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A Scoping Review of Dementia and Diabetes Co-Morbidity Care

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ABSTRACT

Diabetes mellitus is a common co-morbidity with dementia. Diabetes is usually a self-managed condition requiring an individual to have a high level of cognitive functioning; hence dementia makes managing diabetes very challenging for the individual with dementia and their caregivers. The purpose of this literature review was to synthesise what is currently known about diabetes and dementia co-morbidity care outcomes.

Online databases (AMED, CINAHL, PROQUEST, EBM Reviews, TRIP, Medline and PsycINFO) were searched for the period 2012 – 2023, from which we selected 27 publications. Of the 27 publications 8 were literature reviews/expert discussion of the literature, 1 audit, 1 case report, 5 cohort studies, 2 cross sectional studies, 4 mixed methods studies, 2 realist reviews, 1 longitudinal observation study and 3 qualitative studies. Selected literature was from the UK, USA, Canada, Japan, Austria, Germany, France and Poland. Five themes permeated this literature: key principles of care, challenges of diabetes management as a consequence of dementia, complexity of care, quality of care and workforce issues. This review highlights the complexity of care for those with co-morbid diabetes and dementia, which are both progressive diseases which change over time. There is a need to develop the underpinning evidence base in order to provide guidelines for best practice, to support staff to deliver appropriate care to people living with this co-morbidity

Keywords: Dementia, Diabetes, co-morbidity, complexity, glucose monitoring, scoping review

Introduction

Currently, it is estimated that there are 900,000 people living with dementia in the UK, and this is projected to rise to 1.6 million by 2040¹. There are 4.3 million people in the UK who are diagnosed with diabetes mellitus (all types) (https://www.diabetes.org.uk/about_us/news/number-people-living-diabetes-uk-tops-5-million-first-time). While there are no statistics available for the co-existence of dementia and diabetes, the assumption can be made that the conditions exist co-morbidly in a large number of people over the age of 65 due to the high prevalence rates of both illnesses^{2,3,4} and diabetes is specifically identified as one of the more common co-morbidities in people with dementia^{4,5}. Type 2 diabetes increases the risk of Alzheimer's Disease and cerebrovascular disease 1.5 to 2-fold³ and strong links have been demonstrated between the two diseases, due to the underlying pathology⁶.

Diabetes is largely a self-managed condition that necessitates high-level cognitive capabilities for patients to self-care with regards to medication, glucose monitoring and lifestyle (modifications to diet and exercise)^{3,7}. However, memory loss, impaired problem-solving, and other dementia-related symptoms make diabetes management extremely difficult both for people living with dementia, and their caregivers⁴. Where people have co-morbid dementia and diabetes there is an increased risk of medication errors (when self-caring) leading to hyper/hypoglycaemic events, an increase in hospitalisation rates and generally less specialist follow-up than for those with diabetes without dementia. This can lead to a reduced ability to self-care and an increase in patient distress³.

People with all types of diabetes as a single diagnosis are at risk of hypoglycaemia^{8,9}, however, patients with severe cognitive impairment have been found to be at double the risk of hypoglycaemia compared to those with normal cognitive function^{10,3}, as well as more prone to variable glucose readings⁴. This can present a range of challenges in relation to clinical management³. Furthermore, caregivers report that caring for a person with dementia and diabetes can be highly burdensome and overwhelming¹¹.

In light of societal ageing, general concerns about the provision of care, and the likely increase in the prevalence of multi-morbidity, a scoping review was conducted in order to systematically map research on the topic and to identify gaps in knowledge. The following research question was formulated: what is known from the literature about co-morbid dementia and diabetes care?

Methods

We undertook a scoping review informed by a systematic search of the literature to identify evidence concerning dementia and diabetes co-morbidity care, to clarify key practice guidelines in this literature, and to examine the research methods adopted to conduct research on this topic as advocated by Munn and colleagues (2018)¹² and the Prisma -extension guideline (<http://www.prisma-statement.org/Extensions/ScopingReviews?AspxAutoDetectCookieSupport=1>). The search strategy was guided by systematic review methodology and employing extensive database searches.

Search strategy

The following databases were searched for the period 2012 – 2023 (databases 1-6 were utilised in combination by the library search system during the review, PsychINFO being searched separately):

1. AMED (Allied and Complementary Medicine)
2. CINAHL (Nursing and Allied Health)
3. PROQUEST
4. EBM Reviews – Cochrane Controlled Trials Register, Cochrane Reviews and Medline
5. TRIP (Turning Research into Practice)
6. Medline
7. PsycINFO

The search was undertaken with the following MeSH terms and free words, terms did not require adaptation between library database search (database 1-6) and PsychINFO:

'older people', 'elderly people', 'geriatric(s)', 'aged', 'retired', 'retirement', 'senior citizen(s)', 'pensioner(s)', 'residents' (all used to capture the concept of 'older people')

AND

'dementia', 'mild cognitive impairment', 'Alzheimer's'

AND

'diabetes', 'diabetes type one', 'diabetes type two,'

OR

'diabetes care', 'diabetes services',

OR

'diabetes nurse', 'diabetes nurse practitioner' (an information specialist advised on the use of these provider based terms).

Item Identification

The initial search led to the identification of 98 records. Duplicates and false hits (e.g., diabetes screening, dementia types) were removed (n = 35). The citations of the remaining records were searched and a further 3 items were added; one outside of the search date range, and identification of 2 items that were expert reviews and practice

guidelines. Two researcher assessors (J.M. and G.C.) screened the title and abstract of the identified studies (n=66). To be included in the review the papers needed to address co-morbid dementia and diabetes care. Peer-reviewed papers were included if they were written in English; involved human participants (people living with both dementia and diabetes, caring for a person with both dementia and diabetes); qualitative, quantitative, and mixed methods studies were included in order to consider different aspects of care and care outcomes; or literature reviews/practice guidelines relating to dementia and diabetes co-morbid care. Papers were excluded if they did not address the scoping review question; did not include research, audit, literature review or practice guidance review that address dementia and diabetes co-morbidity care; and if the resource was not retrievable. Applying these criteria resulted in 27 items being included in the scoping review. Automation tools were not used to exclude records. Item identification is summarised in figure 1.

Data extraction from the selected items and analysis

Two researchers (J.M. and G.C.) read each selected item in full. Both extracted methodological and outcomes data from the 27 selected publications, and the results were compared. Discrepancies were discussed to reach an agreement. From the research papers the methods data that was extracted included population, country, method, and outcomes. The outcomes data extracted from the selected papers provided a summary of the key findings or results (see Table one). Concurrent with the extraction of outcomes data, a thematic analysis of the findings/results of the selected literature was undertaken to identify common themes, topics,

ideas, and outcomes that came up repeatedly, in addition to the identification of isolated specific outcomes. This process led to the identification of 5 themes: key principles of care, challenges of diabetes management as a consequence of dementia, complexity of care, quality of care and workforce issues.

Summary of the selected publications

Of the 27 selected publications 8 were literature reviews/expert discussion of the literature. One paper represented the results of 74 studies, and of the total, 12 concerned the co-morbidity of dementia and diabetes. The other 2 reviews represented 35 studies that were related to co-morbid diabetes and dementia. It should be noted that 5 of these reviews did not include details of the number of items selected for review. The remaining items included 1 audit, 1 case report, 5 cohort studies, 2 cross-sectional studies, 4 mixed methods studies, 2 realist reviews, 1 longitudinal observation study and 3 qualitative studies. Selected literature was from the UK, USA, Canada, Japan, Austria, Germany, France and Poland. It is notable that none of the selected papers were from the global south and Asia. Of the 19 research papers, 13 included participants who were living with dementia, 6 included caregivers, 4 included practitioners and 1 included care providers. Five of the studies included different categories of participants. Of note is that there was no standard approach to applying inclusion criteria for participants living with dementia, hence few papers indicated whether the study population had low, moderate or severe dementia. Nor did all of the papers indicate whether participants had type one or two diabetes. These latter points impact on the extent that generalisation can be drawn from this literature to the wider population.

Figure 1: Flow diagram of the process of identification and selection of the literature for review

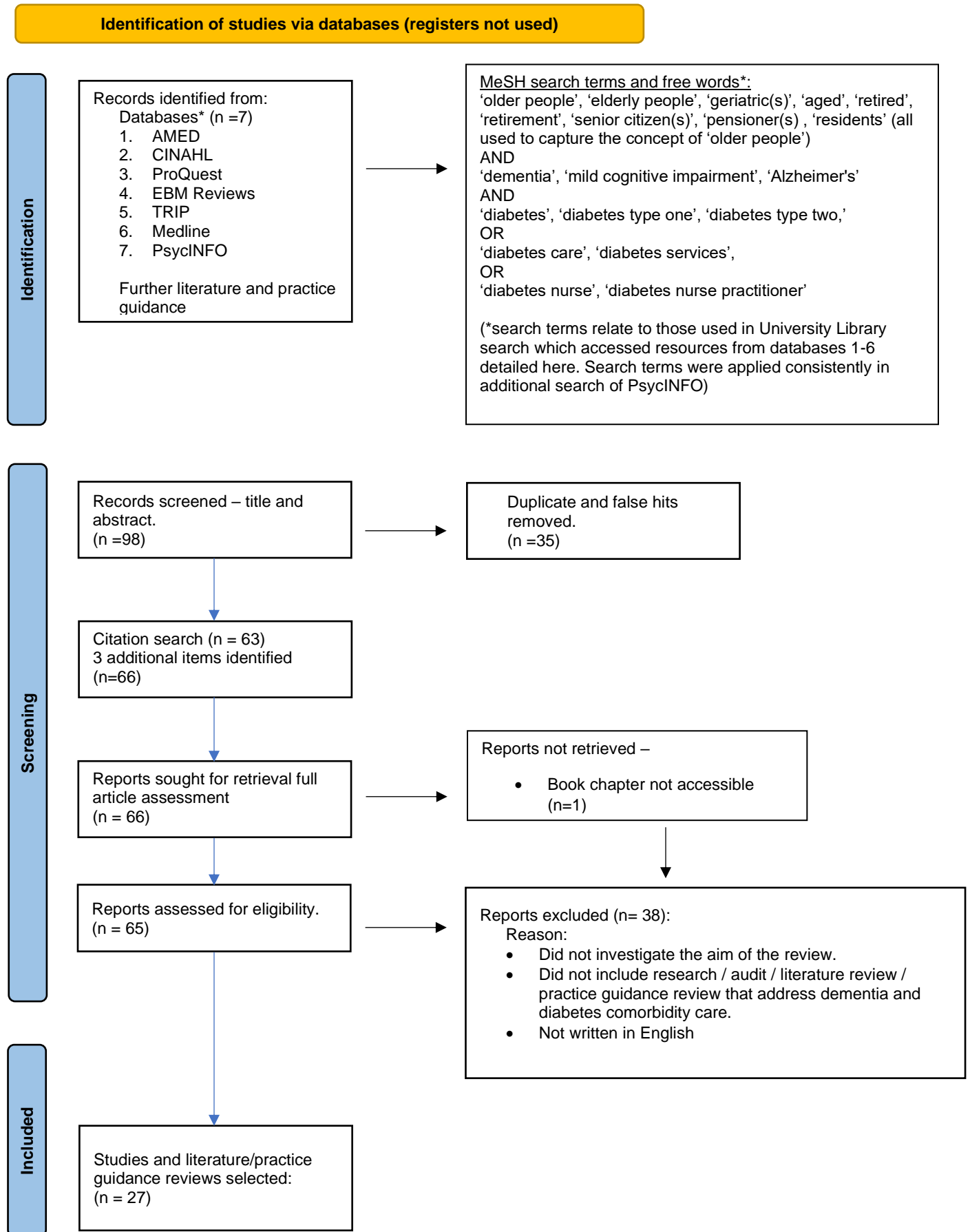


Table one: Data extraction from the selected items

Authors	Population Country/Region	Method	Outcomes
Abdelhafiz, A., McNicholas, E. & Sinclair, A.J. (2016)	Keywords relating to hypoglycaemia, frailty, dementia, older people, diabetes mellitus and management. Articles limited to English language literature.	Literature review 1996 to 2023 Searching Medline and Embase.	Hypoglycaemia, frailty and dementia have a reciprocal relationship. Hypoglycaemic events seem to be common in older people with diabetes. This group of patients currently appear to be overtreated and seem to be inappropriately using medications that likely increase the risk of hypoglycaemia. As patients with diabetes get older or develop dementia, overtreatment should be avoided, targets need to be re-set and the effect of frailty and weight loss should be considered with a view of reducing or even completely withdrawing hypoglycaemic medications. New guidelines are needed to clarify when to adjust medications to optimise outcomes.
Alagiakrishnan, K. & Sclater, A. (2012)	Key words: diabetes, elderly psychiatric disorders, cognitive impairment, dementia, depression, delirium, eating disorders, self-neglect, schizophrenia and anxiety. Articles limited to English language literature.	Literature review 1990-2010 Searching MEDLINE, PubMed, Scopus and PsychINFO.	Decreased cognitive function in people with diabetes is associated with poor adherence to diabetic self-care and leads to increased frequency of hospitalisation. Effective management of diabetes can improve cognitive functioning. The most practical approach to prevent cognitive decline is to optimise glycaemic control and prevent hypoglycaemic episodes.
Alves, R.V., Smith, L. & Manchip, S. (2013)	39 patients living in care homes in Swindon (UK) who have co-morbid dementia and diabetes.	Audit to explore if people with comorbid dementia and diabetes are receiving adequate monitoring for their diabetes.	61.5% had HbA1c monitoring within 12 months meeting the required standard of monitoring, 7.7% had never had an HbA1c checked and 51.3% required admission to hospital with complications possibly related to diabetes. Patients with raised HbA1c levels had increased hospital admissions for hyperglycaemia and infections. Patients with low HbA1c levels had a higher percentage of hospital admissions due to falls, perhaps due to hypoglycaemia. Blood sugar regulation for diabetic patients with dementia has numerous challenges due to variation in exercise, oral intake, disorientation, dietary patterns, and stress levels as a result of the dementia process. Dementia appears to have a negative impact on the quality of diabetes care that care home residents receive, resulting in a high incidence of diabetic complications and hospital admissions.
Barman, N.R., Casten, R.J. & Rovner, B.W. (2021)	101 black individuals with diabetes and mild cognitive impairment over the age of 60 years old, and less than 80% adherence to diabetes medications. Participants recruited from primary care from 2015 - 2017. Philadelphia, USA.	Cross-sectional study Continuous data were summarised using means and SDs and categorical variables using numbers and percentages. Pearson correlations were computed to examine bivariate	Regimen-related diabetes distress and self-reported functioning are independently associated with A1C. No cognitive test scores were significantly associated with A1C, likely because the range of scores was constrained to the lower end, given that all participants had MCI. Age was not significant once the effects of diabetes distress were considered. Cognitive impairment has been shown to make adherence to a healthy lifestyle and prescribed medications particularly

		relationships between A1C and demographic characteristics, diabetes distress, number of health conditions, physical functioning, and cognitive functioning.	frustrating. Diabetes distress is comparatively higher in Black individuals than in White individuals with diabetes, and greater diabetes distress correlated with worse diabetes self-management.
Bunn, F., Burn, A.M., Goodman, C., Rait, G., Norton, S., Robinson, L., Schoeman, J., & Brayne, C. (2014)	Key words: dementia and diabetes, Dementia and stroke, dementia and visual impairment, dementia and comorbidity.	Scoping review of co-morbidity and dementia, including all types of research relating to the prevalence of comorbidities in people with dementia; current systems, structures and other issues relating to service organisation and delivery; patient and carer experiences; and the experiences and attitudes of service providers. Arksey and O'Malleys methodological framework was used. Authors searched AMED, Cochrane Library, CINAHL, PubMed, NHS Evidence, Scopus, Google Scholar, PubMed. Checked reference lists and performed citation searches on PubMed and Google Scholar from 1989 to 2014. 12 papers that were included in the review concerned people with dementia and diabetes. Studies conducted in care homes were excluded.	Lack of continuity in health care systems and structures for people with dementia and comorbidity, with little integration or communication between different teams and specialities. Models of care are focused on single diseases and do not take into account the needs of those with multimorbidity or of their family carers. There was evidence that people with dementia and diabetes did not have the same access to treatment and monitoring as people who do not have dementia. There is limited guidance on how to support people with dementia and diabetes.
Bunn, F., Burn, A.M., Goodman, C., Robinson, L., Rait, G., Norton, S., Bennet, H., Poole, M., Schoeman, J., & Brayne, C. (2016)	28 community-dwelling PLWD with one of our target comorbidities (50% had diabetes), 33 family carers and 56 HCPs specialising in diabetes, stroke, VI or primary care. UK study	Mixed methods: a scoping review, cross-sectional analysis of a population cohort database, interviews with PLWD and comorbidity and their family carers and focus groups or interviews	PLWD had poorer access to services than those without dementia. Many healthcare professionals feel underprepared to care for people living with dementia. PLWD and diabetes may not be getting regular eye and foot checks. Key elements of good care for PLWD and comorbidity include having the PLWD and family carer at the centre, flexibility around processes and good communication. The

		with health-care professionals (HCPs).	impact of a diagnosis of dementia on pre-existing conditions should be incorporated into guidelines and care planning. PLWD are likely to benefit from longer appointments, in both primary and secondary care. There is a need to link medication and monitoring of diabetes with the provision of meals. Staff at all levels require dementia care education. Current systems may unintentionally block access to care for PLWD.
Bunn, F., Burn, A.M., Goodman, C., Jones, P.R., Russell, B., Trivedi, D., Sinclair, A., Bayer, A., Rait, G., Rycroft-Malone, J. & Burton, C. (2017).	89 papers included in scoping review, 10 of which focused on people living with dementia and diabetes. Twenty-six stakeholders (user/patient representatives, dementia care providers, clinicians specialising in dementia or diabetes and researchers) from England, (UK) took part in interviews and 24 participated in a consensus conference.	Realist review, using an iterative, stakeholder-driven, four-stage approach. This involved scoping the literature and conducting stakeholder interviews to develop initial programme theories, systematic searches of the evidence to test and develop the theories, and the validation of programme theories with a purposive sample of stakeholders.	This review suggests that there is a need to prioritise quality of life, independence and patient and carer priorities over a more biomedical, target-driven approach. Current research specific to people living with dementia and diabetes, identifies deficiencies in, and problems with, current systems. The need for personalised care, continuity and family-centred approaches was highlighted there is much evidence to suggest that this is not currently happening. Staff caring for people with diabetes need appropriate training on dementia and how this might have an impact on the management of diabetes. This applies to staff at all levels, including more senior staff. Self-management for people with dementia and diabetes needs to be conceptualised as an activity that frequently involves not just the person with dementia but also their family members.
Bunn, F., Goodman, C., Jones, P.R., Russell, B., Trivedi, D., Sinclair, A., Bayer, A., Rait, G., Rycroft-Malone, J. & Burton, C. (2017)	89 papers included in scoping review, 10 of which focused on people living with dementia and diabetes. Twenty-six stakeholders (user/patient representatives, dementia care providers, clinicians specialising in dementia or diabetes and researchers) from England, (UK) took part in interviews and 24 participated in a consensus conference.	Realist review, using an iterative, stakeholder-driven, four-stage approach. This involved scoping the literature and conducting stakeholder interviews to develop initial programme theories, systematic searches of the evidence to test and develop the theories, and the validation of programme theories with a purposive sample of stakeholders.	Evidence highlighted the need for personalised care, continuity and family-centred approaches, although there was limited evidence that this happens routinely. Suggests there is a need for a flexible service model that prioritises quality of life, independence and patient and carer priorities. Future research on the management of diabetes in older people with complex health needs, including those with dementia, needs to look at how organisational structures and workforce development can be better aligned to their needs.
Du, Y., Paiva, K., Cebula, A., Kim, S., Lopez, K., Li, C., White, C., Myneni, S., Seshadri, S. & Wang, J. (2020)	A total of 419 posts were extracted from 5496 that were identified using 'diabetes' as the search term. Posts were posted between 22.02.2012 and 03.01.2019 the ALZConnected care giver's forum, USA.	Thematic analysis of 419 user posts on the Alzheimer's Association ALZConnected caregiver forum was conducted. Data reduction and open coding were carried out, followed by code validation and then coding reconciliation.	7 key themes: (1) disease linkages and comorbidities, (2) ADRD or diabetes symptoms without diagnosis, (3) diabetes management, (4) ADRD and diabetes complications and progress, (5) management strategies for ADRD and other comorbidities, (6) caregiver social support, and (7) caregiver health and self-care. Comorbidities of ADRD were common topics of discussion among family caregivers. Diabetes management in ADRD challenged family caregivers. Family caregivers might neglect their own health care because of the caring burden, and they

			reported poor health outcomes and reduced quality of life. The online forum provided a platform for family caregivers to seek support in their attempts to learn more about how to manage the ADRD of their care recipients and seek support for managing their own lives as caregivers.
Feil, D.G., Lukman, R., Simon, B., Walston, A. & Vickrey, B. (2011)	21 caregivers who had family members with both diabetes and dementia. 11 were African American, five were of Asian descent, two were Hispanic/Latino, two were Caucasian, and one did not wish to identify race/ethnicity. USA.	Qualitative study using six focus groups to obtain in-depth information about caregivers' barriers and facilitators to providing diabetes care for their family members with dementia.	3 themes (1) Memory loss was the first identified cause of self-care neglect leading to caregiver intervention. (2) Behavioural and psychological symptoms of dementia (BPSD) disrupted the daily diabetes care routine, with 'denial' of having diabetes or memory loss (anosognosia) being the most disruptive. (3) Caregivers reported that caring for people with diabetes and dementia was highly burdensome, felt overwhelmed with BPSD, and wanted more support from family and patients' healthcare providers. Carers also had difficulty providing diabetes care in relation to administration insulin, glucose monitoring, Dr visits, exercise and diabetic diet.
Gungabissoon, U., Broadbent, M., Perera, G., Ashworth, M., Galwey, N. & Stewart, R. (2022)	Using a linkage between a primary care (Lambeth DataNet) and a secondary mental healthcare database, up to 5 individuals aged ≥ 65 y with preexisting T2D without dementia were matched to each individual with dementia based on age, sex, and general practice. London, UK.	Retrospective matched cohort study. Comparisons were made for HbA _{1c} trajectories (linear mixed effects models), markers of diabetes-related management and severity at dementia diagnosis (logistic regression), mortality (Cox regression), and health care utilization (multilevel mixed effects binomial regression).	Highlights important differences in the monitoring, management and control of diabetes in people with dementia. The effects of frailty and the extent of cognitive impairment on the ability to self-manage diabetes and on glycaemic control may need to be considered in treatment guidelines and by primary care. PWD less likely to have routine diabetes-related management. Higher prevalence of macrovascular complications, foot morbidity and mortality.
Hopkins, R., Shaver, K. & Weinstock, R.S. (2016)	People with dementia and diabetes.	Professional practice discussion/guidance.	More research is required to better understand optimal treatment approaches in this population. Monitoring blood glucose through the use of a continuous glucose monitoring (CGM) device is of particular benefit for people with frequent hypoglycaemia or hypoglycaemic unawareness. Recent reviews and diabetes practice guidelines have recognised that stage of cognitive impairment, availability of assistance by caretakers, and use of assistive technologies are significant factors affecting care plans, including determining individualised A1C and other diabetes care targets.
Kim, M.J. & Fritschi, C. (2020)	Search terms (a) cognitive impairment OR dementia OR Alzheimer's disease, (b) self-care OR self-management OR self-regulation OR self-monitoring OR adherence OR compliance, and (c) type 2 diabetes OR type 2 diabetics OR non-insulin dependent diabetes mellitus.	Integrative review using Whittemore and Knafli's 2005 framework and the Crowe Critical Appraisal Tool. Systematic search carried out in March 2020 using PubMed, CINAHL,	Cognitive impairment in older adults with type 2 diabetes can have negative effects on their diabetes self-management behaviours. Despite the importance of cognitive function on diabetes health, cognitive health of patients with diabetes is often overlooked in practice. Clinicians should simplify patients' self-management regimens when needed based on the screening results.

	There were 27 studies included in the synthesis.	PsychINFO, Scopus and Embase.	
Kamimuro, T. & Ito, H. (2014)	79-year-old female with type 2 diabetes and mild cognitive impairment (Clinical Dementia Rating score of 0.5) MMMS 30. Japan.	Case report of a woman who lived at home and required prompting and reminding to take medication.	After a month, medication adherence improved to 95% (one missed dose per week), and HbA1c decreased to 7.8%. She reported an increase in self-confidence because of these improvements. Daughter's burden while assisting to maintain the medication regimen decreased from "3: mild burden" before activation of the device to "2: little burden" after one month of usage. Both patient and her daughter reported the device as helpful, especially in relieving their worries about taking medication. After three months, medication adherence was 100%, and HbA1c was 6.9%.
Mattishent, K., Lane, K., Salter, C., Dhatariya, K., May, H.M., Neupane, S. & Loke, Y.K. (2019)	Patients aged ≥ 65 with diabetes and abbreviated mental test score ≤ 8 or known dementia. 12 participants with an average age of 85 years completed the study. Community dwellers in the UK.	Mixed methods feasibility study. Data collection from Libre 2 plus semi-structured interviews.	Intervention – application of FreeStyle Libre CGM. Only 4 out of the 12 participants reached the target of 70% or more data capture in fourteen days. Participants and carers overwhelmingly found using the device acceptable. Participants reported the device was so unobtrusive and that it did not interfere with day-to-day activities. Participants confirmed that they were not aware of the device at night when they were sleeping. All participants would recommend the use of CGM.
Prinz, N., Stingl, J., Dapp, A., Denking, M.D., Fashing, P., Jehle, P.M., Merger, S., Muhldorfer, S., Pieper, U., Schuler, A., Zeyfang, A. & Hol, R. (2016)	215,932 type 2 diabetes patients aged 40 years (median [Q1;Q3]: 70.4 [61.2;77.7] years) from the standardised, multicentre German/Austrian registry. For group comparisons, multiple hierarchic regression modelling with adjustments for age, sex, and duration of diabetes was applied. Austria and Germany.	Cohort study Continuous variables were compared by Kruskal–Wallis test and binary data by χ^2 -test. As multiple tests were performed, p-values were adjusted using Bonferroni step-down correction (Holm method). For the comparison of metabolic control, diabetes therapy and the presence of diabetes-related complications between groups, multiple hierarchic regression modelling was implemented to account for potential confounders. SAS v. 9.4 was applied for statistical analysis.	T2D patients with comorbid dementia had more diabetes-related complications, primarily hypoglycaemia, besides a more intense diabetes management with insulin and a comparable metabolic control. Clinical care should focus on the avoidance of hypoglycaemia in patients with dementia. Therapeutic choice should be reconsidered in elderly T2D patients with comorbid dementia as the benefits of an intense diabetes management with insulin and focus on tight glycaemic control without considering other factors appear to be outweighed by the risks.
Palmer, S.J. (2020)	Patients aged ≥ 65 with diabetes and abbreviated mental test score ≤ 8 or known dementia. 12 participants with an average age of 85 years completed the study.	Mixed methods feasibility study. Data collection from Libre 2 plus semi-structured interviews.	No participant reported anxiety or stress in having to wear the CGM device. Carers found the device particularly useful, as it helped them to feel reassured. Use of the device was found to be less distressing for confused patients who often felt distressed by the finger-prick single-use monitoring. A

	People living in the community in the UK.		continuous monitoring system that does not require the regular finger pricks used by single-use glucose monitors is a possible solution, enabling smoother care and prevention of hypoglycaemic episodes. The requirement of scanning the device on an 8-hourly basis may be challenging for those with significant memory problems or without a regular carer to do this for them. It would be beneficial to trial a product that does not require continuous monitoring. It remains questionable that an older person with memory problems would remember to swipe with a reader every 8 hours and may not understand device alerts.
Punthakee, Z., Miller, M.E., Launer, L.J., Williamson, J.D., Lazar, R.M., Cukierman-Yaffee, T., Seaquist, E.R., Ismail-Beigi, F., Sullivan, M.D., Lovato, L.C., Bergenstal, R.M., & Gerstei, H.C. (2012)	2,956 adults aged >55 years with type 2 diabetes and additional cardiovascular risk factors USA and Canada	Prospective cohort analysis of data from the ACCORD trial. 2,956 participants followed for a median of 3.25 years,	Cognition is a significant consideration as to whether a person can self-manage their diabetes. Poor cognitive function increases the risk of severe hypoglycaemia in patients with type 2 diabetes. Clinicians should consider cognitive function in assessing and guiding their patients regarding safe diabetes self-management regardless of their glycaemic targets.
Puttanna, A., Padinjakara, N.K, (2017)	People with dementia and diabetes.	Professional practice discussion/guidance.	Therapy should be individualised with involvement of the patient's care team. Clear instructions need to be put in place to define roles, goals of therapy and need for regular review. The simplest and least complicated management plan should be in place for people with dementia and diabetes and should be under continuous review. A written glycaemic control plan for individual patients by the specialist teams, especially if they are in a nursing home setting, provides a clear and patient-centred approach aiding clarity for the caregivers and avoiding unnecessary hospital admissions.
Rahman, S.U., Hirano, Y., Hirakawa, Y. & Yatsuya, H. (2022)	Healthcare professionals involved in supporting people with dementia to manage their diabetes. Japan.	A qualitative study using in-depth interviews as a data collection method. A purposive sample was used of 7 physicians and 8 nurses. A qualitative content analysis of the codes was performed to generate the themes.	The major themes focused on the management of medications/therapeutic regimens, difficulties of continuing health care, emotional aspects of PLWD for adherence to lifestyle modification, and varying direction and degree of family support for diabetes care. Dementia itself makes it difficult to understand and memorise the self-management process. Limited scope of the home visit care providers. PLWD are often hesitant to get diabetes care from healthcare providers or from family carers. PLWD are often not willing to modify or restrict their lifestyle. The biggest challenge is the restriction of food. Continuity of care is important.
Santos, T., Lovell, J., Shiell, K., Johnson, M. & Ibrahim, J.E. (2018)	The study population was restricted to community-dwelling older persons and those with cognitive impairment approaching dementia as this is the population of emerging importance in the literature. Inclusion criteria	Systematic literature search with a narrative review Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. In 2016 10 databases were	Decrements in all self-care domains were associated with cognitive impairment. Problem-solving was related to reduced disease knowledge resulting in poorer glycaemic control. Decision-making impairments manifested as difficulties in adjusting insulin doses, leading to more hospital admissions. A lack of interaction with health care providers was demonstrated

	comprised original empirical research studies of any design available in English and published in a peer-reviewed journal from 1 January 2000 to 22 March 2016. 8 studies were included in the analysis.	searched OVID Medline, EMBASE, CINAHL, EBSCOHost, PsychINFO, ProQuest Research Library, Health Technology Assessment Database, The Cochrane Library, Web of Science, and Scopus.	through reduced receipt of important routine investigation including eye examinations, HbA1c testing, and LDL-C testing. Action-taking deficits were apparent through less self-testing of blood sugar levels resulting in poorer glycaemic control, self-care, and more frequent micro/macrovascular complications. Cognitive impairment affects ability to self-care. Low score in the MMSE corresponded with decreased self-care, diabetes monitoring, activities of daily living, increased personal care assistance, and increased hospitalisations.
Sinclair, A.J., Hillson, R. & Bayer, A.J. (2014)	People with dementia and diabetes.	Expert position statement based on round table discussion and evidence review.	The development of blindness, arterial vascular complication or end-stage renal failure as a result of diabetes in someone with dementia can be devastating and worsen prognosis significantly. The paper outlines core competencies for staff supporting people with dementia and diabetes and offers a summary of best clinical practice.
Sugimoto, T., Ono, R., Kimura, A., Niida, S., Toba, K. & Sakurai, T. (2019)	123 patients with type 2 DM aged 70 years or older first presenting to the Memory Clinic of the National Centre for Geriatrics and Gerontology (NCGG) of Japan from October 2010 to March 2017. Of these, 30 and 93 patients were diagnosed with mild cognitive impairment and Alzheimer's disease, respectively. Japan.	Retrospective cohort study.	Poor and excessive glycaemic control as determined by the glycaemic targets of the JDS/JGS Joint Committee increased the risk of ADL decline in the Memory Clinic patients over a 1-year period. In older adults, excessive glycaemic control (HbA _{1c} < 7.5%) increases the occurrence of hypoglycaemia dramatically, resulting in a further increased risk for cognitive decline, dementia, cardiovascular events, falls, and fall-related adverse events.
Swiatoniowska-Lonc, N., Polanski, J., Tanski, W. & Jankowska-Polanska, B. (2021)	Participants had a clinically confirmed type 2 diabetes diagnosis and were hospitalised in an internal medicine department. Inclusion criteria: clinical diagnosis of type 2 diabetes as per the PTD guidelines, age over 18 years, treatment with oral hypoglycaemic agents and/or insulin for at least 6 months, and written informed consent to participate. Exclusion criteria: exacerbation of another chronic condition (chronic heart failure—NYHA-IV, ischemic heart disease—CCS-IV, neoplastic disease, acute respiratory disease), inability to complete the questionnaire, lack of consent to participate. 169 were included in the study. Poland.	Cross-sectional and observational design. The study used a closed-ended standardized survey and 1-on-1 interviews. Standardised tools were used: Mini-mental State Examination (MMSE) to assess cognitive function and the Self-Care of Diabetes Inventory (SCODI) to assess the level of self-care. Nabb-Whitney and Kruskal-Wallis tests were used for data comparison. Multiple-factor analysis was performed using multiple logistic regression.	Patients with cognitive impairment had significantly lower results in all domains of the SCODI. Correlation analysis showed that the MMSE score correlates significantly and positively with all SCODI subscales, and the higher the MMSE score the higher the level of self-care. There was an association between cognitive impairment and patients' clinical characteristics. Cognitively impaired patients required more drugs, had a longer duration of diabetes, had more frequent hyperglycaemic episodes, and had less frequent diabetic follow-ups than those with a normal cognitive status.

<p>Thorpe C.T., Thorpe, J.M., Kind, A.J.M.H., Bartels, C.M., Everett, C.M. & Smith, M.A. (2012)</p>	<p>288,885 Medicare fee-for-service beneficiaries with a diagnosis of diabetes mellitus before 2006, 44,717 (16%) of whom had evidence of comorbid dementia in claims. USA.</p>	<p>Retrospective cohort study. Secondary analysis of 2005/2006 claims and enrolment data for a 5% national random sample of Medicare beneficiaries.</p>	<p>Dementia reduces the likelihood that individuals with diabetes will receive recommended annual monitoring. Dementia was identified as a barrier to the receipt of the minimal level of annual diabetes monitoring advocated by treatment guidelines specifically developed for older, frail adults with diabetes.</p>
<p>Wargny, M., Gallini, A., Hanaire, H., Nourhashemi, F., Andrieu, S. & Gardette, V. (2018)</p>	<p>The France-Démence cohort: individuals aged 65 years or older suffering from incident ADRS, based on long-term disease registry, hospitalisation for dementia, or antedementia drug delivery. They were matched (1:1) to a pair free of ADRS on age, sex, residence area, and insurance scheme. The FRA-DEM cohort included 352,595 individuals with incident ADRS and their pair between January 2011 and December 2012. France.</p>	<p>Longitudinal observational study from 2010 to 2014. To compare diabetes monitoring and the incidence of acute diabetic complications between patients with and without incident Alzheimer's Disease and Related Syndromes (ADRS). Data was obtained from the French national health system database.</p>	<p>Incident ADRS is associated with a less frequent diabetes monitoring and an increased risk of diabetes complications compared with older people without ADRS. Individuals with ADRS were significantly less likely to receive recommended monitoring than counterparts without ADRS. The magnitude of the differences in diabetes monitoring between groups tended to increase over time. Individuals with ADRS were more frequently hospitalised for diabetes-related conditions than individuals without ADRS, particularly for coma and ketoacidosis, but also for nephropathy and neuropathy.</p>
<p>Yarnell, A. J., Hayes, L., Hawthorne, G.C., Candlish, C.A. & Aspray, T.J. (2011) Short Report: Care Delivery Diabetes in care homes: current care standards and residents' experience. <i>Diabetic Medicine</i>. 29 (1) 132 - 135</p>	<p>Thirty-one individuals known to have diabetes and resident in 7 different care homes: 71-90 years; 25% residents were diet controlled; majority were prescribed at least one hypoglycaemic drug to control diabetes and a 25% used insulin. The median number of different drugs prescribed for each resident was 8.5. England.</p>	<p>Mixed methods combining interview and focus group interviews and audit of practice against Diabetes UK good clinical practice guidelines for care home residents. Managers from 5 care homes were interviewed and 7 care home staff participated in a focus group.</p>	<p>Glucose monitoring took place in all residents who received insulin but was monitored unnecessarily in those with diet-controlled diabetes. The majority of residents had seen a chiropodist and had received eye screening recently. Only one of the care homes had staff that had diabetes training. Residents reported little knowledge of diabetes management.</p>

Results:

KEY PRINCIPLES OF CARE

With the progression of dementia, the ability to self-manage diabetes deteriorates. Hence, Sinclair, Hillson and Bayer³ advocate case finding for early detection of diabetes in a person with dementia, or detection of dementia in a person with diabetes. Following identification of this co-morbidity, Sinclair et al³ expert participants drew attention to the importance of regular clinical assessment to identify additional care needs, support requirements to optimise cognitive and physical function, early detection of secondary conditions (related to diabetes such as cardiovascular disease, visual impairment, foot problems), and person-centred treatment plans for enhanced clinical support. The provision of appropriate care and levels of monitoring is central to minimising distress related to these co-morbidities. For example, the National Institute for Health and Care Excellence guidance advises that efforts should be made to reduce the number of capillary blood glucose tests/monitoring via finger pricking, as this can be distressing to those who no longer understand the purpose of this test¹³.

Problems of concordance to medications can occur as a consequence of co-existing dementia and diabetes, hence the national working group in the UK for diabetes recommended the simplification of the medication regimen³. They recommend reducing the total number of medicines, if possible, and administering tablets once a day. Added to issues of concordance is the increased risk of hypoglycaemia, hence the need to prescribe glucose-lowering medications with a low risk of hypoglycaemia (i.e., avoiding sulphonylureas is recommended³. National Institute of Clinical Excellence¹³ guidance acknowledges the balance that needs to be achieved in determining appropriate glycaemic targets (HbA1c) to reduce complications whilst managing diabetes with particular reference to a relaxation of targets in those who are older or frail and at significant risk of hypoglycaemia.

People living with dementia may forget to eat, have difficulty eating and completing a meal through distraction and loss of concentration, not want to eat due to altered taste and may have swallowing difficulties. For these reasons, there is a need to link medication and monitoring of glucose levels with the provision of meals¹⁶. Maintenance of weight and good nutrition alongside regular review of nutritional status is important to quality of life³.

In the terminal phase of severe dementia nutritional status requires careful monitoring and medications should be appropriately modified³. This is a stance

supported by TREND and Diabetes UK¹⁵ noting that as dementia progresses, reduced appetite and decreased nutritional intake become regular issues, increasing the risk of hypoglycaemia. Hence changes in eating habits need to be considered when making decisions about medication choice and dosing. The complexity of managing these co-existing conditions is evident at all stages of the disease trajectory, hence Bunn et al¹⁴ conclude that these patients would benefit from more frequent, longer appointments, in both primary and secondary care.

Challenges to diabetes management as a consequence of dementia

Lifestyle modification is one of the major components of managing diabetes effectively. Some evidence indicates people living with dementia often find it difficult or are generally resistant to making adjustments to their lifestyles or daily routines^{16,17,18}. This can be due to lack of insight whereby they believe they are managing their health very well, and there is no need to further modify their lifestyle, or as a result of not being able to remember the instructions provided by healthcare professionals⁵. Sometimes there can just be a general resistance to interventions which further complicates care⁴. Lack of short-term memory can make diabetes education challenging and at times ineffective. However, Kim & Fritschi's¹⁹ review found that older adults who participated in some qualitative studies showed an elevated level of insight into their cognitive impairment and acknowledged that perceived cognitive problems interfered with them being able to maintain desirable diabetes self-management behaviours.

Cognitive impairment interferes with a range of effective diabetes self-management behaviours in older adults^{20,21}; glucose regulation can be difficult due to variations in physical activity, oral intake, disorientation, dietary patterns and stress levels²²; medication management, particularly in terms of insulin therapy can be compromised as this involves multiple complex decisions and a high level of cognitive functioning. This can lead to an increase in hospital admissions due to hypoglycaemia, diabetic ketoacidosis, or other long-term complications of diabetes^{4,5,7,9,17,18}. Conversely, evidence highlights some people living with dementia may forget that they have already eaten and eat twice, resulting in hyperglycaemia^{20,23}. Additionally, awareness of hypoglycaemia may become impaired, whereby signs and symptoms of a hypoglycaemic episode are not recognised. Repeated episodes of hypoglycaemia can result in autonomic desensitisation which makes the early warning signs

of low glucose levels more difficult to identify, which can result in a delay in treatment.

A bi-directional relationship exists between dementia and hypoglycaemia in older people with diabetes. Patients with cognitive dysfunction may have difficulty with tasks such as identification and treatment of low glucose levels and self-administration of medication, setting a spiral of more frequent hypoglycaemic episodes and worsening cognitive decline²³. However, a single case report by Kamimuro & Ito²⁴ noted that concordance with oral medication could be improved with the use of an electronic prompting device. It is also recognised that over-treatment of diabetes occurs in adults with cognitive impairment^{17,18,20}, particularly those with other complex co-morbidities²³. Much of this is with reference to excessive glycaemic control (via medication) leading to increased episodes of hypoglycaemia²⁵. Findings demonstrate that people living with dementia may forget that they have diabetes and as a result, refuse oral medication or insulin therapy, further increasing the risk of unstable glucose levels and increased glucose variability. They may lose weight in the middle to later stages of dementia which can increase the risk of hypoglycaemia for patients taking sulphonylurea or insulin therapy²². A further complication is that some people with dementia are prescribed antipsychotic medications which are associated with a higher risk of hyperglycaemia².

In care homes it has been shown that dementia has a negative impact on the quality of diabetes care that residents receive, resulting in a high incidence of diabetes-related complications and hospital admissions²². There are also increased challenges for adults with diabetes and cognitive impairment who live alone who are at particular risk of self-neglect and harm due to potential inadequate food and drink intake, poor medication concordance, and poor hygiene²⁰. The daily diabetes self-management tasks that are affected by cognitive impairment were summarised by Hopkins, Shaver & Weinstock²⁰ including glycaemic monitoring, medication management, coordination of health services and appointments, nutrition and eating activities, mobilising and engaging in physical activity, and addressing personal hygiene. The impact on this range of activities illustrates how cognitive impairment affects every aspect of diabetes self-management behaviours.

Given the wide range of activities that are affected by cognitive impairment, it is imperative that a person-centred approach is taken to care, especially where medication is involved, and a

team approach be implemented¹³. Bunn et al^{26,27} highlight the need for personalised care including prioritising quality of life, independence and patient and carer priorities over a more biomedical, target-driven approach. They also identify deficiencies in, and problems with, current health systems as evidence suggests that personalised care, continuity, and family-centred approaches are not facilitated in practice.

Complexity of care

As highlighted in the previous section, cognitive impairment affects every aspect of diabetes self-management behaviours²⁰. This makes supporting someone with diabetes and dementia very complex. This is further exacerbated by the lack of available research and clinical guidelines as how best to meet the needs of this population. For people with dementia, diabetes self-management needs to be conceptualised as a multi-dimensional, complex phenomenon affecting individuals, dyads and families, and interventions may need to target family carers^{26,27}. This is emphasised in the literature that addresses complexity, predominantly in relation to the experience of caregivers.

In a qualitative study by Du et al⁴, caregivers frequently discussed management strategies for how they met the needs of their care recipients with dementia and diabetes. For example, some caregivers helped care recipients to manage their diabetes through a diet with inventive approaches such as halving juice with water, providing meals at home through subscriptions such as the UK meals on wheels service, or slowly exchanging poor food choices with more healthy alternatives. Caregivers often noted that these changes had to be made slowly, as abrupt changes often resulted in resistance from their care recipients⁴. However, some caregivers felt that a more direct approach was more effective and instead opted to obtain the medical power of attorney or hire a home health professional to manage the care recipient's diabetes themselves. Whether their strategies were direct or indirect, caregivers frequently discussed practical ways to encourage or enforce concordance with diabetes management regimens through medication or diet⁴. Caregivers also expressed feelings that the overall quality of life for the person with dementia and diabetes was more important than strict adherence; however, they still maintained that diabetes management was important⁴. The need for adherence to a strict diabetes management plan can become more challenging as dementia progresses. Physical frailty or end-stage dementia compounds the complexity of diabetes management, with decisions needing to be made about whether to maintain strict treatment

or consider admission into nursing home care and the subsequent relaxation of diabetes targets^{26,27}.

Caregivers identify that the behaviour of the person with dementia can disrupt the daily diabetes care routine, with 'denial' of having diabetes or memory loss (anosognosia) being the most disruptive. In Feil et al's¹¹ qualitative study caregivers reported that caring for people with both diabetes and dementia was highly burdensome, that they felt overwhelmed by the person with dementia's resistance to care and wanted more support from family and patients' healthcare providers. Sometimes the behaviour of the person with dementia (which is often a means of communication) may have an impact on the management of diabetes and lead to dementia becoming the focus of attention to the detriment of diabetes management^{17,18}. Some signs and symptoms of diabetes can be confused with those of dementia and are treated as such, while diabetes is neglected²². For example, hyper/hypoglycaemia can make people irritable and unsettled. Hyperglycaemia can make people more prone to fungal and bacterial infections, urinary tract infections and possible incontinence owing to polyuria (the passage of large volumes of urine with an increase in urinary frequency), when the individual was previously continent; hypoglycaemia can be mistaken for other presentations of dementia e.g., confusion, unsteadiness, falls, frailty and stroke²².

The management of diabetes is constantly developing in the wake of the availability of continuous glucose monitors (CGM). Now, in the UK anyone with T1D can access any form of CGM that best suits their needs²⁸. In 2022, NICE¹³ updated guidance to allow patients with dementia and type 2 diabetes to access CGM. For type 2 diabetes, CGM's are available for people on multiple daily injections of insulin (MDI) and who also meet one of the following: they have recurrent hypoglycaemia or severe hypoglycaemia; they have impaired hypoglycaemia awareness; they have a condition or disability (including a learning disability or cognitive impairment) that means they cannot self-monitor their blood glucose by capillary blood glucose monitoring but could use a CGM device (or have it scanned for them); they would otherwise be advised to self-measure at least 8 times a day.

Continuous glucose monitors (CGM) are a wearable device that allows interstitial glucose levels to be monitored externally via a continual stream of glucose data using a smartphone or specific reader device. They are generally worn on the back of the arm or the abdomen. Caregivers reported that the

use of CGM's were particularly useful and helped to reassure them about the care recipient's glucose levels. No participant (person living with co-morbid dementia and diabetes) reported anxiety or distress through having to wear a CGM device. Wearing CGM was found to cause less distress than testing blood glucose levels via finger pricking and was shown to confer improvements in interstitial glucose levels and also HbA1c^{17,18}.

People with cognitive impairment, who are self-managing their diabetes, may become challenged by the use of CGM technology and have a reduced ability to interpret the data to make appropriate self-management decisions. However, the CGM devices' alarm features (for hypoglycaemia and hyperglycaemia), trend arrows and ability to transmit glucose data to caregiver devices have the potential to help caregivers better assist in a patient's management, particularly overnight²⁰. The use of CGM to reduce hypoglycaemia/hyperglycaemia in adults with cognitive difficulties has not been studied and is potentially a focus for future research²⁰.

Quality of Care

People with co-morbid dementia and diabetes were shown to have increased healthcare utilisation around the dementia diagnosis, but less likely to have input to support the management of their diabetes²⁹, including reduced HbA1c monitoring³⁰. There is also evidence that people with dementia do not have the same access to treatment and monitoring for other conditions that developed as a result of co-morbid diabetes, such as visual impairment and foot problems, compared to those with similar co-morbidities but without dementia^{9,14,29}. Thorpe et al² also identified that these individuals experienced reduced access to annual diabetes monitoring. This becomes more prominent in those with moderate to severe dementia compared to those who are diagnosed as having mild dementia²⁹. There may be a variety of factors that contribute to this finding. For example, people with dementia may be less likely to attend regular appointments or to notice or report relevant symptoms and they may be more reliant on carers to manage and facilitate appointments³¹.

It is also possible that clinicians may be more reluctant to investigate and treat patients who also have dementia either because of the difficulties involved in securing patient cooperation or because treatments are considered inappropriate for older patients with multi-morbidity. In addition, if the dementia is symptomatic, or the person with dementia is having difficulty communicating and expressing this through their behaviour, then

dementia may become clinically dominant and detract from the management of conditions such as diabetes mellitus⁹, however, this can result in the person with dementia experiencing further complications of their diabetes³⁰.

Poor communication is a major barrier to the provision of good care for people with dementia and a co-morbid health condition such as diabetes⁹. It is highlighted that professionals often find it challenging to communicate with people with dementia, particularly if there are other issues such as hearing or sight loss. Difficulties in communication were also noted between different professionals and services which made consistent care difficult to deliver. There is little integration between different teams and specialities which may be involved to support the person with diabetes and dementia⁹. A key element of quality care for a person with dementia and their carers includes good communication and flexibility around processes. It is important that everyone involved in supporting the person with dementia and their family, are aware that the person does have dementia so that they are able to consider this in relation to the delivery of person-centred care¹⁴.

People with dementia and diabetes need to have all aspects of their care monitored closely. The patient's fluid and nutritional intake must be monitored and recorded frequently to avoid hypoglycaemia or hyperglycaemia as the patient may not be able to communicate physical changes or effects from medications to others²⁹. There is often unnecessarily tight glycaemic control implemented with people with dementia, despite them often having a lower body mass index than the rest of the population²⁹, and current guidelines recommend relaxing glycaemic targets and reducing the use of hypoglycaemic medications in this population¹³.

Workforce issues

Within clinical settings, it is the healthcare professional's responsibility to ensure patients have adequate levels of hydration, and appropriate nutrition, with input from a dietitian if needed. With respect to the management of diabetes, there is also responsibility for agreeing glucose targets and routinely monitoring individuals. This requires competence in both dementia and diabetes care and managing the interaction between these conditions and the respective treatment. However, in Bunn et al's¹⁴ mixed-method study on improving health care for people living with dementia, it was identified that many healthcare professionals felt underprepared to care for people living with both dementia and diabetes. Previously Yarnall et al's⁸

mixed methods study which combined an audit of practice against Diabetes UK good clinical practice guidelines, alongside interview and focus group interviews with managers and care home staff from 5 care homes, concluded that there was a poor level of diabetes education. In only one of the participating care homes, had staff received diabetes training. This impacted on practice. For example, glucose monitoring took place in all residents who received insulin but was monitored unnecessarily in those with diet-controlled type 2 diabetes. Care home staff participants did not feel comfortable dealing with diabetic emergencies such as hypoglycaemia or diabetic ketoacidosis (DKA)⁸, yet the presence of dementia and diabetes increases the likelihood of these emergencies occurring. This limited literature highlights the specialist knowledge that staff require to care for individuals with this co-morbidity. This includes self-management and key indicators that individuals, or their family carer, may need additional support; enablement approaches, deprescribing and minimally disruptive medicine; interaction of medications on glucose levels, such as atypical antipsychotics which increase the risk of hyperglycaemia; and enhanced risk of incontinence, fungal and bacterial infections (including urinary tract infections)^{26,27}.

Discussion

This literature review highlights the complex nature of supporting a person with co-existing dementia and diabetes. Both dementia and diabetes require specific treatment regimens that can be complex, requiring multiple decisions to be made in order to preserve safety and maintain health and well-being. Managing multiple medications, dietary requirements, glucose monitoring and medication administration for diabetes along with cognitive and behavioural interventions for dementia can be overwhelming for the individual as well as their informal and professional caregivers.

The current literature draws attention to the prevalence of this co-morbidity and underpinning biological pathways and treatment, with less attention given to care, particularly models of care in settings where the prevalence of this co-morbidity is high, such as care homes. Research has focused on the interplay between these conditions suggesting that chronic hyper and hypoglycaemia, insulin resistance, and vascular complications associated with diabetes may increase the risk of developing dementia²¹. Furthermore, there has been exploration of the relationship between glycaemic control and cognitive function in individuals with dementia and diabetes. Better glycaemic control may help preserve cognitive function and reduce

the risk of cognitive decline in these individuals. However, the relationship between cognitive impairment and diabetes self-management behaviours in older adults remain unclear¹⁹. It should not be assumed that cognitive deficits alone account for poor diabetes self-management behaviours¹⁶. Capacity³² must always be assessed in relation to individual decisions and the right to make decisions not aligned to guidance¹³, must be upheld, in instances where the person with dementia is assessed to have capacity. There may be times where the goal of treatment differs between the person with dementia and the healthcare professionals supporting them. It is important that goals around glucose management and methods for monitoring this are negotiated with the person with dementia and their carers, in line with current guidance^{13,33}.

Dementia-related cognitive impairment can lead to a reduced ability to recognize and manage hypoglycaemia. This can be dangerous for individuals with diabetes as it may lead to confusion, falls, or other health complications. The management of this issue requires a high level of competence from formal and informal carers. However, the literature review highlights the concerns, particularly of formal carers around their perceptions of under preparedness to care for individuals with this co-morbidity. The literature also highlights a dearth in education on this specific topic. For example, people with dementia may have difficulty communicating their symptoms, including fluctuations in glucose levels or diabetes-related complications. Healthcare providers and caregivers need to be competent in identifying and addressing diabetes-related issues promptly as people with dementia and diabetes are less likely to be able to recognise the symptoms of low glucose levels for themselves. Given the increased risk of hospitalisation for people with dementia and diabetes, priority needs to be given to educating staff in both conditions in order to personalise and deliver effective support.

In addition to the overall complexities of managing this co-morbidity across the spectrum of disease presentation, it is important to consider approaches to care in the context of disease progression in both dementia and all type of diabetes over time³⁴. Priorities for management of both conditions require effective collaboration between the multidisciplinary team, the person living with dementia and diabetes, and their formal and informal carers. Recognising the terminal phase of severe dementia, with associated modifications to medications and glycaemic targets is of key importance³.

There is a need for more longitudinal studies that follow individuals with co-morbid dementia and diabetes over an extended time. This would help understand the interplay of these conditions and the impact of treatment approaches on outcomes such as cognitive function, glycaemic control and quality of life. These studies must include more diverse populations where the impact of cultural, socioeconomic, racial, and ethnic factors can be considered in relation to access to support, care delivery, treatment outcomes and healthcare disparity. Until now, the majority of the research has been conducted in Western populations, hence limiting understanding of the unique challenges faced by diverse populations and ethnicities with co-existing dementia and diabetes.

The role of technology, particularly the use of CGM in people with dementia and diabetes is also under-researched. Continuous glucose monitors are usually considered as a self-monitoring tool. However, they have potential for remote monitoring in 24-hour care environments. Continuous glucose monitors have the potential to give care staff a much greater depth of information about glucose ranges and trends throughout the day and night, potentially allowing them to intervene and stop episodes of hyper and hypoglycaemia earlier, particularly overnight. In addition, the sensor data that is generated can be used to further personalise diabetes management plans and tailor medication regimes, to ensure the needs of the individual are met. Continuous glucose monitors, as highlighted in the limited literature, are well tolerated by people with dementia and less intrusive and distressing than finger pricking. However, further education of care staff would be essential to ensure that they were used effectively.

Conclusions

This scoping review highlights the complexity of providing co-morbid dementia and diabetes care. The management of these conditions becomes more confounded when the individual becomes less able to self-manage diabetes and as progression with dementia impacts on concordance with treatment and care. Several gaps in the existing evidence base are also identified. Given the gravity of the consequence for individuals living with this co-morbidity, and the likely increased prevalence, there is a pressing need for increased practice-based research to determine how individuals living with both dementia and diabetes can best be supported.

Equal contribution and first authorship: These authors contributed equally to this work and share first authorship.

Contribution to the field

The co-morbidity of diabetes and dementia has a direct impact on quality of life. The ability to self-manage diabetes decreases as dementia

progresses and there is an increasing need for intervention by caregivers. The provision of such intervention and ongoing care is highly complex, yet the evidence base for this form of care is underdeveloped. This scoping review provides a synthesis of what is currently known and highlights topics for further research and practice development.

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