

Association between self-care and chronic kidney disease in patients with type 2 diabetes mellitus

Dear Editor,

Chronic kidney disease (CKD) is one of the key complications occurring in 25–40% of patients with type 2 diabetes mellitus (T2DM).¹ Our earlier study also showed that CKD was present in 53% of patients with T2DM recruited from a secondary care diabetes centre and primary care polyclinic in Singapore.² T2DM management comprises not only medical care, but also “self-care”, which is crucial in preventing end-organ complications.³

The Summary of Diabetes Self-Care Activities (SDSCA) questionnaire⁴ is a reliable and valid measure of diabetes mellitus (DM) self-care adherence in observational and interventional studies. These studies have addressed issues related to psychological well-being and quality of life, but not diabetic nephropathy.⁵ Current scant literature⁶ suggests that self-care potentially reduces the risks of developing diabetic nephropathy. We examine the association between self-care and CKD in T2DM patients, and aim to establish if glycaemic control mediates the possible association between self-care and CKD.

This was a cross-sectional study of 631 patients with T2DM (age 57.0 ± 11.5 years, 54.7% male, 45.2% Chinese, 33.3% Malay and 20.0% Indian) recruited from November 2017 to December 2020 from the Diabetic Kidney Disease – Onset and Progression Risk Factors (DORIS) cohort in Singapore.⁷ Patients self-administered SDSCA to quantify the following self-care activities performed over 7 days: general diet, specific diet, exercise, self-monitoring of blood glucose (SMBG), and foot care. CKD, with a prevalence of 62.3% in the cohort, was defined as estimated glomerular filtration rate (eGFR) $<60 \text{ mL/min/1.73 m}^2$ and/or urinary albumin-to-creatinine ratio (uACR) $\geq 30 \text{ mg/g}$ from blood and urine samples collected according to Kidney Disease: Improving Global Outcomes (KDIGO) Clinical Practice Guidelines for the Evaluation and Management of Chronic Kidney Disease guidelines.⁸ Group differences between non-CKD and CKD were examined by Student's t-test, Wilcoxon rank sum test for continuous variables, and chi-square test for categorical variables. Logistic

regression models examined the association between self-care measures and CKD in T2DM patients. Mediation analysis based on Baron and Kenny's framework⁹ was performed to examine the role of haemoglobin A1c (HbA1c) as a possible mediator for the association between SDSCA score for SMBG and the presence of CKD. Results with $P < 0.05$ were considered statistically significant.

The distribution of ethnicity of patients in this study was: Chinese 45.2%, Malay 33.3% and Indian 20.0%. Patients with CKD were older in age and belonged to a lower educational background ($P < 0.001$). They had a longer DM duration, alongside a more deleterious metabolic profile: higher body mass index, higher systolic blood pressure, higher HbA1c, higher triglycerides, lower eGFR and higher uACR ($P < 0.001$). They were on more medications, whether oral and insulin, insulin only, or a renin-angiotensin system antagonist ($P < 0.001$).

Mean scores ($\pm$ standard deviation) (higher scores more favourable) for self-care were: general diet 3.9 ± 2.1 ; specific diet 4.8 ± 1.5 ; exercise 2.8 ± 2.0 ; SMBG 2.0 ± 2.1 ; and foot care 3.7 ± 2.8 . SMBG had the lowest score. This trend was similar for both non-CKD and CKD patients, with no significant difference in scores for SMBG between both groups of patients. Higher SMBG scores, suggestive of better self-care, were inversely associated with reduced odds of CKD (odds ratio [OR] after adjusting for demographics 0.91, 95% confidence interval [CI] 0.84–0.99; $P = 0.024$) and also after adjusting for demographics, metabolic profile and medications (OR 0.90, 95% CI 0.82–0.99; $P = 0.035$). The other self-care measures were not significantly associated with CKD (Table 1).

SDSCA scores for SMBG were positively correlated with age and eGFR, and negatively correlated with triglycerides ($P < 0.05$). In terms of DM medications, SDSCA scores for SMBG were higher in patients on insulin only (3.4 ± 1.8) compared to those on oral medication(s) only (1.8 ± 2.1), and combined oral medication(s) and insulin (2.3 ± 2.1) ($P = 0.002$). There was no association between SDSCA scores for SMBG and ethnicity ($P = 0.064$), education level ($P = 0.179$) and housing type ($P = 0.821$).

Table 1. Association between Summary of Diabetes Self-Care Activities (SDSCA) scores and chronic kidney disease

SDSCA score	Odds ratio (95% confidence interval), <i>P</i> value		
	Unadjusted	Model 1	Model 2
General diet	0.98 (0.91–1.06), 0.649	0.97 (0.89–1.06), 0.515	1.05 (0.95–1.16), 0.382
Specific diet	1.09 (0.97–1.21), 0.144	0.98 (0.87–1.12), 0.808	0.98 (0.84–1.14), 0.798
Exercise	0.94 (0.87–1.02), 0.119	0.95 (0.87–1.03), 0.223	0.99 (0.89–1.10), 0.833
Blood glucose testing	0.94 (0.87–1.01), 0.089	0.91 (0.84–0.99), 0.024	0.90 (0.82–0.99), 0.035
Foot care	1.07 (1.01–1.13), 0.029	1.00 (0.94–1.07), 0.919	0.95 (0.87–1.03), 0.244

Model 1 adjusted for age, sex and ethnicity

Model 2 adjusted for age, sex, ethnicity, housing type, education, diabetes duration, systolic blood pressure, haemoglobin A1c, type of diabetes medications and use of renin-angiotensin antagonist

In the mediation analysis, a higher SDSCA score for SMBG was negatively associated with HbA1c when adjusted for age, sex and ethnicity, with a coefficient of -0.13 ($P=0.006$). HbA1c was positively associated with CKD, with a coefficient of 0.26 ($P<0.001$). Higher SDSCA score for SMBG was negatively associated with CKD, with a coefficient of -0.12 ($P=0.012$). The association between the SDSCA score for SMBG and CKD was attenuated upon adjusting for HbA1c with a coefficient of -0.11 ($P=0.035$). Putting the various pathways together, HbA1c mediated 24.9% of the overall association between SMBG and CKD ($P=0.017$). Therefore, more frequent SMBG could result in a reduced HbA1c, of which higher HbA1c scores are inimical to CKD.

SMBG was the only aspect of self-care independently associated with lower odds of CKD. We postulate that SMBG is a more objective measure of self-care quantified by the SDSCA scale. Patients implicitly receive actionable feedback on the effects of their lifestyle measures with SMBG, which can motivate them to keep up or improve their self-care.

Nevertheless, while SMBG was independently associated with lower odds of CKD, the SDSCA score for SMBG was the lowest among patients, similar to other studies performed.¹⁰ The association between SMBG and CKD could be explained by the mediation analysis, where HbA1c acted as a mediator. Moreover, SDSCA scores for SMBG were positively correlated with eGFR ($P<0.05$). Some possible explanations for the poor performance of SMBG include the cost of test strips, pain due to finger pricking, and the low priority of SMBG compared to other self-care practices.¹⁰

To our knowledge, this is the first study in Singapore that evaluates the relationship between self-care and

CKD in T2DM patients. However, we note that the ethnic distribution in our sample population is not entirely reflective of the Singapore population. The small CKD group size is a limitation. Other residual confounding factors may be significant, such as the nature of the person doing SMBG, in addition to SMBG itself.

In conclusion, while SMBG was independently associated with lower odds of CKD, it was the most under-performed among patients. Heightened awareness and efforts in SMBG may play a role in reducing CKD in T2DM. Moreover, other self-care aspects such as diet, exercise and foot care were not correlated with CKD progression. This suggests that lifestyle modification alone may not suffice; a holistic approach including testing, medication and compliance is essential in improving chronic disease management outcomes.

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