Constructs of the Collaboration between Hospital and Community Pharmacists: Findings from Community Pharmacist Perspective Using Multivariate Analysis and Structural Equation Modeling

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Summary

Collaborations between hospital and community pharmacists play a key role in ensuring consistent continuation of pharmacotherapy within official medical care plans designed to promote community-based healthcare. A previous study conducted by the authors clarified the constructs of collaboration between the hospital and community pharmacists from the hospital pharmacist's perspective. In this study, a similar questionnaire was used to survey a group of pharmacies with 424 outlets nationwide, and 244 responses were collected. Factor analysis from the community pharmacists’ perspective extracted five latent factors comprising 18 variables, and structural equation modeling yielded a model with a high goodness-of-fit. In the latter model, variables representing “Organizational climate” and “Basic policy on collaboration” formed the foundation of the collaboration between hospital and community pharmacists, while variables representing “Understanding of healthcare policy,” “Resources for collaboration,” and “Community support systems” represented concepts that flexibly compensated for fluctuations in medical policy. These trends were similar to those of the constructs previously indicated by hospital pharmacists. We performed multiple regression analysis and structural equation modeling to confirm the impact of the inclusion of “Need for collaboration” as a dependent variable on the proposed constructs of hospital-community pharmacist collaboration using different analytical methods. Our results indicated that “Organizational climate,” “Basic policy on collaboration,” and “Community support systems” affected the “Need for collaboration”. Our findings indicate that future studies are needed to confirm and clarify the causal relationships demonstrated by the constructs of hospital-
community pharmacist collaboration seen within the current study.

**Keywords**

latent factor; multivariate analysis; structural equation modeling; community pharmacist
Introduction

The separation between prescribing and dispensing practices is based on a physician's or dentist's diagnosis, and the community pharmacy dispensing and auditing the prescription from an independent standpoint. The separation of prescribing and dispensing practices, in Japan, effectively began in 1974 as a national policy. As of February 2021, 76.9% of all prescriptions issued nationwide are handled by community pharmacies. 1) According to a summary of the 2019 Report on Public Health Administration and Services, there are over 60,000 pharmacies operating in Japan. 2) In addition to playing an important role in providing medical and pharmaceutical products, community pharmacies are increasingly expected to contribute to community medical care.

The "Pharmacy Vision for Patients," formulated in 2015, 3) states that community pharmacies should uniformly and continuously monitor patients' medication information and promote further pharmacological management and guidance from collaboration with medical institutions. Additionally, the 2020 revision of the Act on Securing the Quality, Efficacy, and Safety of Products Including Pharmaceuticals and Medical Devices (The Pharmaceuticals and Medical Devices Act) established a new system for certifying pharmacies that collaborate with specialist medical institutions. 4) This revision indicated that specialized pharmaceutical management for conditions such as cancer, human immunodeficiency virus (HIV), or intractable diseases should be addressed proactively by community pharmacies. Therefore, as patient-centered information for services must be collected through active collaborations with
relevant organizations, including specialist medical institutions, a larger number of community pharmacies are emphasizing collaborations with hospital pharmacists.

To date, there have been some reports that evaluate the collaborations between hospital and community pharmacists. These reports were conducted in Japan as well as in other countries. The latter reports have demonstrated the need for establishing collaborative relationships between hospital and community pharmacists in order to maintain and improve medication management after hospital discharge; they have also identified and emphasized the importance of mutual information sharing. Meanwhile, reports from Japan have discussed efforts for collaborations between hospital and community pharmacists, such as in a case study in which hospital-community pharmacist collaborations formed a successful basis for promoting positive economic effects among outpatients. To the best of our knowledge, this is the first study conducted in order to clarify what constructs are necessary in order to establish such effective collaborations.

In a previous study, we conducted a survey evaluating constructs of collaboration between municipal hospital pharmacists and community pharmacists and proposed a structural model for evaluating these constructs from the hospital pharmacist's perspective. Because the collaboration between hospital and community pharmacists comes from a mutual relationship, it was necessary to consider the perspective of the community pharmacist. Moreover, we believe that considering our mutual perspectives could provide essential additional information.
contributing to the promotion and optimization of medical collaboration that is necessary to optimize healthcare delivery across Japan.

Therefore, in the current study, our aim was to clarify the constructs of collaboration between hospital and community pharmacists from the perspective of community pharmacists. Additionally, the influence of the constructs on the overall evaluation was confirmed in an exploratory manner.

**Materials and Methods**

1. Survey Methodology

We used a web-based survey format, Google Forms, to create the questionnaire for the study survey. The questionnaires were collected, and the responses tabulated. The survey was administered between October 27 and November 30, 2020. Eligible survey participants were pharmacist managers at any of the 424 Nanohana Pharmacy stores, a nationwide pharmacy chain operated by Medical System Network Co., Ltd (Sapporo, Japan).

The inclusion criteria for this study were pharmacies with stores nationwide, with good intranet for information sharing, and pharmacies that focused on active involvement and education in collaboration between the hospital and community pharmacists, which the Nanohana Pharmacy met.

This study was approved by the ethics review board of the Matsudo City Hospital Group
(approval no. R2-23) and was conducted in accordance with the previously published Ethical Guidelines for Medical Research Involving Human Subjects; the study adhered to the guidelines of this medical center, as well as the principles of the Declaration of Helsinki and its later amendments. We provided an overview on the top screen of the survey and obtained consent to participate in the survey. We ensured that participants could withdraw from the survey at any time without facing any adverse consequences or cancellation of benefits to which they were otherwise entitled.

2. Selection Measures

In terms of collaborations between hospital and community pharmacists, the extent of collaborations varies according to an individual’s interpretation of collaboration. In the current study, the items measuring constructs of hospital-community pharmacist collaborations were adapted from a questionnaire developed for use in our previous study among hospital pharmacists. As mentioned above, the questionnaire content was partially revised for community pharmacists (Table 1). To examine potential causal relationships between the evaluated constructs, we added “Need for collaboration” as a new comprehensive evaluation measure within the 33-item questionnaire. Each item was rated on the following five-point Likert scale: “strongly agree,” “agree,” “neither agree nor disagree,” “disagree,” or “strongly disagree.”

3. Statistical Analysis
3.1 Descriptive Statistics

We calculated descriptive statistics for respondents’ basic medical and demographic characteristics. We likewise checked for response distributions as well as ceiling and floor effects for each measure evaluated within the questionnaire.

3.2 Exploratory Factor Analysis

The number of relevant factors was estimated using Hori’s method (sandwiching parallel analysis) based on squared multiple correlation (SMC) and minimum average partial (MAP) methodologies.\(^{34}\) Factor analysis using the maximum likelihood method and Promax rotation was performed based on the derived number of factors. The analysis was repeated until the factor interpretation was optimized.

3.3 Scale Reliability

After reviewing reverse-scored items, Cronbach’s \(\alpha\) was calculated as a measure of reliability and was used to confirm internal consistency.

3.4 Confirmatory Factor Analysis

We performed a path analysis based on structural equation modeling to evaluate latent variables as well as associated variables obtained through exploratory factor analysis. Structural equation modeling aims to construct a visual model demonstrating causal relationships and can suggest an optimal model using fit indices. Here, statistical analyses were performed using a
hypothetical model set with covariance between each latent variable, such that the observed variable would be affected by the corresponding latent factor. We built a model based on components of hospital-community pharmacist collaborations after revising the hypothetical model based on the overall goodness of fit obtained and partial evaluation statistics. The chi-square test was used to examine the model’s overall goodness of fit using the following indices, the goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). Partial model evaluations were conducted after assessing partial correlations between path coefficients using t-tests.

3. 5 Multiple Regression Analysis and Structural Equation Modeling

Multiple regression analysis is a statistical technique in which a single dependent variable is predicted and explained using multiple independent variables. Herein, we conducted an analysis with “Need for collaboration” as the dependent variable. We obtained mean scores with respect to the items included within each latent variable as independent variables. The variance inflation factor (VIF) was calculated to check for multicollinearity in these analyses. Additionally, “Need for collaboration” was added to the conceptual construct model of collaboration between hospital pharmacists and community pharmacists obtained from confirmatory factor analysis and compared with the results of multiple regression analysis.

Descriptive statistics, exploratory factor analysis, and multiple regression analysis were performed using SPSS statistical software (version 28.0, IBM Corp., Armonk, N.Y., USA).
Structural equation modeling was performed using SPSS Amos structural equation modeling software (version 27.0, IBM Corp., Armonk, NY, USA).

**Results**

1. Descriptive Statistics

Of the 424 eligible facilities, data from 244 individuals collected prior to November 30, 2020, were included in the analysis. Respondent sex, age group, career information, and work location are shown in Table 2. Most participants had fewer than 10 years of experience in managerial positions. Respondents were located in 31 different regions.

Descriptive statistics revealed ceiling effects for Question 2 (“Information sharing”), Question 5 (“Attitude of compromise”), Question 16 (“Trust from hospitals”), and Question 17 (“Trust in hospitals”), as well as a high standard deviation for Question 26 (“Attitude of service”). These five items were excluded from the factor analysis in consideration of their distributions and contents (Table 3).

2. Exploratory Factor Analysis

Factor analysis using the maximum likelihood method and Promax rotation was performed for 27 items, after excluding the five aforementioned items with a high standard deviation or confirmed ceiling effects. The number of relevant factors was determined with reference to the parallel analysis via SMC and MAP sandwiching methodologies previously proposed by Hori.
The five factors believed to be most suitable for this evaluation were selected from among the three factors identified via MAP and the seven factors identified via SMC. Factor extraction was performed by repeating analyses, aiming towards a factor loading of 0.45 or higher. This process resulted in the extraction of 18 items (Table 4).

Factor 1 comprised the following five items: “Awareness activities,” “Changes in awareness,” “Organizational climate promoting autonomy,” “Professionalism,” and “Human resource development,” and was thus termed “Organizational climate.” In contrast, Factor 2 comprised the following five items: “Use of information,” “Unifying the purpose,” “System of cooperation,” “Equal footing,” and “Risk management system,” and was thus termed “Basic policy on collaboration.” Factor 3 comprised the following three items: “Pharmacy vision for patients,” “Community comprehensive care system,” and “Controlling medical costs,” and was thus termed “Understanding of healthcare policy.” Factor 4 comprised the following three items: “Assign a person,” “Secure a time,” and “Face-to-face relationship,” and was thus termed “Resources for collaboration.” Factor 5 comprised the following two items: “System to ensure health” and “Safety and security,” and was thus termed “Community support system.”

3. Scale Reliability

Within the reliability analysis, Cronbach’s $\alpha$ coefficients were 0.896 for “Organizational climate,” 0.873 for “Basic policy on collaboration,” 0.852 for “Understanding of healthcare policy,” 0.726 for “Resources for collaboration,” and 0.919 for “Community support system.” Although Cronbach’s $\alpha$ coefficient was below 0.800 for Factor 4, all factors showed adequate

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4. Confirmatory Factor Analysis

Structural equation modeling was used to confirm the relationships between the five aforementioned latent variables and the 18 extracted variables. We constructed Model I assuming that each item would be impacted by its corresponding factor (Fig. 1). Model I was revised to Model II in order to further improve goodness of fit and maintain theoretical consistency (Fig. 2).

All path coefficients connecting latent variables to observed variables were statistically significant at the 0.1% level, in Model I. We found a $\chi^2$ value of 262.834, a GFI of 0.893, an AGFI of 0.854, a CFI of 0.952, and an RMSEA of 0.067 with respect to this model. There were no issues with regard to partial assessments. However, this model required improvements in terms of overall accuracy. Accordingly, we considered adding paths and error covariance with reference to methodologic papers published by Kano, Haebara, and colleagues.35-37)

In Model II, we added four new paths. Three paths from Factor 3 (“Understanding of healthcare policy”) to the following variables: “Human resource development” ($p<0.001$), “Risk management system” ($p<0.01$), and “Assign a person” ($p<0.01$), as well as one path from Factor 5 (“Community support system”) to the following variables: “Face-to-face relationship”
(p<0.001), while confirming factor loadings, path coefficients, and p-values.

Next, we explored variables with high error covariance coefficients according to a statistical significance level of 5%. As a result, error covariance was added between the following items: “Pharmacy vision for patients” and “Safety and security” (p<0.001), as well as “Community comprehensive care system” and “Safety and security” (p<0.01). We found a χ² value of 214.917, a GFI of 0.913, an AGFI of 0.875, a CFI of 0.967, and an RMSEA of 0.058 in this evaluation. All indices were improved, and the model was thus successfully revised to have good fit and accuracy in both the partial and overall assessments.

5. Multiple Regression Analysis and Structural Equation Modeling

Structural equation modeling suggested a conceptual model comprised of five latent variables. To confirm the effects of this construct model, we performed multiple regression analysis using “Need for collaboration” as the dependent variable. For independent variables, the observed variables associated with the latent variables within Model I were averaged into subscale scores (Table 5).

All five independent variables demonstrated positive values, with “Organizational climate” (p<0.001), “Basic policy on collaboration” (p<0.001), and “Community support system” (p<0.05) demonstrating a statistically significant effect on the dependent variable. “Understanding of healthcare policy” and “Resources for collaboration” showed some effect
but did not reach the level of statistical significance. The VIF of all independent variables was below three, suggesting that there were no major issues with multicollinearity due to correlations between independent variables. However, because the independent variables represent the averages of the observed variables, they are believed to be inadequate for obtaining a deeper understanding of causal relationships. Accordingly, “Need for collaboration” was added to Model II for comprehensive evaluation, and the effects of the five latent variables were confirmed using structural equation modeling (Table 6).

Although adding “Need for collaboration” to Model II resulted in a slight decrease in the evaluated GFIs, the model’s overall indices and partial assessments remained at an adequate level (Fig. 3). All the newly added paths showed positive values, and the paths from “Organizational climate” to “Need for collaboration” ($p<0.001$) as well as from “Basic policy on collaboration” to “Need for collaboration” ($p<0.01$) demonstrated statistically significant effects. “Community support system” was found to have an effect on “Need for collaboration,” although this path did not show a statistically significant difference. We note that statistically significant differences were likewise not found with respect to “Understanding of healthcare policy” or “Resources for collaboration,” and that the observed effects on “Need for collaboration” were weak.

Similar results were obtained within multiple regression analysis and structural equation modeling. Our results suggested that the “Organizational climate,” “Basic policy on
collaboration,” and “Community support system” variables have a statistically significant effect on “Need for collaboration.”

Discussion

The current study investigated the constructs of collaboration between hospital and community pharmacists from the perspective of community pharmacists, with reference to our previously conducted investigation; we likewise proposed a construct model using factor analysis and structural equation modeling. Multiple regression analysis and structural equation modeling were used to determine the effects of the construct model on the study dependent variable (“Need for collaboration”) using different analytic methodologies.

Scrupulous repetition of the factor analysis and close examination of the observed variables led to the extraction of eighteen items with high factor loading. Following this, latent variables representing “Organizational climate,” “Basic policy on collaboration,” “Understanding of healthcare policy,” “Resources for collaboration,” and “Community support system” were derived from among the eighteen aforementioned variables. The “Organizational climate” variable represents fundamental concepts such as awareness, attitude, and behavior as a pharmacist. The “Basic policy on collaboration” variable represents the relationships that allow community and hospital pharmacists to share information appropriately, including systems and policies for promoting collaboration. These two concepts are believed to form the nucleus of hospital-community pharmacist collaborations and, in the present study, showed trends similar
to those reported from the perspective of hospital pharmacists.\textsuperscript{7)}

Next, “Understanding of healthcare policy” refers to a keen awareness of national healthcare policy, such as the recent revision of the payment system for medical services. Meanwhile, “Resources for collaboration” and “Community support system” refer to elements necessary for community pharmacists to collaborate as well as to be perceived as a familiar presence by patients and members of the community. Awareness of national healthcare policy is essential for both hospital and community pharmacists.

Despite their different standpoints, both types of pharmacists appear to have an attitude of flexibility that is, adapting to policy changes. However, due to their closer interactions with patients, community pharmacists have a differing perspective from that of hospital pharmacists and therefore may be more likely to raise timely and topical concerns that should be addressed when establishing and promoting collaborations. However, these three concepts are expected to change in the future due to shifts in healthcare policy, improvements in medical technology, and demands from patients. Thus, it may be necessary for community and hospital pharmacists to work together to establish more practical hospital-community pharmacist collaborations. In this sense, we believe that targeting pharmacies that are actively involved in collaboration between hospital and community pharmacists provided meaningful information.

We evaluated the constructs of collaboration between hospital and community pharmacists via
structural equation modeling with respect to latent variables derived through exploratory factor analysis. Model I was only a foundational model. However, this model already showed an adequate goodness of fit. Nevertheless, focusing on the observed variables associated with “Understanding of healthcare policy” that had high factor loadings, we considered the addition of new paths while monitoring p-values. It was also necessary to check for error covariance, as we had used a questionnaire adapted from our prior study. Adding error covariance tends to improve fit indices, but at the same time suggests room for improvement in construct measures.

In light of the above factors, we added both paths and error covariance in building Model II, which was consequently improved in terms of both partial and overall assessments. In the model proposed herein, the latent variables demonstrated high positive correlation coefficients. This result is similar to that of the model derived from our prior study of hospital pharmacists. However, the model for community pharmacists described herein appears to demonstrate a more stable structure with consideration of the balance between the observed variables obtained from the evaluated latent variables.

In addition to proposing a construct model for collaboration between hospital and community pharmacists, we confirmed the effect of each latent variable herein. More specifically, we performed multiple regression analysis with “Need for collaboration” as the dependent variable to confirm the effects arising from the constructs. “Organizational climate” and “Basic policy on collaboration” formed the nucleus of collaboration between hospital and community pharmacists and had statistically significant impacts on the dependent variable (“Need for
collaboration”). “Community support system” was believed to have an effect on the dependent variable due to the fact that community pharmacists are a familiar presence to patients and are typically perceived as being responsible for community medical care. Meanwhile, “Understanding of healthcare policy” and “Resources for collaboration” had weak effects on the dependent variable and did not reach the level of statistical significance.

All five independent variables had VIF values \( \leq 3 \), suggesting a minimal possibility of multicollinearity. However, there is no way to effectively address multicollinearity at this stage,\(^{38}\) and the reliability of obtained partial regression coefficients is usually never perfect. Moreover, because the independent variables were based on the average values of the observed variables, it was difficult to confirm the effects of the evaluated constructs with respect to hospital-community pharmacist collaboration on the dependent variable through multiple regression analysis alone. Accordingly, the aforementioned dependent variable was added to Model II and a supplemental confirmatory analysis was performed via structural equation modeling.

Among the paths added to “Need for collaboration” from the five latent variables, the paths from “Organizational climate” and “Basic policy on collaboration” showed statistically significant effects. “Community support system” likewise had a positive effect, although not at the level of statistical significance. Meanwhile, “Understanding of healthcare policy” and “Resources for collaboration” demonstrated low path coefficients and no statistically
significant differences, suggesting that their impact on the dependent variable was weak. A comparison of multiple regression analysis and structural equation modeling findings showed similar results, thus successfully confirming the impact of the evaluated constructs with respect to hospital-community pharmacist collaborations on the study dependent variable through different analytic methodologies. At the same time, it was determined from the results of the structural equation modeling that there were no concerns with the reliability of the partial regression coefficients due to multicollinearity.

In addition to the previously established concept of the collaboration between hospital and community, the results from the community pharmacy reported in this study enabled us to examine the concept from both perspectives. In addition, we believe that the comparison between multiple regression analysis and structural equation modeling has proposed new possibilities. Despite these findings, this study has some limitations. First, the survey was administered to members of community pharmacists employed at a company operating a chain of 424 pharmacies, and thus does not represent the experiences of pharmacists employed at other pharmacy chains or at privately operated pharmacies. Second, the survey did not include variables representing the medical care environment or regional characteristics and thus may not have suggested the most practical and optimal constructs. Third, our scrupulous repetition of the factor analysis led to the loss of many observed variables, and we likewise found room for improvement with respect to the measures used to evaluate hospital-community pharmacist collaborations. Accordingly, it is necessary to integrate constructs relevant to community and
hospital pharmacists and to propose constructs that are not impacted by problems specific to the medical care environment or regional characteristics in future research. Collecting new information and using improved measures for evaluating hospital-community pharmacist collaborations will contribute to the promotion of collaborations between hospital and community pharmacists and thus improve healthcare delivery and patient care in the future.

Conclusion

In this study, we extracted five concepts of collaboration between hospital and community pharmacists from the perspective of community pharmacists using factor analysis and structural equation modeling. Among these five concepts, “Organizational climate” and “Basic policy on collaboration” formed the foundation for hospital-community pharmacist collaboration, while “Understanding of healthcare policy,” “Resources for collaboration,” and “Community support system” were comprised of concepts relevant to compensating for fluctuations in healthcare policy. These concepts showed similar trends to the constructs demonstrated in our prior study of hospital pharmacists. We then used multiple regression analysis and structural equation modeling to attempt to determine the effects of the proposed constructs on the study’s dependent variable (“Need for collaboration”) through different analytic methodologies. Our results confirmed the effects of “Organizational climate,” “Basic policy on collaboration,” and “Community support system” on “Need for collaboration,” and thus successfully identified meaningful associations informing the promotion of hospital-community pharmacist collaborations to improve healthcare delivery. Our findings guide future
research directions and directly inform health policy decisions.
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Conflicts of Interest

Tatsuhiko Suzuki is an employee of MEDICAL SYSTEM NETWORK Co., Ltd. Kenji Takahashi, Kengo Kojima, Rie Nakajima, and Fumiyuki Watanabe declare that they have no conflict of interest.
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Fig. 1
Title: Model I
Legends: $\chi^2 = 262.834; \text{GFI} = 0.893; \text{AGFI} = 0.854; \text{CFI} = 0.952; \text{RMSEA} = 0.067$

Fig. 2
Title: Model II
Legends: $\chi^2 = 214.917; \text{GFI} = 0.913; \text{AGFI} = 0.875; \text{CFI} = 0.967; \text{RMSEA} = 0.058$

Fig. 3
Title: Structural equation monitoring with dependent variable added
Legends: $\chi^2 = 244.808; \text{GFI} = 0.906; \text{AGFI} = 0.865; \text{CFI} = 0.964; \text{RMSEA} = 0.059$
| Factor                              | Question items                                                                 | Item abbreviation                  |
|------------------------------------|-------------------------------------------------------------------------------|-----------------------------------|
| Information sharing                | 1. I think we need to unify the purpose of our information sharing.            | Unify the purpose                 |
|                                    | 2. I think there needs to appropriate information sharing.                    | Information sharing               |
|                                    | 3. I think it is necessary to hold joint conferences on a regular basis.      | Joint conference                  |
|                                    | 4. I think it is necessary to make appropriate use of information mutually.   | Use of information                |
|                                    | 5. I think we need to have a mutual attitude of compromise.                   | Attitude of compromise            |
|                                    | 6. I think we need to discuss this as pharmacists on an equal footing.        | Equal footing                     |
|                                    | 7. I think we need to check with each other about medical resources and services.| Medical resources and services   |
|                                    | 8. I think it is necessary to have a system of cooperation across the board.  | System of cooperation             |
|                                    | 9. I think we need a risk management system that minimizes the disadvantages of collaboration. | Risk management system |
|                                    | 10. I think there needs to be a clear system of responsibility on both sides. | System of responsibility          |
|                                    | 11. I think it is necessary to assign a person to serve as a mutual contact point. | Assign a person                   |
|                                    | 12. I think we need to secure a time for collaboration.                       | Secure a time                     |
|                                    | 13. I think we need to secure a budget for collaboration.                     | Secure a budget                   |
|                                    | 14. I think a new collaborative item (e.g., tracing report) needs to be established. | New collaboration item           |
|                                    | 15. I think that a mutual "face-to-face relationship" is necessary.           | Face-to-face relationship         |
|                                    | 16* I think we need to have trust from hospitals.                             | Trust from hospitals              |
|                                    | 17* I think we need to have trust in hospitals.                               | Trust in hospitals                |
|                                    | 18. I think it is necessary to understand the regional characteristics.      | Regional characteristics          |
|                                    | 19. I think it is necessary to give consideration to the safety and security of local residents. | Safety and security   |
|                                    | 20. I think we need a system to ensure the health of local residents.        | System to ensure health           |
|                                    | 21. I think we need a proper understanding of the “pharmacy vision for patients.” | Pharmacy vision for patients     |
|                                    | 22. I think it is necessary to have a correct understanding of the community comprehensive care system. | Community comprehensive care system |
|                                    | 23. I think it is necessary to take the perspective of controlling medical costs. | Controlling medical costs         |
|                                    | 24. I think it is necessary to establish a new medical fee.                  | New medical fee                   |
|                                    | 25. I think that policy induction by the government is necessary.             | Policy induction                  |
|                                    | 26. I think we need to have an attitude of service in our collaboration.     | Attitude of service               |
|                                    | 27. I think pharmacists need to be professional.                             | Professional                      |
|                                    | 28. I think what you need as a pharmacist is the ability to execute.         | Ability to execute                |
|                                    | 29. I think it is necessary to develop human resources who will be responsible for collaboration. | Human resource development         |
|                                    | 30. I think there is a need to awareness activities in the workplace about collaboration. | Awareness activities             |
|                                    | 31. I think we need to changes in the awareness for collaboration.          | Changes in awareness              |
|                                    | 32. I think we need an organizational climate where people can think and act on their own. | Organizational climate that promotes autonomy |
| Comprehensive evaluation           | 33. I think we need to promote and activate the collaboration between hospital and community pharmacists. | Need for collaboration          |

*The questions in 16 and 17 were modified for community pharmacies.
Table 2. Respondent attributes (N=244)

| Characteristics (Number of prefecture) | Responses | Non-responses |
|----------------------------------------|-----------|---------------|
| Work location                          | 244(31)   | 0             |

| Characteristics | n  |
|-----------------|----|
| Sex             |    |
| Male            | 121|
| Female          | 123|
| Age             |    |
| 20-29           | 18 |
| 30-39           | 111|
| 40-49           | 74 |
| 50-59           | 36 |
| ≥60             | 5  |
| Career*         |    |
| 0-4             | 109|
| 5-9             | 80 |
| 10-14           | 25 |
| 15-19           | 12 |
| 20-24           | 12 |
| 25-29           | 5  |
| ≥30             | 1  |

*Years of service as a manager
| Item Abbreviation                              | Min | Max | Mean | SD  |
|----------------------------------------------|-----|-----|------|-----|
| 1 Unify the purpose                          | 2   | 5   | 4.13 | 0.696|
| 2 Information sharing                        | 2   | 5   | 4.34 | 0.670*|
| 3 Joint conference                           | 1   | 5   | 3.80 | 0.849|
| 4 Use of information                         | 2   | 5   | 4.16 | 0.673|
| 5 Attitude of compromise                     | 2   | 5   | 4.32 | 0.683*|
| 6 Equal footing                              | 2   | 5   | 4.13 | 0.723|
| 7 Medical resources and services             | 2   | 5   | 4.34 | 0.661|
| 8 System of cooperation                      | 2   | 5   | 4.09 | 0.709|
| 9 Risk management system                     | 2   | 5   | 4.18 | 0.687|
| 10 System of responsibility                  | 2   | 5   | 3.96 | 0.744|
| 11 Assign a person                           | 1   | 5   | 3.88 | 0.860|
| 12 Secure a time                             | 1   | 5   | 4.23 | 0.766|
| 13 Secure a budget                           | 1   | 5   | 3.70 | 0.902|
| 14 New collaboration item                    | 1   | 5   | 4.15 | 0.718|
| 15 Face-to-face relationship                 | 1   | 5   | 4.09 | 0.853|
| 16 Trust from hospitals                      | 1   | 5   | 4.36 | 0.709*|
| 17 Trust in hospitals                        | 1   | 5   | 4.33 | 0.714*|
| 18 Regional characteristics                 | 2   | 5   | 4.17 | 0.709|
| 19 Safety and security                       | 2   | 5   | 4.27 | 0.650|
| 20 System to ensure health                   | 2   | 5   | 4.24 | 0.649|
| 21 Pharmacy vision for patients              | 1   | 5   | 4.00 | 0.745|
| 22 Community comprehensive care system       | 1   | 5   | 4.07 | 0.711|
| 23 Controlling medical costs                 | 1   | 5   | 3.82 | 0.801|
| 24 New medical fee                           | 1   | 5   | 3.47 | 0.913|
| 25 Policy induction                          | 1   | 5   | 3.74 | 0.877|
| 26 Attitude of service                       | 1   | 5   | 3.35 | 1.014**|
| 27 Professional                              | 1   | 5   | 4.15 | 0.761|
| 28 Ability to execute                        | 2   | 5   | 4.21 | 0.692|
| 29 Human resource development                | 1   | 5   | 4.14 | 0.737|
| 30 Awareness activities                      | 1   | 5   | 4.01 | 0.720|
| 31 Changes in awareness                      | 2   | 5   | 4.11 | 0.679|
| 32 Organizational climate that promotes autonomy | 1   | 5   | 4.11 | 0.731|
| 33 Need for collaboration                    | 2   | 5   | 4.16 | 0.693|

*Ceiling effect
**Subject of exclusion
Table 4. Results of factor analysis

| Item abbreviation | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|-------------------|----------|----------|----------|----------|----------|
| 30 Awareness activities | .910 | .027 | -.033 | -.094 | -.029 |
| 31 Changes in awareness | .879 | .007 | -.013 | .045 | -.063 |
| 32 Organizational climate that promotes autonomy | .872 | -.040 | .013 | -.033 | .076 |
| 27 Professional | .637 | .009 | -.023 | .011 | .175 |
| 29 Human resource development | .519 | .078 | .229 | .134 | -.179 |
| 4 Use of information | -.004 | .968 | -.040 | -.020 | -.040 |
| 1 Unify the purpose | .097 | .734 | .046 | -.138 | .001 |
| 8 System of cooperation | .006 | .536 | .102 | .126 | .087 |
| 6 Equal footing | -.004 | .526 | .047 | .146 | .001 |
| 9 Risk management system | -.063 | .481 | .233 | .114 | .108 |
| 21 Pharmacy vision for patients | -.010 | .024 | .913 | -.096 | .075 |
| 22 Community comprehensive care system | .035 | .025 | .853 | .065 | -.049 |
| 23 Controlling medical costs | .018 | .061 | .566 | -.031 | .052 |
| 11 Assign a person | -.068 | -.154 | .210 | .753 | -.047 |
| 12 Secure a time | -.014 | .135 | -.176 | .735 | -.056 |
| 15 Face-to-face relationship | .159 | .027 | -.107 | .538 | .204 |
| 20 System to ensure health | -.006 | .090 | -.017 | -.050 | .977 |
| 19 Safety and security | .025 | -.071 | .228 | .028 | .718 |

Cronbach’s α: .896 .873 .852 .726 .919

Factor correlation matrix

| Factor | 1     | 2     | 3     | 4     | 5     |
|--------|-------|-------|-------|-------|-------|
| 1      | 1.000 | .640  | .588  | .552  | .587  |
| 2      |       | 1.000 | .705  | .674  | .701  |
| 3      |       |       | 1.000 | .600  | .688  |
| 4      |       |       |       | 1.000 | .538  |
| 5      |       |       |       |       | 1.000 |
### Table 5. Results of multiple regression analysis

| Dependent variable | Independent variable                      | B     | SE B | β     | VIF  | \( R^2 \) |
|--------------------|-------------------------------------------|-------|------|-------|------|-----------|
| Organizational climate | 0.329                                      | 0.066 |      | 0.290*** | 1.840 |           |
| Basic policy on collaboration | 0.401                                      | 0.088 |      | 0.329*** | 2.779 |           |
| Understanding of healthcare policy | 0.061                                      | 0.069 |      | 0.059    | 2.313 | 0.557*** |
| Resources for collaboration  | 0.061                                      | 0.058 |      | 0.059    | 1.656 |           |
| Community support system   | 0.155                                      | 0.075 |      | 0.140*   | 2.434 |           |

\( B \): partial regression coefficient  
\( SE B \): Standard error of \( B \)  
\( \beta \): Standardized partial regression coefficient  
\( VIF \): Variance inflation factor  
\( R^2 \): Coefficient of determination

* \( p < 0.05 \), ** \( p < 0.01 \), *** \( p < 0.001 \)
Table 6. Standardized estimates from structural equation modeling

| Dependent variable | Independent variable                     | Standardized estimate | SE  |
|--------------------|------------------------------------------|-----------------------|-----|
| 33 Need for collaboration | Organizational climate | 0.293*** | 0.079 |
|                    | Basic policy on collaboration         | 0.376**               | 0.143 |
|                    | Understanding of healthcare policy     | 0.045                 | 0.084 |
|                    | Resources for collaboration            | 0.046                 | 0.119 |
|                    | Community support system               | 0.116                 | 0.090 |

*SE: Standard error  
*p <0.05, **p <0.01, ***p <0.001*
Fig. 1. Model I
Fig. 2. Model II
Fig. 3. Structural equation monitoring with dependent variable added