RESEARCH ARTICLE

Prevalence, Awareness, Control, and Treatment of Hypertension and Diabetes in Korean Cancer Survivors: A Cross-Sectional Analysis of the Fourth and Fifth Korea National Health and Nutrition Examination Surveys

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Abstract

Background: Management of hypertension and diabetes in cancer survivors is an important issue; however, not much is known about the level of management of such chronic disease in Korea. This study therefore assessed the prevalence, awareness, control, and treatment of hypertension and diabetes in Korean cancer survivors compared to non-cancer survivors. Materials and Methods: A cross-sectional design was employed, wherein data were obtained from standardized questionnaires completed by 943 cancer survivors and 41,233 non-cancer survivors who participated in the Fourth and Fifth Korea National Health and Nutrition Examination Surveys (2007-2011). We calculated adjusted proportions for prevalence and management of hypertension and diabetes in non-cancer survivors and cancer survivors. We also assessed the associated factors with prevalence and management of cancer survivors. Results: Cancer survivors are more likely than the general population to have higher prevalence, awareness, treatment, and control of hypertension. However, diabetic management was not significantly higher in cancer survivors than in non-cancer survivors, despite their having a higher prevalence. Several factors, such as, age, drinking, years since cancer diagnosis, self-perceived health status, and specific cancer types were found to affect to management of hypertension and diabetes. Conclusions: These data suggest that cancer survivors appear to be better than non-cancer survivors at management of hypertension, but not diabetes. There is a need for healthcare providers to recognize the importance of long-term chronic disease management for cancer survivors and for the care model to be shared between primary care physicians and oncologists.

Keywords: Prevalence - awareness - control - treatment - hypertension - diabetes - cancer survivors - Korea

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Introduction

Five-year relative survival rates of cancer patients have been improving worldwide (Jung et al., 2011). In Korea, five-year relative survival rate in 2006 to 2010 was 64.1%. And, the prevalence of cancer was 1925.9 per 100,000 people in 2010 (National Center Information Center, 2011). With the increasing number of cancer survivors, evaluation and management of their chronic comorbid conditions have become important issues (Ogle et al., 2000). Hypertension is the most common comorbidity in cancer survivors, with a prevalence of 20%-65% (Ogle et al., 2000; Park et al., 2006; Shin et al., 2008; Braithwaite et al., 2009). Prevalence of hypertension at the time of cancer diagnosis is similar to that in the general population, however, the much higher rate is observed after treatment such as chemotherapy (Mouhayar et al., 2011). Compared with non-cancer survivors, cancer survivors also have higher rates of diabetes (Keating et al., 2005). The prevalence of diabetes is reported to range from 8% to 32% in cancer survivors, although it differs among study populations (Stava et al., 2007; Griffiths et al., 2012; Sanchez Peralta et al., 2012).

Several studies have also indicated that chronic illness such as hypertension or diabetes can affect the prognosis of cancer survivors. Inadequately controlled comorbidities tend to adversely affect health status or disability as well as cancer treatment in cancer survivors, and they have prognostic significance in relation to survival disparity (Muss et al., 1992; Hewitt et al., 2003). Although

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hypertension and diabetes accounted for a poorer prognosis among cancer survivors in a limited number of studies on certain types of cancers, hypertension was associated with all-cause survival disparity and poor prognosis in stomach, lung, and colon cancer (Park et al., 2006; Shin et al., 2008; Braithwaite et al., 2009), and diabetes was significantly associated with higher mortality and recurrence rates in cancer survivors (Richardson et al., 2005; Griffiths et al., 2012). Therefore, proper management of hypertension and diabetes is important for better survival and quality of life for cancer survivors.

Although some studies have examined the prevalence and factors associated with management of hypertension and diabetes in cancer survivors (Park et al., 2006; Baker et al., 2007; Braithwaite et al., 2009), little is known about the management, awareness, and control of hypertension and diabetes in cancer survivors based on population-level data. Therefore, this study assessed the prevalence, management, awareness, and control of hypertension and diabetes in cancer survivors, using data from the Korean National Health and Nutrition Examination Survey 2007-2009 (KNHANES IV) and 2010-2011 (KNHANES V).

Materials and Methods

Study population

We used the data of the KNHANES IV (2007-2009) and KNHANES V (2010-2011). These are nationwide surveys that represent the general Korean population and include comprehensive information on health status, health behavior, and sociodemographics. A stratified multistage probability sampling design was used. Face-to-face interviews were conducted at participants' homes by trained interviewers to gather health information. Each participant gave informed consent prior to inclusion in the studies. The initial sample for the present study comprised 42,176 candidates who completed both the health interview and health examination surveys. Of these, 943 cancer survivors were selected as the study population, and 41,233 non-cancer-survivors were selected as the controls. Because the survey data that we analyzed are publicly available, this study did not require the ethical approval of our Institutional Review Board.

Associated factors and definition of prevalence, awareness, control, and treatment of hypertension and diabetes

From the surveys, we collected information about various factors potentially associated with the prevalence, awareness, control, and treatment of hypertension and diabetes. The risk factors were divided into three groups: sociodemographic, behavioral, and clinical factors. The sociodemographic factors were current age (<65 years, and ≥65 years), sex, education level (more than college, middle/high school, and less than elementary school), household monthly income (≥ 3,010,000 won, 1,010,000 - 3,000,000 won, and ≤1,000, 000 won), area of residence (urban or rural), and health insurance types (medical assistance or none, government health insurance without private health insurance, government health insurance with private health insurance). Socioeconomic status and educational level were included as potential risk factors because these have previously been shown to be associated with a number of chronic diseases in previous studies (Bestehorn et al., 2011).

The behavioral risk factors included smoking status (nonsmoker, past smoker, current smoker), alcohol consumption (nondrinker or non-risky drinker, risky drinker), physical activity (inactive, inadequately active, active), body mass index (BMI), and self-perceived health status. Risky drinking was defined as alcohol consumption exceeding 3 standard drinks per day (Ganry et al., 2000). Physical activity was classified as follows: inactive group (no physical activity), active group (moderate physical activity for at least 30 min per day 5 days per week or vigorous physical activity for at least 20 min per day 3 days per week), and inadequately active group (exercised regularly but at levels that were less than sufficient) (Han et al., 2009). BMI was calculated in kilograms per meter squared, and the participants were divided into 2 categories: <25 and ≥25 kg/m^2. Self-perceived health status was classified in two levels according to responses to the question "How do you assess your own health status?" One level included the responses "very good," "good," and "fair," and the other level included the responses "poor" and "very poor." The clinical factors included all cancer types (gastric, hepatic, colon, breast, cervical, lung, thyroid, and other cancers), and time since cancer diagnosis (<5 years, 5-10 years, and >10 years). Hypertension was defined as an average systolic blood pressure (SBP) ≥140 mmHg and/or an average diastolic BP (DBP) ≥90 mmHg, and/or self-reported pharmacological treatment for hypertension. Blood pressure was measured in the sitting position with a mercury sphygmomanometer (Baumanometer; WA Baum Co Inc., New York, NY, USA) after a 5-min rest period. The subjects were asked to refrain from smoking for 30 minutes before the measurement. Three readings were taken at 30-s intervals, and the average of the latter two was used in the analysis (Korea National Health & Nutrition Examniation Survey, 2012). Among subjects with hypertension, awareness was defined as a self-report of any prior diagnosis of hypertension by a physician. Treatment of hypertension was defined as self-reported use of any antihypertensive medications more than 20 days in a month. Control of hypertension was defined according to recent guidelines as the lowering of BP levels to <140/90 mmHg. Diabetes was defined by either of the following conditions: (1) a measured fasting glucose of ≥126 mg/dL, or (2) the use of hypoglycemic medications or insulin. Subjects were instructed to finish meals by 7:00 P.M. the evening before blood sampling and to drink only water after 7:00 P.M. The next morning, 2 mL of blood was collected. On the same day, the blood samples were properly processed and transported in cold storage to the Central Testing Institute in Seoul, South Korea (Korea National Health & Nutrition Examniation Survey, 2012). Awareness of diabetes was defined as a self-report of any prior diagnosis of diabetes by a physician. Treatment of diabetes was defined as self-reported use of any antidiabetic medications or insulin. Control of diabetes was defined as the lowering of HbA1C levels to <6.5 (Korea National Health and Nutrition Examniation Survey, 2012).

Data analysis

We used a weighted population sample to reflect the sampling method and response rate. We calculated the estimated proportions and standard errors for basal characteristics related to management of chronic disease in non-cancer survivors and cancer survivors. The statistical significance of difference between groups according to cancer status was assessed using logistic regression. We calculated the adjusted proportions of prevalence, awareness, treatment, and control of hypertension and diabetes in non-cancer survivors vs. cancer survivors. In addition, we calculated adjusted odds ratios (aORs) using multivariate logistic regression for all cancer controls. The proportion and associated factors were obtained by adjusted for patient characteristics (age, sex, educational level, monthly income, residential area). The significance threshold was set at 0.05.

All estimates in the analysis were properly weighted to represent the general Korean population using a complex, multistage, probability sampling design. All statistical analyses were performed using STATA 10.0 (Stata Corp., College Station, TX, USA)

Results

General characteristics and prevalence, awareness, treatment, and control of hypertension and diabetes

Table 1 shows the baseline characteristics of the study population by cancer status. Non-cancer survivors and cancer survivors differed on almost all variables except monthly income, physical activity and health insurance types. The most common cancer type among all patients was gastric cancer. The most prevalent cancer types in men were gastric cancer, colon cancer, and liver cancer, whereas those in women were cervical cancer, breast cancer, and thyroid cancer. This distribution is a little different from data of Korea Central Cancer Registry. According to national statistics, the most prevalent cancers in all cancer patients are thyroid cancer, and in men are gastric and colon cancer, whereas those in women are thyroid and breast cancer (National Center Information Center, 2011). Of the cancer-survivor group, almost half (48.4%) had been diagnosed with cancer less than 5 years previously, some 64.0% were <65 years old, and 35.4% were men.

Table 1. Characteristics of Non-Cancer Survivors (N=41,233) *vs*. Cancer Survivors (n=943)

Variables		Total population Estimated proportion % (SE)	Non-cancer survivors Estimated proportion % (SE)	Cancer survivors Estimated proportion % (SE)	p value
Age (y)	<65	89.15 (0.26)	89.64 (0.25)	64.04 (1.88)	
	≥65	10.85 (0.26)	10.36 (0.25)	35.96 (1.88)	<0.05
Sex	Male	50.19 (0.25)	50.47 (0.26)	35.40 (1.97)	
	Female	49.81 (0.25)	49.53 (0.26)	64.60 (1.97)	<0.05
Education	≥college	24.07 (0.43)	24.18 (0.43)	18.36 (1.70)	
	Middle/high school	43.69 (0.41)	43.69 (0.41)	43.60 (1.97)	
	≤elementary school	32.24 (0.37)	32.13 (0.37)	38.04 (1.78)	<0.05
Monthly income	≥3,010	41.46 (0.73)	41.62 (0.73)	33.11 (2.13)	
(1000 KRW)	1,010-3,000	42.31 (0.64)	42.40 (0.64)	37.66 (2.12)	0.31
	≤1,000	16.23 (0.42)	15.99 (0.43)	29.23 (1.83)	<0.05
Area of residence	Urban	81.16 (1.29)	81.23 (1.29)	77.69 (1.96)	
	Rural	18.84 (1.29)	18.77 (1.29)	22.31 (1.96)	<0.05
Smoking	Non smoker	67.94 (0.36)	67.76 (0.37)	76.73 (1.70)	
	Past smoker	10.17 (0.21)	10.07 (0.21)	14.74 (1.43)	<0.05
	Current smoker	21.89 (0.32)	22.17 (0.32)	8.53 (1.17)	<0.05
Alcohol	Non	67.85 (0.46)	67.41 (0.47)	89.67 (1.55)	
	Risky drinking*	32.15 (0.46)	32.59 (0.47)	10.33 (1.55)	<0.05
Physical activity†	Inactive	74.24 (0.36)	74.19 (0.36)	76.78 (1.62)	
	Inadequately active	17.54 (0.28)	17.61 (0.28)	14.43 (1.38)	<0.05
	Active	8.22 (0.20)	8.21 (0.20)	8.79 (1.10)	0.81
BMI	<25	73.77 (0.30)	73.86 (0.29)	69.48 (1.94)	
	≥25	26.22 (0.30)	26.14 (0.29)	30.52 (1.94)	<0.05
Health insurance type	Medical assistance or none	3.59 (0.21)	3.54 (0.21)	2.78 (0.94)	
	Government HI without private HI	24.29 (0.41)	23.95 (0.41)	42.01 (2.05)	0.69
	Government HI with private HI	72.12 (0.45)	72.51 (0.46)	52.21 (2.10)	<0.05
Self-perceived	Very good/good/fair	83.74 (0.29)	84.27 (0.29)	56.96 (1.93)	
health status	Poor/very poor	16.26 (0.29)	15.73 (0.29)	43.04 (1.93)	<0.05
Cancer type	Others			32.34 (1.91)	
	Gastric			16.72 (1.50)	
	Hepatic			3.24 (0.71)	
	Colon			9.45 (1.19)	
	Breast			12.72 (1.35)	
	Cervical			14.18 (1.40)	
	Lung			2.01 (0.45)	
	Thyroid			8.95 (1.25)	
Time since cancer	<5 years			48.42 (2.61)	
diagnosis	5~10 years			24.58 (1.69)	
	≥10 years			26.99 (1.76)	

*Risky drinking is defined as consuming more than 3 standard drinks per day, † Physical activity was classified as inactive group (no physical activity), active group (moderate physical activity for at least 30 min per day 5 days per week or vigorous physical activity for at least 20 min per day 3 days per week) and inadequately active group, Abbreviations: BMI, body mass index; HI, health insurance, Data are weighted to the residential population of Korea

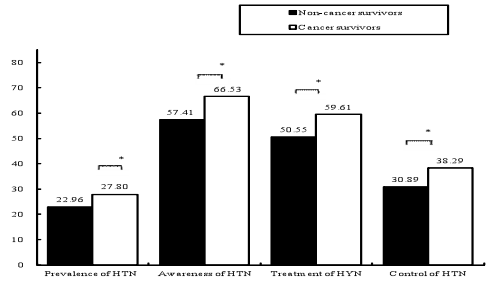

Figure 1. Adjusted Proportions of Prevalence, Awareness, Treatment, and Control of Hypertension Among Non-Cancer Survivors *vs.* Cancer Survivors. Adjusted for patient characteristics (age, sex, educational level, monthly income, residential area) *p <0.05

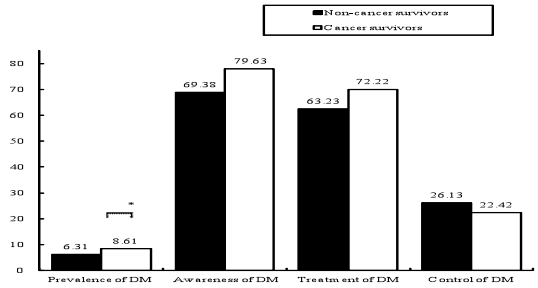

Figure 2. Adjusted Proportions of Prevalence, Awareness, Treatment, and Control of Diabetes Among Non-Cancer Survivors *vs.* Cancer Survivors. Adjusted for patient characteristics (age, sex, educational level, monthly income, residential area) *p<0.05

Table 2. Factors Associated with of Prevalence, Awareness, Treatment, and Control of Hypertension Rates Using Multivariate Logistic Regression Analysis Adjusted for Sociodemographic Factors

Variables	Prevalence aOR (95% CI)	Awareness aOR (95% CI)	Treatment aOR (95% CI)	Control aOR (95% CI)
Age (y)				
<65	1	1	1	1
≥65	3.18 (2.08-4.85)	2.67 (1.39-5.11)	2.01 (1.02-3.97)	1.56 (0.89-2.73)
Sex				
Male	1	1	1	1
Female	1.06 (0.72-1.57)	1.93 (0.98-3.77)	1.56 (0.84-2.90)	1.19 (0.68-2.09)
Education				
≥college	1	1	1	1
Middle/high school	1.61 (0.91-2.83)	1.16 (0.43-3.12)	1.41 (0.57-3.49)	0.90 (0.34-2.36)
≤elementary school	2.98 (1.64-5.41)	1.99 (0.75-5.32)	1.86 (0.73-4.73)	2.14 (0.44-2.97)
Monthly income (1000 KRW)				
≥3,010	1	1	1	1
1,010-3,000	0.88 (0.56-1.38)	0.96 (0.44-2.06)	1.36 (0.65-2.85)	0.88 (0.45-1.71)
≤1,000	0.89 (0.52-1.53)	0.82 (0.39-1.74)	1.12 (0.51-2.44)	0.91 (0.45-1.87)
Area of residence				
Urban	1	1	1	1
Rural	0.91 (0.60-1.39)	1.32 (0.63-2.78)	1.41 (0.73-2.74)	1.50 (0.87-2.59)
Smoking				
Non smoker	1	1	1	1
Past smker	0.83 (0.46-1.52)	1.09 (0.43-2.77)	1.46 (0.57-3.72)	2.22 (0.94-5.26)
Current smoker	1.05 (0.48-2.26)	0.55 (0.18-1.68)	0.65 (0.22-1.92)	2.37 (0.47-4.00)
Alcohol				
Non	1	1	1	1
Risky drinking*	1.34 (0.84-2.13)	0.59 (0.28-1.23)	0.54 (0.26-1.09)	0.42 (0.20-0.91)
Physical activity†				
Inactive	1	1	1	1
Inadequately active	1.23 (0.73-2.08)	0.80 (0.35-1.86)	0.73 (0.34-1.56)	1.49 (0.73-3.03)
Active	0.69 (0.35-1.36)	0.74 (0.24-2.29)	0.54 (0.19-1.53)	0.16 (0.05-0.52)
BMI				
<25	1	1	1	1
≥25	1.93 (1.28-2.90)	0.66 (0.36-1.24)	0.98 (0.55-1.77)	0.98 (0.60-1.58)
Health insurance type				
Medical assistance or none	1	1	1	1
Government HI without private HI	0.76 (0.37-1.63)	0.86 (0.23-3.23)	1.03 (0.31-3.47)	0.71 (0.25-1.97)
Government HI with private HI	0.57 (0.26-1.26)	0.71 (0.19-2.72)	0.82 (0.23-2.95)	0.44 (0.13-1.42)
Self-perceived health status				
Very good/good/fair	1	1	1	1
Poor/very poor	1.01 (0.71-1.44)	1.33 (0.70-2.52)	1.29 (0.72-2.31)	1.17 (0.67-2.03)
Cancer type				
Others	1	1	1	1
Gastric	0.50 (0.29-0.85)	0.75 (0.30-1.86)	0.56 (0.23-1.37)	0.66 (0.30-1.49)
Hepatic	0.72 (0.23-2.21)	0.64 (0.16-2.56)	0.34 (0.09-1.34)	0.82 (0.20-3.33)
Colon	0.42 (0.22-0.82)	5.77 (0.19-1.79)	0.49 (0.16-1.44)	0.93 (0.38-2.30)
Breast	0.88 (0.49-1.59)	0.90 (0.25-3.25)	0.59 (0.18-1.91)	0.57 (0.23-1.43)
Cervical	0.86 (0.49-1.51)	0.39 (0.13-1.14)	0.38 (0.14-1.00)	0.56 (0.24-1.31)
Lung	0.36 (0.11-1.14)	1.32 (0.19-9.22)	0.61 (0.08-4.40)	0.25 (0.03-2.19)
Thyroid	0.98 (0.52-1.86)	0.75 (0.21-2.68)	0.68 (0.21-2.24)	0.99 (0.33-3.01)
Time since cancer diagnosis				
<5 years	1	1	1	1
5~10 years	0.90(0.57-1.41)	0.78(0.35-1.74)	1.04(0.49-2.20)	0.64(0.31-1.33)
≥10 years	1.13(0.74-1.72)	0.51(0.26-1.00)*	0.57(0.30-1.09)	0.53(0.28-0.97)

All variables were adjusted for age, sex, educational status, monthly income, and residential area, Statistically significant results were written in bold

Table 3. Factors Associated with of Prevalence, Awareness, Treatment, and Control of Diabetes Rates Using Multivariate Logistic Regression Analysis Adjusted for Sociodemographic Factors

Variables	Prevalence aOR (95% CI)	Awareness aOR (95% CI)	Treatment aOR (95% CI)	Control aOR (95% CI)
Age (y)				
<65	1	1	1	1
≥65	4.78 (2.65-8.62)	2.34 (0.92-5.93)	3.05 (1.21-7.69)	0.58 (0.19-1.78)
Sex				
Male	1	1	1	1
Female	0.95 (0.57-1.58)	0.61 (0.14-2.70)	0.85 (0.22-3.33)	0.39 (0.14-1.12)
Education				
≥college	1	1	1	1
Middle/high school	1.59 (0.66-3.85)	1.48 (0.12-17.79)	2.79 (0.46-16.92)	5.89 (0.72-48.15)
≤elementary school	1.98 (0.79-4.96)	0.94 (0.09-9.55)	1.97 (0.29-13.19)	9.45 (0.92-96.86)
Monthly income (1000 KRW)				
≥3,010	1	1	1	1
1,010-3,000	0.46 (0.25-0.85)	5.51 (1.13-28.88)	3.88 (1.00-15.02)	0.30 (0.06-1.48)
≤1,000	0.61 (0.31-1.17)	1.41 (0.43-4.62)	1.06 (0.34-3.27)	0.88 (0.17-4.56)
Area of residence				
Urban	1	1	1	1
Rural	0.84 (0.50-1.44)	1.21 (0.33-4.38)	1.39 (0.42-4.62)	0.70 (0.17-2.84)
Smoking				
Non smoker	1	1	1	1
Past smoker	1.80 (0.88-3.66)	1.0 (0.17-10.12)	0.66 (0.14-3.15)	0.81 (0.21-3.14)
Current smoker	1.40 (0.59-3.35)	0.25 (0.04-1.58)	0.33 (0.07-1.61)	0.29 (0.06-1.33)
Alcohol				
Non	1	1	1	1
Risky drinking*	0.97 (0.50-1.90)	0.41 (0.09-1.78)	0.65 (0.17-2.53)	0.46 (0.13-1.64)
Physical activity†				
Inactive	1	1	1	1
Inadequately active	1.68 (0.83-3.38)	2.24 (0.28-18.17)	1.95 (0.45-8.46)	1.49 (0.31-7.16)
Active	0.71 (0.27-1.84)	0.82 (0.14-4.77)	0.74 (0.12-4.49)	0.57 (0.08-4.05)
BMI				
<25	1	1	1	1
≥25	2.46 (1.49-4.07)	0.28 (0.09-0.91)	0.43 (0.15-1.26)	0.88 (0.30-2.60)
Health insurance type				
Medical assistance or none	1	1	1	1
Government HI without private HI	0.70 (0.30-1.62)	N/A	N/A	1.10 (0.20-6.25)
Government HI with private HI	0.51 (0.20-1.27)	N/A	N/A	1.11 (0.15-8.17)
Self-perceived health status				
Very good/good/fair	1	1	1	1
Poor/very poor	2.05 (1.21-3.47)	2.60 (0.88-7.73)	2.72 (1.14-6.47)	2.51 (0.80-7.87)
Cancer type				
Others	1	1	1	1
Gastric	0.43 (0.21-0.89)	1.94 (0.12-32.15)	4.23 (0.33-54.82)	5.50 (1.13-26.75)
Hepatic	2.70 (0.78-9.43)	N/A	3.78 (0.15-96.09)	10.73 (1.33-86.63)
Colon	1.47 (0.61-3.53)	0.21 (0.03-1.25)	0.21 (0.04-1.04)	0.38 (0.06-2.52)
Breast	0.51 (0.21-1.23)	0.98 (0.08-12.22)	0.47 (0.09-2.49)	4.05 (0.64-25.73)
Cervical	0.96 (0.44-2.10)	0.53 (0.14-2.02)	0.71 (0.14-3.44)	0.19 (0.02-2.16)
Lung	2.03 (0.54-7.60)	0.44 (0.02-10.84)	1.6 (0.05-24.83)	N/A
Thyroid	0.96 (0.32-2.92)	0.04 (0.02-0.70)	0.15 (0.01-1.61)	16.57 (1.42-193.50)
Time since cancer diagnosis				
<5 years	1	1	1	1
5~10 years	1.01 (0.55-1.84)	0.69 (0.14-3.37)	0.71 (0.15-3.28)	0.52 (0.13-2.02)
≥10 years	1.63 (0.91-2.91)	1.09 (0.26-4.77)	0.70 (0.20-2.42)	1.18 (0.39-3.63)

All variables were adjusted for age, sex, educational status, monthly income, and residential area, Statistically significant results were written in bold

Adjusted proportions of prevalence, awareness, treatment, and control of hypertension and diabetes among non-cancer survivors vs cancer survivors

With regard to hypertension, the adjusted proportions for age, sex, educational level, monthly income, and residential area in non-cancer survivors and cancer survivors are as follows: prevalence, 22.96% and 27.80%; awareness, 57.41% and 66.53%; treatment, 50.55% and 59.61%; and control of hypertension, 30.89% and 38.29% respectively (all p<0.05) (Figure 1). And with regard to diabetes, the adjusted proportions in non-cancer survivors and cancer survivors are as follows; prevalence, were 6.31% and 8.61% (p<0.05); awareness, 69.38% and 79.63% (p=0.08); treatment, 63.23% and 72.22% (p=0.15); and control of diabetes, 26.13% and 22.42% (p=0.43) (Figure 2).

Factors associated with prevalence, awareness, treatment, control of hypertension and diabetes

Prevalence of hypertension was significantly higher in elderly group, lower educational group, higher BMI group, and significantly lower in specific cancer types such as gastric and colon cancer. Awareness and treatment of hypertension were also higher in elderly group. Control of hypertension was statistically lower in risky drinking group, active exercise group, and loner time since cancer diagnosis (Table 2). The prevalence of diabetes was higher in elderly group, high BMI group, and group with

poor/very poor self-perceived health status. Awareness of hypertension was lower in higher BMI group, and in specific cancer type such as thyroid cancer type .Treatment of diabetes was associated with elderly group, and group with poor/very poor self-perceived health status. Control of diabetes was higher in specific cancer types such as gastric, hepatic and thyroid cancer (Table 3).

Discussion

To our knowledge, this is the first study to compare prevalence, awareness, treatment, and control of hypertension and diabetes between cancer survivors and the general population, using a population-level sample. Our results indicate that compared with the general population, cancer survivors are more likely to have a higher prevalence and management of hypertension. However, diabetes management among cancer survivors was not significantly higher than among non-cancer survivors, although the prevalence of diabetes in the former was higher than in non-cancer survivors.

Previous studies found no significant difference in the prevalence of hypertension between cancer survivors and non-cancer survivors (Enright et al., 2010),slightly higher prevalence in cancer survivors according to cancer types (Shin et al., 2008; Weaver et al., 2013), or specific treatment methods (Jain et al., 2007; Valentova et al., 2011). Hypertension was the most frequent comorbid condition treated in cancer survivors (Goytia et al., 2009), and there is a widespread need for the management of chronic diseases and related risk factors to reduce the late adverse effects of chemotherapy and radiation (Daher et al., 2012). In general, cancer survivors are known to have better behaviors related to hypertension management, as we found. Cancer survivors were more likely to report medication adherence, measurement for blood pressure, and good perceived control of hypertension (Shin et al., 2012a). Furthermore, cancer survivors are considered engage more actively than the general population in other health-promotion behaviors. For example, cancer survivors were more likely than individuals without a cancer history to obtain screening examinations and to engage in other preventive actions such as influenza vaccination (Earle et al., 2003; Cho et al., 2010), and also exhibit higher adherence to diets to prevent cancer or high blood pressure (Kim et al., 2012).

No statistically significant difference was found in the management of diabetes between cancer survivors and non-cancer survivors, although the prevalence of diabetes in cancer survivors was known to be higher than in non-cancer survivors, and the incidence of secondary primary cancer (Chen et al., 2013), and mortality rate were increased in cancer survivors with diabetes (Chiou et al., 2012; Bella et al., 2013). Previous research reported a higher prevalence of diabetes and suboptimal glycemic control in cancer survivors compared to non-cancer survivors, and this varied by cancer types (Stava et al., 2007; Karlin et al., 2012). The reasons for this difference are not clear, but some studies have indicated that cancer treatment such as chemotherapy and cancer-related symptoms could have a negative impact on diabetes management (Hershey et al., 2012). In addition, many medications used in cancer treatment or organ failure in advanced cancer patients can have an effect on glycemic control. Typically, glucocorticoids used for symptom control can evoke marked hyperglycemia. The development of hepatic and renal failure affects the mechanism of hypoglycemic agents (Poulson et al.,1997). Further research will be needed to evaluate factors affecting the management of diabetes and interventions for better management of diabetes in cancer survivors.

Several factors, such as, age, drinking, years since cancer diagnosis, self-perceived health status, and specific cancer types were found to affect to management of hypertension and diabetes.

Elderly cancer survivors were more likely to have adequate compliance of hypertension and diabetes. This result was not consistent with previous study. Previous study indicated that younger cancer survivors could have good antihypertensive medication adherence due to stronger social support, or good physical function (Shin et al., 2010). This result may be due to a lot of time to focus health care and higher concerns to management of chronic disease after retirement in elderly population.

Risk drinkers were found to have a poor management of hypertension. There were few data of drinking and management of chronic diseases of cancer survivors. However, excessive alcohol is included as behavioral factors associated with poor control of blood pressure in general population (Hackam et al., 2010; Briet et al., 2013). Many previous studies have documented dependent relationship between alcohol intake and blood pressure, independent of other risks factors (Koliaki et al., 2013). Cancer survivors, like as general population, should be focus to restrict alcohol for one of method in management of hypertension.

Longer time since cancer diagnosis was associated with poor control of hypertension. There were few studies about relationship time since cancer diagnosis and control of hypertension. However, earlier time since cancer diagnosis could be associated with frequent visit to hospital, so it could be a motivation to control of diseases.

This study has revealed a significant difference between cancer survivors' self-perceived health status and their prevalence and treatment of diabetes. The general population who self-perceived their health as poor reported more diabetes (Barreto et al., 2009). However, this result was not consistent with previous data to general population (Kartal et al., 2011). This study didn't reveal the relationship between treatment of diabetes and who self-perceived their health in cancer survivors. Poor who self-perceived their health can act as a driven force to treat diabetes with their cancer illness.

The control of diabetes among cancer survivors was significantly higher in gastric cancer, hepatic cancer and thyroid cancer. Previous study didn't show the difference across cancer types (Karlin et al., 2012). Various treatments received by cancer survivors, such as GI tract loss by surgery, chemotherapy or steroid use, will have a significant impact to control of diabetes. It is difficult to understand various characteristics in the management of chronic disease or health behavior according to cancer

types. Perhaps these differences could be explained by the characteristics of the etiology of cancer and the characteristics of cancer itself. Other sociodemographic, clinical, and behavioral factors can affect the management of chronic disease, and disease-management models are complex.

Because the number of cancer survivors with long-term survival after a diagnosis of cancer has increased, the management of chronic diseases affecting the health of cancer survivors is important. In particular, utilizing a shared care model is known to improve the management of complex health issues. Joint care management involving primary care and specialty care physicians (Gerber et al., 2012) requires the care provider to play a more active role than simply making referrals to specialists by an education program or information exchange (Smith et al., 2008). Through this model, primary care physicians and specialists share responsibility for a cancer survivor's care by monitoring and sharing skills or knowledge to achieve optimal care. Typically, the oncologist deals mainly with issues related to the cancer, with less emphasis on other health problems (Shin et al., 2012b). However, many cancer survivors want to share their cancer follow-up with primary care physicians and are appropriately cared for by secondary care specialists (Hall et al., 2011). This shared care model enables good communication and effective information exchange between the primary care physician and specialists (Madarnas et al., 2011).

Although we determined the prevalence, awareness, treatment, and control of hypertension and diabetes in cancer survivors, this study has several limitations that should be considered. First, because much of the information was collected from self-reported questionnaires, the possibility of reporting bias cannot be excluded. Second, we unfortunately could not evaluate the types of treatment or cancer staging for cancer survivors included in our study, which may have influenced the results. Therefore, this study could not provide detailed reasons for a difference in management in cancer survivors compared to non-cancer survivors or cancer types. Future research will be required for more specific investigation of the mechanisms of better management of hypertension or diabetes in cancer survivors or according to cancer types. Finally, this study did not examine physician-patient interaction, which could be a significant factor in health-related behaviors such as medication adherence (Roumie et al., 2011).

This study sheds light on the management status of hypertension and diabetes as representative chronic diseases among cancer survivors. Despite the higher prevalence of chronic diseases in cancer survivors, they did not appear to show better management of chronic diseases, especially for diabetes, compared to the general population. Cancer survivors are now living longer and are sharply increasing in number; thus, we need to recognize health-related behaviors of survivors and long-term health effects, and to develop targeted behavioral interventions that can help cancer survivors manage comorbid conditions as well as cancer and its treatment. Healthcare providers can play an especially critical role in maintenance of positive health behaviors and management of hypertension and diabetes to prevent long-term complications and minimize the risk for chronic disease.

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