

**Breast and Cervical Cancer Screening  
Participation of Women with Chronic  
Diseases in Korea: Analysis of the 2012  
Korean National Health and Nutrition  
Examination Survey**

**A Thesis Submitted to  
the Department of Cancer Control and Population Health  
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for the Master's Degree of Public Health**

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## ABSTRACT

### **Breast and Cervical Cancer Screening Participation of Women with Chronic Diseases in Korea: Analysis of the 2012 Korean National Health and Nutrition Examination Survey**

**BACKGROUND:** Cancer is a leading cause of death, and cancer burden is expected to grow worldwide due to aging population. For 2012, GLOBOCAN reported 14.1 million new cancer cases and 8.2 million deaths from cancer worldwide. Chronic disease morbidity is a concern for cancer research. Contradictory results have been reported concerning adherence to breast and cervical cancer screening among patients with chronic diseases.

**STUDY OBJECTIVE:** This study was conducted to assess the adherence to breast and cervical cancer screening of women with chronic diseases in Korea.

**METHODS:** This study was a cross sectional and population based study, the data came from the Korean National Health and Nutrition Examination Survey (KNHANES) 2012. The analyses for breast and cervical cancer screening were conducted separately. Participation in breast and cervical cancer screening were analyzed among women who had eight

chronic diseases (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancer) adjusting for socioeconomic and behavioral factors. Pearson's chi-squared test and multiple logistic regression analysis were performed using STATA version 14.

**RESULTS:** A total of 2,404 women aged 40 years or older were included in analysis of breast cancer screening and 2,986 women aged 30 or older were included in analysis of cervical cancer screening. Among them, 77.3% and 70.7% had experienced breast and cervical cancer screening, respectively. In logistic regression model, adherence to breast cancer screening was significantly lower in women who have ever been diagnosed as diabetes mellitus (odds ratio (OR)= 0.61, 95% confidence interval (95%CI) = 0.44-0.86) and significantly higher in women who have ever been diagnosed as dyslipidemia (OR= 2.28, 95%CI= 1.65-3.16), osteoarthritis (OR= 1.61, 95%CI= 1.24-2.08) and cancers (OR= 1.90, 95%CI= 1.03-3.51) even after adjusting for socioeconomic and behavioral factors. Low participation in breast cancer screening was observed in women who were on treatment of diabetes mellitus (OR= 0.63, 95%CI= 0.45-0.88) and stroke (OR= 0.35, 95%CI= 0.15-0.83). High participation in breast cancer screening was observed in women who were on treatment of dyslipidemia (OR= 1.99, 95%CI= 1.36-2.92). Adherence to cervical cancer screening was significantly lower in women who have ever been diagnosed as diabetes mellitus (OR=

0.72, 95%CI= 0.53-0.96) and significantly higher in women who have ever been diagnosed as dyslipidemia (OR= 2.01, 95%CI= 1.54-2.62) even after adjusting for socioeconomic and behavioral factors. High participation in cervical cancer screening was observed in women who were on treatment of dyslipidemia (OR= 1.85, 95%CI= 1.34-2.54) and depression (OR= 1.84, 95%CI= 1.05-3.22).

**CONCLUSION:** Low participation in breast cancer screening was observed in women with diabetes mellitus, asthma and stroke. Low participation in cervical cancer screening has been observed in women with hypertension, osteoarthritis and diabetes mellitus. Educational programs need to be developed not only for the general population and healthcare professionals, but also for women with chronic diseases to increase and maintain the awareness of the importance of cancer screening services.

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# **1. Introduction**

## **1.1 Study background**

Cancer is a leading cause of death, and cancer burden is predictable to grow worldwide due to aging population. For 2012, GLOBOCAN reported 14.1 million new cancer cases and 8.2 million deaths from cancer worldwide [1]. Cancer screening remains essential in cancer detection at early stage before the cancer gets complicated as it increases the chance for successful treatment through early diagnosis [2].

For cancer control, cervical smear has showed the effectiveness to reduce cervical cancer incidence and mortality [3]. For breast cancer, although the percentage of mortality reduction attributable to screening has been subject to debate [4], recent studies have found a 10% to 20% reduction in breast cancer mortality among women who underwent mammographic screening [4, 5]. Scientific evidence showed that screening for either breast cancer or cervical cancer in appropriate age group reduces mortality by 20% to 60 % depending on the condition and baseline risk-level of the group being screened [6, 7].

Chronic illness is an important of increasing implication for cancer research worldwide [8]. Comorbidity is common among cancer patients and with an old population is becoming more [9]. Comorbidity possibly affects the development, stage at diagnosis, treatment, and outcomes of people with cancer [9]. Though, chronic conditions are already the leading cause of death worldwide and their burden is expected to increase, it has been shown that all-cause mortality as well

as cancer-specific mortality is higher for recently diagnosed cancer patients suffering from chronic conditions, even when stage at diagnosis or treatment are taken into description [10, 11].

More definitely, comorbidity at the time of diagnosis is an independent prominent factor for survival among both cervical cancer [12, 13] and breast cancer patients [14]. The study showed that the presence of one chronic condition was comparable to one tumor stage modification in terms of breast cancer survival decrease [15].

However, varying results have been reported regarding adherence to recommended screening procedures among patients suffering from chronic diseases. Some conditions were generally associated with higher cancer screening rates (e.g. cancer survivors, hypertension) [16-18], others with lower cancer screening rates (e.g. diabetes, obesity, depression) [17, 19-22] and differing results were reported for conditions such as rheumatoid arthritis where was no dissimilarity in cancer screening participation compared to the general population [23] . When the complete effect of chronic morbidity on cervical and breast cancer screening is studied using summary methods, increased comorbidity is associated with decreased screening in clinic-based studies and with increased screening in population-based studies [18]. This study is intended to investigate the participation of women with chronic diseases in breast and cervical cancer screening in Korea in spite of the existence of the national cancer screening program (NCSP).

In France, an opportunistic cervical cancer screening is recommended for women aged 25 to 65 years every three years. A nationwide organized breast cancer screening has been implemented in 2004 and women aged 50 to 74 years were individually invited to attend mammography screening, free of charge, every two years. This organized program existed together with opportunistic screening, since individual prescriptions of mammograms were reimbursed. The conditions were identified with participation in cervical and breast cancer screening, even when accounting for major determinants of cancer screening. Obese women participated less in cervical cancer screening. Obese women and women with diabetes participated less in mammographic screening and organized breast cancer screening seemed to incompetently address barriers to participation [17].

In USA, a study found that women with diabetes were significantly less likely to have had a mammogram during 2-year period than were women without diabetes, despite more health care visits. These results suggested that, because of the difficulty involved in diabetes care, repetitive preventive cares such as cancer screening were often ignored. Another study found that women with diabetes were equally likely to be screened for breast cancer, less likely to be screened for cervical cancer, but more likely to be screened for colorectal cancer compared to women without diabetes [21]. Other study conducted in two rural Oregon communities, has reported that women with asthma, chronic lung disease and with cardiovascular disease were less likely to be screened for mammography compared to women without those conditions, women with arthritis, diabetes

mellitus and hypertension were less likely to be screened for cervical cancer compared to women without those conditions, also women with depression were less likely to be screened compared to women without depression [24]. A study conducted also in USA, has reported that there was no difference in breast, cervical and colorectal cancer screening among individuals with rheumatoid arthritis compared to the general population [25].

In Spanish, women with diabetes constantly underused breast and cervical cancer screening tests compared with non-diabetic women [20]. Proof on screening determinants was extensive and a large range of variables were associated with smear use or mammography including demographic and socioeconomic characteristics, health behaviors and healthcare related variables. Pleasing in regular health care has been shown to be a predictor of cancer screening among women, there was also evidence that fewer factors were associated with screening participation when organized programs existed. In particular, women with lower socioeconomic position were more likely to attend screening through organized programs than through opportunistic screening [26].

In 2014, there was 217,057 new cancer cases and 76,611 cancer deaths in Korea [27]. There was the increase of cancer incidence annually by 3.4% from 1999 to 2012, and the decline started after 2012 [27].

In 1999, there was the establishment of the National Cancer Screening Program (NCSP) by the government of Korea in order to offer organized cancer screening to decrease the burden of cancer. Starting 1999 the Nationwide Cancer Screening Program offered screening for gastric, breast and cervical cancers free

of charge to Medical Aid until 2001. In 2002, the beneficiaries of National Health Insurance in the lower 20% income stratum were involved in NCSP. Since 2003, beneficiaries in the lower 30% income stratum and liver cancer screening were added. In 2004, colorectal cancer screening was added in NCSP. From 2005, the NCSP has been given to Medical Aid recipients and NHI beneficiaries in the lower 50% income level with screening for five types of cancer (stomach, liver, colorectal, breast, and cervical cancer). The NHI beneficiaries in the upper 50% income level obtained screening services for the same five types of cancer from the NHI Corporation with the payment of 10% of the screening cost [28, 29].

**Table 1: Cancer screening protocols issued by the National Cancer Screening Program (NCSP) in Korea in 2012**

Cancer	Target Population	Interval	Test
Stomach	Aged $\geq 40$ years	2 years	Upper endoscopy or UGI
Liver	High-risk group aged $\geq 40$ years	1 year	Ultrasonography and AFP
Colorectal	Aged $\geq 50$ years	1 year	FOBT
Breast	Women aged $\geq 40$ years	2 years	Mammography
Cervical	Women aged $\geq 30$ years	2 years	Pap smear

**UGI:** Upper gastrointestinal series, **AFP:** alpha-fetoprotein, **FOBT:** fecal occult blood test. In the case of an abnormality on the UGI, endoscopy is recommended, and a biopsy is performed when an abnormality is found during endoscopy. Patients at high risk for liver cancer include those with chronic hepatitis determined by serological evidence of infection, with hepatitis B or C virus or liver cirrhosis. In the case of an abnormality on FOBT, colonoscopy or a double-contrast barium enema is recommended, and a biopsy is performed when an abnormality is found during colonoscopy.

Based on researches conducted, few studies have been done in Korea that have evaluated the participation in breast and cervical cancer screening of women with chronic diseases using a large number of chronic diseases. This contributes to this study to be done that is aimed to examine the participation of women with chronic diseases in breast and cervical cancer screening in Korea using the 2012 Korean National Health and Nutrition Examination Survey data.

## **1.2 Study Objectives**

To identify those chronic diseases that were associated with the participation of women in breast and cervical cancer screening.

To assess if there was any difference for women with chronic diseases to participate in breast and cervical cancer screening compared to the general population.

To identify other factors that influenced participation of women with chronic diseases in breast and cervical cancer screening.

## **2. Methodology**

### **2.1 Data source**

This study was a cross sectional and population based study, the data came from the Korean National Health and Nutrition Examination Survey (KNHANES) 2012. The KNHANES 2012 has been chosen for the reason that it has the recent full information about chronic diseases as well as about breast and cervical cancer screening. Many government organizations and researchers used mostly KNHANES data. KNHANES is a continuing national surveillance system that evaluates the health and nutritional status of Koreans, monitors inclination in health risk factors and the prevalence of major chronic diseases and offers data for the development and evaluation of health policies and programs in Korea. The first establishment of KNHANES was in 1998, the observation system of KNHANES has been managed by Korea Center for Disease Control and Prevention (KCDC). KNHANES is composed of three surveys: a health interview, health examination and nutrition survey [30].

### **2.2 Data information**

KNHANES has been led in 1998, 2001, 2005, 2007–2009, 2010–2012 and 2013-2015, 2016 was the initial of the seventh KNHANES (2016–2018). The first and second surveys were done in November and December of 1998 and 2001, the third survey was led from April to June of 2005. From 2007, the frequency of

KNHANES has been restructured from once every 3 years to every year in directive to offer appropriate health statistics for monitoring variation in health risk factors and diseases and evolving associated public health strategies and health plans.

The survey period before 2007 was done within two to three months of the year. From 2007, it has been done within all weeks of the year, which could crack the difficult of periodic disparities [30]. The data are available in the National Health and Nutrition Survey homepage. Our study used KNHANES 2012 data.

### **2.3 Sampling methods**

The KNHANES uses a multifaceted, multi-stage likelihood sample design. The sample represents the total non-institutionalized neutral population of Korea. From the development of KNHANES, the sample design became an ongoing annual survey. Since 2007, every year and any assemblage of successive years contain a nationally descriptive sample. KNHANES used three stage sample design. Using a sampling setting of all census wedges or resident registration addresses, the primary sample units (PSUs) were selected. The composition of every PSU was almost 50-60 households. All houses in the PSU were registered and 20 households were nominated through the field survey for household screening for succeeding the choice of PSUs. All members of family aged 1 year and over were designated to contribute in survey, and the final choice occurs in the household. Almost 10,000 persons are appraised in total in all 192 PSUs per year. The objective for the overall answer rate for the KNHANES is 75%.

## **2.4 Survey procedure**

Health interviews and examinations are performed in the mobile examination Centre (MEC) and then the nutrition survey is conducted in the respondents' homes a week later. The field operation team consists of nurses, a dentist, a radiological technician, interviewers, and dietitians. The MEC is open three days each week for 48 weeks of the year.

An advanced computer system with servers, notebook computers, and wide-area networking house all of the data are available. The operation staff can automatically transmit data into central databases. The Survey information is available to KCDC staff within 24 hours of collection. The health interview and health examination are performed by trained medical staff and interviewers at the mobile examination Centre (MEC).

The health interview and health examination surveys are conducted over three days (Wednesday to Friday) for each primary sampling units (PSU) at MECs, which travel to locations across the country. One unit of MEC consists of two trucks for the exclusive use of KNHANES, which have rooms for surveys and health examination instruments. The nutrition survey is conducted at participants' homes a week after the health interview. All the surveys are conducted with the participants' consent. Participants' consent for additional contacts and the use of unique personal identification numbers are collected for potential follow-up surveys and electronic linkage with other secondary data, such as mortality, healthcare utilization and cancer registries [30].

## **2.5 Measures and study population**

KNHANES data are open data free of charge, KNHANES collects a number of variables regarding participants' demographic, social, health and nutritional status from three component surveys: the health interview, health examination and nutrition survey. This nationally representative cross-sectional survey includes approximately 10 000 individuals each year as a survey sample. We have downloaded the 2012 KNHANES dataset from KNHANES home page, the questionnaire and also the codebook used. We did the translation of the questionnaire and the codebook from Korean to English using google translator to understand well the variables.

Our study was focusing on eight (8) chronic diseases: hypertension, diabetes mellitus, dyslipidemia, stroke, asthma, osteoarthritis, depression and cancer (other than breast cancer for breast cancer screening sample and other than cervical cancer for cervical cancer screening sample) that have been assessed during health examination and health interview in KNHANES V. Cancers focused on were gastric, liver, colon, breast, cervical, lung, thyroid cancer and other cancers.

Information about chronic diseases was collected in questionnaire face to face from study participants after signing a consent form. The questions asked were “have you ever been diagnosed with chronic disease (hypertension / /dyslipidemia/ stroke / osteoarthritis / asthma /diabetes mellitus /depression /cancer)? and are you on treatment of chronic disease (hypertension

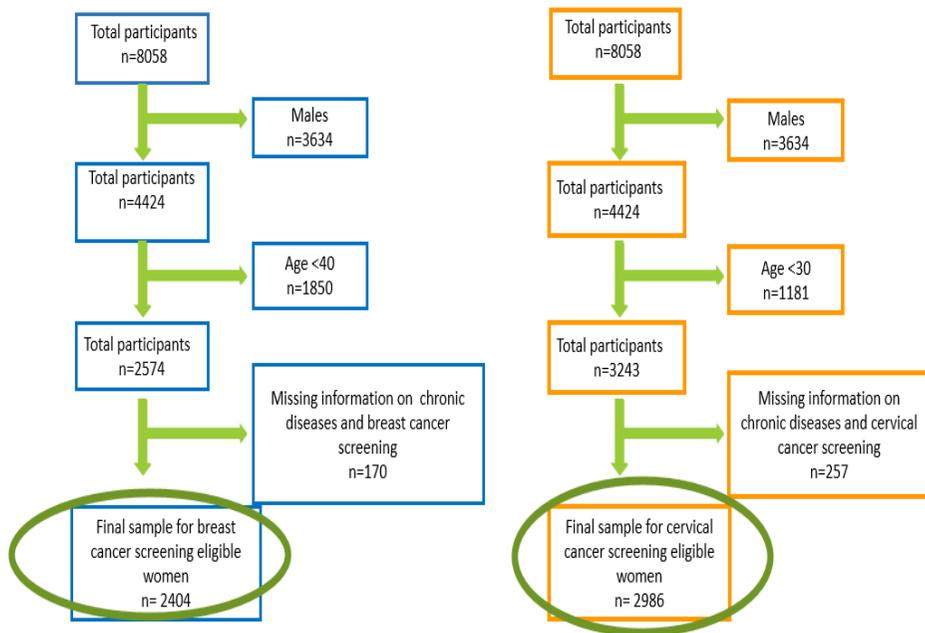
/dyslipidemia/ stroke / osteoarthritis / asthma /diabetes mellitus /depression /cancer)? Breast and cervical cancer screening were assessed by asking “have you ever experienced breast/ cervical cancer screening? (lifelong breast/ cervical cancer screening), and also by asking when did you experience breast/cervical cancer screening? (timely breast/ cervical cancer screening)”. Women who did not provide or miss information about chronic diseases as well as cervical and breast cancer screening were excluded from the study.

Our study had not focused only on the association between cancer screening participation and chronic disease, it has also focused on screening determinants to investigate if the association between chronic conditions and screening participation was modified by those determinants [31, 32].The determinants included socioeconomic factors (age, education, marital status, average monthly house income and subjective health status) and health behaviors (alcohol drinking and smoking).We used the information from the questionnaire used and we have got information on the chronic conditions, participation of women in breast and cervical cancer screening as well as screening determinants.

The target study population was women who were aged 30 years and old in 2012 for cervical cancer screening participation and chronic diseases, also women who were aged 40 years and old in 2012 for breast cancer screening participation and chronic diseases.

In KNHANES 2012, total participants were 8058. In cervical cancer screening, 2,986 women were included in the final analysis (3634 males participants, 1181 participants aged lower to 30 years and 257 participants that missed information

on chronic conditions and cervical cancer screening were excluded from our final analysis). In breast cancer screening, 2,404 women were included in the final analysis (3634 males participants, 1850 participants aged lower to 40 years and 170 participants that missed information on chronic conditions and breast cancer screening were excluded from our final analysis study) (**Figure 1**).



**Figure 1: Flowcharts describing breast (left panel) and cervical cancer (right panel) screening sample selection**

## 2.6 Statistical analysis

The analyses for breast and cervical cancer screening were conducted separately. The general characteristics of participants were calculated using summary statistics. We compared screening participation between women with chronic diseases of interest versus women without the diseases in general using

chi-squared test and also we compared screening participation between women with each chronic disease of interest versus women without the disease using chi-squared test. Logistic regression analyses were conducted to estimate the difference between women with chronic diseases and women without chronic diseases who undergone both breast and cervical cancer screening.

To determine the variables that were independent predictors of breast and cervical cancer screening among women with chronic diseases, multivariate logistic regression was applied. All models were systematically adjusted for two categories of screening determinants, socioeconomic factors and health behaviors in a full-adjusted model. The odds ratio (OR) and 95% confidence interval (95% CI) were calculated to measure the strength of association. The statistical significance was considered to be  $< 0.05$ . For all models, adherence to screening was the dependent variable and chronic conditions were specified as dichotomous explanatory variables. Available sampling design and overall non-response were applied and our estimates can be extrapolated to the total non-institutionalized civilian population of Korea. All statistical analyses were performed using Stata version 14 (Stata Corp LP, College Station, TX) software in survey mode.

## 3. Results

### 3.1. General characteristics of participants in breast cancer screening

A total of 2,404 women were included in final analysis of breast cancer screening. Among them, 50.7% were aged 40-59 years and 49.3% were aged 60 years and over. Women who had education level of lower than middle school were 1357 (56.5%) and only 17.7% had education level of college and over. More than half were married (71.9%) and only 1.1% were singles. Women with average monthly income lower to two million won were 42.8% and 28.4% had average monthly income over four million won. In addition, half of women (51.7%) reported that their health status was average. In terms of behavior factors, more than half (70.3%) had experienced drinking and only 29.7% did not experience drinking. Most of women (92.8%) were never smokers and only 3.7% were current smokers (**Table 2**).

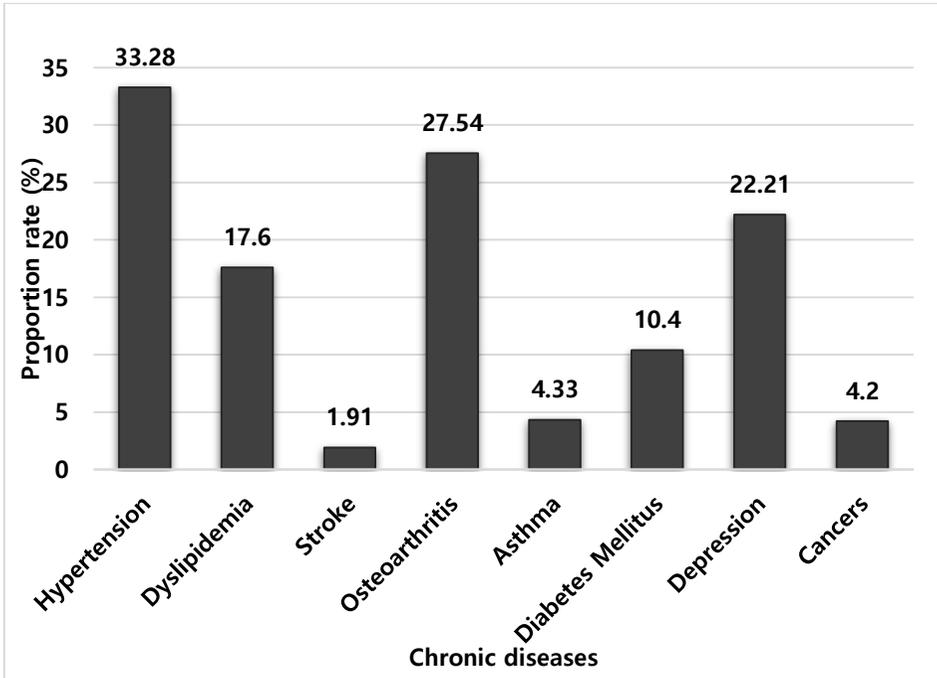
**Table 2: General characteristics of participants in breast cancer screening**

	<b>N=2404</b>	<b>%</b>
<b>Age</b>		
40-59 years	1,218	50.67
60 years and above	1,186	49.33
<b>Education level</b>		
Lower than middle school	1,357	56.45
High school	621	25.83
College and over	426	17.72
<b>Marital status</b>		
Married	1,729	71.92
Divorced/Separated/Widowed	648	26.96
Singles	27	1.12
<b>Average monthly house income</b>		
< 2 million won	1,029	42.8
2-4 million won	692	28.79
> 4 million won	683	28.41
<b>Subjective health status</b>		
Bad	597	24.83
Average	1,242	51.66
Good	565	23.5
<b>Alcohol drinking</b>		
No	713	29.66
Yes	1691	70.34
<b>Smoking</b>		
Never	2,231	92.8
Past smoker	84	3.49
Current smoker	89	3.7

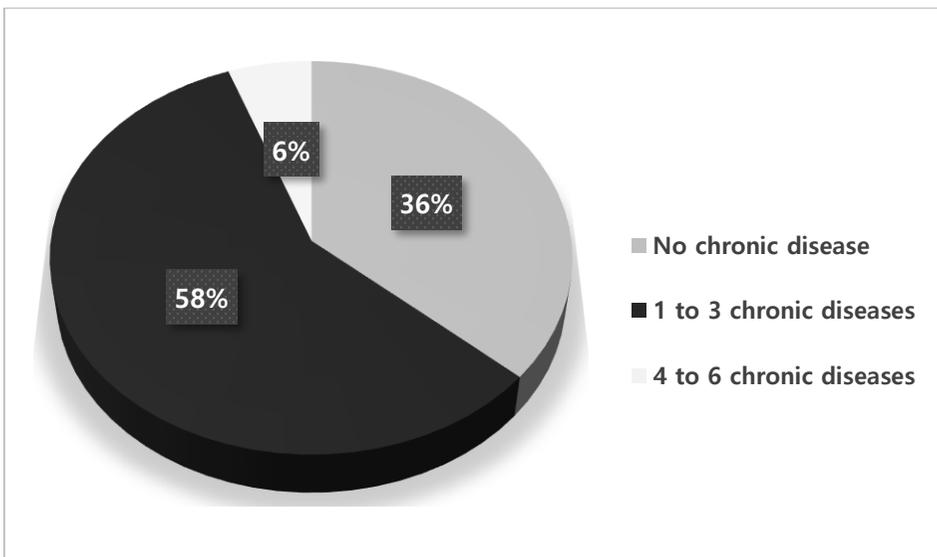
(%: Percentage).

### **3.2. Prevalence of chronic diseases in women aged of 40 years and over**

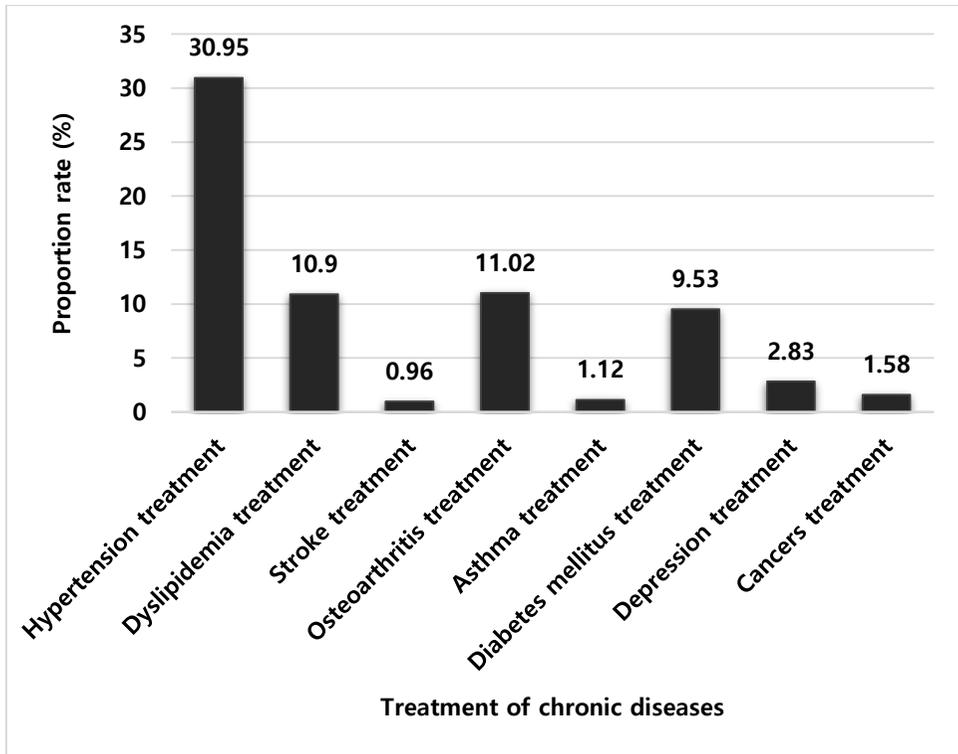
Participants were asked if they have been ever diagnosed as chronic diseases. Among 2,404 participants in breast cancer screening, hypertension (33.3%) was prevalent. For other diseases, the prevalence was 17.6%, 1.9%, 27.5%, 4.3%, 10.4%, 22.2% and 4.2% for dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Figure 2**). In general, 36% did not have any chronic diseases, 58% had one to three chronic diseases and only 6% had four to six chronic diseases (**Figure 3**). Also, participants were asked if they were on treatment of chronic diseases. For breast cancer screening, 31% of them were on treatment of hypertension, 10.9%, 1%, 11.0%, 1.1%, 9.5%, 2.8% and 1.6% were on treatment of dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Figure 4**).



**Figure 2: Ever diagnosed as chronic disease in women aged of 40 years and over**



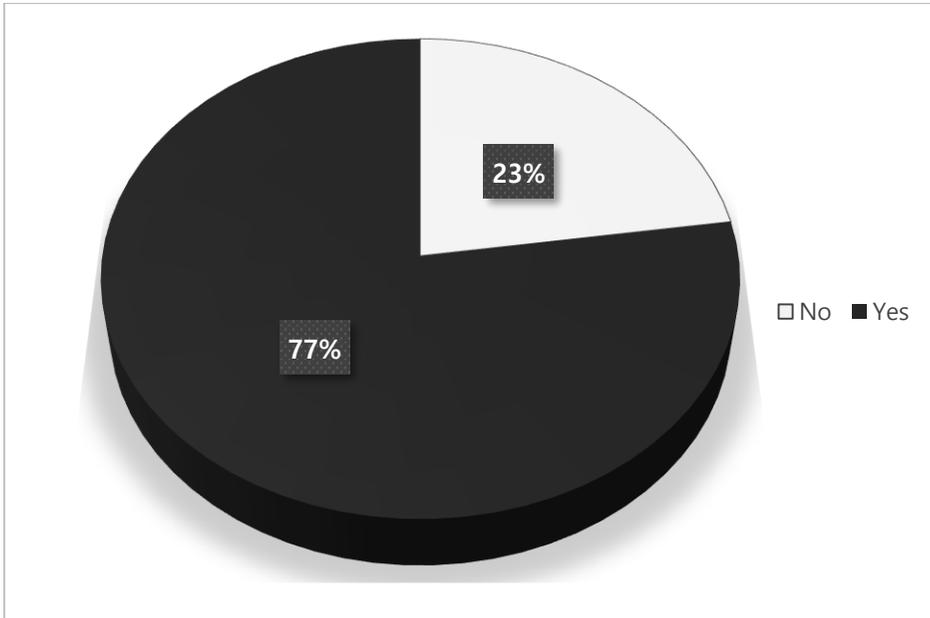
**Figure 3: Partition of chronic diseases in women aged of 40 years and over**



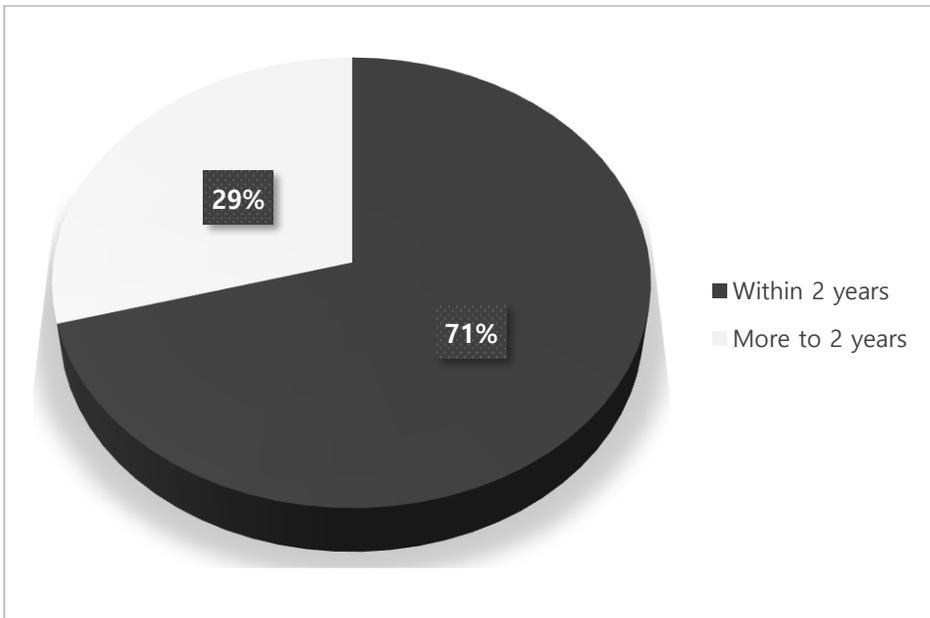
**Figure 4: On treatment of chronic diseases in women aged of 40 years and over**

### **3.3. Breast cancer screening participation**

In a total of 2,404 women, more than half (77.3%) have done breast cancer screening and only 22.7% have not done breast cancer screening (**Figure 5**). Among women who did breast cancer screening, 70.7% have done breast cancer screening within two years and 29.3% have done breast cancer screening in period more to two years (**Figure 6**).



**Figure 5: Ever experienced of participation in breast cancer screening**

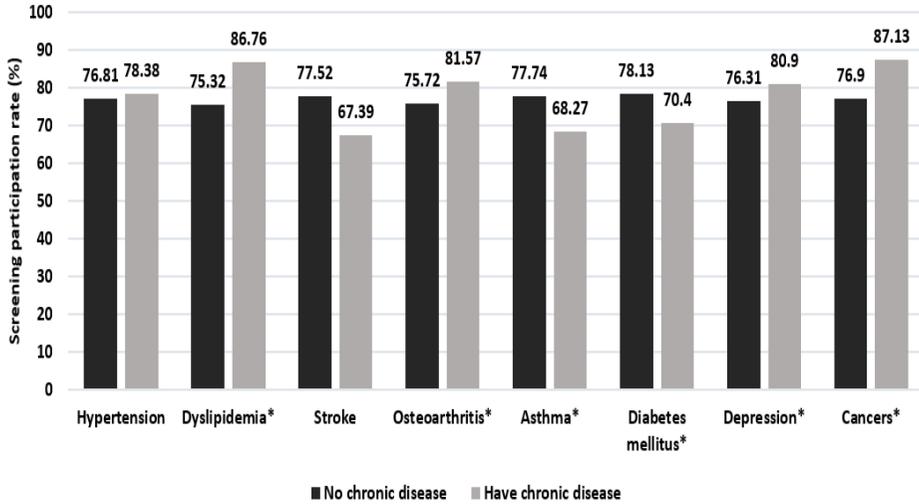


**Figure 6: Latest timing done breast cancer screening**

### **3.4. Association between chronic diseases and participation in breast cancer screening**

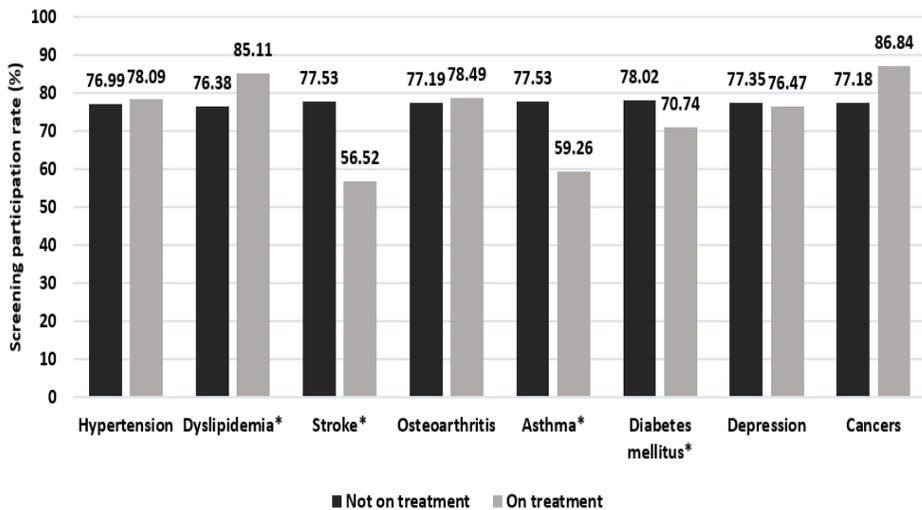
In breast cancer screening, women who have ever been diagnosed as dyslipidemia were more likely to participate in lifelong breast cancer screening (86.8%). Women who have ever been diagnosed as osteoarthritis showed higher participation in lifelong breast cancer screening (81.6%). Women who have ever been diagnosed as depression and cancer were more likely to participate in lifelong breast cancer screening (80.9% and 87.1% respectively). Women who have ever been diagnosed as diabetes mellitus and asthma were less likely to participate in lifelong breast cancer screening (70.4% and 68.3% respectively) (**Figure 7**). Women who have ever been diagnosed as dyslipidemia were more likely to participate in timely breast cancer screening within 2 years (62.2%). Also, women who have ever been diagnosed as diabetes mellitus were less likely to participate in timely breast cancer screening within 2 years (47.6%) (**Table 3**).

Regarding treatment, women who were on treatment of dyslipidemia were more likely to participate in lifelong breast cancer screening (85.1%). Women who were on treatment of asthma, diabetes mellitus and stroke were less likely to participate in lifelong breast cancer screening (59.3%, 70.7% and 56.5% respectively) (**Figure 8**). Women who were on treatment of dyslipidemia were more likely to participate in breast cancer screening within 2 years (61.8%). Additionally, women who were on treatment of diabetes mellitus were less likely to participate in breast cancer screening within 2 years (48.0%) (**Table 4**).



Diseases with \* showed statistical significance for p-value < 0.05 in chi-square test (Dyslipidemia, Osteoarthritis, Asthma, Diabetes mellitus, Depression and cancers)

**Figure 7: Ever diagnosed as chronic disease and lifelong participation in breast cancer screening**



Diseases with \* showed statistical significance for p-value < 0.05 in chi-square test (Dyslipidemia, Stroke, Asthma and Diabetes mellitus)

**Figure 8: Being on treatment of chronic diseases and lifelong participation in breast cancer screening**

**Table 3: Lifelong and timely breast cancer screening participation in women ever diagnosed as chronic disease**

Ever diagnosed as	Total N (%)	Lifelong breast cancer screening participation		Timely breast cancer screening participation within 2 years	
		Yes N (%)	p-value*	Yes N (%)	p-value*
<b>Hypertension</b>			0.387		0.112
Non	1604(100)	1232(76.81)		895(55.80)	
Yes	800(100)	627(78.38)		419(52.38)	
<b>Dyslipidemia</b>			0.001		0.001
No	1981(100)	1492(75.32)		1051(53.05)	
Yes	423(100)	367(86.76)		263(62.17)	
<b>Stroke</b>			0.104		0.347
Non	2358(100)	1828(77.52)		1292(54.79)	
Yes	46(100)	31(67.39)		22(47.83)	
<b>Osteoarthritis</b>			0.002		0.512
Non	1742(100)	1319(75.72)		945(54.25)	
Yes	662(100)	540(81.57)		369(55.74)	
<b>Asthma</b>			0.024		0.329
Non	2300(100)	1788(77.74)		1262(54.87)	
Yes	104(100)	71(68.27)		52(50.00)	
<b>Diabetes mellitus</b>			0.006		0.018
Non	2154(100)	1683(78.13)		1195(55.48)	
Yes	250(100)	176(70.40)		119(47.60)	
<b>Depression</b>			0.026		0.369
Non	1870(100)	1427(76.31)		1013(54.17)	
Yes	534(100)	432(80.90)		301(56.37)	
<b>Cancers</b>			0.016		0.237
Non	2303(100)	1771(76.90)		1253(54.41)	
Yes	101(100)	88(87.13)		61(60.40)	

(\*Chi-square test).

**Table 4: Lifelong and timely breast cancer screening participation in women on treatment of chronic disease**

Treatment of	Total N (%)	Lifelong breast cancer screening participation		Timely breast cancer screening participation within 2 years	
		Yes N (%)	p-value*	Yes N (%)	p-value*
<b>Hypertension</b>			0.55		0.081
Non	1660(100)	1278(76.99)		927(55.84)	
Yes	744(100)	581(78.09)		387(52.02)	
<b>Dyslipidemia</b>			0.001		0.013
No	2142(100)	1636(76.38)		1152(53.78)	
Yes	262(100)	223(85.11)		162(61.83)	
<b>Stroke</b>			0.017		0.064
Non	2381(100)	1846(77.53)		1306(54.85)	
Yes	23(100)	13(56.52)		8(34.78)	
<b>Osteoarthritis</b>			0.632		0.809
Non	2139(100)	1651(77.19)		1171(54.75)	
Yes	265(100)	208(78.49)		143(53.96)	
<b>Asthma</b>			0.024		0.144
Non	2377(100)	1843(77.53)		1303(54.82)	
Yes	27(100)	16(59.26)		11(40.74)	
<b>Diabetes mellitus</b>			0.012		0.034
Non	2175(100)	1697(78.02)		1204(55.36)	
Yes	229(100)	162(70.74)		110(48.03)	
<b>Depression</b>			0.864		0.967
Non	2336(100)	1807(77.35)		1277(54.67)	
Yes	68(100)	52(76.47)		37(54.41)	
<b>Cancers</b>			0.158		0.086
Non	2366(100)	1826(77.18)		1288(54.44)	
Yes	38(100)	33(86.84)		26(68.42)	

(\*Chi-square test).

### 3.5. Participation in breast cancer screening by chronic diseases status

In general, lifelong breast cancer screening participation was significantly higher among women with chronic diseases (79.8%). In timely breast cancer screening within 2 years, women with chronic diseases participated higher but the results are not significant (Table 5).

**Table 5: Participation in breast cancer screening by chronic disease status**

	Total N (%)	Lifelong breast cancer screening participation		Timely breast cancer screening participation within 2 years	
		Yes N (%)	p-value *	Yes N (%)	p-value *
<b>Chronic disease status</b>			< 0.001		0.070
No	875(100)	639(73.03)		457(52.23)	
Yes	1529(100)	1220 (79.79)		857(56.05)	

(\*Chi-square test).

### 3.6. Associated general characteristics of participants with breast cancer screening

Overall, high lifelong participation in breast cancer screening was observed in women aged 40-59 years (80.5%). Women with education level of high school (82.5%) were more likely to participate in lifelong breast cancer screening. Married women (82.0%) were more likely to participate in lifelong breast cancer screening. Women with average monthly house income over four million won were more likely (83.6%) to participate in lifelong breast cancer screening. Women who were never smokers (78.4%) showed high participation in lifelong

breast cancer screening. Women who have had any chronic disease (79.79%) showed high participation in lifelong breast cancer screening. Based on time done breast cancer screening, women aged 40-59 years (59.5%) were associated with high participation in breast cancer screening within 2 years. Women with high school education level (59.3%) were more likely to do breast cancer screening within 2 years. Married women (58.5%) were more likely to do breast cancer screening within 2 years. Women with average monthly house income over to 4 million won (61.8%) were more likely to do breast cancer screening within 2 years. Women who were no smoker (55.8%) were more likely to do breast cancer screening within 2 years (**Table 6**).

In logistic regression model, women aged 60 years or over had low participation in lifelong breast cancer screening (OR= 0.69, 95%CI= 0.57-0.83) than women aged 40-59 years. Women with high school level of education had high participation (OR= 1.37, 95%CI= 1.07-1.74) in lifelong breast cancer screening but women with college or over had low participation (OR= 0.66, 95%CI= 0.52-0.84) compared to women with education of lower than middle school. Divorced/separated/widowed women showed low participation in lifelong breast cancer screening (OR= 0.41, 95%CI= 0.33-0.50) compared to married women. Women with average monthly income of two to four million won and above four million (OR= 1.41, 95%CI= 1.12-1.77, OR= 1.95, 95%CI= 1.53-2.49 respectively) were more likely to participate in lifelong breast cancer screening than women with average monthly income of lower to two million won. Past smoker and current smoker women (OR= 0.52, 95%CI= 0.33-0.83 and OR=

0.45, 95%CI= 0.29-0.69 respectively) showed low participation in lifelong breast cancer screening compared to women who were never smokers. Women who had any chronic diseases (OR= 1.46, 95%CI= 1.20-1.77) showed high participation in lifelong breast cancer screening compare to women without chronic disease. Based on time done breast cancer screening, women who were aged 60 years and over (OR= 0.67, 95%CI= 0.57-0.79) were less likely to do breast cancer screening within 2 years compared to women aged 40-59 years. Women who had high school level of education (OR= 1.24, 95%CI= 1.02-1.50) were more likely to do breast cancer screening within 2 years compared to women with lower than middle school level of education. Divorced/separated/widowed women (OR= 0.58, 95%CI= 0.48-0.69) were less likely to do breast cancer screening within 2 years compared to married women. Women who had average monthly house income of 2 to 4 million won (OR= 1.33, 95%CI= 1.10-1.61) and over to four million won (OR= 1.68, 95%CI= 1.38-2.05) were more likely to do breast cancer screening within 2 years compared to women with average monthly house income less to 2 million won. Current and past smoker women (OR= 0.51, 95%CI= 0.33-0.79 and OR= 0.54, 95%CI= 0.35-0.84 respectively) were less likely to do breast cancer screening within 2 years compared to women who were never smoker (**Table 7**).

**Table 6: Breast cancer screening participation rate according to general characteristics and presence of chronic disease**

	Total N(%)	Lifelong Breast cancer screening Participation		Timely breast cancer screening participation within 2 years	
		Yes N (%)	p- value*	Yes N(%)	p- value*
<b>Age</b>			<0.001		<0.001
40-59 years	1218(100)	981(80.54)		725(59.52)	
60 years and over	1186(100)	878(74.03)		589(49.66)	
<b>Education</b>			<0.001		0.010
Lower than middle school	1357(100)	1051(77.45)		733(54.02)	
High school	621(100)	512(82.45)		368(59.26)	
College and over	426(100)	296(69.48)		213(50.00)	
<b>Marital status</b>			<0.001		<0.001
Married	1729(100)	1418(82.01)		1011(58.47)	
Separated/Divorced/ widowed	648(100)	421(64.97)		290(44.75)	
Singles	27(100)	20(74.07)		13(48.15)	
<b>Average monthly house income</b>			<0.001		<0.001
< 2 million won	1029(100)	744(72.30)		504(48.98)	
2 -4 million won	692(100)	544(78.61)		388(56.07)	
Over 4 million won	683(100)	571(83.60)		422(61.79)	
<b>Subjective health status</b>			0.371		0.153
Bad	597(100)	453(75.88)		308(51.59)	
Average	1242(100)	958(77.13)		683(54.99)	
Good	565(100)	448(79.29)		323(57.17)	
<b>Alcohol drinking</b>			<0.001		<0.001
No	713(100)	492(69.00)		331(46.42)	
Yes	1691(100)	1367(80.84)		983(58.13)	
<b>Smoking status</b>			<0.001		<0.001
Never	2231(100)	1749(78.40)		1245(55.80)	
Past smoker	84(100)	55(65.48)		34(40.48)	
Intermittent/ Daily smoker	89(100)	55(61.80)		35(39.33)	
<b>Presence of chronic disease</b>			<0.001		0.070
No	875(100)	639(73.03)		457(52.23)	
Yes	1529(100)	1220(79.79)		857(56.05)	

(\*Chi-square test).

**Table 7: Logistic regression results for breast cancer screening participation according to general characteristics and presence of chronic disease**

	Lifelong Breast cancer screening Participation			Timely breast cancer screening participation within 2years		
	OR	95% CI	p-value	OR	95% CI	p-value
<b>Age</b>						
40-59 years	Ref			Ref		
60 and over	0.69	0.57-0.83	<0.001	0.67	0.57-0.79	<0.001
<b>Education level</b>						
Lower than middle school	Ref			Ref		
High school	1.37	1.07-1.74	0.012	1.24	1.02-1.50	0.029
College and over	0.66	0.52-0.84	0.001	0.85	0.68-1.06	0.148
<b>Marital status</b>						
Married	Ref			Ref		
Divorced/Separated/ Widowed	0.41	0.33-0.50	<0.001	0.58	0.48-0.69	<0.001
Singles	0.63	0.26-1.50	0.292	0.66	0.31-1.41	0.284
<b>Average monthly house income</b>						
< 2 million won	Ref			Ref		
2-4 million won	1.41	1.12-1.77	0.003	1.33	1.10-1.61	0.004
> 4 million won	1.95	1.53-2.49	<0.001	1.68	1.38-2.05	<0.001
<b>Subjective health status</b>						
Bad	Ref			Ref		
Average	1.07	0.85-1.35	0.551	1.15	0.94-1.39	0.171
Good	1.22	0.92-1.61	0.164	1.25	0.99-1.58	0.057
<b>Drinking experience</b>						
No	Ref			Ref		
Yes	1.90	1.55-2.31	<0.001	1.60	1.34-1.91	<0.001
<b>Smoking status</b>						
Never	Ref			Ref		
Past smoker	0.52	0.33-0.83	0.006	0.54	0.35-0.84	0.006
Current smoker	0.45	0.29-0.69	<0.001	0.51	0.33-0.79	0.003
<b>Presence of chronic disease</b>						
No	Ref			Ref		
Yes	1.46	1.20-1.77	<0.001	1.16	0.99-1.38	0.070

(Ref: Reference).

### **3.7. Associated general characteristics with chronic diseases in women aged of 40 years and over**

Among 2,404 participants, most chronic diseases were more likely to occur in women aged of 60 years or over (51.5%, 24%, 2,9%, 42.8%, 5.6%, 16.0% and 5.1% for hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus and cancers respectively). Also chronic diseases were more prevalent in women of lower than middle school level of education (45.8%, 21.7%, 3%, 38.5%, 5.8%, 15.2%, 25.1% and 4.5% for hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively). Living alone (separated, widowed or divorced) was associated with high prevalence of chronic diseases as 47.4%, 19.3%, 3.4%, 38.1%, 6.5% and 15.7% for hypertension, dyslipidemia, stroke, osteoarthritis, asthma and diabetes mellitus respectively were separated, widowed or divorced. Most chronic diseases were prevalent in women of lower to two million won as average monthly house income (46.1%, 21.8%, 38.2%, 15.6% and 25.2% for hypertension, dyslipidemia, osteoarthritis, diabetes mellitus and depression respectively). In addition, women who reported that their health status were bad were more likely to have chronic diseases (50.6%, 27.6%, 3.5%, 45.9%, 8.7%, 18.6%, 37.7% and 5.9% for hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Table 8**).

In terms of treatment, among 2,404 participants, most women who were on treatment of chronic diseases were aged of 60 years or over (49.2%, 16.4%, 19%,

1.8% and 14.8%) for treatment of hypertension, dyslipidemia, osteoarthritis, asthma and diabetes mellitus respectively. Also most women who were on treatment of chronic diseases had lower than middle school level of education (43.8%, 13.6%, 1.4%, 16.4%, 1.6% and 13.8%) for treatment of hypertension, dyslipidemia, stroke, osteoarthritis, asthma and diabetes mellitus respectively. Being separated, widowed or divorced were associated with high prevalence of women on treatment of chronic diseases as 45.4%, 13.1%, 15.3%, 2.0% and 14.0% who were on treatment of hypertension, dyslipidemia, osteoarthritis, asthma and diabetes mellitus respectively were separated, widowed or divorced.

Most women on treatment of chronic diseases had lower to two million won as average monthly house income as 43.7%, 14.5%, 15.8%, 2.1%, 14.4% and 4% were on treatment of hypertension, dyslipidemia, osteoarthritis, asthma, diabetes mellitus and depression respectively. Also, most women on treatment of chronic diseases reported that their health status was bad as 47.1%, 16.6%, 2.2%, 21.9%, 3.9%, 17.6%, 6.0% and 2.0% were on the treatment of hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Table 9**).

**Table 8: Association between general characteristics and ever diagnosed as chronic diseases in women aged of 40 years and over**

	<b>Hypertension N=800 (%)</b>	<b>Dyslipidemia N=423 (%)</b>	<b>Stroke N=46 (%)</b>	<b>Osteoarthritis N=662 (%)</b>	<b>Asthma N=104 (%)</b>	<b>Diabetes mellitus N=250 (%)</b>	<b>Depression N=534 (%)</b>	<b>Cancers N=101 (%)</b>
<b>Age</b>								
40-59 years	189(15.52)	139(11.41)	12(0.99)	155(12.73)	38(3.12)	60(4.93)	255(20.94)	41(3.37)
60 years and over	611(51.52) *	284(23.95) *	34(2.87) *	507(42.75) *	66(5.56) *	190(16.02) *	279(23.52)	60(5.06) *
<b>Education level</b>								
Lower than middle school	622(45.84) *	295(21.74) *	40(2.95) *	522(38.47) *	78(5.75) *	206(15.18) *	340(25.06) *	61(4.50) *
High school	134(21.58)	89(14.33)	3(0.48)	99(15.94)	13(2.09)	31(4.99)	138(22.22)	33(5.31)
College and over	44(10.33)	39(9.15)	3(0.70)	41(9.62)	13(3.05)	13(3.05)	56(13.15)	7(1.64)
<b>Marital status</b>								
Married	489(28.28)	294(17.00)	24(1.39)	413(23.89)	61(3.53)	145(8.39)	364(21.05)	77(4.45)
Living alone	307(47.38) *	125(19.29) *	22(3.40) *	247(38.12) *	42(6.48) *	102(15.74) *	163(25.15)	22(3.40)
Singles	4(14.81)	4(14.81)	0(0.00)	2(7.41)	1(3.70)	3(11.11)	7(25.93)	2(7.41)
<b>Monthly income</b>								
< 2 million won	474(46.06) *	224(21.77) *	27(2.62)	393(38.19) *	52(5.05)	160(15.55) *	259(25.17) *	49(4.76)
2 - 4 million won	191(27.60)	108(15.61)	11(1.59)	149(21.53)	28(4.05)	56(8.09)	151(21.82)	24(3.47)
> 4 million won	135(19.77)	91(13.32)	8(1.17)	120(17.57)	24(3.51)	34(4.98)	124(18.16)	28(4.10)

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<b>Subjective health status</b>								
Bad	302(50.59) *	165(27.64) *	21(3.52)*	274(45.90) *	52(8.71)*	111(18.59)*	225(37.69)*	35(5.86)*
Average	378(30.43)	200(16.10)	21(1.69)	300(24.15)	40(3.22)	114(9.18)	246(19.81)	54(4.35)
Good	120(21.24)	58(10.27)	4(0.71)	88(15.58)	12(2.12)	25(4.42)	63(11.15)	12(2.12)
<b>Drinking experience</b>								
No	293(41.09)	140(19.64)	17(2.38)	223(31.28)	35(4.91)	104(14.59)	140(19.64)	38(5.33)
Yes	507(29.98)	283(16.74)	29(1.71)	439(25.96)	69(4.08)	146(8.63)	394(23.30)	63(3.73)
<b>Smoking status</b>								
Never	749(33.57)	395(17.71)	40(1.79)	614(27.52)	96(4.30)	226(10.13)	478(21.43)	94(4.21)
Past smoker	29(34.52)	15(17.86)	3(3.57)	25(29.76)	6(7.14)	17(20.24)	28(33.33)	5(5.95)
Current smoker	22(24.72)	13(14.61)	3(3.37)	23(25.84)	2(2.25)	7(7.87)	28(31.46)	2(2.25)

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(With \*: Significantly higher for p-value <0.05 in chi-square test, **living alone**: Separated, divorced or widowed).

**Table 9: Association between general characteristics and being on treatment of chronic diseases in women aged of 40 years and over**

	<b>Hypertension</b> N=744 (%)	<b>Dyslipidemia</b> N=262 (%)	<b>Stroke</b> N=23 (%)	<b>Osteoarthritis</b> N=265 (%)	<b>Asthma</b> N=27 (%)	<b>Diabetes mellitus</b> N=229 (%)	<b>Depression</b> N=68 (%)	<b>Cancers</b> N=38 (%)
<b>Age</b>								
40-59 years	161(13.22)	68(5.58)	7(0.57)	40(3.28)	6(0.49)	54(4.43)	29(2.38)	16(1.31)
60 years and over	583(49.16)*	194(16.36)*	16(1.35)	225(18.97)*	21(1.77)*	175(14.76)*	39(3.29)	22(1.85)
<b>Education level</b>								
Lower than middle school	594(43.77)*	185(13.63)*	19(1.40)*	222(16.36)*	22(1.62)*	187(13.78)*	42(3.10)	23(1.69)
High school	113(18.20)	54(8.70)	2(0.32)	34(5.48)	3(0.48)	30(4.83)	20(3.22)	13(2.09)
College and over	37(8.69)	23(5.40)	2(0.47)	9(2.11)	2(0.47)	12(2.82)	6(1.41)	2(0.47)
<b>Marital status</b>								
Married	448(25.91)	174(10.06)	12(0.69)	166(9.60)	14(0.81)	135(7.81)	43(2.49)	30(1.74)
Separated	294(45.37)*	85(13.12)	11(1.70)	99(15.28)*	13(2.01)*	91(14.04)*	23(3.55)	8(1.23)
Singles	2(7.41)	3(11.11)	0(0.00)	0(0.00)	0(0.00)	3(11.11)	2(7.41)	0(0.00)
<b>Monthly income</b>								
< 2 million won	450(43.73)*	149(14.48)*	11(1.07)	163(15.84)*	22(2.14)*	148(14.38)*	41(3.98)*	16(1.55)
2 - 4 million won	170(24.57)	64(9.25)	8(1.16)	65(9.39)	4(0.58)	50(7.23)	15(2.17)	10(1.45)
> 4 million won	124(18.16)	49(7.17)	4(0.59)	37(5.42)	1(0.15)	31(4.54)	12(1.76)	12(1.76)

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<b>Subjective health status</b>								
Bad	281(47.07)*	99(16.58)*	13(2.18)*	131(21.94)*	23(3.85)*	105(17.59)*	36(6.03)*	12(2.01)*
Average	356(28.66)	129(10.39)	7(0.56)	107(8.62)	3(0.24)	103(8.29)	25(2.01)	25(2.01)
Good	107(18.94)	34(6.02)	3(0.53)	27(4.78)	1(0.18)	21(3.72)	7(1.24)	1(0.18)
<b>Drinking experience</b>								
No	275(38.57)	93(13.04)	9(1.26)	96(13.46)	12(1.68)	99(13.88)	23(3.23)	13(1.82)
Yes	469(27.74)	169(9.99)	14(0.83)	169(9.99)	15(0.89)	130(7.69)	45(2.66)	25 (1.48)
<b>Smoking status</b>								
Never	697(31.24)	248(11.12)	20(0.90)	253(11.34)	26(1.17)	211(9.46)	60(2.69)	34(1.52)
Past smoker	27(32.14)	7(8.33)	2(2.38)	7(8.33)	0(0.00)	16(19.05)	6(7.14)	4(4.76)
Current smoker	20(22.47)	7(7.87)	1(1.12)	5(5.62)	1(1.12)	2(2.25)	2(2.25)	0(0.00)

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(With \*: Significantly higher for p-value <0.05 in chi-square test, **living alone**: Separated, divorced or widowed).

### **3.8. Logistic regression for the association of participation in breast cancer screening and chronic diseases**

Overall, women who have ever been diagnosed as dyslipidemia were more likely (OR= 2.15, 95%CI= 1.59-2.90) to participate in lifelong breast cancer screening even in full model adjusted for general characteristics (OR= 2.28, 95%CI= 1.65-3.16). Women who have ever been diagnosed as osteoarthritis were more likely (OR= 1.42, 95%CI= 1.13-1.78) to participate in lifelong breast cancer screening even in full model adjusted for general characteristics (OR= 1.61, 95%CI= 1.24-2.08). Women who have ever been diagnosed as depression showed high participation (OR= 1.31, 95%CI= 1.03-1.67) in lifelong breast cancer screening. Women who have ever been diagnosed as cancer were significantly associated with high participation in lifelong breast cancer screening (OR= 2.03, 95%CI= 1.13-3.67) even in full model adjusted for general characteristics (OR= 1.90, 95%CI= 1.03-3.51). Low participation in lifelong breast cancer screening was observed in women who have ever been diagnosed as diabetes mellitus (OR= 0.67, 95%CI= 0.50-0.89) and in women who have ever been diagnosed as asthma (OR= 0.62, 95%CI= 0.40-0.94) even in full model adjusted for general characteristics (OR= 0.61, 95%CI= 0.44-0.86) for diabetes mellitus (**Table 10**).

Women who have ever been diagnosed as dyslipidemia showed high participation in timely breast cancer screening within 2 years (OR= 1.45, 95%CI= 1.17-1.80) even in model adjusted for general characteristics (OR= 1.64, 95%CI= 1.30-2.07). Women who have ever been diagnosed as diabetes

mellitus were less likely to participate in timely breast cancer screening within 2 years (OR= 0.73, 95%CI= 0.56-0.95) (**Table 11**).

In terms of treatment, women on treatment of dyslipidemia showed high participation in lifelong breast cancer screening (OR= 1.77, 95%CI= 1.24-2.52) even in a full model adjusted for general characteristics (OR= 1.99, 95%CI= 1.36-2.92). Women on treatment of stroke were associated with low participation in lifelong breast cancer screening (OR= 0.38, 95%CI= 0.16-0.86) even when adjusted for general characteristics (OR= 0.35, 95%CI= 0.15-0.83). Women on treatment of asthma showed low participation in lifelong breast cancer screening (OR= 0.42, 95%CI= 0.19-0.91). Also, low participation in lifelong breast cancer screening were observed for women who were on treatment of diabetes mellitus (OR= 0.68, 95%CI= 0.50-0.92) even in a full model adjusted for general characteristics (OR= 0.45, 95%CI= 0.45-0.88) (**Table 12**).

Women who were on treatment of dyslipidemia showed high participation in timely breast cancer screening within 2 years (OR= 1.39, 95%CI= 1.07-1.81), even when adjusted for general characteristics (OR= 1.65, 95%CI= 1.24-2.20). Additionally, women who were on treatment of diabetes mellitus showed low participation in timely breast cancer screening within 2 years (OR= 0.75, 95%CI= 0.57-0.98) (**Table 13**).

**Table 10: Logistic regression results for lifelong breast cancer screening participation rate associated with chronic diseases ever diagnosed and other factors**

Ever diagnosed as	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95 % CI	OR	95% CI
Hypertension	1.09	0.89-1.34	1.01	0.81-1.27	1.22	0.95-1.57
Dyslipidemia	2.15	1.59-2.90	2.30	1.67-3.15	2.28	1.65-3.16
Stroke	0.60	0.32-1.12	0.52	0.27-1.00	0.60	0.31-1.19
Osteoarthritis	1.42	1.13-1.78	1.36	1.07-1.73	1.61	1.24-2.08
Asthma	0.62	0.40-0.94	0.62	0.40-0.95	0.66	0.42-1.05
Diabetes mellitus	0.67	0.50-0.89	0.53	0.38-0.72	0.61	0.44-0.86
Depression	1.31	1.03-1.67	1.24	0.97-1.59	1.28	0.99-1.67
Cancers	2.03	1.13-3.67	1.97	1.08-3.58	1.90	1.03-3.51

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than breast cancer (gastric, liver, colon, cervical, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

**Table 11: Logistic regression results for timely breast cancer screening participation rate within 2 years associated with chronic diseases ever diagnosed and other factors**

Ever diagnosed as	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95% CI	OR	95% CI
Hypertension	0.87	0.73-1.03	0.83	0.69-1.00	0.95	0.78-1.16
Dyslipidemia	1.45	1.17-1.80	1.62	1.29-2.04	1.64	1.30-2.07
Stroke	0.76	0.42-1.36	0.76	0.42-1.39	0.85	0.46-1.56
Osteoarthritis	1.06	0.89-1.27	1.07	0.89-1.39	1.22	0.99-1.50
Asthma	0.82	0.56-1.22	0.86	0.58-1.28	0.91	0.60-1.37
Diabetes mellitus	0.73	0.56-0.95	0.69	0.52-0.91	0.78	0.59-1.04
Depression	1.09	0.90-1.33	1.06	0.86-1.29	1.09	0.89-1.34
Cancers	1.28	0.85-1.92	1.28	0.85-1.93	1.29	0.84-1.96

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than breast cancer (gastric, liver, colon, cervical, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

**Table 12: Logistic regression results for lifelong breast cancer screening participation rate associated with chronic diseases on treatment and other factors**

On treatment of	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95 % CI	OR	95 % CI	OR	95% CI
Hypertension	1.07	0.87-1.31	1.08	0.85-1.35	1.25	0.97-1.61
Dyslipidemia	1.77	1.24-2.52	1.94	1.33-2.81	1.99	1.36-2.92
Stroke	0.38	0.16-0.86	0.35	0.15-0.81	0.35	0.15-0.83
Osteoarthritis	1.08	0.79-1.47	1.11	0.80-1.53	1.18	0.84-1.66
Asthma	0.42	0.19-0.91	0.42	0.19-0.93	0.49	0.21-1.12
Diabetes Mellitus	0.68	0.50-0.92	0.58	0.42-0.81	0.63	0.45-0.88
Depression	0.95	0.54-1.68	0.99	0.56-1.77	1.05	0.58-1.89
Cancers	1.95	0.76-5.02	1.98	0.76-5.16	1.68	0.63-4.43

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than breast cancer (gastric, liver, colon, cervical, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

**Table 13: Logistic regression results for timely breast cancer screening participation rate within 2 years associated with chronic diseases on treatment and other factors**

On treatment of	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95% CI	OR	95% CI
Hypertension	0.86	0.72-1.02	0.84	0.69-1.01	0.95	0.78-1.17
Dyslipidemia	1.39	1.07-1.81	1.6	1.21-2.11	1.65	1.24-2.20
Stroke	0.44	0.19-1.04	0.46	0.19-1.09	0.48	0.20-1.17
Osteoarthritis	0.97	0.75-1.25	1.04	0.80-1.36	1.12	0.85-1.48
Asthma	0.57	0.26-1.23	0.6	0.28-1.32	0.7	0.31-1.56
Diabetes mellitus	0.75	0.57-0.98	0.72	0.54-0.97	0.8	0.60-1.08
Depression	0.99	0.61-1.61	0.99	0.61-1.62	1.1	0.67-1.82
Cancers	1.81	0.91-3.61	1.87	0.93-3.75	1.83	0.90-3.71

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than breast cancer (gastric, liver, colon, cervical, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

### **3.9. General characteristics of participants in cervical cancer screening**

A total of 2,986 women were included in final analysis of cervical cancer screening. Among them, 40.8% of them were aged 40–59 years old, 39.2% were aged 60 years or over and only 19.5% were aged 30–39 years old. Also, 1365 women (45.7%) had education level lower than middle school. Most of women (73.9%) were married and only 3.6% were singles. There was no big difference in average monthly house income as 34.7% had lower to two million won as income, 32.9% had two to four million won as income and 30.4% had more to four million as income. More than half (53.3%) reported that their health status is average. In terms of behavior factors, 2229 women (74.7%) experienced drinking and only 757 women (25.4%) did not experience drinking. Also, 91.1% had never experience smoking and only 4.6 % were current smoker (**Table 14**).

**Table 14: General characteristics of participants in cervical cancer screening**

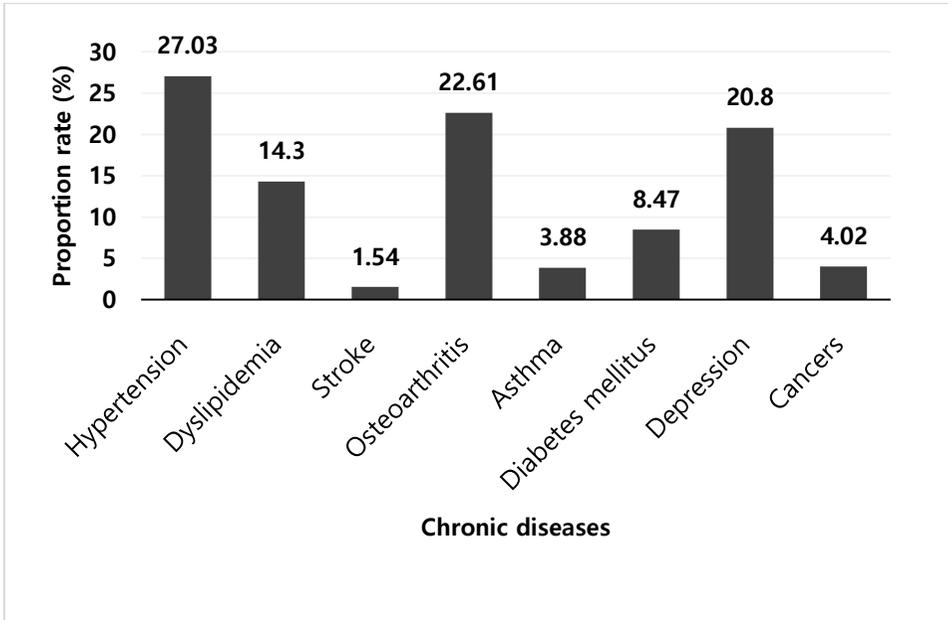
	<b>N=2986</b>	<b>%</b>
<b>Age</b>		
30-39 years old	582	19.49
40-59 years old	1,218	40.79
60 years and over	1,186	39.72
<b>Education level</b>		
Lower than middle school	1,365	45.71
High school	842	28.20
College and over	779	26.09
<b>Marital status</b>		
Married	2207	73.91
Divorced/Separated/Widowed	671	22.47
Singles	108	3.62
<b>Average monthly house income</b>		
<2 million won	1095	34.67
2 - 4 million won	983	32.92
> 4 million won	908	30.41
<b>Subjective health status</b>		
Bad	658	22.04
Average	1592	53.32
Good	736	24.65
<b>Alcohol Drinking</b>		
No	757	25.35
Yes	2229	74.65
<b>Smoking</b>		
Never	2721	91.13
Past smoker	129	4.32
Current	136	4.55

(%: Percentage).

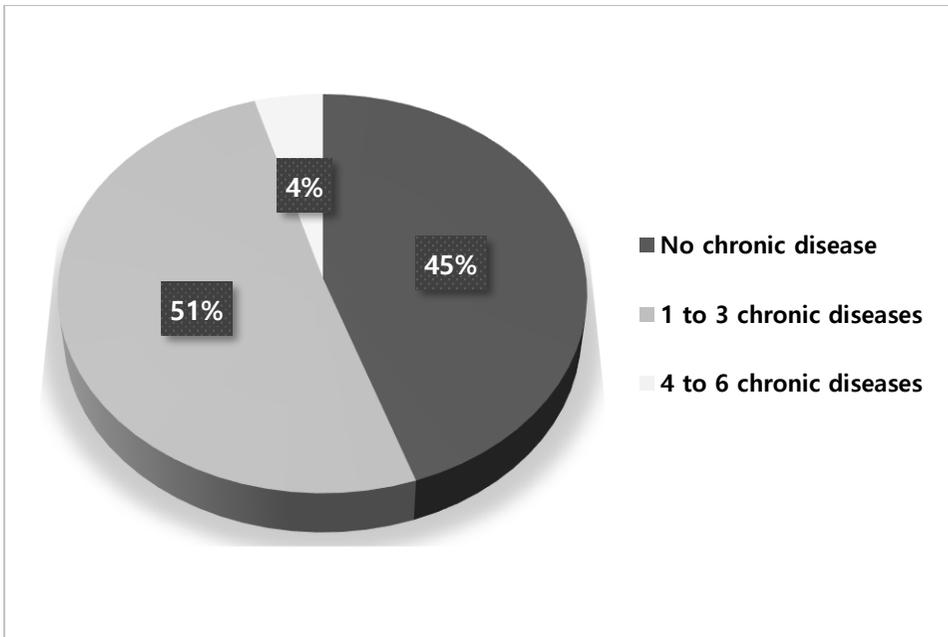
### **3.10. Prevalence of chronic diseases in women aged 30 years and over**

Among 2,986 participants in cervical cancer screening, hypertension (27.0 %) was prevalent. For other diseases, the prevalence was 14.3%, 1.5%, 22.6%, 3.9%, 8.5%, 20.8% and 4.0% for dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Figure 9**). In general, 45% of women did not have any chronic disease, 51% had one to three chronic diseases and only 4% had four to six chronic diseases (**Figure 10**).

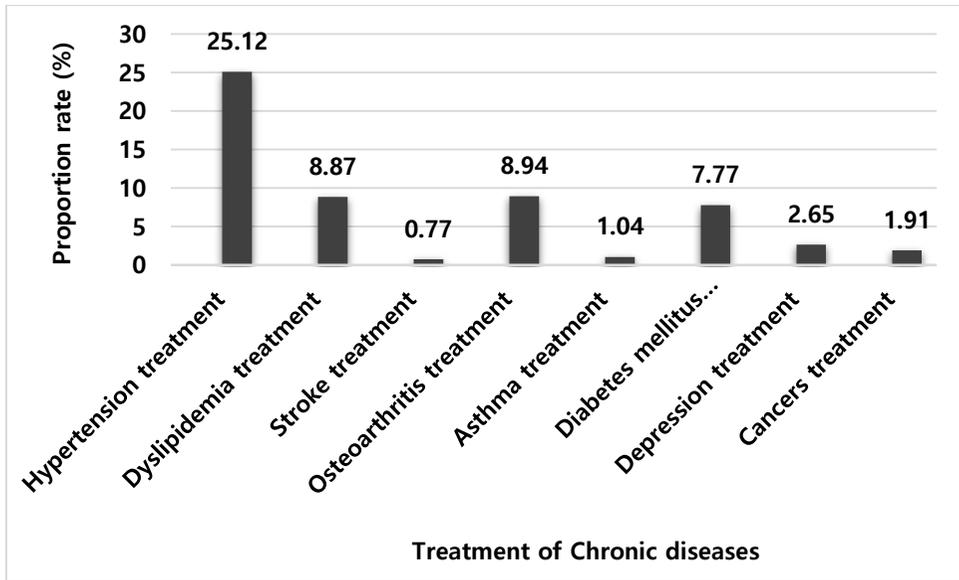
Overall, 25.12% of women were on treatment of hypertension, 8.9%, 0.8%, 8.9%, 1.0%, 7.8%, 2.7% and 1.9% were on treatment of dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Figure 11**).



**Figure 9: Ever diagnosed as chronic disease in women aged 30 years and over**



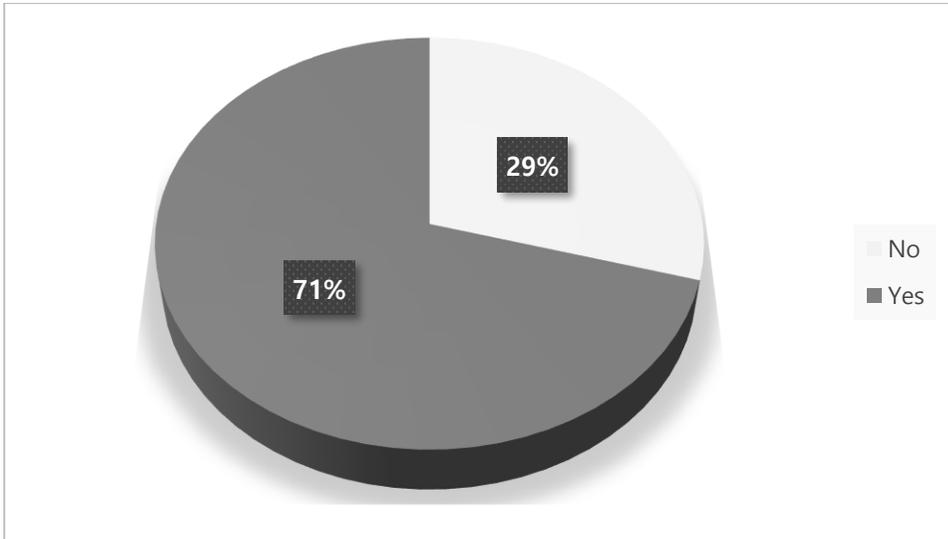
**Figure 10: Partition of chronic diseases in women aged 30 years and over**



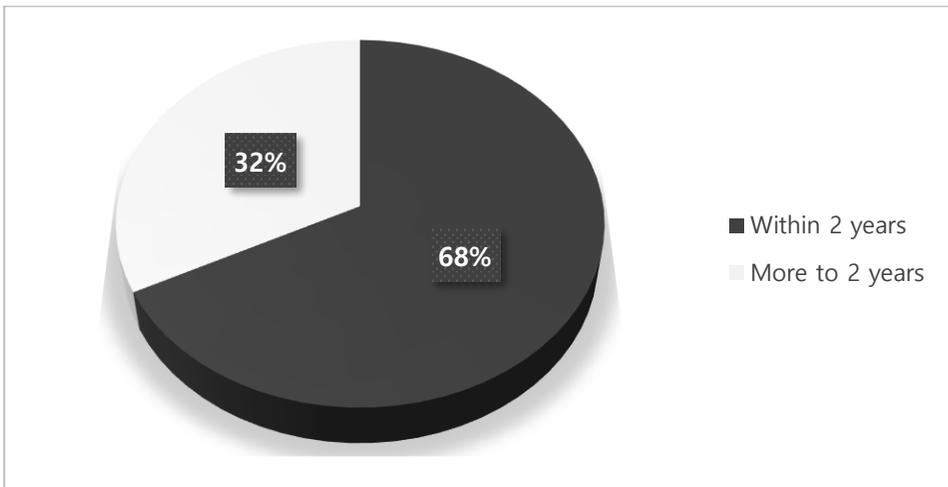
**Figure 11: Treatment of chronic diseases in women aged 30 years and over**

### **3. 11. Cervical cancer screening participation**

In a total of 2,986 women, more than half (70.7%) have done cervical cancer screening and 29.3% have not done cervical cancer screening (**Figure 12**). Among women who did cervical cancer screening, more than half (67.5%) have done cervical cancer screening within two years and 32.5% have done cervical cancer screening in period more to two years (**Figure 13**).



**Figure 12: Ever experienced of participation in Cervical cancer screening**



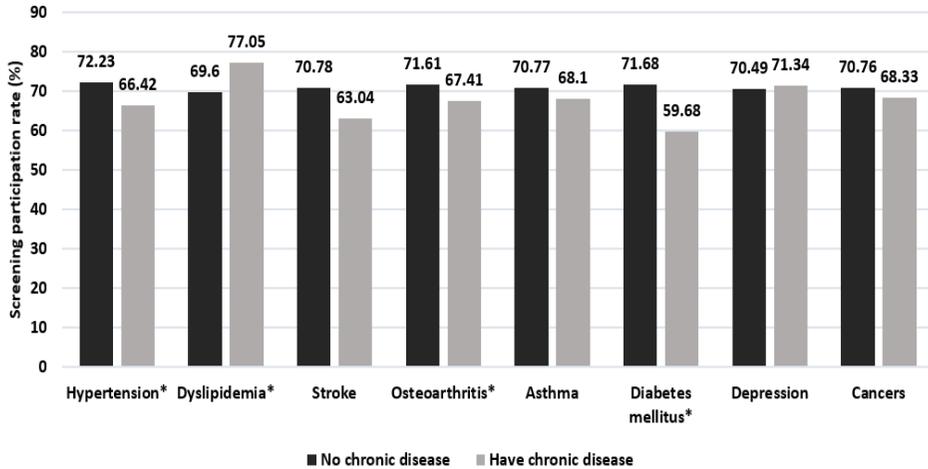
**Figure 13: Latest timing done cervical cancer screening**

### **3. 12. Association between chronic diseases and participation in cervical cancer screening**

In cervical cancer screening, women who have ever been diagnosed as hypertension showed low participation (66.4%) in lifelong cervical cancer

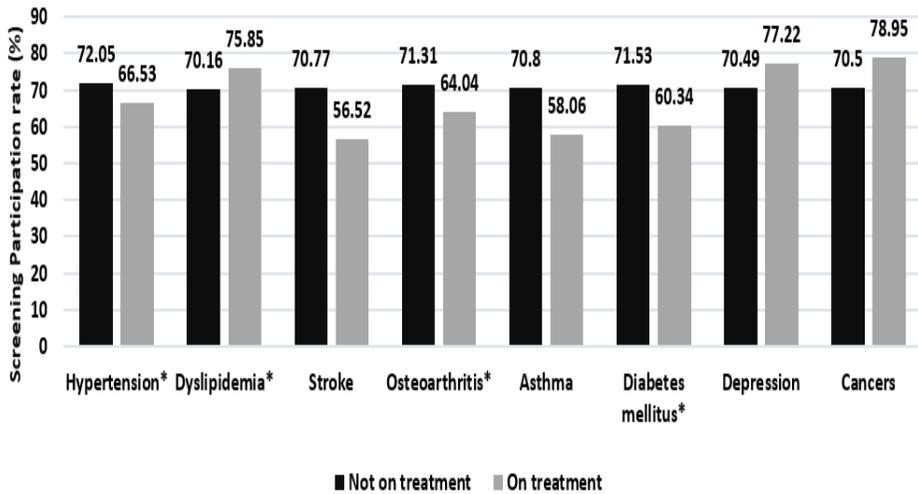
screening. Women who have ever been diagnosed as dyslipidemia showed high participation (77.1%) in lifelong cervical cancer screening. Women who have ever been diagnosed as diabetes mellitus showed low participation (59.7%) in lifelong cervical cancer screening. Women who have ever been diagnosed as osteoarthritis showed low participation (67.4%) in lifelong cervical cancer screening (**Figure 14**). Women who have ever been diagnosed as hypertension showed low participation (40.3%) in timely cervical cancer screening within 2 years. Women who have ever been diagnosed as osteoarthritis showed low participation (42.2%) in timely cervical cancer screening within 2 years. Additionally, women who have ever been diagnosed as diabetes mellitus showed low participation (36.8%) in timely cervical cancer screening within 2 years (**Table 15**).

In terms of treatment, women who were on treatment of hypertension showed lower significant participation (66.5%) in lifelong cervical cancer screening. Women who were on treatment of dyslipidemia (75.9%) showed higher participation in lifelong cervical cancer screening. Women who were on treatment of osteoarthritis (64.0%), and diabetes mellitus (60.3%) were less likely to participate in lifelong cervical cancer screening (**Figure 15**). Additionally, women who were on treatment of hypertension, osteoarthritis and diabetes mellitus were less likely (39.3%, 37.5% and 37.1% respectively) to participate in timely cervical cancer screening within 2 years (**Table 16**).



Diseases with \* showed statistical significance for p-value < 0.05 in chi-square test (Hypertension, Dyslipidemia, Osteoarthritis and Diabetes mellitus)

**Figure 14: Ever diagnosed as chronic disease and lifelong participation in cervical cancer screening**



Diseases with \* showed statistical significance for p-value < 0.05 in chi-square test (Hypertension, Dyslipidemia, Osteoarthritis, Diabetes mellitus and Depression)

**Figure 15: Being on treatment of chronic diseases and lifelong participation in cervical cancer screening**

**Table 15: Lifelong and timely cervical cancer screening participation in women ever diagnosed as chronic disease**

Ever diagnosed as	Total N (%)	Lifelong cervical cancer screening participation		Timely cervical cancer screening participation within 2 years	
		Yes N(%)	p-value*	Yes N(%)	p-value*
<b>Hypertension</b>			0.002		<0.001
Non	2179(100)	1574(72.23)		1100(50.48)	
Yes	807(100)	536(66.42)		325(40.27)	
<b>Dyslipidemia</b>			0.002		0.334
No	2559(100)	1781(69.60)		1212(47.36)	
Yes	427(100)	329(77.05)		213(49.88)	
<b>Stroke</b>			0.253		0.240
Non	2940(100)	2081(70.78)		1407(47.86)	
Yes	46(100)	29(63.04)		18(39.13)	
<b>Osteoarthritis</b>			0.035		0.001
Non	2311(100)	1655(71.61)		1140(49.33)	
Yes	675(100)	455(67.41)		285(42.22)	
<b>Asthma</b>			0.537		0.409
Non	2870(100)	2031(70.77)		1374(47.87)	
Yes	116(100)	79(68.10)		51(43.97)	
<b>Diabetes mellitus</b>			<0.001		<0.001
Non	2733(100)	1959(71.68)		1332(48.74)	
Yes	253(100)	151(59.68)		93(36.76)	
<b>Depression</b>			0.679		0.831
Non	2365(100)	1667(70.49)		1131(47.82)	
Yes	621(100)	443(71.34)		294(47.34)	
<b>Cancers</b>			0.567		0.960
Non	2866(100)	2028(70.76)		1368(47.73)	
Yes	120(100)	82(68.33)		57(47.50)	

(\*Chi-square test).

**Table 16: Lifelong and timely cervical cancer screening participation in women on treatment of chronic disease**

Treatment of	Total N (%)	Lifelong cervical cancer screening participation		Timely cervical cancer screening participation within 2 years	
		Yes N (%)	p- value*	Yes N (%)	p- value*
<b>Hypertension</b>			0.004		<0.001
Non	22369(100)	1611(72.05)		1130(50.54)	
Yes	750(100)	499(66.53)		295(39.33)	
<b>Dyslipidemia</b>			0.052		0.476
No	2721(100)	1909(70.16)		1293(47.52)	
Yes	265(100)	201(75.85)		132(49.81)	
<b>Stroke</b>			0.135		0.408
Non	2963(100)	2097(70.77)		1416(47.79)	
Yes	23(100)	13(56.52)		9(39.13)	
<b>Osteoarthritis</b>			0.013		<0.001
Non	2719(100)	1939(71.31)		1325(48.73)	
Yes	267(100)	171(64.04)		100(37.45)	
<b>Asthma</b>			0.121		0.170
Non	2955(100)	2092(70.80)		1414(47.85)	
Yes	31(100)	18(58.06)		11(35.48)	
<b>Diabetes mellitus</b>			<0.001		0.001
Non	2754(100)	1970(71.53)		1339(48.62)	
Yes	232(100)	140(60.34)		86(37.07)	
<b>Depression</b>			0.195		0.873
Non	2907(100)	2049(70.49)		1388(47.75)	
Yes	79(100)	61(77.22)		37(46.84)	
<b>Cancers</b>			0.165		0.309
Non	2929(100)	2065(70.50)		1394(47.59)	
Yes	57(100)	45(78.95)		31(54.39)	

(\*Chi-square test).

### 3.13. Participation in cervical cancer screening by chronic diseases status

The participation in lifelong cervical cancer screening was higher but not significant among women without chronic diseases (71.6%), participation in timely cervical cancer screening within 2 years was higher in women without chronic diseases (50.4%) and the results are significant (**Table 17**).

**Table 17: Participation in cervical cancer screening by chronic disease status**

	Total N (%)	Lifelong cervical cancer screening participation		Timely cervical cancer screening participation within 2 years	
		Yes N (%)	p-value*	Yes N (%)	p-value*
<b>Chronic disease status</b>			0.307		0.008
No	1335 (100)	956 (71.61)		673(50.41)	
Yes	1651 (100)	1154 (69.90)		752(45.55)	

(\*Chi-square test).

### **3.14. Associated general characteristics of participants with cervical cancer screening**

Overall, lifelong cervical cancer screening participation was higher in women aged 40-59 years (79.0%). Women with high school level of education, college and over (78.3%, 73.2% respectively) were more likely to participate in lifelong cervical cancer screening. Married women (76.6%) were more likely to participate in lifelong cervical cancer screening. Women with monthly income of above four million won and two to four million won (80.7%, 73.6% respectively) were mostly associated with higher participation in lifelong cervical cancer screening. Women whom their health status was good or average (75.4% and 71.0% respectively) participated higher in lifelong cervical cancer screening. Based on time done cervical cancer screening, women who were aged 30-39 years and 40-59 years (53.1% and 56.1% respectively) were more likely to do cervical cancer screening within 2 years. Women with College and over as level

of education (54.2%) were more likely to do cervical cancer screening within 2 years. Women who were married (53.5%) were more likely to do cervical cancer screening within 2 years. Women with average monthly house income above 4 million won (59.0%) were more likely to do cervical cancer screening within 2 years. Women who reported to have good health status (53.3%) were more likely to do cervical cancer screening within 2 years. Additionally, women without chronic diseases (50.41%) were more likely to do cervical cancer screening within 2 years (**Table 18**).

In logistic regression, women aged 40-59 years (OR= 1.34, 95% CI= 1.06-1.69) had high participation in lifelong cervical cancer screening compared to women aged 30-39 years and compared also to women aged 60 years or over (OR= 0.55, 95%CI= 0.44-0.68). Women with an education level of high school, college and over (OR= 1.98, 95%CI= 1.62-2.41 and OR= 1.50, 95%CI= 1.23-1.82 respectively) had higher participation in lifelong cervical cancer screening than women in lower and middle school. We found low participation in lifelong cervical cancer screening of women who divorced or widowed or separated (OR= 0.38, 95%CI= 0.32-0.46) and also singles women (OR= 0.23, 95%CI= 0.15-0.34) compared to married women. Women with average monthly house income of two to four million won (OR= 1.88, 95%CI= 1.56-2.26) and average monthly house income above to four million (OR= 2.82, 95%CI= 2.30-3.46) participated higher in lifelong cervical cancer screening than women with low average monthly house income. Women whom their health status was average (OR= 1.35, 95%CI= 1.12-1.64) and good (OR= 1.69, 95%CI= 1.34-2.13) had high participation in lifelong cervical cancer

screening. Based on time done cervical cancer screening, women aged 60 years and over were less likely to do cervical cancer screening within 2 years (OR= 0.51, 95%CI= 0.42-0.62) than women aged 30-39 years. Women with high school (OR= 1.71, 95%CI= 1.44-2.04) and college and over (OR= 1.75, 95%CI= 1.46-2.09) were more likely to do cervical cancer screening within 2 years. Divorced/separated/widowed women (OR= 0.40, 95%CI= 0.33-0.48) and single women (OR= 0.40, 95%CI= 0.26-0.60) were less likely to do cervical cancer screening within 2 years compared to married women. Women with average monthly house income of 2 to 4 million won (OR= 1.92, 95%CI= 1.61-2.29) and over 4 million won (OR= 2.65, 95%CI= 2.21-3.17) were more likely to do cervical cancer screening within 2 years compared to women with average monthly house income less to 2 million won. Women who reported that their health status was average (OR= 1.44, 95%CI= 1.20-1.74) and good (OR= 1.74, 95%CI= 1.41-2.16) were more likely to do cervical cancer screening within 2 years. Women who were current smokers (OR= 0.66, 95%CI= 0.47-0.95) were less likely to do cervical cancer screening within 2 years than never smoker women. Women who had any chronic disease (OR= 0.82, 95%CI= 0.71-0.95) were more likely to do cervical cancer screening within 2 years than women without chronic diseases (**Table 19**).

**Table 18: Cervical cancer screening participation rate according to general characteristics and presence of chronic disease**

	Total N(%)	Lifelong Breast cancer screening Participation		Timely breast cancer screening participation within 2years	
		Yes N(%)	P- value*	Yes N(%)	P- value*
<b>Age</b>			<0.001		<0.001
30-39 years	582(100)	429(73.71)		309(53.09)	
40-59years	1218(100)	962(78.98)		683(56.08)	
60 years and over	1186(100)	719(60.62)		433(36.51)	
<b>Education level</b>			<0.001		<0.001
Lower than middle school	1365(100)	881(64.54)		551(40.37)	
High school	842(100)	659(78.27)		452(53.69)	
College and over	779(100)	570(73.17)		422(54.17)	
<b>Marital status</b>			<0.001		<0.001
Married	2207(100)	1691(76.62)		1181(53.51)	
Separated/Divorced /Widowed	671(100)	373(55.59)		210(31.30)	
Singles	108(100)	46(42.59)		34(31.48)	
<b>Average monthly house income</b>			<0.001		<0.001
<2 million won	1095(100)	654(59.73)		386(35.25)	
2 - 4 million won	983(100)	723(73.55)		503(51.17)	
Above 4 million won	908(100)	733(80.73)		536(59.03)	
<b>Subjective health status</b>			<0.001		<0.001
Bad	658(100)	424(64.44)		260(39.51)	
Average	1592(100)	1131(71.04)		773(48.56)	
Good	736(100)	555(75.41)		392(53.26)	
<b>Alcohol Drinking</b>			<0.001		<0.001
No	757(100)	431(56.94)		265(35.01)	
Yes	2229(100)	1679(75.33)		1160(52.04)	
<b>Smoking</b>			0.615		0.071
Never	2721(100)	1928(70.86)		1313(48.25)	
Past smoker	129(100)	91(70.54)		60(46.51)	
Current smoker	136(100)	91(66.91)		52(38.24)	
<b>Presence of chronic disease</b>			0.307		0.008
No	1335(100)	956(71.61)		673(50.41)	
Yes	1651(100)	1154(69.90)		752(45.55)	

(\*Chi-square test).

**Table 19: Logistic regression results for cervical cancer screening participation according to general characteristics and presence of chronic disease**

	Lifelong Breast cancer screening Participation			Timely breast cancer screening participation within 2years		
	OR	95 % CI	p-value	OR	95% CI	p-value
<b>Age</b>						
30-39 years	Ref			Ref		
40-59 years	1.34	1.06-1.69	0.013	1.13	0.93-1.38	0.234
60 and over	0.55	0.44-0.68	<0.001	0.51	0.42-0.62	<0.001
<b>Education</b>						
Lower than middle school	Ref			Ref		
High school	1.98	1.62-2.41	< 0.001	1.71	1.44-2.04	<0.001
College and over	1.50	1.23-1.82	< 0.001	1.75	1.46-2.09	<0.001
<b>Marital status</b>						
Married	Ref			Ref		
Divorced/Separated /Widowed	0.38	0.32-0.46	< 0.001	0.40	0.33-0.48	<0.001
Singles	0.23	0.15-0.34	< 0.001	0.40	0.26-0.60	<0.001
<b>Average monthly house income</b>						
< 2 million won	Ref			Ref		
2-4 million won	1.88	1.56-2.26	< 0.001	1.92	1.61-2.29	<0.001
> 4 million won	2.82	2.30-3.46	< 0.001	2.65	2.21-3.17	<0.001
<b>Subjective health status</b>						
Bad	Ref			Ref		
Average	1.35	1.12-1.64	0.002	1.44	1.20-1.74	<0.001
Good	1.69	1.34-2.13	< 0.001	1.74	1.41-2.16	<0.001
<b>Drinking experience</b>						
No	Ref			Ref		
Yes	2.31	1.94-2.75	<0.001	2.01	1.70-2.39	<0.001
<b>Smoking status</b>						
Never	Ref			Ref		
Past smoker	0.98	0.67-1.45	0.939	0.93	0.65-1.33	0.699
Current smoker	0.83	0.58-1.20	0.325	0.66	0.47-0.95	0.023
<b>Presence of chronic disease</b>						
No	Ref			Ref		
Yes	0.92	0.79-1.08	0.328	0.82	0.71-0.95	0.016

(Ref: Reference).

### **3.15. Associated general characteristics of participants with chronic diseases**

Over all in 2,986 participants, most chronic diseases were more likely to occur in women aged of 60 years or over (51.5%, 24%, 2.9%, 42.8%, 5.6%, 16.0%, 23.5% and 5.6% for hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively). Also chronic diseases were more prevalent in women with lower than middle school as level of education (45.6%, 21.8%, 2.9%, 38.2%, 5.7%, 15.1%, 25% and 4.84% for hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively). Being separated, widowed or divorced were associated with high prevalence of chronic diseases as 45.8%, 18.8%, 3.3%, 37.1%, 6.3%, 15.2% and 25.9% with hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus and depression respectively were separated, widowed or divorced. Most chronic diseases were prevalent in women with lower to two million won as average monthly incomes (43.4%, 20.6%, 2.5%, 36.1%, 14.7% and 24.8% for hypertension, dyslipidemia, stroke, osteoarthritis, diabetes mellitus and depression respectively). In addition, women who reported that their health status were bad were more likely to have chronic diseases as 46.2%, 25.1%, 3.2%, 42.1%, 8.2%, 17.2%, 37.8%, and 6.5% had hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Table 20**).

In terms of treatment, among 2,986 participants, most women who were on

treatment of chronic diseases were aged of 60 years or over (49.2%, 16.4%, 1.4%, 19%, 1.8% and 14.8%) for the treatment of hypertension, dyslipidemia, stroke, osteoarthritis, asthma and diabetes mellitus respectively. Also most women who were on treatment of chronic diseases had lower than middle school by means of level of education as 43.6%, 13.7%, 1.4%, 16.3%, 1.6%and 13.7% were on treatment of hypertension, dyslipidemia, stroke, osteoarthritis, asthma and diabetes mellitus respectively.

Being separated, widowed or divorced was associated with high prevalence of women on treatment of chronic diseases as 43.8%, 12.8%, 1.6%, 14.9%, 1.9% and 13.6% who were on treatment of hypertension, dyslipidemia, stroke, osteoarthritis, asthma and diabetes mellitus respectively were separated, widowed or divorced. Most women on treatment of chronic diseases had lower to two million won as average monthly house income as 41.2%, 13.8%, 15%, 2.0%, 13.6% and 3.9% were on the treatment of hypertension, dyslipidemia, osteoarthritis, asthma, diabetes mellitus and depression respectively. In addition, most women on treatment of chronic diseases reported that their health status were bad as 43.0%, 15.1%, 2%, 20.2%, 3.7%, 16.3%, 6.1% and 3.2% were on the treatment of hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers respectively (**Table 21**).

**Table 20: Association between general characteristics and ever diagnosed as chronic diseases in women aged of 30 years and over**

	<b>Hypertension</b> N=807 (%)	<b>Dyslipidemia</b> N=427 (%)	<b>Stroke</b> N=46 (%)	<b>Osteoarthritis</b> N=675 (%)	<b>Asthma</b> N=116 (%)	<b>Diabetes mellitus</b> N=253 (%)	<b>Depression</b> N=621 (%)	<b>Cancers</b> N=120 (%)
<b>Age</b>								
30-39 years	7(1.20)	4(0.69)	0(0.00)	13(2.23)	12(2.06)	3(0.52)	87(14.95)	6(1.03)
40-59 years	189(15.52)	139(11.41)	12(0.99)	155(12.73)	38(3.12)	60(4.93)	255(20.94)	48(3.94)
60 years and over	611(51.52)*	284(23.95)*	34(2.87)*	507(42.75)*	66(5.56)*	190(16.02)*	279(23.52)*	66(5.56)*
<b>Education level</b>								
Lower than middle school	623(45.64)*	297(21.76)*	40(2.93)*	522(38.24)*	78(5.71)*	206(15.09)*	341(24.98)*	66(4.84)*
High school	137(16.27)	91(10.81)	3(0.36)	106(12.59)	17(2.02)	34(4.04)	182(21.62)	39(4.63)
College and over	47(6.03)	39(5.01)	3(0.39)	47(6.03)	21(2.70)	13(1.67)	98(12.58)	15(1.93)
<b>Marital status</b>								
Married	495(22.43)	296(13.41)	24(1.09)	423(19.17)	70(3.17)	148(6.71)	432(19.57)	94(4.26)
Living alone	307(45.75)*	126(18.78)*	22(3.28)*	249(37.11)*	42(6.26)*	102(15.20)*	174(25.93)*	23(3.43)
Singles	5(4.63)	5(4.63)	0(0.00)	3(2.78)	4(3.70)	3(2.78)	15(13.89)	3(2.78)
<b>Monthly income</b>								
< 2 million won	475(43.38)*	226(20.64)*	27(2.47)*	395(36.07)*	52(4.75)	161(14.70)*	271(24.75)*	52(4.75)
2 -4 million won	196(19.94)	110(11.19)	11(1.12)	157(15.97)	36(3.66)	58(5.90)	197(20.04)	31(3.15)
> 4 million won	136(14.98)	91(10.02)	8(0.88)	123(13.55)	28(3.08)	34(3.74)	153(16.85)	37(4.07)

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<b>Subjective health status</b>								
Bad	304(46.20)*	165(25.08)*	21(3.19)*	277(42.10)*	54(8.21)*	113(17.17)*	249(37.84)*	43(6.53)*
Average	383(24.06)	204(12.81)	21(1.32)	306(19.22)	48(3.02)	115(7.22)	294(18.47)	57(3.58)
Good	120(16.30)	58(7.88)	4(0.54)	92(12.50)	14(1.90)	25(3.40)	78(10.60)	20(2.72)
<b>Drinking experience</b>								
No	294(38.84)	140(18.49)	17(2.25)	224(29.59)	36(4.76)	104(13.74)	144(19.02)	41(5.42)
Yes	513(23.01)	287(12.88)	29(1.30)	451(20.23)	80(3.59)	149(6.68)	477(21.40)	79(3.54)
<b>Smoking status</b>								
Never	753(27.67)	395(14.52)	40(1.47)	625(22.97)	106(3.90)	228(8.38)	539(19.81)	110(4.04)
Past smoker	31(24.03)	17(13.18)	3(2.33)	25(19.38)	6(4.65)	17(13.18)	40(31.01)	5(3.88)
Current smoker	23(16.91)	15(11.03)	3(2.21)	25(18.38)	4(2.94)	8(5.88)	42(30.88)	5(3.68)

(With \*: Significantly higher for p-value <0.05 in chi-square test, **living alone**: Separated, divorced or widowed).

**Table 21: Association between general characteristics and being on treatment of chronic diseases in women aged of 30 years and over**

	<b>Hypertension</b> N=750 (%)	<b>Dyslipidemia</b> N=265 (%)	<b>Stroke</b> N=23 (%)	<b>Osteoarthritis</b> N=267 (%)	<b>Asthma</b> N=31 (%)	<b>Diabetes mellitus</b> N=232 (%)	<b>Depression</b> N=79 (%)	<b>Cancers</b> N=57 (%)
<b>Age</b>								
30-39 years	6(1.03)	3(0.52)	0(0.00)	2(0.34)	4(0.69)	3(0.52)	11(1.89)	5(0.86)
40-59 years	161(13.22)	68(5.58)	7(0.57)	40(3.28)	6(0.49)	54(4.43)	29(2.38)	24(1.97)
60 years and over	583(49.16) *	194(16.36) *	16(1.35) *	225(18.97) *	21(1.77) *	175(14.76) *	39(3.29)	28(2.36)
<b>Education level</b>								
Lower than middle school	595(43.59) *	187(13.70) *	19(1.39) *	222(16.26) *	22(1.61) *	187(13.70) *	43(3.15)	31(2.27) *
High school	116(13.78)	55(6.53)	2(0.24)	36(4.28)	5(0.59)	33(3.92)	24(2.85)	18(2.14)
College and over	39(5.01)	23(2.95)	2(0.26)	9(1.16)	4(0.51)	12(1.54)	12(1.54)	8(1.03)
<b>Marital status</b>								
Married	453(20.53)	175(7.93)	12(0.54)	167(7.57)	17(0.77)	138(6.25)	51(2.31)	44(1.99)
Living alone	294(43.82) *	86(12.82) *	11(1.64) *	100(14.90) *	13(1.94) *	91(13.56) *	24(3.58)	12(1.79)
Singles	3(2.78)	4(3.70)	0(0.00)	0(0.00)	1(0.93)	3(2.78)	4(3.70)	1(0.93)
<b>Monthly income</b>								
< 2 million won	451(41.19) *	151(13.79) *	11(1.00)	164(14.98) *	22(2.01) *	149(13.61) *	43(3.93) *	21(1.92)
2 -4 million won	174(17.70)	65(6.61)	8(0.81)	66(6.71)	8(0.81)	52(5.29)	19(1.93)	16(1.63)
> 4 million won	125(13.77)	49(5.40)	4(0.44)	37(4.07)	1(0.11)	31(3.41)	17(1.87)	20(2.20)

<b>Subjective health status</b>								
Bad	283(43.01) *	99(15.05) *	13(1.98) *	133(20.21) *	24(3.65) *	107(16.26) *	40(6.08) *	21(3.19) *
Average	360(22.61)	132(8.29)	7(0.44)	107(6.72)	6(0.38)	104(6.53)	32(2.01)	32(2.01)
Good	107(14.54)	34(4.62)	3(0.41)	27(3.67)	1(0.14)	21(2.85)	7(0.95)	4(0.54)
<b>Drinking experience</b>								
No	275(36.33)	93(12.29)	9(1.19)	96(12.68)	12(1.59)	99(13.08)	24(3.17)	16(2.11)
Yes	475(21.31)	172(7.72)	14(0.63)	171(7.67)	19(0.85)	133(5.97)	55(2.47)	41(1.84)
<b>Smoking status</b>								
Never	700(25.73)	248(9.11)	20(0.74)	255(9.37)	30(1.10)	213(7.83)	66(2.43)	52(1.91)
Past smoker	29(22.48)	8(6.20)	2(1.55)	7(5.43)	0(0.00)	16(12.40)	7(5.43)	4(3.10)
Current smoker	21(15.44)	9(6.62)	1(0.74)	5(3.68)	1(0.74)	3(2.21)	6(4.41)	1(0.74)

(With \*: Significantly higher for p-value <0.05 in chi-square test, **living alone**: Separated, divorced or widowed).

### **3.16. Logistic regression for the association of participation in cervical cancer screening and chronic diseases**

Overall, lifelong cervical cancer screening was higher in women who have ever been diagnosed as dyslipidemia (OR= 1.47, 95%CI= 1.15-1.87) even after adjusting for general characteristics (OR= 2.01, 95%CI= 1.54-2.62). Low lifelong cervical cancer screening participation was observed in women who have ever been diagnosed as hypertension (OR= 0.76, 95%CI= 0.64-0.90), even in multiple analysis (OR= 0.77, 95%CI= 0.63-0.93). Women who have ever been diagnosed as osteoarthritis were less likely to participate in lifelong cervical cancer screening (OR= 0.82, 95%CI= 0.68-0.99). Significantly lower adherence to lifelong cervical cancer screening was observed in women who have ever been diagnosed as diabetes mellitus (OR= 0.58, 95%CI= 0.45-0.76) even when adjusted for general characteristics (OR= 0.72, 95% CI= 0.53-0.96) (**Table 22**).

Women who have ever been diagnosed as hypertension showed low participation (OR= 0.66, 95%CI= 0.56-0.78) in timely cervical cancer screening within 2 years even in multiple analysis (OR= 0.68, 95%CI= 0.57-0.82). Women who have ever been diagnosed as dyslipidemia showed high participation (OR= 1.44, 95%CI= 1.15-1.80) in timely cervical cancer screening within 2 years in multiple analysis, even when adjusted for general characteristics (OR= 1.53, 95%CI= 1.21-1.93). Women who have ever been diagnosed as osteoarthritis and diabetes mellitus participated less (OR= 0.75, 95%CI= 0.63-0.89, OR= 0.61, 95%CI= 0.47-0.80 respectively) in timely cervical cancer screening within 2 years (**Table 23**).

Based on chronic disease treatment, lifelong cervical cancer screening was higher in women on treatment of dyslipidemia (OR= 1.34, 95%CI= 1.00-1.79) even after adjusting for general characteristics (OR= 1.85, 95%CI= 1.34-2.54). Women on treatment of depression were more likely to participate in lifelong cervical cancer screening when adjusted for general characteristics (OR= 1.84, 95%CI= 1.05-3.22). Lower lifelong cervical cancer screening was observed in women who were on treatment of hypertension (OR= 0.77, 95%CI= 0.65-0.92). Women on treatment of osteoarthritis were less likely to participate in lifelong cervical cancer screening (OR= 0.72, 95%CI= 0.55-0.93). Significantly lower adherence to lifelong cervical cancer screening was observed for women who were on treatment of diabetes mellitus (OR= 0.61, 95%CI= 0.46-0.80) even in multiple analysis (OR= 0.60, 95%CI= 0.45-0.81) (**Table 24**).

Women who were on treatment of hypertension, osteoarthritis and diabetes mellitus showed low participation (OR= 0.63, 95%CI= 0.54-0.75, OR= 0.63, 95%CI= 0.48-0.82 and OR= 0.62, 95%CI= 0.47-0.82 respectively) in timely cervical cancer screening within 2 years. Women who were on treatment of dyslipidemia showed high participation (OR= 1.63, 95%CI= 1.23-2.16) in timely cervical cancer screening within 2 years when adjusted for general characteristics (**Table 25**).

**Table 22: Logistic regression results for lifelong cervical cancer screening participation rate associated with chronic diseases ever diagnosed and other factors**

Ever diagnosed as	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95 % CI	OR	95% CI
Hypertension	0.76	0.64-0.90	0.77	0.63-0.93	1.13	0.91-1.41
Dyslipidemia	1.47	1.15-1.87	1.90	1.46-2.46	2.01	1.54-2.62
Stroke	0.70	0.38-1.29	0.75	0.40-1.40	0.90	0.47-1.73
Osteoarthritis	0.82	0.68-0.99	0.85	0.70-1.03	1.20	0.97-1.49
Asthma	0.88	0.59-1.31	0.98	0.65-1.47	1.16	0.76-1.78
Diabetes mellitus	0.58	0.45-0.76	0.58	0.44-0.77	0.72	0.53-0.96
Depression	1.04	0.86-1.27	1.05	0.61-1.36	1.13	0.91-1.39
Cancers	0.89	0.60-1.32	0.91	2.34-2.89	0.89	0.59-1.35

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than cervical cancer (gastric, liver, colon, breast, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, Drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

**Table 23: Logistic regression results for timely cervical cancer screening participation rate within 2 years associated with chronic diseases ever diagnosed and other factors**

Ever diagnosed as	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95 % CI	OR	95% CI
Hypertension	0.66	0.56-0.78	0.68	0.57-0.82	0.97	0.79-1.19
Dyslipidemia	1.11	0.90-1.36	1.44	1.15-1.80	1.53	1.21-1.93
Stroke	0.70	0.39-1.1.27	0.82	0.45-1.52	0.99	0.52-1.86
Osteoarthritis	0.75	0.63-0.89	0.82	0.68-0.98	1.11	0.90-1.36
Asthma	0.85	0.59-1.24	0.96	0.65-1.40	1.09	0.74-1.63
Diabetes mellitus	0.61	0.47-0.80	0.68	0.51-0.90	0.87	0.65-1.17
Depression	0.98	0.82-1.17	1.01	0.84-1.21	1.09	0.90-1.33
Cancers	0.99	0.69-1.43	1.04	0.72-1.51	1.08	0.73-1.59

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than cervical cancer (gastric, liver, colon, breast, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

**Table 24: Logistic regression results for lifelong cervical cancer screening participation rate associated with chronic diseases on treatment and other factors**

On treatment of	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95 % CI	OR	95% CI
Hypertension	0.77	0.65-0.92	0.81	0.66-0.99	1.23	0.98-1.54
Dyslipidemia	1.34	1.00-1.79	1.67	1.22-2.28	1.85	1.34-2.54
Stroke	0.54	0.23-1.23	0.61	0.26-1.42	0.64	0.27-1.52
Osteoarthritis	0.72	0.55-0.93	0.79	0.60-1.04	1.04	0.79-1.39
Asthma	0.57	0.28-1.17	0.62	0.30-1.30	0.83	0.39-1.79
Diabetes mellitus	0.61	0.46-0.80	0.60	0.45-0.81	0.74	0.55-1.01
Depression	1.42	0.83-2.42	1.46	0.85-2.51	1.84	1.05-3.22
Cancers	1.57	0.83-2.98.	1.63	0.85-3.11	1.57	0.81-3.04

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than cervical cancer (gastric, liver, colon, breast, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, Drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

**Table 25: Logistic regression results for timely cervical cancer screening participation rate within 2 years associated with chronic diseases on treatment and other factors**

On treatment of	Univariate analysis		Multivariate analysis		Multivariate adjusted for general characteristics	
	OR	95% CI	OR	95 % CI	OR	95% CI
Hypertension	0.63	0.54-0.75	0.65	0.54-0.79	0.93	0.75-1.15
Dyslipidemia	1.10	0.85-1.41	1.47	1.12-1.93	1.63	1.23-2.16
Stroke	0.70	0.30-1.63	0.90	0.38-2.11	0.99	0.41-2.39
Osteoarthritis	0.63	0.48-0.82	0.74	0.56-0.96	0.95	0.71-1.26
Asthma	0.60	0.29-1.26	0.72	0.34-1.54	0.98	0.45-2.12
Diabetes mellitus	0.62	0.47-0.82	0.71	0.53-0.95	0.89	0.65-1.21
Depression	0.96	0.62-1.51	0.97	0.61-1.53	1.21	0.76-1.95
Cancers	1.31	0.78-2.22	1.36	0.80-2.32	1.36	0.78-2.35

**OR:** odd ratio. **95% CI:** 95% confidence interval. **Cancers:** Other cancers than cervical cancer (gastric, liver, colon, breast, lung, thyroid and other cancers). **General characteristics:** Age, education, marital status, average monthly house income, subjective health, drinking experience and smoking status. **Multivariate** (hypertension, dyslipidemia, stroke, osteoarthritis, asthma, diabetes mellitus, depression and cancers). **Full adjusted:** All covariates (general characteristics). **Reference category** is women who have not reported the disease of interest.

## 4. Discussion

Our study was conducted to examine participation of women with chronic diseases in breast and cervical cancer screening using KNHANES data 2012. The target study population was women who were aged 30 years and old in 2012 for cervical cancer screening participation and chronic diseases, also women who were aged 40 years and old in 2012 for breast cancer screening participation and chronic diseases. Our study had focused on 8 chronic diseases: hypertension, diabetes, dyslipidemia, stroke, asthma, osteoarthritis, depression and cancer (others than breast cancer for breast cancer screening sample and others than cervical cancer for cervical cancer screening sample) that have been assessed during health examination and health interview in KNHANES V.

In this study, generally women with chronic diseases participated higher in lifelong breast cancer screening compared to women without chronic diseases, however women without chronic diseases participated higher in timely cervical cancer screening within 2 years than women with chronic diseases. Participation in both breast and cervical cancer screening was higher, the higher participation may be due to easy access to health care services and also to National Health Insurance in Korea.

Adherence to lifelong breast cancer screening was higher in women who have ever been diagnosed as dyslipidemia. Also, women who were on treatment of dyslipidemia showed higher participation in lifelong breast cancer screening. Higher participation in lifelong breast cancer screening was also observed for

women who have ever been diagnosed as osteoarthritis, depression and cancer. Lower participation in lifelong breast cancer screening was observed in women who have ever been diagnosed as asthma and diabetes mellitus. Lower participation in lifelong breast cancer screening was also observed for women who were on treatment of stroke, asthma and diabetes mellitus.

Adherence to lifelong cervical cancer screening was higher in women who have ever been diagnosed as dyslipidemia. Women who were on treatment of dyslipidemia and depression showed also higher participation in lifelong cervical cancer screening. Lower participation in lifelong cervical cancer screening was observed in women who have ever been diagnosed as hypertension. Women who have ever been diagnosed as diabetes mellitus showed lower participation in lifelong cervical cancer screening compared to women without diabetes mellitus. Lower participation in lifelong cervical cancer screening was also observed in women who have ever been diagnosed as osteoarthritis. In addition, lower participation in lifelong cervical cancer screening was observed for women who were on treatment of hypertension, osteoarthritis and diabetes mellitus.

Low participation in timely breast cancer screening have been observed in women who have ever been diagnosed as diabetes mellitus as well as women who were on treatment of diabetes mellitus. High participation in timely breast cancer screening have been observed in women who have ever been diagnosed as dyslipidemia as well as women who were on treatment of dyslipidemia. Low participation in timely cervical cancer screening have been observed in women who have ever been diagnosed as hypertension, osteoarthritis and diabetes

mellitus as well as women who were on treatment of hypertension, osteoarthritis and diabetes mellitus. High participation in timely cervical cancer screening have been observed when adjusted for general characteristics, in women who have ever been diagnosed as dyslipidemia as well as women who were on treatment of dyslipidemia.

Some differences have been observed in associations of lifelong and timely breast and cervical cancer screening with chronic diseases like asthma, depression, cancers, osteoarthritis and stroke for lifelong breast cancer screening, also for depression in lifelong cervical cancer screening. Although there are some differences in statistical significance, but the tendency of screening participation rate is similar in chronic disease associated with both lifelong and timely participation in breast and cervical cancer screening. The higher rate is measured by lifelong participation than timely participation. Those differences may be due to the long duration of chronic diseases.

Socioeconomic status was associated with breast and cervical cancer screening. In breast cancer screening, women in age 40-59 were more likely to participate in breast cancer screening. Women with high school as education level were more likely to participate in breast cancer screening. Married women were more likely to participate in breast cancer screening. Women with average monthly house income more to four million were associated with high participation in breast cancer screening. Women who reported good health status were more likely to participate in breast cancer screening. Women who were no smoker were associated with high participation in breast cancer screening. In cervical cancer

screening, women in age 40-59 were more likely to participate in cervical cancer screening. Women with high school as education level were more likely to participate in cervical cancer screening. Married women were more likely to participate in cervical cancer screening. Women with average monthly house income more to four million were associated with high participation in cervical cancer screening. Women who reported good health status were more likely to participate in cervical cancers screening. Women who were no smoker were associated with high participation in cervical cancer screening.

For both breast and cervical cancer screening, most chronic diseases were prevalent in women aged 60 years and above, with low education level, living alone, with average monthly income lower to two million won and in women who reported that their health status was bad.

Few studies have examined the association between a large range of chronic conditions and cancer screening as we did in our study. Several studies suggested that most chronic conditions were not associated with screening participation. Distinguished results have been found regarding adherence to screening among patients suffering from chronic diseases. Some conditions were associated with higher cancer screening rates (e.g. cancer survivors, hypertension) [16, 33], others with lower cancer screening rates (e.g. diabetes, obesity, depression) [17, 19-22]. But unlike results were reported for conditions such as rheumatoid arthritis [25] where were no difference in cancer screening. The Lower participation in breast and cervical cancer screening was frequently reported among women with diabetes mellitus both in clinic-based and population –based

studies [17, 18, 20, 22, 34], and also among obese women [17, 35, 36]. Several studies have found the association between hypertension and cervical as well as breast cancer screening [18, 33].

Cancer is among the infrequent chronic conditions associated with higher cervical smear or mammography use [16]. We have found in our study that higher participation in breast cancer screening was observed for women who have ever been diagnosed as cancer. Ours results are consistent with study conducted in France that reported higher participation in breast cancer screening for cancer survivors [17]. Being treated for a cancer will likely expose an individual to the awareness of breast and cervical cancer screening and the benefits associated with it. We also assume that cancer patients visit frequently health care facilities as they are worry that they can get another type of cancer so that can lead them to use more health services as well as screening services.

In our study, women who have ever been diagnosed as dyslipidemia were associated with higher screening participation in both breast and cervical cancer screening, also women who were on treatment of dyslipidemia were associated with higher participation in both breast and cervical cancer screening. The higher participation in screening of women with dyslipidemia may be due to easy accessibility of health services in Korea. Since elevated cholesterol level is asymptomatic and more unlikely to lead people to seek medical attention, its association with breast and cervical cancer screening is more likely mediated by health consciousness. People with dyslipidemia do not have disabilities and still use health care facilities as usually.

Adherence to breast cancer screening was higher in women who have ever been diagnosed as depression. However, breast cancer screening rates are not significant after adjusting other demographic factors. Adherence to cervical cancer screening was higher in women who were on treatment of depression after adjusting for screening determinants. Our results are different from results found in studies conducted in USA where they reported low participation of women with depression in breast and cervical cancer screening [19, 24, 37]. Patients with and on treatment of depression have high rates of somatization, symptom strengthening, more complain of nonspecific symptoms and sensitive awareness of bodily sensation that lead them to use more health care services as well as breast and cervical cancer screening [38]. Also, people with depression spend more time for counseling in health facilities, that can make them know more on preventive services as well as breast and cervical cancer screening.

Osteoarthritis was associated with lower participation in cervical cancer screening but no significance observed when adjusted for socioeconomic and behavioral factors. Women who were on treatment of osteoarthritis were associated with low participation in cervical cancer screening but also no significance observed when adjusted for socioeconomic and behavioral factors. Our findings are similar to study conducted in Oregon communities that reported low participation in cervical cancer screening for women with osteoarthritis [24].

Women with osteoarthritis might experience pain and moving difficulties for the Pap test procedures. Also, osteoarthritis was prevalent in aged women by the

time cervical cancer screening was higher in younger women which led to low participation of women with osteoarthritis in cervical cancer screening. However, different results have been found in breast cancer screening where women with osteoarthritis were associated with higher participation in breast cancer screening. During breast cancer screening procedures, women with osteoarthritis do not experience many movements as in cervical cancer screening procedures, this may not cause pain and difficulties in moving for women with osteoarthritis. Our results are consistent with results of study conducted in Boston that showed high participation of women with osteoarthritis in breast cancer screening compared to women without osteoarthritis [39]. Another study conducted in Boston [23] reported no difference in breast, cervical and colon cancer screening for patients with rheumatoid arthritis compared to the general population.

Our study found low participation in cervical cancer screening among women who have ever been diagnosed and on treatment of hypertension, the results are consistent with the results of study conducted in Oregon communities which found low participation in cervical cancer screening among women with hypertension [24]. Introducing cancer screening together with health care visits may be more difficult by the time the visits are for the diseases that necessitate variations in medication management like hypertension. Nevertheless, a study conducted in North Carolina has reported high participation in breast and cervical cancer screening among people with hypertension [5, 33]. Our study found low participation in cervical cancer screening for women who have ever been diagnosed as diabetes mellitus. Women on treatment of diabetes mellitus were

also associated with low participation in cervical cancer screening. The results are consistent with other studies conducted in France, Spanish, Oregon and USA [17, 20, 21, 24] that reported low participation of women with diabetes in cervical cancer screening.

Low participation in breast cancer screening was observed in women who have ever been diagnosed as diabetes mellitus in our study. Women who were on treatment of diabetes mellitus were associated with low participation in breast cancer screening. The results are consistent with other different studies conducted in France, Spanish, Ontario and Oregon [17, 20, 22, 24] that have reported also low participation in breast cancer screening for women with diabetes mellitus. Study conducted in Rochester [40] reported also low participation in breast cancer screening of women with diabetes. Diabetes is concomitant with higher risk of postmenopausal breast cancer but the link is more uncertain and the carcinogenesis mechanism is less clear. A recent meta-analysis has concluded a significant association between type II diabetes and postmenopausal breast cancer [41]. It has been showed that more concentration of physicians is made on specific chronic disease controlling rather than other preventive care practices including breast and cervical cancer screening among diabetics [42]. There is evidence that cancer screening rate increases with increasing number of chronic conditions [43]. In addition, a more frequent medical follow-up has been associated with higher cancer screening rate among individuals with diabetes mellitus [20, 42].

Our study has also found lower screening participation in breast cancer

screening in women who have ever been diagnosed as asthma as well as women who were on treatment of asthma. A study conducted in Oregon has also reported low participation of women with asthma in breast cancer screening which is consistent with our study [24]. Asthma is a condition that mostly found in women of families with lower income and low education level. Also screening rate in families with lower income as well as low education level is low. Women on treatment of stroke were associated with low participation in breast cancer screening, stroke cause serious disability so for people with stroke may not easily access health services due to the disability.

Socioeconomic status was associated with breast and cervical cancer screening. Our results indicate that being married or living with a partner increases the chance of being screened for breast and cervical cancer. A previous study ascribed the health difference to fiscal protection liked by married women without job [44]. The difference in screening uptake, away from other factors, may be due to the enjoyment made by couples away from their partners. Though, a longitudinal study may be able to well describe this alteration. The level of education was also found to determine the difference in breast and cervical cancer screening uptake in our study. Those who have received education higher than high school level were `likely to receive screening for breast and cervical cancer. Still, education is well known to be a significant determinant of health. In terms of screening, education level of an individual may impact the level of understanding of breast and cervical cancer and also the benefits of screening. The awareness is more likely to drive a person to accept and undergo screening.

A study conducted in Korea has shown inequalities in breast and cervical cancer screening [45], results from this study are consistent with our results. A study conducted in Britain has revealed inequalities in breast and cervical cancer screening [26] which is consistent with our study. Also, a study conducted in Italy have reported socio-economic disparities in uptake of breast and cervical cancer screening [46].

We did comparison of self-reported and directly measured prevalence of KNHANES 2012 for some prevalent chronic diseases presented in KNHANES 2012 report. The difference has been observed between self-reported and directly measured prevalence as the prevalence of hypertension was 33.3 % (for women aged 40 years and over) and 27.0% (for women aged 30 years and over) in self-reported measures and 25.4 % in directly measured. For dyslipidemia, the prevalence in self-reported was 17.6 % (for women aged 40 years and over) and 14.3% (for women aged 30 years and over), and the prevalence in directly measured was 16.4%. For diabetes mellitus, the prevalence in self-reported was 10.4% (for women aged 40 years and over) and 8.5 % (for women aged 30 years and over), and the prevalence in directly measured was 8.0% (**Table 26**).

The difference in prevalence between self-reported and directly measured maybe due to recall bias of self-reported measures. In self-reported, it included the women who have ever been diagnosed as chronic diseases but by the time of directly measured they may not have the disease. The directly measured are taken at one point of time and some chronic diseases vary by time, also some chronic diseases may vary in measures depending on position (like

hypertension), or depending on fasting status (like diabetes mellitus). The directly measured were not taken in hospital setting nor by physicians which could also cause the variation in measurement. The diagnosis of chronic diseases needs two or more direct measurements commonly. Thus the prevalence between self-reported and directly measured can be different.

**Table 26: Comparison between self-reported and directly measured prevalence for some chronic disease in KNHANES 2012**

Chronic disease	Self-reported in KNHANES 2012		Directly measured in KNHANES 2012
	Breast cancer screening (Aged 40 or over)	Cervical cancer screening (Aged 30 or over)	
Hypertension	33.28%	27.03%	25.4%
Dyslipidemia	17.6%	14.30%	16.4%
Diabetes mellitus	10.4%	8.47%	8.0%

We did also comparison between self-reported and directly measured prevalence of some prevalent chronic diseases (hypertension, dyslipidemia, osteoarthritis and diabetes mellitus) in KNHANES 2012 by age group. We found differences in prevalence, but still as were for KNHANES 2012 self-reported results, some chronic diseases (hypertension, dyslipidemia, osteoarthritis and diabetes mellitus) showed in KNHANES 2012 report were more prevalent in aged women (60 years and over) (Table 27). The difference in prevalence of chronic diseases by age maybe due to the difference in denominator between self-reported and directly measured. In self-reported, the denominator was women aged 30 years and over (for cervical cancer screening) and women aged 40 years and over (for breast cancer screening). In directly measures, they did not

specify the starting age. As were for self-reported, chronic diseases were most prevalent in women with low income level in directly measured.

**Table 27: Comparison between self-reported and directly measured prevalence by age for some chronic diseases in KNHANES 2012**

	Self-reported in KNHANES 2012		Directly measured in KNHANES 2012
	Breast cancer screening	Cervical cancer screening	
<b>Hypertension</b>			
<=30 years	-	-	29.80%
30 – 39 years	-	1.20%	3.20%
40 – 49 years	9.12%	9.12%	18.10%
50 – 59 years	21.14%	21.14%	30.40%
60 – 69 years	43.13%	43.13%	52.80%
>=70 years	59.60%	59.60%	71.60%
<b>Dyslipidemia</b>			
<=30 years	-	-	18.20%
30 – 39 years	-	0.69%	5.70%
40 – 49 years	3.68%	3.68%	10.40%
50 – 59 years	18.21%	18.21%	28.00%
60 – 69 years	26.80%	26.80%	31.20%
>=70 years	21.19%	21.19%	26.40%
<b>Osteoarthritis</b>			
<=30 years	-	-	
30 – 39 years	-	2.23%	19.30%
40 – 49 years	4.56%	4.56%	
50 – 59 years	19.91%	19.91%	6.70%
60 – 69 years	39.35%	39.35%	22.30%
>=70 years	46.03%	46.03%	36.70%
<b>Diabetes mellitus</b>			
<=30 years	-	-	9.10%
30 – 39 years	-	0.52%	2.00%
40 – 49 years	2.63%	2.63%	5.80%
50 – 59 years	6.94%	6.94%	9.50%
60 – 69 years	14.60%	14.60%	15.50%
>=70 years	17.38%	17.38%	21.50%

- **Strengths and limitations**

We used data from a large national survey, taking account of the survey's overall size to study a large number of chronic conditions and clarifying variables. This study is among few studies directing on participation in breast and cervical cancer screening of women with chronic diseases in Korea. Self-reported measures of chronic diseases status and the receipt of cancer screening were used and are subject to recall bias. However, some studies suggest that despite the fact that overestimation of adherence to cancer screening may occur, self-reporting may be the only effective and feasible way to gather data on preventive services uptake among large samples of the population [47]. Since our study was a cross-sectional survey, we were not able to identify exactly if chronic diseases were diagnosed before or after breast and cervical cancer screening. However, when we checked both of the lifelong screening rate and timely screening rate, the associations with chronic disease were almost similar in both breast and cervical cancer screening rates. We were unable to exclude women who had already cancers or other conditions to be diagnosed therefore we were not sure whether a test was for screening only or for a diagnostic purpose. Also we were unable to exclude women for whom screenings for cancers were no longer needed (e.g. women who have had a normal pap test for many years). Some data on screening participation and chronic diseases were missed. It was unknown whether women attended screening through national cancer screening programs or private programs.

## 5. Conclusion

Cancer screening is one of the important methods for cancer control, and it has demonstrated the effectiveness for cervical and breast cancer mortality reduction. Low participation in breast cancer screening was observed in women with diabetes mellitus, asthma and stroke. Low participation in cervical cancer screening has been observed in women with hypertension, osteoarthritis and diabetes mellitus. Higher participation in breast cancer screening has been found in women with dyslipidemia, depression, cancers and osteoarthritis. Higher participation in cervical cancer screening has been found in women with dyslipidemia and depression. Socioeconomic and behavior factors were also significantly associated with breast and cervical cancer screening participation as well as with chronic diseases. The results from this study may provide an important contribution for helping to maintain and increase participation in cancer screening of patients with chronic diseases. Educational programs need to be developed not only for the general population and healthcare professionals, but also for women with chronic diseases to increase and maintain the awareness of the importance of cancer screening services. To improve the participation rate for breast and cervical cancer screening, more attention should be given to women in low sociodemographic groups. Further investigation is needed to better understand breast and cervical cancer screening among women with chronic diseases and to design interventions that competently increase screening coverage in those groups.

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