ISSN 2435-0990

看護経済・政策研究学会誌
Journal of Nursing Economics and Policies

Vol. 2 No. 1 (2019)

看護経済・政策研究学会
Japan Society of Nursing Economics and Policies

研究ノート

Does community nursing care really make population's health better? Primitive analysis using individual data of national datasets

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（受付：2019 年 3 月 25 日　採択：2019 年 7 月 10 日）

【Abstract】

Shifting from hospital to community due to growing the importance of community-based holistic care provision had been common in developed countries. While it is critical to know whether improving community-based nursing care provision really make health status of residents better, no previous studies provide the answer to this question. Therefore, we tried to assess patient outcomes generated by nurse-led intervention through the pooled information of health status and provision density of intervention by national database.

After descriptive and econometric analysis, we found that the more total number of physician (engaging quasi primary care) increased in community, the more total score of Life-Related Disease (LRD) increased but mental illness decreased. In contrast, the more total number of community nursing services (home visit nursing) increased, the more holistic awareness of bad health status in population decreased. However, we could find no evidence of both professions' contribution on easing mental stress in community population. Further, both in physician and nurse provision, geographic attribute like high population density have strongly negative impact on population's better health. In spite of several limitations, our study suggested the requirement of re-building closer relationship between physician and nurse in community for making health status of community residents.

Key words: Nurse-led community care, Qusai primary care physician, Home visit nursing, Self-reported health status, National survey dataset

Background

As a global context, the place of patient care has been shifting from hospital to community due to growing awareness of the importance of community-based holistic care provision and the shortage of physicians. Japanese government, like other developed countries, takes first step into rebuilding care system from physician centered hospital care to team or nurse-led community care in order to establish seamless transaction from cure to care by reconstruction of adequate skill-mix.

When we intend to change care environment from bed-bounded to community basis, what kind of clinical outcome

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indicators should be selected is very critical. While mortality, morbidity or average life expectancy are the most popular so far because its objectivity and comparability[1)2)], these indicators does not identify nurse‐ specified effectiveness because almost all of these clinical outcomes seemed to be induced mainly by physician's interventions or prescriptions. Recent interests of health services researchers encourage to increase the number of scrutinized researches addressing to the relationship between nurse‐led intervention and clinical effectiveness or outcome of the population living in community. The most of the case, however, should be focused its research subject on particular illness or symptom(s) due to the necessity of "controlled" environment to assess the effectiveness whether intervention implemented. But, if we want to know more about holistic figures of community residents, specifying illness or symptoms may not be sufficient sense.

As WHO remarks[3)], it would be better if we will be able to grasp the subjective or self‐reported health status of population basis because those who have problems physically do not always feel bad mentally, vise a versa. Unfortunately quite a less number of studies have tried to assess the relationship between nurse‐led intervention and community population health status through subjective or self‐reported indicators. Particularly it is very critical to know whether improving community‐based nursing care provision really make holistic health status of residents better. However, no previous studies provide us the answer. Therefore, in order to capture primitive answer to this question, we tried to conduct community level assessment of patient outcomes generated by nurse‐led intervention through the information of pooled score of subjective/self‐reported health status and provision density of intervention in community reported by national data base.

Aim of the study

This study aims to assess, in Japanese context, the contribution of community‐based nurse‐led intervention on the health and consciousness of populations through comparative analysis among the primary care physician and home visiting nurse by using individual based national data set of ***Comprehensive Survey of Living Conditions*** and ***Survey of Medical Institutions***. The main research question in this study is to know whether, to what extent, home visiting nursing services contribute to improve community residents' holistic health status assessed by subjective health status indicators including self‐evaluated physical and mental conditions, comparing to physician care by employing pooled health score as an outcome and the density of workforce provision as impact factor in community.

This research question contains two research perspectives ; one is to follow up the previous findings of the effectiveness of physician substitution by nurse and, second, is to assess which clinical area of care subjects might be really effective by nurse‐led care intervention compare to physician intervention.

Previous studies

The clinical effectiveness or outcomes by nurse‐led care has been assessed in several perspectives so far ; nurse staffing ratio as an input of nursing care to the clinical outcomes is a typical one. Aiken et al. (2014) reported in her simple evaluation of the relationship between patient‐nurse ratio and clinical outcomes that such hospital wards having higher nurse staffing ratio showed lower mortality rate after general surgery operation in European counties' hospital[4)]. Yasukawa (2008) also reported in a study conducted in one Japanese private hospital that the ADL and self‐recognition of patients improved significantly when nurse‐patient ratio is high in chronic disease wards[5)]. Another perspective of study focusing on community basis public nurse intervention onto elderly people care showed, in contrast, only few improvement in aged clients' QOL had been observed (Shaffer et al. 2017)[6)]. This result may clearly contrast to those in studies related to physician's intervention[7) 8) 9)].

Several systematic reviews related to the substitution of physicians by community‐based nurse‐led intervention resulted that the effectiveness of nurse intervention both to primary and chronic disease had been confirmed[10)11)]. In contrast, in several psychiatric nursing contexts, nurse‐led intervention to the home‐based patients induced higher patient satisfaction than those in hospital basis[12)13)]. Particularly, Wi Mahmoud (2015), for example, reported nurse‐

led intervention against the community patients induced higher self-reported good mental health, even though physical conditions of subjects were varied[14]. Further, prospective study of the effect of home visit nursing intervention on patient outcomes in South Korea indicated that significant improvement of clinical outcomes and QOL at the end of intervention had been confirmed comparing to the beginning (Han et al. 2013)[15]. Finally, in the context of team community care, Chao et al. (2012) reported positive effect of adequate co-work of primary care physician with district nurse both on physical betterment and self-reported well-being in rural China[16]. However, this study could not identify to what extent nursing care contributed under such team intervention.

While these previous studies suggested to encourage more installation of nurse-led intervention into community care settings, these findings may be so seductive that we could not make strict conclusion whether improving community-based nursing care provision really make health status of residents better because they showed very conflicting results as positive or negative against the question. Therefore, in order to capture primitive answer to this question, we tried to conduct community level assessment of patient outcomes generated by nurse-led intervention through the information of pooled score of health status and provision density of intervention in community reported by national data base.

Method

Descriptive assumption

We illustrated a typical relationship between physician working at clinic in community (in study, they are assumed to engage in *quasi* primary care practice) and home visiting nurse represented (represented as community based nursing care in our study) as a descriptive assumption for analysis. In model, while physicians is expected to take roles of physical maintenance, diagnoses and treatment for community population, home visiting nurse may be expected to provide health check-up, mental or stress support and, in some case, appropriate reference to more specific medical treatment (i.e. primary they physician or physician specialists). If these functional aspects are implemented properly, we can assume that the more physician practice would provide, the less physical complaints in population in community may be realized. Similarly, the more home visiting nurse intervention would be delivered, the less mental/stress complaints also be confirmed. Of course we need to consider the effect of individual attributes both in health professions and population on this assumption respectively (see Figure 1).

Needless to say, we recognize the works of *quasi* primary physician and community nurse are closely related, and, in several parts, are complementary to each other. But it is also said that physicians tend to concentrate their professional contribution onto treating symptoms. Nurses, on the contrary, wish to engage in observing and treating whole aspects

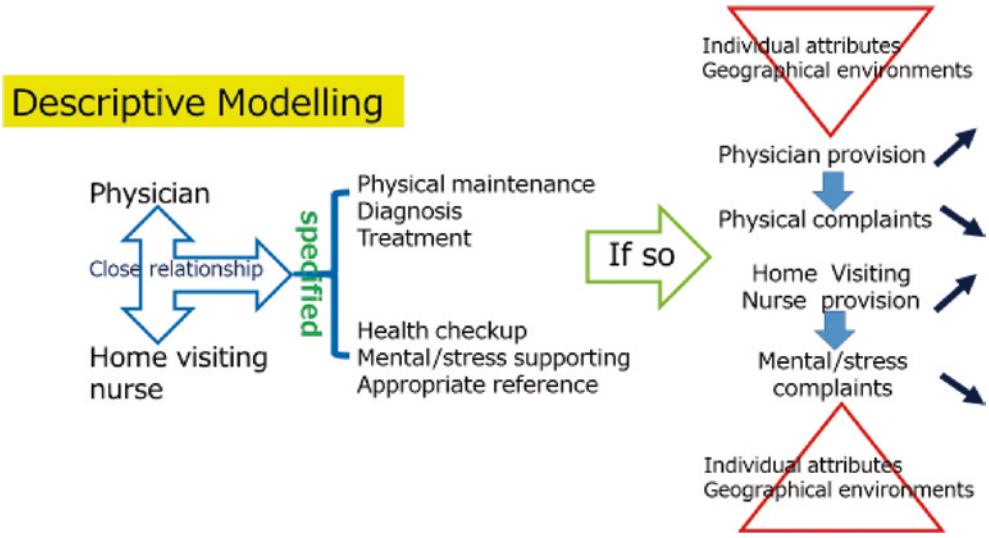


Fig.1 : Descriptive model of relationship between physician practice and home visiting nurse in community

of patients and tend to lead them to better physical and mental condition rather than physicians in some ways. Therefore, comparing contribution between these two professions on population health status means looking, partially, at substitution of physician work by nurse and, partially, at distinguishing each contribution.

After building descriptive model, we set out analytical model along anticipated scenario. The scenario is to identify the determinants of workforce density as well as geographic situation on the total score of self-reported medical complaint and mental consciousness of health status. In this scenario we assume the higher number of quasi primary care physician (per population) will make the score of medical complaints lower, and the higher number of home visiting case per population will have a positive impact on the decreasing of holistic self-viewing mental condition or stress in community residents (see Eq. 1, 2).

$$Y_i = \Phi \{P_{di}, N_{di,} Geoi, Z_i\} \quad \text{(Eq. 1)}$$

$$G_i = \Phi \{P_{di}, N_{di,} Geoi, Z_i\} \quad \text{(Eq. 2)}$$

Where Y_i represents a vector of multinomial value of individual self-reported total score of medical complaint including total amount score of lifestyle related disease (LRD), severity of mental illness, severity of stress and total health awareness. G_i represents a vector of multinomial value of individual self-reported mental consciousness and stress. P_{di}, N_{di} Geoi represent vectors of the density of quasi primary care physician, home visiting nurse case per population and geographic characteristics respectively. Z_i represents a vector of several attributes of each household member such as age, sex, existence of dementia, experiences of cancer examination.

Data sources

The sources from which extracted the data for analyses are a couple of Japanese fundamental statistic survey ; ***Comprehensive Survey of Living Conditions*** and ***Survey of Medical Institutions***. Former survey is consisted of sampling, individual-based dataset in association with multi-dimensional health condition of each member of household, income and expenditures compiling household unit. On the other hands, latter is a unique census database compiling all healthcare facilities, in which the number of facilities, units, clinical departments, medical equipment possessed by facility, health related workforces and the amount of services including home care, home visit nursing (HVN hereafter) and long-term care are stored every year. We used data from former survey as output (dependent) variables and from latter as input (independent) ones along with our research scenario.

Data selection, data matching and statistic technique

We extracted the data related to self- reported physical and mental health condition appeared on former survey in a form of “exist” and “none” as a set of dependent variable ; making total amount of Lifestyle Related Disease (LRD) score by summing all “YES = exist” in physical condition column, and using mental illness, stress and whole awareness data about herself as an amount of mental condition, stress and health awareness as well (in health awareness we added 1 in response to an statement of problem, so total amount of health awareness should be read as the amount of problems subjects recognized). These variables were divided as four units of analytical model. Similarly, we extracted the data of health workforce provisions from latter survey as a set of independent variables in accordance with city-basis by following clusters, 1) Sendai and Kyoto as the representation of high population density cities, 2) Morioka, Akita, Otsu, Nara, Kochi, Oita and Kagoshima as representation of middle population density cities : and 3) Kofu, Tottori and Tokushima as representation of low population density cities. Installing population density cluster into analysis was one of our unique challenge because no previous studies reported clear evidence whether influence of geographic difference on relationship between nursing intervention and outcome has been observed. In our study, in order to grasp any differences among the level of population density intuitively, we incorporated dichotomous independent variable represented “high population density area or not” as 1 or 0, instead of ordered grade as high, middle and low, in analyti-

cal models. We conducted cross section analysis by using 18,133 individual basis data which getting through matched up of 2014FY input workforce data and 2016FY individual output data because we need to consider "time lag" between care provision and their effect. We employed multinomial logit technique for the estimation of analytical models.

Result

Descriptive statistics

Descriptive statistics presented in Table1 shows that both the number of quasi primary care physician and of home visiting nurse case are huge differences across dataset, and self-reported health status also varied from none to 11 (LRD), 24 (severity of mental illness), 16 (severity of stress) and 5 (health awareness).

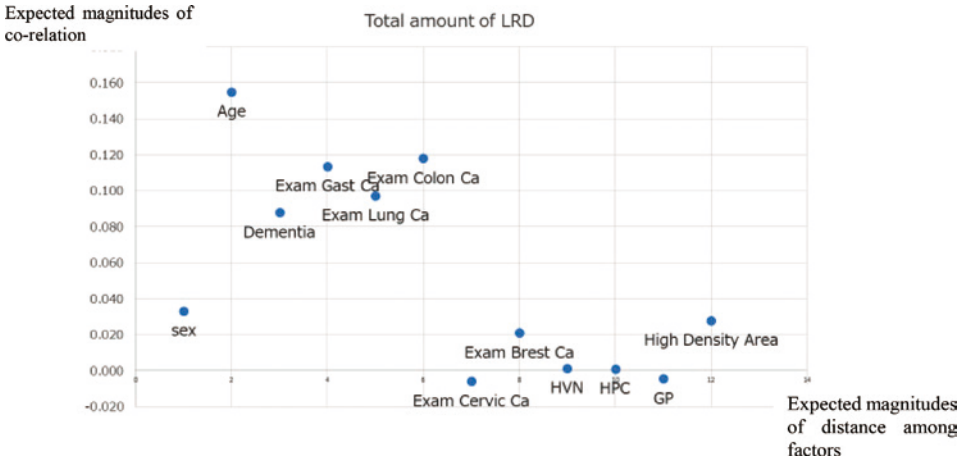
Explanatory power test

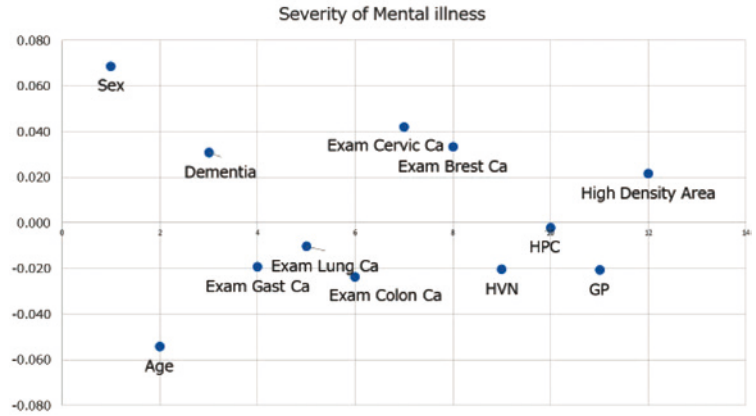
Before carrying out metric investigation, we tested explanatory power of input factors by assessing strength of visible co-relation among variables. In this test, expected magnitudes of co-relation of each independent factor with dependent variable are appeared on vertical axis in the graph and expected magnitudes of impact distances among independent factors on horizontal axis. Through knowing this, we not only understand mass direction and depth of the input determination along with attributes of factors against expected outcomes, but also recognize mutual strength of impacts among factors. Quasi primary care physician (appeared "GP" on the graphs), for example, have neutral or negative direction (vertical axis) of effect on almost all outcomes we set with relatively strong power (horizontal axis), in other words, physician contribute at least fair or good impact on achieving good health status (score). Similarly, health-related workforces include physician show positive impact on decreasing bad health status. In contrast, we can find the geographic attribute like "high density cities" have positive and deep impact on growing bad health status. The point we intend to clarify is the relationship between the provision of physician and home visiting nurse (GP v.s. HVN on the graph). Through the graph we intuitively grasp a "position" of impact between two on outcomes ; namely, for total health awareness in community residents, density of home visiting nurse service "may" encourage to provide better health status than physician comparing to other health outcomes.

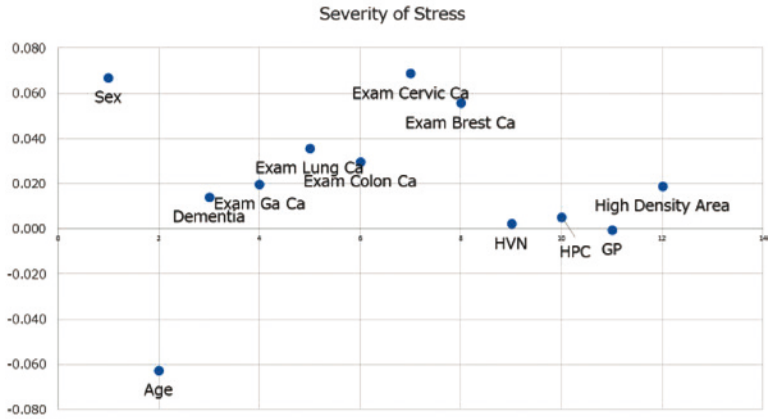
Table1. Descriptive statistics of inputs and outputs in analyses

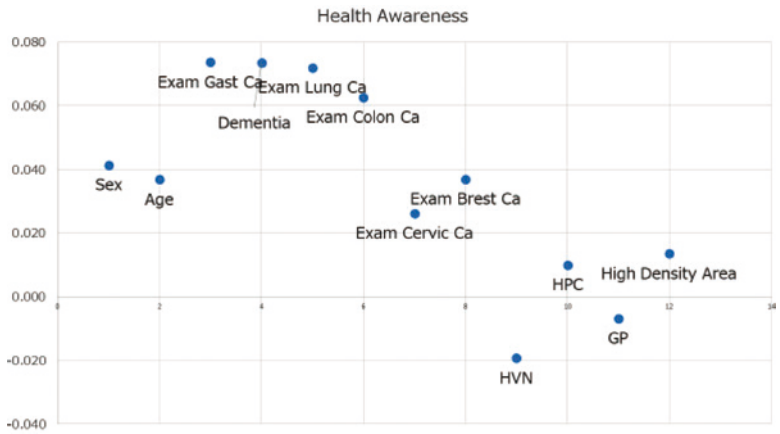
Variables	n	Average	SD	Min	Max
Sex	18133	0.231	0.421	0.000	1.000
Age	18133	57.644	17.844	12.000	101.000
Dementia dummy	18133	0.008	0.091	0.000	1.000
Exam for Gastric Cancer dummy	18133	0.356	0.479	0.000	1.000
Exam for Lung Cancer dummy	18133	0.393	0.488	0.000	1.000
Exam for Colon Cancer dummy	18133	0.331	0.471	0.000	1.000
Exam for Cervical Cancer dummy	18133	0.050	0.218	0.000	1.000
Exam for Brest Cancer dummy	18133	0.051	0.219	0.000	1.000
Number of Home Visiting Nurse(HVN)	18133	81.958	44.887	9.740	171.240
Number of Home Palliative Care(HPC)	18133	5.745	3.026	0.000	12.480
Number of Physician(=GP in our context)	18133	76.908	24.366	24.85	113.230
High density area dummy	18133	0.246	0.431	0.000	1.000
Total amount of Lifestyle-Related Disease (LRD)	18133	0.675	1.097	0.000	11.000
Severity of Mental Illness	18133	2.992	4.252	0.000	24.000
Severity of Stress	18133	0.868	1.380	0.000	16.000
Health Awareness (problems)	18133	2.520	1.125	0.000	5.000

Graph 1~4. Strength of co-relation among each variables (expected co-relation × expected distance)









Metric analysis

We then conducted econometric analysis using multinomial logit estimation along with our analytical models. As mentioned above, in four models, we set out self-reported total score of "Life-Related Disease (LRD) as dependent variable in Model1, "severity of mental illness in Model 2, severity of stress" in Model 3, and "health awareness (problems)" in Model 4 (Table 2). We defined "self-reported score" as total number of self-statement by respondents whether they are suffered by a series of symptoms or bad feeling (stated YES or NO). If they stated "YES", it counted one point, and total amount of point in each dependent variables are defined as "total score" of their conscience against own health status. Therefore, while positive sign of coefficient in regression result means the inputs may make the expected outcome worse, in contrast, negative sign of coefficient means they may have good contribution on the outcomes.

First, in all models, we can understand that age is a strong determinant on increasing bad health status ; that means aged people should have more complaints than young.

In model 1 and 2, GP (quasi primary care physician) has really strong impact on decreasing symptoms of LRD and mental illness of individual in community households. At the same, those who live in the area of high population density are faced more probability to be suffered by these symptoms. In contrast, in model 4, total amount of the case of home visit nursing showed its contribution on better health awareness (negatively affected on problem score), though statistical significance is little bit weak, instead of physician cases.

We can confirm that the residents living in high population density cities face higher risk, nearly 39% of increasing score of complaints, by LRD and mental illness rather than other areas. And, importantly, we also confirm that home visiting nurse seemed not to perform significant contribution on such situation but showing supportive role as improving total health awareness.

Finally, as an amazing result in model 3, those who have strong (mental) stress seemed not to receive appropriate health supports from, not only, physicians, but also nurses.

Discussion

From our primitive analyses, we can confirm our one of hypothesis that aged population in community may strongly

Table 2. Multinomial logit estimation for four models

	Model 1		Model 2		Model 3		Model 4	
	Total amount of LRD		Severity of Mental illness		Severity of Stress		Health Awareness	
	Co-efficient	P value	Co-efficient	P value	Co-efficient	P value	Co-efficient	P value
Sex (m-dummy)	0.0148	0.4766	0.7856	p < 0.001	0.2388	p < 0.001	0.0622	0.0060
Age	0.0211	p < 0.001	-0.0239	p < 0.001	-0.0090	p < 0.001	0.0101	p < 0.001
Dementia	0.6384	p < 0.001	1.8501	p < 0.001	0.4049	p < 0.001	0.7201	p < 0.001
Exam for Gastric Cancer	0.0883	p < 0.001	-0.0378	0.6937	-0.0215	0.4908	0.0751	0.0028
Exam for Lung Cancer	0.0674	0.0016	0.1091	0.2177	0.1000	p < 0.001	0.0973	p < 0.001
Exam for Colon Cancer	0.0991	p < 0.001	-0.1290	0.1694	0.0780	0.0103	-0.0035	0.8858
Exam for Cervical Cancer	-0.0763	0.1165	0.1837	0.3620	0.1855	0.0045	0.0347	0.5102
Exam for Brest Cancer	0.0345	0.4765	-0.0776	0.6988	-0.0039	0.9522	0.0539	0.3047
Number of Home Visiting Nurse(HVN) *	0.0001	0.8213	0.0003	0.8068	0.0007	0.1093	-0.0010	0.0028
Number of Home Palliative Care(HPC)*	0.0059	0.1219	0.0453	0.0043	0.0072	0.1617	0.0096	0.0209
Number of Physician(GP)*	-0.0024	0.0013	-0.0104	p < 0.001	-0.0019	0.0664	-0.0003	0.6717
High Density Area dummy	0.0945	p < 0.001	0.3893	p < 0.001	0.0673	0.0119	0.0508	0.0186
Constant	-0.5166	p < 0.001	4.5945	p < 0.001	1.2929	p < 0.001	1.8931	p < 0.001

* per 100,000 population

be dependent on quasi primary care physicians than community nursing care provision when they have complaints of lifestyle related disease and mental health including dementia. This indicates clearly that expected medical provision by physician meets to community basis population's health needs. On the other hands, the result that those who feel strong stress in their life may not be received appropriate healthcare supports from any health professions indicate serious reality we face in community care settings. In recent decade, Japanese government has emphasized the mitigation of nation's mental stresses in all generations and encouraging reliable implementation of "stress check" in workplace. But, our matched data set from *Comprehensive Survey of Living Conditions* and *Survey of Medical Institutions* discovered "an inconvenient truth" that, at least in community level, intervention by health related professions seemed to bring no positive consequences in relation to mitigating mental stress of nation.

Turn to our research question, a finding of regression in model 4 presents fine, but partially complicated implication for us that the more home visiting nurse case increased, the less total health awareness (problem) seemed to be reported. Although the consequence in model 4 supports our hypothesis of an advantageous role of nursing intervention on making no physical health status better rather than physician doing, in case of other models, mental illness and stress, never. Most notably, those who live urban area might not be received such advantageous commitment from nurse intervention. This indicates that residents who live urban should be potential but highly important target (or customer) for community nurse specialists in Japan.

Further arguable point is, to what extent we will be able to validate the credibility of self-reported health status in residents. First of all, Yamauchi K et al. (2015) found that subjective health status evaluation by aged people may be changed worse through respondents' condition of clinical indicators (i.e. score of High Blood Pressure(HBP), existence of Diabetes Mellitus (DM) symptoms etc.) and frequencies of receiving medical treatment[17]. Unfortunately, since the data we used does not report the frequency of medical treatment for each residents as well as actual clinical data like HBP or DM, we could not confirm the real impacts of these factors on our results. As the second, more generally be concerned, Japanese people seem to intend to express their health status lower than those in other countries. For example, OECD report indicated that self-evaluated health conscience of Japan is appeared as around 35 points, when the other developed countries showed averagely 60 points[18]. This may teach us we need to consider any biases when we employ the self-reported scores as the evaluation of the reality in health status.

Finally, we will have to recognize that there are some rooms to establish closer partnership between community physicians and nurses because none of four models suggested the good combination of physicians and nurses on easing population's bad health (there are no significance of positive impact by professions *simultaneously* on outcomes).

Limitations of the study

In this study we have a couple of limitations in terms of modeling and estimation technique. First of all, in analytical modeling, we had to be abandoned to install economic information such as individual basis income level or earned salary because of failing appropriate data matching. Japanese social insurance system well covers visiting service provision both by physician and nurse, hence some previous studies reported there is no significant relationship between (total) demand of home care services and clients' income level to elderly people[19][20], however we unfortunately could not confirm the reality in the case of nursing care provision to broader client generations.

Second limitation related to technical issue addressed to the characteristic of cross section analysis. Ideally it is preferable to assess the same samples or subjects if we tend to observe the community populations' health improvement over time. Since, unfortunately, the survey of living conditions we used extracts different samples of household in each year, therefore we could not construct the database as a panel format. The lack of observation of time effect on the outcome of healthcare intervention put us a halfway status in research.

Finally, it should be mentioned that our study did not clarify the reason why home visiting nurse provisions could not make any contribution on easing mental illness or stress instead of team health care might be implemented in community. One possibility is an existence of clinical segmentation beforehand among workforce. That is, outreaching

dementia person, for example, may not be included in a menu of HVN but the business of quasi primary physician by some reason. Since this is not an expected story for our health policy installing at moment, we need deeper investigation whether substitutive relationship between physician and nurse might be observable by checking cross term effect.

Conclusion

We tried to primitive investigation whether Japanese community nursing provision may significant contribution on the improvement of population's health status by analyzing individual-basis, matched up data set extracted from two national fundamental surveys. Results indicated that community nursing intervention really provide some extent of contribution on improving population's self-reported health awareness. In other words, holistic health status might be better by receiving intervention of community nursing provision comparing to physicians who are in charge of maintenance of physical problems in population. However, several "inconvenient truth" had emerged, that is, both physicians and nurses deliver no contributive care to those who are suffered by mental stress, as well as less combination between both professions may be conceivable. We, if so, must engage further in rebuilding an appropriate relationship between community nurses and physicians as critical players making community population's health status better.

Though several limitations remain in this study, we hope this primitive investigation may encourage more sophisticated analyses to assess the outcome of nurse intervention in community setting in Japan.

Funding source

This paper is one of research consequence by "Re-projection of physician demand and supply considering health economic analyses of community health resource allocation" (Grant-in-Aid for Scientific Research (KAKENHI) in 2018 : Category B : Project No.1816H03634)

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看護経済・政策研究学会誌　第 2 巻 1 号

2019 年 12 月発行

編集・発行

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組版 : 笹氣出版印刷株式会社　http://www.sasappa.co.jp/

Journal of Japan Society of Nursing Economics and Policies

Vol. 2 No. 1 December 2019

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