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Needs for a Facility for Elderly Surveillance System and External Training, and its Value

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Abstract

The Facility for Elderly Surveillance System (FESSy) asks residential facility staff members to report residents and staff members with certain symptoms or with infectious disease diagnoses. Thereafter, FESSy information is shared among physicians, commissioned doctors, public health centers, and local governments. Using demand analyses for FESSy and external training, we assessed needs reported by internal trainees and nurses. Our survey was administered in Ibaraki prefecture, Japan during January 18–28, 2022 at 335 facilities for elderly people. Logistic regression was applied to estimate demand for FESSy. Tobit estimation with a lower bound of zero and an upper limit of 100 thousand yen was used to estimate willingness to pay (WTP) for external training. To reduce simultaneous determination bias, an average treatment effect model (inverse probability weighted adjustment) was used to ascertain WTP for external training and for consideration of joining FESSy. From 104 responding facilities, data of 79 long-term care facilities were analysed. Estimated results for the need for FESSy indicated facilities providing short stay services as negative and the number of nurses as positive. The Tobit estimation average treatment effect model for WTP for external training revealed no significant variable. Significant need for FESSy was not found. Results demonstrated that respondents regarded FESSy as effective because of nurses' contributions. The estimated value of FESSy was six million yen (43 thousand US dollars). Regarding external training, constraints imposed by the small sample and the inadequate questionnaire limited meaningful findings.

Keywords: Average treatment effect model, Elderly facility, External training, Facility for Elderly Surveillance System, Inverse probability weighted adjustment, Nurse; Professional caregiver, Willingness to pay.

Introduction

Residents of facilities for elderly people have remained vulnerable to COVID-19 outbreaks [1]. Infection control at such facilities is anticipated as the most important countermeasure to reduce disease burdens attributable to COVID-19 [2].

However, in Japan, infection control policy since May 8, 2023 has been relaxed. Public health centers have become unable to recognize outbreak situations at facilities for elderly people unless more than ten cases are reported within seven days. To fill that important information

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gap, the Facility for Elderly Surveillance System (FESSy) has been implemented at public health centers to monitor conditions at facilities within their jurisdiction, although it had been developed before the COVID-19 pandemic. In fact, FESSy has been expected to be activated nationwide and to contribute to timely detection and rapid infection control at facilities [3,4]. The object of this study was to explore demand for FESSY through the use of an original survey and to consider the mechanisms affecting demand.

For residents at facilities for elderly people, FESSy is a mode of syndromic surveillance that monitors symptoms and infectious diseases. It is a web system for smart phone reporting by separate facilities to collect data of the number of residents or staff members with certain symptoms or of people who have been diagnosed as having infectious diseases. The reporting can be done by the units in which residents reside and where they are managed. Figure 1 presents the system concept. Targeted symptoms include fever, cough or difficulty breathing, vomiting, diarrhea, and eruption, among others. Diagnosed infectious diseases include COVID-19, influenza, infectious gastroenteritis, herpes zoster, and scabies, along with others. Aberrations are inferred by units at each facility using artificial intelligence. If an aberration is inferred and thereby detected, then such information is delivered to commissioned doctors, infection control nurses in the community, public health centers, medical associations, and local governments that are allowed access to data at the facility, as shown on the right-hand side of figure 1. Their timely response to the facility can then be expected to reduce the intensity of the outbreak and to mitigate its adverse outcomes.

However, no system similar to FESSY has been developed and operated to date. Actually, we searched relevant literature using PubMed, which yielded 267 reports through a systematic review on June 1, 2023. Nevertheless, after excluding inappropriate studies, only one study investigated syndromic surveillance at a facility for elderly people [5]. That study used information about symptoms of 41,061 residents of 126 facilities in France on a national server for six years until February 2017. However, that was a retrospective study. The system had not started to operate prospectively. Moreover, they had never described utilization at a public health center. For that reason, it remains unknown how the data have been used as syndromic surveillance. Moreover, the study had no object to detect outbreak in a facility. It merely defined an outbreak assuming that all residents were living in the same community. Unless usual and frequent interaction among residents or staff members occurs across facilities, such infection does not constitute an outbreak in a community. Therefore, it might not be appropriate for comparison to official sentinel surveillance in a community. Therefore, this earlier study was quite different from FESSy, which has been used prospectively for timely detection of an outbreak at each facility to encourage earlier response by staff or public health center. In this sense, it seems probable that no system resembling FESSy exists today in the world. Actually, a systematic review in 2020 found no syndromic surveillance at elderly facilities despite some syndromic surveillance systems particularly monitoring schools [6]. If a similar system to that of FESSy were planned to operate in France, then it could be expected to be much easier to expand than extending FESSy throughout Japan. Unfortunately, the earlier study did not mention its operation to save the lives of residents at facilities.

Infection control at facilities for elderly people is conventionally performed mainly by nurses. In this sense, FESSy and the tasks or skills of nurses might be regarded as substitutes. Alternatively, if a facility manager considers that summarizing information to enter data to FESSy or to interpret information from FESSy requires nurses'

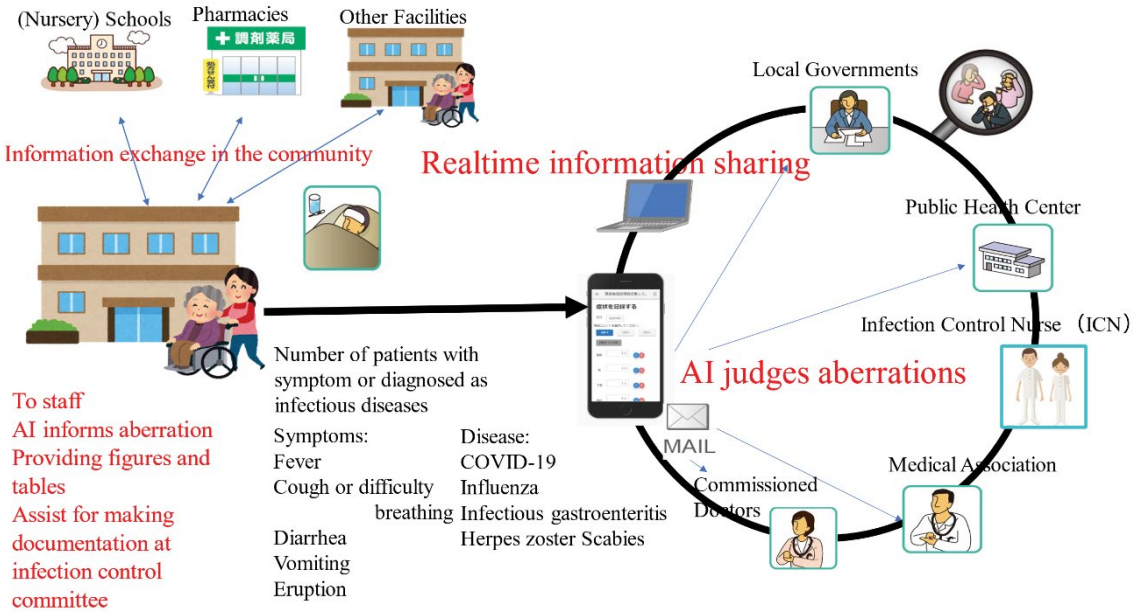

Figure 1: Concept of Facility for Elderly Surveillance System.

skill, then the necessary labor time and skills would be supplementary factors. Nevertheless, infection control at a facility solely by nurses has definite limitations. To raise infection control capabilities at a facility, training for all staff members including professional caregivers is expected to be important [7]. At a facility, nurses conventionally lecture or train professional caregivers or other staff members as internal training. Moreover, nurses and other staff might participate in external training provided by governments, universities, or private companies. In this sense, nurses and internal training appear to be supplementary.

Because internal and external training can raise infection control capabilities, these training modes might be substitutes. However, if external training were to raise the skill levels of nurses for performing internal training, then external training might be supplementary. If internal training were able to raise the skill levels of infection control for staff other than nurses, then nurses might be substitutes for internal training.

No earlier study has examined needs for external training in Japan, but a study conducted in the US revealed that infection control staff at almost all facilities for elderly people in one state recognized the necessity for external training about infection control [8]. Another study investigated three states in the US, finding that infection control staff who attended external training for infection control retained that knowledge obtained during training for three months to a year [9]. Nevertheless, these studies specifically examined the infection control profession, with no investigation of external training for professional caregivers or all other staff at a facility for elderly people, as we did for the present study.

One can consider and hypothesize associations among internal training, external training, and nurses, and FESSy, but such exercises are mere speculation. Therefore, we should examine them empirically, according to the relevant data. The object of this study is assessing the internal training and nurse efforts associated with meeting these needs through analysis of needs for FESSy and external training. As described above, no system similar to FESSy is being used. No earlier study has assessed needs for external training. Elucidating needs for FESSy or external training can ultimately help to improve public health of elderly people at facilities. Therefore, we examined the value of FESSy by assessing needs for it.

Materials and Methods

During January 18–29, 2022, we sent survey questionnaires to all 335 long-term care welfare facilities for elderly people (Special Nursing Homes for Elderly) in Ibaraki prefecture, Japan, which is an area somewhat north of metropolitan Tokyo. We elicited their requests for training courses about infection control. The questionnaire asked facility managers about the numbers of residents and staff members at facilities, especially nurses, classifications of facilities providing services such as short stay or day care services, training for infection control at the facility, outbreak experience of COVID-19 and other infectious diseases, willingness to pay (WTP) for external training, and their particular demands for FESSy.

A facility's WTP for external training was defined by the response to the question "How much can you spend for external training for infection control, at maximum?" Five choices were provided as responses to the question.

1) We would like to pay any total amount.

2) We would like to pay the total amount if it is less than the maximum amount of willingness to pay.

3) We would like to pay part of the amount.

4) We would never like to pay for it.

5) No idea.

Moreover, the questionnaire asked the maximum amount which would be paid by facilities which responded with the second choice.

The question about the need for FESSy was "Do you want to join a system by which a facility can recognize the situation and record it, with automatic detection of aberrations, and with contacting of doctors and by which public health centers can monitor situations at each facility at any time by entering the number of residents or staff members with certain symptoms or who had been diagnosed as having infectious diseases to the system?" Three choices were provided as "yes", "no", and "no idea."

Procedures for estimating the need for FESSy were for logistic regression. For WTP for external training, the estimation procedure was Tobit estimation with the upper bound of 100 thousand yen and the lower bound of zero. Given this specification, because the needs for FESSy and WTP for external training were presumed to be determined simultaneously, the WTP for external training and the need for FESSy were not included as explanatory variables. Moreover, to eliminate simultaneous determination bias, we estimated the average treatment effect model for WTP for the external training. Particularly, we used inverse probability weighted adjustment as the average treatment effect model weighted by the inverse of probability estimated by logistic regression to FESSy demand for facilities needing FESSy and by the inverse of one minus the probability estimated by logistic regression for not needing FESSy facilities [10,11].

Explanatory variables for logistic regression and Tobit estimation were providing services, size, number of nurses, situation of internal training, and outbreak experience. Providing services included group homes, short stays, and day care centers. "Group home" is a facility where residents live together with a small number of patients with dementia. "Short stay" is a temporary stay facility with residence for short periods. A "day care center" provides care for non-resident visitors. We set three dummy variables for each service. The dummy variable for X was defined as X=1 if X was true, and X=0 otherwise.

Size was measured by the number of facility residents. The number of working hours of part-time nurses was assumed to be half that of full-time nurses. Therefore, we define the number of nurses as the number of full-time nurses plus half of the number of part-time nurses. The

internal training situation was represented by two dummy variables. One is a dummy variable for performing routine internal training every year, even if some staff members did not attend. The other is a dummy variable for performing routine internal training every year with all staff attending. Outbreak experience was a dummy variable set as one if a facility has experienced a COVID-19 outbreak or other infectious disease, and zero otherwise.

"Need for FESSy" was defined as one if a facility responded "yes" and zero otherwise. The WTP of a facility for external training was defined as 100 thousand yen if a respondent chose "We would like to pay the total amount of any amount" to the question of "How much can you spend for external training, at maximum?" Also, 100 thousand yen was the maximum amount for those who responded to the question with "We would like to pay some amount less than the maximum amount." It was defined as the responded amount if they responded with "We would like to pay some amount less than the maximum amount" to the question. If they responded with "We would like to pay a part of the amount," then we set their WTP as 2000 yen, which was the minimum amount responded to the question ""We would like to pay some amount less than the maximum amount." Otherwise, it was defined as zero if they responded to the question with "We would never like to pay for it" or "No idea." Consequently, 100 thousand yen and 2000 yen were defined as the maximum and minimum values of responded amounts if they responded as "We would like to pay some amount less than the maximum amount."

Two thousand and 100 thousand yen in the above setting in WTP were just an assumption. To check robustness, we used sensitivity analysis of one thousand instead of two thousand and 200 thousand instead of 100 thousand,

The average treatment effect model of WTP for external training included the need for FESSy as an explanatory variable as well as explanatory variables in Tobit estimation. To check the robustness of facility size, we also used logistic regression to assess the need for FESSy stratified as larger facilities and smaller facilities than average. Estimation results of logistic regression were shown as odds ratios.

We adopted 5% as the significance level. We used software (Stata SE 17.0; Stata Corp.) to conduct all statistical analyses.

Written documentation about the research purpose, method, and protection procedure for information was provided to all participants. The documentation also described that participation was voluntary and that participants would not be disadvantaged even if they chose not to participate. Moreover, the documentation stated that the data were not personally identifiable. It was declared clearly that a response to the questionnaire was understood as consent to cooperate with the questionnaire. This study used data obtained from questionnaires given to facilities. Because the subjects were facilities and because this study was non-invasive, this study included no private or personal information, or any intervention. Therefore, informed consent beyond a response to the questionnaire was unnecessary. Furthermore, this study was approved by the Ethics Committee of Ibaraki Prefectural University of Health Sciences (No.1017).

Results

Although 104 facilities responded to the questionnaire, we limited responses to those of long-term care (Special Nursing Home for Elderly) facilities: data of 79 facilities were analyzed as explained below. Of those, 34 facilities needed FESSy. Two facilities had group homes, 28 facilities provided short stay services, and 19 facilities provided day care services. Some facilities were providing multiple services among these additional three services, in addition to long-term care.

The number of residents was 25 at minimum, 170 at maximum, and 66.3 on average. The median was 70. The related histogram is shown as figure 2. The number of professional caregivers adjusted by working hours was 0 at minimum, 81 at maximum, and 32 average, with a median of 32. The number of nurses' adjusted working hours was 0 at minimum, 8 at maximum, and 4.1 average, with a median of 4.

Table 1 presents the average of summarized explanatory variables in logistic regression by the need for FESSy and the p value for the Wilcoxon rank-order test. Short stay services and the number of nurses were significant. Facilities needing FESSy had more nurses; fewer provided short stay services.

Regarding internal training, 56 facilities hold routine internal training every year for all staff; 23 facilities hold routine internal training every year, but for only some staff. Related to WTP for external training, 34 facilities responded as "we would like to pay total amount in any amount." Also, 32 facilities responded as "we would like to pay some amount less than maximum amount." Among the 32 facilities, the minimum of the maximum amount which a facility could accept as a payment for training was 2000 yen; the maximum of the maximum amount a facility could accept as a payment for training was 100 thousand yen. Moreover, five facilities responded that "we would like to pay a part of amount," three facilities responded that "we never would like to pay for it," and six facilities had no idea how to respond to the question. The distribution of WTP for external training defined by the procedure described above is shown as a demand curve in figure 3.

Table 2 presents the estimation results. Logistic regression for the need for FESSy showed the number of nurses as positive and significant; short stay services were negative and significant. The respective odds ratios of these variables were 1.5 and 0.03. These were consistent with Wilcoxon rank-order test results shown in table 1. In the average treatment effect model, the estimated coefficient of short stay services was 174 thousand and day care services was -173 thousand. However, these were not significant in Tobit estimation. Facilities providing short stay services require external training and did not need FESSy.

Table 3 presents a summary of the estimation results of logistic regression in the subgroup, larger or smaller

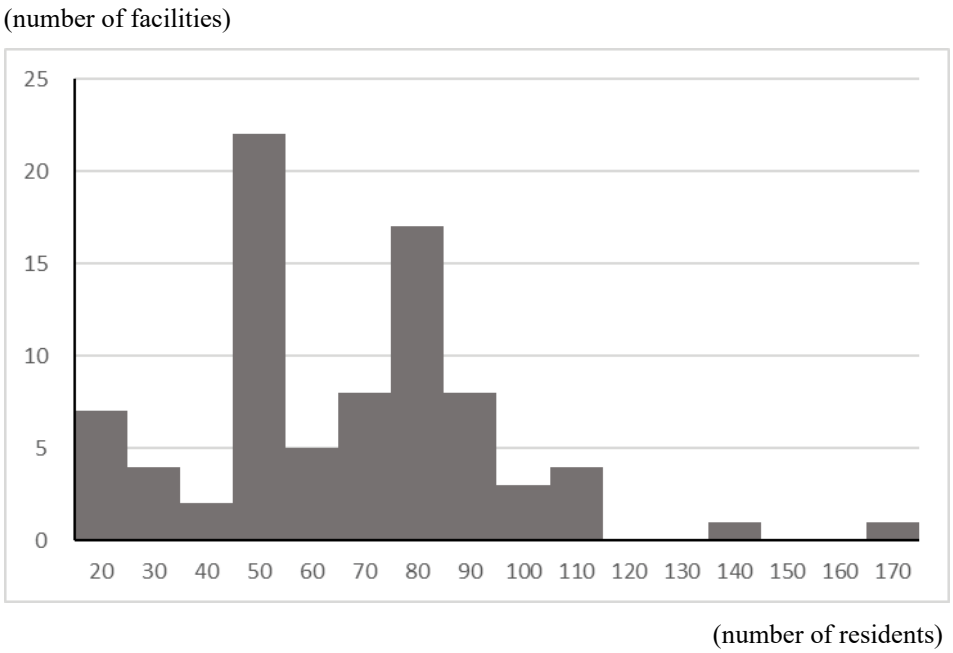

Figure 2: Histogram of the numbers of residents at facilities.

Note: The number of facilities was 79. Bars represent the numbers of facilities which have more than or equal to the number below bar and less than ten plus the number of residents. The average of number of residents was 68.0, with a median of 70. Among larger than average facilities, the average was 89.0; the median was 83. Among smaller than average facilities, the average was 46.0; the median was 50.

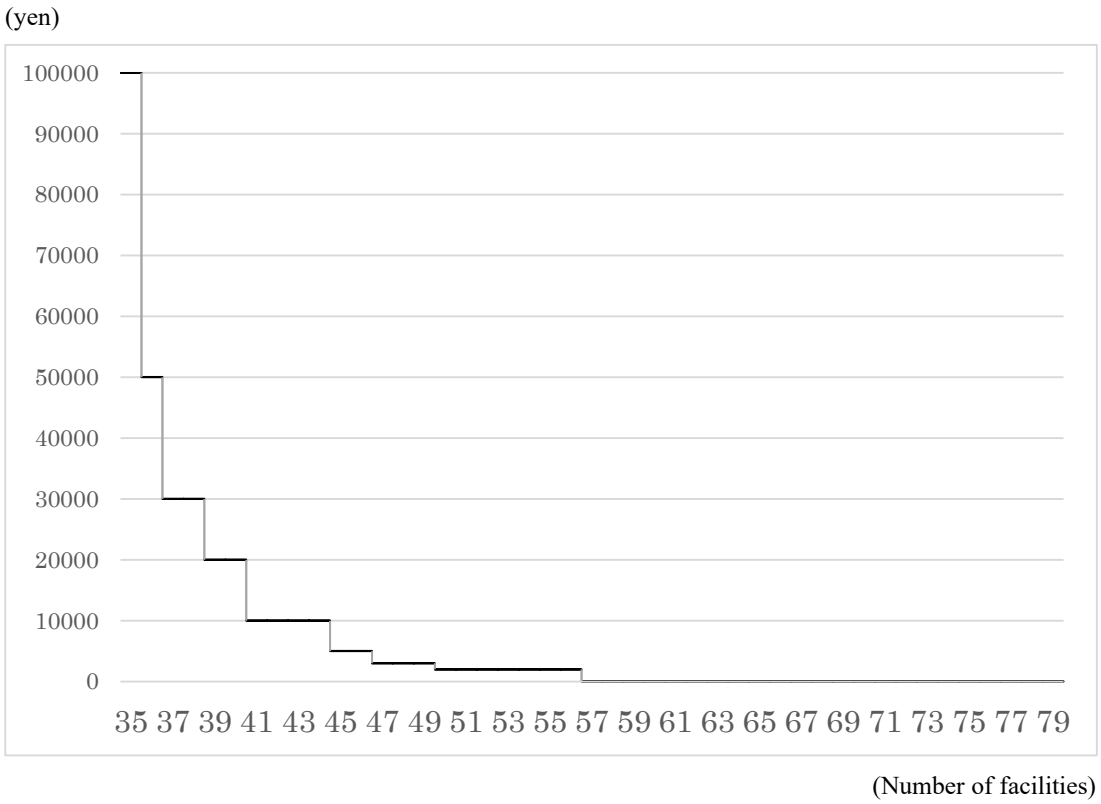

Figure 3: Demand curve of external training based on willingness to pay.

Note: Willingness to pay (WTP) for external training was defined as 100 thousand yen if respondents stated "We would like to pay the total amount of any amount" to the question "How much can you spend for external training for infection control, at maximum? "It was defined as the responded amount if they responded with "We would like to pay some amount less than the maximum amount" to the question. If they responded with "We would like to pay a part of the amount," then we set their WTP as 2000 yen. Otherwise, it was defined as zero if they responded to the question with "We would never like to pay for it" or "No idea." Consequently, 10 thousand yen and 2000 yen were defined as the maximum and minimum values of responded amounts if they responded with "We would like to pay some amount less than the maximum amount."

	Average		
	facilities with need for FESSy	facilities without need for FESSy	*p*-values for Wilcoxon test
with group home	0.029	0.022	0.858
with short stay service	0.200	0.467	0.014
with day care service	0.200	0.267	0.490
number of residents	70.1	65.6	0.475
number of nurses	4.70	3.73	0.043
COVID-19 outbreak experience	0.257	0.156	0.263

Table 1: Summary statistics for variables in estimation.

Note: Of 79 observations, 34 facilities needed FESSy. "Group homes" are facilities with cohabitation of a small number of patients with dementia. Number of nurses was defined as the number of full-time nurses plus half of the number of part-time nurses, assuming working hours of part-time nurses as half of the working hours of full-time nurses.

Dependent variable	**Need for FESSy**		**WTP**			
Estimation Procedure	**Logistic Regression**		**Tobit Estimation**		**Average Treatment Effect Model**	
	Odds ratio	***p* value**	**Estimated coefficient**	***p* value**	**Estimated coefficient**	***p* value**
group home	1.559	0. 823	-65367	0.623	-99181	0.525
short stay service	0.033	0.009	60641	0. 359	174191	0.044
day care service	6.793	0.143	-111094	0.113	-173288	0.028
number of residents	1.004	0.742	694.8	0.455	602.6	0.544
number of nurses	1. 523	0.020	5646	0.631	3604	0.835
routine internal training	0. 703	0.783	-3444	0.970	19781	0.876
routine internal training for all staff	0.809	0.717	112120	0.807	28053	0.656
outbreak experience	0.755	0.459	70463	0.143	118625	0.070
need for FESSy					105313	0.067
constant			-50686	0.645	-145476	0.351
pseudo-R^2	0.169		0.012		0.033	

Table 2: Estimation results of logistic regression to need for FESSy and external training, and Tobit estimation for WTP for external training and the average treatment effect model.

Note: Data points for the sample were 79. The estimation procedure was logistic regression for need for FESSy and Tobit with 100 thousand yen as the upper limit and 0 yen as the lower bound for WTP for external training. The estimation procedure for the average treatment effect model was inverse probability weighted adjustment, weighted by the inverse of probability estimated using logistic regression in this table for facilities needing FESSy and by the inverse of one minus the probability estimated using logistic regression for non-need FESSy facilities. The WTP of the facility for external training was defined as 100 thousand yen if they responded as accepting the "full burden" of payment. Such a facility responded as willing to pay the maximum amount which the facility can expend. For a facility responding that they would pay a partial expense, WTP was either the responded amount, or it was set as 2000 yen. "Need for FESSy" was excluded from explanatory variable logistic regression because it was a dependent variable itself. In addition, "need for FESSy" was excluded from explanatory variable Tobit estimation to avoid simultaneously determined bias, as discussed in the main text. The odds ratio of the constant term was not available in logistic regression.

Subgroup	Smaller facilities		Larger facilities	
	Odds ratio	*p* value	Odds ratio	*p* value
short stay service	0.182	0.089	0.020	0.019
day care service			6.82	0.192
number of nurses	1.42	0.094	1.92	0.047
routine internal training			0.189	0.329
routine internal training for all staff	0.646	0.570	0.933	0.938
outbreak experience	0.712	0.673	0.211	0.190
pseudo-R^2	0. 112		0.226	

Table 3: Estimation results of logistic regression to need for FESSy stratified by numbers of residents.

Note: Numbers of samples were 39 for smaller than average facilities and 40 for larger facilities. "Day care service" and "routine internal training "in the smaller subgroup were not identified because of the lack of variation. They were therefore dropped from explanatory variables.

than average facilities. Some variables were not identified because of a lack of variation. As one might expect, there was no significant estimator in the smaller facility subgroup. By contrast, the estimation result in the larger facilities subgroup was similar to that presented in table 2: short stay service reduces the probability and the number of nurses increases the probability of need for FESSy. Therefore, the estimation results in table 2 were driven by responses from larger facilities.

Sensitivity analysis results for maximum or minimum but with a larger than zero amount of WTP are shown in table 4. Similarly, for table 4, however, when we set one thousand yen instead of two thousand yen, the outbreak experience was significant and positive in the average treatment effect model. Moreover, the need for FESSy was marginally significant and positive. That finding implies that outbreak experience induces some eagerness to join external training. The latter might be implied by supplemental association between external training and FESSy.

Discussion

The number of nurses was found to be associated significantly with the need for FESSy, meaning that FESSy and nurses share a supplementary association. In other words, nurses might be needed not only for data entry associated with FESSy, but also to interpret information provided by FESSy and to use that information for infection control at their facility. At the same time, it might mean that a facility with many nurses can operate for infection control even without FESSy, or that FESSy can reduce the number of nurses.

One must recall that estimation results for the number of nurses are not a simple size effect, which means that larger facilities need FESSy more. Actually, regulation has determined the minimum number of nurses according to the number of residents in a long-term care facility. A facility with more residents has employed more nurses. However, because the facility size is controlled in logistic regression for the needs of FESSy, it should be interpreted as meaning that facilities with more nurses consider that the number of residents need FESSy more. Table 1 shows that the numbers of residents were not different among FESSy-needing facilities and others. Moreover, the number of nurses and residents were not highly correlated in the using data. Its correlation coefficient was just 0.3805; it was significantly different from one. In other words, the null hypothesis that the number of nurse was perfectly correlated with size can be rejected. Therefore, a simple size effect can be denied completely for the need for FESSy.

The estimated odds ratio of number of nurses, 1.5, is difficult to understand intuitively. Table 1 presents the average number of nurses at a facility needing FESSy as significantly larger by about one. However, that quantity is just the unadjusted difference, which is not controlled by other factors such as size. We regressed the number of nurses on the need for FESSy and on other explanatory variables included in table 2. Although its estimation results are not shown in the table, the estimated coefficient of need for FESSy was 1.22; its p value was 0.005. That finding implied that because 1.22 more nurses play a key role in infection control and because FESSy was expected to replace 1.22 nurses, then its expected value can be estimated as 1.22 times the annual payment for a nurse at a facility for elderly people. Because the average annual pay of a nurse at long-term care facility was 5.07 million yen (approximately 34.8 thousand US dollars, assuming 145.5 Japanese yen/ US dollar) in 2020, the value of FESSy was therefore estimated as 6.19 million yen (42.5 thousand US dollars) [12].

Some readers might have some disagreeable feelings about this interpretation of the estimation results about the replacement of nurses. Because the number of nurses is regulated and because nurses have many tasks at a facility other than infection control, they consider that FESSy cannot replace a nurse even though the obtained results are valid. However, the estimation results do not mean that the number of nurses was actually smaller at a facility with FESSy than without FESSy. It means only that the nurses were fewer at a facility which needs FESSy. Therefore, this replacement of nurses by FESSy is an interpretation by facility managers. Such a replacement is not a phenomenon found in the real

Changing in parameter	Lowest WTP which is higher than zero				Highest WTP			
Estimation procedure	Tobit estimation		Average treatment effect model		Tobit estimation		Average treatment effect model	
	Estimated coefficient	*p* value	Estimated coefficient	*p* value	Estimated coefficient	*p* value	Estimated coefficient	*p* value
group home	-141547	0. 580	-219428	0.441	-65709	0.622	-99624	0.523
short stay service	130596	0.009	344230	0.031	60720	0. 358	174328	0.044
day care service	-218463	0.106	-321603	0.026	-111316	0.113	-173496	0.028
number of residents	1689	0.346	1758	0.437	695.4	0.455	602.8	0.644
number of nurses	7287	0.747	-550.7	0.985	5679	0.629	3627	0.834
routine internal training	-9181.508	0.958	38935	0.871	-3128	0.973	20133	0.874
routine internal training for all staff	16412.21	0.853	40275.19	0.726	11181	0.808	28038	0.657
outbreak experience	154031	0.098	250926	0.032	70403.35	0.143	118622	0.070
need for FESSy			206658	0.050			105327	0.067
constant	-122351	0.564	-318503	0.266	-51116	0.642	-145930	0.350
pseudo-R^2	0.012		0.036		0.012		0.033	

Table 4: Sensitivity analysis for maximum or minimum but larger than zero amount of WTP.

Note: This table shows estimation results of sensitivity analysis for one thousand instead of two thousand (left four columns) and 200 thousand instead of 100 thousand (right four columns) for both Tobit estimation and the average treatment effect model.

world. Moreover, because correlation between nurses and residents was not high for the data used, the idea that regulation alone decides the number of nurses might be too restrictive. If there were some variation in the number of nurses of a given size, then replacement of a nurse might be observed when FESSy becomes prevalent in the real world.

The average treatment effect model is used widely in social sciences to evaluate programs: participants choose to join a program spontaneously, such as a job training program or an unemployment payment program [13-15]. However, in the natural sciences, a researcher can perform experiments and thereafter delete selection bias in the choice of subjects. Nevertheless, such experiments are expensive and require a longer period.

In medicine, random assignment experiments conducted after launching are difficult. Circumstances and parameters change after trials: mutated strains emerge, vaccine coverage and/or developing treatments might affect drug effectiveness, making them impossible to evaluate. Particularly, mortality tends not to be used as an outcome for evaluation, even though it should be the endpoint of greatest concern. Therefore, experiments in medicine for changing situations and mortality might be difficult. To overcome this difficulty, an average treatment effect model was used to evaluate the changing situation using a statistically pseudo-random assignment experiment. Particularly, it was applied for orthopedic surgery and cardiovascular research [16,17]. However, these studies used propensity scoring matching: a simple comparison of outcomes between a treatment group and no treatment group with almost identical probabilities of receiving treatment. In other words, propensity score matching did not control for any outcome other than treatment. It might bias the result by the potential confounder. Therefore, we used another average treatment model with inverse probability weighted regression adjustment. Its second step was weighted regression for an outcome weighted with inverse probability of the first step for whether it was treated or not [10,11]. It can control covariates for outcomes other than whether one has been treated or not.

For this study, the need for FESSy cannot be assigned randomly and compulsorily. Therefore, the needs for FESSy and external training were presumed to be determined simultaneously. For instance, a facility with enthusiasm for infection control probably needs both. Therefore, simultaneous determination bias contaminates the effect of a "need for FESSy" to external training. To avoid such bias, we used the average treatment effect model, especially inverse probability weighted adjustment. However, the reliance of randomness at the pseudo-experimental situation on the precision of logistic regression is the first step. The estimation results presented in table 2 show a low pseudo-R2. Even though pseudo-R2 in the nonlinear regression such as logistic regression does not represent the proportion of explanatory variables, as does linear regression, the estimation results at the second step might be affected.

In fact, WTP has been used widely as a proxy to assess the importance of something or the eagerness of a person, organization or society, even in the field of health economics [18-20]. For the present study, WTP is an indicator of the enthusiasm of a facility to participate in external training.

Facilities with short stay services were found to be

negatively and significantly associated. Because short stay service users stay at a facility for a short period and because they are presumed to return home in principle when they show some symptoms, outbreaks among short stay service users might be less important for facility managers compared to illness among facility residents. By contrast, short stay service users are closer to a community than facility residents. Because some staff members for short stay service share contact with staff for residents, short stay users can transmit pathogens to residents through staff members. A similar relation might hold for day care service for the WTP in an average treatment effect model. That fact indicates that the WTP of facilities with day care service was lower than that of facilities without day care service. Moreover, it indicates that day care services might reduce eagerness for external training. Therefore, FESSy is expected to be important not only for residents, but also for short stay service or day care services. Elucidating that importance is anticipated as the next challenge for FESSy.

However, WTP was not found to have any significant association with the number of nurses in average treatment effect model. That finding suggests that demand for external training is not associated with nurses.

These unexpected results might derive from the questionnaire for WTP. Especially, we assumed the upper amount of WTP as 100 thousand yen, but it probably differed among facilities. Moreover, the assumption of the lower amount of WTP as 2000 yen might be overly restrictive. These were just speculative presumptions. Actually, sensitivity analysis showed some possible association between WTP and FESSy. More thoughtful specification of the questionnaire for WTP in future surveys might resolve this question. Moreover, we did not indicate a particular situation of external training such as contents, times, frequency, location (remote or face-to-face), or lecturer. Therefore, respondents might feel difficulty in imagining external training. Future questionnaires can be expected to resolve these difficulties.

Moreover, there might be insufficient precision in the first step logistic regression in the average treatment effect model, as described previously. Less precise prediction of the probability of a need for FESSy leads to wider variation of the estimator. Unfortunately, the questionnaire used for this study did not give more information to increase precision in indicating the need for FESSy. Future surveys should evaluate the need for FESSy with a better predictor, although we have no particular idea what it might be. It remains as a challenge for future research.

Limitations

First, because this study was based on questionnaire responses and because the response rate was not so high (31%), selection bias might be inferred for the responses. Facilities that experienced a severe outbreak of COVID-19 might have hesitated to respond to the questionnaire. If so, then our obtained results might be biased toward infection control facilities.

Second, although we provided information about FESSy to respond to their needs, they cannot be expected to have a precise image of FESSy. When FESSy becomes prevalent throughout Japan, especially in Ibaraki prefecture, managers will know well or will have experienced FESSy. Therefore, needs for FESSy might change over time. Regarding external training, approximately 30% of facilities in Ibaraki prefecture participated in external training conducted by Ibaraki Prefectural Health Science University after the survey associated with this study. Therefore, we can measure WTP for external training to attended facilities. The findings might specifically indicate some possibility of association among external training and FESSy which was indicated by sensitivity analysis.

Third, during the survey period, FESSy had not prevailed well in Ibaraki prefecture yet. Analysis for actual demand might be different from needs. That subject remains as a future challenge.

Fourth, results of statistical analyses such as those obtained from this study do not indicate causality. Although we inferred that the number of nurses would increase the need for FESSy, FESSy requires more working hours or skill of nurses. One must bear such points in mind when interpreting the results.

Conclusion

Results demonstrated that number of nurses increases the need for FESSy. Moreover, the value of FESSy was estimated as six million yen. Regarding external training, we were unable to obtain meaningful results about association with nurses or FESSy because of questionnaire limitations. An improved questionnaire is expected to be necessary for future surveys.

Conflict of Interest

No author has any conflict of interest, financial or otherwise, to declare in relation to this study.

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Ethical Consideration

This study was approved by the Ethics Committee of Ibaraki Prefectural University of Health Sciences (No.1017).

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IMCJ Statement

JK was responsible for the coordination of the study and

analyzed the data. NS performed the survey. All authors contributed to the writing of the final manuscript.

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