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Prevalence and mortality of congenital heart disease in Korean adults

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Abstract

The aim of this study was to assess the age-standardized prevalence (prevalence) and age-standardized mortality (mortality) of congenital heart disease (CHD) by sex in Korean adults. Data were collected from the National Health Insurance Service in Korea from 2006 through 2016. The data consisted of main and secondary diagnoses related to CHD. We calculated the prevalence and mortality of CHD in adults with the direct method using the estimated Korean population in 2015 as the reference. The prevalence of CHD in Korean adults increased from 35.8 cases per 100,000 persons in 2006 to 65.6 cases in 2015. In 2015, the prevalence in the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group was 54.6, 69.6, and 95.1 cases, respectively. Among women, the prevalence was 34.3 and 31.3 cases in men. The mortality of CHD in adults decreased from 3.061 persons per 100,000 persons in 2007 to 0.551 persons in 2015. The 5-year survival rate (SR) for people with CHD was 0.92 (95% confidence interval [CI] 0.91–0.93). The 5-year SR for the 20- to 44- and 45- to 64-year-old groups was more than 0.95; however, the 5-year SR of the older than 65 years group was only 0.73 (95% CI 0.72–0.74). The prevalence of CHD in Korean adults increased and the related mortality decreased during a decade. The 5-year SR of CHD for those over 65 years was lower than that for younger age groups.

Abbreviations: ASD = atrial septal defect, CHD = congenital heart disease, CI = confidence interval, ICD x = the xth revision of the International Statistical Classification of Diseases and Related Health Problems (x is number), SR = survival rate, VSD = ventricular septal defect.

Keywords: adults, congenital heart disease, mortality, prevalence, survival rates

1. Introduction

The population of adults with congenital heart disease (CHD) has dramatically increased during the past few decades in developed Western countries[1,2] because of early detection of CHD and increased survival of neonate and infant patients made possible by rapid progress in pediatric cardiology, cardiac surgery, anesthesia, and intensive care.[3] CHD surgery in the young became more in Korea common in 1980s, and the number of adult patients with CHD thus is expected to have increased. Previous studies have shown the distribution of CHD in adult patients who were diagnosed when they were young.[4,5] However, few studies have reported the overall distribution of adult patients with CHD, including patients who were not diagnosis in childhood, and few studies have evaluated the prevalence and mortality of CHD using adult national health data. Therefore, our aim in this study was to assess the overall prevalence of CHD in Korean adults, considering sex differences, using Korean National Health Insurance Service data from 2006 to 2015. We also show mortality and survival rates (SRs) for patients newly diagnosed with CHD from 2007 to 2015.

2. Methods

2.1. Study population

We collected data from Korean National Health Insurance[6] benefit records from 2006 to 2015, excluding records for medical aid. Data in the National Health Insurance benefit records represent each patient's first diagnosis in that year. CHD diagnoses were extracted from the records after considering the data given for the primary and secondary diagnoses, which depended on the complaint and symptoms. The National Health Insurance benefit records do not contain information confirming diagnoses or describing treatments at medical institutes. Therefore, the final diagnoses could differ from the diagnoses in the data. In this study, we used death data for Koreans from 2007 to 2016.

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2.2. Diagnosis

As shown in Table 1, the data contain primary and secondary diagnoses related to CHD according to the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD 10). There are 2 types of CHD. Acyanotic CHD comprises

congenital ventricular and/or atrial septal defects, including ventricular septal defect (VSD) (Q21.0, Q21.00, Q21.01, Q21.08, Q21.09), atrial septal defect (ASD) (Q21.1, Q21.10, Q21.11, 21.18, Q21.19), atrioventricular septal defects (Q21.2), and congenital malformation of the cardiac septum, unspecified (Q21.9);
patent ductus arteriosus (Q25.0);
pulmonary artery stenosis (Q22.1, Q25.6);
coarctation of aorta (Q25.1);
pulmonary venous connection (Q26.2, Q26.3, Q26.4);
congenital tricuspid stenosis (Q22.4, Q22.8, Q22.9);
congenital stenosis of aortic valve (Q23.0);
congenital insufficiency of aortic valve (Q23.1);
congenital mitral stenosis (Q23.2, Q23.3);
malformation of coronary vessels (Q24.5, Q24.8, Q24.9); and
stenosis or malformation of aorta (Q24.4, Q25.2, Q25.3, Q25.4, Q25.8, Q25.9).

Cyanotic CHD comprises Tetralogy of Fallot (Q21.3), Ebstein anomaly (Q22.5), transposition of great arteries (Q20.3, Q20.5), Eisenmenger syndrome (Q21.81, I21.81), double outlet right ventricle (Q20.1), and single ventricle (Q20.4). The reason for classifying the 2 types of CHD, acyanotic, and cyanotic is that symptoms of acyanotic CHD can range from asymptomatic to

Table 1

Composition of acyanotic and cyanotic congenital heart disease.

Variables	ICD 10	Congenital heart disease*
Acyanotic congenital heart disease		
Congenital ventricular and/or atrial septal defect	Q21.0	Ventricular septal defect
	Q21.00	Muscular ventricular septal defect
	Q21.01	Perimembranous ventricular septal defect
	Q21.08	Other ventricular septal defect
	Q21.09	Ventricular septal defect, unspecified
	Q21.10	Patent or persistent foramen ovale
	Q21.11	Sinus venosus defect
	Q21.18	Other artrial septal defect
	Q21.19	Atrial septal defect, unspecified
	Q21.1	Atrial septal defect
	Q21.2	Artrioventricular septal defect
	Q21.9	Congenital malformation of cardiac septum, unspecified
Patent ductus arteriosus	Q25.0	Patent ductus arteriosus
Pulmonary artery stenosis	Q22.1	Congenital pulmonary valve stenosis
	Q25.6	Stenosis of pulmonary artery
Coarctation of aorta	Q25.1	Coarctation of aorta
Pulmonary venous connection	Q26.2	Total anomalous pulmonary venous connection
	Q26.3	Partial anomalous pulmonary venous connection
	Q26.4	Anomalous pulmonary venous connection, unspecified
Congenital tricuspid stenosis	Q22.4	Congenital tricuspid stenosis
	Q22.8	Other congenital malformations of tricuspid valve
	Q22.9	Congenital malformation of tricuspid valve, unspecified
Congenital stenosis of aortic valve	Q23.0	Congenital stenosis of aortic valve
Congenital insufficiency of aortic valve	Q23.1	Congenital insufficiency of aortic valve
Congenital mitral stenosis	Q23.2	Congenital mitral stenosis
	Q23.3	Congenital mitral insufficiency
Malformation of coronary vessels	Q24.5	Malformation of coronary vessels
	Q24.8	Other specified congenital malformation of heart
	Q24.9	Congenital malformation of heart, unspecified
Stenosis or malformation of aorta	Q24.4	Congenital subaortic stenosis
	Q25.2	Atresia of aorta
	Q25.3	Stenosis of aorta
	Q25.4	Other congenital malformation of aorta
	Q25.8	Other congenital malformation of great arteries
	Q25.9	Congenital malformation of great arteries, unspecified
Cyanotic congenital heart disease		
Tetralogy of Fallot	Q21.3	Tetralogy of Fallot
Ebstein anomaly	Q22.5	Ebstein anomaly
Transposition of great arteries	Q20.3	Transposition of great arteries
	Q20.5	Corrected transposition of great vessels
Eisenmenger syndrome	Q21.8	Eisenmenger defect
	I27.8	Eisenmenger complex syndrome
Double outlet right ventricle	Q20.1	Double outlet right ventricle
Single ventricle	Q20.4	Single ventricle

* ICD 10 codes of congenital heart disease are Q20, Q21, Q22, Q23, Q24, Q25, and Q26.

severe, whereas the symptoms of cyanotic CHD can be mostly seen as soon as baby is born or during infancy. Because ICD 10 code Q21.0 (VSD or ASD) was subdivided in 2011, we ran additional analyses for the age-standardized prevalence and mortality of VSD (Q21.00, Q21.01, Q21.08, Q21.09) and ASD (Q21.11, Q21.10, Q21.18, Q21.19, Q21.2) from 2011 to 2015.

2.3. Statistical methods

We calculated the age-standardized prevalence of CHD in adults with the direct method[7] using the beneficiaries of health insurance from the Korean National Health Insurance Statistical Yearbook from 2006 to 2015 as the patients and the estimated Korean population in 2015 as the reference.[8] We washed out the first year (2006) for newly detected cases to see the age-standardized mortality of newly diagnosed CHD from 2007 to 2015. The Kaplan–Meier method was also used to compare survival among patients with CHD by age group and sex using log-rank tests.

2.4. Ethics

This study protocol was exempted by the Institutional Review Board of Samsung Medical Center (IRB File No: 2017-02-032).

3. Results

3.1. Prevalence of CHD in Korean adults

Table 2 shows the age-standardized prevalence of CHD in Korean adults, which was 35.8 cases in 2006 and 65.6 cases in 2015. The age-standardized prevalence for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group increased from 28.3 cases, 31.4 cases, and 45.5 cases, respectively, in 2006 to 54.6 cases, 69.6 cases, and 95.1 cases in 2015. The age-standardized prevalence in women increased from 21.5 cases in 2006 to 34.3 cases in 2015; in men, it rose from 14.2 cases in 2006 to 31.3 cases in 2015 (Table 2 and Supplementary [Supp.] Table 1, http://links.lww.com/MD/C325). The age-standardized prevalence of congenital ventricular and/or atrial septal defects in Korean adults increased from 21.2 cases in 2006 to 31.7 cases in 2015. The age-standardized prevalence for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group was 25.7 cases, 34.8 cases, 44.7 cases, respectively, in 2015. The age-standardized prevalence was 17.9 cases for women and 13.7 cases for men in 2015 (Table 2 and Supp. Table 1-1, http://links.lww.com/MD/C325). We also showed the age-standardized prevalence of VSD (Supp. Table 1-1-1, http://links.lww.com/MD/C325) and ASD (Supp. Table 1-1-2, http://links.lww.com/MD/C325) in Korean adults from 2011 to 2015. The age-standardized prevalence of patent ductus arteries in Korean adults increased from 1.94 cases in 2006 to 2.68 cases in 2015 (Table 2 and Supp. Table 1–2, http://links.lww.com/MD/C325). The age-standardized prevalence of pulmonary artery stenosis in Korean adults increased from 0.41 cases in 2006 to 0.74 cases in 2015 (Table 2 and Supp. Table 1–3, http://links.lww.com/MD/C325). The age-standardized prevalence of Coarctation of aorta in Korean adults increased from 0.27 cases in 2006 to 0.58 cases in 2015 (Table 2 and Supp. Table 1–4, http://links.lww.com/MD/C325). The age-standardized prevalence of pulmonary venous connection in Korean adults increased from 0.05 cases in 2006 to 0.16 cases in 2015 (Table 2 and Supp. Table 1–5, http://links.lww.com/MD/C325). The age-standardized prevalence of congenital tricuspid stenosis in Korean adults was 0.25 cases in 2006 and 0.21 cases in 2015 (Table 2 and Supp. Table 1–6, http://links.lww.com/MD/C325). The age-standardized prevalence of congenital stenosis of aortic valve in Korean adults was 0.34 cases in 2006 and 0.50 cases in 2015 (Table 2 and Supp. Table 1–7, http://links.lww.com/MD/C325). The age-standardized prevalence of congenital insufficiency of aortic valve in Korean adults increased from 0.91 cases in 2006 to 6.51 cases in 2015 (Table 2 and Supp. Table 1–8, http://links.lww.com/MD/C325). The age-standardized prevalence of congenital mitral stenosis in Korean adults was 0.63 cases in 2006 and 0.46 cases in 2015 (Table 2 and Supp. Table 1–9, http://links.lww.com/MD/C325). The age-standardized prevalence of malformation of coronary vessels in Korean adults increased from 2.58 cases in 2006 to 9.07 cases in 2015 (Table 2 and Supp. Table 1–10, http://links.lww.com/MD/C325). The age-standardized prevalence of stenosis or malformation of aorta in Korean adults increased from 0.96 cases in 2006 to 1.95 cases in 2015 (Table 2 and Supp. Table 1–11, http://links.lww.com/MD/C325). The age-standardized prevalence of Tetralogy of Fallot in Korean adults increased from 1.32 cases in 2006 to 3.12 cases in 2015 (Table 2 and Supp. Table 1–12, http://links.lww.com/MD/C325). The age-standardized prevalence of Ebstein anomaly in Korean adults increased from 0.60 cases in 2006 to 1.04 cases in 2015 (Table 2 and Supp. Table 1–13, http://links.lww.com/MD/C325). The age-standardized prevalence of transposition of great arteries in Korean adults increased from 0.38 cases in 2006 to 0.83 cases in 2015 (Table 2 and Supp. Table 1–14, http://links.lww.com/MD/C325). The age-standardized prevalence of Eisenmenger syndrome in Korean adults increased from 1.38 cases in 2006 to 1.81 cases in 2015; the 2015 age-standardized prevalence for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group was 1.49 cases, 1.75 cases, and 3.05 cases, respectively, and was 1.11 cases for women and 0.70 cases for men (Table 2 and Supp. Table 1–15, http://links.lww.com/MD/C325). In additional analysis, in 2015, the age-standardized prevalence of primary pulmonary hypertension (main diagnoses; ICD 10 code: I27.0 and I27.2) in Korean adults was 4.64 persons; for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group, it was 2.33 persons, 5.06 persons, and 14.9 persons, respectively, and was 3.24 persons for women and 1.39 persons for men (Supp. Table 1-15-1, http://links.lww.com/MD/C325). The age-standardized prevalence of double outlet right ventricle in Korean adults increased from 0.19 cases in 2006 to 0.48 cases in 2015 (Table 2 and Supp. Table 1–16, http://links.lww.com/MD/C325). The age-standardized prevalence of single ventricle in Korean adults increased from 0.14 cases in 2006 to 0.65 cases in 2015 (Table 2 and Supp. Table 1–17, http://links.lww.com/MD/C325).

3.2. Mortality and SR for patients newly diagnosed with CHD

Table 2 also shows the age-standardized mortality of adult CHD. The age-standardized mortality of CHD in Korean adults was 3.061 persons in 2007 and 0.551 persons in 2015. The age-standardized mortality for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group was 0.066, 0.292, and 2.527 persons, respectively, in 2015. The age-standardized mortality was 0.296 persons for women and 0.245 persons for men in 2015 (Table 2 and Supp. Table 2, 2-1 to 2-17, http://links.lww.com/MD/C325).

Table 2

Age-standardized prevalence and mortality of congenital heart disease in adults between 2006 and 2015 (per 100,000).

	Prevalence				Mortality			
	2006		2015		2007		2015	
	n	Prevalence (95% CI)	n	Prevalence (95% CI)	n	Mortality (95% CI)	n	Mortality (95% CI)
Congenital heart disease								
All	49,010	100.8 (99.9–101.7)	85,188	167.5 (166.4–168.7)	1509	3.703 (3.512–3.894)	593	1.184 (1.089–1.279)
Adults	11,193	35.8 (35.1–36.4)	26,917	65.6 (64.8–66.4)	833	3.061 (2.850–3.272)	216	0.551 (0.477–0.624)
20–44 y	5746	28.3 (27.5–29.0)	10,332	54.6 (53.5–55.6)	144	0.715 (0.598–0.832)	13	0.066 (0.029–0.103)
45–64 y	3593	31.4 (30.4–32.4)	10,665	69.6 (68.3–70.9)	213	1.795 (1.554–2.037)	45	0.292 (0.206–0.378)
Over 65 y	1854	45.5 (43.4–47.5)	5920	95.1 (92.7–97.5)	476	10.83 (9.863–11.81)	158	2.527 (2.131–2.922)
Women	24,713	51.5 (50.9–52.2)	42,552	83.8 (83.0–84.6)	816	2.034 (1.891–2.177)	293	0.586 (0.519–0.653)
Adults	6642	21.5 (21.0–22.0)	14,046	34.3 (33.7–34.9)	457	1.715 (1.556–1.874)	116	0.296 (0.242–0.350)
20–44 y	3204	15.7 (15.2–16.3)	5114	27.0 (26.2–27.7)	66	0.327 (0.248–0.406)	6	0.027 (0.002–0.053)
45–64 y	2275	19.9 (19.0–20.7)	5474	35.7 (34.7–36.6)	94	0.791 (0.630–0.952)	23	0.146 (0.084–0.207)
Over 65 y	1163	28.5 (26.9–30.1)	3458	55.5 (53.7–57.4)	297	6.758 (5.989–7.528)	87	1.385 (1.091–1.679)
Men	24,297	49.2 (48.6–49.8)	42,636	92.1 (91.3–92.9)	693	1.668 (1.541–1.795)	300	0.596 (0.528–0.663)
Adults	4551	14.2 (13.8–14.6)	12,871	31.3 (30.7–31.8)	376	1.346 (1.208–1.484)	100	0.254 (0.204–0.304)
20–44 y	2542	12.5 (12.0–13.0)	5218	27.5 (26.8–28.3)	78	0.382 (0.296–0.468)	7	0.033 (0.005–0.060)
45–64 y	1318	11.5 (10.9–12.1)	5191	33.8 (3239–34.8)	119	1.004 (0.823–1.185)	22	0.139 (0.079–0.199)
Over 65 y	691	16.9 (15.6–18.2)	2462	39.5 (37.9–41.1)	179	4.079 (3.482–4.677)	71	1.126 (0.861–1.391)
Acyanotic								
Congenital ventricular and/or atrial septal defects								
All	26,793	55.2 (54.8–56.2)	43,778	86.0 (85.2–86.8)	76	0.173 (0.133–0.213)	113	0.225 (0.184–0.267)
Adults	6660	21.2 (20.6–21.7)	12,999	31.7 (31.1–32.2)	40	0.134 (0.091–0.178)	55	0.138 (0.101–0.175)
20–44 y	3444	16.9 (16.3–17.5)	4881	25.7 (25.0–26.5)	12	0.055 (0.021–0.089)	6	0.027 (0.002–0.053)
45–64 y	2197	19.2 (18.4–20.3)	5331	34.8 (33.8–35.7)	13	0.106 (0.046–0.166)	14	0.086 (0.038–0.134)
Over 65 y	1019	25.0 (23.4–26.5)	2787	44.7 (43.1–46.5)	15	0.334 (0.161–0.507)	35	0.548 (0.361–0.734)
Women	14,038	29.4 (28.9–29.9)	23,311	45.8 (45.2–46.4)	39	0.087 (0.059–0.116)	61	0.120 (0.090–0.151)
Adults	4098	13.2 (12.7–13.6)	7360	17.9 (17.5–18.3)	18	0.060 (0.030–0.090)	30	0.074 (0.046–0.101)
20–44 y	1992	9.80 (9.37–10.2)	2671	14.1 (13.5–14.6)	4	0.016 (0.000–0.036)	3	0.011 (0.000–0.029)
45–64 y	1464	12.8 (12.1–13.4)	2962	19.3 (18.6–20.0)	7	0.053 (0.009–0.097)	9	0.053 (0.014–0.091)
Over 65 y	642	15.7 (14.5–16.9)	1727	27.7 (26.4–29.0)	7	0.152 (0.034–0.270)	18	0.289 (0.155–0.422)
Men	12,755	26.0 (25.5–26.5)	20,467	40.2 (39.6–40.7)	37	0.083 (0.055–0.111)	52	0.102 (0.074–0.131)
Adults	2562	7.99 (7.67–8.31)	5639	13.7 (13.3–14.0)	22	0.070 (0.039–0.101)	25	0.061 (0.036–0.086)
20–44 y	1452	7.15 (6.78–7.51)	2210	11.6 (11.1–12.1)	8	0.038 (0.011–0.066)	3	0.011 (0.000–0.029)
45–64 y	733	6.41 (5.94–6.87)	2369	15.4 (14.8–16.0)	6	0.046 (0.005–0.087)	5	0.026 (0.000–0.055)
Over 65 y	377	9.25 (8.32–10.1)	1060	17.0 (15.9–18.0)	8	0.167 (0.041–0.293)	17	0.258 (0.128–0.388)
Patent ductus arteries								
All	4361	9.11 (8.83–9.38)	7973	15.6 (15.3–16.0)	30	0.066 (0.042–0.091)	12	0.021 (0.008–0.035)
Adults	618	1.94 (1.78–2.10)	1108	2.68 (2.52–2.84)	15	0.049 (0.023–0.075)	2	0.002 (0.000–0.009)
20–44 y	329	1.62 (1.44–1.79)	461	2.43 (2.21–2.65)	5	0.022 (0.000–0.044)	1	0.000 (0.000–0.010)
45–64 y	203	1.77 (1.53–2.02)	470	3.06 (2.78–3.34)	5	0.039 (0.002–0.076)	1	0.000 (0.000–0.012)
Over 65 y	86	2.10 (1.65–2.54)	177	2.83 (2.41–3.25)	5	0.106 (0.006–0.206)	0	0.000 (0.000–0.000)
Women	2440	5.13 (4.92–5.34)	4381	8.60 (8.35–8.86)	18	0.039 (0.020–0.059)	6	0.009 (0.000–0.019)
Adults	472	1.50 (1.36–1.64)	833	2.02 (1.88–2.16)	10	0.033 (0.011–0.054)	1	0.000 (0.000–0.004)
20–44 y	239	1.17 (1.02–1.32)	314	1.65 (1.47–1.84)	3	0.011 (0.000–0.027)	0	0.000 (0.000–0.000)
45–64 y	165	1.44 (1.22–1.66)	375	2.44 (2.22–2.69)	3	0.019 (0.000–0.048)	1	0.000 (0.000–0.012)
Over 65 y	68	1.65 (1.26–2.05)	144	2.31 (1.93–2.69)	4	0.076 (0.000–0.165)	0	0.000 (0.000–0.000)
Men	1921	3.97 (3.79–4.15)	3592	7.06 (6.83–7.29)	12	0.025 (0.010–0.039)	6	0.009 (0.000–0.019)
Adults	146	0.44 (0.36–0.51)	275	0.66 (0.58–0.74)	5	0.013 (0.000–0.028)	1	0.000 (0.000–0.004)
20–44 y	90	0.43 (0.34–0.52)	147	0.77 (0.65–0.90)	2	0.005 (0.000–0.019)	1	0.000 (0.000–0.010)
45–64 y	38	0.33 (0.22–0.43)	95	0.61 (0.49–0.74)	2	0.013 (0.000–0.036)	0	0.000 (0.000–0.000)
Over 65 y	18	0.44 (0.22–0.64)	33	0.51 (0.33–0.69)	1	0.015 (0.000–0.059)	0	0.000 (0.000–0.000)
Pulmonary artery stenosis								
All	1123	2.20 (2.07–2.33)	3395	6.67 (6.45–6.90)	28	0.060 (0.036–0.084)	10	0.019 (0.007–0.032)
Adults	133	0.41 (0.33–0.48)	312	0.74 (0.66–0.83)	9	0.033 (0.011–0.055)	4	0.009 (0.000–0.019)
20–44 y	78	0.38 (0.29–0.46)	199	1.04 (0.90–1.19)	2	0.005 (0.000–0.019)	1	0.000 (0.000–0.010)
45–64 y	36	0.31 (0.20–0.41)	73	0.47 (0.36–0.58)	1	0.006 (0.000–0.023)	0	0.000 (0.000–0.000)
Over 65 y	19	0.45 (0.24–0.66)	40	0.63 (0.44–0.83)	6	0.121 (0.012–0.231)	3	0.045 (0.000–0.100)
Women	538	1.06 (0.97–1.15)	1741	3.42 (3.26–3.58)	13	0.027 (0.011–0.043)	4	0.007 (0.000–0.015)
Adults	80	0.24 (0.19–0.30)	169	0.40 (0.34–0.46)	5	0.016 (0.000–0.032)	2	0.004 (0.000–0.012)
20–44 y	43	0.21 (0.14–0.27)	100	0.52 (0.42–0.63)	2	0.005 (0.000–0.019)	0	0.000 (0.000–0.000)
45–64 y	28	0.23 (0.14–0.33)	43	0.27 (0.19–0.36)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	9	0.21 (0.06–0.35)	26	0.41 (0.25–0.57)	3	0.060 (0.000–0.138)	2	0.030 (0.000–0.074)
Men	585	1.13 (1.04–1.23)	1654	3.25 (3.09–3.41)	15	0.033 (0.016–0.050)	6	0.009 (0.000–0.019)

(*continued*)

Table 2

(continued).

	Prevalence				Mortality			
	2006		2015		2007		2015	
	n	Prevalence (95% CI)	n	Prevalence (95% CI)	n	Mortality (95% CI)	n	Mortality (95% CI)
Adults	53	0.15 (0.11–0.20)	143	0.34 (0.28–0.39)	4	0.013 (0.000–0.029)	2	0.004 (0.000–0.011)
20–44 y	35	0.17 (0.11–0.22)	99	0.52 (0.41–0.62)	0	0.000 (0.000–0.000)	1	0.000 (0.000–0.010)
45–64 y	8	0.06 (0.01–0.11)	30	0.19 (0.12–0.26)	1	0.006 (0.000–0.023)	0	0.000 (0.000–0.000)
Over 65 y	10	0.24 (0.09–0.39)	14	0.21 (0.09–0.33)	3	0.060 (0.000–0.138)	1	0.015 (0.000–0.046)
Coarctation of aorta								
All	629	1.25 (1.15–1.35)	1288	2.53 (2.39–2.66)	16	0.037 (0.018–0.056)	9	0.017 (0.006–0.029)
Adults	91	0.27 (0.21–0.33)	246	0.58 (0.51–0.66)	7	0.024 (0.005–0.044)	1	0.002 (0.000–0.007)
20–44 y	58	0.28 (0.20–0.35)	167	0.88 (0.74–1.01)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	21	0.17 (0.10–0.25)	58	0.37 (0.27–0.46)	4	0.033 (0.000–0.066)	0	0.000 (0.000–0.000)
Over 65 y	12	0.28 (0.12–0.45)	21	0.33 (0.19–0.47)	3	0.060 (0.000–0.138)	1	0.015 (0.000–0.046)
Women	264	0.52 (0.46–0.59)	533	1.04 (0.95–1.13)	10	0.023 (0.007–0.038)	5	0.009 (0.001–0.018)
Adults	46	0.14 (0.09–0.18)	108	0.25 (0.20–0.30)	5	0.019 (0.002–0.036)	1	0.002 (0.000–0.007)
20–44 y	27	0.12 (0.07–0.17)	68	0.35 (0.26–0.44)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	10	0.08 (0.03–0.14)	29	0.18 (0.11–0.25)	2	0.013 (0.000–0.036)	0	0.000 (0.000–0.000)
Over 65 y	9	0.21 (0.06–0.35)	11	0.16 (0.06–0.27)	3	0.060 (0.000–0.138)	1	0.015 (0.000–0.046)
Men	365	0.72 (0.64–0.79)	755	1.48 (1.37–1.58)	6	0.012 (0.001–0.023)	4	0.005 (0.000–0.013)
Adults	45	0.12 (0.08–0.16)	138	0.32 (0.27–0.38)	2	0.005 (0.000–0.015)	0	0.000 (0.000–0.000)
20–44 y	31	0.14 (0.09–0.20)	99	0.52 (0.41–0.62)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	11	0.09 (0.03–0.15)	29	0.18 (0.11–0.25)	2	0.013 (0.000–0.036)	0	0.000 (0.000–0.000)
Over 65 y	3	0.06 (0.00–0.14)	10	0.15 (0.05–0.25)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Pulmonary venous connection								
All	162	0.30 (0.25–0.35)	482	0.94 (0.86–1.03)	6	0.010 (0.000–0.020)	3	0.003 (0.000–0.010)
Adults	17	0.05 (0.02–0.07)	68	0.16 (0.12–0.20)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	9	0.03 (0.01–0.06)	37	0.19 (0.13–0.25)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	6	0.04 (0.01–0.08)	25	0.15 (0.09–0.22)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	2	0.04 (0.00–0.11)	6	0.09 (0.01–0.16)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Women	77	0.15 (0.11–0.18)	223	0.43 (0.37–0.49)	3	0.004 (0.000–0.011)	1	0.000 (0.000–0.003)
Adults	10	0.02 (0.01–0.04)	41	0.09 (0.06–0.12)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	6	0.02 (0.01–0.05)	23	0.11 (0.06–0.16)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	4	0.03 (0.00–0.06)	16	0.09 (0.04–0.15)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	0	0.00 (0.00–0.00)	2	0.03 (0.00–0.07)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Men	85	0.17 (0.13–0.21)	259	0.50 (0.44–0.57)	3	0.004 (0.000–0.011)	2	0.001 (0.000–0.007)
Adults	7	0.02 (0.01–0.04)	27	0.06 (0.03–0.08)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	3	0.01 (0.00–0.02)	14	0.07 (0.03–0.11)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	2	0.01 (0.00–0.03)	9	0.05 (0.01–0.09)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	2	0.04 (0.00–0.11)	4	0.06 (0.00–0.12)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Congenital tricuspid stenosis								
All	328	0.64 (0.57–0.72)	320	0.62 (0.55–0.69)	11	0.023 (0.008–0.037)	6	0.011 (0.002–0.021)
Adults	82	0.25 (0.19–0.30)	88	0.21 (0.16–0.25)	2	0.005 (0.000–0.016)	2	0.004 (0.000–0.012)
20–44 y	46	0.22 (0.15–0.28)	63	0.33 (0.25–0.41)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	29	0.25 (0.16–0.34)	17	0.10 (0.05–0.15)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	7	0.16 (0.04–0.29)	8	0.12 (0.03–0.12)	2	0.030 (0.000–0.093)	2	0.030 (0.000–0.074)
Women	148	0.30 (0.25–0.35)	141	0.27 (0.22–0.32)	7	0.014 (0.002–0.026)	4	0.007 (0.000–0.015)
Adults	49	0.15 (0.11–0.20)	39	0.09 (0.06–0.12)	2	0.005 (0.000–0.016)	2	0.004 (0.000–0.012)
20–44 y	23	0.11 (0.06–0.15)	24	0.12 (0.07–0.17)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	21	0.17 (0.10–0.25)	10	0.05 (0.01–0.10)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	5	0.12 (0.01–0.22)	5	0.07 (0.01–0.14)	2	0.030 (0.000–0.093)	2	0.030 (0.000–0.074)
Men	180	0.34 (0.29–0.39)	179	0.35 (0.29–0.40)	4	0.006 (0.000–0.014)	2	0.001 (0.000–0.007)
Adults	33	0.09 (0.06–0.12)	49	0.11 (0.08–0.14)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	23	0.11 (0.06–0.15)	39	0.20 (0.14–0.26)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	8	0.06 (0.01–0.11)	7	0.03 (0.01–0.07)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	2	0.04 (0.00–0.11)	3	0.04 (0.00–0.10)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Congenital stenosis of aortic valve								
All	296	0.63 (0.56–0.71)	617	1.21 (1.12–1.31)	12	0.031 (0.013–0.049)	8	0.015 (0.004–0.027)
Adults	97	0.34 (0.27–0.41)	204	0.50 (0.43–0.57)	9	0.033 (0.010–0.055)	5	0.012 (0.000–0.023)
20–44 y	33	0.16 (0.10–0.21)	73	0.38 (0.29–0.47)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	30	0.25 (0.16–0.35)	60	0.38 (0.28–0.48)	3	0.019 (0.000–0.048)	0	0.000 (0.000–0.000)
Over 65 y	34	0.82 (0.54–1.10)	71	1.12 (0.86–1.39)	5	0.106 (0.006–0.206)	5	0.076 (0.005–0.146)
Women	115	0.25 (0.20–0.30)	222	0.43 (0.37–0.49)	3	0.008 (0.000–0.018)	4	0.007 (0.000–0.016)
Adults	50	0.17 (0.12–0.22)	81	0.20 (0.15–0.24)	3	0.011 (0.000–0.025)	3	0.007 (0.000–0.016)

(*continued*)

Table 2

(continued).

	Prevalence				Mortality			
	2006		2015		2007		2015	
	n	Prevalence (95% CI)	n	Prevalence (95% CI)	n	Mortality (95% CI)	n	Mortality (95% CI)
20–44 y	17	0.08 (0.04–0.12)	25	0.12 (0.07–0.17)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	15	0.12 (0.05–0.19)	26	0.16 (0.10–0.23)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	18	0.44 (0.23–0.64)	30	0.47 (0.29–0.64)	3	0.060 (0.000–0.138)	3	0.045 (0.000–0.100)
Men	181	0.38 (0.32–0.43)	395	0.77 (0.70–0.85)	9	0.020 (0.006–0.035)	4	0.007 (0.000–0.015)
Adults	47	0.16 (0.11–0.21)	123	0.30 (0.24–0.35)	6	0.019 (0.002–0.036)	2	0.004 (0.000–0.012)
20–44 y	16	0.07 (0.03–0.11)	48	0.24 (0.17–0.32)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	15	0.12 (0.05–0.19)	34	0.21 (0.14–0.29)	3	0.019 (0.000–0.048)	0	0.000 (0.000–0.000)
Over 65 y	16	0.38 (0.18–0.57)	41	0.65 (0.45–0.85)	2	0.030 (0.000–0.093)	2	0.030 (0.000–0.074)
Congenital insufficiency of aortic valve								
All	439	1.01 (0.91–1.10)	3196	6.30 (6.08–6.51)	13	0.035 (0.015–0.055)	16	0.031 (0.015–0.047)
Adults	272	0.91 (0.80–1.03)	2651	6.51 (6.26–6.76)	13	0.046 (0.019–0.073)	14	0.034 (0.015–0.053)
20–44 y	100	0.48 (0.39–0.58)	631	3.33 (3.07–3.59)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	124	1.08 (0.89–1.27)	1317	8.60 (8.13–9.06)	7	0.053 (0.009–0.097)	5	0.026 (0.000–0.055)
Over 65 y	48	1.17 (0.83–1.50)	703	11.2 (10.4–12.1)	6	0.121 (0.012–0.231)	9	0.137 (0.042–0.231)
Women	167	0.39 (0.33–0.45)	1044	2.06 (1.94–2.19)	5	0.014 (0.001–0.027)	7	0.013 (0.003–0.024)
Adults	104	0.36 (0.29–0.44)	858	2.12 (1.98–2.26)	5	0.019 (0.002–0.036)	6	0.014 (0.002–0.027)
20–44 y	28	0.13 (0.08–0.18)	157	0.82 (0.69–0.95)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	49	0.42 (0.30–0.54)	404	2.63 (2.37–2.89)	2	0.013 (0.000–0.036)	2	0.006 (0.000–0.024)
Over 65 y	27	0.65 (0.40–0.90)	297	4.76 (4.22–5.30)	3	0.060 (0.000–0.138)	4	0.060 (0.000–0.123)
Men	272	0.61 (0.53–0.68)	2152	4.23 (4.05–4.40)	8	0.020 (0.005–0.036)	9	0.017 (0.005–0.029)
Adults	168	0.54 (0.46–0.63)	1793	4.38 (4.18–4.59)	8	0.027 (0.006–0.048)	8	0.019 (0.005–0.033)
20–44 y	72	0.34 (0.26–0.43)	474	2.50 (2.27–2.72)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	75	0.65 (0.50–0.80)	913	5.95 (5.57–6.34)	5	0.039 (0.002–0.076)	3	0.013 (0.000–0.035)
Over 65 y	21	0.50 (0.28–0.72)	406	6.51 (5.88–7.15)	3	0.060 (0.000–0.138)	5	0.076 (0.005–0.146)
Congenital mitral stenosis								
All	877	1.73 (1.61–1.85)	911	1.79 (1.67–1.90)	22	0.058 (0.033–0.083)	6	0.009 (0.000–0.019)
Adults	195	0.63 (0.54–0.73)	194	0.46 (0.39–0.52)	18	0.066 (0.034–0.097)	2	0.004 (0.000–0.011)
20–44 y	90	0.43 (0.34–0.52)	145	0.76 (0.64–0.89)	2	0.005 (0.000–0.019)	1	0.000 (0.000–0.010)
45–64 y	68	0.59 (0.45–0.73)	28	0.17 (0.11–0.24)	5	0.039 (0.002–0.076)	0	0.000 (0.000–0.000)
Over 65 y	37	0.89 (060–1.19)	21	0.33 (0.19–0.47)	11	0.243 (0.095–0.391)	1	0.015 (0.000–0.046)
Women	474	0.93 (0.85–1.02)	550	1.08 (0.99–1.17)	13	0.035 (0.015–0.055)	1	0.000 (0.000–0.003)
Adults	109	0.35 (0.28–0.42)	114	0.27 (0.22–0.32)	12	0.044 (0.018–0.069)	0	0.000 (0.000–0.000)
20–44 y	48	0.23 (0.16–0.29)	85	0.44 (0.34–0.53)	2	0.005 (0.000–0.019)	0	0.000 (0.000–0.000)
45–64 y	41	0.35 (0.24–0.46)	18	0.11 (0.05–0.16)	2	0.013 (0.000–0.036)	0	0.000 (0.000–0.000)
Over 65 y	20	0.48 (0.27–0.70)	11	0.16 (0.62–0.27)	8	0.167 (0.041–0.293)	0	0.000 (0.000–0.000)
Men	403	0.79 (0.71–0.87)	361	0.70 (0.63–0.78)	9	0.023 (0.007–0.038)	5	0.007 (0.000–0.016)
Adults	86	0.27 (0.21–0.34)	80	0.19 (0.14–0.23)	6	0.022 (0.003–0.040)	2	0.004 (0.000–0.011)
20–44 y	42	0.20 (0.14–0.26)	60	0.31 (0.23–0.39)	0	0.000 (0.000–0.000)	1	0.000 (0.000–0.010)
45–64 y	27	0.23 (0.14–0.32)	10	0.05 (0.01–0.10)	3	0.019 (0.000–0.048)	0	0.000 (0.000–0.000)
Over 65 y	17	0.41 (0.21–0.60)	10	0.15 (0.05–0.25)	3	0.060 (0.000–0.138)	1	0.015 (0.000–0.046)
Malformation of coronary vessels								
All	5555	11.3 (11.0–11.6)	5970	11.8 (11.5–12.1)	55	0.131 (0.095–0.167)	25	0.049 (0.029–0.069)
Adults	765	2.58 (2.40–2.77)	3664	9.07 (8.77–9.36)	34	0.121 (0.079–0.162)	18	0.044 (0.023–0.065)
20–44 y	311	1.53 (1.36–1.70)	567	2.99 (2.74–3.24)	6	0.027 (0.003–0.051)	0	0.000 (0.000–0.000)
45–64 y	272	2.37 (2.09–2.65)	1863	12.1 (1.16–12.7)	12	0.099 (0.042–0.157)	6	0.033 (0.001–0.064)
Over 65 y	182	4.46 (3.81–5.10)	1234	19.8 (18.7–20.9)	16	0.350 (0.171,0.528)	12	0.182 (0.073–0.291)
Women	2725	5.66 (5.44–5.87)	2782	5.52 (5.31–5.72)	29	0.071 (0.044–0.098)	8	0.015 (0.004–0.026)
Adults	455	1.58 (1.43–1.73)	1689	4.20 (4.00–4.40)	17	0.063 (0.032–0.094)	2	0.004 (0.000–0.012)
20–44 y	168	0.82 (0.70–0.95)	228	1.20 (1.04–1.36)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	151	1.31 (1.10–1.52)	792	5.16 (4.80–5.52)	6	0.046 (0.005–0.087)	0	0.000 (0.000–0.000)
Over 65 y	136	3.33 (2.77–3.89)	669	10.7 (9.93–11.5)	10	0.213 (0.071–0.354)	2	0.030 (0.000–0.074)
Men	2830	5.64 (5.43–5.85)	3188	6.30 (6.08–6.51)	26	0.060 (0.036–0.084)	5	0.009 (0.008–0.018)
Adults	310	1.00 (0.89–1.12)	1975	4.86 (4.65–5.08)	17	0.057 (0.029–0.085)	4	0.009 (0.000–0.020)
20–44 y	143	0.69 (0.58–0.81)	339	1.78 (1.59–1.97)	5	0.022 (0.000–0.044)	0	0.000 (0.000–0.000)
45–64 y	121	1.05 (0.86–1.24)	1071	6.99 (6.57–7.40)	6	0.046 (0.005–0.087)	0	0.000 (0.000–0.000)
Over 65 y	46	1.12 (0.80–1.45)	565	9.07 (8.32–9.82)	6	0.121 (0.012–0.231)	4	0.060 (0.000–0.123)
Stenosis or malformation of aorta								
All	554	1.27 (1.16–1.38)	1319	2.61 (2.47–2.75)	43	0.117 (0.081–0.152)	22	0.043 (0.024–0.062)
Adults	272	0.96 (0.85–1.08)	788	1.95 (1.82–2.09)	34	0.129 (0.085–0.173)	16	0.039 (0.019–0.059)
20–44 y	85	0.41 (0.32–0.50)	179	0.94 (0.80–1.08)	3	0.011 (0.000–0.027)	0	0.000 (0.000–0.000)

(*continued*)

Table 2

(continued).

	Prevalence				Mortality			
	2006		2015		2007		2015	
	n	Prevalence (95% CI)	n	Prevalence (95% CI)	n	Mortality (95% CI)	n	Mortality (95% CI)
45–64 y	99	0.86 (0.69–1.03)	283	1.84 (1.62–2.05)	8	0.066 (0.019–0.113)	1	0.000 (0.000–0.012)
Over 65 y	88	2.14 (1.69–2.59)	326	5.23 (4.66–5.80)	23	0.517 (0.303–0.731)	15	0.228 (0.106–0.350)
Women	213	0.49 (0.42–0.56)	582	1.16 (1.06–1.25)	20	0.054 (0.029–0.078)	12	0.023 (0.009–0.037)
Adults	113	0.41 (0.33–0.48)	382	0.95 (0.86–1.05)	17	0.063 (0.032–0.094)	8	0.019 (0.005–0.034)
20–44 y	32	0.15 (0.10–0.20)	68	0.35 (0.26–0.44)	2	0.005 (0.000–0.019)	0	0.000 (0.000–0.000)
45–64 y	40	0.34 (0.23–0.45)	124	0.80 (0.66–0.94)	4	0.033 (0.000–0.066)	1	0.000 (0.000–0.012)
Over 65 y	41	1.00 (0.69–1.31)	190	3.04 (2.61–3.47)	11	0.243 (0.095–0.391)	7	0.106 (0.023–0.189)
Men	341	0.77 (0.69–0.86)	737	1.45 (1.35–1.56)	23	0.060 (0.034–0.086)	10	0.019 (0.006–0.032)
Adults	159	0.55 (0.46–0.64)	406	1.00 (0.90–1.09)	17	0.063 (0.031–0.094)	8	0.019 (0.005–0.034)
20–44 y	53	0.26 (0.19–0.33)	111	0.58 (0.47–0.69)	1	0.000 (0.000–0.019)	0	0.000 (0.000–0.000)
45–64 y	59	0.51 (0.38–0.64)	159	1.03 (0.87–1.19)	4	0.033 (0.000–0.066)	0	0.000 (0.000–0.000)
Over 65 y	47	1.14 (0.81–1.47)	136	2.17 (1.80–2.54)	12	0.258 (0.104–0.413)	8	0.121 (0.032–0.210)
Cyanotic								
Tetralogy of fallot								
All	2370	4.47 (4.28–4.65)	3622	7.07 (6.84–7.30)	15	0.031 (0.014–0.048)	4	0.005 (0.000–0.013)
Adults	494	1.32 (1.20–1.43)	1320	3.12 (2.95–3.29)	8	0.024 (0.006–0.043)	0	0.000 (0.000–0.000)
20–44 y	417	2.05 (1.85–2.24)	1087	5.74 (5.40–6.08)	4	0.016 (0.000–0.036)	0	0.000 (0.000–0.000)
45–64 y	70	0.61 (0.46–0.75)	216	1.41 (1.22–1.59)	1	0.006 (0.000–0.023)	0	0.000 (0.000–0.000)
Over 65 y	7	0.16 (0.04–0.29)	17	0.25 (0.12–0.38)	3	0.060 (0.000–0.138)	0	0.000 (0.000–0.000)
Women	989	1.87 (1.75–1.99)	1502	2.93 (2.78–3.07)	7	0.014 (0.002–0.026)	2	0.001 ((0.000–0.007)
Adults	234	0.62 (0.54–0.71)	566	1.34 (1.23–1.45)	3	0.008 (0.000–0.020)	0	0.000 (0.000–0.000)
20–44 y	193	0.94 (0.81–1.08)	455	2.40 (2.18–2.62)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	40	0.34 (0.23–0.45)	102	0.66 (0.53–0.79)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	1	0.01 (0.00–0.06)	9	0.13 (0.04–0.23)	2	0.030 (0.000–0.093)	0	0.000 (0.000–0.000)
Men	1381	2.59 (2.45–2.73)	2120	4.14 (3.96–4.31)	8	0.016 (0.004–0.028)	2	0.001 (0.000–0.007)
Adults	260	0.69 (0.60–0.77)	754	1.78 (1.65–1.91)	5	0.013 (0.000–0.027)	0	0.000 (0.000–0.000)
20–44 y	224	1.09 (0.95–1.24)	632	3.33 (3.07–3.60)	3	0.011 (0.000–0.027)	0	0.000 (0.000–0.000)
45–64 y	30	0.25 (0.16–0.35)	114	0.73 (0.60–0.87)	1	0.006 (0.000–0.023)	0	0.000 (0.000–0.000)
Over 65 y	6	0.13 (0.01–0.25)	8	0.12 (0.03–0.21)	1	0.015 (0.000–0.059)	0	0.000 (0.000–0.000)
Ebstein anomaly								
All	308	0.68 (0.61–0.76)	651	1.27 (1.17–1.37)	13	0.031 (0.012–0.049)	4	0.005 (0.000–0.013)
Adults	190	0.60 (0.51–0.69)	430	1.04 (0.94–1.14)	11	0.035 (0.012–0.058)	2	0.002 (0.000–0.008)
20–44 y	96	0.47 (0.37–0.56)	152	0.79 (0.67–1.40)	3	0.011 (0.000–0.027)	2	0.005 (0.000–0.020)
45–64 y	66	0.57 (0.43–0.71)	203	1.32 (1.14–1.50)	3	0.019 (0.000–0.048)	0	0.000 (0.000–0.000)
Over 65 y	28	0.68 (0.43–0.93)	75	1.20 (0.92–1.47)	5	0.106 (0.006–0.206)	0	0.000 (0.000–0.000)
Women	170	0.38 (0.32–0.44)	387	0.75 (0.68–0.83)	6	0.014 (0.001–0.028)	1	0.000 (0.000–0.003)
Adults	111	0.35 (0.28–0.42)	282	0.68 (0.60–0.76)	5	0.016 (0.000–0.033)	1	0.000 (0.000–0.004)
20–44 y	53	0.26 (0.19–0.33)	89	0.46 (0.36–0.56)	1	0.000 (0.000–0.009)	1	0.000 (0.010–0.907)
45–64 y	42	0.36 (0.25–0.47)	137	0.89 (0.74–1.04)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	16	0.38 (0.18–0.57)	56	0.89 (0.66–1.13)	4	0.076 (0.000–0.165)	0	0.000 (0.000–0.000)
Men	138	0.30 (0.24–0.35)	264	0.51 (0.45–0.57)	7	0.016 (0.003–0.029)	3	0.003 (0.000–0.010)
Adults	79	0.24 (0.19–0.30)	148	0.35 (0.29–0.41)	6	0.019 (0.003–0.035)	1	0.000 (0.000–0.004)
20–44 y	43	0.21 (0.14–0.27)	63	0.33 (0.25–0.41)	2	0.005 (0.000–0.019)	1	0.000 (0.000–0.010)
45–64 y	24	0.20 (0.12–0.29)	66	0.42 (0.32–0.52)	3	0.019 (0.000–0.048)	0	0.000 (0.000–0.000)
Over 65 y	12	0.28 (0.12–0.45)	19	0.30 (0.16–0.44)	1	0.015 (0.000–0.059)	0	0.000 (0.000–0.000)
Transposition of the great arteries								
All	946	1.77 (1.65–1.88)	1717	3.38 (3.22–3.54)	10	0.023 (0.007–0.038)	4	0.007 (0.000–0.015)
Adults	127	0.38 (0.31–0.45)	350	0.83 (0.74–0.92)	7	0.022 (0.003–0.040)	1	0.002 (0.000–0.012)
20–44 y	73	0.35 (0.27–0.43)	259	1.36 (1.19–1.53)	3	0.011 (0.000–0.027)	0	0.000 (0.000–0.000)
45–64 y	43	0.37 (0.25–0.48)	68	0.43 (0.33–0.54)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	11	0.25 (0.09–0.41)	23	0.36 (0.21–0.51)	4	0.076 (0.000–0.165)	1	0.015 (0.000–0.046)
Women	266	0.52 (0.46–0.59)	393	0.76 (0.69–0.84)	5	0.010 (0.000–0.021)	1	0.000 (0.000–0.003)
Adults	68	0.20 (0.15–0.26)	166	0.39 (0.33–0.45)	4	0.011 (0.000–0.024)	0	0.000 (0.000–0.000)
20–44 y	36	0.17 (0.11–0.22)	105	0.55 (0.44–0.66)	2	0.005 (0.000–0.019)	0	0.000 (0.000–0.000)
45–64 y	26	0.22 (0.13–0.31)	43	0.27 (0.19–036)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	6	0.13 (0.01–0.25)	18	0.28 (0.15–0.42)	2	0.030 (0.000–0.093)	0	0.000 (0.000–0.000)
Men	680	1.24 (1.14–1.33)	1324	2.61 (2.47–2.75)	5	0.010 (0.000–0.021)	3	0.005 (0.000–0.012)
Adults	59	0.17 (0.12–0.22)	184	0.43 (0.37–0.49)	3	0.008 (0.000–0.020)	1	0.002 (0.000–0.007)
20–44 y	37	0.17 (0.11–0.23)	154	0.81 (0.68–0.93)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	17	0.14 (0.07–0.21)	25	0.15 (0.09–0.22)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)

(*continued*)

Table 2

(continued).

	Prevalence				Mortality			
	2006		2015		2007		2015	
	n	Prevalence (95% CI)	n	Prevalence (95% CI)	n	Mortality (95% CI)	n	Mortality (95% CI)
Over 65 y	5	0.12 (0.01–0.22)	5	0.07 (0.01–0.14)	2	0.030 (0.000–0.093)	1	0.015 (0.000–0.046)
Eisenmenger syndrome								
All	500	1.26 (1.14–1.37)	822	1.61 (1.50–1.72)	37	0.092 (0.061–0.122)	15	0.029 (0.014–0.045)
Adults	386	1.38 (1.24–1.52)	744	1.81 (1.68–1.95)	34	0.112 (0.073–0.152)	15	0.037 (0.017–0.056)
20–44 y	131	0.64 (0.53–0.75)	284	1.49 (1.32–1.67)	10	0.044 (0.013–0.075)	2	0.005 (0.000–0.020)
45–64 y	105	0.91 (0.74–1.09)	269	1.75 (1.54–1.96)	13	0.106 (0.046–0.166)	5	0.026 (0.000–0.055)
Over 65 y	150	3.66 (3.07–4.25)	191	3.05 (2.62–3.49)	11	0.243 (0.095–0.391)	8	0.121 (0.032–0.210)
Women	267	0.67 (0.59–0.76)	488	0.95 (0.87–1.04)	21	0.050 (0.027–0.073)	9	0.015 (0.004–0.027)
Adults	210	0.75 (0.65–0.86)	456	1.11 (1.01–1.21)	19	0.063 (0.033–0.092)	9	0.019 (0.005–0.034)
20–44 y	73	0.35 (0.27–0.43)	177	0.93 (0.79–1.06)	6	0.027 (0.003–0.051)	2	0.005 (0.000–0.020)
45–64 y	48	0.41 (0.30–0.53)	157	1.02 (0.86–1.18)	7	0.053 (0.009–0.097)	4	0.019 (0.000–0.045)
Over 65 y	89	2.17 (1.72–2.63)	122	1.94 (1.60–2.29)	6	0.121 (0.012–0.231)	3	0.045 (0.000–0.100)
Men	233	0.58 (0.50–0.65)	334	0.65 (0.58–0.72)	16	0.039 (0.019–0.060)	6	0.011 (0.001–0.021)
Adults	176	0.62 (0.53–0.72)	288	0.70 (0.62–0.78)	15	0.049 (0.023–0.076)	6	0.014 (0.002–0.027)
20–44 y	58	0.28 (0.20–0.35)	107	0.56 (0.45–0.66)	4	0.016 (0.000–0.036)	0	0.000 (0.000–0.000)
45–64 y	57	0.49 (0.36–0.62)	112	0.72 (0.58–0.86)	6	0.046 (0.005–0.087)	1	0.000 (0.000–0.012)
Over 65 y	61	1.49 (1.11–1.86)	69	1.09 (0.83–1.35)	5	0.106 (0.006–0.206)	5	0.076 (0.005–0.146)
Double outlet right ventricle								
All	584	1.10 (1.01–1.19)	1049	2.05 (1.93–2.18)	9	0.016 (0.004–0.029)	5	0.007 (0.000–0.016)
Adults	75	0.19 (0.15–0.24)	204	0.48 (0.41–0.54)	3	0.008 (0.000–0.018)	0	0.000 (0.000–0.000)
20–44 y	65	0.31 (0.23–0.39)	188	0.99 (0.85–1.13)	2	0.005 (0.000–0.019)	0	0.000 (0.000–0.000)
45–64 y	9	0.07 (0.02–0.12)	13	0.07 (0.03–0.12)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	1	0.01 (0.00–0.06)	3	0.04 (0.00–0.10)	1	0.015 (0.000–0.059)	0	0.000 (0.000–0.000)
Women	223	0.41 (0.36–0.47)	405	0.79 (0.71–0.87)	5	0.010 (0.000–0.020)	2	0.001 (0.000–0.007)
Adults	34	0.09 (0.06–0.12)	86	0.20 (0.15–0.24)	2	0.005 (0.000–0.014)	0	0.000 (0.000–0.000)
20–44 y	28	0.13 (0.08–0.18)	76	0.39 (0.30–0.48)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	5	0.03 (0.01–0.07)	7	0.03 (0.01–0.07)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	1	0.01 (0.00–0.06)	3	0.04 (0.00–0.10)	1	0.015 (0.000–0.059)	0	0.000 (0.000–0.000)
Men	361	0.68 (0.61–0.75)	644	1.26 (1.16–1.36)	4	0.006 (0.000–0.013)	3	0.003 (0.000–0.010)
Adults	41	0.10 (0.07–0.13)	118	0.27 (0.22–0.32)	1	0.000 (0.000–0.004)	0	0.000 (0.000–0.000)
20–44 y	37	0.17 (0.11–0.23)	112	0.58 (0.47–0.69)	1	0.000 (0.000–0.009)	0	0.000 (0.000–0.000)
45–64 y	4	0.03 (0.00–0.06)	6	0.03 (0.01–0.06)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	0	0.00 (0.00–0.00)	0	0.00 (0.00–0.00)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Single ventricle								
All	347	0.63 (0.56–0.70)	1038	2.03 (1.91–2.16)	4	0.006 (0.000–0.013)	5	0.007 (0.000–0.016)
Adults	53	0.14 (0.10–0.18)	277	0.65 (0.57–0.72)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	47	0.22 (0.16–0.29)	269	1.42 (1.25–1.59)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	1	0.01 (0.00–0.02)	7	0.03 (0.01–0.07)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	5	0.12 (0.01–0.22)	1	0.01 (0.00–0.04)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Women	128	0.22 (0.18–0.27)	437	0.85 (0.77–0.93)	2	0.002 (0.000–0.007)	3	0.003 (0.000–0.010)
Adults	25	0.06 (0.03–0.09)	114	0.26 (0.21–0.31)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	23	0.11 (0.06–0.15)	112	0.58 (0.47–0.69)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	0	0.00 (0.00–0.00)	2	0.01 (0.00–0.02)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	2	0.04 (0.00–0.11)	0	0.00 (0.00–0.00)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Men	219	0.40 (0.34–0.45)	601	1.17 (1.08–1.27)	2	0.002 (0.000–0.007)	2	0.001 (0.000–0.007)
Adults	28	0.07 (0.04–0.10)	163	0.38 (0.32–0.44)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
20–44 y	24	0.11 (0.06–0.16)	157	0.82 (0.69–0.95)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
45–64 y	1	0.01 (0.00–0.02)	5	0.02 (0.00–0.05)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)
Over 65 y	3	0.06 (0.00–0.14)	1	0.01 (0.00–0.04)	0	0.000 (0.000–0.000)	0	0.000 (0.000–0.000)

Age-standardized prevalence rates of congenital heart disease were calculated using age groups according to the direct method using the estimated Korean population in 2015 as a reference.
CI = confidence interval.

Figure 1 and Supp. Table 3, http://links.lww.com/MD/C325 show the cumulative SR for adults with CHD and specific diseases from 2007 through 2016. The 5-year SR for CHD was 0.91 (95% confidence interval [CI] 0.90–0.92). The 5-year SR for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group was 0.98 (95% CI 0.97–0.99), 0.95 (95% CI 0.94–0.95), and 0.73 (95% CI 0.72–0.74) ($P<.001$), respectively. The 5-year SR by sex was 0.91 (95% CI 0.90–0.92) for men and 0.92 (95% CI 0.91–0.93) for women ($P<.001$) (Fig. 1A). The 5-year SR for Korean adults with congenital ventricular and/or atrial septal defect was 0.93 (95% CI 0.92–0.94). The 5-year SR for the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group was 0.98 (95% CI 0.97–0.99), 0.95 (95% CI 0.94–0.96), and 0.75 (95% CI 0.74–0.77) ($P<.001$), respectively. The 5-year SR by sex was 0.93 (95% CI 0.92–0.94) for men and 0.94 (95% CI 0.93–0.95)

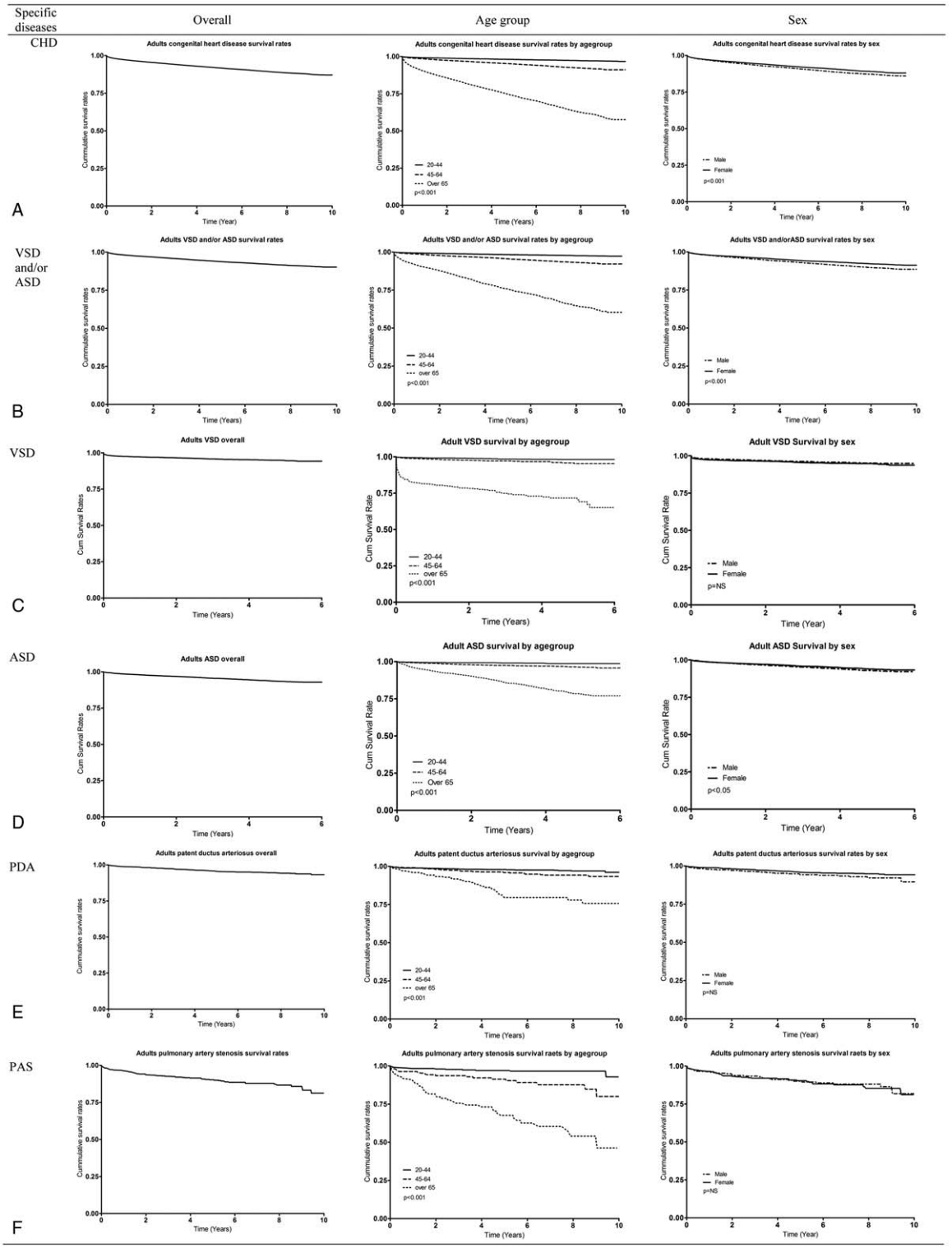

Figure 1. Survival curve of congenital heart disease in Korean adults. AR = congenital insufficiency of aortic valve, AS = congenital stenosis of aortic valve, CHD = congenital heart disease, CoA = coarctation of aorta, MS = congenital mitral stenosis, PAS = pulmonary artery stenosis, PDA = patent ductus arteriosus, TGV = transposition of great vessels, TOF = Tetralogy of Fallot, VSD and/or ASD = ventricular septal defect and/or atrial septal defect.

($P<.001$) for women (Fig. 1B). In additional analyses, we considered VSD and ASD from 2011 to 2016 (6 years). The 5-year SR for Korean adults with VSD was 0.94 (95% CI 0.93–0.95) (Fig. 1C). The 5-year SR for Korean adults with ASD was 0.93 (95% CI 0.92–0.94) (Fig. 1D). The 5-year SR for Korean adults with patent ductus arteriosus was 0.95 (95% CI 0.94–0.96) (Fig. 1E). The 5-year SR for Korean adults with pulmonary artery stenosis was 0.92 (95% CI 0.87–0.92) (Fig. 1F). The 5-year SR for coarctation of aorta in Korean adults was 0.91 (95% CI 0.87–0.93) (Fig. 1G). The 5-year SR for Korean adults with

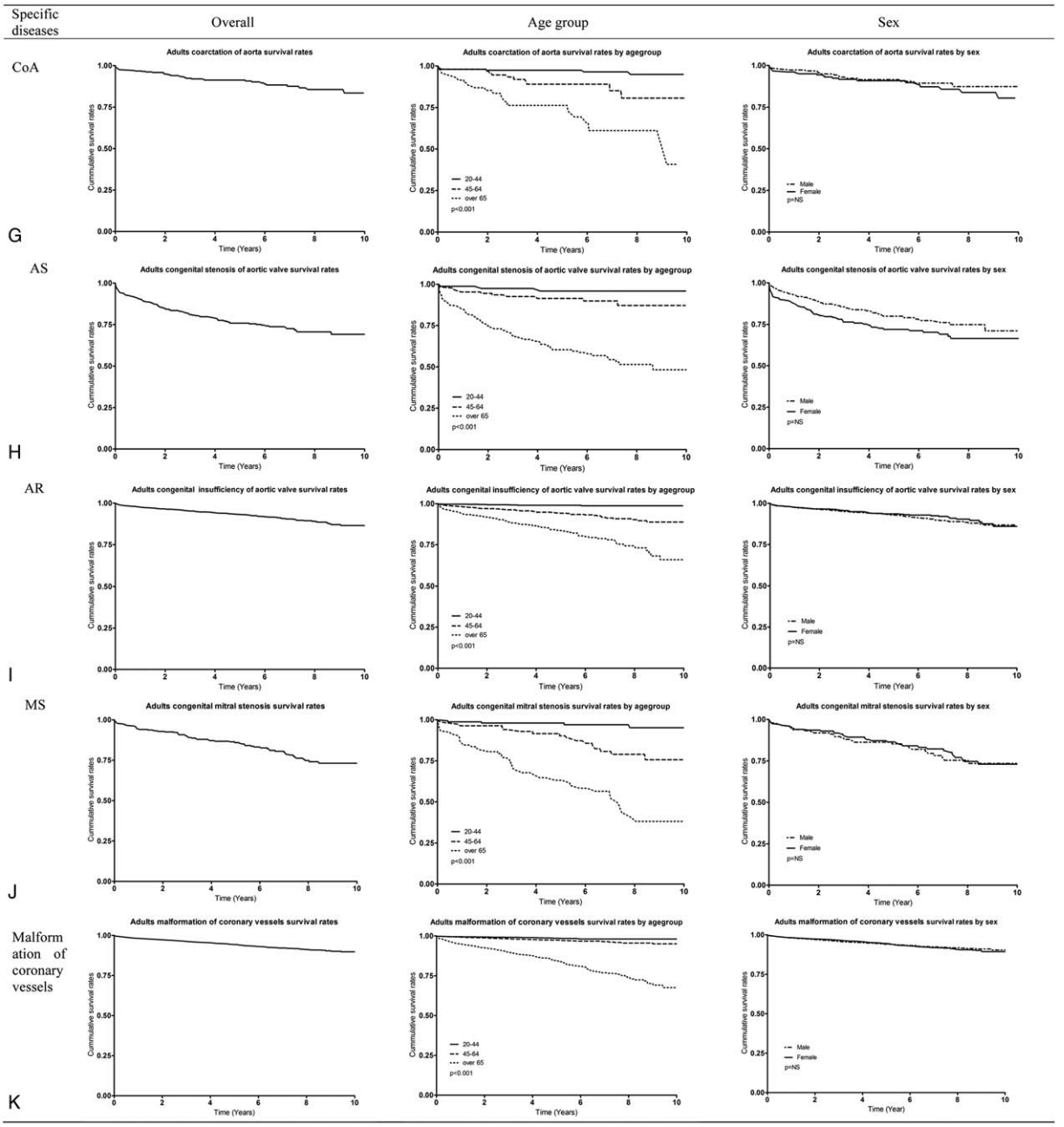

Figure 1. Continued.

congenital stenosis of aortic valve was 0.75 (95% CI 0.71–0.79) (Fig. 1H). The 5-year SR for Korean adults with congenital insufficiency of aortic valve was 0.93 (95% CI 0.92–0.94) (Fig. 1I). The 5-year SR for Korean adults with congenital mitral was 0.85 (95% CI 0.81–0.89) (Fig. 1J). The 5-year SR for Korean adults with malformation of coronary vessels was 0.94 (95% CI 0.93–0.94) (Fig. 1K). The 5-year SR for Korean adults with stenosis or malformation of aorta was 0.79 (95% CI 0.77–0.80) (Fig. 1L). The 5-year SR for Korean adults with Tetralogy of Fallot was 0.96 (95% CI 0.95–0.97) (Fig. 1M). The 5-year SR for Korean adults with the Ebstein anomaly was 0.92 (95% CI 0.89–0.94) (Fig. 1N). The 5-year SR for Korean adults with transposition of great arteries was 0.85 (95% CI 0.80–0.89) (Fig. 1O). The 5-year SR for Korean adults with Eisenmenger syndrome was 0.61 (95% CI 0.58–0.63); in the 20- to 44-year-old group, 45- to 64-year-old group, and the older than 65 years group, it was 0.84 (95% CI 0.80–0.87), 0.69 (95% CI 0.64–0.73), and 0.46 (95% CI 0.42–0.79) ($P<.001$), respectively, and it was 0.56 (95% CI 0.52–0.60) for men and 0.64 (95% CI 0.61–0.67) for women ($P<.001$) (Fig. 1P).

4. Discussion

Our findings show that the overall age-standardized prevalence of CHD in adults increased from 35.8 cases per 100,000 persons in 2006 to 65.6 cases in 2015. Our data include main and

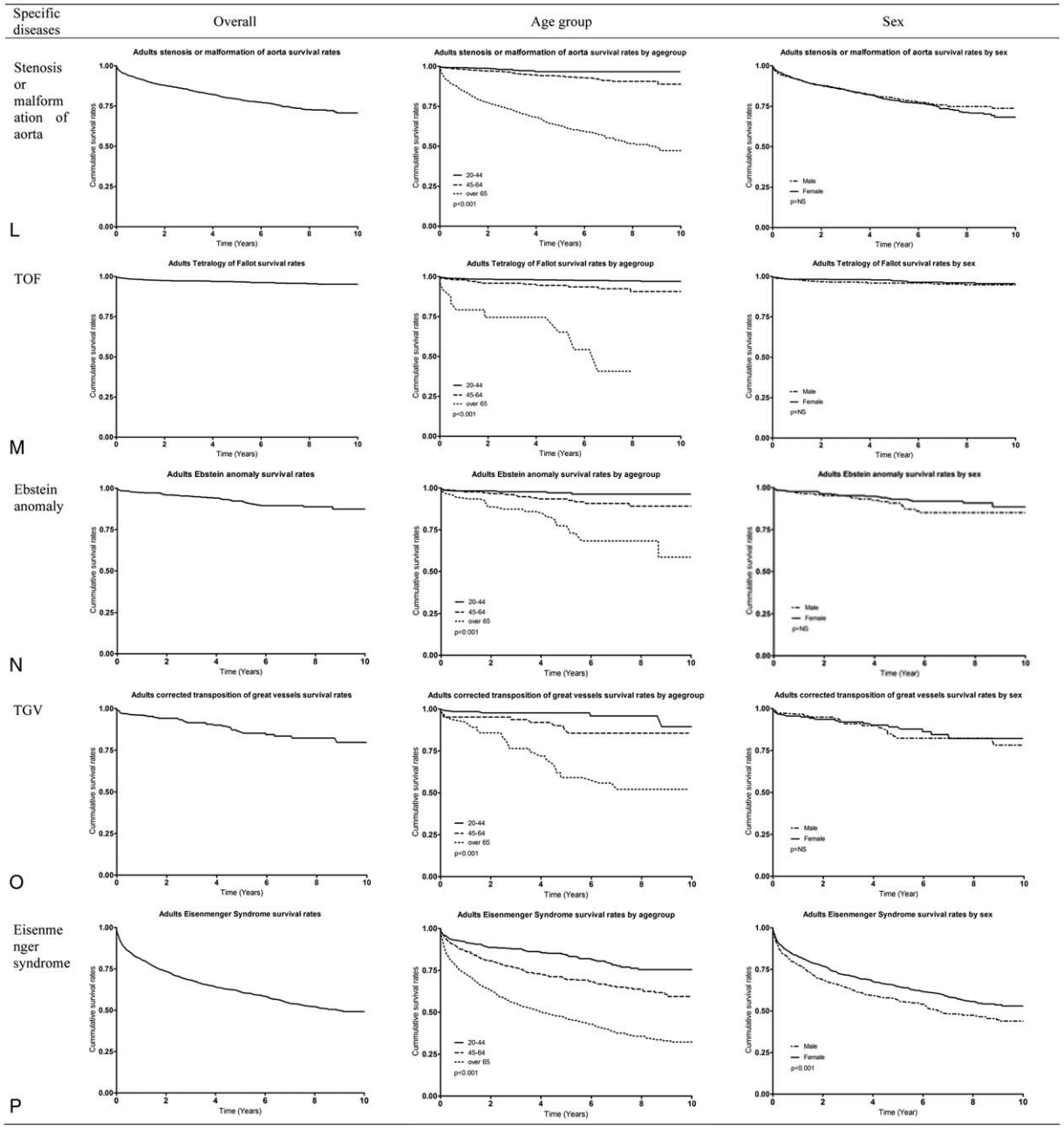

Figure 1. Continued.

secondary diagnoses of CHD based on signs and/or symptoms in the hospital. Therefore, it is difficult to compare our results with previous data. Nevertheless, the overall tendency in the prevalence of CHD in adults is similar to that found in previous studies.[9–11] The prevalence of CHD in adults increased from 17,911 persons in 1985 to 23,536 persons in 2000 in a Quebec study using ICD 9,[12,13] and about 1 million American adult patients with treated or untreated CHD were reported from 1940 to 2002 in a study of CHD patients in the United States (US) who survived childhood.[4] We partially attribute the increasing prevalence of CHD in Korean adults to the increasing role of echocardiography in popular health-screening examinations. There were 21,301 echocardiography devices used to assess the structure and function of the heart available at a total of 62,853 hospitals or clinics registered with the National Health Insurance Service as of mid-2013 in Korea (Supp. Table 4, http://links.lww.com/MD/C325).[14,15] In addition, we had concerns about the accuracy of the data recorded. Therefore, we checked the distribution of both CHD and acquired heart disease by heart surgery status using data from the Korean Heart Foundation from 2006 to 2015.[16] The Korean Heart Foundation has kept statistics since 2001 for interventions in pediatric, medicine, and surgery departments that involve chest surgery for cardiovascular disease, using surveys completed by pediatricians, cardiologists, and thoracic surgeons in 73 hospitals in Korea. The number of persons undergoing CHD surgery increased from 4546 in 2006

to 5723 in 2015. This score included interventions in pediatric departments (971 in 2006 and 1891 in 2015), departments of medicine (71 in 2006 and 483 in 2015), and departments of chest surgery (3504 in 2006 and 3349 in 2015). Further, to determine the accuracy of the data we used in this study,[15] we considered the classification of 298 mutually independent disease categories from the Korean National Health Insurance Service yearbook from 2006 to 2013 (Supp. Fig. 2, http://links.lww.com/MD/C325), including all congenital malformations of the cardio- and neurovascular systems (ICD 10: Q20.0–Q28.9).[17] Whereas the data we used from the National Health Insurance benefit records represent first diagnoses, the classification of the 298 disease categories represents main diagnoses. Congenital malformations of the cardio- and neurovascular systems from the classification of the 298 diseases also showed an increasing trend in adult CHD, with a pattern similar to that demonstrated in our results (Supp. Fig. 2, http://links.lww.com/MD/C325). We also showed CHD data (ICD 10: Q20.0–Q26.9) from a tertiary hospital from 2006 to 2013 (Supp. Fig. 3, http://links.lww.com/MD/C325).

The most frequent type of CHD in adults in this study was ventricular and/or atrial septal defects. Our results correspond well with those from other countries, such as a study of US prevalence of congenital cardiovascular defects distribution conducted in 2002,[2] a nationwide hospital trend study in the US from 2003 to 2012,[18] a CHD study in Quebec, Canada,[12] a hospital-based study of CHD in adults in Thailand,[19] an adult CHD study in Japan,[11] and a Nigerian CHD study.[20] Although the birth prevalence of specific congenital heart defects varies by ethnicity,[21] the prevalence of congenital ventricular and/or atrial septal defects in adults is the highest in all ethnicities.

We found that both overall and among adults, the prevalence of congenital ventricular and/or atrial septal defects, patent ductus arteriosus, the Ebstein anomaly, and Eisenmenger syndrome was higher in females than in males. The age-standardized prevalence of Eisenmeger syndrome revealed a higher distribution in the 65 years and over group. The age-standardized prevalence of primary pulmonary hypertension, which is similar in clinical appearance to Eisenmenger syndrome, also showed a similar distribution to Eisenmenger syndrome in this study. Interestingly, the prevalence of congenital ventricular and/or atrial septal defects in this study greatly increased from 2006 to 2015. We attribute this change to the subdivision of congenital malformations of the cardiac septa (Q21.0) in ICD 10 in 2011. Therefore, we used additional analyses to show that the age-standardized prevalence of both VSD and ASD increased from 2011 to 2015 (Supp. Table 1-1-1, 1-1-2, http://links.lww.com/MD/C325). In children, our finding of a higher prevalence of congenital ventricular and/or atrial septal defects in females was in close agreement with a hospital-based echocardiographic study of CHD in newborns in China.[22] In adults, results for the prevalence of congenital ventricular and/or atrial septal defects are similar to those from a large cohort of adult patients born with the secundum ASD in Europe. That study also found that the prevalence of ASD was higher in women than in men.[23]

We showed that the age-standardized mortality of CHD in Korean adults decreased from about 3 persons per 100,000 in 2007 to about 0.5 persons in 2015. Overall, age-standardized mortality decreased from 3.7 persons in 2007 to 1.2 persons in 2015. The mortality patterns of the present study correspond well with those of an earlier study. The overall age-standardized mortality of CHD in the US decreased from 1.37 in 1999 to 1.04 in 2006.[24]

The SR across a decade for Korean adults with CHD was about 92%. To compare CHD SR, we calculated the percentage of deaths at each age divided by the total number of deaths per year from 2006 to 2015 using Korean Census data and drew the survival curve (Supp. Fig. 4, http://links.lww.com/MD/C325). In this survival curve, the survival for the age groups from 0 to 4 years to 65 to 69 years was more than 92%, and the rate for the age groups from 70 to 74 years to 80 to 84 years was around 80%. Therefore, Korean adults with CHD had higher SR than the general Korean population, probably because patients with CHD receive regular health care. Interestingly, the 5-year SR for patients older than 65 years who have pulmonary artery stenosis, congenital stenosis of aortic valve, congenital mitral stenosis, stenosis or malformation of aorta, Tetralogy of Fallot, or transposition of great arteries was 0.59 to 0.67. The 5-year SR for Eisenmenger syndrome in those older than 65 years was lower than those among younger people. The 5-year SR for men with Eisenmenger syndrome was significantly lower than those for women. Overall SRs, including both children and adults, for CHD and specific CHD are provided in Supp. Figure 1 and Supp. Table 3, http://links.lww.com/MD/C325.

Our results could have important clinical and public health implications. The increasing prevalence of CHD in adults primarily applied to acyanotic CHD, especially congenital ventricular and/or atrial septal defects, and varied by sex. The age-standardized prevalence in women was higher than that in men; on the contrary, age-standardized mortality was higher in men than in women in our study. However, it is difficult to explain why the prevalence and mortality associated with CHD in adults varies by sex. Therefore, appropriate health resources should be allocated to improve diagnoses, treatments, research, and health policies that affect CHD in adults, with particular attention to gender, as the number of adults with CHD is expected to continue to increase. In addition to considering gender perspectives, CHD health policies should also consider socioeconomic position because of potential associated with disease, poverty, unemployment, or old age.

4.1. Study limitations

Our study has several limitations. First, the data included only CHD. We used the main and secondary diagnoses based on signs and symptoms, which could differ from the final diagnosis. Therefore, the prevalence of CHD in this study might be under- or overestimated. Second, the National Health Insurance benefit records might have missed adult patients with CHD who did not use medical services, paid for their own medical expenses, or had Medical Aid.[15] Third, we could not evaluate preexisting complex diseases, the perils of CHD, or corrected transposition of the great arteries because of data limitations. Fourth, we could not determine the cause of death because Korean National Health Insurance benefit data do not include that information. Therefore, because of the increasing prevalence of CHD in adults, Korea needs a well-designed hospital-based CHD registry.

5. Conclusion

We found that the age-standardized prevalence of CHD in Korean adults was 65.6 cases per 100,000 persons in 2015, age-standardized mortality was 0.5 persons per 100,000 persons in 2015, and SR across a decade exceeded 90%. Those over the age of 65 and men showed lower SR than younger age groups and women, respectively. Those patterns in prevalence and mortality

should be considered in future research designs and policies for cardiovascular health care services, with particular consideration of sex differences.

Author contributions

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