The role of pharmacists in the management of type 2 diabetes: A literature review

Nitisha Khunti, Andrew Willis, Melanie Davies, Kamlesh Khunti

Diabetes is one of the primary causes of death and disability globally, affecting over 371 million people, which is said to rise to 552 million people by 2030 (International Diabetes Federation, 2012). Current estimates suggest that there are over 3 million people in England with diabetes, of whom roughly a quarter are undiagnosed (Holman et al, 2011). The prevalence of diabetes is higher in developed countries than in developing countries but as developing countries become more industrialised, the incidence of diabetes will also increase. In the UK, it is estimated that the cost of treating diabetes and its related complications is approximately £14 billion (around 85% of that being due to type 2 diabetes), accounting for around 10% of the total NHS expenditure for England and Wales (Kanavos et al, 2012). In 2012, around 4.8 million deaths resulted from the disease and its associated complications worldwide (International Diabetes Federation, 2012). Diabetes has been stated to be the underlying cause of 12% of all new cases of legal blindness, over one third of new cases of end-stage renal disease and approximately half of non-traumatic lower-extremity amputations. It has also been indicated that people with diabetes are two to four times more likely to die from heart disease or suffer a stoke (Powers, 2001).

Diabetes management is a life-long process and necessitates a large amount of effort on behalf of the person with the condition. This individual is arguably the most vital component of effective management of the condition. Inadequate diabetes management results in increased severity of complications. Adherence to medication is therefore extremely important; however, poor adherence has been an ongoing problem for both patients and healthcare workers (Nagasawa et al, 1990; Vermeire et al, 2001).

Appropriate glycaemic control is key when managing patients with type 2 diabetes mellitus. HbA1c is now used as the monitoring test of choice for measuring glycaemic control in people with diabetes (Reynolds et al, 2006). A high HbA1c is a good indicator of poor glycaemic control over the past 3 months. Improved glycaemic control is essential for preventing the risk of diabetic complications. The United Kingdom Prospective Diabetes Study (UKPDS) established that for every 1% decrease in HbA1c, a 21% reduction is seen in deaths related to diabetes, with a 37% reduction in microvascular complications (Stratton et al, 2000).

NICE suggests a target HbA1c of 6.5% for people with type 2 diabetes requiring no medication and 7.5% for those on multiple therapies (Home et al, 2008). The specific HbA1c level should be tailored for each individual and should be agreed in concordance with the person with the condition and his or her GP or nurse. HbA1c targets of less than 6% are not...
recommended owing to increased risk of severe hypoglycaemia and increased mortality (Mayor, 2008; Schernthaner, 2010).

The pharmacist’s role in diabetes management
In both the UK and US, the role of the pharmacist is of increasing importance in the management of chronic illnesses (Lindenmeyer et al, 2006). The community pharmacist is becoming considered as the first port of call in order for patients to obtain advice on managing their disease (Glasgow and Anderson, 1999). It is estimated that on average, a person with diabetes visits the pharmacy three to eight times more often than other patients (Pinto et al, 2006). Consequently, community pharmacists have the opportunity of playing a fundamental role in managing diabetes along with its complications by providing people who have diabetes with programmes for monitoring therapeutic interventions and improving medicine compliance, as well as counselling on lifestyle factors for improving their quality of life (Baran et al, 1999; Nichols-English et al, 2002).

Although, at present, pharmacists do not diagnose diabetes, they can play an important role in helping the individual to maintain control of his or her condition. Owing to the rapid development of accessible medications to treat diabetes, the pharmacist’s role in caring for people with diabetes has evolved. The pharmacist is able to educate individuals about the correct way of taking and using medication, identify drug interactions, explain monitoring devices and make recommendations for additional products and services (Palaian et al, 2005).

Medication adherence is also an essential part of effectively managing diabetes, and pharmacists are in an ideal position to positively influence this (Bogden et al, 1998). It has been acknowledged that owing to the difficulties in people complying with medication regimens for chronic diseases, “Pharmacists have an important role to play in health care, which is much more than selling medicines” (WHO, 2006). This includes the “seven-star concept”, where a pharmacist has been described as a caregiver, communicator, decision-maker, teacher, life-long learner, leader and manager and is therefore ideally situated to carry out efficient interventions aimed at improving long-term health outcomes.

The 2005 Community Pharmacy Contract was aimed at implementing changes to pharmacists’ roles by extending them to optimise public health. Pharmacists are becoming increasingly involved in clinical care in a number of ways, such as counselling, reviewing medication and independent prescribing. Type 2 diabetes has been recognised as a significant condition as part of the New Medicine Service
Diabetes (NMS), which is provided by pharmacists to deliver support to individuals prescribed long-term therapies for the first time. Patients are also able to receive support and counselling for their medicines via the Medicines Use Review (MUR) service. Both these services can be utilised and extend how pharmacists can make a contribution to patient care in diabetes (Ali et al, 2012). As is mentioned above, an average person with diabetes is thought to visit the pharmacist approximately three to eight times more often than other patients, creating many opportunities for a community pharmacist to get involved and play an important role in the management of diabetes and its complications (Pinto et al, 2006).

Review method

Primary research question

The question we examined was: “To what extent do pharmacist-led interventions lead to improvements in glycaemic control evaluated by HbA1c?”

Literature search

Studies on the role of the pharmacists in the management of type 2 diabetes were identified through a search of MEDLINE (1946–2012), PubMed, Scopus and Google search engines on the Internet. Search terms included in the searches were “type 2 diabetes mellitus”, “pharmacist interventions” and “HbA1c”.

Criteria

Any studies that had taken place in the community, outpatient, primary care and hospital (secondary care) settings were included. Studies were considered suitable if they comprised people with type 2 diabetes and were designed to measure an improvement in HbA1c following an intervention delivered by a pharmacist. Only papers available in English were considered.

Results

Study selection

This review focuses on 18 studies that were accessible in full text and recognised as suitable. Ten studies were carried out in the US (Jaber et al, 1996; Coast-Senior et al, 1998; Nowak et al, 2002; Cranor et al, 2003; Rothman et al, 2003; Leal et al, 2004; Choe et al, 2005; Kiel and McCord, 2005; Odegard et al, 2005; Scott et al, 2006). The remainder were studies based in the UK (Al Mazroui et al, 2009; Ali et al, 2012), Australia (Clifford et al, 2005; Taylor et al, 2005; Krass et al, 2007), Spain (Fornos et al, 2006), Malaysia (Lim and Lim, 2010) and Iran (Farsaei et al, 2011). Table 1 gives an overview of the studies and the different interventions used.
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### Table 1. Study characteristics.

<table>
<thead>
<tr>
<th>Citation</th>
<th>Country</th>
<th>Title</th>
<th>Size (Population)</th>
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<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al-Mazroui et al., 2009</td>
<td>UK</td>
<td>“Influence of pharmaceutical care on health outcomes in patients with type 2 diabetes mellitus”</td>
<td>Total: n=240  Intervention: n=120 Control: n=120 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>A pharmaceutical care programme, which consisted of patient education along with medication adherence, metabolic control and lifestyle advice.</td>
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<tr>
<td>Ali et al., 2012</td>
<td>UK</td>
<td>“Impact of community pharmacy diabetes monitoring and education programme on diabetes management: a randomized controlled study”</td>
<td>Total: n=46  Intervention: n=23 Control: n=23 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients were provided with a programme of education about diabetes, its treatment and associated cardiovascular risk factors. They were seen for monitoring/counselling by a community pharmacist on six occasions over a 12-month period.</td>
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<tr>
<td>Choe et al., 2006</td>
<td>USA</td>
<td>“Outcomes of pharmacist-managed diabetes”</td>
<td>Total: n=65  Intervention: n=36 Control: n=29 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients received evaluation and modification of pharmacotherapy, self-management of diabetes education, and reinforcement of diabetes complications screening processes through clinic visits and telephone follow-up.</td>
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<tr>
<td>Clifford et al., 2005</td>
<td>Australia</td>
<td>“Effect of a pharmaceutical care program on vascular risk factors in type 2 diabetes”</td>
<td>Total: n=180  Intervention: n=92 Control: n=88 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients had face-to-face medication and lifestyle counselling at baseline and at 6 and 12 months along with 6-weekly telephone assessments and were also provided with other educational material.</td>
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<tr>
<td>Farsaei et al., 2011</td>
<td>Iran</td>
<td>“Effect of pharmacist-led patient education on glycaemic control of type 2 diabetes: a randomized controlled trial”</td>
<td>Total: n=172  Intervention: n=87 Control: n=85 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients received an educational programme about oral antidiabetes medications, adherence, and a diabetes diary, log and pill box usage. Patients' glycaemic control was monitored for 3 months via either telephone or face-to-face interviews with the pharmacist.</td>
</tr>
<tr>
<td>Fornos et al., 2006</td>
<td>Spain</td>
<td>“A pharmacotherapy follow-up program in patients with type 2 diabetes in community pharmacies in Spain”</td>
<td>Total: n=112  Intervention: n=56 Control: n=56 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Pharmacists identified and resolved drug-related problems and provided education on diabetes complications, lifestyle changes, foot inspections, correct medication use and self-monitoring.</td>
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<tr>
<td>Jaber et al., 1996</td>
<td>USA</td>
<td>“Evaluation of a pharmaceutical care model on diabetes management”</td>
<td>Total: n=39  Intervention: n=17 Control: n=22 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients in the intervention group received diabetes education, medication counselling, instructions on dietary regulation, exercise, and home blood glucose monitoring, and evaluation and adjustment of their antidiabetes regimens.</td>
</tr>
<tr>
<td>Krass et al., 2007</td>
<td>Australia</td>
<td>“The Pharmacy Diabetes Care Program: assessment of a community pharmacy diabetes service model in Australia”</td>
<td>Total: n=289  Intervention: n=149 Control: n=140 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients were provided with a diabetes service that included detection of drug-related problems, management and review of disease, medications, and lifestyle, along with support for self-monitoring, adherence, and reminders of complications.</td>
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<tr>
<td>Osdaghi et al., 2005</td>
<td>USA</td>
<td>“Caring for poorly controlled diabetes mellitus: a randomized pharmacist intervention”</td>
<td>Total: n=57  Intervention: n=34 Control: n=23 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>The pharmacist intervention comprised development of a diabetes care plan, regular pharmacist-patient communication on diabetes care progress, and pharmacist-provider communication on the patient’s diabetes care progress.</td>
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<tr>
<td>Scott et al., 2006</td>
<td>USA</td>
<td>“Outcomes of pharmacist-managed diabetes care services in a community health center”</td>
<td>Total: n=149  Intervention: n=76 Control: n=73 (Type 2 diabetes)</td>
<td>Randomised controlled trial</td>
<td>Patients in the intervention group were enrolled into a pharmacist-managed diabetes care programme.</td>
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<td>Coast-Senior et al., 1998</td>
<td>USA</td>
<td>“Management of patients with type 2 diabetes by pharmacists in primary care clinics”</td>
<td>Total: n=23  (Type 2 diabetes)</td>
<td>Non-randomised prospective study</td>
<td>The pharmacist provided patients with diabetes education, medication counselling, monitoring, and insulin initiation and/or adjustments. Face-to-face interactions were provided for patients initially and after that patient-pharmacist interactions were either face-to-face or via telephone. Pharmacists provided patients with a consultation and patients were then provided with the opportunity to meet with pharmacists in order to monitor treatment goals and to receive diabetes education, home glucose meter training, and information about adherence to their regimen. Pharmacists also referred patients to their physician or the diabetes education centre, as required.</td>
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<tr>
<td>Kiel and McCord, 2005</td>
<td>USA</td>
<td>“Pharmacist impact on clinical outcomes in a diabetes disease management program via collaborative practice”</td>
<td>Total: n=109  (Majority had type 2 diabetes)</td>
<td>Retrospective review</td>
<td>Patients received suitable diagnostic, educational, and therapeutic management services, including prescribing medication and ordering laboratory tests.</td>
</tr>
<tr>
<td>Leal et al., 2004</td>
<td>USA</td>
<td>“Improving quality of care in diabetes through a comprehensive pharmacist-led disease management program”</td>
<td>Total: n=199  (Majority had type 2 diabetes)</td>
<td>Observational prospective study</td>
<td>A pharmacist-managed diabetes medication therapy adherence clinic.</td>
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<tr>
<td>Lim and Lim, 2010</td>
<td>Malaysia</td>
<td>“Evaluation of a pharmacist-managed diabetes medication therapy adherence clinic”</td>
<td>Total: n=41  (Majority had type 2 diabetes)</td>
<td>Retrospective cross-sectional study</td>
<td>Patients received a management session on diabetes education, treatment recommendations and counselling and were provided medication management.</td>
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<tr>
<td>Nowak et al., 2002</td>
<td>USA</td>
<td>“Metabolic control and adherence to American Diabetes Association practice guidelines in pharmacist-managed diabetes clinic”</td>
<td>Total: n=57  Intervention: n=28 Control: n=29 (Type 2 diabetes)</td>
<td>Retrospective analysis</td>
<td>A pharmacist-managed diabetes clinic.</td>
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<tr>
<td>Rothenhan et al., 2003</td>
<td>USA</td>
<td>“Pharmacist led, primary care-based disease management improves hemoglobin A1c in high-risk”</td>
<td>Total: n=118  (Type 2 diabetes)</td>
<td>Retrospective study</td>
<td>Patients received a management session on diabetes education, treatment recommendations and counselling and were provided medication management.</td>
</tr>
<tr>
<td>Taylor et al., 2005</td>
<td>Australia</td>
<td>“A cost-effectiveness analysis of a community pharmacist-initiated disease state management service for type 2 diabetes mellitus”</td>
<td>Total: n=99  Intervention: n=53 Control: n=46 (Type 2 diabetes)</td>
<td>Parallel-group design</td>
<td>Patients were educated about blood glucose monitoring and were given MediSense blood glucose monitors, which they were asked to use during the study. Patients were provided with six follow-up visits. Patients were also counselled on their lifestyle and self-care and the downloaded blood glucose monitoring data were printed out and discussed at each visit.</td>
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Effect of pharmacist interventions on HbA1c

For all 18 studies, the primary outcome measure was change in HbA1c. All the studies found that the interventions had been successful in significantly reducing HbA1c in people with type 2 diabetes (see Table 2). The largest reduction in HbA1c was 26 mmol/mol (2.4%), from 89 to 63 mmol/mol (10.3% to 7.9%; Jaber et al, 1996). Taylor et al, (2005) found the smallest reduction in HbA1c, from 62.4 to 57.4 mmol/mol (7.86% to 7.40%), resulting in a decrease in HbA1c of 5.0 mmol/mol (0.46%).

Discussion

This paper examines the evidence of the effectiveness of pharmacist interventions on reducing HbA1c. The studies reviewed reported that interventions by a pharmacist were successful in significantly reducing HbA1c in people with type 2 diabetes. They suggest that a pharmacist intervention in people with type 2 diabetes could potentially reduce diabetic complications, mortality rates and associated treatment costs.

Overall, studies in which patients had a higher baseline HbA1c level presented a greater reduction over the course of the pharmacist intervention. From the studies, it can be seen that the pharmacist interventions included many different aspects such as counselling on medications, strategies to improve adherence and self-monitoring, and lifestyle advice. It is not possible to categorically state which components of the included interventions resulted in improvements of HbA1c. However, it is noteworthy that two of the studies displaying large reductions in HbA1c (Jaber et al, 1996; Farsaei et al, 2011) included equipment to allow self-monitoring of blood glucose in addition to advice on self-monitoring. This has been shown by a recent systematic review and meta-analysis to be effective in reducing HbA1c (Farmer et al, 2012). However, as we did not conduct any statistical analysis of interventional effects based on intervention type, any hypothesis on effects of individual aspect of interventions could not be substantiated. It could therefore be assumed that the amalgamation of these interventions together resulted in a synergistic improvement in glycaemic control. The Australian Fremantle Diabetes Study (Clifford et al, 2005) demonstrated that HbA1c can be reduced significantly independent of pharmcotherapeutic changes, which shows the improvements in HbA1c were most likely due to improved adherence and lifestyle modifications. Pharmacist interventions that include pharmcotherapeutic changes could thus further improve glycaemic control.

Compared with other type 2 diabetes interventions, by other healthcare professionals, this review suggests that pharmacist interventions can lead to relatively greater improvements in glycaemic control. A past Cochrane review looked at the
specialist nurse interventions in diabetes. No conclusive evidence was found to show that specialist nurses aided in the reduction of HbA1c (Loveman et al, 2003), although this does not imply that there is actually a lack of effect.

A report on the 2009–2010 National Diabetes Audit (NHS Information Centre, 2011) suggested that a large number of people with diabetes in England and Wales are not receiving the expected standard of diabetes care. This demonstrates how the roles of the community pharmacist can be extended, especially in the management of long-term conditions and public health. From this review, it can be seen that pharmacist intervention can improve HbA1c. This could lead to further extending the pharmacists’ role in diabetes to early detection. Around 1.6 million people visit the community pharmacy in the UK every day (National Pharmacy Association, 2010). Screening for diabetes in the pharmacy environment offers a chance for this to be obtained by people who do not visit their GPs.

Limitations
This review has several limitations. Firstly, not all of the studies reviewed were randomised controlled trials. Some of the pieces of research were non-controlled studies, meaning that the decrease in HbA1c in these trials may not have been due to the pharmacist intervention. In addition, the long-term effects of pharmacist interventions in type 2 diabetes is unknown. The longest study reviewed was that of Choe et al (2005), which had follow-up out to 24 months. There is scope for future research on how pharmacists can continue interventions to assist in the long-term treatment of people with type 2 diabetes. Regardless of the stated limitations, these results are considered to be important and indicate comprehensive evidence in support of the important role of pharmacists in diabetes management.

Other considerations
The review shows how pharmacists are ideally situated to educate people with diabetes on the importance of medication adherence. By using their knowledge and drug expertise a personal relationship of trust between the pharmacist and the patient can be formed, which can be utilised to improve diabetes care and outcomes. Involving pharmacists with long-
The role of pharmacists in the management of type 2 diabetes: A literature review

The role of pharmacists in the management of type 2 diabetes has proved effective in other conditions beyond diabetes. A review and meta-analysis of pharmacist interventions to enhance blood pressure control and adherence to antihypertensive therapy found that from 2619 patients in eight studies, pharmacist interventions significantly reduced both systolic blood pressure and diastolic blood pressure (Morgado et al, 2011).

A UK study involving a cross-sectional questionnaire survey in order to learn the attitudes of community pharmacists regarding services for people with type 2 diabetes reported that over 80% of returned questionnaires reported that pharmacists saw people with diabetes “very often” or “often” when they picked up their prescriptions, but around three-quarters stated that they “never/rarely” or only “sometimes” counselled patients on what to expect from their medication (Abduelkarem et al, 2003). More than 90% of the pharmacists considered a healthy lifestyle to be important; however, most “never/rarely” or were only “sometimes” involved in its promotion. The study demonstrated that the advice and services provided by community pharmacists was inadequate and did not reach the standards and objectives set out in the National Service Framework for Diabetes. An American study found that pharmacists’ attitudes were significantly positive regarding the requirement for specific diabetes care education, the significance of tight glycaemic control, the team approach to care, and providing people with diabetes education in an outpatient setting (Younis et al, 2001).

A UK study reviewed patient perceptions of the current and future roles of the community pharmacist in type 2 diabetes management (Twigg et al, 2012). People who had had diabetes for a long period of time and who felt they had not received adequate care from the medical practice acknowledged pharmacist care more. Individuals who already had a good relationship with their GP or nurse and who had well-controlled diabetes did not see a place for a pharmacist in their care outside medicines supply. Nevertheless, this still draws attention to the fact that for people with poorly controlled diabetes or who do not receive their information from the medical practice, the pharmacy can be an alternative place for obtaining information from a qualified health professional in a suitable and reachable location.

Weitzman et al (2009) found from a survey of 468 patients, 94.9% would feel comfortable talking to their pharmacist about their diabetes and more than 70% would see their pharmacist on a regular basis to have their glucose levels checked. Sixty-six per cent of individuals were not aware that pharmacists are able carry out blood glucose testing. The majority of responders (97.9%) trusted their pharmacists’ advice on medications. However, despite this, more than 35% of patients do not go to the pharmacists for medicines advice. The patients’ lack of awareness of pharmacists’ abilities is highlighted in this study along with the communication gap between patients and pharmacists.

Conclusion
Tight glycaemic control is extremely important when managing people with type 2 diabetes and this review demonstrates the useful role pharmacists can play in helping people successfully control their diabetes. We believe that pharmacists are in a perfect position to aid in managing people with diabetes, through intervening and helping them with medication adherence. Although there is a limited number of studies used in the review, they highlight the clear benefit that pharmacist interventions could provide in order to improve therapeutic adherence in diabetes.

In order for people with diabetes to take advantage of the pharmacy services, they must be aware that these facilities are offered. It has been acknowledged that not all patients confide in their pharmacists about their medicines and other health issues. Pharmacists are medicine specialists, are educated on a varied range of health issues, and are easily accessed by patients. As a result of this, it is unclear why there is a communication gap between pharmacists and patients.

Community pharmacists can educate and counsel patients which, as seen, can result in significant improvements in glycaemic control.

Page points
1. Tight glycaemic control is extremely important when managing people with type 2 diabetes and this review demonstrates the useful role pharmacists can play in helping people successfully control their diabetes.
2. The authors believe that pharmacists are in a perfect position to aid in managing people with diabetes, through intervening and helping them with medication adherence.
3. Although there is a limited number of studies used in the review, they highlight the clear benefit that pharmacist interventions could provide in order to improve therapeutic adherence in diabetes.
ultimately leading to a decrease in risk of strokes, cardiovascular events and mortality. These interventions will also improve the quality of life of people with diabetes. Owing to the current NHS changes and the rising incidence and cost of diabetes, it is becoming more and more vital to consider the pharmacist as an important healthcare provider who can efficiently aid in managing the diabetes crisis.

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Glasgow R, Anderson R (1999) In diabetes care, moving from compliance to adherence is not enough. Something entirely different is needed. Diabetes Care 22: 2090–2


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