

**Article title:** Spatial Distribution and Birth Prevalence of Congenital Heart Disease in Iran: A Systematic Review and Hierarchical Bayesian Meta-analysis

**Journal name:** International Journal of Health Policy and Management (IJHPM)

**Authors' information:** Roghaye Farhadi Hassankiadeh<sup>1</sup>, Annette Dobson<sup>2</sup>, Somayeh Rahimi<sup>3</sup>, Abdollah Jalilian<sup>4</sup>, Volker J Schmid<sup>5</sup>, Behzad Mahaki<sup>1\*</sup>

<sup>1</sup>Department of Biostatistics, School of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.

<sup>2</sup>School of Public Health, University of Queensland, Brisbane, QLD, Australia.

<sup>3</sup>Department of Clinical Biochemistry, Kermanshah University of Medical Sciences, Kermanshah, Iran.

<sup>4</sup>Department of Statistics, Razi University, Kermanshah, Iran.

<sup>5</sup>Department of Statistics, Ludwig-Maximilians-University, Munich, Germany.

**\*Correspondence to:** Behzad Mahaki; Email: [behzad.mahaki@gmail.com](mailto:behzad.mahaki@gmail.com)

**Citation:** Farhadi Hassankiadeh R, Dobson A, Rahimi S, Jalilian A, Schmid VJ, Mahaki B. Spatial distribution and birth prevalence of congenital heart disease in Iran: a systematic review and hierarchical Bayesian meta-analysis. *Int J Health Policy Manag.* 2024;13:7931. doi:[10.34172/ijhpm.2024.7931](https://doi.org/10.34172/ijhpm.2024.7931)

#### Supplementary file 4

**Table 1**

#### Summary of studies included in the review

ID	First author	Year of publication	Total sample size	Event of CHD	Province	Study period	Age	Male	Female
1	Naderi, S	1979	9623	11	Fars	1972-1975	0-1	-	-
2	Farhud, D	1986	13037	25	Tehran	1969 -1977	0-1	12	13
3	Shahmohammadi, F	1997	2510	0	Markazi	1997- 1998	0-1	-	-
4	Zamani, A	2000	4073	8	Tehran	1999-2000	0-1	-	-
5	Movahedian, A	2001	2840	46	Isfahan	1996-2000	0-1	26	25
6	Ghahramani, M	2002	12319	1	Razavi Khorasan	1994 - 2001	0-1	-	-
7	Toutouchi, P	2003	2291	2	Tehran	1999 - 2000	0-1	-	-
8	Akbari, M	2003	6424	11	Tehran	2000 -2001	0-1	-	-
9	Ghorbani, M	2004	12853	1	Golestan	2000-2001	0-1	-	-
10	Khatami, F	2005	10450	11	Razavi Khorasan	1991-1993	0-1	-	-
11	Pouladfar, Gh	2005	722	0	Bushehr	2002-2003	0-1	-	-
12	JGolalipour,M.J	2005	10000	0	Golestan	1997-1999	0-1	-	-
13	Hematyar, M	2005	1000	2	Tehran	2003 - 2018	0-1	-	-
14	Shajari,H	2006	3840	0	Tehran	2002-2004	0-1	-	-

ID	First author	Year of publication	Total sample size	Event of CHD	Province	Study period	Age	Male	Female
15	Dastgiri, S	2007	95119	129	East Azerbaijan	2000 -2004	0-1	-	-
16	Mosayebi, Z	2007	3529	16	Isfahan	2001 -2002	0-1	-	-
17	Movafagh, A	2008	33380	202	Ghazvin	2000- 2004	0-8 years	90	112
18	Ahmadzadeh, A	2008	4660	3	Khuzestan	2003- 2006	0-1	-	-
19	Rahim, F	2008	217250	1544	Khuzestan	1998 - 2007	0-10 years	-	79
20	Abdi-Rad, I	2008	14121	0	West Azerbaijan	2001- 2005	0-1	-	-
21	Sereshti, M	2008	2854	0	Chaharmahal and Bakhtiari	2005-2006	0-1	-	-
22	Aliakbarzadeh,R	2009	7786	13	South Khorasan	2005 -2006	0-1	9	4
23	Delshad, S	2009	61112	12	Tehran	2005 -2007	0-1	4	8
24	Akhavan Karbasi, S	2009	4800	9	Yazd	2003 - 2004	0-1	-	-
25	Tayebi, N	2010	1195	4	Yazd	2008-2008	0-1	-	-
26	Mirzarahimi, M	2011	2928	47	Ardabil	2006 - 2007	0-1	-	-
27	Dastgiri, S	2011	185650	451	East Azerbaijan	2000 - 2009	0-1	-	-
28	Nikyar, B	2011	11739	97	Golestan	2007- 2008	0-1	56	41
29	Samadirad, B	2012	22524	12	East Azerbaijan	2010-2011	0-1	-	-
30	Nazemi Gheshmi,A	2012	7007	0	Hormozgan	2007-2008	0-1	-	-
31	Farhangniya, M	2013	978	12	Tehran	2008 -2010	0-1	-	-
32	Alijahan, R	2013	6868	0	Ardabil	2010-2011	0-1	-	-
33	Golalipour, M.J	2013	6204	32	Golestan	2007-2007	0-1	-	-
34	Masoodpoor, N	2013	6089	27	Kerman	2007-2008	0-1	-	-
35	Vakilian, K	2013	20751	3	Semnan	2001-2007	0-1	-	-
36	Mohsenzadeh, A	2014	43195	177	Lorestan	2006-2011	0-1	113	64
37	Mashhadi Abdolahi, H	2014	22500	46	East Azerbaijan	2004 - 2012	0-1	-	-
38	Nikyar, B	2014	18162	138	Golestan	2007- 2009	0-1	76	63
39	Khoshhal-Rahdar, F	2014	4235	30	Khuzestan	2013-2014	0-1	-	-
40	Hosseini, S	2014	1800	0	Sistan and Balochistan	2012-2012	0-1	-	-
41	Amini Nasab, Z	2014	22076	34	South Khorasan	2007- 2012	0-1	-	-
42	Bagheri, M.M	2014	2757	74	Tehran	2011 - 2013	0-1	31	43
43	Jalali, S.Z	2015	1824	10	Gilan	2011- 2012	0-1	-	-
44	Taheri, M	2015	21867	96	Yazd	2012 -2013	0-1	54	42
45	Sayehmiri, K	2016	460	3	Ilam	2011-2011	0-1	-	-
46	Stone, D. H.	2017	261024	914	East Azerbaijan	2000-2014	0-1	-	-
47	Rostamizadeh, L	2017	2738	9	East Azerbaijan	2002-2003	0-1	-	-

<b>ID</b>	<b>First author</b>	<b>Year of publication</b>	<b>Total sample size</b>	<b>Event of CHD</b>	<b>Province</b>	<b>Study period</b>	<b>Age</b>	<b>Male</b>	<b>Female</b>
48	Movahedian, A.H	2017	7154	78	Isfahan	2014-2014	0-1	41	37
49	Mirfazeli, A	2018	144920	1209	Golestan	2008 - 2013	0-1	-	-
50	Safaei Nezhad, A	2018	41265	16	Zanjan	2015-2016	0-1	-	-
51	Davari, H.A	2019	156620	56	Isfahan	2014- 2015	0-1	-	-
52	Saberi, M	2020	5455	20	Isfahan	2016-2017	0-1	-	-
53	Molapour, H	2021	291569	1084	East Azerbaijan	2000 -2019	0-1	-	-
54	Tarighat, F	2021	297734	1105	East Azerbaijan	2000-2020	0-1	-	-
55	Vafaei, H	2021	1469	24	Fars	2012 -2013	0-1	-	-
56	Mohammadzadeh, I	2013	1684	11	Mazandaran	2007-2009	0-1	-	-
57	Amiri Simkouii, F	2021	15000	24	yazd	2015-2017	0-1	-	-
58	Radvar, M	2022	19941	341	West Azerbaijan	2014-2020	0-1	208	133
59	Heidarzadeh, M	2022	347839	144	iran	2019-2021	0-1	-	-
	Heidarzadeh, M	2022	395728	116	iran	2019-2021	0-1	-	-
60	Rafati, Sh	2023	160717	309	Yazd	2017-2022	0-1	-	-
61	Arandavar, A	2023	5700	3	kermanshah	2018-2022	0-1	-	-
62	Asemi-Rad, A	2023	59085	187	Sistan and Baluchestan	2009-2019	0-1	-	-

**Table 2**

**Summary of Specific CHD Subtypes Investigated in the Review**

ID*	VSD	ASD	PDA	PS	TOF	AVSD	AS	CoA	HLHS	MR	MVP	PA	TGA	PFO	TR	PR
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	22	13	3	-	9	-	1		1	-	-	-	5	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	5	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	79	166	186	25	165	9	0	39	0	0	0	29	0	0	0	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	16	4	10	5	0	0	0		0	0	0	0	2	0	0	0
27	23	55	68	-	-	-	-	-	-	-	-	-	-	-	-	-
28	10	31	15	4	2	0	0		0	2	1	0	0	1	2	0
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	8	9	5	2	1	0	0		0	0	1	0	0	1	2	1
34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

36	78	37	15	8	2	0	6	-	0	0	0	0	7	0	0	
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	15	43	15	4	2	0	0		0	2	1	0	1	1	4	-
39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	16	0	0	0	3	1	2	5	0	0	0	2	3	0	10	-
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	16	9	0	4	3	0	0	4	0	0	0	0	0	0	0	
45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	-	-	11	0	17	0	0		0	0	0	0	6	0	0	-
49	-	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	8	3	6	0	1	0	0	0	0	0	0	0	0	0	0	-
58	102	65	39	2	16	2	2	31	10	0	0	15	26	0	0	-
59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	19	16	22	0	10	4	5	0	0	0	0	6	0	0	0	-

\*The ID in this table corresponds to the order of studies in Table 1.

**Table 3****Title of studies included in the review**

ID*	Title
1	Congenital abnormalities in newborns of consanguineous and nonconsanguineous parents
2	Congenital malformations and genetic diseases in Iranian infants
3	Statistical Investigation of The Gross Congenital Anomalies in Alive Newborns in Taleghani Hospital
4	Prevalence of congenital malformations in neonate born in imam khomeini and shariati hospitals
5	Prevalence of congenital heart disorders in neonates hospitalized in Shahid Beheshti Hospital during the years 1996-2000
6	A Survey Of Causes And Prevalence Of Congenital Anomalies In Live Bornneonates In Gonabad 22 Bahman Hospital(1373-1380).
7	Easily identifiable congenital anomalies: Prevalence and risk factors
8	Incidence of observable congenital abnormalities among births mirza kochak-khan, imam khomeini and shariatti hospitals (november 2000 to september 2001)
9	The Study of Incidence of Congenital Anomalies and Relationship Between Anomalies and Personal and Family-Social Factors
10	Survey of congenital major malformation in 10,000 newborns
11	The prevalence of minor congenital anomalies and normal variations in neonates in bushehr port
12	Congenital malformations at a referral hospital in Gorgan, Islamic Republic of Iran
13	Prevalence of congenital anomalies in 1000 live births in Javaheri Hospital, Tehran, 2004
14	Prevalence of congenital malformations observed in neonates in Shariati Hospital (1381-1383)
15	Congenital anomalies in Iran: a cross-sectional study on 1574 cases in the North-West of country
16	Pattern of congenital malformations in consanguineous versus nonconsanguineous marriages in Kashan, Islamic Republic of Iran
17	Occurrence of congenital anomalies and genetic diseases in a population of Ghazvin Province, Iran: a study of 33380 cases
18	Congenital malformations among live births at Arvand Hospital, Ahwaz, Iran-A prospective study
19	Prevalence of congenital heart disease in Iran: A clinical study
20	The prevalence at birth of overt congenital anomalies in Urmia, Northwestern Iran
21	Prevalence of apparent major congenital malformations and some associated factors, in terminated pregnancies in Hajar hospital of Shahrekord, 2005-2006, Iran
22	The Incidence of Apparent Congenital Anomalies in Neonates in Mobini Maternity Hospital in Sabzevar, Iran in 2005-6
23	The incidence of selected congenital malformations during a two-year period in Tehran, Iran
24	Prevalence of congenital malformations in Yazd (Iran)
25	The prevalence of congenital malformations and its correlation with consanguineous marriages
26	Heart murmur in neonates: how often is it caused by congenital heart disease?
27	Early diagnosis and screening of congenital cardiac anomalies
28	Prevalence and Pattern of Congenital Heart Disease among Neonates in Gorgan, Northern Iran (2007-2008)
29	Congenital anomalies and termination of pregnancy in Iran
30	The Frequency Of Congenital Anomalies In Newborns In Two Maternity Hospitals In Bandar Abbas: 2007-2008
31	Comparison of congenital abnormalities of infants conceived by assisted reproductive techniques versus infants with natural conception in Tehran
32	Prevalence of Congenital Abnormalities and Its Related Risk Factors in Ardabil, Iran, 2011
33	Incidence and pattern of congenital malformations in Gorgan-north of Iran

<b>ID*</b>	<b>Title</b>
34	Prevalence and pattern of congenital malformations in newborn in rafsanjan, iran (2007-08)
35	Frequency of congenital structural anomalies in newborns of Shahroud, Iran
36	prevalence and types of congenital heart disease in babies born in the city of Khorramabad (2007- 2011)
37	Prevalence of congenital anomalies: a community-based study in the Northwest of Iran
38	Ethnic variations in the incidence of congenital heart defects in gorgan, northern iran: a single-center study
39	The prevalence of congenital malformations in Dezful-2012
40	Race of apparent abnormalities in neonates born in Amir-Almomenin hospital of Sistan
41	Demographical condition of neonates with congenital abnormalities under Birjand city health centers during 2007-2012
42	Prevalence and etiology of heart murmurs in 2-24-months-old infants Kerman, Iran
43	The incidence of obvious congenital abnormalities among the neonates born in Rasht hospitals in 2011
44	Population attributable danger of hereditary heart breaks. Risk factors among newborns in Yazd, Iran
45	Investigating the prevalence of congenital anomalies and its associated factors in Ilam city
46	Uses, Limitations, and Validity of a Registry of Congenital Anomalies in Iran: A Critical Review
47	Alteration in incidence and pattern of congenital anomalies among newborns during one decade in Azarshahr, Northwest of Iran
48	Congenital Heart Disease: Frequency and the need for intervention on the first year of birth
49	Birth Defects in Northern Iran (2008-2013)
50	The prevalence of birth defects and related factors in Zanjan city (Northwest, Iran) during 2015-2016
51	Major congenital anomalies and associated risk factors in isfahan province, iran, 2014-2015
52	Evaluation of Incidence and Main Risk Factors of Major Congenital Anomalies in Hospitals Affiliated with Isfahan University of Medical Sciences during 1395
53	Prevalence and time trend of congenital heart defects: a registry-based study in Iran
54	Prevalence of Congenital Anomalies in the Northwest of Iran
55	Prevalence of single umbilical artery, clinical outcomes and its risk factors: A cross-sectional study
56	Prevalence of external congenital malformations in neonates born in Mehregan Hospital, North of Iran
57	Comparative study of pulse oximetry, physical examination and echocardiography results in the diagnosis of congenital heart defects in neonates in the first 24 hours of life
58	Epidemiology of clinical findings and outcome in neonates with congenital heart disease
59	The incidence of congenital anomalies in newborns before and during the Covid-19 pandemic
60	Examining the frequency and types of congenital anomalies of newborns born in hospitals in Yazd province
61	Investigating the number of congenital anomalies in babies born at Imam Khomeini Hospital in Islamabad Gharb city
62	Prevalence of congenital anomalies and related factors in live births in Zahedan, Southeast of Iran: A cross-sectional study

\*The ID in this table corresponds to the order of studies in Table 1.