blood pressure after the intervention and during follow up to levels of less than 135mmHg (median of 130mmHg during follow up). Although these blood pressure levels are considered well controlled for people with diabetes (especially with a high urine microalbumin/creatinine ratio) it raises a question of future risk to the study population, with a median age of 63 years. We assume the improvement in blood pressure was mainly due to the nurse's intervention and patient empowerment, which may result in better adherence to diet, exercise and medications. Medical systems will need to address this issue.

The nurse intervention averaged 2.7 clinic intervention visits and 1.69 phone calls per patient over the 6 months period. The number of visits with the family physician rose by 37.8% between baseline and follow up periods. Although this large increase in visits may be seen as a burden on the system, we must remember that these are people with poorly controlled diabetes and there is a definite advantage to closer family physician supervision, at least initially, until optimal long-term control is achieved. The overall improvement in these patients health should eventually cut morbidity, costs and finally clinic visits. Furthermore, if we examine the increase in referrals to the dietician, we see a significant increase during the intervention period, which dropped close to baseline levels during the follow-up period. This supports the hypothesis that patients continue the consultants visits "according to need" so the burden to the system caused by a high referral rate is necessary. Further study is needed to examine continued follow up and care of these patients, optimal referral rate and the long-term cost in terms of clinic burden.

About half of the patients were referred to the dietician during the intervention period. However, there was no significant difference in HbA<sub>1c</sub> levels between those who actually visited the dietician and those who did not. This may imply that basic counseling given by the nurse may be sufficient for a large portion of the patients, although there may be differences in tools for a healthy diet provided to those who consulted the dieticians, which may become evident in longer follow-ups. Further research is needed to investigate if these long-term differences can be elucidated. We found that almost all patients who had not consulted the dietician before intervention, complied with the referral if an appointment was made for them, and some continued with the dietician follow up visits in the follow up period. This implies that disease management and the nurse's influence holds an important role for people with diabetes.

Multidisciplinary support workshop is offered to all people with diabetes at a nominal cost; however, there was no significant change in the control measures. Here too, it may be that the long-term tools for dealing with diabetes provided by this workshop would contribute to the long-term control of the disease.

## LIMITATIONS

Our study has several limitations. First, the study is retrospective and the population was composed of people with diabetes from a central urban multidisciplinary clinic, which may not represent rural or peripheral clinics. Further prospective research could be conducted in a wider geographical range. Second, the study was conducted in a multidisciplinary clinic with a nurse specialised in diabetes. The study results show the advantages of the nurse as a disease manager, however, further studies should test if non-diabetes-specialised nurses can also achieve similar results. Third, chronic disease such as diabetes may also be related to other chronic diseases such as depression. We did not test the patients mental status at the baseline, however, following studies may address this issue as well as other clinical lab measures. Fourth, we did not collect any medicines information. Further studies, with far larger sample will be needed to assess medicines education, which is also a core nursing activity. Finally, median follow up in this study was 25 months. More research is needed to further investigate longer lasting effect of the intervention.

## CONCLUSIONS AND RECOMMENDATIONS

The results of our study show that intervention by a multidisciplinary team managed proactively by a nurse significantly improves diabetes control in almost all measures examined. These improvements are observed in the post intervention follow up period. As expected, these changes include an immediate improvement in Diabetes control markers, but also in the patients' ability to manage their illness, as exhibited in the continued visits to the multidisciplinary staff. Other than improving clinical outcomes, management of chronic diseases is also an important professional development for community nurses in the field of managing care in the healthcare system. Individualized focus on the patient and personal professional accompaniment by the nurse contribute to this achievement of goals. We suggest policymakers should consider a nurse as the chronic disease manager of diabetes in the community setting.

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