

Tables

Table 1 Pharmacy diabetes intervention studies included in this review

Paper	Type of Study	Participants	Intervention	Intervention Duration	Results
Ali M et al. Impact of community pharmacy diabetes monitoring and education programme on diabetes management: a randomized controlled study. <i>Diabet Med.</i> 2012;29(9):e326-33. [42]	Randomised Controlled Trial	Adults with type 2 diabetes 46 participants	Monitoring/counselling by a community pharmacist on six occasions over a 12-month period alongside an education programme on diabetes, its treatment and associated cardiovascular risk factors.	12 months	HbA _{1c} fell from 66 mmol/mol (8.2%) to 49 mmol/mol (6.6%) (P < 0.001) in the intervention group, compared with reduction from 65 mmol/mol (8.1%) to 59 mmol/mol (7.5%) in the control group (P = 0.03). Blood pressure fell from 146/87 to 126/81 mmHg in the intervention group (P = 0.01) compared with no significant change in the control group (136/86 to 139/82 mmHg). Significant reductions in BMI (30.8 to 27 kg/m ² , P < 0.001) and blood glucose (8.8 to 6.9 mmol/l, P < 0.001) were also observed in the intervention group as compared with no significant changes in the control group. Lipid profile changes were mixed. In the intervention group, improvements were seen in diabetes-related quality of life (P = 0.001), diabetes knowledge (P = 0.018), belief about the need for medication (P = 0.004) and reduced concerns regarding medication (P < 0.001).
Obarcanin E et al. Pharmaceutical care of adolescents with diabetes mellitus type 1: the DIADEMA study, a randomized controlled trial. <i>International Journal of Clinical Pharmacy.</i> 2015;37(5):790-8. [45]	Randomised Controlled Trial	Adolescents with type 1 diabetes 68 participants	Monthly structured pharmaceutical care visits delivered by pharmacists plus supplementary visits and phone calls on an as needed basis, for 6 months.	6 months	The improvement from baseline in HbA _{1c} was significantly greater in the intervention group than in the control group after 6 months (change from baseline -0.54 vs. +0.32 %, p = 0.0075), even after adjustment for country-specific variables (p = 0.0078). However, the effect was more pronounced after only 3 months (-1.09 vs. +0.23 %, p = 0.00002). There was no significant between-group difference in the number of severe hypoglycemia events. (p = 0.1276).
Lauffenburger JC et al. Impact of a novel pharmacist-delivered behavioral intervention for patients with poorly-controlled diabetes: The ENhancing outcomes through Goal Assessment and Generating Engagement in Diabetes Mellitus (ENGAGE-DM) pragmatic randomized trial. <i>PLOS ONE.</i> 2019;14(4):e0214754. [49]	Randomised Controlled Trial	1400 adults (age 18-64 yr) with type 2 diabetes	A telephone intervention by a clinical pharmacist consisting of a 2-step process that integrated brief negotiated interviewing and shared decision-making to identify patient goals and options for enhancing diabetes management.	12 months	Change in HbA _{1c} from baseline was -0.79 (SD:2.01) in the control arm and -0.75 (SD:1.76) in the intervention arm (difference:+0.04, 95%CI: -0.22, 0.30). There were no significant differences in adherence. In as-treated analyses, the intervention significantly improved diabetes control (-0.48, 95%CI: -0.91, -0.05).
Syarifuddin S et al. Impact of Pharmacist Intervention on Improving the Quality of Life of Patients with Type 2 Diabetes Mellitus. <i>Open Access Macedonian Journal Of Medical Sciences.</i> 2019;7(8):1401-5. [41]	Cohort Study	Adults with type 2 diabetes 45 participants	Education provided to the participants comprised lifestyle changes (physical activity and eating habit), adherence to the prescribed medications, and how to use and to store the medications.	3 months	The mean QOL (in the score) of the participants: before the intervention, 61.07 ± 15.13; after the intervention, 70.15 ± 14.23, there was a significant difference between groups with and without interventions, p < 0.001.

Withidpanyawong U et al, Family-based intervention by pharmacists for type 2 diabetes: A randomised controlled trial. Patient education and counselling. 2019;102(1):85-92. [44]	Randomised Controlled Trial	Adults with type 2 diabetes 196 participants	A pharmacist delivered educational sessions and encouraged family members to take an active role in self-management practices.	9 months	There was a greater reduction in glycated haemoglobin (HbA _{1c}) in the intervention group than in the control group (-1.37% and -0.21%, respectively; P < 0.001). Between-group differences in the improvements of low-density lipoprotein cholesterol (LDL-C) and blood pressure were found (P < 0.05). Higher scores in diabetes knowledge of patients, family support, medication adherence, self-management and self-efficacy were seen in the intervention group than in the control group (P < 0.05). Multivariable analysis showed family members who were spouses or women were strong predictors of improved glycaemic control.
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Table 2: Table of review articles included in this review

Study	Type of Review	Number of studies included	Results
Machado M et al, Sensitivity of Patient Outcomes to Pharmacist Interventions. Part I: Systematic Review and Meta-Analysis in Diabetes Management, Annals of Pharmacotherapy, 2007. 1569-82 p. [30]	Systematic Review and Meta-analysis	36 in total: -18 randomised controlled trials -9 non-randomised controlled trials -2 pre- and post observational cohorts -1 retrospective cohort study -5 chart reviews and -1 database study	Diabetes education (69%) and medication management (61%) were the most frequently used Interventions. Mean ± SD quality was 62 ± 11% (fair). Fifty-one (69%) study results were sensitive, Meta-analysis of data from 2247 participants in 16 studies found a significant reduction in hemoglobin A _{1c} levels in the pharmacists' intervention group (1.00 ± 0.28%; p < 0.001) but not in controls (0.28 ± 0.29%; p = 0.335). Pharmacists' interventions further reduced HbA _{1c} values 0.62 ± 0.29% (p = 0.03) over controls.
Collins C et al, Effect of pharmacist intervention on glycaemic control in diabetes. Diabetes Research and Clinical Practice. 2011;92(2):145-52. [28]	Systematic Review and Meta-analysis	14 randomised controlled trials	Pharmacist intervention significantly lowered HbA _{1c} (n = 14 trials, WMD -0.76%, 95%CI -1.06 to -0.47) and fasting blood glucose (FBG) (n = 4 trials, WMD -29.32 mg/dL, 95%CI -39.54 to -19.10). A moderate to high degree of statistical heterogeneity was observed in these analyses (I ² ≥ 44.1% for both).
Santschi V et al, Pharmacist Interventions to Improve Cardiovascular Disease Risk Factors in Diabetes. Diabetes Care. 2012;35(12):2706. [31]	Systematic Review and Meta-analysis	15 randomised controlled trials. -8 pharmacy only interventions -7 interventions with pharmacists in collaboration with other HCPs.	Pharmacist interventions included medication management, educational interventions, feedback to physicians, measurement of CVD risk factors, or patient-reminder systems. Compared with usual care, pharmacist care was associated with significant reductions for systolic BP (12 studies with 1,894 participants; -6.2 mmHg [95% CI -7.8 to -4.6]); diastolic BP (9 studies with 1,496 patients; -4.5 mmHg [-6.2 to -2.8]); TC (8 studies with 1,280 patients; -15.2 mg/dL [-24.7 to -5.7]); LDL cholesterol (9 studies with 8,084 patients; -11.7 mg/dL [-15.8 to -7.6]); and BMI (5 studies with 751 patients; -0.9 kg/m ² [-1.7 to -0.1]). Pharmacist care was not associated with a significant change in HDL cholesterol (6 studies with 826 patients; 0.2 mg/dL [-1.9 to 2.4]).
Antoine S-L et al, Improving the adherence of type 2 diabetes mellitus patients with pharmacy care: a systematic review of randomized controlled trials. BMC Endocrine Disorders. 2014;14(1):53. [27]	Systematic Review	6 randomised controlled trials	The outcomes of the analysed studies indicate that pharmacists could have an influential and important role in the respective health care system to improve adherence in patients taking oral type 2 diabetes mellitus medication. However, the heterogeneity of study populations interventions, adherence measures and outcomes in the included studies prevents a comparison as well as a generalization.
Pousinho S et al, Pharmacist Interventions in the Management of Type 2 Diabetes Mellitus: A Systematic Review of Randomized Controlled Trials. Journal of	Systematic Review	36 randomised controlled trials.	HbA _{1c} was evaluated in 26 studies, of which 24 reported a greater reduction in this outcome in the intervention group compared with the control group, with the difference in change between groups ranging from -0.18% to -2.1%. Eighteen studies assessed change in systolic blood pressure, of which 17 studies reported a greater improvement in this outcome in the intervention group, with the difference in change between groups varying between -3.3 mmHg and -

Managed Care & Specialty Pharmacy. 2016;22(5):493-515. [36]			23.05 mmHg. For diastolic blood pressure, a greater effect was also observed in the intervention group in 14 out of 15 studies, with the difference in change between groups varying between -0.21 mmHg and -9.1 mmHg. Thirteen studies described total cholesterol as an outcome measure, of which 10 reported a greater improvement in this outcome in the intervention group, with the difference in change between groups ranging from +18.95 mg/dL to -32.48 mg/dL. With regard to low-density lipoprotein cholesterol, a greater reduction in this parameter in the intervention group was documented in 12 out of 15 studies, with the difference in change between groups varying between +7.35 mg/dL and -30 mg/dL. Similarly, favourable data were reported on high-density lipoprotein cholesterol in the intervention group in 9 out of 12 studies that assessed this outcome, with the difference in change between groups ranging from -5.8 mg/dL to +11 mg/dL. Data on triglycerides were also reported in 12 studies, of which 9 reported a greater reduction in triglycerides levels in the intervention group, with the difference in change between groups varying between +12 mg/dL and -62 mg/dL. Overall, a beneficial effect on BMI was also described in the intervention group in 12 out of 14 studies. Of note, in all 6 studies that estimated the 10-year CHD risk among study patients, a greater improvement in the intervention group versus the control group was found. In addition, pharmacist interventions also had a positive impact on medication adherence and HRQoL in most studies that ascertained these outcomes. Finally, although only 3 studies conducted a cost-effectiveness analysis, pharmacist interventions proved to be cost-effective.
Deters MA et al, Effective Interventions for Diabetes Patients by Community Pharmacists: A Meta-analysis of Pharmaceutical Care Components. Annals of Pharmacotherapy. 2017;52(2):198-211. [32]	Systematic Review and Meta-analysis	11 randomised controlled trials	The calculated meta-analytical effect of 640 analysed patients was a HbA _{1c} difference of -0.66%, with a 95% CI of -0.86% to -0.45%. The analysis revealed that most intervention elements had a significant positive meta-analytical effect on the HbA _{1c} values.
Fazel MT et al, Impact of Diabetes Care by Pharmacists as Part of Health Care Team in Ambulatory Settings: A Systematic Review and Meta-analysis. Annals of Pharmacotherapy. 2017;51(10):890-907. [38]	Systematic Review and Meta-analysis	42 randomised controlled trials (35 included in the meta-analysis)	The overall standardized mean difference (SMD) for A1C for pharmacist care versus comparison was 0.57 ($P < 0.01$), a moderate effect representing a mean difference of 1.1% (95% CI = 0.88-1.27). The effects for systolic blood pressure and low-density lipoprotein cholesterol were between small and moderate (SMD = 0.31 and 0.32; $P < 0.01$). The heterogeneity was high for all outcomes (>83%), indicating functional differences among the studies.
van Eikenhorst L et al, Pharmacist-Led Self-management Interventions to Improve Diabetes Outcomes. A Systematic Literature Review and Meta-Analysis. Frontiers in pharmacology. 2017;8:891-897. [39]	Systematic Review and Meta-analysis	24 randomised controlled trials	Pharmacist-led self-management interventions included education on diabetes complications, medication, lifestyle, and teaching of self-management skills. Some studies focused on patient needs through a tailored intervention. No key components for a successful self-management intervention could be identified. Pharmacist-led self-management interventions improve HbA _{1c} levels with a mean of 0.71% (CI -0.91, -0.51; overall effect $P < 0.0001$) and had a positive effect on blood pressure (SBP -5.20 mm Hg [-7.58; -2.92], DBP -3.51 mmHg [-6.00; -1.01]), BMI (-0.49 kg/m ² [-0.79; -0.19]), lipids (total cholesterol -0.19 mmol/l [-0.33; -0.05], LDL-C mmol/l -0.16 [-0.26; -0.06], HDL-C 0.32 mmol/l [0.02; 0.61]), self-management skill development, and adherence to medication.
Bukhsh A et al, Efficacy of Pharmacist Based Diabetes Educational Interventions on Clinical Outcomes of Adults With Type 2 Diabetes Mellitus: A Network Meta-Analysis. Frontiers in pharmacology. 2018;9:339-347. [37]	Network meta-analysis	43 randomised controlled trials	Network meta-analysis demonstrated that all interventions significantly lowered HbA _{1c} compared to usual care, but there was no statistical evidence from this study that one intervention was significantly better than the other for reducing HbA _{1c} . Pharmacist based diabetes education plus pharmaceutical care showed maximum efficacy for reducing HbA _{1c} [-0.86, 95% CI -0.983, -0.727; $p < 0.001$]. Pharmacist based diabetes education plus pharmaceutical care was observed to be statistically significant in lowering levels of systolic blood pressure [-4.94; 95%CI -8.65, -1.23] and triglycerides levels [-0.26, 95%CI -0.51, -0.01], as compared to the interventions which involved diabetes education by pharmacist, and for body mass index (BMI) [-0.57; 95%CI -1.25, -0.12] in comparison to diabetes education by health care team involving pharmacist as member.
Bukhsh A et al, Effectiveness of pharmacist-led educational interventions on self-care activities and glycaemic control of type 2 diabetes patients: a	Meta-analysis	11 randomised controlled trials	Meta-analysis demonstrated that pharmacist-led interventions had a significant effect on lowering HbA _{1c} (-0.66; 95% CI [-0.83, -0.50]; $I^2=58.3\%$; $P=0.008$), in comparison to usual care. Self-care activities were assessed by using Summary of Diabetes Self-care Activities tool in eight studies. Overall meta-analysis of self-care activities for included studies

systematic review and meta-analysis. Patient preference and adherence. 2018;12:2457-74. [40]			demonstrated a significant effect of pharmacist-led interventions on improvement of self-monitoring of blood glucose (1.62; 95% CI [0.92, 2.32]; $I^2=70.5\%$; $P=0.005$), foot care (1.20; 95% CI [0.49, 1.90]; $I^2=95.0\%$; $P<0.001$), and overall diet (1.16; 95% CI [0.38, 1.93]; $I^2=64.2\%$; $P=0.094$).
Babar ZUD et al, Glycemic control through pharmaceutical care: a meta-analysis of randomized controlled trials. Journal of Pharmaceutical Health Services Research. 2019;10(1):35-44. [34]	Systematic Review	13 randomised controlled trials	The interventions included care plan development, medication reviews, patient education and counselling of patients with follow-up. All RCTs reported statistically significant reductions in HbA _{1c} in the intervention group (SMD = -0.97; 95% CI -1.21 to -0.73; $P = 0.00001$) as compared to the control group. Significant heterogeneity in SMD ($\chi^2 = 68.96$) was observed.
Presley B et al, Pharmacy-led interventions to improve medication adherence among adults with diabetes: A systematic review and meta-analysis. Research In Social & Administrative Pharmacy: RSAP. 2019;15(9):1057-67. [35]	Meta-analysis	59 randomised controlled trials	Pharmacist-led interventions enhanced outcomes in patients with diabetes (standardized mean difference (SMD) -0.68; 95% CI -0.79, -0.58; $p < 0.001$). Sub-group analysis by intervention strategy, the type of intervention and outcome measures produced similar results. Further analysis showed that education, printed/digital material, training/group discussion, were more effective than other interventions.
Soprovich AL et al, Systematic review of community pharmacy-based and pharmacist-led foot care interventions for adults with type 2 diabetes. Canadian Pharmacists Journal. 2019;152(2):109-16. [43]	Systematic Review	7 studies (2 were randomised controlled trials)	Six out of 7 studies reported significantly positive findings related to foot care practices.