ORIGINAL ARTICLE

pISSN 1975-8456 / eISSN 2093-5951

J Korean Med Assoc 2014 February; 57(2): 167-175

http://dx.doi.org/10.5124/jkma.2014.57.2.167

우리나라의 능동 및 수동적 감시체계 간 의사의 신고경향

강 혜 영[1] · 신 의 철[2] · 김 예 순[3] · 김 진 경[4] | 연세대학교 약학대학[1],가톨릭대학교 의과대학 예방의학교실[2], 국립재활원 재활연구소 재활표준연구과[3], 건양대학교 병원관리학과[4]

Comparing physicians' reporting propensity with active and passive surveillance systems in South Korea

Hye-Young Kang, PhD[1] · Euichul Shin, MD[2] · Ye-Soon Kim, MPH[3] · Jin Kyung Kim, PhD[4]

[1]College of Pharmacy, Yonsei University, Seoul, [2]Department of Preventive Medicine, The Catholic University of Korea College of Medicine, Seoul, [3]Department of Rehabilitation Policy and Standardization, Rehabilitation Research Institute, National Rehabilitation Center, Seoul, [4]Department of Hospital Administration, Konyang University, Nonsan, Korea

Passive surveillance (PS) is a traditional approach to communicable disease surveillance. To complement the approach, several countries have adopted active surveillance (AS) systems that involve the voluntary participation of physicians. This study compares AS versus PS systems in Korea based on the systems' reporting propensity of chickenpox. A mail questionnaire survey was conducted with a random sample of physicians involved in the PS system (N=1,955) and all sentinel physicians of the AS system (N=193). Multiple regression analysis was conducted to identify factors associated with reporting propensity. The reporting propensity of physicians in the AS system was significantly higher than that in the PS surveillance system, 2.7 versus 1.9 on a 5-point Likert scale ($p<0.05$). Multiple regression analysis showed that, in addition to the type of the surveillance system, physician knowledge of chickenpox as a notifiable disease and the type of institution with which a physician was affiliated were significant factors for a physician's reporting propensity. For both systems, the common barriers for reporting were 'lack of confidence in diagnosis,' 'burden from interference by the public health department following reporting,' and 'complexity of the reporting system.' In conclusion, AS of communicable diseases appeared to have a significantly better performance compared to PS in Korea in the case of chickenpox reporting. These findings would be useful for countries concerned with developing more effective strategies for improving the reporting rate of notifiable diseases.

Key Words: Chickenpox; Communicable diseases; Mandatory reporting; Sentinel surveillance

Introduction

Public health surveillance, defined as the ongoing and systematic collection, analysis, and interpretation of disease data for the planning, implementation, and evaluation of public health practices, consists of two primary mechanisms: passive and active surveillance [1,2]. Most of the countries operate a passive surveillance system as the basic mechanism for reporting and containing the spread of communicable diseases. A passive surveillance system is one in which physicians, laboratories, and health care institutions are mandated by law to inform local health authorities of reportable diseases [3]. The system does not require the constant and active monitoring of local health

Received: September 9, 2013 **Accepted:** December 12, 2013

Corresponding author: Euichul Shin
E-mail: eshin@catholic.ac.kr

authorities; it is thus relatively inexpensive and can cover large areas. However, because the disease reporting in a passive surveillance system depends completely on the compliance of physicians and health care institutions, it tends to be incomplete and variable [2]. Underreporting in particular has been a perennial problem in many countries [4-6]. Underreporting threatens the integrity of the public health surveillance system; undermines societal efforts to identify, prevent, and assess disease threats; and may incur significant health and socioeconomic costs to the public.

To complement passive surveillance and to overcome the associated underreporting, several countries such as the Netherlands, France, the United Kingdom, and Australia have adopted active surveillance systems. This is also known as a sentinel surveillance system [7-9]. Unlike the passive surveillance system that mandates the involvement of all physicians and health care organizations, an active surveillance system involves only a small group of physicians and health care facilities strategically selected to monitor and report the occurrence of targeted diseases. The participation of those physicians and health care facilities is voluntary. The system also requires the staff of public health agencies to regularly contact health care providers to seek information about disease conditions. Thus, it is more expensive to operate. Another downside of the active system is that sentinel sites cover only selected areas that may not be representative of the population. Despite these problems, active surveillance is believed to yield more accurate and timely information [10]. Furthermore, proponents of the active surveillance system maintain that reports received through this type of system are of higher quality because more resources and experienced health professionals at sentinel sites are dedicated to collecting and reporting disease information.

In 1997, the Korean government started to experiment the sentinel surveillance system (i.e., the active surveillance system), to supplement the passive surveillance system that has been operated since 1954. The initial active surveillance system was focused on influenza and had 70 sentinel sites. By 2004, the system had expanded to include three sentinel networks (school-based infectious diseases, pediatric diseases, and eye diseases) [11]. In particular, the pediatric diseases network started in 2001 with the cooperation of the Korean Society of Pediatrics. Five communicable diseases were selected for monitoring: measles, mumps, rubella, chickenpox, and aseptic meningitis. Physicians participating in the network are members of the Korean Association of Pediatrics. They were recommended by the association and appointed by the Director of Korea Centers for Disease Control and Prevention (KCDC). In December 2003, the network had 193 participating pediatricians (or sentinel sites) with coverage of about 100,000 individuals per sentinel site [11].

Several studies from western countries have shown that the reporting rate of active surveillance is higher than that of passive surveillance [12,13]. However, little is known if the same high performance can be achieved in a relatively new active surveillance system like Korea. Thus, this study was conducted: 1) to compare the reporting propensity of participants in an active surveillance system with those in a passive surveillance system, and 2) to examine factors that may affect the propensity of disease reporting among physicians. To compare the active and passive systems in Korea, we investigated the propensity of physicians to report the same disease in both systems. Chickenpox was designated as being reportable by both passive and active systems in 2001 and 2005, respectively [14].

Methods

1. Study subjects

Study subjects were drawn from physician participants in the active and passive surveillance systems. A total of 193 physicians were listed as participants in the active (sentinel) surveillance of pediatric diseases in December 2002. All of them were included as subjects for the active surveillance system survey.

In the passive surveillance system, law mandates that all physicians monitor and report designated diseases. Therefore, a sampling of physicians was included for the questionnaire survey. Using physician files from the 2005 National Health Insurance Claims data, we randomly selected 1,955 (assuming a response rate of 20% and 95% confidence interval) from 17,638 physicians who would be most likely to see patients with chickenpox, which were general practitioners and related specialists (i.e., family medicine, internal medicine, pediatrics, and dermatology). Since this study did not use human subjects or patient information, institutional review board approval was waived.

2. Data collection and study variables

A survey questionnaire was developed to ask physicians about their experience in reporting chickenpox over the past two years using a 5-point Likert-type scale: 1, never; 2, sometimes; 3, occasionally; 4, generally; and 5, always. The response to this question was conceptualized as 'reporting propensity' as to how extensive physicians have reported chickenpox patients. A pediatrician and an internal medicine specialist from a university hospital were involved in the questionnaire development and helped ensure the content validity.

The self-administered mailed questionnaire survey was conducted with sampled physicians between August 3rd and 19th, 2006. To increase response rates, we sent an official letter from Director of the KCDC encouraging cooperation, provided a free one-year subscription to the Korean Communicable Diseases Monthly Report if the respondents wanted one, and resent the questionnaire one additional time if the recipient was unresponsive after three weeks.

The questionnaire also include factors believed to affect physicians' reporting propensity: age, gender, specialty of the responding physicians; awareness that chickenpox is a notifiable infectious disease; attitudes about the mandatory disease reporting system; reasons for not reporting cases of chickenpox in the past; and selected characteristics of the physicians' medical institutions. Age was grouped into four categories: 39 and younger, 40 to 49, 50 to 59, and 60 and older. Specialty was categorized into general practice, internal medicine, pediatrics, family medicine, and dermatology. The medical institutions were grouped according to the level of care into clinic, hospital, general hospital, and tertiary care hospital categories. Ownership of the institutions was classified as private, corporate, and national/public. Urbanization was indicated as metropolitan, mediumsized city, and rural area.

We asked about knowledge of and attitude toward the disease reporting based on the KAP (knowledge, attutude, practice) model [15,16]. According to Becker and Maiman [15], knowledge of and attitude toward medical care recommendation are among the significant determinants for acceptance of recommended health behaviors. In this study, we asked respondents whether they were aware that chickenpox is one of the communicable diseases they are required to report. We also asked the participants

Table 1. Characteristics of respondents by type of surveillance system

Characteristics		Frequency (%)		χ^2-statistics (*P*-value)
		Passive surveillance (n=185)	Active surveillance (n=62)	
Individual characteristics				
Gender	Male	147 (79.5)	44 (71.0)	1.9 (0.17)
	Female	38 (20.5)	18 (29.0)	
Age (yr)	≤39	53 (28.7)	6 (9.7)	15.1 (0.00)
	40-49	81 (43.8)	41 (66.1)	
	50-59	41 (22.2)	15 (24.2)	
	≥60	10 (5.4)	0 (0.0)	
Specialty	General practice	37 (19.9)	1 (1.6)	107.0 (0.00)
	Internal medicine	65 (34.9)	0 (0.0)	
	Pediatrics	43 (23.1)	61 (98.4)	
	Family medicine	32 (17.2)	0 (0.0)	
	Dermatology	7 (3.8)	0 (0.0)	
	Others	2 (1.1)	0 (0.0)	
Institutional characteristics				
Level of care	Clinic	140 (75.7)	59 (95.2)	11.7 (0.01)
	Hospital	15 (8.1)	1 (1.6)	
	General hospital	18 (9.7)	2 (3.2)	
	Tertiary care hospital	12 (6.5)	0 (0.0)	
Ownership	Non-corporate private	144 (77.8)	60 (96.8)	11.9 (0.00)
	Corporate private	25 (13.5)	2 (3.2)	
	National/public	16 (8.7)	0 (0.0)	
Location	Seoul	48 (26.0)	12 (19.4)	10.7 (0.10)
	Kyeonggi	37 (20.0)	9 (14.5)	
	Kangwon	3 (1.6)	2 (3.2)	
	Chungcheong	11 (6.0)	6 (9.7)	
	Kyeongsang	75 (40.5)	22 (35.5)	
	Jeonra	9 (4.9)	9 (14.5)	
	Jeju	2 (1.1)	2 (3.2)	
Urbanization of the location	Metropolitan city	121 (65.4)	34 (54.8)	5.5 (0.06)
	Medium-sized city	50 (27.0)	26 (41.9)	
	Rural area	14 (7.6)	2 (3.2)	

to rate their perception of the public health importance of reporting notifiable diseases on a 5-point scale: 1 means unimportant at all; 2, unimportant; 3, neither important nor unimportant; 4, important; and 5, very important. Finally, the respondents were asked to list a maximum of three reasons for not reporting chickenpox in the past, which were conceptualized as potential barriers of reporting notifiable diseases.

3. Data analysis

Average chickenpox reporting propensity scores of the physicians were compared between the passive and active surveillance systems using a *t*-test. To examine whether the difference in physician reporting propensity between the two surveillance systems remains significant after adjusting for differences in baseline physician's and institutional characteristics, multiple regression analysis was carried out. Furthermore, the independent associations between the physician reporting propensity and the selected physician's and institutional characteristics included in the regression model were examined to identify which factors play as barriers or enabling factors for physician's reporting activity.

Results

1. Individual and institutional characteristics

A total of 62 out of the 193 active surveillance physicians responded to the questionnaire (response rate: 32.1%). For the passive surveillance sample, 231 out of the 1,955 physicians responded (response rate: 11.8%)[Table 1]. We excluded 46 physicians from the passive surveillance respondents who had not seen any chickenpox patients in the past, resulting in 185 respondents for the final analysis.

Table 2. Physicians' reporting propensity and perception on disease reporting by type of surveillance system

	Passive surveillance system	Active surveillance system	*P*-value[a]
Reporting propensity[b]	1.9±1.4	2.7±1.8	0.002
Knowledge			
Whether aware chickenpox as a reportable disease			
Yes	123 (66.5)	61 (98.4)	0.000
No	62 (33.5)	1 (1.6)	
Attitude			
Public importance of disease reporting[c]	3.4±1.0	3.9±0.9	0.007
Potential barriers: reasons for not reporting[d]			
Lack of recognition of the notifiable diseases	46 (10.8)	1 (0.8)	Not applicable
Ignorance about the mandatory reporting requirement	41 (9.6)	1 (0.8)	
Lack of confidence on diagnosis	92 (21.5)	32 (25.8)	
Low perception on the importance of disease reporting	29 (6.8)	3 (2.4)	
Lack of knowledge on how to report the disease	34 (8.0)	7 (5.6)	
Unavailability of report sheet	19 (4.4)	4 (3.2)	
Complexity of the reporting procedure	50 (11.7)	15 (12.1)	
Feeling of burden from interference by the public health department following reporting	75 (17.6)	34 (27.4)	
Fear of decreases in patient volume due to invasion of privacy and heavy involvement that patients experience after reporting	22 (5.2)	25 (20.2)	
Others	19 (4.4)	2 (1.6)	

Values are presented as mean±SD or n (%).
[a]Difference between the two systems was assessed by a *t*-test or chi-square test.
[b]Measured on a 5-point scale: 1, never reported; 2, sometimes; 3, occasionally; 4, generally; and 5, always.
[c]Measured on a 5-point scale: 1, unimportant at all; 2, unimportant; 3, neither important nor unimportant; 4, important; and 5, very important.
[d]Multiple responses with a maximum of three.

Respondents were mostly male for both of the passive (79.5%) and active (71.0%) surveillance groups. Age distribution was significantly different between the two groups (P=0.00). A wide distribution of physicians in their 30s to 50s was observed for the passive surveillance group with a highest proportion in their 40s (43.8%), while the majority of the active surveillance group were in their 40s (66.1%) or 50s (24.2%). Since the active surveillance system examined in the study is the pediatric diseases network, almost all respondents were pediatrician. On the other hand, respondents from the passive system represent various specialties including internal medicine (34.9%), pediatrics (23.1%), general practice (19.9%), family medicine (17.2%), and dermatology (3.8%).

There were significant differences in level of care and ownership of the physicians' medical institutions between the two groups. Results showed that medical institutions that the respondents in the active surveillance group work for are more typically clinics and under private ownership than are those of the passive group (P<0.05).

2. Comparison between active and passive surveillance systems

We compared the two surveillance systems by assessing the average reporting propensity of physicians in each system. The average reporting propensity of chickenpox in the active system was found to be significantly higher than that in passive system (2.7±1.8 vs. 1.9±1.4, P=0.002) [Table 2]. The proportion of respondents from the passive system who were aware that chickenpox is a disease for which reporting is required was only 66.5%, while this was 98.4% from the active system (P=0.000). Physicians from the active surveillance system have more positive attitudes toward the disease reporting system compared to those from the passive system (3.9 vs. 3.4, P=0.007).

For both systems, the common barriers for reporting were found to be 'lack of confidence in diagnosis,' 'feeling of burden from interference by the public health department following reporting,' and 'complexity of the reporting system.' Unlike the active system, an overall lack of knowledge about the reporting system was discovered the most frequent responses among the respondents from the passive system. Specific

Table 3. Regression analysis results on factors associated with reporting propensity of chickenpox among Korean physicians

	Regression coefficient	standard error
Surveillance type		
Passive (reference)		
Active	0.55[a]	0.25
Age (yr)		
≤39 (reference)		
40-49	-0.06	0.25
50-59	-0.21	0.29
≥60	-0.35	0.47
Gender		
Male (reference)		
Female	0.06	0.24
Awareness of chickenpox as a reportable disease		
No (reference)		
Yes	0.91[b]	0.24
Public health importance of disease reporting		
Unimportant (reference)		
Neutral	-0.14	0.29
Important	0.03	0.28
Type of institution according to level of care		
Clinic (reference)		
Hospital/general hospital	0.80[b]	0.29
Tertiary hospital	0.65	0.46
Location of institutions		
Seoul (reference)		
Gyonggi	0.04	0.33
Others	0.12	0.25
Urban/rural		
Metropolitan cities (reference)		
Medium-sized cities	-0.15	0.24
Rural areas	0.09	0.39
No. of observations	247	
Adjusted R-square	0.12	

[a]Statistically significant at 0.05.
[b]Statistically significant at 0.01.

3. Factors affecting physicians' reporting propensity

After adjusting for other factors that may affect physicians' reporting propensity by multiple regression analysis, the active surveillance system was found to significantly increase physicians' reporting propensity (ß=0.55, P<0.05)[Table 3]. Another factor that significantly affected physicians' reporting propensity was the knowledge of physician about reporting requirements of chickenpox (ß=0.91, P<0.01). Additionally, physicians working for hospitals or general hospitals had significantly increased reporting propensity compared to those working in clinics (ß=0.80, P<0.01). In Korea, hospitals are required to maintain more than 30 inpatient beds. General hospitals are required to have 100 or more inpatient beds and, at a minimum, clinical departments in internal medicine, general surgery, pediatrics, obstetrics, anesthesiology, clinical pathology, psychiatry, and dentistry.

Discussion

items include 'lack of recognition of the notifiable disease,' 'ignorance of the mandatory reporting requirement,' and 'lack of knowledge on how to report the disease.' An additional barrier commonly reported by the respondents from the active system was 'fear of decrease in patient volume due to invasion of privacy and heavy involvement that patients experience after reporting.'

This study confirmed that the policy of the active surveillance system in a country like Korea with little experience was effective showing a higher reporting rate for chickenpox as compared with the existing passive surveillance system. The higher reporting rate of participants in the active surveillance system has also been observed in many countries. From a randomized controlled trial in New South Wales, Australia, Dong et

al. [17] determined that active surveillance physicians are inclined to report 19.6 times more frequently than passive surveillance physicians. In a study done in the US, the passive reporting system identified only 50% of all cases that were identified by the active system in several metropolitan counties in Tennessee [12]. Richard et al. [13] showed that the mandatory surveillance system for measles reported 2- to 36-fold lower estimates for incidence rates than the sentinel surveillance in Switzerland.

Many studies showed results similar to our study in that one of the factors for physician underreporting was a lack of knowledge [4,18,19]. According to the regression analysis results from this study, physicians who are aware of chickenpox as a notifiable disease are significantly more likely to report chickenpox. This result suggests that physician education on the mandatory reporting system is the single most important activity that may have a strong impact on improving report rates.

The reasons for not reporting chickenpox cases cited by the respondents provide valuable information which can be used to generate effective strategies to improve report rate. 'Lack of confidence in diagnosis' was the most frequent reason for underreporting regardless of which system the respondents belong to. Another common barrier to report was 'feeling of burden from interference by the public health department following reporting' and 'complexity of the reporting procedure.' The physicians from the active system, who tend to have more experience in disease reporting than those from the passive system, indicated that the fear of decreased patient volume due to invasion of privacy and heavy involvement that patients experience following reporting was the most prominent barrier to reporting. This implies that minimizing extra work, and physicians' and patients' involvement associated with reporting activities could be one strategy to encourage physicians to report. Automated case identification and reporting from electronic insurance claims or electronic health data could provide a promising new strategy to minimize extra involvement related to reporting activities and ultimately improve the detection rate of reportable diseases [20]. For countries like Korea that have mandatory national health insurance for the entire population, automated case identification and reports from the national health insurance claims database could be particularly useful.

One of the study limitations was low response rate of physicians in the passive surveillance system (11.8%). Although the authors tried to increase the response rate by several ways, the survey response rate of Korean physicians was generally quite low. There are several survey-based studies involving physicians with very low response rates of 10% to 25% [21-24]. There could be several explanations for the low response rates. First, incorrect addresses could be one reason. Physicians relocating to new areas in search of new markets make the probability of having the incorrect address even higher. Secondly, Korean physicians are quite busy and see as many patients as possible because of the low fee schedule of services, and my not have time to participate in surveys. Finally, the low response rate may be due to physicians not having an interest in the social sciences, especially studies using survey method, which is different from their educational and professional backgrounds.

Because the active surveillance system of chicken-pox was operated with the cooperation of the Korean Society of Pediatrics, almost all of the survey respondents were pediatricians. On the other hand,

survey respondents from the passive system represent various specialties including pediatrics, general practice, internal medicine, etc. The difference in the composition of physician specialties between the two systems may give misleading implication that pediatricians have better knowledge of chickenpox as a reportable disease and higher reporting rate than physicians with other specialties.

This study was carried out in 2006, based on both active and passive systems at that time. There have been changes in both systems after the amendment of the Law of Prevention and Management of Communicable Disease in 2010 in Korea. Therefore, there should be a caution when applying the result of the present study to the current reporting system in Korea.

Conclusion

The voluntary participation in surveillance system significantly increased reporting propensity of physicians. Therefore, adopting an active surveillance system could be a practical method for improving surveillance performance. Active surveillance, however, is not a panacea for all types of disease surveillance. Consideration of disease and socio-environmental characteristics would also be important. Factors affecting physicians' reporting propensity were found to be physician knowledge of disease reporting requirements and feeling burdened by inference from the public health department after reporting. These findings would be useful for countries concerning to develop more effective strategy to improve reporting rate of notable disease and consequently to prevent the spread of such diseases in their community.

Acknowledgement

This study was funded by the KCDC.

ORCID

Hye-Young Kang

http://orcid.org/0000-0003-3260-2623

Euichul Shin

http://orcid.org/0000-0002-7953-021X

Ye-Soon Kim

http://orcid.org/0000-0003-1424-0163

Jin kyung Kim

http://orcid.org/0000-0002-3872-1925

REFERENCES

1. Harman J. Topics for our times: new health care data: new horizons for public health. Am J Public Health 1998;88:1019-1021.
2. Teutsch SM. Considerations in planning a surveillance system. In: Teutsch SM, Churchill RE, editors. Principles and practice of public health surveillance. 2nd ed. New York: Oxford University Press; 2000. p.17-29.
3. Groseclose SL, Sullivan KM, Gibbs NP, Knowles CM. Management of surveillance information system and quality control of data. In: Teutsch SM, Churchill RE, editors. Principles and practice of public health surveillance. 2nd ed. New York: Oxford University Press; 2000. p. 92-111.
4. Konowitz PM, Petrossian GA, Rose DN. The underreporting of disease and physicians' knowledge of reporting requirements. Public Health Rep 1984;99:31-35.
5. Shin E, Meng K, Shin H, Park Y, Park K, Lee J. Estimation of report rate of acute communicable diseases legally notifiable in Korea. Korean J Epidemiol 1996;18:18-26.
6. Marier R. The reporting of communicable diseases. Am J Epidemiol 1977;105:587-590.
7. Dunstone M, Macharper T, Cameron S, White C. Surveillance and sentinel systems. Aust Fam Physician 1990;19:1267-9, 1272-7.
8. Garnerin P, Saidi Y, Valleron AJ. The French communicable diseases computer network: a seven-year experiment. Ann N Y Acad Sci 1992;670:29-42.
9. Fleming DM, Crombie DL, Ross AM. Weekly returns service report for 1994. Birmingham: Birmingham Research Unit, Royal College of General Practitioners; 1995.

10. White ME, McDonnell SM. Public health surveillance in low- and middle-income countries. In: Teutsch SM, Churchill RE, editors. Principles and practice of public health surveillance. 2nd ed. New York: Oxford University Press; 2000. p. 287-315.
11. Yoo YO, Jeong EK, Park O, Chun BC. Sentinel surveillance system for pediatric communicable diseases. Korean J Epidemiol 2004;26:32-42.
12. Standaert SM, Lefkowitz LB Jr, Horan JM, Hutcheson RH, Schaffner W. The reporting of communicable diseases: a controlled study of Neisseria meningitidis and Haemophilus influenzae infections. Clin Infect Dis 1995;20:30-36.
13. Richard JL, Vidondo B, Mausezahl M. A 5-year comparison of performance of sentinel and mandatory notification surveillance systems for measles in Switzerland. Eur J Epidemiol 2008; 23:55-65.
14. Division of Epidemic Intelligence Surveillance. The status of varicella reported through pediatric sentinel surveillance in Korea. Seoul: Korea Centers for Disease Control and Prevention; 2008.
15. Becker MH, Maiman LA. Sociobehavioral determinants of compliance with health and medical care recommendations. Med Care 1975;13:10-24.
16. De Tullio PL, Eraker SA, Jepson C, Becker MH, Fujimoto E, Diaz CL, Loveland RB, Strecher VJ. Patient medication instruction and provider interactions: effects on knowledge and attitudes. Health Educ Q 1986;13:51-60.
17. Dong Z, Ferson MJ, Yankos P, Delpech V, Hurst R. Randomized controlled trial of active physician-based surveillance of foodborne illness. Emerg Infect Dis 2002;8:106.
18. Voss S. How much do doctors know about the notification of infectious diseases? BMJ 1992;304:755.
19. Durrheim DN, Thomas J. General practice awareness of notifiable infectious diseases. Public Health 1994;108:273-278.
20. Calderwood MS, Platt R, Hou X, Malenfant J, Haney G, Kruskal B, Lazarus R, Klompas M. Real-time surveillance for tuberculosis using electronic health record data from an ambulatory practice in eastern Massachusetts. Public Health Rep 2010;125: 843-850.
21. Shin HC. The strategy on inducing response rate of survey. J Korean Acad Fam Med 2005;26(Suppl 11):261-265.
22. Moon SI, Lee HR. Computer use and factors affecting computer use by family physicians. J Korean Acad Fam Med 2000; 21:479-488.
23. Kim SM. Dental care and the state of education and training of dentists for the handicapped. J Korean Acad Pediatr Dent 2001;28:87-94.
24. Lee TJ, Lee HJ, Choi YH, Jo HS, Bae S. Knowledge of drug price and preference for prescribed drugs among family physicians in Korea. In: Proceedings of the 53rd Conference of Korean Society for Preventive Medicine; 2001 Dec 26; Sokcho, Korea. Seoul: Korean Society for Preventive Medicine; 2001. p. 182-183.