—Regular Articles—

Structural Features of Pharmacy Function —The Analysis Using Structural Equation Modeling—

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In order to examine the structural features of community pharmacy function and to clarify areas meriting priority in efforts to expand pharmacy functions in the home care field, a questionnaire survey was conducted. Using the distribution of responses regarding the actual conditions entailed in the 16 categories of pharmacy services, factor analysis was carried out. Structural equation modeling was performed and the fitness of the path model constructed to study the interrelatedness of the individual factors extracted by factor analysis was considered. Four factors comprised pharmacy services ''dispensing'', ''supply of goods'', ''offering home care'', and ''cooperation in community health and medical programs''. The interrelatedness of four pharmacy functions by the result of structural equation modeling indicated the following insights. 1) By strengthening ''cooperation in community health and medical programs'', it is possible to directly improve the functions of ''dispensing'', and ''offering home care''. An improvement in ''collecting and utilizing patient information'', ''providing appropriate instruction'', ''providing introductions to medical institutions and physicians'', and ''supplying over-the-counter drugs'' can be expected as a result of direct benefits accrued by ''cooperation in community health and medical programs''. 2) By strengthening ''offering home care'', it is possible to directly improve ''supply of goods''. An improvement in ''stocking long-term care goods and sanitary goods'' can be expected as a result of direct benefits accrued by ''offering home care''. In conclusion, this study indicated that the areas meriting priority in the expansion and upgrading of pharmacy functions is stronger ''cooperation in community health and medical programs''.

Key words——community pharmacy; pharmacist; pharmacy function; home care; healthcare policy

INTRODUCTION

The introduction of the Long-Term Care Insurance System in April 2004 has led to explicit positioning of pharmacies as local resources for the comprehensive provision of health care, medical treatment, and social welfare services.[1] In addition to medical services related to the filling of prescriptions, community pharmacies and pharmacists are now being called upon to play a variety of roles that draw upon these other fields, including offering consultations on nursing care and welfare services, managing and guiding the administration of home care, lending medical and health care apparatus, and supplying materials required for long-term nursing care.[2—5]

The Revised Long-Term Care Insurance System implemented in April 2006 has indicated the need for a ''changeover to a prevention-oriented system that gives priority to health maintenance and preventing patients from reaching a state where they require long-term nursing care, as well as improving the condition of those who do''.[6] Accordingly, pharmacies are now expected to function as one base for early detection of physical deterioration of elderly patients so that intervention may be taken to prevent the need for long-term care. The community also now looks to pharmacies to take part in regional comprehensive support center consortia and to guide and manage the administration of home care designed to prevent patients from requiring long-term nursing care.

Previous studies on the theme of pharmacy functions targeted pharmacies/pharmacists,[7] users of home care services,[8] medical practitioners,[9] and visiting nurses/home helpers[10] to examine the characteristics of pharmacy services, the needs the community expects the pharmacy to satisfy, and cooperation between pharmacists and other home care related professionals. As a result, it was found that 1) prior to the introduction of the Long-Term Care Insurance System, pharmacies did little in the

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way of providing health care and social welfare-related services;[7] 2) users of home care services were hoping that pharmacists would check for side effects, offer explanations and guidance on how to take medications, provide support in the storage and management of medications, and meet with patients for consultations;[8] 3) medical practitioners hope that, in addition to dispensing medications, pharmacists will accept consultations with patients and caregivers regarding administration of medications and also visit patients at home to manage and supervise drug therapy;[9] and 4) about 60% of visiting nurses and home helpers acknowledge that ''there are problems with the administration and management of medications'' at the home care sites they visit, and desire intervention on the part of pharmacists.[10] Moreover, a study comparing the state of pharmacy services before and after introduction of the Long-Term Care Insurance System showed that: 1) introduction of this system made it clear that health care and social welfare services were one of the functions of a pharmacy, and 2) in order to expand pharmacy functions, it would be necessary to promote active participation in existing local health care and social welfare activities, along with cooperation with other professionals.[11]

The present study aims to examine in detail the structural features of community pharmacy functions subsequent to the introduction of the Long-Term Care Insurance System, along with the relationships among the individual functions, using structural equation modeling, with the goal of clarifying areas meriting priority in efforts to expand pharmacy functions in the home care field.

METHODS

With the consent and cooperation of the chairpersons of the Pharmacists' Associations of ''Town T'' and ''Town I'' in Japan's Kansai region, we had pharmacy directors at all member pharmacies fill out questionnaires regarding the services performed by their pharmacies. The forms were to be filled out on-site, by the respondents themselves during a two-month period in 2004 (June and July). The pharmacy directors at each drug store were asked to cooperate after giving their consent to the survey's statement of purpose, and the questionnaire responses were collected by mail. The questions pertained to the number of prescriptions they were asked to fill per month (average value during the preceding one-year period), the number of pharmacists on duty, and the actual conditions of pharmacy services. Using the 2003 Pharmacy Function Evaluation Manual Provisional Edition (published in March, 2004), prepared under commission from the Ministry of Health, Labor, and Welfare by Japan Pharmaceutical Association to promote the ''work of evaluating pharmacy functions'', we selected 16 principal categories of pharmacy services. We adopted the manual's own 4-level rating scale. Using the results, we carried out factor analysis by principal factor method (employing varimax rotation) to ascertain the factor structure of pharmacy services. We examined the internal consistency of each factor by calculating the Cronbach's coefficient alpha (which determines the extent of relatedness between question items and expresses the internal consistency of the scale as a whole[12]).

Next, we used statistical software (AMOS 5.0) to perform structural equation modeling and considered the fitness of the path model constructed to study the interrelatedness of the individual factors extracted by factor analysis. We conducted χ^2 test. As fit indices, we employed Goodness of Fit Index (GFI), Adjusted GFI (AGFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). In the factor analysis, we extracted factors with eigenvalues of 1 or higher, and factor naming and further study was carried out for items with factor loading of at least 0.5. Statistical analysis package SPSS11.5J for Windows was used for all statistical processing.

RESULTS

Attributes of Survey Subjects Responses were obtained from 111 of the 185 pharmacies (recovery rate: 60.0%). The average number of prescriptions filled per month was 1403.5, and the average number of pharmacists employed was 4.6. The exact breakdowns of figures for towns ''T'' and ''I'' are shown in Table 1.

Actual Conditions of Services at Each Pharmacy The distribution of responses regarding the 16 categories of pharmacy services and the actual conditions entailed is shown in Table 2. In this table, ''Subtotal'' indicates the total for responses ''Very active stance'' and ''active''. The categories of service that over 50% of pharmacies actively engage in are compounding, handling inquiries, providing information and in-

Table 1. Recovery Rates and Pharmacy Overview

Item	Town "T"	Town "I"
Number of questionnaires distributed	101	84
Number recovered	62	49
Recovery rate (%)	61.4	58.3
Number of prescriptions filled per month	1541.6	1230.1
Number of pharmacists employed	4.5	4.6
Full time	2.4	2.4
Part time	2.1	2.2

struction on drug administration, medication record management, providing necessary information with medication pocketbook, collecting and utilizing patient information, cooperation with medical institutions, and collecting and providing information in connection with the sale of over-the-counter (OTC) drugs. Both active and inactive pharmacies were roughly evenly matched on the following items: supplying OTC drugs, obtaining information on or introducing patients to local medical institutions, and health care services targeting community residents. The services that were actively performed by fewer

Table 2. Actual Conditions of Pharmacy Services (n=111)

Figures in each column indicate %

Pharmacy activities	No.	1) Very active stance	2) Active	Subtotal	3) Will engage in as needed	4) Do not engage in
Supplying types of over-the-counter drugs required by local residents	1	11.9	38.6	50.5	40.6	8.9
Stocking long-term care goods geared to local conditions and characteristics	2	6.9	14.9	21.8	51.5	26.7
Stocking sanitary goods geared to local conditions and characteristics	3	7.9	33.7	41.6	45.5	12.9
Visiting homes to provide guidance in consideration of patient's condition, medical history, physical constitution, living environment, etc.	4	5.9	23.8	29.7	23.8	46.5
Cooperation with other professionals (nurses, home helpers, and other service providers)	5	7.9	11.9	19.8	22.8	57.4
Gathering information on community health and welfare and providing advice to customers visiting pharmacy	6	5.0	23.7	28.7	41.6	29.7
Providing introductions to medical institutions and physicians in response to patient requests	7	11.9	38.6	50.5	38.6	10.9
Supporting community efforts to prevent lifestyle-related diseases and promote health for local residents and patients	8	8.9	43.6	52.5	28.7	18.8
Collecting and disseminating necessary information on over-the-counter drugs and making them available for sale as appropriate	9	15.8	60.4	76.2	17.9	5.9
Carrying out compounding considering improvement of medication compliance	10	37.6	46.5	84.1	11.9	4.0
Responding to inquiries as appropriate, and retaining accurate records of their content, etc.	11	45.5	50.5	96.0	4.0	0.0
Establishing a system to write and manage medication records according to set rule	12	34.6	51.5	86.1	11.9	2.0
Proactively collecting and utilizing patient information and feedbacking them to physicians as needed	13	14.9	58.4	73.3	20.8	5.9
Providing appropriate and guaranteeing the quality of dosage and administration instruction	14	16.8	72.3	89.1	10.9	0.0
Providing necessary information to patients on the proper use of the drugs dispensed with a medication pocketbook	15	23.7	58.4	82.1	15.0	3.0
Engaging in patient-centered cooperation with physicians and medical institutions	16	16.8	49.5	66.3	25.7	7.9

than 50% of pharmacies included supply of long-term care and sanitary goods, cooperation with home helpers and social workers, home visiting to manage and supervise medication, and gathering information on community health and welfare and providing advice to customers.

Factor Structure of Pharmacy Services Four factors were extracted as a result of factor analysis using the distribution of actual conditions for pharmacy services shown in Table 2 (*see* Table 3). The primary factors, which can be interpreted as ''factors related to dispensing'', had a factor contribution rate of 21.0 %. Secondary factors, those ''related to supply of goods'', had a contribution rate of 17.5%. Tertiary factors, ''related to offering home care'', contributed 17.2%. The factor contribution rate for quaternary factors, ''related to cooperation in community health and medical programs'', was 10.4%.

The contribution ratio indicates the extent to which the factor in question has power of explanation vis-à-vis the total variance. The factor contribution is calculated by squaring the factor load and taking the total for all variables; this is then divided by the number of variables to obtain the factor contribution rate.[13]

Study of Interrelatedness of Pharmacy Functions, Using Path Model Taking the 4 factors that comprise pharmacy services (''dispensing'', ''supply of goods'', ''offering home care'', and ''cooperation in community health and medical programs'') as the latent variables, we constructed a path model using the actual implementation conditions of the services included in each factor as observed variables. The results of the investigation of their goodness of fit are

Table 3. Factor Structure of Pharmacy Functions

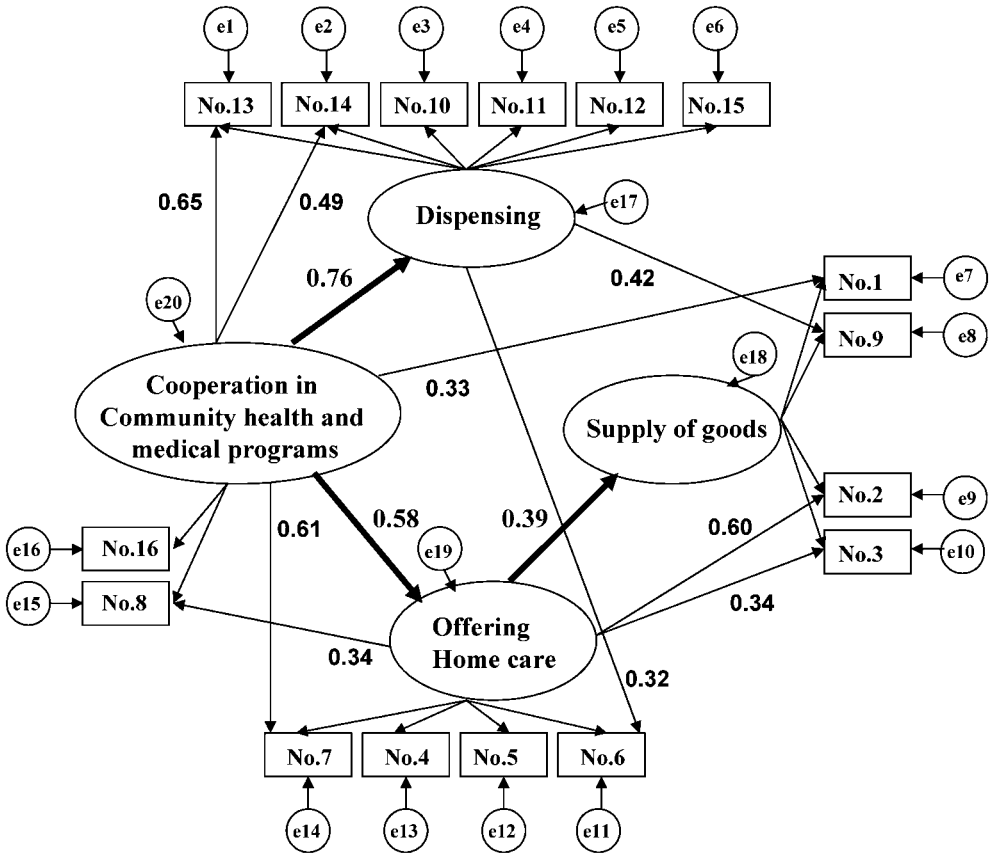
Observed variables	No.	F1	F2	F3	F4
Responding to inquiries as appropriate, and retaining accurate records of their content, etc.	11	0.82	0.06	−0.01	−0.01
Carrying out compounding considering improvement of medication compliance	10	0.77	0.09	0.25	0.04
Establishing a system to write and manage medication records according to set rule	12	0.71	0.19	−0.12	0.24
Proactively collecting and utilizing patient information and feedbacking them to physicians as needed	13	0.68	0.04	0.05	0.33
Providing appropriate and guaranteeing the quality of dosage and administration instruction	14	0.65	0.17	−0.07	0.47
Providing necessary information to patients on the proper use of the drugs dispensed with a medication pocketbook	15	0.62	−0.05	0.34	−0.19
Supplying types of over-the-counter drugs required by local residents	1	0.06	0.87	0.04	0.22
Stocking sanitary goods geared to local conditions and characteristics	3	0.05	0.83	0.26	−0.10
Stocking long-term care goods geared to local conditions and characteristics	2	0.10	0.72	0.43	−0.15
Collecting and disseminating necessary information on over-the-counter drugs and making them available for sale as appropriate	9	0.15	0.64	0.06	0.35
Cooperation with other professionals (nurses, home helpers, and other service providers)	5	0.08	0.11	0.83	0.02
Gathering information on community health and welfare and providing advice to customers visiting pharmacy	6	0.17	0.27	0.75	0.05
Visiting homes to provide guidance in consideration of patient's condition, medical history, physical constitution, living environment, etc.	4	−0.01	0.25	0.68	0.25
Providing introductions to medical institutions and physicians in response to patient requests	7	−0.01	0.04	0.60	0.49
Engaging in patient-centered cooperation with physicians and medical institutions	16	0.48	−0.06	0.30	0.61
Supporting community efforts to prevent lifestyle-related diseases and promote health for local residents and patients	8	0.14	0.40	0.33	0.57
Contribution rate		21.01	17.47	17.19	10.35
α-coefficient		0.88	0.87	0.86	0.86

shown in Fig. 1. Single-headed arrows, ellipses, rectangles, and letter ''e'' represent paths, unobserved variables, observed variables, and error respectively in Fig. 1.

Chi-square is 107.760 ($p=0.065$). The fit indices are GFI: 0.888, AGFI: 0.854, CFI: 0.967, and RMSEA: 0.049, respectively. GFI, AGFI, CFI, and RMSEA are indices of the validity or applicability of the model. In the case of GFI, AGFI, and CFI, the closer each of these indices is to 1, the better the model is considered to be. In general, it is thought best to avoid adopting any model for which RMSEA exceeds 0.1.[14] As a result of the investigation conducted on the basis of these criteria, we judged the fitness of the model we constructed to be ensured.

''Cooperation in community health and medical programs'' has a primary effect upon ''dispensing'', and ''offering home care'' (standardized coefficients of 0.76, 0.58, respectively). ''Offering home care'' also has a direct effect upon ''supply of goods'' (standardized coefficient of 0.39).

''Cooperation in community health and medical programs'' has a positive effect upon ''collecting and utilizing patient information'', ''providing appropriate instruction'', ''providing introductions to medical institutions and physicians'', and ''supplying over-the-counter drugs'' (standardized coefficients of 0.65, 0.49, 0.61, and 0.42, respectively). ''Dispensing'' has a positive effect upon ''gathering information on community health and welfare and providing advice



Chi-square=107.760 P=0.065
GFI=0.888 AGFI=0.854
CFI=0.967
RMSEA=.049

Fig. 1. Path Model
Path diagram shown the result of structural equation modeling to analyze structural features of pharmacy function.

to customers'', and ''collecting and disseminating necessary information on OTC drugs'' (standardized coefficients of 0.32, 0.42, respectively). ''Offering home care'' has a positive effect upon ''stocking long-term care goods and sanitary goods'' (standardized coefficients of 0.60, 0.34, respectively).

Effect indicators (standardized coefficients) representing effect of latent variables upon observed variables all exceeded 0.4, and the correspondence between latent variables and observed variables was appropriate.

DISCUSSION

The two towns where the survey was conducted are located midway between Osaka and Kyoto. They are typical of commuter towns that have developed as satellites of large cities. Town ''T'' has a population of about 350000 people, roughly 18% of whom are elderly, and Town ''I'', with about 260000 people, has an elderly segment of approximately 15% (both as of the end of March 2005).

No notable differences or biases were observed between the questionnaire recovery rates, number of prescriptions filled per month, or number of pharmacists employed by each drug store in towns ''T'' and ''I''.

Therefore, the results obtained in this study by analyzing the data for the two towns in an integrated manner are judged to reflect actual conditions in community pharmacies located in typical commuter towns in the suburbs of major cities.

Looking at implementation conditions for each service, we confirmed that in over 90% of the pharmacies, services such as medication record management, instruction on dosage and administration, and providing information – all of which relate to the pharmacy functioning as a ''facility for the delivery of medical care'' in connection with the filling of prescriptions – are being actively performed against the background of the growing separation of dispensing and prescribing functions. About 50% of the pharmacies were actively providing patients with information on community medical institutions or introductions to physicians, as well as supporting community efforts to prevent lifestyle-related diseases and promote good health. There are also suggestions of a growing tendency to take positive stances toward cooperation in community health and medical programs.

However, our results evidenced the fact that community pharmacy involvement in such services as visiting drug management and supervision (whether covered by medical insurance or long-term care insurance), more comprehensive supply of goods, cooperation with visiting nurses and home helpers, offering guidance about community health and welfare services, remains at low levels.

The results of the factor analysis showed how the multifaceted activities of a pharmacy could be broadly condensed into 4 main functions: ''dispensing'', ''supply of goods'', ''offering home care'', and ''cooperation in community health and medical programs''. But because the cumulative contribution rate of these 4 factors is 66.02, further polishing and elaboration of the questionnaire items would be desirable in order to better reflect actual pharmacy functions. In this study, some important services were excluded because of data distribution. They include supplying infection drugs for home infusion, cooperating with hospital/clinic pharmacists as well as those at other pharmacies, and participating in programs of lectures, etc., on the proper use of pharmaceuticals for community residents.

In the path model, the result indicated that strengthening ''cooperation in community health and medical programs'', directly improve the functions of ''dispensing'', and ''offering home care'' since standardized coefficient was relatively high (0.76, 0.58, respectively). As the background of the result, engaging in patient-centered cooperation with physicians in medical institutions and supporting community efforts to promote health for local residents enabled pharmacists to proactively collect and utilize patient information and to provide the quality of dosage and administration instruction to patients. Also, promotion of communication and information exchange among physicians and medical institution increase the possibility to accept physicians' request to home visiting.

Also, ''gathering information on community health and welfare and providing advice to customers'', and ''collecting and disseminating necessary information on OTC drugs'' can be expected as a result of direct benefits accrued by ''dispensing''.

Moreover, strengthening ''offering home care'', directly improve ''supply of goods''. The result implied that an improvement in ''stocking long-term care goods and sanitary goods'' can be expected as a

result of direct benefits accrued by ''offering home care''.

CONCLUSIONS

The results of the factor analysis showed that pharmacy activities could be broadly condensed into 4 main functions: ''dispensing'', ''supply of goods'', ''offering home care'', and ''cooperation in community health and medical programs''.

As a result of our study of the interrelatedness of pharmacy functions using structural equation modeling, we gained the following insights.

1) By strengthening ''cooperation in community health and medical programs'', it is possible to directly improve the functions of ''dispensing'', and ''offering home care''.

2) By strengthening ''offering home care'', it is possible to directly improve ''supply of goods''.

We can thus conclude that the areas meriting priority in the expansion and upgrading of pharmacy functions to facilitate home care are stronger ''cooperation in community health and medical programs''.

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