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Association between Visiting Time and Data Quality of Community Health Survey; based on Short Time Survey and Concordance of 2015 Community Health Survey, Korea

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서울대학교 보건대학원
보건학과 보건학전공
윤 태 환

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지도교수 조 성 일

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보건학과 보건학전공

윤 태 환

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위 원 장 김 호 (인)

부 위 원 장 조 영 태 (인)

위 원 조 성 일 (인)

Abstract

Association between Visiting Time and Data Quality of Community Health Survey; based on Short Time Survey and Concordance of 2015 Community Health Survey, Korea

Yoon Taehwan

Department of Epidemiology

Graduate school of Public Health

Seoul National University

Introduction: Community health survey is one of main health statistics used by community health centers for making local health improvement program. However, the environment around this survey is getting hard to perform because of many social reasons, so strategy on when to visit household was argued as one of methods to enhance survey performance. However, verification on whether visiting time can affect to data quality should be

advanced before making visiting time strategy. This study's objective is to examine that visiting time can affect to data quality and provide appropriate evidence and materials to make new strategies.

Methods: 2015 community health survey data (n= 228,588) telephone inspection data (n= 24,545, 10% of the original data was sampled for re-checking main survey by telephone) were used for this study. As representatives of data quality, short time survey (10 mins or under) and question concordance were used through main data and telephone survey data each. Logistic regression considering clustered sampling was used to find the association between visiting time and data quality.

Results: For short time survey, the data was analyzed separately according to employment status. In employed group, there was higher likelihood for short time survey to be happened during 11-13 and 14-16 hour than 8 – 10 hour. In employed group, there was higher likelihood that short time survey happens than 8 – 10 hour. Concordance was not clearly statistically associated with visiting time.

Conclusions: Community health survey needs quite longer time for survey than other surveys. So, Short time survey could mean respondent's insincerity response or data that was collected inappropriate way. So, more targeted monitoring on certain time frame will be needed and better guideline and education for interviewers will be needed to block short time survey event to be happened.

Keywords: short time survey, concordance, visiting time, community health survey

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Contents

Tables

I. Introduction

Introduction

As Korea society is changing, the trend of communities of local are changing. In the past, nation's strategies were centralized on the central government. However, it was not enough to meet each community's need in the past way. Therefore, local autonomy era had begun and public health policy had been started to be changed after 1995 and, September on the same year, 'Local Public Health Law' was revised for a self-governing body to make a plan and perform programs that is necessary to enhance community's health level up(K. S. Lee, 1997; S. Y. Lee, Kim, & Moon, 1997). So, each local body performed some surveys and examinations by themselves, but it was not standardized well that it was hard to diagnose status of local residence's health and use the data properly(S. Y. Lee et al., 1997). At that time, there was Korea National Health and Nutrition Examination Survey (KNHNES), but since the survey was national level health statistic, it was not appropriate to use and apply the information for establishing community based health plan(Kwon et al., 2010). In order to make local based health strategy, health information of state/province/region level was needed.

So as to solve this problem, Korea Centers for Disease Control and Prevention (KCDC) had organized and performed Community Health Survey (CHS) centered on local community from 2007 at which year KCDC had performed pilot program on 20 state/province/region, and then had extended the range to whole nation(Y. T. Kim et al., 2012). In 254 Community Health Center (CHC) as total, about 900 participants were sampled systematically per each CHC, and a trained interview visited household sampled with a survey computer and performed with 1:1 Computer Assisted Personal Interviewing (CAPI) method(KCDC, 2016). In order to perform CHS, many interested party was involved such as KCDC, universities in charge, interviewers, CHC and etc., and the data collected has been used so widely in local CHCs to organize health related programs and plan for local residences' health improvement(KCDC, 2009; Y. T. Kim et al., 2012). So, CHS is the key factor for CHCs' efficient public health activities. However, CHS is getting hard to perform because survey environment got tougher, for example, single person household has been increased, which has been making interviewers meet respondent very hard. So, as one of methods to overcome the situation and sustain CHS well, better visiting time frame strategy was mentioned rather than visiting household just many times(KCDC, 2014). Especially, WHO also mentioned the importance of visiting time, saying that it is better to choose another time if interviewers could not meet a respondent at a certain

time(WHO, 2008). However, before giving guideline about visiting time, we should identify whether the visiting time, time frame during a day, can affect to the quality of the data or not. Since human's psychological status, situation, brain activity can different by time, it can affect to respondent's attitude. Furthermore, CHS is the survey that needs quite longer time (about 197 questions at 2015 CHS) than other short questionnaire, so the focus of respondents to this survey is very crucial to get accurate answer.

As to control the CHS data quality, KCDC is using 10 tools; replacement rate of sample household, household completion rate, survey completion rate, answer rejecting rate, concordance, days taken to upload data, short time survey data rate, long time survey data rate, frequency of submitting of self-checklist written by university in charge and on-the-spot checking. Those most index looked to get better over time, but, concordance and short time survey data is unstable and those two index were what KCDC focused on specially(KCDC, 2015a). Moreover concordance and short time survey data is important index for representing CHS data quality because concordance is a good tool for securing accuracy of the data. Concordance was checked by telephone survey on about 10% sampled systematically of total participants with 5 questions and others related interviewers' behaviors. For concordance questions, 5 – 6 questions has been used, but 5 questions was used for 2015

survey; ‘subjective health conception,’ ‘whether to drive or not,’ ‘mean sleep time, smoking status’ and ‘whether hypertension diagnosed by a doctor or not.’ Those questions were confirmed by KCDC, considering public health significance. If respondent answered same answer that was written in the main survey, the value is ‘1’ or ‘0’ if not. Even though the most questions showed high concordance value, subjective health conception and mean sleep time showed relatively lower concordance and wider range of value with bigger standard deviation than other three questions(KCDC, 2015a). So, identifying factors making low concordance is needed to enhance the concordance and make better plan to secure quality.

And short data could also affect to the quality of data, because the shorter a response time is, the bigger possibility of being done in an inappropriate way is. For example, not following the guidelines of this survey could be short time survey cases such as interviewer’s self-answering, not respondent’s one, or substitute answering by someone else, which are factors harming data quality. With these importance of concordance, short time survey data and time frame, studies on that are very rare. Especially there is none to study about the association between short time survey data and visiting time. Research on concordance was performed before one time, but it was based on 2014 data(J. Kim et al., 2016) and variables was not enough, and short time

survey and time frame was not considered. So, in this research, we will study association between visiting time and concordance and short time survey with other important variables so that it could be able to present basic evidence and foundation for making more effective monitoring methods considering diverse characteristics in communities and establishing new strategy for visiting time, and it will contribute to secure data quality high.

II. Materials and methods

2-1. Data sources

Data for this study was used from Korean Community Health Survey of 2015. This survey has been conducted from 2008 annually by Korean Centers for Disease Control and Prevention (KCDC) and is the only community based health survey in Korea. The participants were selected based on a Community Health Center (CHC) and household with systematic sampling way among over 19 years old adults, and around 900 people per a CHC have been surveyed, and total sample size surveyed for all of 254 CHCs was 228,558 (102,829 men, 125,729 women; age mean: 52.67, min: 19, max: 106) last year, 2015. All of data were used for analyzing an association between visiting time and short time survey data. This survey is 1:1 Computer Assisted Personal Interview (CAPI) and around 191 questions were asked per a person by a trained interviewer(KCDC, 2015b).

For the control of data quality, telephone inspection was conducted. 10% of total participants who finished the survey were sampled systematically per a CHC, and about 90 participants were sampled to each CHC. Total number of persons who were inspected by telephone was 24,545 (10509 men, 13811

women, 225 unidentified as problematic data). All of these data were used for analyzing association between visiting time and concordance except for 225 data deleted because of problems. The telephone inspection checked whether to participate it, an interviewer used CAPI system or not and to coincide with a data uploaded in the web, only 5 questions, and also checked interviewer's attitude(KCDC, 2015a).

2-2. Study Variables

In order to analyze the association between visiting time (an independent variable) and short time data (a dependent variable), short time defined as less than 10 minutes, including 10 minutes. Since the number of questionnaire is little bit different by each province, there are little difference on survey time. A mean time required for this survey was calculated as around 23 minutes and KCDC picked standard time for short time data as from 8 min 15sec to 12 min 54 sec which is 1% quantile of survey time length distribution per each province for under 65 years(KCDC, 2015a). However, since 1% quantile is too minimum, considering rationality and experiences, we defined 10 minutes and less as problematic data by short time survey. Visiting time is when an interviewer visit house and start this survey on the computer. Time range was used from 8 am to 10 pm, excluding other time frames as outliers, and was categorized into 5 constant interval (8 – 10, 11 – 13, 14 – 16, 17 – 19 and 20 – 22). Sex, age, income, education, house type (Apartment or general house), city or rural, comorbidity, job and weekdays or weekend variables were used for adjustment.

Concordance was conducted with 5 questions; subjective health conceptions (Very bad, bad, normal, good, very good), whether to drive or not, mean sleep time per a day (0~24 hours), whether to diagnosed hypertension by a doctor

or not and smoking status (everyday, sometimes, past smoker, never-smoker). When the telephone interviewer called and check those questions, if the answers are perfectly same, it was defined as concordance. And other demographic variables were used as same as short time analysis plus lag time between actual survey done and time of telephone inspection, except for house type and weekdays.

2-3. Data analysis

Short time survey data analysis

In order to examine the correlation between short time and visiting time, time variable was categorized into 5 group (8 – 10, 11 – 13, 14 – 16, 17 – 19 and 20 – 22). And some data that took over 2 hours were excluded. And since this study's objective is to find out association between time frame and data quality, life pattern difference is crucial. People who have a job and who does not have one have very different life pattern a day. So, the total sample was divided into two sub-groups and then analyzed separately (employed: 146,720, unemployed: 73,957). Especially student was categorized into an employed group because their life pattern a day tends to be similar to an employed group(Yoon & Hwang, 2014), so unemployed group includes the unemployed, housewife and student. Employed group was categorized into manual, non-manual and others. Age was categorized as 19-44, 45-64 and over 65, and income level was divided into three classes; 'under 200' (two million KRW), '200 – 400' (two million to under four million KRW), and '400 (four million KRW) and over.' Education was categorized into 3 group ('middle school graduation or under,' 'high school graduation,' and 'university graduation or over'. House type was divided into apartment and general house, and week variable was divided into weekdays and weekend. City type was categorized into city or rural, and comorbidity was defined as

‘comorbidity yes’ if any one of hypertension, diabetes, dyslipidemia and arthritis have been diagnosed, and if none of them has been diagnosed, it was categorized as ‘comorbidity none.’ Chi-square test was performed for descriptive analysis.

This data was clustered by a health center of each province. In other words, almost same number of participants, approximately 900 persons, belong to one community health center of a region. So, 2-level is a CHC and 1-level is an individual. Considering these characteristics of the data and locally cluster and binary outcome, hierarchical generalized linear models (HGLMs) was used for this study, which is usually for multilevel analysis(Ene, Leighton, Blue, & Bell, 2015). Short time survey event as dependent variable was examined with demographics, city type, weekdays or weekend, comorbidity and house type variables into odds ratio (OR) with 95% confidence interval (95% CI). SAS 9.4 was used with PROC GLIMMIX procedure with LAPLACE option which is maximum likelihood estimation.

Concordance

For 5 questions, if an answer is same, a value is ‘1,’ and ‘0,’ if not. If all questions are coincided, the total value is ‘5.’ However, for this examination, 5 questions concordance were analyzed separately. And a lag time between

actual survey day and telephone inspection, and short time survey were added as well as other variables (time, sex, age, income, education, job, city type and comorbidity) used for short time analysis, except for weekdays and house type. Job variable was used for this examination as 4 categories (non-manual workers, manual workers, others and the unemployed). Lag time between the main survey and telephone inspection was categorized into 3 groups; '3 days and under,' '4 – 10 days' and '11 days and over.' As same as short time analysis, same examination method and SAS procedure were used.

Ⅲ. Results

228,588 participants' data were collected for 2015 CHS, however, 220,677 were used for analysis except for data that had missing values at main variables used for this study. 23,598 participants' data that had finished all concordance questions by the telephone inspection were used among total 24,545 participants' data, excluding data that had missing values on concordance and other main variables.

3-1. General characteristics

Short time survey

Participants who had a job (66.49%) were more than the unemployed (33.51%). As regards the employed, the CHS survey had been done during 17 – 19 hour (32.21%) the most during a day, and then 23.68% at 14 – 16 hour, 18.92% at 11 -13 hour, 14.39% at 20 – 22 hour and 10.8% at 8 – 10 hour in a row. Regarding demographics, 54.01% was male, 42.92% reported 45 – 64 year, '19 – 44' was 40.63%, 37.81% had two million won to four million won, 31.78% had four million and over family income. 37.21% had finished high school, 33.71% got university education and over, 59.82% lived in

general house, 67.11% lived in city, and 67.43% had no any comorbidity. Manual workers was 65.57% and non-manual workers was 29.28% (Table 1). Regarding the unemployed, the survey was performed the most during 14 – 16 hour (29.86%) and then 29.11% at 17 – 19 hour, 22.57% at 11 – 13hour, 11.51% at 8 – 10 and then 6.96% at 20 – 22 hour as last. As demographics, 73.23% was female, 51.05% was 65 age and over, 28.08% was 45 – 64 aged. 55.17% belonged to under two million family income, 28.51% was two-four million family income. 54.01% was middle educated or under, 25.49% finished high school course and 62.68% lived in general house. And 69.17% lived in city area, 54.70% had comorbidity, and 77.03% of participants performed the survey during weekdays. 0.64% was short time survey data. (Table 1).

Concordance

Of 23,598 who did telephone inspection who were selected as a sample group from 220,670 participants, 7,267 participants performed the main survey during 17 -19 hour (30.79%) the most and then 26.72% at 14 – 16 hour, 20.40% at 11 – 13 hour, and 10.73% at 20 – 22 hour. Female was 56.97%, and 45 -64 age group was the highest proportion (37.77%) and '65 and over' group was 29.26%. For the income group, 40.30% was under two million won family

income and 34.02% was two to four million won. 38.36% finished middle education or under, 32.37% got high education, 43.57% was not-manual workers, 34.71% was unemployed and 43.57% was manual workers. Mean of interval days between main survey and telephone survey was about 11 days and 52.98% was done within 4 to 10 days and 37.37% was done after 11days. 67.94% lived in city, 58.15% did not have any comorbidity and 0.57% was short time survey data. Total concordance mean of all the 5 questions was 4.32. For the each question, a concordance proportion of 'subjective health conception (5 points scale)' was 61.23%, 'whether drive or not' was 96.35%, 'mean sleep time per a day (0 – 24 hour, ±1 adjustment)' was 87.92%, 'smoking status' was 93.33%, and 'whether to diagnosed hypertension by a doctor' was 92.85% (Table 2).

[Table 1] General characteristics of study subjects by employment status (N=220,677)

Variables	Category	Employed		Unemployed		*P*-value
		n	%	n	%	
Total		146,720	66.49	73,957	33.51	
Time(hour)	8 - 10	15,841	10.80	8,513	11.51	
	11 - 13	27,763	18.92	16,690	22.57	
	14 - 16	34,746	23.68	22,084	29.86	**<.0001**
	17 - 19	47,263	32.21	21,526	29.11	
	20 - 22	21,107	14.39	5,144	6.96	
Sex	Male	79,241	54.01	19,797	26.77	**<.0001**
	Female	67,479	45.99	54,160	73.23	
Age	19 - 44	59,617	40.63	15,438	20.87	
	45 - 64	62,970	42.92	20,765	28.08	**<.0001**
	65 or over	24,133	16.45	37,754	51.05	
Income[1)]	Under 200	44,550	30.36	40,803	55.17	
	200 - 400	55,542	37.86	21,088	28.51	**<.0001**
	400 or over	46,628	31.78	12,066	16.31	
Education level	Middle or under	42,667	29.08	39,942	54.01	
	High	54,591	37.21	18,851	25.49	**<.0001**
	University	49,462	33.71	15,164	20.50	
House type	General house	87,771	59.82	46,355	62.68	**<.0001**
	Apartment	58,949	40.18	27,602	37.32	
City type	City	98,459	67.11	51,155	69.17	**<.0001**
	Rural	48,261	32.89	22,802	30.83	
Comorbidity	Yes	47,791	32.57	40,451	54.70	**<.0001**
	No	98,929	67.43	33,506	45.30	
Week	Weekdays	98,810	67.35	56,972	77.03	**<.0001**
	Weekend	47,910	32.65	16,985	22.97	

[Table 1] Continued

Short	Short	990	0.67	475	0.64	0.375
	Normal	145,730	99.33	73,482	99.36	
Job	Non-manual	42,954	29.28			
	Manual	96,200	65.57			
	Others	7,566	5.16			

[1)] Unit is ten thousand KRW (ex. 200 is 2,000,000 KRW)

[Table 2] General characteristics of telephone survey participants (10 % of total) and concordance proportion of each question

Variables	Category	n	%
Total		23,598	100.00
Time (hour)	8 - 10	2,678	11.35
	11 - 13	4,815	20.40
	14 - 16	6,306	26.72
	17 - 19	7,267	30.79
	20 - 22	2,532	10.73
Sex	Male	10,154	43.03
	Female	13,444	56.97
Age	19 - 44	7,780	32.97
	45 - 64	8,914	37.77
	65 or over	6,904	29.26
Income	Under 200	9,509	40.30
	200 - 400	8,027	34.02
	400 or over	6,062	25.69
Education level	Middle or under	9,053	38.36
	High	7,638	32.37
	University	6,907	29.27
Job	Non-manual	4,441	18.82
	Manual	10,282	43.57
	Others	683	2.89
	Unemployed	8,192	34.71
Interval (days)	3 or under	2,277	9.65
	4 - 10	12,503	52.98
	11 or over	8,818	37.37
City type	City	16,032	67.94
	Rural	7,566	32.06

[Table 2] Continued

Comorbidity	Yes	9,875	41.85
	No	13,723	58.15
Short	Short	135	0.57
	Normal	23,463	99.43
Mean (STD) of the interval days between telephone inspection and actual survey:			10.997 (6.16)
Total concordance mean (STD) of 5 questions			4.32 (0.83)
Number and proportion (%) of each question concordance			
Subjective health conceptions (5 points)		14,450	61.23
Whether to drive or not (yes or no)		22,736	96.35
Mean sleep time per a day (0~24 hours)		20,748	87.92
Smoking status (everyday, sometimes, past smoker, none)		22,024	93.33
Whether to diagnosed hypertension by a doctor (yes or no)		21,910	92.85

3-2. Association between visiting time and short time

Association between visiting timeframe of an interviewer to house had been shown differently by employment status. Regarding the employed group, 11 – 13 (OR: 1.57, 95% CI: 1.20 – 2.04) and 14 – 16 hour (OR: 1.35, 95% CI: 1.04 – 1.75) had higher likelihood to be short data than 8 – 10 hour. And Female had more likelihood to be short data (OR: 1.48, 95% CI: 1.30 – 1.68). And 45 – 64 age group had lower likelihood (OR: 0.59, 95% CI: 0.50 – 0.70) then 19-44 group. Rural area had lower likelihood to be short data (OR: 0.43, 95% CI: 0.24 – 0.77) and group without comorbidity had higher likelihood (OR: 2.02, 95% CI: 1.64 – 2.49) as well. And during weekend, short data had lower likelihood to be happened than weekdays (OR: 0.86, 95% CI: 0.75 – 0.99). For job, compared to non-manual workers, manual workers had lower trend (OR: 0.79, 95% CI: 0.67 – 0.94) and others showed higher likelihood (OR: 2.24, 95% CI: 1.73 – 2.90) (Table 3).

As regards the unemployed group, visiting time was statistically associated with short time data event only at night time, 20 – 22 hour (OR: 2.12, 95% CI: 1.43 – 3.15). Female had higher likelihood (OR: 1.94, 95% CI: 1.49 – 2.53) than male like the case in the employed group. Income had shown positive association on four million won and over group then under two million group (OR: 1.45, 95% CI: 1.10 – 1.93). Rural area had lower likelihood (OR: 0.39, 95% CI: 0.21 – 0.72) to be short data than city. A group

without comorbidity had higher likelihood (OR: 1.86, 95% CI: 1.48 – 2.36) to be short data than the other group (Table 3).

3-3. Association between visiting time and concordance

Association between concordance and other variables are shown in Table 4. Odds ratio (OR) and confidence interval (CI) were used to estimate likelihoods of the association between concordance and other independent variables.

As for time frame, only 'whether to drive or not (Q2)' question had shown positive association on 11 – 13 hour (OR: 1.35, 95% CI: 1.04 – 1.75). Regarding sex, all questions showed higher likelihood on female; 'subjective health conception' (OR: 1.12, 95% CI: 1.06 – 1.19), 'whether to drive' (OR: 1.42, 95% CI: 1.23 – 1.64), 'mean sleep time' (OR: 1.20, 95% CI: 1.10 – 1.31), 'smoking status' (OR: 4.51, 95% CI: 4.00 – 5.10), 'hypertension diagnosed' (OR: 1.63, 95% CI: 1.46 – 1.81). As for age, in 'subjective health conception,' concordance decreased as it gets older; 45 – 64 years (OR: 0.83, 95% CI: 0.77 – 0.90), over 65 years (OR: 0.61, 95% CI: 0.55 – 0.67). And at 'mean sleep time,' age was associated with concordance on 45 – 64 years (OR: 1.20, 95% CI: 1.04 – 1.37) and over 65 years (OR: 0.75, 95% CI: 0.64 – 0.88), and 'hypertension diagnosed' was associated on over 65 years (OR: 0.59, 95% CI: 0.48 – 0.74). For, income level, 'subjective health conception' showed better concordance likelihood at 200 – 400 family income (OR: 1.12, 95% CI: 1.04 – 1.20), 'mean sleep time' had an association on under 200 (OR: 1.24, 95% CI: 1.12 – 1.39) and '400 or over' (OR: 1.34, 95% CI: 1.17 – 1.53) and

‘smoking status’ was associated with concordance on 200 – 400 group (OR: 1.29, 95% CI: 1.12 – 1.48) and 400 or over (OR: 1.27, 95% CI: 1.08 – 1.50) then under 200 group. Education level had shown positive association as it got higher; high school (OR: 1.14, 95% CI: 1.05 – 1.23) and university (OR: 1.21, 95% CI: 1.10 – 1.33) in ‘subjective health conception’ and high school (OR: 1.76, 95% CI: 1.56 – 1.98) and university (OR: 2.33, 95% CI: 1.98 – 2.74) in ‘mean sleep time,’ and high school (OR: 1.20, 95% CI: 1.03 – 1.40) and university (OR: 1.29, 95% CI: 1.08 – 1.56) in ‘smoking status.’ In ‘whether to drive,’ high education had lower likelihood of concordance than middle or under education group (OR: 0.79, 95% CI: 0.65 – 0.98). Lastly ‘hypertension diagnosed’ showed better concordance on high education (OR: 1.52, 95% CI: 1.30 – 1.76). As for job, unemployed group showed lower likelihood to be coincided in ‘whether to drive’ (OR: 0.75, 95% CI: 0.60 – 0.94) and ‘mean sleep time’ (OR: 0.77, 95% CI: 0.65 – 0.91), and showed higher concordance likelihood in ‘hypertension diagnosed’ (OR: 1.26, 95% CI: 1.02 – 1.55), compared to non-manual workers. And others in job had lower concordance in ‘whether to drive’ (OR: 0.60, 95% CI: 0.41 – 0.86), compared to non-manual group. Manual workers showed higher concordance in ‘smoking status’ (OR: 1.24, 95% CI: 1.05 – 1.47) and ‘hypertension diagnosed’ (OR: 1.23, 95% CI: 1.01 – 1.50). Interval days between the survey and telephone inspection reported the shorter the days were taken, the better

concordance was shown in ‘subjective health conception’ (OR: 1.17, 95% CI: 1.10 – 1.24 in 4 – 10 days; OR: 1.43, 95% CI: 1.29 – 1.57 in 3 days and under) and ‘mean sleep time’ (OR: 1.26, 95% CI: 1.15 – 1.38 in 4 – 10 days; OR: 1.50, 95% CI: 1.28 – 1.75 in 3 days and under), compared to 11 days and over. In ‘smoking status,’ when the telephone inspection was done within 3 days or under, the concordance got higher (OR: 1.27, 95% CI: 1.04 – 1.55) than when the telephone survey was done after 11 days. Rural area had a tendency to have lower concordance than city area; ‘subjective health conception’ (OR: 0.88, 95% CI: 0.82 – 0.95), ‘mean sleep time’ (OR: 0.75, 95% CI: 0.67 – 0.84) and ‘hypertension diagnosed’ (OR: 0.80, 95% CI: 0.71 – 0.91). Participants who had no comorbidity had lower concordance (OR: 0.80, 95% CI: 0.67 – 0.94) than the other who have it in ‘whether to drive’, and showed higher concordance (OR: 3.49, 95% CI: 3.06 – 3.99) in ‘hypertension diagnosed,’ compared to the one who have comorbidity. When data was normal time survey data, concordance of ‘subjective health conception’ (OR: 2.22, 95% CI: 1.57 – 3.14) and ‘mean sleep time’ (OR: 1.99, 95% CI: 1.23 – 3.23) had higher likelihood to have better concordance than short time survey data (Table 4).

[Table 3] Association between short time survey and visiting time by employment status

Variables	Category	Employed			Unemployed		
		Odds ratio	95% CI		Odds ratio	95% CI	
			Lower	Upper		Lower	Upper
Time(hour)	8 - 10	1.00	(reference)		1.00	(reference)	
	11 - 13	**1.57**	**1.20**	**2.04**	1.23	0.86	1.77
	14 - 16	**1.35**	**1.04**	**1.75**	1.06	0.74	1.51
	17 - 19	1.24	0.97	1.60	1.16	0.81	1.65
	20 - 22	1.15	0.87	1.52	**2.12**	**1.43**	**3.15**
Sex	Male	1.00	(reference)		1.00	(reference)	
	Female	**1.48**	**1.30**	**1.68**	**1.94**	**1.49**	**2.53**
Age	19 - 44	1.00	(reference)		1.00	(reference)	
	45 - 64	**0.59**	**0.50**	**0.70**	0.88	0.67	1.16
	65 or over	0.80	0.58	1.11	1.24	0.88	1.75
Income	Under 200	1.00	(reference)		1.00	(reference)	
	200 - 400	1.03	0.85	1.25	1.27	0.99	1.62
	400 or over	1.21	0.99	1.48	**1.45**	**1.10**	**1.93**
Education level	Middle or under	1.00	(reference)		1.00	(reference)	
	High	1.03	0.80	1.34	0.81	0.61	1.10
	University	1.18	0.89	1.57	1.21	0.87	1.68
House type	General house	1.00	(reference)		1.00	(reference)	
	Apartment	1.02	0.88	1.19	0.98	0.79	1.22
City type	City	1.00	(reference)		1.00	(reference)	
	Rural	**0.43**	**0.24**	**0.77**	**0.39**	**0.21**	**0.72**
Comorbidity	Yes	1.00	(reference)		1.00	(reference)	
	No	**2.02**	**1.64**	**2.49**	**1.86**	**1.48**	**2.36**
Week	Weekdays	1.00	(reference)		1.00	(reference)	
	Weekend	**0.86**	**0.75**	**0.99**	1.03	0.83	1.28

[Table 3] Continued

Job	Non-manual	1.00	(reference)	
	Manual	**0.79**	**0.67**	**0.94**
	Others	**2.15**	**1.70**	**2.73**

[Table 4] Association between concordance and visiting time by each question (odds ratio and 95% confidence intervals)

Variables	Category	Odds ratio	95% CI	
			Lower	Upper
Q01. Subjective health conception				
Time (hour)	8 - 10	1.00	(reference)	
	11 - 13	1.02	0.93	1.13
	14 - 16	1.04	0.95	1.14
	17 - 19	1.03	0.94	1.13
	20 - 22	0.95	0.85	1.07
Sex	Male	1.00	(reference)	
	Female	**1.12**	**1.06**	**1.19**
Age	19 - 44	1.00	(reference)	
	45 - 64	**0.83**	**0.77**	**0.90**
	65 or over	**0.61**	**0.55**	**0.67**
Income	Under 200	1.00	(reference)	
	200 - 400	**1.12**	**1.04**	**1.20**
	400 or over	1.07	0.99	1.16
Education level	Middle or under	1.00	(reference)	
	High	**1.14**	**1.05**	**1.23**
	University	**1.21**	**1.10**	**1.33**
Job	Non-manual	1.00	(reference)	
	Manual	1.00	0.92	1.09
	Others	0.91	0.76	1.09
	Unemployed	0.95	0.86	1.04
Interval (days)	11 or over	1.00	(reference)	
	3 or under	**1.43**	**1.29**	**1.57**
	4 - 10	**1.17**	**1.10**	**1.24**

[Table 4] Continued

City type	City	1.00	(reference)	
	Rural	**0.88**	**0.82**	**0.95**
Comorbidity	Yes	1.00	(reference)	
	No	1.06	1.00	1.13
Short	Short	1.00	(reference)	
	Normal	**2.22**	**1.57**	**3.14**
Q02. Whether to drive or not				
Time (hour)	8 - 10	1.00	(reference)	
	11 - 13	**1.35**	**1.04**	**1.75**
	14 - 16	1.06	0.83	1.34
	17 - 19	0.96	0.76	1.21
	20 - 22	1.05	0.79	1.41
Sex	Male	1.00	(reference)	
	Female	**1.42**	**1.23**	**1.64**
Age	19 - 44	1.00	(reference)	
	45 - 64	1.20	0.99	1.45
	65 or over	0.97	0.75	1.25
Income	Under 200	1.00	(reference)	
	200 - 400	0.97	0.80	1.16
	400 or over	1.01	0.82	1.25
Education level	Middle or under	1.00	(reference)	
	High	**0.79**	**0.65**	**0.98**
	University	1.02	0.79	1.31
Job	Non-manual	1.00	(reference)	
	Manual	1.09	0.87	1.36
	Others	**0.60**	**0.41**	**0.86**
	Unemployed	**0.75**	**0.60**	**0.94**

[Table 4] Continued

Interval (days)	11 or over	1.00	(reference)	
	3 or under	1.11	0.87	1.42
	4 - 10	1.08	0.93	1.26
City type	City	1.00	(reference)	
	Rural	0.92	0.76	1.12
Comorbidity	Yes	1.00	(reference)	
	No	**0.80**	**0.67**	**0.94**
Short	Short	1.00	(reference)	
	Normal	1.70	0.84	3.43

Q03. Mean sleep time per a day

Time (hour)	8 - 10	1.00	(reference)	
	11 - 13	1.03	0.89	1.19
	14 - 16	1.02	0.88	1.17
	17 - 19	0.99	0.86	1.14
	20 - 22	0.99	0.82	1.20
Sex	Male	1.00	(reference)	
	Female	**1.20**	**1.10**	**1.31**
Age	19 - 44	1.00	(reference)	
	45 - 64	**1.20**	**1.04**	**1.37**
	65 or over	**0.75**	**0.64**	**0.88**
Income	Under 200	1.00	(reference)	
	200 - 400	**1.24**	**1.12**	**1.39**
	400 or over	**1.34**	**1.17**	**1.53**
Education level	Middle or under	1.00	(reference)	
	High	**1.76**	**1.56**	**1.98**
	University	**2.33**	**1.98**	**2.74**

[Table 4] Continued

Job	Non-manual	1.00	(reference)	
	Manual	0.97	0.83	1.14
	Others	0.82	0.60	1.12
	Unemployed	**0.77**	**0.65**	**0.91**
Interval (days)	11 or over	1.00	(reference)	
	3 or under	**1.50**	**1.28**	**1.75**
	4 - 10	**1.26**	**1.15**	**1.38**
City type	City	1.00	(reference)	
	Rural	**0.75**	**0.67**	**0.84**
Comorbidity	Yes	1.00	(reference)	
	No	1.06	0.96	1.16
Short	Short	1.00	(reference)	
	Normal	**1.99**	**1.23**	**3.23**
Q04. Smoking status				
Time (hour)	8 - 10	1.00	(reference)	
	11 - 13	1.08	0.89	1.30
	14 - 16	1.14	0.95	1.36
	17 - 19	1.13	0.94	1.35
	20 - 22	0.96	0.77	1.20
Sex	Male	1.00	(reference)	
	Female	**4.51**	**4.00**	**5.10**
Age	19 - 44	1.00	(reference)	
	45 - 64	1.02	0.87	1.18
	65 or over	0.83	0.68	1.01
Income	Under 200	1.00	(reference)	
	200 - 400	**1.29**	**1.12**	**1.48**
	400 or over	**1.27**	**1.08**	**1.50**

[Table 4] Continued

Education level	Middle or under	1.00	(reference)	
	High	**1.20**	**1.03**	**1.40**
	University	**1.29**	**1.08**	**1.56**
Job	Non-manual	1.00	(reference)	
	Manual	**1.24**	**1.05**	**1.47**
	Others	0.91	0.66	1.25
	Unemployed	0.98	0.82	1.18
Interval (days)	11 or over	1.00	(reference)	
	3 or under	**1.27**	**1.04**	**1.55**
	4 - 10	0.98	0.87	1.10
City type	City	1.00	(reference)	
	Rural	0.99	0.86	1.15
Comorbidity	Yes	1.00	(reference)	
	No	0.90	0.80	1.02
Short	Short	1.00	(reference)	
	Normal	1.83	1.00	3.37
Q05. Whether to diagnosed hypertension by a doctor				
Time (hour)	8 - 10	1.00	(reference)	
	11 - 13	0.98	0.82	1.19
	14 - 16	0.95	0.80	1.14
	17 - 19	0.94	0.79	1.12
	20 - 22	0.97	0.76	1.24
Sex	Male	1.00	(reference)	
	Female	**1.63**	**1.46**	**1.81**
Age	19 - 44	1.00	(reference)	
	45 - 64	0.90	0.74	1.09
	65 or over	**0.59**	**0.48**	**0.74**

[Table 4] Continued

Income	Under 200	1.00	(reference)	
	200 - 400	1.12	0.97	1.28
	400 or over	1.12	0.94	1.33
Education level	Middle or under	1.00	(reference)	
	High	**1.52**	**1.30**	**1.76**
	University	**1.65**	**1.35**	**2.02**
Job	Non-manual	1.00	(reference)	
	Manual	**1.23**	**1.01**	**1.50**
	Others	1.06	0.65	1.73
	Unemployed	**1.26**	**1.02**	**1.55**
Interval (days)	11 or over	1.00	(reference)	
	3 or under	1.03	0.86	1.23
	4 - 10	1.03	0.92	1.16
City type	City	1.00	(reference)	
	Rural	**0.80**	**0.71**	**0.91**
Comorbidity	Yes	1.00	(reference)	
	No	**3.49**	**3.06**	**3.99**
Short	Short	1.00	(reference)	
	Normal	1.60	0.76	3.37

[Table 5] Concordance odds ratio comparison of interval days and short data by each question

Variables		Concordance questions				
		Q1.[1)]	Q2.[2)]	Q3.[3)]	Q4.[4)]	Q5.[5)]
Interval (days)	11 or over	ref	ref	ref	ref	ref
	3 or under	**1.43 (1.29,1.57)**	1.11 (0.87,1.42)	**1.50 (1.28,1.75)**	**1.27 (1.04,1.55)**	1.03 (0.86,1.23)
	4 - 10	**1.17 (1.10,1.24)**	1.08 (0.93,1.26)	**1.26 (1.15,1.38)**	0.98 (0.87,1.15)	1.03 (0.92,1.16)
Short	Short	ref	ref	ref	ref	ref
	Normal	**2.22 (1.57,3.14)**	1.70 (0.84,3.43)	**1.99 (1.23,3.23)**	1.83 (1.00,3.37)	1.60 (0.76,3.37)

[1)] Subject health conception (Very bad, bad, normal, good or very good)
[2)] Whether to drive or not (yes or no)
[3)] Mean sleep time per a day (0~24 hour)
[4)] Smoking status (everyday, sometimes, past smoker or never-smoker)
[5)] Whether to diagnosed hypertension by a doctor (yes or no)

IV. Discussion

This study was performed to investigate the association between visiting time (time frame) and data quality based on short time survey and concordance on 5 questions. Even though the association with short time survey was not clear at certain time frame, we still could find it at some time frame differently by employment status. However, contrary to that we thought when respondent got survey can affect to concordance, there was no clear association between visiting time and concordance.

Short time data is a factor that should be controlled for securing accurate data, in especially on the national health survey that has quite many questions. It was reported that insincerity probability on response was high only in the group that finished questionnaire in short time(Y. S. Lee, Lee, & Lee, 2008). In this study, there was higher likelihood for short time survey to be happened at 11- 13 and 14 – 16 hour in employment group. And among the time frame, 11 – 13 had slightly higher then 14 – 16 hour. Usually, for employed people, that time is working time or day-off. So, at that time, there are possibility for interviewers to visit working place, and time is around lunch time at office, so that respondents might not have been willing to participate in the survey with caution. However, there was no association at that time in the

unemployed group, whereas during 20 – 22, the likelihood of short time survey was almost 2 times higher than reference time. It could be because of fatigue built and in other research, at afternoon, respondent showed higher concern of leakage of their personal information than morning(K. H. Kim & Lee, 2002), which could represent the attitude of respondents and then can be interpreted that respondents' attitude to survey can be changed by time. However, in unemployed group, rest of time but 20 – 22 hour, there was no association, then it could mean that short time survey event can rarely happen during 8 am to 7 pm.

Demographic factors are also important factors that can affect response time(Ko & Kim, 2016; Krosnick, Narayan, & Smith, 1996; Olson & Peytchev, 2007). Ko et al(Ko & Kim, 2016) reported that, as income was higher, job was closer to white collar job, age was younger and education level was high, the response time was shorter than the others. However, it was not that clear in our study, contrary to the study of the advance researches. In employment group, young group (19 – 45 years) had higher possibility for short time survey to be happened, compared to middle aged group (45 – 64 years), which is similar to Ko et al(2016) study, and no association on 65 and over. For unemployed group, there was no statistical association at all age group and high family income group (4 million won or over) had bigger likelihood to

have short time survey, but not at middle aged group. There was no association on education level. Although it was not perfectly consisted with advanced researches, somewhat similar result was still shown partially in this study and, even though it was not significant statistically, still similar direction was able to be found. This might be because of analysis method. In this study, we conducted response time as binary outcomes; short time survey under 10 mins vs. normal. If the analysis was done with time as continuous variable, similar outcome might have been presented. Moreover, analyzing response time after setting standard of short time survey is more important(Ko & Kim, 2016), because short time survey itself does not mean the data is wrong, so setting standard of 'short time survey' that has higher possibility to be incorrect data has more meaningful and practical message. Therefore, the result of this study could be interpreted that response time could be related demographic factors, however, short time survey has no apparent association except for certain groups, and for which groups, specific and focused monitoring strategy will be needed to prevent short time survey occurrence.

City type (city or rural), comorbidity, week and job classes were shown to have association on short time survey. In city and people who do not have any comorbidity, there were more short time survey than rural area in both employed and unemployed group. Mostly city people live more busy life,

they might do not want to spare many time on this survey. And in this survey if respondents have comorbidity, they should make sure whether their disease was diagnosed by a doctor, not just self-diagnose. In other words, they should recall whether they had that diagnose experience, which will take a time. And weekdays are better not to have short time survey according to result of the study for employed group, not in unemployed group. So, if some data belongs to city, no comorbidity, weekdays and employed, more cautions will be needed to block short time survey. Lastly, in the job classes, there was significant association; non-manual workers had tendency to have short time data than manual worker, which is consisted with the advanced research(Ko & Kim, 2016). Especially, in this study, others group (student and soldier) had 2 times higher possibility to have short time survey data, so when that group is collected during survey, cautious attention will be needed. And especially, according to one research, it reported that asking again differently, probing, can affect to respondent's answers(Robert H. Hanson, 2012), and Fowler pointed out that maximizing good points of a survey is a characteristic of an excellent interviewer(Fowler, 2009). So educating interviewers on how to appeal benefits to respondents will be one of good methods for blocking short time survey.

Concordance is one of major factors representing quality of data, because if

the answer on telephone survey was not coincided with the original answer, it could be wrong data. In this study, several factors had shown different association by each 5 questions. However, visiting time that when the respondents performed this survey was not statistically associated with concordance, but other factors such as sex, age, income, job, education, interval days and etc. had shown associations differently by each question. Questions with many answer options or continuous such as ‘subjective health conception’ and ‘mean sleep time’ were more apparently related with ages, education, interval days, city types and short time survey at all variables than other questions. As age is older, concordance tended to be lower, except on 45 – 64 group in ‘mean sleep time.’ The other advanced research on concordance of CHS had also shown similar result; the older the age, the lower the concordance is(J. Kim et al., 2016). And especially since those questions are consisted of degree answers rather than simple fact answer such as whether to drive or not, it needs more accurate memory to recall what they answered. Moreover, a prior research pointed out that recalling simple symptoms was easier than other questions that were consisted of quality of life or degree of pain intensity(Schmier & Halpern, 2004). So, higher memory ability or brain ability are needed to recall accurately, and the ability could be associated with education level(Kyung Hyun Kwak, 2006). In this study, more educated got higher concordance on the two questions that had more

complicated answers. Interval days were also critically associated with concordance. The longer days passed, the lower concordance was shown. The telephone survey was recommended to be done within 3 days(Embrain, 2015), the result showed that the concordance was better if it was done within 3 days. However, interval days was not clearly associated with concordance in other 3 questions; ‘driving status,’ ‘smoking status’ and ‘hypertension diagnose’ (table 5). Usually, recall bias can happen thorough several characteristics including time period involved(Coughlin, 1990), but according to this result, concordance of questions related with simple fact are not affected by interval days. In other words, only in simple fact questions, recall bias and interval days would not be associated, but still, in order to get higher concordance in more complicated questions, telephone survey would be needed to be managed to perform it shortly after the main survey.

Short data was also shown apparent association with the concordance of questions that has many answers. In only the two questions, ‘subjective health conception’ and ‘mean sleep time’ short time survey had shown lower concordance as almost two times higher, which could mean a respondent attended the survey without sincerity, and which would be a reason why the respondent cannot remember well, or there would be a possibility of substitute response by the other in the household (table 5). Therefore, monitoring on

short time survey with more caution will be needed to secure better quality of data.

There were some limitations on this study. CHS is the survey performed with CAPI system, which means that every interviewer should visit the household and interview's style is different. Interview's behavioral difference could affect to respondents' attitude. However, In CHS, KCDC has performed intense education program on all interviewers. And intense monitoring was accompanied during entire survey period, and many data were deleted as problematic data, and on the data deleted, no incentives were given to interviews. And all interviewers were supposed to read questions word by word regardless of survey situations(KCDC, 2015c). So, effects that can occur by interviewers would have been supplemented fairly. And we could not see consistent result in all concordance questions, and this would be because the sample is 10 % of the total data, if the study can be conducted as time series, it could be able to find key factors, although the questions slightly had been changed by years.

As conclusion, short time survey was associated with visiting time and could not find clear association in concordance. In employed group, 11 – 14 hour and 14 – 16 hour were likely to have more short time survey than other time

frame and, in unemployed group, 20 – 22 hour was likely to have more short time survey. This finding in the study suggest that, by employment status, more specific targeted monitoring is needed, and it would contribute to find inappropriate data that would be made from insincerity, incorrect and substitute responses, securing the data quality. Besides, although the system of interview education program is well organized, considering that certain time is associated with short time survey, an extra guideline such as motivation and probing skills will be needed for interviewers to be able to adjust speed and respondent's participation attention on the survey.

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국문초록

조사수행시간대와 자료 질의 연관성 분석; 2015년 지역사회건강조사 단시간 조사건수와 일치도를 중심으로

윤태환
보건학과 보건학전공
서울대학교 보건대학원

배경 및 목적: 지역사회건강조사는 질병관리본부에서 매년 수행되고 있는 지역사회 기반 건강통계이다. 해당 통계는 전국의 보건소가 지역기반의 건강증진 사업을 구상하는데 사용되는 매우 중요한 근거자료로서 활용이 되고 있다. 그러나 갈수록 만나기 힘든 대상들로 인해 조사의 수행이 어려워지고 있다. 이에 사람들의 생활패턴을 고려한 시간대별 전략적 접근이 하나의 개선 방안이 될 수 있는데, 이를 수행하기 전에 조사수행 시간대가 자료의 질에 영향을 미치는지 검토해 보는 것이 선행되어야 할 것이다. 이에 본 연구에서는 조사수행 시간대별로 자료의 질이 변하는지 보고 추후 조사수행의 전략구성에 근거자료를 제공하고자 한다.

방법: 본 연구를 위해, 질병관리본부가 수행한 2015년 지역사회건강조사 자료(본 조사, N=228,588)와 해당 조사의 질관리 측면에서 수행한 전화점검결과(N=24,545)를 함께 활용하였다. 본 조사 자료는 전국 만 19세 이상 성인대상으로 수집이 되었으며, 이 중 10%에 전화점검을 수

행하였다. 자료의 질을 나타내는데, 단시간조사(10분 이하)여부와 전화 점검을 통해 수집된 5개 문항 일치 여부(일치도)를 각각 활용하였다. 시간대는 8~22시를 5개 범주로 구분하여, 인구학적, 기저질환, 주말여부 등의 변수와 함께 연관성을 각각 분석하였다. 특별히 단시간 조사여부 분석에는 생활패턴의 차이를 고려하여, 직업유무로 집단을 나누어 분석하였다. 자료분석에는 해당 자료가 군집화 되어 샘플이 뽑혔다는 것을 감안하여 다수준 로지스틱 분석법을 활용하였다.

결과: 직업이 있는 집단에서는 11-13시(OR: 1.57, 95% CI: 1.20-2.04), 14-16시(OR: 1.35, 95% CI: 1.04-1.75)에서 8-10시에 비해 단시간(10분 이하) 조사 건이 발생할 오즈비가 더 높게 나왔다. 직업이 없는 집단에서는 20-22시(OR: 2.12, 95% CI: 1.43-3.15)에서 단시간 조사 발생에 대한 오즈비가 8-10에 비해 더 높았다. 5개 문항 일치도에 대한 시간대와의 통계적 연관성은 '자동차 운전여부'에서 11-13시를 제외하고는 나타나지 않았다.

고찰: 직업유무에 따라 특정 시간대에 단시간 조사건이 더 잘 발생한다는 것을 기반으로, 해당 시간대에 대한 심도 있는 모니터링이 필요할 것이다. 또한 해당 시간대에 대상자가 충분히 생각하지 않고 불성실하게 응답을 할 시, 올바른 대답을 끌어내기 위한 방법을 조사원들에게 교육하여, 단시간 조사건 발생을 최소화 해야 할 것이다.

주요어: 단시간조사, 일치도, 지역사회건강조사, 자료 질

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