Journal of
Diabetes Research & Clinical Metabolism

HOAJ
Herbert Open Access Journals

Research Article Open Access

Applicability of Pharmaceutical Care in endocrine clinic of Hospital Penang, Malaysia

Syed W Gillani[1†*], Syed AS Sulaiman[1†], Suzana C Victor[2†], Yelly O Sari[3,4†], Siti MS Ghadzi[5†], Sabariah N Harun[5†] and Nur H Md Hanafiah[5†]
Correspondence: wasifgillani@gmail.com
[1]School of pharmaceutical sciences, Universiti Sains Malaysia, Pulau Pinang, Malaysia.
[2]Ziauddin College of Pharmacy, Ziauddin University, Karachi, Pakistan.
[3]Faculty of Pharmacy, Andalas University, Padang 25163, Indonesia.
[4]Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia.
[5]School of Pharmaceutical Sciences, Universiti Sains Malaysia, Kubang Kerian, Kelantan.

Abstract

Objective: This study aimed to evaluate the impact of pharmaceutical care on pharmacotherapy optimization and health related quality of life among Diabetes patients of endocrine clinic in Hospital Pulau Pinang, Malaysia.

Methodology: A non-experimental descriptive prospective case-control study design was chosen. A correlation study was considered but was not applicable due to the definition of poor glycaemic control as used in this study. The general hospital is the main government hospital in the Penang state and is situated within the city area offering tertiary care. To achieve a power of 0.7 with alpha set at 0.05, 186 subjects were required for the study but researcher increase the sample to 253 in case of drop out. The Research Ethics Committee of hospital and the Malaysian Medical Research and Ethics Committee approved the study. The Statistical package for Social Sciences [SPSS] version 19 ® was used for this analysis. The level of significance was set at 0.05 for all analysis.

Results: There were no significant differences between cases and controls for any of the demographic variables that were documented. The sample was predominantly elderly type 2 DM patients. During the study period, the median [IQR] HbA1c levels did not change significantly in either the cases or controls at the beginning and end of the study [p>0.50 across time and between groups]. One hundred and three drug therapy interventions were made in the cases after a full medication review and subsequent discussion with the hospital physician. There were no significant differences in HRQOL within or between groups during the course of the study [p>0.11]. As there were no significant differences in HRQOL in the univariate statistics, multivariate analysis was not undertaken.

Conclusion: The PC study highlights the value of the pharmacist as an information resource for patients with diabetes. This extends to complementary medicines where potential interactions with conventional therapy may be neither suspected nor recognized.

Keywords: diabetes mellitus, pharmaceutical care, pharmacist interventions, pharmacy practice

Background

Researchers in the United States, Europe and Asia reported that 40%-90% of individuals with diabetes had received dietary education. However across these continents less than 40% of both type 1 and type 2 diabetes patients followed strict dietary requirements and 10%-25% did not follow any meal plan. The majority sought to balance their dietary habits with some recommendations. This illustrates the widespread difficulty in adhering to dietary recommendations and the discrepancy between diabetes knowledge and self-care practices [1-7]. It also implies other factors influence dietary behavior.

Recent systemic reviews that examined the effectiveness of self-management training of type 2 diabetes based on randomized controlled trials also found significant findings on knowledge improvement regardless of the educational strategies used [8-10]. With regular reinforcement, knowledge level can be sustained for 24 months [11-13].

Patient education appears more effective in younger patients particularly knowledge outcome [12]. No other demographic variable is reposted in relation to knowledge improvement in the meta-analysis. Whereas health literacy literature indicates older subjects, those with less education, minority ethnic groups and do not speak English are factors associated with low health literacy. These subjects often benefit less from education interventions [15-17]. The positive effects of knowledge outcomes via diabetes education must be interpreted within the methodological limitation like possible contamination due to infeasibility of participant blinding, lack of uniform measures

of knowledge and the validity of the tools use [9,10,15,18,19]. Hence the next question is to investigate whether the beneficial effects of education go beyond knowledge.

Addressing the complications of DM with appropriate modification in pharmacotherapy is essential component in reducing the morbidity and mortality associated with type 2 DM. Optimal pharmacotherapy will continue to be reviewed and modified according to the ongoing results of large-scale trials. It is also clear that multifactorial interventions targeting lifestyle modification and appropriate pharmacotherapy are necessary in DM. Recent studies showed remarkable results in management of DM by increasing pharmaceutical care on patient-centered interventions. This study aimed to evaluate the impact of pharmaceutical care on pharmacotherapy optimization and health related quality of life [HRQOL] among Diabetes patients of endocrine clinic in Hospital Pulau Pinang, Malaysia.

Methodology

Method design

A non-experimental descriptive prospective case-control study design was chosen. A correlation study was considered but was not applicable due to the definition of poor glycaemic control as used in this study.

Setting

As 70% of people with diabetes in Malaysia receive treatment in the government healthcare system [20], data was collected from government healthcare settings. The general hospital is the main government hospital in the Penang state and is situated within the city area offering tertiary care. Subjects were not recruited from private clinics and hospitals due to problems with accessibility and differences in socio-economic status which could bias the outcomes.

Sample size

For logistical reasons the study had to be a manageable size within the period of study, so the investigator chose the sample size using the medium effect size of Gamma y = 0.25. To achieve a power of 0.7 with alpha set at 0.05, 186 subjects were required for the study but researcher increase the sample to 253 in case of drop out.

Framework

Investigator prospectively follow-up each selected patient at the time of appointment with the physician. Eventually duration of three month of second visit so researcher [clinical pharmacist] aimed to follow-up for duration of one-year including four-consecutive follow-ups and determines the impact on pharmacotherapy optimization and HRQOL of the patient.

Key definition

Even though glycated haemoglobin [HbA1c] is the gold standard for glycaemic assessment, it was not consistently measured for all diabetic patients in the healthcare system where the study was done. Therefore for the purpose of this study, poor diabetes control was defined as the mean of minimum of three fasting blood glucose [FBG] readings of more than 7 mmol/L in the last year. Prior studies have shown that FBG of more than 7 mmol/L is associated with increased micro-and macro-vascular complications [21-24].

Ethical issues

The Research Ethics Committee of hospital and the Malaysian Medical Research and Ethics Committee approved the study. Written consents which included information to access the subjects' medical records were taken from all participants before the interviews. For those who were illiterate and not able to give their signature, thumbprints were used instead. The medical records were sourced for two pieces of information. First, the subjects' glycaemic status was attained namely fasting blood glucose levels to assist the investigator in identifying the potential subjects [inclusion criteria]. Second, the subjects' current medication[s] was attained since research question three sorts to identify any relationship between medication concordance and poor glycaemic control. No other data was extracted from the medical records. Viewing and extracting information from the subjects' medical records was done solely by the investigator either at the medical in-patient wards or the medical outpatient clinics during official working hours.

Places of data collection

Data collection was done in out-patient departments at the doctors' consultation rooms.

Statistical analysis

The Statistical package for Social Sciences [SPSS] version 19® was used for this analysis. The level of significance was set at 0.05 for all analysis.

Results

Demographics

In this study, two hundred and fifty three patients were recruited, from the Diabetes Outpatient clinic Hospital Pulau Pinang, comprising 127 cases and 126 controls (**Chart 1**). There were no significant differences between cases and controls for any of the demographic variables that were documented. The sample was predominantly elderly type 2 DM patients (**Table 1**).

Glycaemic Control

During the study period, the median [IQR] HbA_{1c} levels did not change significantly in either the cases or controls at the beginning and end of the study [p>0.50 across time and between groups] (**Table 2**).

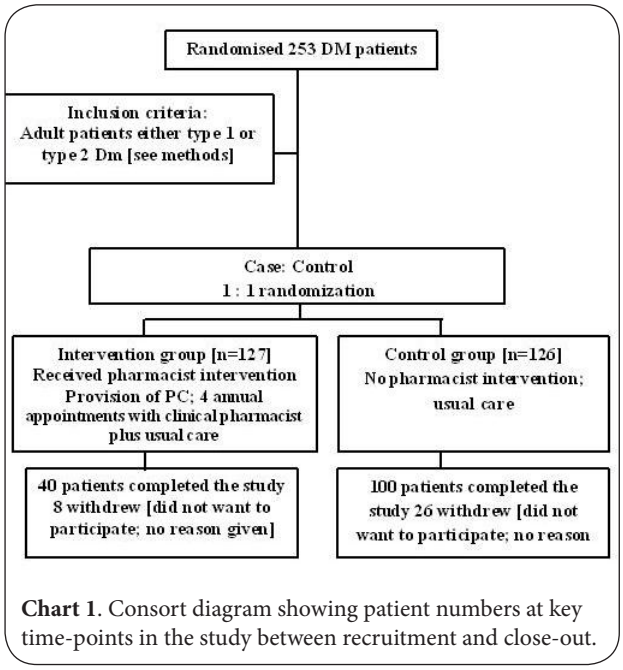

Chart 1. Consort diagram showing patient numbers at key time-points in the study between recruitment and close-out.

Table 1: Patient demographics for patients enrolled in the intervention study

	Cases	Controls	*P*
Total number	127	126	
Type 2 DM [%]	98 [77.2]	101 [80.2]	0.34
Age [years]	62±12	61±12	0.49
Male [%]	66 [52%]	62 [49.2%]	0.21

Table 2: HbA1c [%] levels over time. Data are median [IQR].

	Study entry	12 months	*P*
Cases [n=127]	8.1 [7.2, 9.0]	7.8 [7.3, 8.9]	0.53
Control [n=126]	8.5 [7.2, 97]	8.2 [7.3, 8.9]	0.54
P	0.76	0.51	

Health-related quality of life

Responses to HRQOL questions were rated on a Likert scale from 1 to 5, with higher scores indicating greater dissatisfaction [reported as "satisfaction"], impact [reported as "impact"], and worry [reported as "worry" regarding their diabetes. There were no significant differences in HRQOL within or between groups during the course of the study [p>0.11] (**Table 3**). As there were no significant differences in HRQOL in the univariate statistics, multivariate analysis was not undertaken.

Drug therapy interventions

One hundred and three drug therapy interventions were made in the cases after a full medication review and subsequent discussion with the hospital physician (**Table 4**). All drug therapy suggestions that were discussed with the hospital physician were implemented. No interventions were made in the control group as there was no medication review in this group by the investigator.

Table 3. DQOL for cases and controls at study entry and at 6 months. Data are median [IQR].

Cases n=127 Control n=126		Study entry	*P* Case *vs* control	*12 months*	*P* Case vs control	*P* Study entry –12 months
Satis-faction	**Case**	1.9 [1.4, 2.5]	0.46	2.1 [1.9,2.8]	0.20	0.69
	Control	1.7 [1.4, 2.4]		1.9 [1.2, 2.4]		0.67
Impact	**Case**	2.0 [1.8, 2.4]	0.66	2.5 [2.1, 2.80]	0.69	0.62
	Control	2.2 [2.0, 2.6]		2.3 [1.8, 2.5]		0.28
Worry	**Case**	1.7 [1.3, 2.3]	0.12	2.1 [1.6, 2.6]	0.71	0.14
	Control	1.8 [0.9, 2.6]		1.9 [1.4, 2.5]		0.26
Total	**Case**	1.9 [1.6, 2.3]	0.43	2.3 [1.9, 2.6]	0.60	0.11
	Control	2.0 [1.5,2.3]		2.1 [1.5, 2.4]		0.38

Table 4: Categories of interventions

Intervention	n [%]	Example
Addition of a drug	42 [41]	Addition of metformin to a poorly controlled obese type 2 DM patients on insulin therapy
Cessation of drug	21 [20]	Patients with contraindications to the use of NSAIDS change to regular paracetamol dosing
Adverse drug reaction	3 [3]	Rash to statins
Drug/food interaction	24 [23]	OHAs – advice with respect to timing of doses and meals
Compliance	5 [5]	Patients had discontinued low dose aspirin – advice to restart
Dose increase	8 [8]	Lipid levels remaining high, increase simvastatin dose

Complementary Medicines [CMs]

During the study it was determined that 16% of patients were taking at least once CM, usually without the knowledge of the hospital physician. Fourteen different CMs were being consumed and 9 of these [64%] had the potential to interfere with another medication or affect an existing disease state in the individual patient (**Table 5**).

Discussion

The overall level of glycaemic control in the majority of the present patients was suboptimal [**25**]. It is well documented that good glycaemic control with HbA_{1c} levels of less than 7.0% results in health and cost benefits in the diabetic patient [**26-30**]. As diabetes progresses, the level of glycaemic control generally worsens and it may have been that these patients had a long duration of diabetes, making attainment of good glycaemic control more difficult [**7**].

In the context of this small-scale pilot study it may be that more regular patient contact either by more frequent clinic appointments or via the telephone would have been an important factor in influencing glycaemic control. Asking patients to attend more regularly may have had an impact

Table 5. Complementary medicine use among cases and controls of the study

Cases:= 127 **Number of patients taking CMs = 21 [16.5%]**	**Controls = 126** **Number of patients taking CMs = 20 [16%]**
Number of CMs = 8	**Number of CMs = 6**
Omega – 3 fish oil	**Herbalax®**
Chromium	**Linseed** *and* ***Garlic***
Gingko biloba	Grape seed Extract
Gotu-cola	***Fish Oil and glucosamine***
Glucosamine	
Cod liver oil	
Thiamineact	
Thiamine	

on their HRQOL [31], however more regular contact via the telephone may prove effective [32]. Other educational strategies, such as a regular newsletter addressing different aspects of maintaining good glycaemic control may also have been benefit [33-36]. A longer duration of study may also have been important to see changes in the glycaemic control.

HRQOL is a widely accepted endpoint in intervention studies. HRQOL endpoints that are related health care have been used to adjust measures of effectiveness for clinical decision making and resource allocation, and to evaluate drugs and health-care programs in many areas [37-38]. In the present study, the DQOL did not change in any dimension over the six-month period in cases or controls.

The DQOL was developed for the DCCT [31]. It was postulated that HRQOL might be worse in the DCCT intervention group, due to the increased incidence of hypoglycaemia and the increased demands of intensive therapy. However, there was no intervention-specific difference in HRQOL mean and total scores. The present study was more demanding for the patient as they had to attend the outpatient clinic more regularly. This did not worsen the individual "satisfaction" scores. While the DQOL is a diabetes-specific HRQOL tool [31], it would have been useful to have used a general health related QOL tool such as the SF-36 [39]. Multiple indexes of HRQOL are preferable because no single standard measure exists for assessing the effects of clinical interventions in diabetes [40].

Drug therapy interventions were a result of the PC process [41]. During the process, drug-related problems were identified, discussed with the patient and the physician and changes to the patients medications were then considered. These types of interventions are well described in the literature [16,36,47-49]. As only one measure of clinical outcome was followed in the present study, it can be concluded that the drug therapy interventions did not result in improvement in glycaemic control. If multiple clinical outcomes had been measured and followed [*e.g.* lipids, BP, BMI], the effect of these drug therapy interventions may have been seen.

The use of CMs in patients with diabetes has been described, but the surveys all have methodological differences, making comparison difficult [46-49]. It is clear that the present patient group was consuming CMs and some of these CMs may have the potential for CM-drug interactions or CM-disease interactions. This would increase certain monitoring requirements in a diabetic patient. The importance of a complete patient medication history as part of the PC process becomes paramount.

High-risk patients were targeted on the basis that they would have the greatest potential for clinical benefit from the PC program [50]. It is also possible that the multiple problems and complexities of care facing these patients blunted the impact of the PC program. In addition these patients are usually reviewed by up to five different HCPs, including a hospital physician after referral by their general practitioner to the clinic. Even with this level of care, HbA1c l levels below 8% were not achieved in most of the case and control subjects. The value of adding a pharmacist in this setting appears to be related to the medication review process. The medication review process is an important part of the management of the diabetic patient, and showed benefits in highlighting the use of CMs and drug therapy changes.

There has been a small-scale study of a PC program in a diabetic outpatient clinic involving 39 urban African-American patients [50]. A range of interventions was implemented in addition to medication counseling. The mean HbA_{1c} at the beginning of study was >12% and 9.2% at the end, a level that is still substantially higher than that seen in the patients recruited to the present study. Given the very high initial HbA_{1c} levels in the patients recruited, it is not surprising that a positive result was achieved. Recent evidence suggests that there is no threshold HbA_{1c} level for vascular benefit in diabetes [51]. Although the data from restricted sample in the present study, didn't show a significant reduction in HbA_{1c} even a small improvement as a result of a PC program may prove cost effective.

Thirty-nine interventions were implemented in the case group. These interventions involved a wide range of medications, not just hypoglycaemics. While these interventions did not result in a significant improvement in glycaemic control over a six-month period, it may be that additional vascular risk factors, such as blood lipid and BP may have improved. These secondary endpoints were not considered in the present study.

During the process of medication review, one in six patients was found to be consuming one and two CMs. Of these CMs, 64% had the potential to interact with prescribed medicines or have a potential effect on an existing disease state in the patient. The use of CMs in type 2 DM warrant further investigation and in particular impact of these CMs requires review.

The present study highlights the value of the pharmacist as an information resource for patients with diabetes. This extends to CMs where potential interactions with conventional therapy may be neither suspected nor recognized. The present data and those of others suggest that a larger evaluation of

a PC program for diabetes in the primary care setting may be valuable. The service was offered by a single dedicated clinical pharmacist who had completed self-directed diabetes care training. When reviewing the ability of this service to be adapted to the wider community, Diabetes training of the service provider must included as part of the study design.

Limitation of the PC model

Future studies need to collect further demographic information including duration of diabetes, presence of complications [such as cardiovascular disease], and ethnicity. This information may have helped to explain the poor level of glycaemic control seen in this group of patients and if collected enable the pharmacist to provide more targeted PC.

Future studies need to follow all patient end points relevant to diabetes care including lipid levels, BP, microalbuminuria and body mass index [BMI]. While some of these parameters were inclusion criteria, they were not followed as part of the present pilot study and this is a major limitation. It may well be that even though glycaemic control did not improve in the present study, these other important endpoints that were not followed, may have improved.

A larger cohort and longer study would have been necessary to see statistically significant changes in the various parameters. This study was carried out over a six-month period. It may be that with this cohort of poorly controlled patients with diabetes, a longer time frame may have been necessary. A longer time frame would have allowed for further educational strategies to be implemented and for more contact with the patient.

While the DQOL is a diabetes specific HRQOL tool [**31**], it would have been useful to add a health related QOL tool, such as the SF-36 [**39**]. Multiple indexes of HRQOL are preferable, as one tool does not assess all aspects of HRQOL.

This study identified for the first time a high usage of CMs in high-risk diabetes patients. A larger detailed study of CM usage in patients with diabetes would provide valuable data to further address this issue.

The patient satisfaction survey was developed for the present study and as such was a non validated tool. A larger cohort and more studies would be needed to fully validate the instrument.

A single pharmacist with diabetes specific training completed the intervention. For this intervention to be able to be widely used in the community, pharmacists would have to complete a diabetes related training course.

Conclusions

The PC study highlights the value of the pharmacist as an information resource for patients with diabetes. This extends to CMs where potential interactions with conventional therapy may be neither suspected nor recognized. The present data and those of others suggest that a larger evaluation of a PC program for diabetes in the primary care setting may be valuable. The service was offered by a single dedicated clinical pharmacist who had completed self-directed diabetes care training. When reviewing the ability of this service to be adapted to the wider community, Diabetes training of the service provider must included as part of the study design.

Competing Interests

The authors delcare that they have no competing interests.

Authors' Contribution

SWG: Principle investigator [clinical pharmacist], SASS: Project supervisor, SCV: Design the analysis of the study, YOS: Scientific writing and editing manuscript, SMSG: Scientific Reviewer, SNH: Scientific Reviewer, NHMH: Scientific Reviewer.

Acknowledgement

Researcher want to acknowledge the healthcare professionals of endocrine clinic of Hospital Pulau Pinang and attending nursing staff for assisting in administrative work of this project.

Publication history

Received: 13-May-2012 Revised: 22-July-2012
Accepted: 23-Aug-2012 Published: 20-Sep-2012

References

1. Ruggiero, L. *et al.*: **Diabetes self-management. Self-reported recommendations and patterns in a large population**. *Diabetes Care* 1997, **20**(4):568-576. | Article | PubMed
2. Chang, H. Y. *et al.*: **A population study of the self-care behaviors and their associated factors of diabetes in Taiwan: results from the 2001 National Health Interview Survey in Taiwan**. *Prev Med* 2005, **40**(3):344-348. | Article | PubMed
3. Cox, R. H. *et al.*: **Characteristics of low-income African-American and Caucasian adults that are important in self-management of type 2 diabetes**. *J Community Health* 2004, **29**(2):155-170. | Article | PubMed
4. Meetoo, D.: **Dietary pattern of self-care among Asian and Caucasian diabetic patients**. *Br J Nurs* 2004, **13**(18):1074-1078. | Article | PubMed
5. Nelson, K. M., Reiber, G. & Boyko, E. J.: **Diet and exercise among adults with type 2 diabetes: findings from the third national health and nutrition examination survey (NHANES III)**. *Diabetes Care* 2002, **25**(10):1722-1728. | Article | PubMed
6. Nthangeni, G. *et al.*: **Dietary intake and barriers to dietary compliance in black type 2 diabetic patients attending primary health-care services**. *Public Health Nutr* 2002, **5**(2):329-338. | Article | PubMed
7. Toobert, D. J., Hampson, S. E. & Glasgow, R. E.: **The summary of diabetes self-care activities measure: results from 7 studies and a revised scale**. *Diabetes Care* 2000, **23**(7):943-950. | Article | PubMed
8. Wen, L. K., Parchman, M. L. & Shepherd, M. D.: **Family support and diet barriers among older Hispanic adults with type 2 diabetes**. *Fam Med* 2004, **36**(6):423-430. | Article | PubMed
9. Blaiss, M. S.: **Asthma disease management: a critical analysis**. *Ann Allergy Asthma Immunol* 2005, **95**(5 Suppl 1):S10-16. | Article | PubMed
10. Hartz, A. *et al.*: **Factors that influence improvement for patients with poorly controlled type 2 diabetes**. *Diabetes Res Clin Pract* 2006, **74**(3):227-232. | Article | PubMed
11. Hawthorne, K.: **Effect of culturally appropriate health education on glycaemic control and knowledge of diabetes in British Pakistani women with type 2 diabetes mellitus**. *Health Educ Res* 2001, **16**(3):373-381. | Article | PubMed
12. Taylor, M. D., Frier, B. M., Gold, A. E. & Deary, I. J.: **Psychosocial factors and diabetes-related outcomes following diagnosis of Type 1 diabetes in adults: the Edinburgh Prospective Diabetes Study**. *Diabet Med* 2003, **20**(2):135-146. | Article | PubMed

13. Tu, K. S., McDaniel, G. & Gay, J. T.: **Diabetes self-care knowledge, behaviors, and metabolic control of older adults--the effect of a posteducational follow-up program**. *Diabetes Educ* 1993, **19**(1):25-30. | Article | PubMed
14. Anderson, R. M. *et al.*: **Patient empowerment. Results of a randomized controlled trial**. *Diabetes Care* 1995, **18**(7):943-949. | Article | PubMed
15. Jacobson, A. M. *et al.*: **Psychological characteristics of adults with IDDM. Comparison of patients in poor and good glycemic control**. *Diabetes Care* 1990, **13**(4):375-381. | Article | PubMed
16. Lerman, I. *et al.*: **Psychosocial factors associated with poor diabetes self-care management in a specialized center in Mexico City**. *Biomed Pharmacother* 2004, **58**(10):566-570. | Article | PubMed Abstract | PubMed Full Text
17. Lerman, I.: **Adherence to treatment: the key for avoiding long-term complications of diabetes**. *Arch Med Res* 2005, **36**(3):300-306. | Article | PubMed
18. Ni, H. *et al.*: **Factors influencing knowledge of and adherence to self-care among patients with heart failure**. *Arch Intern Med* 1999, **159**(14):1613-1619. | Article | PubMed
19. Hawthorne, K. & Tomlinson, S.: **Pakistani moslems with Type 2 diabetes mellitus: effect of sex, literacy skills, known diabetic complications and place of care on diabetic knowledge, reported self-monitoring management and glycaemic control**. *Diabet Med* 1999, **16**(7):591-597. | Article | PubMed
20. Merican, M. I., Rohaizat, Y. & Haniza, S.: **Developing the Malaysian health system to meet the challenges of the future**. *Med J Malaysia* 2004, **59**(1):84-93. | PubMed
21. Wild, S. *et al.*: **Global prevalence of diabetes: estimates for the year 2000 and projections for 2030**. *Diabetes Care* 2004, **27**(5):1047-1053. | Article | PubMed
22. Arcavi, L. *et al.*: **High fasting glucose levels as a predictor of worse clinical outcome in patients with coronary artery disease: results from the Bezafibrate Infarction Prevention (BIP) study**. *Am Heart J* 2004, **147**(2):239-245. | Article | PubMed
23. Danaei, G. *et al.*: **Global and regional mortality from ischaemic heart disease and stroke attributable to higher-than-optimum blood glucose concentration: comparative risk assessment**. *Lancet* 2006, **368**(9548):1651-1659. | Article | PubMed
24. Weinger, K., Butler, H. A., Welch, G. W. & La Greca, A. M.: **Measuring diabetes self-care: a psychometric analysis of the Self-Care Inventory-Revised with adults**. *Diabetes Care* 2005, **28**(6):1346-1352. | Article | PubMed
25. Patel A. **Diabetes in focus**. London: Pharmaceutical Press; 1999. | Book
26. **Anonymous. Schedule of Pharmaceutical Benefits**. In. February 2003 ed: Department of Health and Ageing; http://www.hic.gov.auwww.hic.gov.au 2003.
27. Blaum, C. S., Velez, L., Hiss, R. G. & Halter, J. B.: **Characteristics related to poor glycemic control in NIDDM patients in community practice**. *Diabetes Care* 1997, **20**(1):7-11. | Article | PubMed
28. Gilmer, T. P., O'Connor, P. J., Manning, W. G. & Rush, W. A.: **The cost to health plans of poor glycemic control**. *Diabetes Care* 1997, **20**(12):1847-1853. | Article | PubMed
29. Gaster, B. & Hirsch, I. B.: **The effects of improved glycemic control on complications in type 2 diabetes**. *Arch Intern Med* 1998, **158**(2):134-140. | Article | PubMed
30. Wagner, E. H. *et al.*: **Effect of improved glycemic control on health care costs and utilization**. *JAMA* 2001, **285**(2):182-189. | Article | PubMed
31. **Influence of intensive diabetes treatment on quality-of-life outcomes in the diabetes control and complications trial**. *Diabetes Care* 1996, **19**(3):195-203. | Article |PubMed
32. Piette, J. D., Heisler, M., Krein, S. & Kerr, E. A.: **The role of patient-physician trust in moderating medication nonadherence due to cost pressures**. *Arch Intern Med* 2005, **165**(15):1749-1755. | Article | PubMed
33. Kassam, R. *et al.*: **Pharmaceutical care research and education project: pharmacists' interventions**. *J Am Pharm Assoc (Wash)* 2001, **41**(3):401-410. | PubMed
34. Huff, P. S., Ives, T. J., Almond, S. N. & Griffin, N. W.: **Pharmacist-managed diabetes education service**. *Am J Hosp Pharm* 1983, **40**(6):991-994. | Article | PubMed
35. Blanchard, M. A. *et al.*: **Using a focus group to design a diabetes education program for an African American population**. *Diabetes Educ* 1999, **25**(6):917-924. | Article | PubMed
36. Lowe, C. J. *et al.*: **Effects of a medicine review and education programme for older people in general practice**. *Br J Clin Pharmacol* 2000, **50**(2):172-175. | Article | PubMed Abstract | PubMed Full Text
37. Testa, M. A., Anderson, R. B., Nackley, J. F. & Hollenberg, N. K.: **Quality of life and antihypertensive therapy in men. A comparison of captopril with enalapril. The Quality-of-Life Hypertension Study Group**. *N Engl J Med* 1993, **328**(13):907-913. | Article | PubMed
38. Testa, M. A. & Simonson, D. C.: **Health economic benefits and quality of life during improved glycemic control in patients with type 2 diabetes mellitus: a randomized, controlled, double-blind trial**. *JAMA* 1998, **280**(17):1490-1496. | Article | PubMed
39. Ware JE, SF-36 Health Survey; manual and interpretation guide. Boston, Massachusetts: Nimrod Press; 1997.
40. **Quality of life in type 2 diabetic patients is affected by complications but not by intensive policies to improve blood glucose or blood pressure control (UKPDS 37). U.K. Prospective Diabetes Study Group**. *Diabetes Care* 1999, **22**(7):1125-1136. | Article | PubMed
41. Strand L, Cipolle R, Morley P.: **Pharmaceutical care: an introduction**. Kalamazoo, Michigan: Upjhon; 1992. | Book
42. Brown, S. A.: **Effects of educational interventions in diabetes care: a meta-analysis of findings**. *Nurs Res* 1988, **37**(4):223-230. | PubMed
43. Ellis, S. L. *et al.*: **Types of interventions made by clinical pharmacists in the IMPROVE study. Impact of Managed Pharmaceutical Care on Resource Utilization and Outcomes in Veterans Affairs Medical Centers**. *Pharmacotherapy* 2000, **20**(4):429-435. | Article | PubMed
44. Malone, D. C. *et al.*: **An economic analysis of a randomized, controlled, multicenter study of clinical pharmacist interventions for high-risk veterans: the IMPROVE study. Impact of Managed Pharmaceutical Care Resource Utilization and Outcomes in Veterans Affairs Medical Centers**. *Pharmacotherapy* 2000, **20**(10):1149-1158. | Article | PubMed
45. Tett, S. E., Higgins, G. M. & Armour, C. L.: **Impact of pharmacist interventions on medication management by the elderly: a review of the literature**. *Ann Pharmacother* 1993, **27**(1):80-86. | Article | PubMed
46. Welch SA.: **The use of complementary medications by inpatients at St Vincent's hospital Sydney**. *Aust J Hosp Pharm*, 2001, 31(2):111-3. | Article
47. Wandell Wandell, P. E., Brorsson, B. & Aberg, H.: **Drug use in patients with diabetes**. *Diabetes Care* 1996, **19**(9):992-994. | Article | PubMed
48. Ryan, E. A., Pick, M. E. & Marceau, C.: **Use of alternative medicines in diabetes mellitus**. *Diabet Med* 2001, **18**(3):242-245. | Article | PubMed
49. Leese G, Gill G, Houghton G.: **Prevalence of complementary medicines usage within a diabetic clinic**. *Pract Diabetes Int*, 1997; **14**(7):207-8. | Article
50. Jaber, L. A. *et al.*: **Evaluation of a pharmaceutical care model on diabetes management**. *Ann Pharmacother* 1996, **30**(3):238-243. | Article | PubMed
51. Dvorak, S. R., McCoy, R. A. & Voss, G. D.: **Continuity of care from acute to ambulatory care setting**. *Am J Health Syst Pharm* 1998, **55**(23):2500-2504. | Article | PubMed