

ORIGINAL ARTICLE

Development of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes

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Funding information

Japan Society for the Promotion of
Science, Grant/Award Number: 15K11613

Abstract

Aim: The purpose of this study was to develop a scale to assess daily time management capabilities among working patients with diabetes and to test this scale's reliability and validity.

Methods: A self-administered questionnaire survey was conducted among 277 diabetes outpatients, and data from 220 participants (mean age = 54.3 ± 10.2 years, 76.8% male) were analyzed. Questionnaire items were selected through exploratory factor analysis. During the process of developing the questionnaire, opinions were solicited from experts on education for patients with diabetes, and Cronbach's α was calculated as a coefficient of reliability. Correlations with the Instrument of Diabetes Self-Care Agency (IDSCA) were examined and confirmatory factor analysis was performed to check for validity.

Results: Adequacy of a 4-factor, 16-item scale was confirmed. Cronbach's α coefficient was $\geq .7$ for the entire scale and for the subscale items. There was a significant correlation between total IDSCA scores and various factors ($r = .280-.469$). However, there was no correlation between the "adjustment of life rhythms" and parts of the IDSCA subscale.

Conclusion: Although some aspects warrant further investigation, the developed scale provides a reliable and valid means of assessing daily time management capabilities among working patients with diabetes, and can thus be applied to help diabetes patients to manage their daily lives.

KEYWORDS

diabetes mellitus, self-care, self-management, time management, work

1 | INTRODUCTION

The Global Report on Diabetes, published by the World Health Organization, predicts the number of people with diabetes worldwide will increase to more than 700 million by 2025 unless effective actions are taken (World Health Organization, 2016). Education for patients with

diabetes who are in late middle age or older is especially important, considering recent increases in this population. Difficulties in making lifestyle adjustments while working present obstacles for self-care (Tsutsumi, Yanagisawa, & Kondo, 2003), and this has been proposed as a major issue confronting patients in late middle age.

Regarding the relationship between work and glyce-mic control, work-related stress can influence the devel-opment of diabetes and the control of blood glucose levels (Cosgrove, Sargeant, Caleyachetty, & Griffin, 2012; Krajnak, 2014; Sato & Yamazaki, 2012). Various mea-sures to address this problem are currently being pro-moted, including assessment of workplace stress and counseling. Regarding factors other than stress, a lack of time for recuperative activities such as exercise, getting sufficient sleep, and taking insulin injections, is also a problem (Chernyak et al., 2017), and busy workers find it difficult to schedule enough time. We previously investi-gated the difficulties of working patients with diabetes in relation to maintaining a balance between work and self-care and their coping methods. A previous study found that problems related to adjusting the time scheduled for daily activities were associated with a sense of difficulty (Nakao, Shimizu, Nunoi, & Sato, 2017). For working patients with diabetes, efforts have been made to incorpo-rate exercise therapy into daily life as a creative way of promoting recuperative activities without taking up addi-tional time (Audrey et al., 2015; Procter, Mutrie, Davis, & Audrey, 2014), and exercise while commuting has been identified as one effective strategy. In addition, telephone or email education has been considered for those who do not have time to visit hospitals (Azuma, 2012).

As noted above, although some progress has been made in exploring creative ways of promoting recupera-tive activities without taking up too much time, patients also need to adjust their other daily work and life activi-ties, and approaches that incorporate recuperative activi-ties into free time are not likely to succeed because free time can easily be consumed by new daily activities. It is therefore necessary to investigate how patients manage their time in relation to performing daily activities, including recuperative activities, and to provide support that is focused on time management by the patients themselves. Better time management by diabetes patients can help to ensure that their food or medications are taken at appropriate times and that time is made for exer-cise, which in turn helps to control fluctuations in blood sugar levels. Furthermore, workers often cannot take time off for consultations, potentially resulting in treat-ment discontinuation. Despite the development of distance-treatment technologies, regular visits to medical institutions remain necessary, and effective time manage-ment may also allow patients to make time for regular medical visits.

Time management capability can be evaluated using a time management scale for patients with diabetes (Gafarian, Heiby, Blair, & Singer, 1999) or self-care assessment scales that include items evaluating time management as part of the measurement of “application

and adjustment” (Miyawaki et al., 2015). However, these tools cannot assess the time management ability of workers who have difficulty adjusting the time available for different activities. Assessing the ability of patients to adjust their time could prompt the discussion of appropri-ate support methods.

Workers utilize time management as a method of effi-ciently performing their duties. Effective time manage-ment requires the individual to decide what they really want to do and then match their daily activities to their values (Smith, 2009). If time management is to be utilized effectively by patients with diabetes, it is therefore neces-sary to evaluate their progress while taking into account whether they are actually living the lives they want (i.e., exhibiting appropriate behavior for their personal values). It is also necessary to bear in mind that time management does not only mean making time to manage their diabetes.

Based on these considerations, we developed a scale to assess the ability of working patients with diabetes to manage their time for daily activities, as a prelude to considering nursing care to help patients improve their time management capabilities. This scale assessed self-management in patients with type 2 diabetes, which has a stronger association with lifestyle habits than type 1 diabetes, by focusing on the patients’ manage-ment of daily living time. Self-care is often assessed by disease conditions, such as measurements of hemoglo-bin A_{1c} to evaluate blood sugar control or progression of complications. However, patients’ daily lives include many facets other than those related to diabetes, such as family, work, and self-realization. Long-term improvement of blood glucose levels requires adjusting daily life as a whole, and it is important for patients to have the power to make these adjustments. The devel-oped scale will allow the patient’s management abili-ties in relation to daily life and their disease conditions to be assessed, thus making it easier for them to find ways of coping with their diabetes in the long-term, even in the case of patients who have had difficulties with self-management using traditional educational methods for diet or exercise. The present study thus aimed to develop a scale that can be used to assess the daily time management of patients with type 2 diabetes in relation to daily living, to inform future nursing interventions.

2 | METHODS

2.1 | Research design

This was a cross-sectional study using a questionnaire.

2.2 | Terminology

2.2.1 | Daily time management

In this study, daily time management was defined as the capability of an individual to adjust their daily schedule in line with their personal values in terms of health, work, and life, and to lead their desired life.

2.3 | Draft scale preparation

The questionnaire items were devised based on the results of a previous survey conducted from November 2012 to March 2013 to examine the challenges and coping methods around balancing work and self-care (Nakao et al., 2017), and on articles and books on time management.

2.3.1 | Interview data on the challenges and coping methods around balancing work and self-care

The previous survey included 100 outpatients with type 2 diabetes (77 men and 23 women, mean age = 53.1 ± 9.6 years). It is predicted that there was some bias in the characteristics of the respondents because the subjects were patients who visited the outpatient clinic during the survey period and provided their consent, and were not randomly sampled. However, according to the nationwide survey conducted by the Japan Labour Health and Welfare Organization (2013) on working diabetes patients, 80% of the approximately 1300 patients were men with a mean age of 55.6 ± 10.2 years, which was similar to the mean age of subjects in the survey. We therefore considered that, although the data were not necessarily sufficient, they were representative of working diabetes patients. Although the previous survey adopted a mixed methods approach with interviews and questionnaires, the present study only used the results of interviews, in which the participants were asked verbally if they experienced difficulties in balancing work and self-care and how they coped. The investigators produced transcripts of the interviewees' answers to be used as raw data. The data analysis involved generating categories to compare similarities and differences in terms of difficulties in coordinating work and diabetes management. Coping methods that corresponded to each of the categories were then extracted. To formulate the questionnaire items for the present study, we used content found in the subcategories for difficulties readjusting living hours (one challenge of balancing work and self-care) and content

related to behaviors identified as methods of coping with difficulties in this readjustment.

2.3.2 | Literature related to time management

We reviewed the literature on time management by searching PubMed (the medical literature database produced by the United States National Library of Medicine) and the Japanese National Diet Library database using "diabetes" and "time management" as key search terms. One article (Gafarian et al., 1999) and five books (Anselm & Corbin, 1987; Covey, 2013; Drucker, 2006; Smith, 2009; Yukimoto, 2015) were selected and information on time management techniques was extracted from these sources and combined with the items in the above questionnaire. Elements of time management for daily activities were then extracted. The time management techniques identified in this way included "making time and timing of self-care", "controlling time" and "making a schedule". With regard to the ability to take action according to the individual's own values, we identified "setting goals and acting according to your values", "feeling satisfied with your work" and "maintaining interpersonal relationships".

We then re-read the references and wrote specific questions that corresponded to the extracted items, taking account of our own clinical experiences and the references. For example, "making time and timing of self-care" included < able to make time for medical appointments >, < able to make time for exercise >, and < able to take diabetes medication at approximately the same time everyday >. "Controlling time" included < able to adjust schedules in the event of unforeseen events > and < able to carry things on at one's own pace >. "Making a schedule" included < creating lists of things to be done in a day > and < setting an order of priority on things to be done each day >. Sixty-six questions were generated based on the references and researchers' experiences of the major questionnaire items that were extracted.

2.3.3 | Expert opinions

Two chronic disease nurses specializing in diabetes and one nurse certified in diabetes care were asked to confirm the questionnaire items. These experts evaluated the appropriateness of the items and checked for redundancies in meaning and content, bearing in mind the definition of daily time management. Eighteen items were eliminated by this process because they overlapped with other similar items or were unclear questions, resulting in a 48-item draft scale to assess daily time management

capabilities among working patients with diabetes. Responses were rated on a six-point Likert scale ranging from 0 (completely disagree) to 5 (strongly agree).

2.4 | Selection of questionnaire items and examination of reliability and validity

A questionnaire survey was administered among working outpatients with diabetes, using the prepared draft scale. The questionnaire was distributed to 277 outpatients receiving care at three general hospitals and three clinics in Japan. All participants were outpatients aged at least 20 years who had type 2 diabetes. Patients with severe complications (e.g., patients undergoing dialysis, lower extremity amputees) and those who had difficulty answering the questionnaire (e.g., because of poor vision, cerebral infarction) were excluded. The primary investigators or their research collaborators distributed the questionnaire to participants along with a document outlining the study and ethical considerations, from September 2017 to January 2018. Return of the questionnaire was presumed to indicate consent.

2.5 | Study content

2.5.1 | Basic attributes

Responses were recorded for sex, age, height, weight, diabetes type, presence or absence of complications, treatment regimen, hemoglobin A_{1C} level, employment status, and working hours.

2.5.2 | Scales

In addition to the 48-item draft scale to assess daily time management capabilities among working patients with diabetes, the short version of the Instrument for Diabetes Self-Care Agency (IDSCA) was also used to test for concurrent validity. The IDSCA measures self-care agency among patients with diabetes by asking respondents to rate their ability to harmonize self-management with their own life, motivation for self-management, monitoring ability, application or adjustment ability, ability to acquire knowledge, ability to make the most of the support available, stress-coping ability, and ability to recognize one's own physical condition, all using six-point Likert scales. Scores range 0–200, with higher results indicating better self-care agency. Although ability to recognize one's own physical condition was not included in the short version of this scale, we decided to include it in the present study because it was found to be an important element (Waki et al.,

2016). The Cronbach's α coefficient for the entire scale and subscale items were all $\geq .7$, and a covariance structure analysis was performed to check validity.

2.6 | Analysis

Patient characteristics were analyzed for response bias using descriptive statistics, and ceiling and floor effects were confirmed by removing items with a mean \pm standard deviation of ≥ 5.0 or ≤ 0 . A coefficient of $\geq .8$ was designated as the standard for the inter-item correlation analysis, and items showing similarity were removed.

Maximum likelihood exploratory factor analysis with promax rotation was used for exploratory factor analysis, and the number of factors was determined from a scree plot. Only items with factor loadings $\geq .4$ for each item were included in the questionnaire. However, items with factor loadings $< .4$ were also included if they were deemed to be indispensable to the survey.

Cronbach's α coefficients were calculated to test for reliability, and item-total correlation analysis was performed. Criterion-related validity was confirmed by scrutinizing the relationships between scores obtained using the scale and the results of the IDSCA by correlation analysis with Spearman's rank correlation coefficient. Confirmatory factor analysis was performed to check construct validity. All statistical analyses were performed with IBM SPSS Statistics Version 25, AMOS Version 25 (IBM Corp., Armonk, NY, USA), and the two-tailed level of significance was set at $P < .05$.

2.7 | Ethics considerations

Participants were provided with a document describing how the results of the present study would be disclosed and explaining that no personal harm or disadvantage would arise from non-participation and that careful steps would be taken to ensure personal information protection and proper data management. All participants provided informed consent. The research was approved by the participating hospital ethics review board (approval no. 16-0603).

3 | RESULTS

3.1 | Participants

Of the 277 outpatients with diabetes who received the questionnaire, 220 returned responses (return rate, 79.4%). The present analysis used data, including basic attributes, from these 220 responses without missing values to develop a

scale to assess daily time management capabilities among working patients with diabetes. The mean participant age was 54.3 ± 10.2 years, and 76.8% of the participants were men (Table 1). Regarding the sample size for factor

analysis, a minimum of 200 was required (Murakami, 2013) and the present survey (220) therefore met this requirement. The Kaiser-Meyer-Olkin test of sampling adequacy also indicated that .890 and performing a factor analysis would be meaningful.

TABLE 1 Participant characteristics (N = 220)

Item	Mean \pm SD/n (%)
Age, y	54.3 \pm 10.2
Sex	
Male	169(76.8)
Female	51(23.2)
BMI, kg/m ²	25.9 \pm 4.7
A _{1c} , %	7.2 \pm 1.2
Employment status	
Self-employed	26(11.8)
Employee	194 (88.1)
Mean hours of work per day	
<8 hours	90 (40.9)
8 to less than 10 hours	107 (48.6)
\geq 10 hours	23 (10.5)

Abbreviations: BMI, body mass index; SD, standard deviation.

3.2 | Response bias and correlation analyses

Ceiling and floor effects were identified for all items. Three items with a mean \pm standard deviation of ≥ 5.0 were removed because they showed a ceiling effect. In terms of inter-item correlations, $|r| > .8$ was found between “I feel that my work and performance are judged properly” and “I have been given roles and jobs that match with my abilities” ($r = .835$), and the latter item was therefore removed from the analysis.

3.3 | Exploratory factor analysis

We excluded four of the 48 items based on the results of bias and correlation analyses of the responses, and conducted an

TABLE 2 Factor analysis of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes (N = 220)

No. item	Factor				Communality
	1	2	3	4	
18. Work is going well	.830	.199	-.103	-.052	.828
21. I am satisfied with my job	.820	.040	.013	-.060	.696
25. Workplace relationships are going well	.808	-.173	.037	.061	.543
19. I feel my work and performance are being properly evaluated	.757	.084	.010	.087	.741
16. I can make time by myself to manage my health	-.086	.909	-.035	-.031	.679
15. I can make time by myself to do what I want to do	.160	.790	-.087	-.058	.723
17. I currently lead a fulfilling life in which I can live at my own pace	.070	.785	-.010	.039	.730
13. I adjust how I spend my time by myself	.001	.572	.239	.014	.481
29. I have my own goals for my daily (or entire) life	-.057	.035	.910	-.027	.792
31. I have my own goals at work	-.108	.004	.806	.016	.574
30. I have my own goals for health	.171	-.107	.777	.009	.706
35. I act in accordance with my values (or what I consider to be important)	.228	.282	.413	.000	.562
3. I can eat lunch as scheduled	.043	-.227	.075	.799	.510
4. I can eat dinner as scheduled	.024	.038	-.057	.717	.551
9. I have enough time to sleep	.001	.259	-.036	.564	.543
8. I have enough days off	-.096	.384	-.027	.452	.470
Correlations between factors					
Factor 2	.671				
Factor 3	.526	.382			
Factor 4	.377	.542	.158		

exploratory factor analysis of the remaining 44 items using the maximum likelihood method and promax rotation. The total score of the items had a normal distribution according to the Shapiro–Wilk test ($P = .512$).

Of the six factors in the draft questionnaire, we considered four factors to be valid based on the results of the scree plot. Accordingly, the final daily time management scale for use among working people with diabetes comprised four factors and 16 items (Table 2). Item 8 (“I have enough days off”) showed a factor two loading of .384. Although this value was close to .4, the item was accepted because it was deemed to be necessary for structuring the scale. Positive correlations were observed among individual factors ($r = .158-.671$).

Regarding the name of each factor, although in the draft questionnaire the first factor contained items related to feeling satisfied with one's work and maintaining interpersonal relationships, this factor was finally called “adjustment of work” because the analysis revealed that its contents were related to work, including work satisfaction and maintenance of human relations in the workplace. The second factor was called “time control” because it was related to people managing their health and controlling time so that they could do what they wanted. The third factor was called “goal setting and behaviors consistent with personal values” because it was related to tailoring goals to a person's values with regard

to life, work, and health. The fourth factor was originally termed “making time and paying attention to time for recuperative activities” in the draft questionnaire, but was subsequently called “adjustment of life rhythms” because it was related to life rhythms such as the times of eating meals and sleeping. The item “making a schedule” in the draft questionnaire was removed from the final questionnaire as a result of the analysis.

3.4 | Reliability

As shown in Table 3, Cronbach's α as a coefficient of reliability was .896 for the entire scale and $\geq .7$ for all subscales. Item-total correlations ranged .434–.786, and no values were $< .3$ (Polit & Beck, 2010). Cronbach's α values after the removal of a given item ranged .708–.894, and there were no cases where removal of an item led to a considerable increase in Cronbach's α coefficient.

3.5 | Validity

We examined the validity of the scale by performing correlation analysis between our scale and external criteria (the IDSCA). There was a positive correlation between the total IDSCA scores and various factors in the present

TABLE 3 Reliability analysis of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes ($N = 220$)

Item	Item-total correlation	Cronbach's α after item removal	Cronbach's α Overall .896
18. Work is going well	.781	.838	.893
21. I am satisfied with my job	.713	.865	
25. Workplace relationships are going well	.628	.894	
19. I feel my work and performance are being properly evaluated	.786	.851	
16. I can make time by myself to manage my health	.691	.821	.870
15. I can make time by myself to do what I want to do	.742	.811	
17. I currently lead a fulfilling life in which I can live at my own pace	.772	.815	
13. I adjust how I spend my time by myself	.677	.877	
29. I have my own goals for my daily (or entire) life	.508	.763	.851
31. I have my own goals at work	.434	.821	
30. I have my own goals for health	.535	.781	
35. I act in accordance with my values (or what I consider to be important)	.702	.864	
3. I can eat lunch as scheduled	.475	.755	.784
4. I can eat dinner as scheduled	.555	.714	
9. I have enough time to sleep	.627	.708	
8. I have enough days off	.594	.747	

4 | DISCUSSION

4.1 | Subject characteristics

The characteristics of the subjects were investigated to see how well they represented diabetes patients. According to a Japanese patient survey conducted in 2017, 56% of the 3.289 million diabetes patients were men; that is, there was almost no sex difference in diabetes prevalence (Ministry of Health, Labour and Welfare, 2017). The mean age of the patients in the present study was 54.3 ± 10.2 years and 76.8% were men. The greater proportion of men was presumably attributed to the fact that all participants were workers. Eighty percent of subjects in the nationwide survey conducted by the Japan Labour Health and Welfare Organization (2013) on working diabetes patients (mentioned above as the basis for the scale items) were men, and their mean age was 55.6 ± 10.2 years, which suggests that the current survey data were representative of diabetes patients in terms of age and sex ratio. Although our survey was limited to type 2 diabetes, whereas the Japan Labour Health and Welfare Organization survey (2013) also included type 1 diabetes, 92%, that is, the great majority of patients, had type 2 diabetes.

4.2 | Factorial structure of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes

The results of exploratory factor analysis revealed a structure of four factors and 16 items. There were correlations between various factors, but the correlation between “goal setting and behaviors consistent with personal values” and “adjustment of life rhythms” was weak (.158), and confirmatory factor analysis was therefore performed to check the model fit. In the χ^2 distribution, the null hypothesis, that “the composed path diagram is correct” was rejected. Although these results rejected the null hypothesis, we recommend that the model fitness be not judged based on the χ^2 value, which is sensitive to the number of data (Toyoda, 2014). This investigation included 220 counts of data. Furthermore, the Hoelter critical N value was 96 when $P < .05$ and 105 when $P < .01$. Based on these results, we decided to judge the model fitness based on GFI rather than the χ^2 value, because of the possibility that the null hypothesis was rejected due to influence of the data count. Other measures of fit were GFI = .876 and AGFI = .828, both of which were lower than the recommended .9. GFI, AGFI, and CFI $> .9$ are considered a satisfactory fit (even $> .95$ for CFI), RMSEA $< .5$ is considered a good fit, and $\geq .1$ is

considered a poor fit (Toyoda, 2014). However, it was considered to be within the acceptable range considering that CFI was $< .95$ but $\geq .9$, and RMSEA was not $> .1$, which would be considered a poor fit.

The present scale comprised four factors: “adjustment of work,” “time control,” “goal setting and behaviors consistent with personal values” and “adjustment of life rhythms”. “Time control” refers to general time management techniques, such as the ability to make time (e.g., “16. I can make time by myself to manage my health”). It is considered important for individuals to match their personal values and daily activities for effective time management (Smith, 2009). However, these details are implied in “goal setting and behaviors consistent with personal values”. It therefore assesses not only goals related to work and health, but also goal setting that promotes long-term decision-making and daily action taking in view of the future and values (e.g., “29. I have my own goals for my daily (or entire) life” or “35. I act in accordance with my values”). The remaining two factors assessed if individuals were capable of using these time management techniques to proficiently manage their occupation and diabetes. Workers spend most of their time working, and over half of the subjects in the present study accordingly spent at least 8 h a day working. How to adjust work was thus important in considering the daily living time of workers, as shown in “adjustment of work”. “Adjustment of life rhythms” describes how to find the time for health and wellness behaviors, such as “4. I can eat dinner as scheduled”. Meals and sleep have been shown to be associated with diabetes, and recent studies demonstrated that regular lifestyle schedules can modify the circadian rhythm and affect blood sugar control as much as the amounts of food and sleep (Chattu, Chattu, Burman, Spence, & Pandi-Perumal, 2019).

The factors that comprise the scale can also apply to healthy individuals, and it may therefore also be applicable to patients with relatively early-stage diabetes without severe complications. Treatments for such patients consist primarily of changing lifestyle habits, such as diet and exercise, before starting pharmacotherapy. These behavioral modifications for managing diabetes are similar to those employed by non-diabetics to maintain their health, suggesting that the scale items could be general ones and that the scale could also be used by non-diabetics; however, it is currently intended for use by patients with type 2 diabetes.

“Adjustment of work”, “time control”, “goal setting and behaviors consistent with personal values” and “adjustment of life rhythms” are thus the four factors comprising the Daily Time Management Scale for Use by Working People with Type 2 Diabetes.

4.3 | Reliability and validity of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes

With respect to reliability, we assessed internal consistency using Cronbach's α coefficients, with a Cronbach's $\alpha \geq .7$ taken to indicate high reliability (Polit & Beck, 2010); the Cronbach's α values for the scale as a whole and for its constituent subscales were all $\geq .7$. Furthermore, these values did not increase markedly when individual items were removed, thus confirming the reliability of our scale.

With respect to its validity, we solicited opinions from a certified diabetes nurse specializing in diabetes education and two chronic disease nurses who were also certified diabetes educators during the production of the questionnaire items, which established the content validity of the scale.

To ensure criterion-related validity, the scale was compared to the IDSCA, which measures self-care capability among diabetes patients. The daily time management is considered an important aspect of the self-care capabilities of diabetes patients, and is defined as the ability to allocate daily living time wisely with respect to interpersonal relationships and living their preferred lifestyle. The IDSCA was used to assess criterion-related validity because self-care capability as assessed by the IDSCA includes not only management of blood glucose levels, but also the patient's capability to realize their desired lifestyle, such as "ability to harmonize self-management with one's own life" and "application and adjustment abilities". The results of the analysis showed a significant positive correlation between the total scores for IDSCA and subscale items for "adjustment of work", "time control" and "goal setting and behaviors consistent with personal values". However, the correlations with total IDSCA scores and other factors for "adjustment of life rhythms" were weak and there were no correlations with some of the subordinate concepts. Items included in "adjustment of life rhythms" are related to food and sleep. As glucose levels are directly dependent on food intake, dietary parameters are important for diabetes management. In addition, even with optimal nutrition and exercise for maintaining a certain life rhythm, high blood pressure, obesity, and hyperglycemia can be caused by disturbances in the circadian rhythm (Kagawa, 2014); mutations in clock genes can cause hypertension and hyperglycemia due to changes in circadian rhythm, whereas chronic sleep disorder has been shown to affect insulin resistance (Chattu et al., 2019). Therefore, we believe that "adjustment of life rhythms" plays an important role in the fluctuation of blood glucose levels.

In contrast, the scale used to examine the validity of coexistence defined self-care as "activities based on decision-making that reflect personal values and beliefs; activities mediated by social relationships, including patient-healthcare provider relationships; and activities involving trial and error processes that contribute to well-being"; self-care differs from self-management, which is defined as "self-care performed for treatment of diabetes" (Shimizu et al., 2011). Thus, self-management involves activities that contribute to well-being and are necessary for treatment of diabetes; this may be the reason why it alone shows a weak correlation with IDSCA. However, the therapeutic target for diabetes involves maintaining the blood glucose level at a favorable level as well as maintaining the quality of life as a factor of 1–3. In other words, it is a target that cannot be achieved without full use of either of the two management methods described by Shimizu et al. in 2011.

Therefore, the present scale appears to capture the lives of patients in a comprehensive manner by "adjustment of work", "time control", "goal setting and behaviors consistent with personal values" and "adjustment of life rhythms".

4.4 | Practical use of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes for nursing

Patients with chronic diseases need to reorganize their daily lives around their symptoms and therapies, inevitably modifying how they manage their living hours (Anselm & Corbin, 1987). The adjustment of living hours to manage chronic disease can be divided into cases of patients who have too much time and those with too little time (Anselm & Corbin, 1987), with working patients tending to fall into the latter category. The current scale can assess the daily time management capabilities of working patients with diabetes, linked to aspects of work, quality of life, and blood glucose control. In addition, the scale can help patients to reorganize their lives in a manner that complements their individual needs, by identifying the goals that clarify the kind of life they want to lead.

For example, using the scale presented in this article may reveal problems with work adjustment. This situation could be approached by asking the individual concerned about their workplace circumstances and relationships and how they want these things to change, before considering solutions through discussions about goal setting and behaviors consistent with their personal values. Problems with time control may indicate that a person's life revolves around work and issues outside

him/herself; in this situation, it would be useful to ask the individual to talk about how they spend time relaxing or what they really want to do, and to then consider how they can make time for themselves. For those who have problems with adjusting their life rhythms, it may be helpful to consider how to schedule meals and what patients with diabetes can do to enjoy life while managing their condition. The scale introduced in this article can identify the specific details of the problem that needs to be addressed and help healthcare professionals, together with patients, to devise possible solutions. Others have argued that care for chronic conditions should concentrate not just on treatment, but also on how to live with illness (Woog, 1995). Our scale has the potential to help patients live with their illness by not only focusing attention on making time for diabetes management, but also determining if individuals are living the lives they want to lead in terms of employment and other aspects of life.

4.5 | Study limitations and priorities for future research

The present survey was based on a self-administered questionnaire and therefore did not capture the detailed disease conditions of the patients, including complications. Patients' self-care also affects their disease conditions, and further analysis that takes account of complications and diabetes progression is therefore required.

5 | CONCLUSIONS

This study developed a four-factor ("adjustment of work", "time control", "goal setting and behaviors consistent with personal values" and "adjustment of life rhythms"), 16-item Daily Time Management Scale for Use by Working People with Type 2 Diabetes. The internal consistency and external validity of the scale were confirmed by Cronbach's α coefficient and comparison with the IDSCA, respectively, and the factor structure was checked by confirmatory factor analysis. Although further studies are needed to confirm the validity of 2. "adjustment of life rhythms", this scale can be applied effectively to assess the daily time management capabilities of patients with diabetes.

ACKNOWLEDGMENTS

The authors would like to express their deepest gratitude to all participating patients and the facilities where the study was conducted. We thank Dr. Chizuko Inada and

Dr. Takuko Fukui for their assistance with the data collection. The present study was funded by a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (15 K11613).

CONFLICT OF INTEREST

All authors declare there is no conflict of interest.

AUTHOR CONTRIBUTIONS

N.T. and S.Y. contributed to the conception and design of this study. T.C., M.M., Y.Y., N.K., S.Y., and U.Y. contributed to the acquisition of data and the process of creating the scales. N.T. and O.H. performed the statistical analysis. S.Y. and M.T. critically reviewed the manuscript and supervised the entire study process. All authors read and approved the final manuscript.

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How to cite this article: Nakao T, Takeishi C, Nunoi K, et al. Development of the Daily Time Management Scale for Use by Working People with Type 2 Diabetes. *Jpn J Nurs Sci*. 2020;17: e12307. <https://doi.org/10.1111/jjns.12307>