Stigma evaluation for diabetes and other chronic non-communicable disease patients: Development, validation and clinical use of stigma scale – The Kanden Institute Stigma Scale

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INTRODUCTION
Diabetes mellitus is a chronic, progressive disease and is an increasing global health issue1. Lifestyle modification, such as healthy eating and vigorous physical activity, is recommended as basic treatment for diabetes2. Although doctors and health care professionals (HCPs) provide patients with diabetes education, care and support, the social and emotional burden of diabetes self-management still remains a concern3–5. Particularly,
self-stigma associated with having the disease is reported to result in both poor self-esteem and self-management in patients with diabetes 4–8.

Stigma emerges when elements of labeling, stereotyping, separation, status loss, and discrimination concur and disturb the power balance of the individual and society 9. Disease-related stigma is proposed a framework according to its source and personal manifestations of the patients. Sources of stigma consists of social (e.g., media, HCPs, family, public) and internal (i.e., self-stigma) factors. As a personal stigma manifestation, two types of stigma are defined: (i) enacted stigma, also called experienced stigma, which is an actual experience of stigmatizing acts, attitudes and behavior from others because of having the stigmatized condition; and (ii) perceived stigma, which is characterized by feelings of shame and blame for having the disease and the fear of encountering enacted stigma because of the diseased status 10,11. Social stigma is the disapproval of an individual or group based on social characteristics that distinguish them from others. Stigma can also be against oneself, damaging one’s sense of identity. Disease self-stigma is such an attribute in a person owing to their having a disease that is perceived to negatively distinguish them from culturally defined norms 8. To highlight that HCPs could be a source of stigma and to distinguish it from the other components of disease-related social stigma, we propose a novel framework of stigma associated with HCPs as “discordant stigma”, which derives from actual experience of stigmatizing acts, attitudes and behavior from HCPs. Discordant stigma can emerge if there is a discrepancy between an ideal self-care behavior that HCPs expect of their patients and actual self-care behavior of the patients. Discordant stigma might be generated by HCPs who lack proper knowledge of the disease and, therefore, have prejudice and discrimination toward individuals with the disease. However, we should be aware that discordant stigma might also be unintentionally generated by those who are the experts of treatment and care of the disease.

Diabetes stigma, a disease-related stigma that is suffered by patients with diabetes because of having diabetes, can begin when an individual is diagnosed with the disease. In Japan, as well as in other countries, patients with diabetes might hesitate to disclose their diabetes to their employers because of perceived disadvantages to follow 12,13. Furthermore, some patients feel that they might be regarded as incompetent, lazy, an over-eater or having other character flaws that are responsible for their disease condition, as diabetes is casually known as a lifestyle-related disease 14–16.

Because stigma has a pronounced social and cultural aspect, there might be distinctive factors in diabetes stigma formation in Japan 16,17. There are several possible reasons why diabetes is associated with negative social attitudes. Until recently, there were limited treatment options for diabetes, only long-term hospitalization, strict diet restriction, insulin injections and just a few mitigating oral antidiabetic drugs. As a consequence of the insufficient clinical management of glycemia, diabetic complications inevitably occurred, and an image of the disease as ever-increasing suffering became fixed.

In fact, the perceived complications of the disease are well known to contribute to the development of self-stigma in patients with diabetes. However, the feared complications, such as cancer, dementia and periodontitis, are not specific to diabetes, but are comorbidities that are likely to occur in patients with poorly managed disease 18–20. Diabetes stigma is therefore associated with outmoded negative stereotypes, misunderstanding, and prejudice from society, media and even from doctors and HCPs 21 who fail to recognize the far better prognosis for diabetes with optimally managed, professional care. There is no reason for patients with diabetes today to feel ashamed, blamed or to lose their self-esteem and self-efficacy, which can only result in poorer glycemic management and long-term quality of life 14,22.

In contrast, patients with lifestyle-related chronic non-communicable disease (LCNCD) other than diabetes, such as hypertension, dyslipidemia and hyperuricemia, are rarely reported to elicit patient self-stigma. Although it has remained unclear whether patients with diabetes are more likely to suffer self-stigma than patients with other LCNCDs, there is no tool to evaluate stigma in patients with LCNCDs generally. There is therefore an urgent need to develop a rigorous method to evaluate patient stigma that might differentiate its occurrence in patients with LCNCDs other than diabetes from those with diabetes. The aims of the present study were as follows: (i) to develop a scale for evaluating stigma in patients with various LCNCDs, which we named the Kanden Institute Stigma Scale (KISS); (ii) to compare the stigma score obtained by the KISS of patients with diabetes and patients with LCNCDs other than diabetes; and (iii) to explore the factors associated with stigma among patients with diabetes.

MATERIALS AND METHODS

Development of KISS

To develop a novel stigma scale applicable to patients with diabetes and also to patients without diabetes with other lifestyle-related chronic illness, we collected previously published stigma scales 23–25. We also held interviews with various patients with diabetes regarding their experiences with stigma and their expectations, and we applied our findings to development of the questionnaire. An initial 90 questions were drafted and categorized into six subscales: (i) social-enacted; (ii) discordant-enacted; (iii) self-enacted; (iv) social-perceived; (v) discordant-perceived; and (vi) self-perceived. Each question was answered with a 4-point Likert scale (0 = strongly disagree, 1 = slightly disagree, 2 = slightly agree and 3 = strongly agree). An advisory meeting attended by researchers and clinical experts in diabetes was held to assess the clarity and comprehensiveness of each question. A preliminary study was then carried out to extract questions suitable for the concept of the KISS. A total of 104 participants (80 patients with diabetes and 24 patients without diabetes) answered the initial 90 questions. An
An exploratory factor analysis was then carried out to validate the KISS as a 24-item questionnaire comprised of four items for each subscale. After being reviewed by all authors and one clinical psychologist, the final version of the KISS was completed, as shown in Figure 1 (Cronbach’s alpha coefficient = 0.926, Kaiser–Meyer–Olkin measure of sampling adequacy = 0.849).

### Study participants

A cross-sectional, multicenter study was carried out in Kansai Electric Power Hospital, Aizenbashi Hospital and Imazato Heart Clinic between February and March, 2020. The study was approved by the Ethical Committee of Kansai Electric Power Medical Research Institute, and carried out in accordance with the Declaration of Helsinki and the Ethical Guidelines for Medical and Health Research Involving Human Subjects established by the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Health, Labor and Welfare of Japan. Eligible participants were patients with diabetes including type 1, type 2, gestational diabetes (GDM) and other types of diabetes; patients without diabetes, but having lifestyle-related chronic illness, such as hypertension, dyslipidemia and hyperuricemia, aged 20–90 years, and capable of answering the self-reported interview sheet used in the present study. Patients were excluded if they were: (i) susceptible to cognitive impairment and/or psychological and/or psychiatric disorders; and (ii) considered to be ineligible for this study by physicians-in-charge. Anthropometric measures, laboratory data and medication information were collected.

### Validity and reliability analysis

The participants were asked to enter their responses to the KISS questionnaire. They also responded to the Patient Health Questionnaire-9 (PHQ-9), which is a commonly-used instrument for screening, diagnosing, monitoring and measuring the severity of depression, and the Short Form 8 (SF-8) health survey, which is to assess health-related quality of life for a chronic disease, to enable us to assess the construct validity of the KISS. To assess internal consistency of the KISS, Cronbach’s alpha coefficient was calculated. To assess reproducibility, test-retest analysis was carried out. A total of 60 patients were enrolled to respond to a second KISS questionnaire, which was returned by mail 2 weeks after their first response.

### Statistical analysis

Continuous variables with normal distribution were expressed as the mean ± standard deviation, and those with non-normal

|                | Social stigma | Discordant stigma | Self stigma |
|----------------|---------------|-------------------|-------------|
| **Enacted stigma** | 1. I am treated like seriously ill. | 5. I have been blamed by health care professionals because of suboptimal results of the treatment. | 9. I am not a good person because I have this illness. |
|                | 2. Some people believe I am inferior to others who don’t have this illness. | 6. I cannot expect I achieve an optimal treatment. | 10. I feel like I am a failure because I have this illness. |
|                | 3. I am rejected by friends, partners or colleagues. | 7. I feel health care professionals in doubt about my effort for the treatment of this illness. | 11. I feel guilty because I have this illness. |
|                | 4. Some people believe I am not as competent of working as others. | 8. I don’t feel I have enough support for treatment of this illness. | 12. I am not qualified to compete with others because I have this illness. |

| **Perceived stigma** | 13. I don’t tell my friends, colleagues or bosses about this illness. | 17. I behave myself not to be disliked by health care professionals. | 21. I avoid communications with others because of this illness. |
|                | 14. I try to hide this illness from others. | 18. I give up expecting my future. | 22. I keep distance from others because of this illness. |
|                | 15. I try not to take medicine or injection in front of friends, colleagues or family. | 19. I don’t talk to anyone about my worries about this illness. | 23. I give up what I want to do because of this illness. |
|                | 16. I don’t want my friends or colleagues to find me when I go to the hospital for this illness. | 20. I don’t want to get anyone’s help about this illness. | 24. I dare not to make new friends because of this illness. |

**Figure 1** | Final version of the Kanden Institute Stigma Scale. The Kanden Institute Stigma Scale comprises six subscales of stigma: (i) social-enacted (SoE); (ii) discordant-enacted (DE); (iii) self-enacted (SeE); (iv) social-perceived (SoP); (v) discordant-perceived (DP); and (vi) self-perceived (SeP). Each item was answered with 4-point Likert scale (0 = strongly disagree, 1 = slightly disagree, 2 = slightly agree and 3 = strongly agree). Participants are asked to respond to the items on the questionnaire with regard to the illness mentioned (e.g., type 2 diabetes, hypertension).
distribution as median (interquartile range) unless otherwise stated. The Mann–Whitney U-test and Kruskal–Wallis test with Bonferroni’s post-hoc analysis were carried out to compare non-parametric data. For categorical variables, the χ²-test was carried out. Confirmatory factor analysis was carried out to confirm the model’s fitness by the maximum likelihood method, assessed by goodness of fit index, adjusted goodness of fit index, comparative fit index and root mean square error of approximation. Pearson’s correlation was explored to assess construct validity. Intraclass correlation coefficient was calculated to assess test–retest reproducibility. Multiple regression analysis was carried out to explore continuous data. All statistical analyses were carried out using SPSS version 26.0 and AMOS version 26 (SPSS Inc., Chicago, IL, USA). Statistical significance was set at \( P < 0.05 \).

RESULTS

Study participants

A total of 539 patients including 452 patients with diabetes (men/women: 304/148) and 87 patients without diabetes (men/women: 56/31) were recruited (Table 1). Patients with diabetes comprised type 1/type 2/GDM/other types of diabetes: 58/369/13/12; patients without diabetes comprised 13/171/0/42. The mean age was 62.2 ± 14.4 years for patients with diabetes, and 61.0 ± 10.1 years for patients without diabetes; duration of the disease was 14.8 ± 10.7 years for patients with diabetes and 10.1 ± 8.5 years for patients without diabetes. For patients with diabetes, the mean glycated hemoglobin was 8.0 ± 3.7%, and 171 insulin users were included. For patients with diabetes, PHQ-9 score was significantly higher than that for patients without diabetes (3.9 ± 4.0 vs. 2.4 ± 2.6, \( P < 0.001 \)), and the mental component summary derived from SF-8 was significantly lower in patients with diabetes than that in patients without diabetes (50.3 ± 6.3 vs. 51.7 ± 5.0, \( P = 0.048 \)), whereas physical component summary was comparable between the two groups.

Table 1 | Clinical characteristics of the study participants

|          | DM           | NonDM        | \( P \) |
|----------|--------------|--------------|--------|
| \( n \)  | (men/women)  | (men/women)  |        |
| 452 (304/148) | 87 (56/31)  | 0.620        |
| Age (years) | 62.2 ± 14.4  | 61.0 ± 10.1  | 0.479  |
| Type of disease | Type 1/type 2/GDM/other | Hypertension/dyslipidemia/hyperuricemia: 17/60/10 |        |
| Duration (years) | 14.8 ± 10.7  | 10.1 ± 8.5  | <0.001 |
| Systolic blood pressure (mmHg) | 132 ± 17 | 130 ± 15 | 0.438 |
| Diastolic blood pressure (mmHg) | 77 ± 12 | 83 ± 12 | <0.001 |
| BMI (kg/m²) | 25.1 ± 4.2 | 24.6 ± 3.0 | 0.287 |
| HbA1c (%) | 8.0 ± 3.7 | 60.0 ± 5.0 | <0.001 |
| Total cholesterol (mg/dL) | 190 ± 38 | 205 ± 32 | <0.001 |
| HDL cholesterol (mg/dL) | 65 ± 20 | 67 ± 18 | 0.372 |
| LDL cholesterol (mg/dL) | 101 ± 31 | 108 ± 28 | 0.037 |
| Triglyceride (mg/dL) | 142 ± 114 | 174 ± 201 | 0.042 |
| Uric acid (mg/dL) | 53 ± 16 | 56.0 ± 13 | 0.430 |
| Diabetes medication | 106/133/175/88/9/8/105 | – |        |
| (SU/MET/DPP4i/SGLT2/Glinide/αGI/PIO/No Med) | | |        |
| Injection treatment for diabetes | 171/42/20 | – |        |
| (insulin/liraglutide/duraglutide) | | |        |
| Antihypertensive agents (%) | 44.6 | 31.0 | 0.022 |
| Lipid-lowering agents (%) | 50.7 | 69.8 | 0.001 |
| Antihyperuricemic agents (%) | 8.5 | 21.4 | 0.001 |
| PHQ-9 | 3.9 ± 4.0 | 2.4 ± 2.6 | 0.001 |
| PCS | 490 ± 66 | 496 ± 65 | 0.386 |
| MCS | 503 ± 63 | 517 ± 50 | 0.048 |

Data are presented as the mean ± standard deviation. BMI, body mass index; DM, diabetes mellitus; DPP4i, dipeptidyl peptidase-4 inhibitor; GDM, gestational diabetes mellitus; HbA1c, glycated hemoglobin; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MCS, mental component summary; MET, metformin; No Med, no medication; PCS, physical component summary; PHQ-9, Patient Health Questionnaire; PIO, pioglitazone; SGLT2, sodium–glucose cotransporter 2 inhibitor; SU, sulfonylurea; αGI, alpha-glucosidase inhibitor.
0.327, *P* < 0.05, respectively). These results confirm that the KISS has an acceptable construct validity.

**Confirmatory factor analysis**

Confirmatory factor analysis is shown in Figure 2. All of the path loadings are statistically significant. This model also showed that each subscale had a significantly mild-to-moderate correlation with all of the others. In this model, goodness of fit index = 0.886, adjusted goodness of fit index = 0.856, comparative fit index = 0.917 and root mean square error of approximation = 0.067. These results indicate that the KISS has an acceptably good fit.

**Internal consistency**

Cronbach’s alpha coefficient was calculated to assess internal consistency of the KISS. The coefficient of the KISS score was 0.910 with each subscale: (i) social-enacted, 0.775; (ii) discordant-enacted, 0.712; (iii) self-enacted, 0.861; (iv) social-perceived, 0.891; (v) discordant-perceived, 0.729; and (vi) self-perceived, 0.869, which shows excellent internal consistency.

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**Figure 2** | Result of confirmatory factor analysis of the Kanden Institute Stigma Scale. Standardized estimates are shown on the one-way arrows. Correlation coefficients are shown on the two-way arrows. AGFI, adjusted goodness-of-fit index; CFI, comparative fit index; DE, discordant-enacted; DP, discordant-perceived; GFI, goodness-of-fit index; RESEA, root mean square error of approximation; SeE, self-enacted; SeP, self-perceived; SoE, social-enacted; SoP, social-perceived.
Test–retest reliability
Of 60 patients, 42 patients (70%, men/women: 28/14, mean age 60.0 ± 15.0 years) sent back the second KISS, which was used for calculation of test–retest reliability. A wide distribution of the present illness was confirmed (type 1/type 2/GDM/hypertension/dyslipidemia: 5/25/2/7/3) and the mean PHQ-9 score was 3.4 ± 3.0. These results likely represent the study participants generally. Intraclass correlation coefficient of the first and the second KISS score was 0.843 (95% confidence interval 0.728–0.912, P < 0.001), showing excellent reproducibility of KISS.

Comparison of the KISS score between patients with diabetes and patients without diabetes
We confirmed that the KISS has good validity and reproducibility as a measure of stigma both in patients with diabetes and patients without diabetes. Patients with diabetes showed higher scores of the KISS than patients without diabetes in total and in each subscale (patients with diabetes vs patients without diabetes: 12.23 ± 0.49 vs 5.76 ± 0.73, total score; 1.46 ± 0.09 vs 0.52 ± 0.12, social-enacted; 2.58 ± 0.10 vs 1.56 vs 0.21, discordant-enacted; 2.32 ± 0.12 vs 1.29 ± 0.21, self-enacted; 2.26 ± 0.14 vs 0.90 ± 0.18, social-perceived; 2.37 ± 0.11 vs 1.11 ± 0.15, discordant-perceived; 1.25 ± 0.09 vs 0.33 ± 0.10, self-perceived, data are shown as the mean ± standard error of the mean; Figure 3).

Comparison of the KISS score among patients with type 1, type 2 with insulin and type 2 without insulin
We explored whether insulin use was associated with stigma among patients with diabetes. The KISS in patients with type 1 diabetes, for whom insulin treatment is essential, type 2 diabetes with insulin treatment (T2DIns[+]) and type 2 diabetes without insulin treatment (T2DIns[−]) were compared. Total KISS scores were significantly higher in type 1 diabetes and T2DIns[+] than in T2DIns[−] (16.63 ± 1.63 vs 14.00 ± 1.06 vs 10.93 ± 0.56, respectively, P < 0.05; Figure 4).

Comparison of the KISS score among patients without diabetes and patients with diabetes classified by duration
We carried out subgroup analysis to compare the KISS total score among patients with diabetes group classified by duration and also the patients without diabetes group, who could be regarded as undiagnosed or 0 duration of diabetes. We found that the KISS scores in patients with diabetes group with duration of ≤5, 6–10, 11–15, 16–20 and ≥21 years were significantly higher than that in the patients without diabetes group (11.56 ± 1.10, 12.58 ± 1.08, 11.38 ± 1.11, 14.93 ± 1.68, 13.38 ± 1.01 and 5.47 ± 0.76, respectively, P < 0.01; Figure S1).

Factors associated with stigma
To explore the factors associated with stigma in patients with diabetes and patients without diabetes, multiple regression analysis was carried out (Table 2). In patients with diabetes, the KISS score was significantly associated with age (B = −0.175, 95% CI −0.247, −0.103, P < 0.001), male sex (B = −1.944, 95% CI −3.884, −0.004, P < 0.001), duration (B = 0.122, 95% CI 0.029–0.216, P = 0.010), glycated hemoglobin (B = 0.223, 95% CI 0.005–0.422, P = 0.045), PHQ-9 (B = 0.930, 95% CI 0.640–1.220, P < 0.001), mental component summary (B = −0.224, 95% CI −0.403, −0.045, P = 0.014) and insulin use (B = 2.739, 95% CI 0.903–4.575, P = 0.004), whereas in patients without diabetes, the KISS score was significantly associated only with PHQ-9 (B = 1.154, 95% CI 0.396–1.912, P = 0.004).

DISCUSSION
In the present study, we report the development of the KISS, used to evaluate the nature of stigma, as perceived by patients with LCNCD in six novel subgroups. The present study confirms KISS as a questionnaire having good construct validity, good internal consistency and good reliability. The KISS is also shown to be a good fit model by confirmatory factor analysis.

Figure 3 | Comparison of the Kanden Institute Stigma Scale between patients with diabetes (DM) and patients without diabetes (nonDM). Data are shown as the mean ± standard error. DE, discordant-enacted; DP, discordant-perceived; SE, self-enacted; SP, self-perceived; SoE, social-enacted; SoP, social-perceived. *P < 0.05.

Figure 4 | Comparison of the Kanden Institute Stigma Scale score in patients with type 1 diabetes, type 2 diabetes with insulin treatment (T2DIns[+]) and type 2 diabetes without insulin treatment (T2DIns[−]). Data are shown as mean ± standard error. DE, discordant-enacted; DP, discordant-perceived; SE, self-enacted; SP, self-perceived; SoE, social-enacted; SoP, social-perceived; T2D(Ins−), patients with type 2 diabetes without insulin injection therapy; T2D(Ins+), patients with type 2 diabetes with insulin injection therapy. *P < 0.01 T1D vs T2D(Ins−), **P < 0.05 T1D vs T2D(Ins+), ***P < 0.05 T2D(Ins+) vs T2D(Ins−).
The KISS has six subgroups that aid in the assessment of various manifestations and sources of stigma, and includes a novel factor, discordant stigma. Diabetes stigma has long been noted clinically by doctors and HCPs. However, doctors and HCPs engaged in diabetes care have not always been fully aware that they could inadvertently promote self-stigma in their patients. Regarding advocacy for diabetes stigma, promoting awareness and education for clinical specialists is a primary target. This study establishes that patients with diabetes have a higher KISS score in enacted and perceived discordant stigma than patients without diabetes. This finding should encourage diabetes advocates to take the initiative to avoid development of self-stigma in diabetes care.

The primary aim of the present study was to develop an original stigma scale to elucidate the fact that individuals with diabetes are more likely to suffer from social stigma and self-stigma than those without diabetes, and to establish an independent form of stigma that is associated with HCPs as discordant stigma. To achieve these goals, we carefully arranged to develop the new scale to assess stigma status among individuals with diabetes and without diabetes equally. The Self-Stigma Scale (SSS) is one of the existing scales that can be used to evaluate stigma, which is developed for individuals with diabetes with excellent validity and credibility. However, SSS was initially developed to assess stigma for concealed minorities in Hong Kong, and utilized for individuals with diabetes, mental health consumers, immigrants and sexual minorities, but no reports were found for those with hypertension, dyslipidemia or hyperuricemia. Furthermore, self-stigma emerges from the internalization of social stigma, which is influenced by the culture to which they belong. Therefore, we decided to generate a new stigma scale KISS for Japanese individuals with chronic non-communicable diseases, including diabetes. Actually, we found KISS has as good model fitness as SSS-J, the Japanese version of SSS (goodness of fit index: 0.886 for KISS; 0.78 for SSS-J) and good convergent validity with PHQ-9 (r = 0.515, P < 0.01 for KISS in patients with diabetes and r = 0.409, P < 0.01 for KISS in patients without diabetes, r = 0.39, P < 0.01 for SSS-J), which proves that KISS has excellent validity and credibility as a stigma scale for chronic non-communicable diseases.

Using KISS, we showed that patients with diabetes have more disease stigma than patients without diabetes. To our knowledge, this is the first study to establish that patients with diabetes suffer more disease stigma compared with other non-communicable chronic illness patients, such as those with hypertension, dyslipidemia or hyperuricemia. The results of this study highlight the present state of diabetes stigma in Japan, which should impact social policies, diabetes communities and clinical settings. Diabetes stigma is gaining attention in Japan: the Japan Association of Diabetes Education and Care and the Japan Diabetes Society established a Joint Committee for such advocacy in 2019. The results of the present study will empower the Joint Committee to facilitate advocacy of diabetes stigma in patients with diabetes, the community and national policies. A periodic nationwide survey using the KISS would be useful to assess the impact of advocacy on stigma in patients with diabetes.

The present study also showed that type 1 diabetes mellitus patients and type 2 diabetes mellitus patients with insulin therapy suffer more from feelings associated with stigma than type 2 diabetes mellitus patients without insulin therapy. Indeed, it has been reported that insulin therapy is associated with negative feelings, poor treatment satisfaction and poor

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Table 2 | Associations of factors with the Kanden Institute Stigma Scale

|                      | DM                  | NonDM               |                      |                      |
|----------------------|---------------------|---------------------|---------------------|---------------------|
|                      | Simple regression   | Multiple regression | Simple regression   | Multiple regression |
|                      | analysis            | analysis            | analysis            | analysis            |
|                      | r       | P     | B (95% CI) | β    | P     | B (95% CI) | β    | P     |
| Age (years)          | −0.274            | <0.001             | −0.175 (−0.247, −0.103) | −0.232             | <0.001             | −0.186 | 0.100 |
| Sex (males)          | −0.181            | <0.001             | −1.944 (−3.884, −0.004) | −0.086             | <0.001             | 0.140  | 0.169 |
| Duration (years)     | 0.061             | 0.126              | 0.122 (0.029, 0.216)  | 0.125              | 0.010              | 0.015  | 0.459 |
| BMI (kg/m²)          | 0.044             | 0.204              |                     |                     |                    | 0.044  | 0.381 |
| HbA1c (%)            | 0.111             | 0.018              | 0.223 (0.005, 0.422)  | 0.086              | 0.045              | −0.143 | 0.164 |
| PHQ-9                | 0.515             | <0.001             | 0.930 (0.640, 1.220)  | 0.362              | <0.001             | 0.409  | 0.002 |
| PCS                  | −0.192            | <0.001             |                     |                     |                    | −0.236 | 0.051 |
| MCS                  | −0.415            | <0.001             | −0.224 (−0.403, −0.045) | −0.140             | 0.014              | −0.327 | 0.011 |
| Insulin use          | 0.196             | <0.001             | 2.739 (0.903, 4.575)  | 0.129              | 0.004              | −     | −      |

Single and multiple regression analysis were performed to explore factors associated with KISS in DM and nonDM group. 95% CI, 95% confident interval; B, partial regression coefficient; BMI, body mass index; DM, diabetes mellitus; HbA1c, glyca­ted hemoglobin; KISS, Kanden Institute Stigma Scale; MCS, mental component summary; PCS, physical component summary; PHQ-9, Patient Health Questionnaire; r, correlation coefficient; β, standardized regression coefficient.
quality of life. Our results are in accordance with previous reports. It is of interest whether glucagon-like peptide-1 receptor agonist treatment is associated with stigma, as it also requires injection like insulin, but we could not explore it due to the small sample size of glucagon-like peptide-1 receptor agonist users. We also could not explore whether using self-monitoring of blood glucose (SMBG) was associated with a high KISS score, while SMBG is reportedly associated with large burden of patients with diabetes. In Japan, most patients with insulin injection and/or glucagon-like peptide-1 injection treatments use SMBG. Therefore, we could not distinguish whether diabetes stigma is affected by SMBG or by insulin injection.

Some reports showed that a higher body mass index was associated with higher stigma score in individuals with diabetes. In the present study, the KISS score was not associated with body mass index both in patients with diabetes and patients without diabetes. This might be due to the small number of obese patients that participated in this study (11.2% in patients with diabetes and 6.1% in patients without diabetes group were equal to or higher than body mass index 30 kg/m²).

Kato et al. reported that diabetes duration was associated with self-stigma assessed by SSS-J. We found the KISS score was not associated with diabetes duration in simple regression analysis, but significantly associated in multiple regression analysis. This might be because self-stigma develops gradually after receiving treatment and directly experiencing social stigma. However, we should recognize that some individuals with shorter duration of diabetes would also suffer from stigma. We found that KISS scores in patients with diabetes were significantly higher than in patients without diabetes, regardless of duration. This result might suggest that individuals with even a short duration of diabetes suffer from stigma. Social policy and medical care for mitigating diabetes stigma in individuals at the time of diagnosis should be promoted.

The present study had several limitations. First, this was a cross-sectional study, so any causal relationship between social stigma and self-stigma cannot be measured. Previous studies reported that social stigma is associated with patient self-stigma in type 2 diabetes mellitus. Although it is generally assumed that social stigma is related to patient stigma, a longitudinal study has not been reported. Therefore, a study including before and after an action to combat diabetes stigma is required. Second, this study was carried out mainly in a teaching hospital with leading diabetologists, although a branch hospital and a cardiology clinic without a full-time diabetologist participated. Study participants of this study were limited to a regional area in Japan. Therefore, the findings might not be generalized without further investigation. Third, KISS is designed to assess self-stigma in patients with LCNCDS, such as diabetes, hypertension, dyslipidemia and hyperuricemia, but the present participants included type 1 diabetes mellitus, GDM and other types of diabetes. Furthermore, patients with chronic neurological diseases and/or mental illness, who are reported to suffer from disease self-stigma, were not considered in this study; we developed the KISS to evaluate patients with diabetes for stigma, patients who might be more likely to suffer stigma than those having chronic diseases other than diabetes. Further study is necessary to apply the KISS to patients with various other non-communicable diseases or to those with communicable diseases. Fourth, we cannot assess whether the KISS score is associated with the presence of diabetic complications, which reportedly affects emotional burden and quality of life. Further study should be carried out to explore how diabetic complications affect the KISS score among patients with diabetes. Finally, as local and cultural aspects of negative stereotypes and discrimination might well impact diabetes stigma formation, KISS without modification might not be applicable in other countries.

In conclusion, we have developed the KISS, a validated and reliable questionnaire to assess stigma among patients with lifestyle-related chronic non-communicable diseases. In addition, our use of the KISS establishes that patients with diabetes suffer more stigma than patients with other non-communicable diseases. Our present use of the KISS also establishes that patients with diabetes with insulin therapy are more likely to suffer stigma than patients with diabetes without insulin therapy. The present study is a call to action for health care specialists to combat diabetes stigma, and to promote advocacy involving patients, doctors, HCPs and society.

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**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Figure S1** Comparison of Kanden Institute Stigma Scale among patients without diabetes and patients with diabetes classified by duration.