Accessibility and outcomes from a rural diabetes nurse-educator led self-management program

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access, diabetes nurse educator, diabetes self-management, health outcomes, rural, primary health care

ABSTRACT

Objective
To investigate factors associated with access to, and health outcomes of, a diabetes nurse-educator led self-management program for rural Australians with diabetes.

Design
Retrospective cohort study

Setting
A rural community-health service with a dispersed catchment of 10,000 population.

Subjects
Clients diagnosed with type 2 diabetes mellitus and referred to the program between April 2008 and December 2012.

Intervention
A diabetes self-management program comprising an initial assessment, a group education session, and 3, 6, and 12 month clinical reviews.

Main outcome measures
Program attendance after referral; and achievement of management goals for HbA1c, BMI, total cholesterol, quality of life and psychological distress.

Results
Ninety-four percent (n=219/232) of referred clients attended at least once. Multivariate logistic regression showed that attending at least once was significantly associated with living within 25km of the service. Non-smokers/former smokers, general practitioner-referred clients and those with diabetes management plans were significantly more likely to attend three or more sessions. At 12 months clients showed significant improvements in cholesterol, BMI, quality of life and psychological distress.

Conclusion
This study demonstrates that diabetes nurse-educator led self-management programs which adapt to their rural contexts – including geographically dispersed catchment populations and resource constraints – provide highly accessible services meeting the needs of most. Nevertheless, some groups (cigarette smokers, those living furthest from the service) may remain marginalised and less able to access services. Improvements in health outcomes for these clients may require further adaptation of models of care to better target their health care needs.

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INTRODUCTION

Diabetes is a significant global problem. Prevalence among adults is estimated to be 9% and in 2013 it was the 7th leading cause of death (Vos et al 2015; World Health Organization 2014). In Australia, 5.4% of adults have diabetes, and of these 85-90% have type 2 diabetes mellitus (T2DM) (Australian Institute of Health and Welfare 2012; Australian Bureau of Statistics Microdata 2011-2012). The prevalence of T2DM and its associated complications is significantly higher in rural and remote areas and the complications of poor control of T2DM are well known and frequently life-threatening (Australian Institute of Health and Welfare 2008).

Nurses working in rural areas play a key role supporting the management of T2DM, particularly where local staff and healthcare resources are limited. Systematic reviews report that diabetes self-management (DSM) programs improve diabetes knowledge, its management and positively influence health outcomes (Colagiuri et al 2009). However, most of the evidence is based on DSM programs undertaken by specialist-teams in metropolitan settings. In contrast, the evidence-base on the accessibility of DSM programs in rural areas is limited. In rural and remote locations a range of issues affect whether an individual with diabetes accesses appropriate care for their chronic disease. Important dimensions of health service accessibility vary amongst individuals and the contexts in which they live. Nevertheless, health workforce shortages, proximity to health services, the way in which the care is organised, acceptability of the services offered, awareness of what services are available and the affordability of care may each impact on health service utilisation (Russell et al 2013). Similarly, evidence regarding the health outcomes that can be achieved by clients attending rural DSM programs, which have necessarily been adapted to meet population health care needs because of spatial accessibility (availability and proximity) issues, is also limited.

This paper addresses these research gaps, investigating factors associated with participation in a diabetes nurse-educator led self-management program which aimed to increase access to local diabetes support, education and management for rural Australian clients with T2DM. Further, this study investigates the significance of changes in health outcomes (glycosylated haemoglobin (HbA1c), total cholesterol, BMI, quality of life and psychological distress) for individual clients and factors associated with whether or not HbA1c management goals were achieved.

METHOD

Setting

The setting for this study is a community health service located more than 200 kilometres from the nearest major city, Melbourne. The health service provides acute, aged and primary health care services to a catchment population of 10,000.

Participants

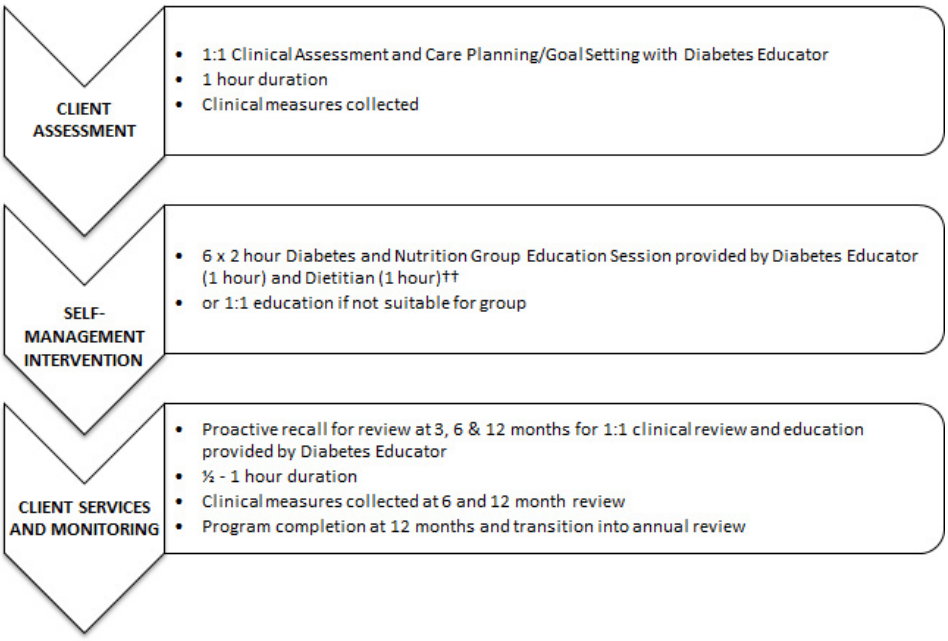
Participants were clients diagnosed with T2DM, according to the National Health and Medical Research Council criteria (National Health & Medical Research Council 2001), and referred to the program by GPs or other health practitioners.

Intervention

The intervention was based on the Victorian Department of Human Services (DHS) DSM program model of care (see figure 1). The program comprised five sessions in total: initial client assessment, an education session, and proactive recalls at 3, 6 and 12 months. While it is recommended that allied health staff, such as a podiatrist, staff the program in this locality of allied health workforce shortages, a diabetes nurse-educator led the program.

Instead of the recommended six weekly 2-hour group education sessions, the program was adapted to comprise one 2-hour group education. This structure was determined based on the limited availability of staff and resources, and to minimise patient travel which was thought to be a barrier to participation in this rural setting. The 2-hour group education session was facilitated by the diabetes nurse-educator and dietitian.

Figure 1: Model of Care – Diabetes Self-Management Program for newly diagnosed Type 2 Diabetes†



† *Source:* Adapted from Victorian Government Department of Human Services, Diabetes self-management Guidelines for providing services to people newly diagnosed with Type 2 diabetes, Melbourne, Victoria: DHS, 2007.

†† Adapted to 1 x 2 hour education session in this setting

Data collection, measures and analysis

Data were extracted from health records of clients referred to the DSM program between April 2008 and December 2012. A tailored data extraction tool was designed and refined following pilot testing on 20 records.

Program attendance was measured according to the number of sessions clients attended. Two binary outcome variables were created; 1) indicating whether clients attended none, compared with at least one of the 5 sessions and 2) indicating whether clients attended 3 or more sessions compared with attending only 1 or 2 sessions.

Demographic predictor variables included age, gender, English language country of birth, employment status, health care card status, receiving government benefits and living arrangements. Distance between the client's home and the health service was calculated using Google maps and categorised (≤5, 5-25, ≥25 kms). Clinical predictor variables included referral source, existence of a care plan, smoking status, treatment with oral hypoglycaemic drugs, presence of chronic pain and number of co-existing chronic diseases.

Achievement of diabetes management goals was measured by assessing individual-level changes in clinical indicators between initial assessment and 12 month review. Indicators included HbA1c, total cholesterol, BMI, psychological distress (K10) and utility scores for health-related quality of life (AQoL4D) (Hawthorne et al 2013; Kessler et al 2002). K10 scores range from 1-50. AQoL4D measures health-related quality of life across dimensions of illness, independent living, social relationships and psychological wellbeing (Hawthorne et al 2013). Management goals were selected based on the Victorian state guidelines for diabetes management in community health settings (Australian Institute for Primary Care & Ageing 2012). Cut-off values for these were based on WHO and national guidelines (Primary Health Care Research and Information Service 2012; Australian Institute of Health and Welfare 2009; World Health Organization 2000).

Statistical analyses were conducted using Stata/IC 11.2 (StataCorp LP, College Station, Texas, USA). Multivariate logistic regression models tested associations between demographic/clinical indicators and 1) the attendance outcome variables and 2) achieving HbA1c management goals. Variables significant at $p<0.25$ in bivariate analysis were included in the initial multivariate models, and retained in the final model if significant at $p<0.05$. Missing data were handled by list-wise deletion. McNemar's test was used to test whether there were significant differences in the proportion of participants achieving improvements compared to those with deteriorations in their diabetes management goals.

ETHICAL APPROVAL

The study was approved by Monash University Human Ethics Research Committee (No. 2012001953).

FINDINGS

Program access

Between April 2008 and December 2012, 232 clients were referred (94% by GPs and 6% by other health professionals) to the program. Of these clients, 219 (94%) attended at least once, while 190 (82%) attended 3 or more sessions. The characteristics of referred clients are shown in table 1. Clients had a mean age of 62 years (SD = 12 years). While most clients lived near the service (median distance 4.4 km), 20% lived more than 25 kilometres away.

Bivariate logistic regression revealed that attending the program at least once was significantly associated with increased distance from the health service ($p<0.05$). Increasing age and having a care plan were significant at $p<0.25$ and were included in a multiple logistic regression model. Non-significant variables excluded from the model were gender, referral source, and being on oral hypoglycaemic medications at the time of referral. The only significant variable remaining after stepwise multiple logistic regression was the distance that the client lived from the health service. Clients living within 5 km of the service were more than five times more likely to attend at least once compared to clients living more than 25 km away.

Factors found to be significantly ($p<0.05$) associated with attendance at three or more sessions via bivariate testing included being a non-smoker, having no asthma or chronic obstructive pulmonary disease, having a GP referral and a diabetes care plan. These variables, and variables significant at the $p<0.25$ level (English speaking country of birth, receipt of a government pension, being a health care card holder and the number of chronic diseases) were included in a multivariate model. The distance from the health service was not significantly associated with attendance at three or more sessions ($p>0.25$) and was not included. The multivariate model showed that being a non-smoker/former smoker, not having a chronic respiratory condition, having a GP referral and a diabetes care plan were significant predictors of attendance at three or more sessions (table 2).

Table 1: Self-reported characteristics of clients upon referral to DSM Program

	n	%
Gender		
Male	130	56.0
Female	102	44.0
Employment status		
Employed	77	35.3
Not employed	141	64.7
Low Income-Health Care Card and/or Gov't payment		
No HCC/Gov't payment	72	31.4
HCC/Gov't payment	157	68.6
Living Status		
Lives alone	46	20.4
Does not live alone	180	79.6
Number of chronic conditions present		
0	54	23.3
1	109	47.0
2+	68	29.7
History of Cardiovascular Disease	153	66.2
History of Mental Illness	46	19.9
Health rating at intake		
Excellent/Very good	53	24.1
Good	103	46.8
Fair/Poor	64	29.1
Smoking status		
Current smoker	46	21.0
Non/Ex-smoker	173	79.0
Medical Management method		
Nutrition	148	63.8
Oral Hypoglycaemic Agent	84	36.2

Table 2: Multiple logistic regression model for clients attending 3 or more diabetes self-management sessions

Reference	Variable	Odds Ratio	95% confidence interval	p value
Current cigarette smoker	Non-smoker or former cigarette smoker	7.8	2.7 – 22.0	<0.001
Asthma or chronic obstructive pulmonary disease	No asthma or chronic obstructive pulmonary disease	4.6	1.5 – 14.2	0.009
Referred by other type of health professional	Referred by General practitioner	6.0	1.3 – 28.7	0.024
No care plan	Care plan	3.5	1.1 – 11.0	0.029
After missing data:		n=170, PseudoR^2=0.232		

Health outcomes

At 12 months, statistically significantly greater proportions of participants achieved improvements rather than deteriorations in diabetes management goals for cholesterol and BMI and in quality of life and psychological distress (table 3). HbA1c results at 12 months were available for 86 participants. Of these, 17 clients (20%) did not achieve HbA1c diabetes management goals, recording levels greater than 7.0%. Factors significantly associated with HbA1c>7.0 at 12 months in bivariate logistic regression ($p<0.05$) included age, English speaking country of birth, HbA1c≤7.0 at initial assessment, neuropathic feet changes at initial assessment, more chronic conditions and hypertension. HbA1c≤7.0 at initial assessment and diagnosed hypertension when referred remained as significant predictors of meeting diabetes management goals for HbA1c in the final model (table 4).

Table 3: Proportion of participants achieving diabetes management goals from assessment to 12 months †

OUTCOME VARIABLE	Diabetes management goals	n pairs	Total number of discordant pairs	Number of discordant pairs showing improvement in management goal	McNemar's chi^2 ¶ statistic	p
HbA1c	≤7% and >7)	64	16	11	2.25	0.134
Total cholesterol	<4 and ≥4 mmol/L	62	17	16	13.24	<0.001
BMI	<30 and ≥30 kg/m2	127	16	14	9.00	0.003
K10 Score	<22 and ≥22	125	7	7	Not appropriate	0.016
AQoL4D Utilities Score	<0.71 and ≥0.71	116	63	49	19.44	<0.001

† Follow up data (at 12 months) was available for n=86 participants

Exact p value calculated using binomial distribution

Table 4: Multiple logistic regression model for clients meeting diabetes management goals for HbA1c

Variable	Reference	Odds Ratio	95% confidence interval	p value
HbA1c≤7.0 at assessment	HbA1c>7.0	6.5	1.7 - 24.9	0.007
Has diagnosed hypertension	No	5.1	1.3 – 19.9	0.017
After missing data:			n=64, PseudoR^2=0.226	

DISCUSSION

This study indicates that diabetes nurse-led DSM programs in rural areas are well accessed and associated with significant improvements in a number of aspects of individual clients' health. Importantly, improvements occurred in client quality of life and in mental health and wellbeing, which, while not being specific for diabetes, are nevertheless important outcomes.

Many of DSM program clients faced considerable socio-economic disadvantage. The study population comprised two thirds on low incomes, one third of whom were dealing with multiple chronic conditions, and 20% of whom were living with mental illness. Each of these factors not only has the potential to inhibit health service use but also may be associated with poorer health outcomes more generally (Arcury et al 2005). This study suggests that the diabetes nurse-educator led program is not only adequately accessible for vulnerable population subgroups but is associated with meaningful health benefits beyond those related specifically to their diabetes. Nevertheless, clients who were cigarette smokers were less likely to attend three or more

sessions compared with non-smokers/former smokers. This suggests that more specific targeting of clients who are cigarette smokers may be needed.

It is likely that accessibility was influenced by the Victorian DHS DSM program design which allows variations in the Models of Care offered by health services. This flexibility in how health services allocate the DSM program funding enabled the health service to tailor delivery to meet the needs of most clients. In this instance, by offering a single group education session which reduced travel burden on clients. Despite these adaptations, distance (living more than 25km away) remains a significant reason for not attending the DSM program, even though it is known that residents of sparsely-populated rural communities are more willing to travel for health care (McGrail et al 2015). While the DSM program offered clients the option for telephone reviews as an alternative to face-to-face consultations, referred clients may be unaware of this possibility until they attend at least an initial assessment. Possible solutions include ensuring that potential and referred clients are aware that services can be delivered via telephone consultations, and offering alternative models of service delivery, such as outreach or other modalities of telehealth, for less proximate clients. A further group of clients who may similarly benefit from being offered alternative models of service delivery that improve accessibility are those with multiple chronic diseases, who otherwise are less likely to attend three or more sessions.

This study showed that the capacity for the diabetes nurse-educator led program to achieve clinical goals for HbA1c is linked to clinical indicators at program commencement, particularly a lower HbA1c at initial assessment and diagnosed hypertension. It is not surprising that patients who had well-controlled diabetes before attending the DSM program also had well-controlled diabetes 12 months later. It also might suggest that diabetes nurse-educator led programs are likely to be more effective in populations with mild to moderate well-controlled diabetes to start with, than in populations with more severe and poorly controlled diabetes. It is not clear from this study why there is an association between diagnosed hypertension and diabetes control at 12 months. One possible mechanism is that patients being managed for hypertension by their GPs may be receiving more regular diabetes care overall and are therefore more likely to have well-managed disease.

This study was limited to a single rural community. Whilst DHS funded multiple sites to implement DSM programs, cross-site comparisons were not possible and there was no control group. As a result it isn't possible to determine whether the improvements noted in clinical outcomes may have occurred anyway (Travaglia and Debono 2009). Further, some of the client pathology results were missing from file notes and this limited the use of regression methods to analyse associations with clinical outcomes. Finally, Victorian Government management guidelines in community health settings identify total cholesterol as a single relevant indicator of lipid control in clients with diabetes. As a result, full lipid profiles of clients are not routinely recorded by programs such as this, so clinically important changes in the lipid profiles of participants related to other lipid components such as the HDL/LDL ratio could not be identified.

These limitations notwithstanding, this research nonetheless demonstrates the significance of geographical accessibility to health services for rural populations managing chronic diseases such as T2DM. It also highlights the importance of several clinical factors (cigarette smoking and having multiple chronic diseases) that are associated with reduced utilisation of the diabetes self-management program.

CONCLUSIONS

This study suggests that diabetes nurse-educator led DSM programs in rural settings that are carefully tailored to meet community and client needs using available resources can be accessible to most and effective at improving diabetes management. This study has identified where further targeting of at-risk populations and program adaptation is needed to encourage attendance – in this instance by smokers, those with multiple chronic diseases and those living further away.

REFERENCES

Arcury, T.A., Gesler, W.M., Preisser, J.S., Sherman, J., Spencer, J., and Perin, J. 2005. The effects of geography and spatial behavior on health care utilization among the residents of a rural region. *Health Services Research*, 40(1):135-155.

Australian Bureau of Statistics Microdata. 2011-2012. Australian Health Survey: Core content - risk factors and selected health conditions. AIHW: Canberra.

Australian Institute for Primary Care & Ageing. 2012. Immediate client outcomes for community health and public dental services in Victoria. La Trobe University: Victoria.

Australian Institute of Health and Welfare. 2008. Indicators for chronic diseases and their determinants 2008. Cat. no. PHE 75. AIHW: Canberra.

Australian Institute of Health and Welfare. 2009. Key indicators of progress for chronic disease and associated determinants: technical report. AIHW: Canberra.

Australian Institute of Health and Welfare. 2012. Australia's health 2012. Australia's health no. 13. Cat. no. AUS 156. AIHW: Canberra.

Colagiuri, R., Girgis, S., Eigenmann, C., Gomez, M. and Griffiths, R. 2009. National evidence based guideline for patient education in type 2 diabetes. *Diabetes Australia and the NHMRC*: Canberra.

Hawthorne, G., Korn, S. and Richardson, J. 2013. Population norms for the AQoL derived from the 2007 Australian National Survey of Mental Health and Wellbeing. *Australian and New Zealand Journal of Public Health*, 37(1):7-16.

Kessler, R.C., Andrews, G., Colpe, L.J., Hiripi, E., Mroczek, D.K., Normand, S.-L.T., Walters, E.E. and A.M., Z. 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine* 32:959-976.

McGrail, M.R., Humphreys, J.S., and Ward, B. 2015. Accessing doctors at times of need-measuring the distance tolerance of rural residents for health-related travel. *BMC Health Serv Res* 15:212.

National Health & Medical Research Council. 2001. National Evidence Based Guidelines for the Management of Type 2 Diabetes Mellitus Part 3 Case Detection and Diagnosis of Type 2 Diabetes. Australian Government: Canberra.

Primary Health Care Research and Information Service. 2012. National performance indicators for Divisions of General Practice. Retreived from http://www.phcris.org.au/divisions/reporting/div/obj/oi_details.php?objid=14 (accessed 08.03.16).

Russell, D.J., Humphreys, J.S., Ward, B., Chisholm, M., Buykx, P., McGrail, M., and Wakerman, J. 2013. Helping policy-makers address rural health access problems. *Australian Journal of Rural Health*, 21(2):61-71.

Travaglia, J. and Debono, D. 2009. Clinical audit: a comprehensive review of the literature. Centre for Clinical Governance Research, University of New South Wales:

Vos, T., Barber, R.M., Bell, B., Bertozzi-Villa, A., Biryukov, S., Bolliger, I., et al. 2015. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 386(9995):743-800.

World Health Organization. 2000. Obesity: preventing and managing the global epidemic - Report of a WHO consultation. Technical report series 894. WHO: Geneva.

World Health Organization. 2014. Global status report on noncommunicable diseases 2014. WHO: Geneva.