

Adult Oral Health Programs in Japanese Municipalities: Factors Associated with Self-Rated Effectiveness

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Health Japan 21 plan establishes specific targets for aspects of health including oral health for 2010, in an effort to increase health expectancy. Despite this, there has been insufficient improvement in oral health status in adults. The objective of this cross-sectional study was to determine the factors associated with effective oral health programs for adults in Japanese municipalities. Questionnaires were mailed to all 1,472 municipalities in Japan and responses were obtained from 862 municipalities (response rate: 58.6%). After excluding 71 municipalities with “unknown” answer, no answer, or lack of relevant information, we analyzed the data from the remaining 791 municipalities with or without oral health programs for adults self-reported as effective within three years. Multilevel Poisson regression models were used to examine the associations of effective programs with oral health personnel, contact with related agencies, the establishment of Health Japan 21 goals, financial status, the density of dentists and population density at the municipality level, and having oral health personnel at the prefecture level. Three hundred and fifty-four municipalities reported having effective programs. In the fully adjusted model, having dental hygienists in the municipal office ($P < 0.05$) and a high number of contacts with related agencies ($P < 0.05$) were significantly associated with having effective programs. These results suggest that having dental hygienists and contact with related agencies such as residents, local dental associations, companies, community general support centers, or medical, nursing or welfare facilities are promoting factors for effective adult oral health programs in Japanese municipalities.

Keywords: adults; contacts; dental hygienists; municipality; oral health program

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Introduction

In 2000, the Ministry of Health and Welfare, Japan (now the Ministry of Health, Labour and Welfare, Japan) put forward the ‘National Health Promotion in the 21st Century (Health Japan 21)’ plan, which set specific health targets for 2010 (Health Japan 21 Working Team for Evaluation 2011). Basic policies of Health Japan 21 included the importance of primary prevention, creation of a supportive environment for the enhancement of health, goal setting and assessment, and the promotion of effective, well-coordinated activities by the various implementing bodies. These activities were intended to cover nine specific areas including oral health.

The oral health status of children, especially regarding the prevalence of dental caries, has improved in Japan

(Health Japan 21 Working Team for Evaluation 2011; Ministry of Health, Labour and Welfare, Japan 2011). However, there has been insufficient improvement in oral health status in adults. The prevalence of dental caries and periodontal disease in middle-aged individuals has not changed in recent years (Ministry of Health, Labour and Welfare, Japan 2011). As these are the major reasons for tooth loss (Aida et al. 2006), their prevention in adults is important and yet a major challenge.

Community health promotion is the primary health care approach that emphasizes prevention. Community oral health approaches include education, screening, diagnosis and treatment (WHO Kobe Centre 2002). Municipalities (cities, towns and villages: 1,742 in 2012) play a major role in the community oral health approach under the supervision of the prefectures (47 in 2012) in Japan. Recent stud-

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ies showed that regional (municipality- and prefecture-level) disparities in oral health are increasing in Japan (Aida et al. 2008; Hirata et al. 2010; Takiguchi et al. 2010). Introducing effective oral health programs in municipalities with poorer oral health may reduce these disparities in oral health.

Oral health programs for children are well implemented by municipalities because oral health examinations and oral health education for 1.5- and 3-year-olds and schoolchildren are mandatory in Japan. In contrast, oral health programs are not compulsory for adults. Some municipalities have periodontal examination programs, but participation rates (3.6% in 2002) are often low (Aoyama et al. 2004). It was recently reported that 54.2% of all municipalities in Japan had conducted periodontal examination programs in 2010 (Ministry of Health, Labour and Welfare, Japan 2012).

Studies showed that municipalities with a high population density (Ozaki et al. 1998, 2011), high economic power (Ozaki et al. 2010), and full-time dental hygienists (Ozaki et al. 1998; Suetaka 2010) were more likely to conduct oral health programs for adults. The results of these studies suggest that it is the large cities with rich economic and human resources that tend to conduct oral health programs. In order to address oral health disparities among municipalities, information about municipalities' modifiable factors, in

addition to the population size and economic power, is needed so that oral health programs for adults in municipalities with poor resources can be planned. For example, a goal-oriented approach (Mold et al. 1991) and an approach in which contacts are established with agencies to create social capital (Tsutsui 2012) have attracted attention in community-based health promotion movements. However, no studies have empirically assessed the association between oral health programs and contact with related agencies. Moreover, previous studies focused only on whether or not oral health programs were conducted and not on the quality of the programs (Ozaki et al. 1998, 2010, 2011; Suetaka 2010).

Based on previous studies, we hypothesized that the presence of oral health personnel at prefectural offices (working every day), urbanization (Ozaki et al. 1998, 2011), economic power (financial status) (Ozaki et al. 2010), density of dentists, the presence of oral health personnel at municipal offices (Ozaki et al. 1998; Suetaka 2010), the establishment of the goals for oral health stipulated in 'Health Japan 21,' and contact with related agencies are directly or indirectly associated with effective programs (Fig. 1). The purpose of the present study was to identify the factors associated with the effectiveness of oral health programs for adults in Japanese municipalities.

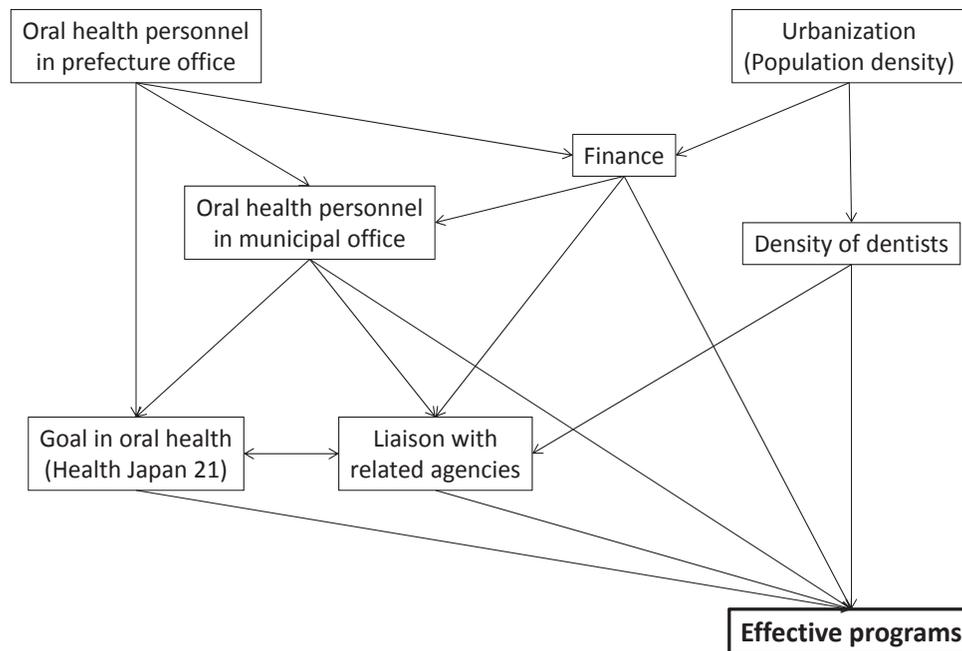


Fig. 1. Possible pathway from factors to effective oral health programs for adults.

Having oral health personnel at prefectural offices may help oral health personnel in the municipal office in the planning of oral health programs, may enable financial support for conducting oral health program in the municipalities, and may provide advice on how to establish goals in oral health (Health Japan 21) in the municipalities. Having oral health personnel at municipal offices may facilitate establishing goals in oral health (Health Japan 21) in the municipalities, and may help establish contact with related agencies such as local dental associations to conduct programs, resulting in more effective programs. Municipalities in urban areas may be more financially stable and may have many dentists. Rich municipalities tend to have oral health personnel and may conduct more effective programs. Municipalities with many dentists may have more opportunities for liaison with municipalities.

Methods

Survey method

Between November 2012 to January 2013, questionnaires were mailed to oral health personnel in all 1,472 municipalities of the 47 prefectures in Japan. Responses were obtained from 862 (58.6%) municipalities.

Dependent variable

Implementation of effective oral health programs for adults in the past three years in the municipalities was ascertained by asking "Have effective oral health programs for adults (including reduction in the prevalence of oral diseases, increase in the number of people with good oral health behavior, and increase in the number of people with oral health knowledge) been held in the past three years in your municipality?" with possible answers of "Yes", "No", or "Unknown". Of the 862 municipalities, 355 (41.2%), 441 (51.2%) and 53 (6.1%) municipalities answered "Yes", "No", and "Unknown", respectively, and 13 (1.5%) municipalities did not answer. The 66 municipalities that answered "Unknown" or did not answer were excluded. Moreover, five municipalities were excluded due to a lack of information on the number of dentists or total population. Thus, the remaining 791 municipalities were used for analyses. The "Yes" or "No" answer for the question was used as the dependent variable.

Independent variables

The questionnaire included information on oral health personnel in the municipal office, contact with related agencies for oral health programs, establishment of the goals for adult oral health from Health Japan 21, and financial status, which were used as independent variables. Oral health personnel in the municipal office included full-time dentists or dental hygienists, and each article of data was categorized into one of three groups: none, one or more, or unknown. Information on contact with related agencies for oral health programs in the past three years was collected by asking, "Are there any resident-run oral health programs?", "Does your oral health program involve contact with a local dental association?", "Does your oral health program involve contact with companies?", and "Does your oral health program involve contact with community general support centers or medical, nursing or welfare facilities?", with possible answers of "Yes", "No", or "Unknown". Establishment of the goals for adult oral health from Health Japan 21, 2000-2012, was ascertained by asking, "Did your municipality establish targets for the goal from Health Japan 21 regarding the percentage of people aged 40 with advanced periodontitis?", "Did your municipality establish targets for the goal from Health Japan 21 regarding the percentage of people aged 80 with 20 or more teeth?", and "Did your municipality establish targets for the goal from Health Japan 21 regarding the percentage of people aged 60 visiting dentists regularly?", with possible answers of "Yes", "No", or "Unknown". The number of goals (0 to 3) was calculated. Whether or not each municipality had an oral health program funded by the municipality alone in 2010 was used as a parameter of economic power, especially regarding oral health, in the municipality.

As another parameter of economic power, data on expenses for public health service and annual expenditure of each municipality was obtained from national survey data, and the percentage of expenses for public health services in the annual expenditure was calculated for each municipality. The number of dentists, total popula-

tion and area of each municipality was also obtained from the national survey data, and the number of dentists per 10,000 population and population density were calculated for each municipality. The numbers of dentists and dental hygienists in each of the 47 prefectural offices were obtained from the Ministry of Health, Labour and Welfare, Japan.

Analysis

Because percentages of municipalities with self-reported effective program (44.8%) were more than 10%, adjusted odds ratio derived from the logistic regression can no longer approximate the prevalence ratio (PR) (Zhang and Yu 1998). First, univariate associations between presence of an effective oral health program for adults and each independent variable were examined with a univariate Poisson regression model, and PR and the 95% confidence interval (CI) were calculated. Then, the municipality-level variables that were significantly ($P < 0.05$) associated with having an effective program (except for each contact variable and each goal variable) and the prefecture-level variables (presence of dentists and dental hygienists in the prefectural office) were simultaneously added to a two-level Poisson regression model with random intercepts and fixed slopes to calculate multilevel PR and 95% CI.

To further explore the association between having an effective program and having agency contacts, four contact variables were simultaneously added to a fully adjusted two-level Poisson regression model instead of the number of contacts. Then, the associations between the number of contacts and each contact variable were examined by cross tabulation to explore easiness/difficulty and order in agency contacts. All statistical analyses were conducted using IBM SPSS Statistics version 21 (IBM Co., Armonk, NY, USA) and the MLwiN 2.28 software package (Centre for Multilevel Modelling, University of Bristol, Bristol, UK).

Results

Univariate Poisson regression models showed that having dental hygienists in municipal offices, contact with residents, local dental associations, companies, and community general support centers or medical, nursing or welfare facilities, establishment of goals for adult oral health stipulated Health Japan 21 (related to the percentages of people aged 40 with advanced periodontitis, people aged 80 with 20 or more teeth, and people aged 60 visiting dentists regularly), having an oral health program funded by the municipality alone in 2010, being in the third quartile for number of dentists per 10,000 population, and having a high population density (1,500 or more people/km²) were each significantly ($P < 0.05$) associated with having effective oral health programs for adults in the municipality (Table 1). The PR increased with the number of contacts.

Having dental hygienists in the municipal office and the number of contacts were independently associated with having effective oral health programs for adults in the municipality after adjusting for having dentists in the municipal office, the number of goals established for adult oral health from Health Japan 21, having an oral health program funded by the municipality alone, the density of dentists, the population density, and having dentists and dental

Table 1. Univariate associations of each variable with presence or absence of an effective oral health program for adults.

	Total no. of municipalities	Municipalities with effective program		Univariate Poisson regression model		
		No.	%	PR	95% CI	P
Municipality-level variables						
Oral health personnel in municipal office						
Dentist						
No	651	274	42.1	1.00		
Yes	52	26	50.0	1.19	(0.79 - 1.78)	0.401
Data missing	88	54	61.4	1.46	(1.09 - 1.95)	0.011
Dental hygienist						
No	517	185	35.8	1.00		
Yes	247	159	64.4	1.80	(1.46 - 2.22)	< 0.001
Data missing	27	10	37.0	1.04	(0.55 - 1.96)	0.916
Contacts in oral health program						
Under the initiative of the residents						
No	533	201	37.7	1.00		
Yes	228	139	61.0	1.62	(1.30 - 2.00)	< 0.001
Unknown or data missing	30	14	46.7	1.24	(0.72 - 2.13)	0.440
Contact with local dental associations						
No	145	24	16.6	1.00		
Yes	640	329	51.4	3.10	(2.05 - 4.70)	< 0.001
Unknown or data missing	6	1	16.7	1.01	(0.14 - 7.45)	0.995
Contact with companies						
No	726	304	41.9	1.00		
Yes	56	43	76.8	1.83	(1.33 - 2.52)	< 0.001
Unknown or data missing	9	7	77.8	1.86	(0.88 - 3.93)	0.105
Contact with community general support centers or medical, nursing or welfare facilities						
No	377	117	31.0	1.00		
Yes	394	229	58.1	1.87	(1.50 - 2.34)	< 0.001
Unknown or data missing	20	8	40.0	1.29	(0.63 - 2.64)	0.486
No. of contacts (sum of above 4 contact types)						
0	87	8	9.2	1.00		
1	235	77	32.8	3.56	(1.72 - 7.38)	0.001
2	252	133	52.8	5.74	(2.81 - 11.72)	< 0.001
3	132	85	64.4	7.00	(3.39 - 14.46)	< 0.001
4	26	24	92.3	10.04	(4.51 - 22.34)	< 0.001
Unknown or data missing	59	27	45.8	4.98	(2.26 - 10.95)	< 0.001
Establishment of goals from Health Japan 21						
% of 40-year-olds with advanced periodontitis						
No	654	279	42.7	1.00		
Yes	118	67	56.8	1.33	(1.02 - 1.74)	0.035
Unknown or data missing	19	8	42.1	0.99	(0.49 - 1.99)	0.971
% of 60-year-olds visiting dentists regularly						
No	467	180	38.5	1.00		
Yes	307	165	53.7	1.39	(1.13 - 1.72)	0.002
Unknown or data missing	17	9	52.9	1.37	(0.70 - 2.68)	0.353
% of 80-year-olds with 20 or more teeth						
No	520	205	39.4	1.00		
Yes	251	140	55.8	1.41	(1.14 - 1.76)	0.002
Unknown or data missing	20	9	45.0	1.14	(0.58 - 2.23)	0.699
No. of goals (sum of above 3 goal types)						
0	376	131	34.8	1.00		
1	169	89	52.7	1.51	(1.15 - 1.98)	0.003
2	162	88	54.3	1.56	(1.19 - 2.04)	0.001
3	57	32	56.1	1.61	(1.09 - 2.37)	0.016
Unknown or data missing	27	14	51.9	1.49	(0.86 - 2.58)	0.157
Financial status						
% of expenses for public health services in annual expenditures						
Lowest (less than 2.8398)	195	82	42.1	1.00		
Low middle (2.8398 - 3.9237)	193	99	51.3	1.22	(0.91 - 1.63)	0.183
High middle (3.9238 - 5.6557)	197	86	43.7	1.04	(0.77 - 1.40)	0.808
Highest (5.6558 or more)	206	87	42.2	1.00	(0.74 - 1.36)	0.978
Oral health program funded by municipality alone						
No	136	45	33.1	1.00		
Yes	614	292	47.6	1.44	(1.05 - 1.97)	0.023
Unknown or data missing	41	17	41.5	1.25	(0.72 - 2.19)	0.428
No. of dentists per population of 10,000						
Lowest (less than 3.592)	194	71	36.6	1.00		
Low middle (3.592 - 4.376)	204	95	46.6	1.27	(0.94 - 1.73)	0.125
High middle (4.377 - 5.214)	197	98	49.7	1.36	(1.00 - 1.84)	0.049
Highest (5.215 or more)	196	90	45.9	1.25	(0.92 - 1.71)	0.153
Population density (/km ²)						
Rural-agricultural (less than 1000.0)	507	191	37.7	1.00		
Suburban (1000.0 - 1499.9)	79	37	46.8	1.24	(0.87 - 1.77)	0.226
Urban (1500.0 - 3999.9)	119	69	58.0	1.54	(1.17 - 2.02)	0.002
Metropolitan (4000.0 or more)	86	57	66.3	1.76	(1.31 - 2.37)	< 0.001
Prefecture-level variables						
Oral health personnel in prefectural office						
Dentist						
No	197	88	44.7	1.00		
Yes	594	266	44.8	1.00	(0.79 - 1.28)	0.984
Dental hygienist						
No	455	204	44.8	1.00		
Yes	336	150	44.6	1.00	(0.81 - 1.23)	0.968

PR, prevalence ratio; CI, confidence interval.

Table 2. Two-level Poisson regression models for presence or absence of an effective oral health program for adults.

	Fully adjusted model		
	PR	95% CI	P
Fixed effect			
Municipality-level variables			
Oral health personnel in municipal office			
Dentist (reference: no)			
Yes	0.85	(0.54 - 1.33)	0.470
Data missing	1.10	(0.77 - 1.57)	0.598
Dental hygienist (reference: no)			
Yes	1.33	(1.01 - 1.75)	0.046
Data missing	1.01	(0.49 - 2.06)	0.977
Contacts in oral health program			
No. of contacts (reference: 0)			
1	3.21	(1.54 - 6.69)	0.002
2	4.64	(2.24 - 9.58)	< 0.001
3	5.15	(2.45 - 10.85)	< 0.001
4	7.28	(3.15 - 16.84)	< 0.001
Unknown or data missing	4.14	(1.86 - 9.25)	0.001
Establishment of goals from Health Japan 21			
No. of goals for adult oral health (reference: 0)			
1	1.23	(0.93 - 1.62)	0.150
2	1.18	(0.89 - 1.57)	0.240
3	1.09	(0.73 - 1.63)	0.687
Unknown or data missing	1.40	(0.80 - 2.45)	0.240
Financial status			
Oral health program funded by municipality alone (reference: no)			
Yes	1.18	(0.85 - 1.62)	0.320
Unknown or data missing	1.13	(0.63 - 2.01)	0.689
No. of dentists per population of 10,000 (reference: lowest (less than 3.592))			
Low middle (3.592 - 4.376)	1.02	(0.74 - 1.40)	0.919
High middle (4.377 - 5.214)	1.08	(0.78 - 1.48)	0.650
Highest (5.215 or more)	0.90	(0.64 - 1.27)	0.551
Population density (/km ²) (reference: rural-agricultural (less than 1000.0))			
Suburban (1000.0 - 1499.9)	1.12	(0.78 - 1.60)	0.550
Urban (1500.0 - 3999.9)	1.24	(0.93 - 1.66)	0.147
Metropolitan (4000.0 or more)	1.30	(0.93 - 1.82)	0.125
Prefecture-level variables			
Oral health personnel in prefectural office			
Dentist (reference: no)			
Yes	1.09	(0.85 - 1.41)	0.494
Dental hygienist (reference: no)			
Yes	1.04	(0.83 - 1.30)	0.730
Intercept	0.07	(0.03 - 0.15)	< 0.001
Random effect			
Prefecture-level variance (SE)	0.000	0.000	

Null model: intercept 0.45 (0.40-0.50); $P < 0.001$, prefecture-level variance (SE): 0.003 (0.024).

hygienists in the prefectural office (Table 2). In the fully adjusted model, the PR increased with the number of contacts.

When the four contact variables were simultaneously added to the fully adjusted model instead of the number of contacts, the PRs (95% CI, P) for residents, the local dental association, companies, and community general support centers, or medical, nursing or welfare facilities were 1.18 (0.94-1.49, 0.154), 2.20 (1.42-3.41, < 0.001), 1.31 (0.94-1.84, 0.111) and 1.40 (1.09-1.79, 0.008), respectively. The associations between the number of contacts and each contact variable are shown in Table 3. The mode of contact with residents, the local dental association, companies, and community general support centers, or medical, nursing or welfare facilities were 3, 2, 4, and 2, respectively.

Discussion

In the present study, the number of contacts with related agencies was significantly associated with having an effective oral health program for adults in the municipality in the fully adjusted model (Table 2). Moreover, the PR for contact with the local dental association (2.20) was significantly higher than that of any other contact variable (1.18-1.40), when the four contact variables were simultaneously added to the fully adjusted model instead of the number of contacts. About 72% of all dentists in Japan are members of the Japan Dental Association (JDA; Japan Dental Association 2015). Regular members of the JDA are licensed as members of both prefectural and local dental associations, and the activities of local dental associations include participation in dental examinations and oral health

Table 3. Association between number of contacts and each contact variable.

No. of contacts	Contact with			
	Residents n = 228	Local dental association n = 640	Companies n = 56	Community general support centers or medical, nursing or welfare facilities n = 394
1	4.8	30.2	1.8	7.6
2	29.4	38.1	10.7	47.5
3	50.0	20.6	37.5	32.7
4	11.4	4.1	46.4	6.6
Data missing	4.4	7.0	3.6	5.6
Total	100.0	100.0	100.0	100.0

Unit: %

education programs to improve public oral health. A study showed that contacts but not density of dentists was an important factor in circulating a school-based fluoride mouthwash program (Takiguchi 1988), which is consistent with the results of the present study. These results suggest that contact with the local dental association facilitates oral health programs in the municipality.

Contact with community general support centers, or medical, nursing or welfare facilities was also a significant independently factor associated with having effective programs. Older adults in nursing or welfare facilities are eligible for oral health programs that seek to maintain oral function and to prevent aspiration pneumonia. Community general support centers play an important role in managing care and welfare of older adults by collaborating with related facilities including hospitals, clinics, and nursing or welfare facilities. Contact with these centers or facilities may therefore result in effective programs.

Companies are suitable for conducting oral health programs, especially screening and health education for periodontal disease, because most of the target population would be involved. Resident-run programs may facilitate participation by residents in the program. The number of municipalities having programs in contact with companies (56) and residents (228) was smaller than other contact variables (394 and 640), and their modes of contact (companies: 4, residents: 3) were higher than other contact variables (2). These results suggest that contact with the local dental association and/or general support centers, or medical, nursing or welfare facilities may be established first because these agency contacts may be easier. Then, contact with companies and/or residents should be facilitated after that because these agency contacts may be difficult. Longitudinal studies or interview studies in municipalities are needed to clarify this order and easiness/difficulty.

The results of the present study showed that having a full-time dental hygienist is associated with having effective oral health programs for adults in the municipality after adjusting for possible confounding factors including population density and the municipality alone funding the oral health program in 2010. Previous studies using univariate

analysis showed that municipalities with a high population density (Ozaki et al. 1998, 2011), high economic power (Ozaki et al. 2010), and full-time dental hygienists (Ozaki et al. 1998; Suetaka 2010) were more likely to conduct oral health programs for adults, and these results support the findings of the present study.

Establishment of the goals for adult oral health from Health Japan 21 was not significantly associated with having an effective oral health program for adults in the municipality in the fully adjusted model. However, the PR in Table 2 was consistently positive (1.09-1.23), suggesting that establishment of the Health Japan 21 goals may be a factor which facilitates the oral health program. Additional studies are needed to clarify this point, as it is not known what factors make it possible to establish these goals in municipalities.

This study has some limitations. First of all, the response rate (58.6%) of the questionnaire survey was not very high. Therefore, caution is needed when generalizing the results of the present study.

Second, the outcome of the present study was self-reported using “yes” or “no” answers and included different levels of outcomes: reduction in the prevalence of oral diseases, increase in the number of people with good oral health behavior, and increase in the number of people with oral health knowledge. The validity of to the question for self-reported effective program was unknown. Thus, the results of this study could be biased.

To address this concern, the following analyses were conducted. In the same questionnaire, we asked for the total number of adults who participated in oral health education programs in 2010. We calculated the percentage of adults who participated in the oral health education program in 2010, and compared the municipalities that have (n = 287) and did not have (n = 301) an effective oral health program for adults. The median (25th and 75th percentiles) of the percentage of adults who participated in oral health programs in 2010 for municipalities with (n = 287) and without (n = 301) effective oral health programs for adults was 0.371 (0.102, 0.371) and 0.200 (0.042, 0.732), respectively. The difference between the groups was statistically signifi-

cant ($P < 0.001$, Mann-Whitney U -test), but may be negligible.

Moreover, we conducted multiple linear regression analysis using data from 443 municipalities, using the percentage of adults who participated in oral health programs in 2010 as a dependent variable and all variables in the fully adjusted model (Table 2) as independent variables. The results showed that the number of contacts (beta: 0.187, $P < 0.001$) but not the number of dental hygienists in the municipalities (beta: 0.070, $P = 0.196$) was significantly associated with the percentage of adults who participated in oral health programs in 2010. An additional study is necessary to confirm the reliability of the programs self-reported as effective.

Third, because we asked only about the effectiveness of programs in the past three years (2009-2011), the results may have been biased by the particular time period. However, large-scale merging of cities, towns and villages has been conducted from 1999 (3,232 municipalities) to 2014 (1,718 municipalities), and 99% of municipality mergers has completed in 2009 (Ministry of Internal Affairs and Communications 2014). Suetaka (2010) reported difficulty to obtain information of oral health programs before municipality mergers from municipalities experienced mergers. Therefore, the period used in the study (three years) may be considered appropriate for obtaining information from both municipalities with and without mergers.

Fourth, we used the Poisson regression model instead of the logistic regression model to avoid overestimation of odds ratios. However, the problem of overdispersion should be considered when using the Poisson regression model. When a logistic regression model was used for the same data, similar results were obtained. However, the values of the odds ratios were higher than those of the PRs in the Poisson regression model.

In conclusion, the results of the present study showed that having full-time dental hygienists in the municipal office and having contact with related agencies, such as local dental associations, community general support centers, or medical, nursing or welfare facilities, in particular, when holding oral health programs, were independently associated with effective oral health programs for adults after adjusting for possible confounding factors. These results suggest that hiring a dental hygienist at all municipal offices and facilitating contact with related agencies, especially the local dental association and community general support centers or medical, nursing or welfare facilities, may result in successful oral health programs for adults.

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Conflict of Interest

The authors declare no conflict of interest.

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