ORIGINAL PAPER

Identifying the social capital influencing diabetes control in Japan

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ABSTRACT

The number of patients with diabetes is increasing in Japan. Recently, Social capital (SC) has received increasing attention as a factor influencing health conditions. In the US, the relation between SC and diabetes control has been reported, but little attention has been paid to this connection in Japan. Three SC questionnaires, entitled "trust in people in a community," "social support," and "social relationships," were constructed. The subjects were adult patients with type 2 diabetes. Information on diabetic conditions, such as HbA1c, self-attainment of diet (SAD) and exercise (SAE), and complications were collected. The reliability coefficients for the SC questionnaire and factor analysis of SC were conducted. Multiple and logistic regressions were used to identify the influence of SC on diabetes control. Sixty-five patients participated in this study. The questionnaires "social support" and "social relationships" were adopted to measure Cronbach alpha coefficient. Factor analysis extracted the factors "hope to be helped (HH)," "participation in favorite events (PFE)," "sense of belonging (SB)," and "social movement (SM)." HbA1c was positively correlated with HH (P < 0.05). SAD and SAE were negatively correlated with HH (P < 0.05). SAE was positively correlated with PFE (P < 0.05). PFE reduced complication risks (P < 0.05). HH includes *amae*, which negatively affected self-efficacy that correlates with diabetes control. Therefore, higher HH might cause higher levels of HbA1c. PFE reduces distress and contributes to glucose control. Reduced distress through PFE might prevent complications. HH and PFE were identified as SC that influences diabetes control.

Keywords: social capital, diabetes, *amae*, self-efficacy, stress management

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INTRODUCTION

The concept of social capital (SC) came from sociology and is defined as "Community features which can improve social efficiency by encouraging cooperating movement".[1] SC comprises features of social organization, such as trust between citizens, norms of reciprocity, and group membership, which facilitate collective action.

In recent years, it has been reported that SC is related to health conditions. Ichiro Kawachi claimed that SC is related to mortality, because there are well-established and biologically plausible links between social isolation and poor health outcomes.[2]

Diabetes control is not an exception. In the US, the effect of SC on diabetes control has been noted. Judith A. Long found that working together to improve the neighborhood (social capital: IMPROVE) affected diabetes control[3] and Bonnie M Vest reported that activating SC from multiple social spheres may help achieve the most effective diabetes management.[4] These studies might be becoming more common as the number of people with diabetes in the US is continually increasing and because it has become a social problem. According to the 2014 National Diabetes Statistics Report, the number of diabetic patients in the US is over 29 million and is still increasing.[5]

The Ministry of Health, Labour and Welfare (MHLW), Japan regards SC as an important factor for a healthy life and encourages people to improve it. However, there is a lack of such research in Japan, where over 3 million people have diabetes (the number is still increasing).[6] This leads not only to lower QOL but also to higher national medical expenditure, even though new therapeutic agents and strategies have been investigated. In fact, Japanese health expenses are 11.2% per GDP.[7] These problems concerning diabetes exist worldwide.[8] Therefore, identifying SC influence on diabetes control is important to help solve this problem.

It is widely noted that recognizing and changing behaviors is important for better self-management of diabetes, which leads to appropriate diabetes control.[9] However, it is difficult to recognize patients' behaviors and change them because, in addition to medical factors, economical, sociological, individual, and social factors are related to changing behaviors, furthermore, medical workers must understand better what motivates continued adherence to lifestyle changes in order to develop more effective long-term interventions.[10] SC can relate to its control from individual and social relational factors.

This study aimed to identify SC among patients with diabetes mellitus and to measure the associations with diabetes conditions, and both health workers' and patients' recognition of SC may begin to address this social problem.

METHODS

Study design

As SC questionnaires focused on diabetic patients have not been created in Japan, three questionnaires—1) "trust in people in a community," 2) "social support," and 3) "social relationships,"— were prepared on the basis of a previous study in Japan that investigated the relation between SC and all-cause mortality.[11] Questionnaire 1 was assessed according to five scores on the Likert scales. The more the patients agreed with the question, the higher was the number they checked. In questionnaire 2, if a patient answered "No," the score was 1, and if he or she answered "Yes," the patient named more types of people (e.g., housemates, relatives, friends, and medical staffs) and chose a higher score for the item. For example, if a patient had answered, "Yes, my housemates and friends do…" (the SC-related activity named in the question) his or

Table 1 SC questionnaires

Questionnaire 1: Trust in people in a community					
1. Do you think you are discriminated against because of your diabetes?	1	2	3	4	5
2. Would you say that mostly people try to be helpful?	1	2	3	4	5
3. Do you think most people would try to take advantage of you if they get a chance?	1	2	3	4	5
4. Do you listen other's concerns and complaints?	1	2	3	4	5
5. Do you look after someone when he/she is sick and has to stay in bed for a few days?	1	2	3	4	5

Questionnaire 2: Social support (If you answer "Yes," please let us know who is that "someone.")	
6. Do you have someone who listens to your concerns and complaints?	Yes/No (Housemates, Relatives, Friends, Medical Staff)
7. Do you have someone who looks after you when you are sick and in bed for a few days?	Yes/No (Housemates, Relatives, Friends, Medical Staff)
8. Do you have someone who acknowledges your existence and value?	Yes/No (Housemates, Relatives, Friends, Medical Staff)
9. Do you think someone provides you proper information about your ills and health conditions?	Yes/No (Housemates, Relatives, Friends, Medical Staff)

Questionnaire 3: Social relationships (Please answer how many times you do each of the following per week on average except for item 17.)				
10. Do you participate in political activities, organizations, or groups?	0	1–3	4–6	Over 7
11. Do you participate in a volunteer group?	0	1–3	4–6	Over 7
12. Do you participate in a citizens' group or organization?	0	1–3	4–6	Over 7
13. Do you participate in religious activities, organizations or groups?	0	1–3	4–6	Over 7
14. Do you participate in a sports club or groups?	0	1–3	4–6	Over 7
15. Do you participate in your community's meetings?	0	1–3	4–6	Over 7
16. Do you participate in a hobby or leisure activity club?	0	1–3	4–6	Over 7
17. How many times do you meet your friends per month?	0	1–3	4–6	Over 7

her score for that item was 3. Then, in Questionnaire 2 the maximum score is 5. Questionnaire 3 was assessed according to four scores. If a patient regularly participated in any event over seven times a week, his or her score is 4 for that event, and if the patient did not participate in an event at all every week, the score was 1 (Table1).

HbA1c, existence of complications, self-attainment of diets (SADs), self-attainment of exercise (SAE) were chosen to measure patients' condition and set them as a diabetes control index. Complications include neuropathy, retinopathy, nephropathy and cardiovascular diseases. Blood glucose level was not used as an indicator because patients can regulate it using pills or insulin. It is difficult to reflect daily management with this measure; however, HbA1c can do this because its levels do not change dramatically. Self-rating of health such as the SADs or the SAEs are measures of self-efficacy and thus may be associated with diabetes control.[12] Therefore, SAD and SAE were used as diabetes control indices. For example, the self-attainment of a diabetic patient can be a predictor of his or her mortality, which is particularly seen in the elderly.[13]

Data collection

Through questionnaires and by directly asking questions from them to each patient, data

was collected for four months from October 2015 to January 2016 among outpatients in four community hospitals: Nagoya Teishin Hospital, Atsumi Hospital, Kainan Hospital, and Nishio Municipal Hospital, all located in Aichi prefecture, Japan. Respondents were selected randomly and included only patients with type 2 diabetes; all patients were aged over 20 years old and provided consent but had never been diagnosed with dementia.

The collection of data by post and Internet is helpful in collecting as many samples as possible by providing them randomly. However, considering elderly people who may have cognitive dysfunction and their written answers can thus be incorrect, we adopted a direct interview for data collection to make questions easy for the respondents to understand and answer. Further, if the questionnaires were provided randomly, we could not precisely check objective data such as HbA1c. This method was also useful as we were able to prevent omissions and uncollected questionnaires.

We checked patients' medical records and noted their objective conditions such as HbA1c, BMI, age, and the existence of complications. SAD and SAE were measured by asking to what extent the patients can attain the ideal amount of exercise and can have their ideal diet control for diabetes management, if they set their ideal exercise and diet as 100%.

Data Analysis

As question 1 and 3 in Questionnaire 1 contain reversible items, we reversed them before analyzing the data. Next, we measured the Cronbach alpha coefficient and factor analysis extracted SCs from questionnaires. Diabetes control indices such as HbA1c, the existence of complications, SAD, and SAE were used as dependent variables and SC as an independent variable. Multiple logistic regression analyses were conducted for HbA1c, SAD, and SAE. HH, SM, and SB were set as continuous variables. Logistic regression analysis was conducted for the existence of complications, because the existence of complications is not a continuous variable. P values lower than 0.05 were defined as significant.

The software used for analysis was IBM SPSS statistics ver.23.

Ethical Considerations

This research was discussed and approved by the ethical committee of Nagoya University School of Medicine and the four hospitals where we conducted our research. Before the interviews, we explained what the purpose of our research was and about privacy contracts and accepted a written consent from every participant at every hospital. We also respected the patients' privacy. For example, we interviewed them in a room that prevented respondents' voices to be audible from outside and kept the data anonymous in the statistical analysis.

RESULTS

In total, 65 diabetic patients (42 males and 23 females) participated in the study, and their average age ± SD was 70.0 ± 9.3 years. Their average BMI ± SD was 24.9 ± 4.3 (Table 2). The number of participants in each hospital was 38 from Nagoya Teishin Hospital, 24 from Atsumi Hospital, 2 from Kainan Hospital, and 1 from Nishio Municipal Hospital. The results of the diabetes control index, such as the HbA1c, existence of complications, SAD, and SAE are shown in Table 3. According to the patients' records, their average level of HbA1c (%) was 7.0% ± 0.8%, and 44 patients had complications. The number of diabetic patients with arteriosclerosis was 27, retinopathy was 20, neuropathy was 32, and nephropathy was 21. Their average percentages of SAD ± SD (%) and SAE ± SD (%) were 58.7% ± 22.6% and 47.5% ± 22.3%.

Table 2 Basic information

Basic information	N = 65
Age*	70.0 ± 9.3 years
	Maximum: 85, Minimum: 43
Sex	M: 42 F: 23
BMI*	24.9 ± 4.3
Place	Nagoya Teishin Hospital: 38
	Atsumi Hospital: 24
	Kainan Hospital: 2
	Nishio Municipal Hospital: 1

*Average ± SD

Table 3 Measurement of health conditions

Measurement of health condition	
HbA1c (%)*	7.0% ± 0.8%
Existence of complications	Yes: 44 No: 21
	Arteriosclerosis: 27
	Retinopathy: 20
	Neuropathy: 32
	Nephropathy: 21
Self-attainment of diet (SAD) (%)*	58.7% ± 22.6%
Self-attainment of exercise (SAE) (%)*	47.5% ± 22.3%
	(one person didn't answer)

*Average ± SD

Table 4 Cronbach alpha coefficients

SC Questionnaires	α coefficient
1. Trust in people in a community	0.334 (excluded)
2. Social Support	0.618
3. Social relationships	0.626

The Cronbach alpha coefficients were 0.334 for "trust in people in a community", 0.618 for "social support", and 0.626 for "social relationships" (Table 4). Cronbach alpha coefficients over 0.6 and lower than 0.7 are questionable[14] and while our Cronbach alpha coefficient values did not exceed 0.7, they were so high probably because of the small number of items constituting the factor. We considered the reliability of "social support" and "social relationships" to be acceptable. Thus, these two questionnaires were regarded as reliable and were adopted for factor analysis.

Factor analysis extracted four SC factors. One SC factor was extracted as "hope to be helped (HH)" from the "social support" questionnaire. From "social relationships" questionnaire, question numbers 14, 16, and 17 were extracted as "participation in favorite events (PFE)", numbers 13 and 15 as "sense of belonging (SB)", and numbers 12 and 14 as "social movement (SM)". These factors were named from the character of the questions (Table 5) and were used as independent variables in multiple and logistic regression analyses. In Questionnaire 3, question number 10—"Do you participate in political activities?"—was excluded from factor analyses, because

Table 5 Results of factor analysis in Questionnaires 2 and 3

Questionnaires 2		Questionnaires 3			
	f1		f1	f2	f3
No.6	0.750	No.16	0.852	0.077	−0.146
No.8	0.748	No.14	0.790	−0.043	0.354
No.7	0.710	No.17	0.555	0.463	0.051
No.9	0.509	No.13	0.118	0.817	0.180
	Hope to be Helped Factor (HH)	No.15	0.000	0.794	−0.100
		No.12	−0.026	−0.109	0.889
		No.11	0.162	0.367	0.553
		Participation in Favorite Events Factor (PFE)	Sense of Belonging Factor (SB)	Social Movement Factor (SM)	

Table 6 Multiple regression analysis of SC and HbA1c

Conditions and Situations of patients with DM	SC	B value	95% CI	P value
HbA1c	HH	0.124	0.015 – 0.233	0.026**
	SM	0.012	−0.216 – 0.240	0.918
	SB	−0.135	−0.316 – 0.046	0.142
	PFE	−0.063	−0.155 – 0.029	0.174
SAD	HH	−3.349	−6.381 – −0.317	0.031**
	SM	1.299	−5.043 – 7.640	0.684
	SB	0.425	−4.608 – 5.459	0.866
	PFE	1.269	−1.278 – 3.815	0.323
SAE	HH	−3.528	−6.369 – −0.706	0.015*
	SM	−2.2	−8.126 – 3.727	0.461
	SB	3.299	−1.444 – 8.042	0.169
	PFE	2.705	0.288 – 5.123	0.029*

**P<0.05, B value indicates the partial regression coefficient and is used for prediction formula.

Table 7 Logistic regression analysis of SC and existence of complications

SC	Odds Ratio	95% CI	P value
HH	0.907	0.668 – 1.231	0.531
SM	1.03	0.532 – 1.995	0.93
SB	1.502	0.853 – 2.646	0.159

all respondents answered "No." Respondents usually answered that they participate in political activities only during the time nearby an election, so nobody participated regularly.

The multiple and logistic regression analysis showed that HH was significantly positively related to HbA1c and negatively to both SAD and SAE (P < 0.05), indicating that help from others can negatively affect diabetes control (Table 6).

The results also indicate that PFE was significantly positively related to SAE and negatively to existence of complications (P < 0.05), indicating that participation in favorite events can positively affect diabetes control. SM and SB were not significantly related to SC (Tables 6 and 7).

DISCUSSION

Our study proved that SC influences on diabetes control. HH negatively affected diabetes control, whereas PFE positively affected diabetes control. To the best of our knowledge, this study is the first cross-sectional study to assess the relation between SC and diabetes control in Japan.

The mechanism HH affects diabetes control

In most case, SC affects health conditions positively, which is why it is promoted, but why does HH lead to worse diabetes control?

HH might negatively affect self-efficacy, SAD, and SAE. According to a previous research, self-efficacy is significantly associated with self-management behaviors such as maintenance of a diet, exercising, self-management of blood glucose, and foot care[12]. In contrast, it also indicated that low self-efficacy worsens self-management of diabetes[12]. Therefore, the self-management of diabetes control can worsen when self-efficacy, SAD, and SAE are low, thus increasing the level of HbA1c.

The negative effect of HH on self-efficacy could be attributed to the effect of *amae*, a feeling particularly found among the Japanese. *Amae* is often translated as dependency, but its meaning is not completely equivalent to that of dependency. In Takeo Doi's *The Anatomy of Dependence*[15], it is defined as the feeling of hoping to be loved and to be able to depend on others, which conflicts western self-consciousness. In *The Anatomy of Self*,[16] Doi writes the following: *amae* itself is an emotion that is constituted tacitly. It is telepathic, pre-linguistic, and does not need the medium of language. It is communicated directly from heart to heart. Certainly it is an emotion of intimacy, but it is also fundamentally related to secrets of the heart.

For example, while the Westerners think highly of their individualism, the Japanese consider harmony as the most valuable characteristic. They tend to be passive and not to claim their opinions, because they are concerned that their behavior might make others feel uncomfortable. It might be inferred that *amae* is a kind of negative thinking, but Japanese people's behaviors are based on the idea of *amae* and they develop relationships according to mutual *amae* without being aware of it. According to this literature, *amae* is not common in East Asia; the Chinese have little idea of *amae* partly owing to the difference between Japanese and Chinese histories.

In the case of diabetic patients, Japanese patients might easily accept help from others, even though such help might negatively affect diabetes control. In fact, during our interview, many male patients stated that they depend on their wives or families for their meals, who sometimes do not know about the patients' diabetes. Such patients are unlikely to make their decisions and dependency on others might lead to low self-efficacy. Moreover, patients often stated that they rarely confess their health condition, which might be (a) because they expect others to understand their diabetes, even though they do not mention or (b) because they do not want their relationships to change or get affected by their illness. This thought is also based on *amae*.

This is not the only case where SC negatively affects a health condition. For example, bonding SC is positively related to mental distress[17] and SC can lead to drug habits that are bad for health.[18]

The mechanism whereby PFE affects diabetes control

The questions contained in PFE determined the number of times the patients participated in exercise or hobby groups each week and the number of times they met their friends in such activities; this factor reflects a patient's opportunities to go outside for participating in their hobbies and sports, and meet their friends as well. Living an active life can positively affect SAE. Furthermore, the opportunities to go out are an important element for diabetes management, because walking is a good exercise for this management. Further, stress management, such as participating in a favorite activity, leads to better glucose control.[19] One reason for this is that tasks of diabetes self-management may themselves become a source of stress. Diabetes complications usually occur due to insufficient glucose control and high HbA1c levels for a prolonged period. Decreasing stress through hobbies or exercise leads to appropriate glucose levels and this, over the long term, might prevent complications. This study showed little relation between SC and HbA1c, with a P value was of 0.174, but HbA1c levels are strongly related to the outbreak of complications. This might be because patients decrease its level by using other medications after complications arise, even though their SC is still low.

As noted in the background section, statistically extracted SCs might influence patients' behaviors and result in patients controlling their conditions.

Limitation

The reliability of our single questionnaire was insufficient. This might be because this study was conducted only in a designated region and the type of patient was limited; most patients were elderly people, and the study was conducted only among outpatients, excluding patients with diabetes from clinics but including those from community hospitals. The study would have been improved by increasing the number of participants. If more patients participated, it would have been possible to identify relations by region, generation, and sex.

In addition, there might be some shortcomings in the questionnaire. Even though we interviewed respondents directly to prevent misunderstandings, some questions might have been unsuitable; the order of the questions might have also been one of the reasons.

As this was an exploratory study, further study and research in other areas is necessary for clearer results.

CONCLUSION

In conclusion, this study was the first and significant report revealing that SCs related to diabetes control in Japan and that HH and PFE are the SCs influencing diabetes control.

This result might support the consideration of *amae* as peculiar to the Japanese and that participation in hobbies or sports groups can positively influence better diabetes control in Japan.

An example of positive social support might be helpers encouraging patients to do tasks by themselves and enabling them to acquire confidence. Furthermore, it is important that the people around the patients should understand that they are diabetic. However, many patients are reluctant to talk about their diabetes; hence, we should regularly enable good relationships so that patients can speak about their conditions.

Social capital and diabetes control

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CONFLICT OF INTERST

All authors declare no conflict of interest with regard to this study.

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