Profile of disabilities and their associated factors in patients with type 2 diabetes evaluated by the Canadian occupational performance measure: the Rio De Janeiro type 2 diabetes cohort study


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Profile of disabilities and their associated factors in patients with type 2 diabetes evaluated by the Canadian occupational performance measure: the Rio De Janeiro type 2 diabetes cohort study

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\textbf{ABSTRACT}

\textbf{Purpose:} To investigate the profile of disability in patients with type 2 diabetes and to evaluate its associated variables. \textbf{Method:} The Canadian Occupational Performance Measure (COPM) assessed disabilities in 475 type 2 diabetic individuals. The activities were categorised by the International Classification of Functioning, Disability and Health. The Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) was used to evaluate pain, emotional and physical functioning domains of life-quality. Multivariable logistic regression assessed the independent correlates of better/worse performance.

\textbf{Results:} Median COPM score was 4.5 (interquartile range 3–6). Problems in mobility (53.6%), self-care (21.1%) and daily-life (13.0%) were most frequently self-reported. Presence of restriction/pain in the upper limbs (odds ratio [OR]: 1.66; 95% CI: 1.11–2.47; \textit{p} = 0.013) and of peripheral neuropathy (OR: 1.64; 95% CI: 1.06–2.53; \textit{p} = 0.026) were associated with greater chance of worse performance. Higher values of SF-36 in pain and emotional domains (each 10 point increase; OR: 0.92 95% CI: 0.85–0.98; \textit{p} = 0.011; OR: 0.96; 95% CI: 0.92–1.00; \textit{p} = 0.063, respectively) and physical activity (OR: 0.63; 95% CI: 0.41–0.98; \textit{p} = 0.042) were associated with better performance. \textbf{Conclusions:} Type 2 diabetic patients frequently reported disabilities in mobility, self-care and daily-life domains; and its associated factors were the presence of depression, upper limb pain and diabetic peripheral neuropathy.

\textbf{IMPLICATIONS FOR REHABILITATION}

- The Canadian Occupational Performance Measure (COPM) instrument can be applied to patients with diabetes, as it identifies several disabilities, mostly in mobility, self-care and domestic life areas.
- Rehabilitation directed to upper limb pain/limitation and to lower limb peripheral neuropathy shall be implemented and may improve diabetic patients’ performance and quality of life.
- A patient-centered rehabilitation strategy, guided by the COPM, may enable greater independence and autonomy, but this should be confirmed in future intervention studies.

\textbf{Introduction}

Diabetes currently represents a serious public health problem in the world, due to its high prevalence and morbidity, becoming an epidemic related to rapid urbanisation, nutrition transition and sedentary lifestyles, paralleling the increase in obesity worldwide.\textsuperscript{[1]} Usually, individuals with diabetes have disease-related complications, in consequence of macrovascular and microvascular disease, and complications unrelated to diabetes including depression and musculoskeletal disorders.\textsuperscript{[2]}

Both kinds of complications are associated with considerable consequences, requiring health care and increasing related costs.\textsuperscript{[3]} Diabetic patients have more frequent and longer hospitalisations compared to the non-diabetic patients, mainly due to renal, neurological, cardiovascular and ophthalmic diseases.\textsuperscript{[4]}

Type 2 diabetes is a well-known risk factor for physical and functional disabilities.\textsuperscript{[5]} Functional disability, defined as difficulty in performing daily life activities and the tasks necessary for the independent functioning...
in daily life instrumental activities,[6] seems to be more common in older adults with diabetes than in those without diabetes.[7,8] Older adults with diabetes had more difficulties in walking, climbing stairs or doing housework, and worse results on direct measures of physical performance, such as in muscle strength and in walking speed.[7,9] They also had high degrees of difficulty in performing leisure and social activity tasks.[10]

The most commonly used strategy to evaluate disabilities is based on self-reported levels of difficulty in performing mobility tasks, such as walking on level ground; in instrumental activities of daily living, such as shopping and housekeeping; and in basic activities of daily living, such as eating and using the bathroom.[11] Objective measures of physical function, including tests of gait and balance, lower and upper-extremity strength, and performance of complex tasks have also been employed.[11] Examples of instruments to assess disability/functionality in these studies were: the Lawton and Brody Scale,[12] the Barthel Index [13] and the Katz Index of Activities of Daily Living.[14] All these instruments pre-specify which activities will be evaluated. Otherwise, the Canadian Occupational Performance Measure (COPM) is an outcome measure designed to help patients identify, prioritise and evaluate the most important disabilities they found in occupational performance.[15] The COPM is a semi-structured interview, with a standard scoring system, which assesses individual patients’ self-perception of actual performance and satisfaction with this performance over time. Its conception is based on the Canadian Model of Occupational Performance and Engagement,[16] and it has been applied to several clinical settings, such as in neurological,[17,18] orthopaedic [19] and neoplastic diseases.[20] However, as far as we know, the COPM has never been evaluated in diabetes.

Therefore, the objectives of this study were to investigate the profile of disability in a high-risk middle-aged to elderly cohort of type 2 diabetic patients (the Rio de Janeiro Type 2 Diabetes [RIO-T2D] cohort study), using the COPM; and to determine the factors associated with the presence of self-reported disabilities, including clinical-laboratory variables, presence of limitation/pain in upper and lower limbs, and emotional and physical pain domains of life quality evaluated by the Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) questionnaire.

**Methods**

It was a cross-sectional study within a cohort of 475 type 2 diabetic patients (the RIO-T2D cohort), enrolled in the outpatient clinic of a tertiary-care university hospital. All participants gave written informed consent and the local Ethics Committee had previously approved the study protocol. The characteristics of this cohort, the baseline procedures and the diagnostic definitions have been detailed elsewhere.[21–24] In brief, inclusion criteria were all adult type 2 diabetic individuals up to 80 years old with either any microvascular (retinopathy, nephropathy or neuropathy) or macrovascular (coronary, cerebrovascular or peripheral artery disease) complication, or with at least two other modifiable cardiovascular risk factors. Exclusion criteria to enter the cohort were a body mass index >40 kg/m², serum creatinine ≥180 mmol/L, the presence of any serious concomitant disease limiting life expectancy, and any cognitive or communication problems.[21–24] All patients were submitted to a standard protocol that included a complete clinical examination and laboratory evaluation. Pain or joint limitation, which hindered the performance of some daily task, was investigated by a standard questionnaire that included inquiries on spine, shoulder, elbow, wrist/hand, hip, knee and ankle/foot. Diagnostic criteria for macrovascular and microvascular degenerative diabetic complications were detailed previously.[21–24] Laboratory evaluation included fasting glycaemia, glycated haemoglobin (HbA1c), and lipid profile and serum creatinine. Mean HbA1c was calculated for the 5 years before disability evaluation.

The COPM was carried on from February 2012 to February 2013, through individual interviews conducted by one occupational therapist (FSM), trained and experienced with the method, and unaware of other patients’ data. The COPM interview has previously been translated and validated in Brazil.[25] Patients were asked to identify up to five daily activities that they had more difficulty to perform, and they rated each one on a scale of importance from 1 (least important) to 10 (most important); and their current level of performance and satisfaction with their performance in each of the activities on a scale from 1 (with great difficulty or not satisfied at all) to 10 (no difficulties or completely satisfied).[15] The activities identified in the COPM interviews were linked to the Activity and Participation domains of the International Classification of Functioning, Disability and Health (ICF) [26] in order to unify terminology of the activities and allow comparisons with other studies. This linkage was standardised and systematic, based on established rules,[27,28] and performed by another experienced occupational therapist not involved in the COPM interviews. To evaluate somatic pain, and emotional and physical functioning domains of quality of life, the SF-36 questionnaire was used, which has been translated and validated in Brazil.[28]
Statistical analysis

Continuous variables were described as means and standard deviations, in case of normal distribution, or as medians and interquartile ranges, if asymmetrically distributed. Unpaired t-test, Mann–Whitney or chi-squared tests, where adequate, were used to compare variables between patients with better and worse performance, according to the COPM below and above the median value (≤4 points/≥5 points). The covariates independently associated with better/worse performance were assessed by multivariate logistic regression using a backward stepwise selection procedure, where a p value ≤0.10 was the criterion to remain into the final model. Variables with a p < 0.20 in the univariate analysis were the candidates to enter the multivariate analysis, except the functional capacity domain of the SF-36, because it was highly correlated with the COPM. Thus, the candidate variables to enter the multivariate models were the following: age, gender, duration of diabetes, schooling years, regular physical activity, peripheral neuropathy, peripheral artery disease, lower limb amputation, hypertension, dyslipidemia, insulin use, mean HbA1c levels, limitation/pain in upper and lower limbs, and the emotional and pain domains of the SF-36. Age and gender were forced into all models, regardless of their significance. Model fitness was evaluated by the Hosmer–Lemeshow goodness-of-fit test (where a higher p value means a better model calibration) and by the area under ROC curve of the estimated probabilities. All statistics were performed with SPSS statistical package version 19.0 (SPSS Inc., Chicago, IL) and a two-tailed p value <0.05 was regarded as significant.

Results

Profile of disabilities

The median COPM score for activities performance and satisfaction was 4.5 points (interquartile range: 3–6 points). Regarding the profile of disability, individuals reported the following main problem areas of occupational performance (according to ICF classification): “Mobility” (53.6%), “Self-care” (21.1%), “Domestic life” (13.0%), and “Learning and applying knowledge” (7.8%). Other areas were all <2%. These data are shown in Figure 1. The most frequently reported disabilities were climbing, walking long distances, squatting, kneeling, standing and carrying in the hands (mobility); cleaning living area (domestic life); managing diet and fitness, and putting on clothes (self-care), watching (learning and applying knowledge), as shown in Table 1. Most patients

Table 1. The most frequently reported disabilities in the COPM interviews with type 2 diabetic patients.

<table>
<thead>
<tr>
<th>Disabilities</th>
<th>N=2065 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climbing</td>
<td>12.45</td>
</tr>
<tr>
<td>Walking long distances</td>
<td>9.64</td>
</tr>
<tr>
<td>Cleaning living area</td>
<td>6.20</td>
</tr>
<tr>
<td>Squatting</td>
<td>5.86</td>
</tr>
<tr>
<td>Managing diet and fitness</td>
<td>4.75</td>
</tr>
<tr>
<td>Watching</td>
<td>4.31</td>
</tr>
<tr>
<td>Kneeling</td>
<td>4.07</td>
</tr>
<tr>
<td>Standing</td>
<td>3.83</td>
</tr>
<tr>
<td>Carrying in the hands</td>
<td>3.78</td>
</tr>
<tr>
<td>Dressing</td>
<td>3.54</td>
</tr>
</tbody>
</table>

Figure 1. Profile of disabilities referred by type 2 diabetic patients at COPM interviews.
identified five activities as difficult to perform and only 19 (4%) identified only one activity.

Comparisons of clinical and laboratory variables of diabetic patients according to performance evaluated by COPM

Table 2 outlines the demographic, clinical and laboratory variables of all diabetic patients and of subgroups of patients according to average performance (categorised at median value, \( \leq 4 \) points/\( \geq 5 \) points). Patients with worse performance (COPM \( \leq 4 \) points) were older, more obese and less physically active, and had higher prevalences of peripheral neuropathy and of peripheral artery disease. Patients with better performance (COPM \( \geq 5 \) points) had higher mean values in the three areas of quality of life evaluated by SF-36, and had fewer complaints related to limitations/pain in upper and lower limbs.

Multivariate logistic regression analysis

Results of multivariate logistic regression analysis for the variables independently associated with better/worse performance (COPM categorised at \( \geq 5/\leq 4 \) points) are presented in Table 3. The presence of restriction/pain in the upper limbs and of diabetic peripheral neuropathy was the variables independently associated with a greater chance of having a worse performance, whereas higher values of SF-36 pain and emotional domains and regular physical activity were associated with a better performance.

Discussion

This study has two main findings. First, it demonstrated the profile of disabilities in elderly type 2 diabetic patients, using an individualised instrument (the COPM), in which the patients themselves prioritise the activities that they perceived as the most difficult to perform. The disabilities included many areas of the Activity and Participation domains of the ICF, confirming the diversity of disabilities in type 2 diabetic patients. There were higher prevalences in the areas of mobility (53.6%), self-care (21.1%) and domestic life (13%), which mainly included activities such as climbing stairs and ramps, walking long distances, squatting, cleaning living area, bathing and dressing. Second, it showed that worse performance (COPM categorised at \( \geq 5/\leq 4 \) points) is associated with a greater chance of having a worse performance.
Table 3. Multivariate logistic regression for variables independently associated with a worse performance evaluated by the average COPM score (≤4 points).

<table>
<thead>
<tr>
<th>Independent covariates</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36 pain domain (each 10 point increase)</td>
<td>0.92</td>
<td>0.85–0.98</td>
<td>0.011</td>
</tr>
<tr>
<td>Limitation/pain in upper limbs</td>
<td>1.66</td>
<td>1.11–2.47</td>
<td>0.013</td>
</tr>
<tr>
<td>Presence of peripheral neuropathy</td>
<td>1.64</td>
<td>1.06–2.53</td>
<td>0.026</td>
</tr>
<tr>
<td>Physical activity</td>
<td>0.63</td>
<td>0.41–0.98</td>
<td>0.042</td>
</tr>
<tr>
<td>SF-36 emotional domain (each 10 point increase)</td>
<td>0.96</td>
<td>0.92–1.00</td>
<td>0.063</td>
</tr>
</tbody>
</table>

Hosmer–Lemeshow goodness-of-fit test p = 0.61.
Area under ROC curve of estimated probabilities: 0.669, 95% confidence interval: 0.621–0.717, p = 0.001.
Candidate variables were age, gender, duration of diabetes, schooling years, physical activity, presence of peripheral neuropathy and peripheral arterial disease, lower limb amputation, arterial hypertension, dyslipidemia, use of insulin, mean HbA1c, limitation/pain in upper and lower limbs, and emotional and pain domains of SF-36. Age and gender were forced into the model.

Performance was independently associated with lower SF-36 pain and emotional domain values, presence of limitation/pain in the upper limbs, presence of peripheral neuropathy and absence of regular physical activity. Hence, beyond optimal metabolic control in order to delay/prevent development of chronic diabetic degenerative complications, treatment of depression, pain control, regular physical activity and rehabilitation are potential factors that may improve self-rated performance in type 2 diabetic patients and, consequently, their quality of life.

As far as we know, this is the first study using the COPM evaluation in a type 2 diabetes population. It is well-accepted that disability measures are key indicators of overall health status. Further, it is believed that the evaluation focussed on the patient may benefit the treatment, because patients would be more proactive in their own healthcare. The COPM is designed for use in people of all ages, with various disabilities and backgrounds; and allows the patients themselves to prioritise their most important perceived disabilities that they would wish to improve.[29] The COPM enables patients to self-quantify the importance they attribute to these activities, and their difficulties and dissatisfaction with them. Furthermore, the identification of the disability, identified by the COPM, can be linked to the ICF profile. However, it is important to recognise that COPM mainly addresses the Activity and Participation elements and only indirectly the body function and structure, as defined by the ICF. Thereby, the disabilities assessed by the COPM may not cover all components of the ICF.

The relationships between type 2 diabetes and functional disabilities have been largely reported.[5–11,31–34] These studies generally assessed whether patients had disabilities related to diabetes, using instruments based on self-reported difficulties on pre-specified activities, such as basic and instrumental activities of daily living, or on specific task tests, such as timed walking and chair stands. Noteworthy is the fact that, although the COPM allows the identification of different activities, the findings of the present study were similar to previous investigations that used these different instruments of evaluation in middle-aged to elderly patients with diabetes, which identified difficulties in mobility and in house working as the most prevalent disabilities, associated with worse performance on physical tests, such as walking speed and muscle strength.[7–9,34]

The association between diabetes and disability is quite complex because many impairments or comorbidities, related or not to diabetes, could intervene in the disablement process.[35] In the present study, peripheral diabetic neuropathy was associated with patient perception of worse performance. Similarly, in previous reports, peripheral diabetic neuropathy was also associated with a worse performance specifically in lower limbs.[36–38] Not unexpectedly, the SF-36 pain domain was associated with a worse performance reported by the patients. It is known that the prevalence of chronic pain is high in older persons; and is particularly higher in patients with diabetes [39] and is strongly associated with physical function.[40] Furthermore, depression is another diabetes comorbidity that contributes to activities of daily living and mobility disabilities.[41] Evaluation of the presence of depressive symptoms in older adults with diabetes is crucial, not only to improve their quality of life, but also to improve adherence to treatment, leading to better glycemic control and reducing the risk of developing chronic diabetes complications. The increased risk of disability from diabetes might be mediated by the duration of diabetes and level of glycemic control. A recent meta-analysis confirmed the increased risk of disability in patients with diabetes, but could not evaluate the effect of duration of diabetes or glycemic control.[5] These relationships have been scarcely investigated. Wu and colleagues suggested that the longer the duration of diabetes, the greater the risk of disability,[33] although this finding was not supported by Gregg and co-workers.[32] We did not find any relationship either with glycemic control, assessed by mean HbA1c levels, or with diabetes duration and an increased risk of worse performance reported by the patient. However, poor glycemic control and longer duration of diabetes increase the risk of micro and macrovascular diabetic complications,[42] which can result in disability.

In the present study, the presence of limitation/pain in upper limbs (shoulder, elbow, wrist or hand) was independently associated with an increased risk of
having a worse self-reported performance. Damage to vessels and nerves, protein glycosylation, and increased collagen in the skin and musculoskeletal connective tissues are some factors that possibly may contribute to the development of musculoskeletal disorders in diabetic patients.[43] This is a relevant finding, as disorders of upper extremity leading to pain, discomfort, and limited motion have generally been under-recognized and poorly treated, compared to the other complications of diabetes. They may lead to considerable disability and poor quality of life in diabetic patients, as demonstrated in our study, which were evaluated by the patients’ self-reported performance.

This study has some limitations that warrant discussion. First, it is a cross-sectional design study and thus we cannot draw conclusions regarding causality between disabilities and their correlated factors. However, some associations demonstrated here are probably bidirectional, as those regarding physical activity and emotional disturbances, whereas other associations may be causally related to increased disability, such as pain and presence of peripheral neuropathy. Second, there was a possibility of a type 1 error because of the several bivariate comparisons presented in Table 2. However, this did not influence the results of the most important multivariate analysis. Third, although the COPM has been used by occupational therapists not only to identify the difficulties perceived by the client, but also as an outcome measure, allowing the determination of whether these difficulties have changed over time, we did not have longitudinal data on duration and course of disabilities. Fourth, we did not evaluate the reproducibility of the COPM in patients with diabetes. Nevertheless, in other conditions, it has been reported as poor for the individually-identified problems, but moderate to high for the averaged scores of all identified disabilities.[30,44] Hence, we used the averaged score to classify patients into better or worse performance subgroups. Finally, our cohort is composed by predominantly elderly female individuals with long-standing type 2 diabetes and high prevalence of chronic complications; hence, our results may not be generalised to younger individuals with recent-onset diabetes.

Otherwise, this study has implications for rehabilitation because the data presented can be used as a guide to the actual difficulties of the patients, allowing to mount more targeted treatment strategies to the demands and needs of the individuals, which may improve treatment compliance. In practical terms, there is a need for client-focussed approaches that address the various areas of performance in order to enable greater independence, autonomy, social participation and quality of life. Future interventional studies are necessary to evaluate the functional outcome of patients with type 2 diabetes.

Conclusion

This study demonstrated that patients with type 2 diabetes self-reported several disabilities by using the COPM tool, with the highest prevalence in the areas of mobility, self-care and domestic life, according to the ICF classification; and that pain, emotional disturbances, lack of regular physical activity and presence of diabetic peripheral neuropathy were their most important independent correlates. These data can be used as a guide to the actual difficulties of the patients with type 2 diabetes, allowing to planning more targeted treatment strategies to the demands and individual needs.

Declaration of interest

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The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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