

Evaluation of the Diabetes Chronic-care System in Japanese Clinics

Takamasa WATANABE¹⁻³, Masato MATSUSHIMA¹, Takuya NAGATA^{1,4}, Tomokazu TOMINAGA^{1,5},
Hiroki YOKOYAMA⁶, and Yasuki FUJINUMA^{3,7}

¹*Division of Clinical Epidemiology, Research Center for Medical Sciences, The Jikei University School of Medicine*

²*Kita-adachi Seikyo Clinic, Tokyo Hokuto Health Co-operative*

³*Centre for Family Medicine Development, Japanese Health and Welfare Co-operative Federation*

⁴*Ongibashi Clinic*

⁵*Musashi-Koganei Clinic, Japanese Health and Welfare Co-operative Federation*

⁶*Jiyugaoka Medical Clinic*

⁷*Interprofessional Education Research Center, Graduate School of Nursing, Chiba University*

ABSTRACT

Aims : The objectives of this cross-sectional study were to clarify the status of the diabetes chronic-care system in Japanese primary care clinics and to identify components for improvement by contrasting family physicians with diabetologists.

Methods : We created a Japanese version of the Assessment of Chronic Illness Care (ACIC) questionnaire to perform a survey among 26 family physician clinics and 40 clinics affiliated with diabetes research groups with known quality as a control for comparison.

Results : The response rate to the ACIC survey was 85% among family physicians and 88% among diabetologists. The total ACIC score (range, 0 to 11) differed significantly between family physicians (3.87) and diabetologists (6.41 ; $P < 0.0001$). The differences were notable in the components of “organization of healthcare” and “decision support.” In both groups, the score for “community linkages” was the lowest among 6 components of the ACIC.

Conclusions : These results suggest that “organization of healthcare” and “decision support” are important components for family physicians. “Community linkages” is required to be improved for both.

(Jikeikai Med J 2016 ; 63 : 63-70)

Key words : chronic care model, chronic illness, assessment, diabetes, care system

INTRODUCTION

Diabetes is “strongly suspected” or “cannot be ruled out” in an estimated 20.5 million persons in Japan¹, but the Japan Diabetes Society has certified (as of March 7, 2014) only 5002 diabetologists². For this reason, all patients with diabetes in Japan cannot be cared for by diabetes specialists, and most patients are likely to be cared for by primary care

physicians. Although family physicians will increase in number and care for more patients with diabetes, the quality of the care is unclear.

An individual physician probably cannot provide high-quality care for a chronic illness on the basis of guidelines^{3,4}. Therefore, to improve the quality of care on the basis of an organized system, the Chronic Care Model (CCM) was developed by Wagner and others^{5,6}. The CCM has 6 compone-

Received for publication, June 10, 2016

渡邊 隆将, 松島 雅人, 永田 拓也, 富永 智一, 横山 宏樹, 藤沼 康樹

Mailing address : Takamasa WATANABE, Division of Clinical Epidemiology, Research Center for Medical Sciences, The Jikei University School of Medicine, 3-25-8 Nishi-shimbashi, Minato-ku, Tokyo 105-8461, Japan.

E-mail : watanabetakamasa@gmail.com

nts : organization of healthcare, community linkages, self-management support, decision support, delivery system design, and a clinical information system. If each component has an organized system developed for it, the quality of care can be improved. The CCM is applicable to the care of various chronic illnesses, such as diabetes managed by family physicians in primary care settings, and its effectiveness of quality improvement has been examined⁷.

To measure the extent to which the CCM can be introduced, the Assessment of Chronic Illness Care (ACIC) was developed as a quality-improvement questionnaire by Bonomi et al. in 2002⁸. The ACIC is a questionnaire consisting of a total of 7 components, including the 6 components of the CCM and an additional “integration of CCM” component, and 34 items. Therefore, the ACIC is a tool to assess the extent to which a chronic illness care system based on the CCM can be established. With respect to the ACIC, research has advanced the quality of chronic illness care, and process evaluation⁹⁻¹¹ and outcomes assessment^{11,12} have been performed. However, because health-care systems differ among countries, the specific items required to effectively improve the quality of care in Japan must be investigated. On the basis of this requirement, we decided to create a Japanese-language version of the ACIC to evaluate the status of the diabetes chronic-care system in the Japanese primary care setting.

We believe that diabetologists working in clinics directly involved in patient care have organized a high-quality diabetes care system that is appropriate in Japan. The features of care by diabetologists can be identified and used to improve the care by family physicians in Japan by comparing their particular care systems. Therefore, to clarify the current status of the diabetes chronic-care system used by family physicians in Japan and to identify how the system can be improved, in the present cross-sectional study we performed a survey with a Japanese version of the ACIC to compare the system of diabetes care provided by family physicians with that provided by diabetologists.

METHODS

1. Creation of a Japanese version of the ACIC

In 2010 we created a Japanese version of the ACIC version 3.5¹³ by having a primary investigator (TK) perform a translation in accordance with the World Health Organiza-

tion’s “Process of translation and adaptation of instruments”¹⁴. The translation was then reviewed by an expert panel that included 2 co-investigators (MM and TT) to create the first Japanese draft version. The initial back-translation to English was performed by a professional scientific translation company (Forte Science Communications, Tokyo, Japan) blinded to the original English version.

We asked the researchers of Improving Chronic Illness Care, which was a national program of the Robert Wood Johnson Foundation launched in 1998 with the CCM at its conceptual core¹⁵, to compare the back-translated version to the original version and to examine the accuracy of the interpretations of the original text. We made revisions and created a second Japanese draft version on the basis of the researchers’ expertise.

The second Japanese draft version was examined by 8 physicians and 4 nurses who were members of the Centre for Family Medicine Development (CFMD) practice-based research network. The CFMD is a nationwide organization in Japan that is involved in the training of residents and fellows in family medicine, education development, and research. The CFMD consists of urban family medical clinics centered in Tokyo and is currently affiliated with 14 facilities. We then made detailed revisions to the phrasing and format to complete the final Japanese version of the ACIC. This final version is presented in the website of Improving Chronic Illness Care¹⁶.

2. Survey with the ACIC

A self-administered questionnaire survey with the Japanese version of the ACIC was mailed in February 2011 to 26 family-physician clinics in settings for primary care and to, as a control for comparison, 40 diabetologist clinics affiliated with diabetes research groups that provide quality diabetes care.

We recruited participants as family physician clinics from 2 sources. One source, as an urban data source centered in Tokyo, was an educational facility of the Japanese Health and Welfare Co-operative Federation affiliated with the CFMD. The other source, as a nationwide data source in Japan, was a facility with physicians participating in a 2-year clinical research training course (Jikei Clinical Research Program for Primary-care) with distance education through e-learning that was targeted at primary care physicians and conducted by The Jikei University School of Med-

icine. The physicians at these clinics were highly motivated and research-oriented, although they were young. Almost all of the physicians were family physicians certified by the Japan Primary Care Association.

The diabetologist clinics, as a control group for comparison, were participating institutions in the Japan Diabetes Clinical Data Management Study Group¹⁷, a nationwide research group of clinics, whose physicians, without charge, register clinical data daily from patients with diabetes through the use of common software for the purpose of scientific research. The physicians at these institutions are research-oriented diabetologists working in primary care settings. The directors of these clinics were internists who were also board-certified diabetologists. We considered them to be appropriate for comparison with family physicians. The participating institutions presented highly motivated family physicians and research-oriented diabetologists nationwide in urban, suburban, and rural areas.

The questionnaire surveys were mailed to the directors at each clinic or to other physicians in similar supervisory positions. The surveys also requested information about each respondent (board-certification as a diabetologist and experience as a physician and a director) and the medical institution (number of full-time physicians, nurses, dieticians, and certified diabetes educators). Certified diabetes educators included nurses, dieticians, pharmacists, clinical laboratory technologists, and physical therapists with specialized knowledge in instructing patients on the self-management of diabetes. These educators have extensive experience, have passed an examination, and are certified by the Diabetes Educator Certification Board in Japan.

3. Statistical analysis

According to a study by Wagner et al.¹⁸, the total ACIC score (range, 0 to 11) improves from 5.06 (standard deviation [SD], 0.94), before intervention with the CCM, to 7.32 (SD, 2.11) afterward. If this degree of difference is assumed between highly motivated family physicians and research-oriented diabetologists, for $\alpha = 0.05$ and power = 0.9, the required sample size was 12 in each group. However, taking into account multiple comparisons for each ACIC component, we decided that the required sample size in each group was 25.

To clarify differences in the quality of the diabetes care systems between family physicians and diabetologists, we

compared the assessment results of the Japanese version of the ACIC. For total ACIC scores and each component score, the F-test was performed for homoscedasticity. Welch's *t*-test was used for heteroscedastic data, and Student's *t*-test was used for homoscedastic data.

Multiple regression analysis was performed to examine whether the ACIC scores were affected by differences between family physicians and diabetologists. Adjustments were made for confounding variables that might affect the assessment results of the Japanese version of the ACIC, including solo practice (= 1)/group practice (= 0), experience as a physician or director (years), and the number of full-time physicians and nurses. We also examined variance inflation factors for assessing collinearity between variables. Statistical analysis was performed with the software program Stata/SE release 14.1 (StataCorp LP, College Station, TX, USA).

4. Ethical considerations

All potential participants were informed with the questionnaire, including the description, that participation in the study was voluntary. For respondents who agreed to participate in this study, we considered informed consent to have been obtained when the questionnaire was returned. This study was performed according to the Declaration of Helsinki and approved by the Ethics Committee of Uji Seikyo Hospital (Approval number 40) and the Ethics Committee of Japan Diabetes Clinical Data Management Study Group (Approval number 1/2010).

RESULTS

The rate of response to the survey with the Japanese version of the ACIC was similarly high among family physicians (85%) and among diabetologists (88%) (Table 1). The median number of full-time physicians was greater in family physician clinics than in diabetologist clinics, which indicates that family physicians in this study worked in the setting of group practice more frequently than diabetologists. However, the median number of certified diabetes educators was lower among family physician clinics. Furthermore, the median numbers of years of experience as a physician and of years of experience as a director were lower among family physicians than among diabetologists.

The total ACIC score was significantly lower among

Table 1. Characteristics of participating clinics

	Family physicians (<i>n</i> = 26)	Diabetologists (<i>n</i> = 40)	<i>P</i> value
Responses, <i>n</i> (%)	22 (85%)	35 (88%)	
Solo practice	6	30	
Board-certified diabetologists	0	32	
Full-time physicians	2 (1-3)	1 (1-1)	0.0007 ^a
Full-time nurses	3 (2-5)	3 (2-4)	0.6 ^a
Full-time dieticians	0 (0-0)	1 (0-2)	0.006 ^a
Full-time certified diabetes educators	0 (0-0)	2 (1-4)	<0.0001 ^a
Experience as physician (years)	10 (9-12)	30 (25-37)	<0.0001 ^a
Experience as director (years)	2.5 (1-5)	11 (8-20)	<0.0001 ^a

Data are *n* or median (25th percentile-75th percentile) unless otherwise indicated.

^aThe Wilcoxon rank sum test was used for nonparametric data.

Table 2. The Assessment of Chronic Illness Care^a component scores

Assessment of Chronic Illness Care ^a components	Family physicians (<i>n</i> = 22)	Diabetologists (<i>n</i> = 35)	Two-group comparison <i>P</i> Value
Organization of health care	4.32 (3.54-5.10)	6.60 (5.93-7.26)	<0.0001 ^b
Community linkages	3.29 (2.54-4.04)	5.37 (4.52-6.21)	0.001 ^b
Self-management support	3.89 (3.04-4.73)	6.56 (5.72-7.41)	0.0001 ^b
Decision support	4.06 (3.46-4.65)	7.31 (6.53-8.10)	<0.0001 ^c
Delivery system design	4.38 (3.33-5.43)	6.89 (6.01-7.76)	0.0005 ^b
Clinical information systems	3.93 (3.06-4.79)	6.55 (5.68-7.41)	0.0001 ^b
Integration of components	3.24 (2.44-4.04)	5.59 (4.70-6.48)	0.0007 ^b
Total Assessment of Chronic Illness Care score	3.87 (3.17-4.57)	6.41 (5.68-7.14)	<0.0001 ^b

Data are means (95% confidence interval).

The Bonferroni correction was performed for multiple comparisons. The level of statistical significance is 0.05/8 = 0.00625.

^aBetween "0" and "2" = limited support for chronic illness care

Between "3" and "5" = basic support for chronic illness care

Between "6" and "8" = reasonably good support for chronic illness care

Between "9" and "11" = fully developed chronic illness care

^bStudent's *t*-test was used for homoscedastic data.

^cWelch's *t*-test was used for heteroscedastic data.

family physicians than among diabetologists (Table 2). Among 4 levels of chronic illness care in the ACIC, family physicians provided level 3 care corresponding to basic support, whereas diabetologists provided one higher level (level 2) of care, corresponding to reasonably good support. Thus, the level of care provided was clearly different.

The comparison of scores by components showed that the total score for all components was lower for family physicians. The differences were notable for the organization of healthcare and decision support (Table 2).

According to the statements on the ACIC⁸ questionnaire, these scores suggest that, although chronic illness care has been incorporated in organizational policy among

family physician groups, there is a lack of leadership, and resources to improve quality have not been allocated. In contrast, leadership is clearer in the diabetologist group, and resources have been secured. Similarly, these scores suggest that evidence-based guidelines are not being used in family physician groups and that the availability of patient education materials is insufficient. In contrast, staff members in diabetologist clinics are being trained in accordance with the guidelines, and patient education materials are being utilized.

In both groups, the score for community linkages was the lowest among 6 components of the ACIC (Table 2).

Multiple regression analysis with the ACIC score as

Table 3. Multiple regression model for the Assessment of Chronic Illness Care score

	Regression coefficient (standard error)	<i>P</i> value
Family physicians (=0), diabetologists (=1)	2.6 (0.8)	0.001
Group practice (=0), solo practice (=1)	-0.9 (0.7)	0.192
Experience as director (years)	0.03 (0.04)	0.372
Part-time physicians (<i>n</i>)	-0.1 (0.1)	0.163
Nurses (<i>n</i>)	0.2 (0.1)	0.030

the target variable showed strong collinearity in the time of experience as a physician according to assessing variance inflation factors (Table 3). Therefore, we excluded that factor from the analysis. After possible confounding factors were adjusted for, the regression coefficient for family physicians (=0)/diabetologists (=1) was 2.6 ($P = 0.001$). As a possible confounding factor, the number of nurses achieved statistical significance. The ACIC score was significantly higher for diabetologists.

DISCUSSION

The present study had 2 major findings. First, in Japan highly motivated family physicians, compared with research-oriented diabetologists, lack a sufficient systematic structure, particularly with respect to “organization of healthcare” and “decision support” components as assessed on the basis of the CCM. Second, “community linkages” are an important component that needs to be improved for both groups in Japan.

Our study found that a sufficient systematic structure was lacked more often by family physicians than by diabetologists, particularly in regard to “organization of healthcare” and “decision support” components as assessed on the basis of a CCM. Family physicians might have had a low score for “organization of healthcare” because they perform a variety of services, including the care of acute and chronic illnesses, disease prevention, and health promotion. Therefore, concentrating their resources on the care of diabetes can be more difficult. In contrast, diabetologists focus their care on a single disease and concentrate their resources more easily. Family physicians might have had a low score for “decision support” because their education about guidelines and their use of guidelines are insufficient. In a diabetologist clinic, where there is specialized care for a specific disease, the medical education and training of staff mem-

bers, such as nurses, are more likely; in contrast, in a family physician clinic, where a wide variety of illnesses are managed, such education is less likely to be comprehensive. Another possible reason for family physicians having a low score for “decision support” is that educational materials for their patients are not readily available. Such educational materials are usually available in a diabetologist clinic but may be less available in an independent family-physician clinic. For educational materials to be available, organized participation in academic societies is necessary.

“Community linkages” are an important component for improving the care provided by both family physicians and diabetologists in Japan but have not been sufficiently addressed. This lack of adequate linkages with community social resources in Japan highlights the need to develop comprehensive community care systems. These community systems should be able to provide housing, medical care, caregiving, prevention services, and assisted living, and measures for developing them by 2025 have been proposed¹⁹. However, such systems are still not available throughout Japan, and pioneering initiatives have been implemented at only a fragmentary level in some regions. In the region of the present study, such initiatives have not been started.

A comparison of ACIC scores of the present study, after a Japanese version of the ACIC was created and implemented, and scores previously reported outside Japan (Fig. 1) suggests that the highly motivated family physician care system remains inadequate in Japan. In contrast, the research-oriented diabetologist care system in Japan is at a level corresponding to the quality improvements based on the CCM in other countries. Although the data may not be representative of particular countries, these trends should serve as a general reference. Therefore, the score of diabetologists was higher than that of family physicians in Japan, as we originally assumed, and the difference corresponds to

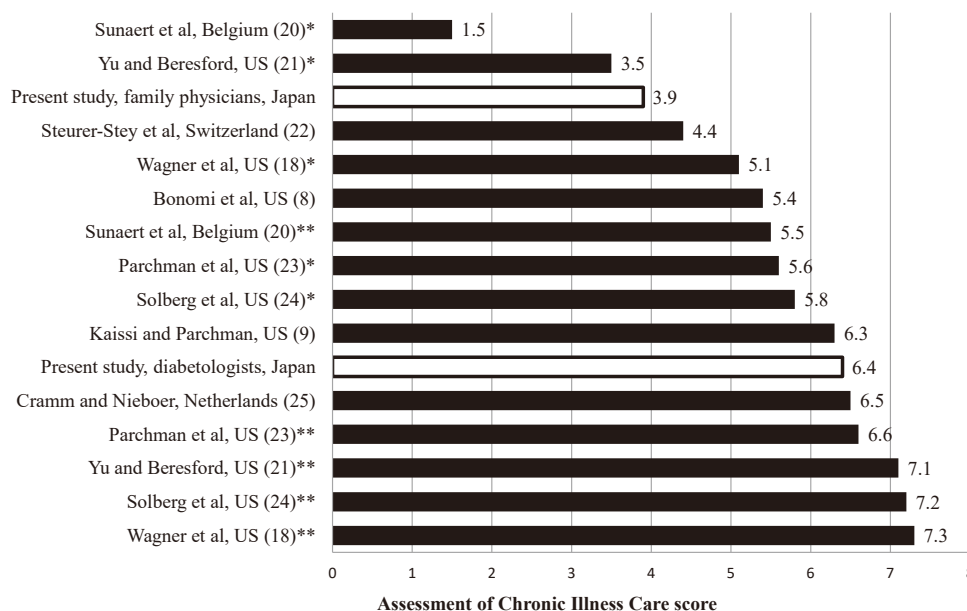


Fig. 1. Assessment of Chronic Illness Care score (international comparison)

The studies performed outside Japan used either the original English version of the Assessment of Chronic Illness Care or versions translated into Dutch or German. Because most studies had been performed as quality improvement intervention based on the Chronic Care Model, most reports included data from both before and after quality improvement intervention. All previous studies assessed family physicians, but no studies assessed specialists, such as the diabetologists assessed by our study in Japan.

*data before quality improvement intervention

**data after quality improvement intervention

the effects of quality improvement intervention in other countries.

The present study had 4 limitations. The first relates to external validity. Our study targeted groups of highly motivated family physicians and research-oriented diabetologists who had an affinity for research. Thus, both groups of subjects might have differed from other family physicians and diabetologists in Japan. The second limitation relates to the survey response rate. Although the response rates among family physicians and diabetologists were extremely high (Table 1), they were not 100% and suggest that bias was possible.

The third limitation of the study is related to the difference of characteristics between family physicians and diabetologists. Although the time of experience as a physician was less for family physicians than for diabetologists, this variable was excluded from multiple regression analysis because of the collinearity. Thus, the time of experience as a physician might have affected ACIC scores. On the other hand, Spearman's correlation coefficients between these 2 variables were -0.47 ($P = 0.03$) in family physicians and

0.22 ($P = 0.21$) in diabetologists. Therefore, the better ACIC score might not be attributed to the longer time as a physician.

The fourth limitation of the present study is related to the internal validity of the Japanese ACIC. The ACIC is a tool developed in the United States to assess care systems; therefore, in Japan, where the healthcare system differs from that in the United States, our use of a version of ACIC that has been translated into Japanese but is otherwise unchanged might be an issue. However, in this study we were able to detect a clear difference between family physicians and diabetologists, as originally hypothesized; therefore, the Japanese version of the ACIC may paradoxically have validity.

CONCLUSIONS

The present study is the first to assess the diabetes chronic-care system in Japanese primary care clinics with a Japanese version of the ACIC we created. We identified the "organization of healthcare" and "decision support" as improvement components for highly motivated family physi-

cians in Japan. We also identified “community linkages” as an important improvement component for both family physicians and diabetologists.

CONFLICTS OF INTEREST

HY is a member of the board of directors of the Japan Diabetes Clinical Data Management Study Group (JDDM). MM is an analysis advisor of JDDM. HY and MM are members of JDDM protocol committee. MM is an adviser of CFMD practice based research network. MM received lecture fee and travel fee for lecture from CFMD. TW, TT, and TN were former residents in family medicine of CFMD. MM is a program director of Jikei Clinical Research Program for Primary-care. YF is a lecturer of Jikei Clinical Research Program for Primary-care. YF received lecture fee and travel fee from The Jikei University School of Medicine. TW, TT, and TN were former trainees of Jikei Clinical Research Program for Primary-care. MM’s daughter worked in Novo Nordisk Pharma Ltd. from April 1, 2013, to July 31, 2014. This work was supported by a research grant of fiscal year 2011 from The Jikei University School of Medicine and Postgraduate Medical School. There is no potential competing interest to be declared relevant to this work other than the above description.

AUTHORS’ CONTRIBUTIONS

TW reviewed and edited the manuscript, conducted the research study, and was primarily responsible for data collection, integrity, and analysis. MM reviewed and edited the manuscript and was primarily responsible for data collection, integrity, and analysis. HY reviewed and edited the manuscript, contributed to this study as a representative member of JDDM, and performed critical review of the manuscript. YF, TT, and TN reviewed and edited the manuscript, contributed to the discussion of the data, and performed critical review of the manuscript. All authors contributed to writing the manuscript. TW is the guarantor of this work and, as such, has full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Acknowledgments : This study was carried out by Division of Clinical Epidemiology at The Jikei University School of

Medicine through the Jikei Clinical Research Program for Primary-care, and we wish to express our appreciation for the advice from the program.

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