

Outbreak Information Delivery to Families with (Pre)School Children and Its Contribution

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Abstract

Background: Infection transmission among them occurs easily and sometimes causes outbreaks at facilities where children live in groups. Early response is necessary for infection control measures to avoid larger clusters. In Japan, (Nursery) School Absenteeism Surveillance System ((N)SASSy), which is a kind of school absenteeism surveillance, has activated since 2007 and covers about 60% of all schools and 40% of all nursery schools in 2017. **Objective:** The objective of the present paper is investigation and demonstration of how caregivers receive information related to infectious diseases in Japan and how (N)SASSy contributes health of children. **Method:** We randomly selected subjects with children by prefecture in October, 2017. The survey questionnaire asked background information and information about infectious diseases to maintain health in children. We regressed health concern variables on background information and information provision situation about community outbreaks using weighted logistic regression. **Results:** We received responses from 1172 people. Estimation results showed higher concern about a facility providing information about community outbreak. Caregivers whose children attend facilities provided about community outbreak or covered (N)SASSy significantly higher opportunity to arrange a schedule when a child has a high fever. **Discussion:** The obtained results demonstrated that activation in (N)SASSy affects the possibility of arranging a schedule when a child has a high fever. This capability might improve community health.

Keywords

School Absenteeism Surveillance, Outbreak Information, Families with (Pre)School Children, Nursery School, Infection Control

1. Introduction

Because children live in groups in nursery schools, kindergartens, schools, and kodomoen (a hybrid facility of nursery school and kindergarten), infection transmission among them occurs easily and sometimes causes outbreaks. Hereafter, the term “(nursery) school” denotes both a nursery school and schools including kindergartens, kodomoen, elementary schools, junior high schools, and high schools. Early response is necessary for infection control measures to avoid larger clusters, prevent complicated cases, and subsequently minimize health damage deriving from an outbreak.

Actually, because caregivers with preschool children have great concern about sudden onset and infectious diseases among children, they eagerly seek information related to outbreak or infectious diseases [1] [2] [3]. If they can receive such information, caregivers use the information to take precautions at home and to rearrange working schedules if they are working.

Regarding earlier response, earlier detection is necessary to find indications of outbreak and then switch the daily modes of activity from usual hygiene to infection control measures. Particularly, surveillance of prescriptions and absenteeism from (nursery) school have been used routinely nationwide and used by local government, public health centers, (nursery) schools or medical institutions. Information about absenteeism from (nursery) school has been integrated and systematized into the (Nursery) School Absenteeism Surveillance System ((N)SASSy) [4]-[12].

Many surveillance efforts conducted worldwide have assessed school absenteeism [13]-[20]. However, they all monitored absenteeism or only those related to influenza. In Japan, by contrast, all reasons for absence from (nursery) schools related to illness, symptoms, and diagnosed diseases are reported to (nursery) schools. (N)SASSy used this virtue as systematic information sharing to monitor all symptoms and diagnosed diseases. Public health authorities and medical professionals have used this system to control the spread of infectious disease [11]. Moreover, an evidence demonstrates that (N)SASSy can reduce the number of patients with some infectious diseases [12].

Caregivers of students who are absent from (nursery) school because of infectious diseases usually report to (nursery) school. School nurses and other teachers provide information to (N)SASSy through the internet. As of the end of 2016, the system encompassed approximately 37,000 schools, including 10,000 nursery schools, or about 60% of all schools and 40% of all nursery schools in Japan. On a daily basis, it monitors the health conditions of about four million children younger than 18 years old. The information in (N)SASSy is used in (nursery) schools themselves to recognize the situation of the surrounding areas and inform teachers, students, and caregivers, thereby promoting precaution if some outbreak is found in surrounding areas but not at their own (nursery) school. Information in (N)SASSy is also shared between (nursery) school doctors, the educational board, the local government offices for nursery schools, the

public health center, and the local medical association. The shared information encourages earlier awareness of infectious diseases, which engenders earlier response to the initial stage of outbreaks in (nursery) schools. Moreover, having such a large trove of data related to children's health promotes large epidemiological studies. Currently, it is conducted by the Japanese Society of School Health.

In terms of public health, Japan's school system is unique. According to the School Health and Safety Act, at all levels of schools except for nursery schools, when students are diagnosed with certain designated infectious diseases such as influenza, varicella, and mumps, schools must not allow students to attend classes. We designate it as "attendance prohibition due to infectious disease". A student who has a defined infectious disease cannot attend classes, but the lack of attendance does not count as an absence. Caregivers must notify the school if their children are diagnosed with a defined infectious disease. Moreover, even if the children have not visited a doctor or have not been diagnosed with any defined disease, caregivers usually call the school and report a child's symptoms, e.g., fever, vomiting, or diarrhea. In these cases, schools do not apply "attendance prohibition due to infectious disease". No other country has a similar system.

Nursery schools, by contrast, are not classified as education institutions but as welfare facilities. Therefore, the School Health and Safety Act is not applied to nursery school children. They do not fall under "attendance prohibition due to infectious diseases" even if diagnosed with a defined infectious disease. Even if such a disease is not diagnosed or the child did not visit a doctor, nursery school caregivers also usually report a child's health condition to the nursery school. Of course, the law requires no action, but almost all nursery schools require caregivers to give a report based on the guideline from the Ministry of Health, Labour, and Welfare. Additionally, the culture, custom, or rule among schoolchildren's caregivers might affect caregiver behavior because nursery school children might be younger siblings of schoolchildren within a family.

In short, all information related to children's health conditions is integrated in (nursery) schools. (N)SASSy maintains a computerized system comprising such information and network of information sharing among the concerned organizations and individuals. Consequently, (N)SASSy can be used as a form of syndromic surveillance in Japan. It can be a powerful public health tool for use during mass gatherings or important political events [4] such as a G7 summit meeting. In fact, it is intended for use during the 2020 Tokyo Olympic Games. It was also used at school nurse workshops. Public health sector and (nursery) schools have been using (N)SASSy.

Nevertheless, for security reasons, caregivers who need outbreak information [1] cannot access (N)SASSy directly, even though they receive information from (N)SASSy through (nursery) schools. Consequently, the objective of the present paper is investigation and demonstration of how caregivers receive information related to infectious diseases in Japan. This might be the first report of the rele-

vant literature describing an examination revealing the current status of caregivers receiving information of infectious diseases.

2. Method and Materials

We randomly selected subjects with children by prefecture in October, 2017 from a list of household which registered to corporate internet survey and has children. This list was provided by an internet survey company. In the survey questionnaire, we elicited background information such as prefecture, age, gender, marriage status, number of children, job status, job status of partner, type of facility the youngest child attends, use of public or private facilities, facility location, and usual information-seeking activities using a smartphone. Moreover, we solicited information about infectious diseases to maintain health in children such as concerns about outbreaks at facilities the children attend, concern about child health conditions, provision of information related to infectious diseases in the facility from the facility, provision of information of infectious diseases in the community from the facility, children's immunization record, whether it is possible to arrange a schedule when a child has a high fever, and concerns about some students in the class in which the child attend showed illness. No personal information for identification in the data was included in this survey. The survey was conducted in October, 2017 and its duration was one week. The survey area was nationwide in Japan. Questionnaire design was similar with the previous studies [2] [3] principally, but it was extended to include the area where (N)SASSy have not been activated so as to evaluate effectiveness of (N)SASSy.

Analysis examined the association among necessarily infectious diseases or health maintenance of children from the survey and activation in (N)SASSy. The activation status of (N)SASSy was classified to two classifications as the facility youngest child attend was covered (N)SASSy. It was activated in (nursery) schools in their residential area. We denoted the former as (N)SASSy in the facility and the latter as (N)SASSy at all facilities.

The area was defined as the municipality. We define caregiver as respondents if the job status of respondents was "no". Conversely, if the job status of respondents was "yes" and job status of respondents' partner was "no", we defined the caregiver as the respondent's spouse. If a respondent was single, or if both the respondent and the spouse worked outside or did not work, then we defined the caregiver as the respondent.

We regressed health concern variables on caregiver age, youngest child age, more than two children, job status of a caregiver, and information provision situation about community outbreaks using weighted logistic regression weighted by the population of the municipality of residence. We presumed five variables as health concern variables: "Are you concerned about outbreaks at the facility the children attend?", "Are you concerned about the health condition of the children?", "Child immunization record", "Are you concerned if your child's classmates show illness?" and "Can you change your schedule if your child has a

high fever?” We assumed three variables as information providing situation about community outbreaks: “Information provision from the facility,” (N)SASSy at the facility, and (N)SASSy at all facilities. As these three variables were supposed to be correlated to each other, we estimated three specifications including one of these three variables separately for each dependent variable.

These dummy variables take the following values: “Caregiver age” is one if the caregiver works outside the home; it is zero otherwise. “More than two children” is one if the family has more than two children; it is zero otherwise. “Job status” takes a value of one if the caregiver works outside home; it is zero otherwise. Also, “Information provision from the facility” takes a value of one if the attended facility provides information about infectious diseases to the community; it is zero otherwise. “(N)SASSy in the facility” is one if the attended facility has activated (N)SASSy; it is zero otherwise. “(N)SASSy at all facilities” is one if the facility located where (N)SASSy was activated in both of nursery schools and schools; it is zero otherwise. “Are you concerned about outbreaks at your child’s facility?”, “Are you concerned about your child’s health condition?”, “Are you concerned if your child’s classmates show illness?” and “Can you change your schedule when your child has a high fever?” were one if answered as yes; they were zero otherwise. “Child’s immunization record” was one if a caregiver kept immunization records; it was zero otherwise.

Ethics

The survey used for the present study includes only anonymous data that were de-linked from individual patient information with no private information such as a name, address or phone number. Therefore, ethical issues in Japan related to the medical science for humans (Ministry of Education, Culture, Sports, Science and Technology and Ministry of Health, Labour and Welfare (22 December, 2014, revised on 28 February 2017) were not applicable to this study. For that reason, no formal ethical review was warranted or required.

3. Results

We received responses from 1172 people. **Table 1** presents their socio-demographical background. Responders were mainly in their 20 s or 40 s; 99% were women. Marriage status revealed that 89.9% were married; 8.6% were divorced or widowed. Regarding the number of children, one child households were the highest, with 48.9%, followed by two child households, with 38.6%. The age of the youngest child was preschool child under five years old, accounting for 52.2%, followed by elementary school child older than 6 but younger than 11 years old, with 35.4%. Of respondents, 58.3% worked outside the home; 82.5% of respondent partners were working. The youngest children attended elementary school in 35.3% of households, followed by nursery school in 23.9%. Of attended facilities, 55.3% were public (nursery) schools; private were 34.8%. Of them, 94.2% attend a facility in their same municipality. Of respondents, 71.5% collect information from a smart phone.

Table 1. Summary statistics of respondents' socio-demographical characteristics.

		Number of respondents	Proportion (%)
Caregiver age	20 - 29	106	9.0
	30 - 39	572	48.8
	40 - 49	449	38.3
	50 - 59	45	3.8
Caregiver gender	male	10	0.9
	female	1162	99.1
Marriage status	married	1054	89.9
	unmarried	17	1.5
	divorce	101	8.6
Number of children	one	573	48.9
	two	452	38.6
	three	131	11.2
	more than four	16	1.4
Youngest child age	0 - 6 years old	612	52.2
	7 - 12 years old	415	35.4
	13 - 15 years old	81	6.9
	16 - 18 years old	64	5.5
Caregiver job status	yes	683	58.3
	no	487	41.6
	unknown	2	0.2
Partner job status	yes	967	82.5
	no	85	7.3
	unknown	2	0.2
	unanswered	118	10.1
Youngest child attends	nursery school	280	23.9
	kodomoen	99	8.4
	kindergarten	234	20.0
	elementary school	414	35.3
	junior high school	54	4.6
	high school	54	4.6
	others	37	3.2
Public or private facility?	public	648	55.3
	private	408	34.8
	others	116	9.9
Is the facility the youngest child attends outside the municipality of residence?	yes	1104	94.2
	no	68	5.8
	yes	838	71.5
Usual information seeking activity by smartphone	sometimes	241	20.6
	no	90	7.7
	unknown	3	0.3

Subjects were asked for background information such as prefecture of residence, age, gender, marriage status, number of children, job status, partner job status, type of facility youngest child attends, and public or private facility.

Table 2 summarized health concern among respondents and situation of providing information about infectious diseases from community or (nursery) schools. Regarding information gathering of infectious diseases for health maintenance, 74.7% of respondents were concerned about the health condition of children, 73.2% were concerned about outbreak in the attended facilities, and 76.4% of them receive some information about infectious diseases from the attended facilities. The highest proportion of frequencies was “as needed” in 69.4%, followed by “every day” in 11.8%. The most common method to receive the information was mail from (nursery) schools, followed by e-mail and notices on a bulletin board.

Related to providing of information of infectious diseases in the community from the facility, 33.4% of respondents received such information. However, 37.8% of respondents answered unknown. Of those received, the highest proportion of frequencies was “as needed”, with 66.2%, followed by “once a week” with 13.8%. The most common method to receive such information was mail from (nursery) schools, which accounted for 42.7% of responses, followed by e-mail (37.1%), and homepages (32.0%). Moreover, 89.3% of those who received information answered that it was useful.

Though it was not shown in table, (N)SASSy had been activated in at least some (nursery) schools in 73% of respondents’ residential areas. Both of (nursery) schools were activated in 20.3% of these areas, schools only in 39.8%, nursery schools only in 4.6%, part of (nursery) schools in 8.4%.

Table 3 presents estimation results of health concern. It contains five dependent variable and three specifications for each dependent variables. Only but consistently caregiver’s outside job significantly negative effect on “Are you concerned about outbreaks in the facility the children attend?” Younger caregivers have significantly less concern about a child’s health condition only in cases of information provision situations about community outbreak as “information provision from the facility.” Caregivers were found to have a significant tendency to keep child immunization records if the facility provided information about community outbreaks. If a family has more than two children, then caregivers have significantly greater concern about the class situation in the same class. They also report significantly higher concern about a facility providing information about community outbreak. Caregivers whose children attend facilities provided about community outbreak or covered (N)SASSy significantly higher opportunity to arrange a schedule when a child has a high fever.

4. Discussion

This study examines at first time to approach the situation at caregivers from the survey rather than how public health section [11] or (nursery) schools use (N)SASSy. Older working caregivers with more than two children tend to have higher health concerns. Moreover, to attend the facility provided about community outbreak or covered (N)SASSy makes it easier to arrange the working schedule if a child had onset suddenly. That information about community

Table 2. Summary statistics of health concern and situation of providing information about infectious diseases from community or (nursery) schools and.

		Number of respondents	Proportion (%)
Concern about outbreaks at the facility the children attend	yes	857	73.1
	no	249	21.2
	unknown	66	5.6
Concern about your child's health condition	yes	875	74.7
	no	282	24.1
	unknown	15	1.3
Child immunization record	yes	1126	96.1
	no	33	2.8
	unknown	13	1.1
Concern about child's classmates' illness	yes	1101	93.9
	no	47	4.0
	unknown	24	2.0
Can you change your schedule when your child has a high fever?	yes	1080	92.2
	no	92	7.8
If your child were diagnosed as having influenza today, who would care for sick child? (Multiple answers allowed)	me	1072	91.5
	family member except me	146	12.5
	grandparent or other relations	129	11.0
	babysitter	6	0.5
	day care for sick children	31	2.6
	others	6	0.5
	do nothing	10	0.9
Providing of information about infectious diseases at the facility from the facility	yes	895	76.4
	no	158	13.5
	unknown	119	10.2
If yes, its frequency is...	every day	106	11.8
	once a week	76	8.5
	once a month	50	5.6
	as needed	621	69.4
	others	42	4.7
If yes, it was provided by...	homepage	78	8.7
	e-mail	406	45.4
	mail	505	56.4
	board at the facility	204	22.8
	others	46	5.1
Providing information about infectious diseases in the community from the facility	yes	391	33.4
	no	338	28.8
	unknown	443	37.8

Continued

If yes, its frequency is...	every day	34	8.7
	once a week	54	13.8
	once a month	31	7.9
	as needed	259	66.2
	others	13	3.3
If yes, it was provided by...	homepage	125	32.0
	e-mail	145	37.1
	mail	167	42.7
	board at the facility	80	20.5
	others	16	4.1
If yes, was it useful?	yes	349	89.3
	no	7	1.8
	unknown	35	9.0

Table 3. Estimation result of weighted logistic regression.

	Estimated coefficient	<i>p</i> -value	Estimated coefficient	<i>p</i> -value	Estimated coefficient	<i>p</i> -value
Dependent variable: Are you concerned about outbreaks at the facility the child attends?						
Caregiver age	-0.081	0.836	-0.050	0.895	-0.052	0.890
Youngest child's age	-0.082	0.053	-0.069	0.090	-0.076	0.070
More than two children	-0.221	0.508	-0.171	0.640	-0.217	0.518
Job status	-1.847	0.000	-1.831	0.000	-1.829	0.000
Information provision from the facility	0.273	0.447				
(N)SASSy in the facility			-0.139	0.701		
(N)SASSy at all facilities					0.127	0.745
Constant	4.460	0.000	4.466	0.000	4.450	0.000
Dependent variable: Are you concerned about your child's health condition?						
Caregiver age	-0.686	0.042	-0.645	0.059	-0.646	0.058
Youngest child's age	-0.089	0.028	-0.082	0.062	-0.078	0.073
More than two children	-0.357	0.270	-0.360	0.277	-0.340	0.295
Job status	-0.477	0.120	-0.483	0.108	-0.473	0.120
Information provision from the facility	0.354	0.326				
(N)SASSy in the facility			0.066	0.847		
(N)SASSy at all facilities					0.347	0.381
Constant	2.815	0.000	2.851	0.000	2.774	0.000
Dependent variable: Child immunization record						
Caregiver age	-0.070	0.920	0.018	0.979	0.042	0.949
Youngest child's age	-0.061	0.338	-0.070	0.300	-0.033	0.622

Continued

More than two children	0.122	0.871	-0.062	0.935	0.171	0.825
Job status	-0.281	0.659	-0.402	0.552	-0.312	0.633
Information provision from the facility	1.372	0.030				
(N)SASSy in the facility			0.996	0.057		
(N)SASSy at all facilities					0.477	0.489
Constant	4.127	0.006	4.401	0.003	4.167	0.003
Dependent variable: Are you concerned if your child's classmates show illness?						
Caregiver age	-0.700	0.213	-0.523	0.321	-0.536	0.319
Youngest child's age	0.021	0.676	0.024	0.650	0.067	0.296
More than two children	1.337	0.012	1.201	0.021	1.398	0.011
Job status	-1.136	0.034	-1.244	0.025	-1.194	0.030
Information provision from the facility	1.845	0.000				
(N)SASSy in the facility			0.748	0.089		
(N)SASSy at all facilities					1.064	0.069
Constant	4.409	0.000	4.676	0.000	4.438	0.000
Dependent variable: Can you change your schedule when your child has a high fever?						
Caregiver age	-0.068	0.868	0.020	0.960	0.033	0.934
Youngest child's age	-0.045	0.224	-0.046	0.246	-0.019	0.653
More than two children	0.736	0.067	0.580	0.139	0.755	0.075
Job status	-0.065	0.876	-0.214	0.632	-0.151	0.727
Information provision from the facility	1.249	0.001				
(N)SASSy in the facility			0.697	0.046		
(N)SASSy at all facilities					0.564	0.298
Constant	2.463	0.002	2.787	0.000	2.602	0.001

Note: "Caregiver age" is one if the caregiver is younger than 30 years old; it is zero otherwise. "More than two children" is one if the family had more than two children; it is zero otherwise. "Job status" is one if the caregiver works outside the home; it is zero otherwise. "Information provision from the facility" is one if the attended facility provides infectious disease information to the community; it is zero otherwise. "(N)SASSy in the facility" is one if the youngest child attends an (N)SASSy activated facility; it is zero otherwise. "(N)SASSy at all facilities" is one if (N)SASSy is activated at both nursery schools and schools; it is zero otherwise. "Are you concerned about outbreaks in the facility the children attend?", "Are you concerned about your child's health condition?", "Are you concerned if your child's classmates show illness?" and "Can you change your schedule when your child has a high fever?" were one if yes; they were zero otherwise. "Children's immunization record" is one if caregivers keep child immunization record; it is zero otherwise. "Are you concerned about outbreaks in the facility the children attend?", "Are you concerned about your child's health condition?", "Are you concerned if your child's classmates show illness?" and "Can you change your schedule when your child has a high fever?" are dependent variables in logistic regression. For each dependent variable, three specifications, which include one of "Information provision from the facility", "(N)SASSy in the facility" or "(N)SASSy at all facilities", were estimated. "0.000" in *p*-value means less than 0.0004. Significant coefficients were emphasized by boldface.

outbreaks is needed [2] and is used for child care. Therefore, the obtained results were consistent with those reported from earlier studies. Results also show that (N)SASSy can mitigate some difficulties of working schedule arrangements. Better information might contribute to eased absence from (nursery) schools, higher probability of visiting a doctor, and minimizing outbreak scale. In this sense, the obtained results might be consistent with those of earlier studies showing

that (N)SASSy activation can reduce the number of patients with some common pediatric infectious diseases [12]. However, “Information provision from the facility” apparently has a stronger effect than “(N)SASSy in the facility” or “(N)SASSy at all facilities.” Results suggest that activation of (N)SASSy might not be sufficiently useful, but it might become more useful through information being delivered from the facility to caregivers.

Conversely, no significant effect of “(N)SASSy at all facilities” was found. In general, information about outbreak situations of different age classes is useful for a caregiver to take precautions. Therefore, the outbreak situation among different age classes is expected to be very useful for caregivers. Nevertheless, that expectation was not supported by estimation results.

Similarly, the youngest child’s age has no significant effect on any health concern variable in any examined specification. In general, it is presumed to affect caregivers’ health concerns. **Table 1** showed that the youngest child was younger than six years old for about half of the respondents. However, it might include a few respondents for whom the youngest children were zero-year-olds or one-year-olds because the caregivers of zero-year-olds or one-year-olds were expected to be more concerned about health. Alternatively, the youngest child’s age might be multicollinearity with other variables such as “more than two siblings” or “caregiver age.”

The study described in this paper includes some limitations. First, we surveyed health concern variables as a hypothetical situation, except for vaccination records. Responses might not match the actual behavior used if the hypothetical situation is actually realized. Therefore, it is necessary to measure effects of (N)SASSy from data of actual behavior when facing outbreak information at a facility or community. That possible shortcoming remains as a challenge for future research.

A second limitation was few respondents reporting zero-year-old or one-year-old children. Data sampling was unbiased geographically and by age distribution. Therefore, few zero-year-old or one-year-old children were included. Nevertheless, children of this age group are the most vulnerable to infectious disease. For that reason, their caregivers are presumed to be more health conscious than caregivers with older children. Future studies might specifically examine caregivers with children of these ages.

A third limitation is that we cannot evaluate the ability of results to represent actual health concerns. Accumulation of data will resolve this difficulty.

5. Conclusion

The obtained results demonstrated that activation in (N)SASSy affects the possibility of arranging a working schedule when a child has a high fever. This capability of arranging a caregivers’ working schedule might improve community health because caregivers can nurse their ill children, they can be absent from (nursery) schools and then outbreak in (nursery) schools will be suppressed. This

report is the first describing benefits of (N)SASSy from a family perspective.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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