

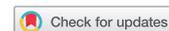
Hospitalisation of Type 2 diabetes mellitus patients with and without major depressive disorder in a private managed healthcare organisation

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Background: The relationship between Type 2 diabetes mellitus (T2DM) and associated co-morbidities, particularly major depressive disorder (MDD), is poorly acknowledged in chronic disease management practices in South Africa. Managed healthcare costs and hospitalisation rates may be influenced by the discrete management of co-morbid conditions. Therefore, the relationship between T2DM and MDD in terms of co-morbidity incidence and hospitalisation resource utilisation was investigated.

Method: This retrospective descriptive study analysed the data of 902 adult patients with T2DM from the health system database of a private managed healthcare organisation for 2014.

Results: The mean age was 57 ± 15 years and 85% of the identified T2DM patients had at least one recorded co-morbidity. Among this population 17% presented with MDD. A higher percentage of T2DM patients with MDD were admitted to hospital (42%, $p = 0.004$) compared with those without MDD (30%). The number of overnight admissions was higher among the T2DM with MDD (76%, $p = 0.016$) compared with T2DM without MDD (66%). The T2DM with MDD group (85%, $p = 0.018$) had greater non-diabetes related hospital events compared with the T2DM without MDD group (73%). The T2DM patients without MDD were more likely to be hospitalised for diabetes-related events (27%, $p = 0.018$) at significantly higher admission cost ($p = 0.001$).

Conclusion: Patients with T2DM and MDD present with more co-morbid conditions and had a higher number of hospitalisations than their non-MDD counterparts. However, the hospitalisation costs were significantly higher for diabetes-related admissions in the non-MDD group due to a higher number of macrovascular events. Healthcare organisations need to focus on an integrated approach in the management of chronic conditions with emphasis on active surveillance of T2DM patients, where MDD is identified and treated to lessen the risk of macrovascular complications.

Keywords: concordant and discordant co-morbidities, hospital utilisation, major depressive disorder (MDD), Type 2 diabetes mellitus (T2DM)

Introduction

Type 2 diabetes mellitus (T2DM) and major depressive disorder (MDD) are major public health problems affecting vast numbers of individuals worldwide. Based on the 2015 International Diabetes Federation (IDF) estimates for South Africa (SA), there were 2.3 million adults (aged 20–79 years) with diabetes; the national prevalence was 7.0% with a comparative world prevalence of 7.6%.¹ T2DM and its complications are a concerning source of mortality and a heightened healthcare burden in sub-Saharan Africa.² Many studies have discussed the healthcare utilisation and costs of T2DM patients with microvascular and macrovascular complications.³ Developing and established economies such as Asia, Russia, Canada, the UK, Germany and Australia show that hospitalisation costs associated with major coronary artery disease (CAD), cerebrovascular disease and heart failure is significantly higher than hospitalisations for non-major cardiovascular outcomes.⁴

Co-morbidities frequently occur in patients with T2DM.⁵ Approximately 80% of T2DM patients have at least one additional co-morbid condition creating further pressure on the patient and healthcare system.⁶ Conditions that are co-morbid with T2DM such as coronary artery and cerebrovascular diseases are often referred to as concordant co-morbidities (CC), due to the similarity of pathogenesis and management. Discordant co-morbidities (DC) such as MDD, cancer and rheumatoid

arthritis are considered discrete conditions to T2DM but may co-occur.⁷ The 2009 prevalence data indicated that 9.7% of South Africans would have an MDD episode in their lifetime.⁸ In the South African private managed healthcare arena the DC, such as patients with both T2DM and MDD, are managed individually through standardised protocols and guidelines per condition.^{9,10}

Traditionally, the focus of managed healthcare models for T2DM is the prevention of hospitalisations due to hypoglycaemia or diabetic ketoacidosis.^{11–13} These models overlook the other aspects in diabetes management such as cardiovascular disease (CVD), yet many studies have demonstrated the benefits of targeting CVD risk factors such as hypertension and hyperlipidaemia in T2DM patients.^{14,15} As many as 50% of T2DM patients die of a CVD event such as CAD, which is a major macrovascular complication of T2DM.^{16,17}

Few studies have focused on mood disorders in patients with T2DM, yet these patients are affected by MDD nearly twice as much as in the general population.¹⁸ MDD has been identified as an independent risk factor for both the development of CAD and for worsening prognosis once CAD is established.¹⁹ In an observational secondary analysis report of patients with CAD, the identification and treatment of MDD showed a 43% reduction of recurrent myocardial infarction.²⁰ Enhanced

depression care for patients with acute coronary syndrome and persistent depressive symptoms has shown promising reduction in the rates of major adverse cardiac events.²¹ Therefore, we investigated the relationship between the stated diagnoses of T2DM and MDD, within a private managed healthcare setting, in terms of co-morbidity incidence and hospitalisation resource utilisation.

Method

Study design

The paper presents a retrospective descriptive study of the 2014 healthcare data of 902 adult T2DM patients in a private managed healthcare database of a Chartered Accountants (SA) Medical Aid Fund (CAMAF). Data were sourced from the iMed database, a commercially available administrative system that maintains membership data, claims processing and premiums of members of private medical aid organisations such as the patients with T2DM and/or MDD within CAMAF. The database included:

- patient-level demographics and periods of health plan enrolment;
- medicine management and prescription drug use;
- programme member registration;
- primary and non-primary International Classification of Diseases and Related Health Problems, 10th revision (ICD10) diagnosis codes;²²
- detailed information regarding hospitalisations, diagnostic testing and therapeutic procedures;
- inpatient and outpatient physician and auxiliary services;
- cost data in the form of managed-care reimbursement rates for each service.

Confidentiality was maintained throughout the analysis; the patients' unique CAMAF membership number and dependent code were used to align patient records.

Setting

The data for this study was obtained at Sanlam Health, a private managed healthcare organisation. Sanlam Health is contracted out to private medical aid bodies such as CAMAF to deliver healthcare services. The study was approved by the University of the Witwatersrand Johannesburg, Faculty of Health Sciences Human Ethics Committee (M140326). Approval was also granted by the Principal Officer of CAMAF for the CAMAF data to be used in the study and by the Human Resources Manager of Sanlam Health to gather data from the iMed database for the research.

Patients

Patients were classified as having T2DM if they had any of the ICD10 diagnosis codes of E11.0 to E11.9 and E12.0 to E12.9 as stated by the practitioner and identified to be on insulin according to the Anatomical Therapeutic Chemical Classification of A10A ('Insulin and analogues'). Patients diagnosed with MDD were identified with ICD10 codes F32.2, F32.3, F32.8, F32.9, F33.1, F33.2, F33.3, F33.4, F33.8, and F33.9. The ICD10 codes utilised in this study were obtained from the Council of Medical Schemes Prescribed Minimum Benefit CMS PMB ICD-10 coded list 2013.²³

Patients were included in the sample if they were registered on a medicine management programme for T2DM, MDD and other

co-morbid conditions in 2014. The disease management programmes target registered patients' disease control in terms of medicines compliance, lifestyle changes and side effects on their medication. Advice is offered on the importance of doctor' visits, performing annual lipograms, blood pressure (BP) monitoring and smoking cessation.

Patients were grouped by their types of co-morbidities as outlined by Piette and Kerr.⁷ Clinically and economically relevant co-morbid conditions with T2DM were identified and categorised as CC and DC.²⁴ Initially, four mutually unique groups were created, i.e. T2DM patients without co-morbidities; T2DM patients with DC; T2DM patients with CC; and T2DM patients with CC and DC, to analyse the co-morbidity profile of the sample. Further analysis was performed on the patients with MDD (T2DM + MDD) versus without MDD (T2DM-MDD) due to the high prevalence of MDD in the sample.

Hospital admissions

Hospital admissions of the T2DM patients in 2014 were extracted from the hospital case management database. The primary diagnoses were identified by ICD10 code at the time of the hospital admission and were classified as hospital admissions for diabetes-related events (hypoglycaemia, micro- and macrovascular events) and for non-diabetes related events.²⁵ Hospitalisations were further categorised by same-day admissions or overnight admissions. Overnight admissions included episodes that required more than one overnight stay in hospital.

Statistical and data analysis

Data from the database were exported to a Microsoft Excel 2016 spreadsheet (Microsoft Corp, Redmond, WA, USA) and statistical analysis was performed with Statistica 13.3 (StatSoft Inc., Tulsa, OK, USA) and SAS 9.4 (SAS Institute, Cary, NC, USA). Continuous variables were presented as mean and SD or median and range and categorical variables as frequency and percentages. Comparisons of three independent groups were performed with analysis of variance (ANOVA). The Bonferroni post-hoc test was used for 2 × 2 comparisons. Categorical variables were compared with chi-square test or Fisher's exact test, as appropriate. Where multiple comparisons between groups were performed, the level of significance was adjusted using a Bonferroni correction, namely α /the number of comparisons. Hospitalisation costs were calculated as the total hospital admission costs in South African rand (ZAR) per annum and the average cost per overnight stay. Similarly, the costs for the diabetes versus non-diabetes related hospital admissions were individually calculated as the total and the average cost per annum. Average costs of hospital admissions were presented with the SD. A significance level was set at 0.05.

Results

Among the 46 000 registered beneficiaries (54.3% female) in the CAMAF database, 902 T2DM patients (2%) were identified. The co-morbidity profile of the T2DM patients is summarised in Table 1. The mean age of this cohort was 57 ± 15 years and predominantly male (57%). In total, 85% of the identified T2DM patients had at least one of the recorded co-morbidities. The T2DM patients who had both a CC and a DC (41%) were significantly older (63 ± 13.3; $p < 0.0001$) and had twice the rate of hospitalisations (44%) compared with the other groups ($p < 0.0001$).

Co-morbidities of the 902 T2DM patients within the healthcare organisation are shown in Figure 1. Patients may have one or more CC or DC, thus representing more than one condition

Table 1: Baseline characteristics of T2DM patients by types of co-morbidities in 2014

| Characteristics | Total | T2DM patients without co-morbidities | T2DM patients with DC | T2DM patients with CC | T2DM patients with CC and DC | p-value |
|---------------------------------------|-----------|--------------------------------------|-----------------------|-----------------------|------------------------------|----------|
| n (%) | 902 (100) | 136 (15) | 33 (4) | 363 (40) | 370 (41) | |
| Age (years) | 57 ± 14.7 | 44 ± 13.1 | 49 ± 11.2 | 56 ± 13.0 | 63 ± 13.3 | < 0.0001 |
| Male n (%) | 518 (57) | 82 (60) | 14 (58) | 233 (64) | 189 (51) | 0.0009 |
| Female n (%) | 384 (43) | 54 (40) | 19 (42) | 130 (36) | 181 (49) | |
| Number of patients on insulin n (%) | 228 (25) | 26 (19) | 8 (24) | 101 (28) | 93 (25) | 0.26 |
| Number of patients hospitalised n (%) | 289 (32) | 28 (21) | 8 (24) | 89 (25) | 164 (44) | < 0.0001 |

within the figures. Hypertension (64%) and hyperlipidaemia (63%) were the most prevalent CC, and MDD (17%) was the most prevalent DC.

T2DM patients with MDD (T2DM + MDD) and without MDD (T2DM-MDD)

Table 2 summarises the characteristics of the patients with T2DM + MDD and T2DM-MDD. In a predominantly male sample (Table 1), a significantly higher proportion of the female sample (Table 2) fell into the T2DM + MDD group ($p < 0.0001$). The T2DM + MDD group had a higher proportion of DC than those without MDD.

Hospital resource utilisation of T2DM + MDD and T2DM-MDD patients

The comparison of the hospital resource utilisation of the two groups is presented in Table 3. There were a greater number

of T2DM + MDD patients admitted to hospital (42%) compared with the T2DM-MDD (30%) group ($p = 0.004$) and more patients were admitted overnight in the T2DM + MDD group (36%) compared with the T2DM-MDD group (21%), $p = 0.0001$. The overall admission rate was significantly higher in the T2DM + MDD group (82%; $p = 0.0001$; with 76% being an overnight admission, $p = 0.016$), compared with the T2DM-MDD group (56%) admissions (66% were overnight stays).

Hospital admissions for diabetes and non-diabetes related events in both groups

Table 4 compares the diabetes related admissions and costs between the T2DM + MDD and T2DM-MDD groups. Significantly more T2DM-MDD patients had diabetes related admissions (27%, $p = 0.018$) and significantly higher cost ($p = < 0.001$). Figure 2 further shows that these admissions were for

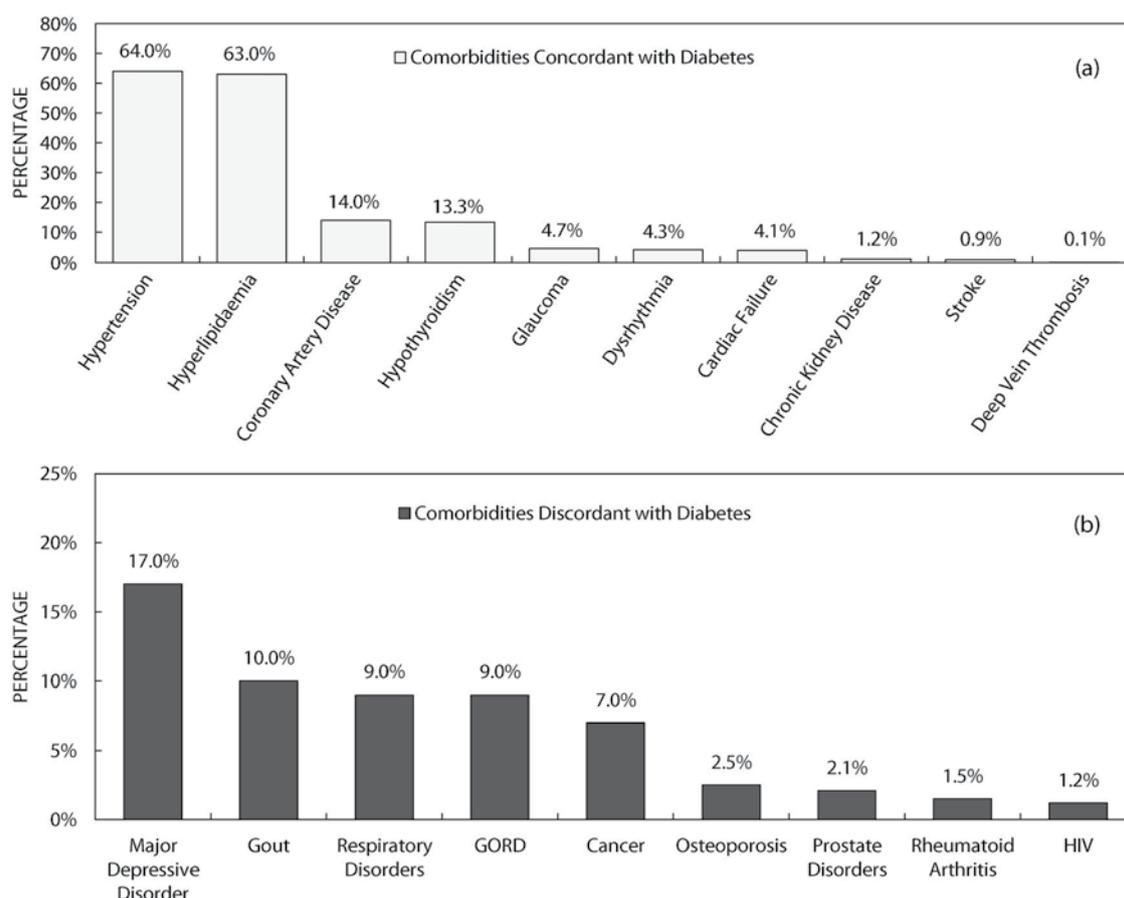
**Figure 1:** Percentage of T2DM patients with co-morbidities (a) concordant and (b) discordant with diabetes in the study.

Table 2: Characteristics of T2DM + MDD and T2DM-MDD patients in 2014

| Characteristics | T2DM + MDD n = 153 (17%) | T2DM-MDD n = 749 (83%) | p-value |
|--------------------------------------|--------------------------------|------------------------------|---------|
| Age (years) | 60 ± 14 | 58 ± 15 | 0.13 |
| Female, n (%) | 97 (63) | 287 (38) | <0.0001 |
| Number of patients on insulin, n (%) | 42 (28) | 186 (25) | 0.43 |
| Concordant co-morbidities (CC): | | | |
| Hypertension, n (%) | 109 (71) | 475 (63) | 0.06 |
| Hyperlipidaemia, n (%) | 111 (73) | 458 (61) | 0.02 |
| Hypothyroidism, n (%) | 33 (22) | 88 (12) | 0.01 |
| Coronary artery disease, n (%) | 23 (15) | 104 (14) | 0.75 |
| Cardiac failure, n (%) | 4 (3) | 14 (2) | 0.44 |
| Cardiomyopathy, n (%) | 2 (1) | 6 (1) | 1.00 |
| Dysrhythmia, n (%) | 10 (7) | 29 (4) | 0.10 |
| Stroke, n (%) | 3 (2) | 5 (1) | 0.29 |
| Chronic renal disease, n (%) | 3 (2) | 8 (1) | 0.29 |
| Glaucoma, n (%) | 9 (6) | 34 (5) | 0.67 |
| Deep vein thrombosis, n (%) | 0 (0) | 6 (1) | 0.21 |
| Discordant co-morbidities (DC): | | | |
| Cancer, n (%) | 15 (10) | 50 (7) | 0.20 |
| Asthma, n (%) | 20 (13) | 46 (6) | 0.002 |
| COPD, n (%) | 7 (5) | 12 (2) | 0.031 |
| Epilepsy, n (%) | 8 (5) | 7 (1) | 0.0004 |
| Gout, n (%) | 14 (9) | 78 (10) | 0.71 |
| GORD, n (%) | 31 (20) | 51 (7) | <0.0001 |
| HIV, n (%) | 2 (1) | 9 (1) | 1.00 |
| Osteoarthritis n (%) | 12 (8) | 19 (3) | 0.003 |
| Rheumatoid arthritis, n (%) | 4 (3) | 10 (1) | 0.049 |
| Parkinson's disease, n (%) | 5 (3) | 4 (1) | 0.049 |
| Prostate disorders, n (%) | 2 (1) | 17 (2) | 0.40 |
| Osteoporosis, n (%) | 8 (5) | 15 (2) | 0.031 |

COPD = chronic obstructive pulmonary disease; GORD = gastro-oesophageal reflux disorder; HIV = human immunodeficiency virus.

macrovascular complications 66% of the time, and microvascular complications in 34% of cases.

Table 5 indicates significantly higher non-diabetes related admissions for the T2DM + MDD group (85%) compared with the T2DM-MDD group (73%; $p = 0.018$) (Figure 3). The cost of non-diabetes related admissions was similar in the two groups.

Table 3: Hospital resource utilisation amongst T2DM + MDD and T2DM-MDD patients in 2014

| Hospital resource utilisation | T2DM + MDD (n = 153) (17%) | T2DM-MDD (n = 749) (83%) | p-value |
|--|----------------------------------|--------------------------------|---------|
| Total number of patients hospitalised, n (%) | 64 (42) | 225 (30) | 0.004 |
| Number of patients hospitalised overnight, n (%) | 53 (36) | 160 (21) | 0.0001 |
| Total number of hospital admissions, n (%) | 126 (82) | 417 (56) | <0.0001 |
| Number of overnight hospital admissions, n (%) | 96 (76) | 277 (66) | 0.016 |
| Median length of stay, days (min, max) | 4 (2, 50) | 4 (2, 78) | 0.67 |

Table 4: Costs of diabetes-related hospitalisations amongst T2DM + MDD and T2DM-MDD patients in 2014

| Types of hospital admissions | T2DM + MDD (n = 153) | T2DM-MDD (n = 749) | p-value |
|--|-------------------------|-----------------------|---------|
| Diabetes-related hospital admissions, n (%) | 14/96 (15) | 74/277 (27) | 0.018 |
| Total costs | R455 358 | R4 746 683 | – |
| Average cost per diabetes-related hospital admission | R32 526 ± R16 575 | R64 144 ± R88 761 | < 0.001 |

Discussion

This study reviewed the 2014 membership data of the CAMAF iMed database and extracted 902 member records of patients registered on the medicine management programme as having T2DM. The co-morbidity profiles were analysed in terms of CC and DC, yielding high rates of cardiovascular co-morbidity and a concerning 17% of the sample presenting with MDD, warranting further investigation into the relationship between these conditions. Factors such as other co-morbidities, hospital resource utilisation, diabetic versus non-diabetic complications and associated costs were investigated.

Despite the predominantly female population of the CAMAF membership, the sample comprised significantly more male T2DM patients (57%, $p = 0.0009$), but the female patients were more likely to have co-morbid MDD (63%, $p = < 0.0001$). It is well known that the incidence of T2DM is slightly higher in the male population²⁶ and the incidence of MDD is higher in the female T2DM population,²⁷ as reflected in our results.

In this study 85% of the T2DM patients had at least one additional recorded co-morbidity and were older than the group without co-morbidities. These results are similar in the findings of a cross-sectional analysis of 161 174 patients with T2DM using electronic health record (EHR) data supplied by United States providers in 2008–2012.²⁸ Hypertension (64%) and hyperlipidaemia (63%) were the most common CC and are specifically targeted within the CAMAF disease management programmes, which provides disease specific support and education to registered members. Despite being on a private managed care programme the number of T2DM patients treated for the above two major contributors to CVD was lower than the targets set by the 2017 Society for Endocrinology, Metabolism and Diabetes of SA (SEMDSA) guideline recommendations.⁹ The guidelines advocate that dyslipidaemia and other CVD risk factors should be surveyed for and aggressively managed in every patient with T2DM. The treatment gap indicates that one in three T2DM patients within this managed care organisation may need antihypertensive or lipid-lowering intervention, as all T2DM patients should be considered at risk.⁹ The prevalence rate of hypertension and hyperlipidaemia was also lower than those reported for hypertension (82%) and hyperlipidaemia (77%) in a study conducted by Iglay *et al.* from 2014 to 2015 using EHR of a cohort of 1 389 016 American adult T2DM patients.²⁹ This difference could be due to the higher prevalence of older, black and non-Hispanic patients among the US population.

The presence of DC is an additional burden on a diabetic patient, in terms of not only affordability to the healthcare resources, but also the understanding of the diseases and their management. The presence of DC has shown to be associated with diminished care, as the illnesses have unrelated pathogenesis and disparate

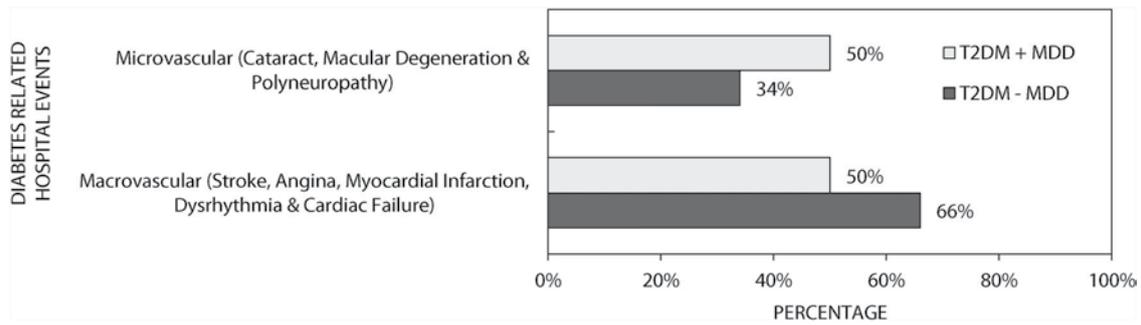


Figure 2: Diabetes-related hospital events in T2DM + MDD and T2DM-MDD.

Table 5: Costs of non-diabetes related hospitalisations amongst T2DM + MDD and T2DM-MDD patients in 2014

| Types of hospital admissions | T2DM + MDD (n = 153) | T2DM-MDD (n = 749) | p-value |
|--|----------------------|--------------------|---------|
| Non-diabetes related admissions, n (%) | 82/96 (85) | 203/277 (73) | 0.018 |
| Total costs | R4 150 932 | R10 018 689 | – |
| Average cost per non-diabetes related hospital admission | R50 621 ± R87 567 | R49 353 ± R53 625 | n.s. |

n.s. = non-significant.

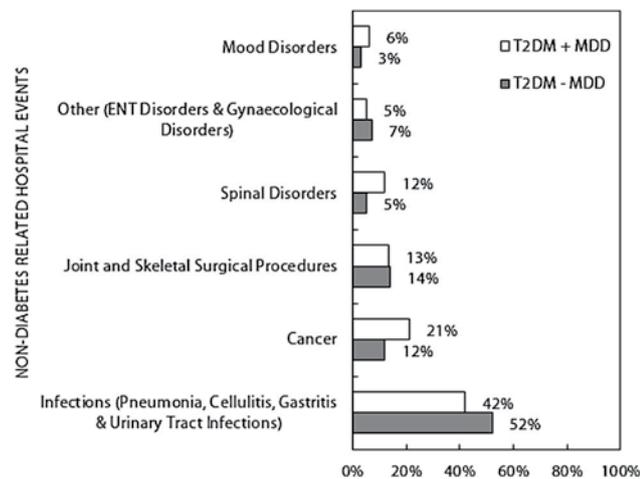


Figure 3: Non-diabetes related hospital events in T2DM + MDD and T2DM-MDD.

management plans to the T2DM management, unlike the similarity of care in CC.²⁴ In the National Health and Nutrition Examination Surveys (NHANES) conducted in the United States from 1988 to 2010, less than 50% of diabetic patients with multiple co-morbidities achieved glycaemic, BP and LDL cholesterol targets set by diabetes guidelines.³⁰

The high incidence of MDD (17%) as a co-morbidity in this sample is consistent with international statistics. A meta-analysis of 51 331 people between 1980 and 2005 similarly showed that MDD was significantly higher in patients with T2DM compared with those without T2DM (17.6% vs. 9.8%).²⁷ Data of 16 180 T2DM patients presented by a health maintenance organisation (HMO) showed 17.9% incidence of MDD.³¹ Depressive symptoms in individuals with diabetes have shown to be associated

with poor glycaemic control and increased risk of micro- and macrovascular complications.^{32,33}

Certain antidepressants i.e. paroxetine, mirtazapine and venlafaxine, have been shown to be associated with increased lipid levels and could possibly contribute to hyperlipidaemia in the group of patients treated for MDD.^{34,35} The clinical parameters, i.e. lipid levels, BP and blood glucose, of the T2DM patients with and without MDD were not evaluated at this stage. Further studies will require evaluation of the clinical parameters of this cohort of T2DM patients. In this study, hyperlipidaemia was a generic classification on the system as a code and did not specify the type of hyperlipidaemia.

The presence of DC may draw resources away from other disease management and could compromise diabetes self-care in patients with pre-existing CC.²⁴ The T2DM + MDD group indicated higher rates of both CC and DC than their non-MDD counterparts. To support our findings Von Korff and colleagues have revealed that childhood adversity and depression occurring in adolescence to early adulthood were independent risk factors for development later of a range of medical disorders, including diabetes, CAD, asthma, osteoarthritis, epilepsy and hypertension.³⁶

Conditions such as MDD, arthritis and asthma pose significant barriers to lifestyle changes and regimen adherence in patients with T2DM.³⁷ The prevalence of gastro-oesophageal reflux disorder (GORD) was significantly higher in patients with MDD in a cross-sectional study using the National Health Insurance Research Database in Taiwan during 2005; the study subjects included 4 790 patients with MDD and 728 749 people in the general population.³⁸ Likewise in our study, a significantly higher number of T2DM patients with MDD had co-morbid GORD compared with the group of T2DM without MDD.

A greater proportion of the T2DM + MDD patients (42%) were hospitalised compared with those without MDD (30%) during 2014. The increased rate of hospital admissions could be due to non-adherence to diabetic management, which leads to increased rates of diabetic complications such as ischaemic heart disease, peripheral vascular disease and admissions as reported in the Canadian study.³⁹ In our study, the diabetic patients who were being treated for MDD experienced more microvascular (polyneuropathy, macular degeneration) complications than those with diabetes alone. The presence of MDD might compromise diabetes care possibly because of over- or under-treatment, competing for time, attention or limited resources. This suggests the need for integrated care

coordination within the healthcare system to improve diabetes care among patients with MDD.

In addition, the results of this study also showed that in T2DM patients with MDD the rate of hospitalisation for non-diabetes related complications was much higher than for those without MDD. In a systematic review between the years 1995 and 2008 the studies focused mainly on outcomes, such as the changes in depressive symptoms and HbA1c.⁴⁰ Reduction of diabetes and non-diabetes related complications by active surveillance of diabetes and depression can improve and benefit this group of diabetic patients. Within CAMAF, DC are not looked at in the management of T2DM patients, as the focus is mainly targeting the CC, i.e. hypertension and hyperlipidaemia.

There was significantly higher hospitalisation cost for T2DM-MDD, though the LOS in hospital was similar between the T2DM + MDD and T2DM-MDD groups. The increased hospital costs could be attributed to the macrovascular complications of T2DM without MDD. Studies showed that hospitalisation costs associated with major CAD, stroke and heart failure are significantly higher than hospitalisations for non-major cardiovascular outcomes.⁴

In our group of T2DM + MDD, the patients were less likely to be hospitalised for macrovascular complications than those without MDD, which is contrary to what is stated in the literature where the presence of MDD in T2DM patients may compromise T2DM care. However, the T2DM-MDD were more likely to be hospitalised for macrovascular complications with significantly higher cost per admission. This suggests that the CAMAF medicine and the mental wellness programmes may be more effective in managing T2DM and MDD, and that the patients are more aware of their health status and were compliant with their treatment for T2DM and MDD. However, as we have very little information on the behaviour of the T2DM patients with and without MDD within CAMAF, future studies will be required to investigate the difference in outcomes of these groups of T2DM patients.

Patients registered for MDD on the chronic programme are treated for depressive symptoms with psychotherapy and antidepressants. This suggests that if the underlying MDD in T2DM patients is identified and treated, it would result in better T2DM outcomes, i.e. less hospitalisation for diabetic-related events or better diabetes management. The American Heart Association Science advisory committee, endorsed by the American Psychiatric Association, recommends that if the underlying MDD in CVD patients is identified and treated, the cardiovascular outcome is much improved.⁴¹ Evidence exists for improved outcomes and lower financial burden by managing combined co-morbid conditions such as diabetes and hypertension; it was demonstrated in the UKPDS study¹⁷ that tight BP control in patients with hypertension and T2DM reduced the risk of diabetes-related complications and deaths. Similarly, improved outcomes were demonstrated in a randomised control trial done on the integration management of T2DM and co-morbid MDD treatment to improve medication adherence at primary care level.⁴² Due to the higher incidence of MDD in patients with T2DM (17%), more active surveillance of the T2DM patients for depressive symptoms is warranted for the early identification and treatment of MDD, possibly improving the CVD outcomes.

There is a need for additional research into the relationships between discordant co-morbid conditions such as MDD in T2DM patients to identify strategies to improve clinical

outcomes. Further focus on the co-morbid status of other DC-related conditions would shed light on the pattern and clusters of multiple conditions that the T2DM patients are burdened with and associated poor patient outcomes. Healthcare organisations need to emphasise integrated multiple disease management in T2DM and MDD patients to lower the disease burden and improve outcomes.

Conclusion

Our results showed that in this cohort of 902 T2DM patients the incidence of MDD was 17%, a major discordant co-morbidity warranting deeper investigation into the relationship between T2DM and MDD.

Hospital resource utilisation of overnight admissions was higher among the patients with MDD compared with those without MDD. There was a greater number of admissions for non-diabetes related hospital events in the T2DM + MDD group compared with the T2DM-MDD group.

Active surveillance of T2DM patients is a recommendation for the future, where MDD is identified and treated to lessen the disease burden and reduce micro- and macrovascular complications. Future research needs to look at hospital and resource utilisation in T2DM patients with the added burden of MDD and to elucidate the healthcare needs of those patients.

A prospective study is being conducted on T2DM patients with and without MDD to identify factors associated with diabetes control such as blood glucose, BP and lipid profiles, and to compare the total healthcare costs.

Limitations

The administrative claims database has limitations regarding accuracy of diagnostic coding, billing practices and incomplete records. As the T2DM patients were from a private managed care organisation, their healthcare utilisation and costs might not represent those of uninsured patients or those managed in a public healthcare sector. The outcomes of this study are thus limited to the privately managed healthcare environment in South Africa.

The study was not statistically powered to perform a multivariate analysis to determine the contributions to number and cost admissions adjusting for individual co-morbidities.

Conflict of interest

The data for this paper were obtained from Sanlam Health, a managed healthcare organisation. There is no conflict of interest with the author obtaining the data from the workplace. Approval was granted unconditionally to utilise the data for research purposes only. No financial or non-financial interest was laid by the employer to perform the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Received: 01-12-2018 Accepted: 26-04-2019