

Offspring sex ratio of Iranian dentists

Hadi Ghasemi¹  · Seyedeh Reihaneh Mirdehghan¹ · Mahshid Namdari¹ · Fariborz Bayat²

Received: 16 February 2016 / Accepted: 14 June 2016 / Published online: 21 June 2016
© The Japanese Society for Hygiene 2016

Abstract

Objective To assess the impact of occupational factors on the sex ratio of dentists' children.

Methods A randomly selected 501 Iranian dentists participated in a telephone interview. The participants were contacted by their mobile number to answer questions about demographic variables (gender, age, marriage status), practice-related variables (year of graduation as general or specialist dentist, years of clinical work, working hours, average number of radiographs taken in a day, and spouse's job), and questions about their children (number, gender and date of birth of each child). Kruskal–Wallis and Chi-square tests served for statistical evaluation.

Results Of all participating dentists, 71 % were men, about two-thirds were 35- to 50-year olds, and 89 % were married. In total, the dentists had 768 children; about 21 % had no child. Of all the children, 54 % were boys (overall sex ratio = 1.17). The offspring sex ratio was 1.13 among male dentists, 1.50 for female dentists, and 1.44 when both parents were dentists. Higher percentages of boys were prevalent among female dentists, younger dentists, and general dental practitioners ($p < 0.008$).

Conclusion Demographic and practice-related factors showed some impact on proportions of both sexes of dentists' children in this study. However, the result needs evaluation in further studies.

Keywords Offspring · Sex ratio · Dentists · Occupational factors · Birth outcome

Introduction

The effect of several environmental and occupational factors on human sex ratio at birth (ratio of number of male births to female births) has been the subject of numerous studies in recent decades. These include exposure to hazardous chemicals, ionizing and non-ionizing radiation, g-force, demographic factors, various sources of stress, and parental occupation [1–3]. Studies on offspring sex ratio in occupations like pilots and astronauts, radiologists, physiotherapists, orthopedic surgeons, and other jobs inquire into the relation between sex ratio and occupation and may result in an improved understanding of probable pathophysiologic explanations [4].

Unique characteristics of the working environment of dentistry may have an impact on the reproductive outcomes of dentists in terms of sex ratio in their children. The profession of dentistry is naturally prone to a wide range of health hazards. Dentists are frequently exposed to various sources of infection, different types of chemicals, and physical and psychological stresses [5–7]. The objective of this study was to assess the offspring sex ratio of Iranian dentists in relation to demographic and practice-related factors in their lives.

Materials and methods

This human observational study conforms to the STROBE Guidelines [8]. Participants in this cross-sectional study were chosen by simple random selection from the list of all

✉ Hadi Ghasemi
ha.ghasemi@sbmu.ac.ir; hadighasemi558@yahoo.com

¹ Department of Community Oral Health, School of Dentistry, Shahid Beheshti University of Medical Sciences, Daneshjou Blvd., Evin, Postal Code: 1983963113 Tehran, Iran

² Dental Research Institute, School of Dentistry, Shahid Beheshti University of Medical Sciences, Tehran, Iran

dentists in Iran. An updated list of all registered dentists in Iran served as the study framework. Of about 25,000 registered dentists, 501 computer-derived random numbers became the study sample. If 50 % is considered the proportion of male offspring, to estimate it in the current population with 95 % confidence and determining a 0.045 error, the required sample size is 476 individuals. To compensate for probable loss of samples, an additional 25 provided 501 subjects for the final study sample.

The dentists selected were contacted by their cell phone numbers. After excluding unsuccessful contacts, data from 501 dentists were complete and served as working data in this study.

The questions in the telephone interview included demographic questions (gender, age by year, marital status), practice-related questions (year of graduation, years of clinical work, working hours per day and per week, average number of radiographs taken per day, and occupation of spouse), and questions about their children (number of biological children, gender and date of birth of each child).

As a pilot study, the telephone interview was tried with ten selected dentists; based on this experience, small revisions improved the questions and the method of asking. Following that, one of the authors (RM) performed the main telephone interviews during October–December 2014.

The ethical considerations of the study were approved by the department of Community Oral Health, Shahid Beheshti School of Dentistry. All dentists were assured that their information would be strictly confidential.

Descriptive statistics included frequencies and percentages of the dentists by personal and practice-related factors and also percentage of children and sex ratio in each subgroup. Statistical evaluation included the Kruskal–Wallis test for differences in sex ratio among subgroups and the Chi-square test for differences in frequencies between the dentists’ subgroups. SPSS software version 21 served as the statistical tool.

Results

Of all 501 dentists participating, 71 % were men, about two-thirds were 35–50 years old, and the majority were married (Table 1). More than 60 % of the dentists reported at least 10 years of clinical work experience and 87 % were general dental practitioners.

In total, the participating dentists reported having 768 children; about 21 % of the dentists had no child, and 55 % had two or more children (Table 2). More than half the children were boys, an overall sex ratio of 1.17. Offspring sex ratio among female dentists (1.50) was higher than when both parents were dentists (1.44), or in male dentists

Table 1 Distribution (%) of the 501 Iranian dentists based on their personal and practice-related factors

	All (n)	Men (%)	Women (%)	p value ^a
Age groups (years)				
<35	90	6	54	<0.001
35–44	140	30	30	
45–50	181	51	11	
>50	51	13	5	
Marital status				
Married	455	93	84	0.002
Non-married	46	7	16	
Clinical work (years)				
<11	190	30	62	<0.001
11–16	183	43	21	
>16	120	27	17	
Average no. of radiograph/day				
0	88	15	26	0.016
1–5	256	53	48	
>5	149	32	26	
Dental specialty				
Non-specialist	431	91	77	<0.001
Specialist	63	9	23	

From 7 to 39 missing data due to no answer for various factors

^a Chi-square test

(1.13). The percentages of boys in these three ‘groups were a respective 60 %, 59 %, and 53 %, a difference statistically significant ($p < 0.001$).

Higher percentages of boys among all children appeared in the age <35 group (Table 3). Difference in percentages of boys in the subgroups based on dentists’ age, clinical work, and type of specialty were statistically significant ($p < 008$).

Discussion

In total, the percentage of boys was higher than that of girls among dentists’ children, and these higher percentages were prevalent among female dentists, younger dentists, and general dental practitioners. Moreover, the majority of the dentists were married, and one out of five had no child.

To the best of our knowledge, this is the first study focusing on the association of offspring sex ratio with the profession of dentistry in Iran and also worldwide. Since the participants in this study were a random sample of all dentists in Iran, results are fairly well generalizable to the population of dentists in the country. Limitations in the cross-sectional study design, however, make it difficult to draw firm conclusions from the existing data. It was also

Table 2 Distribution of 501 Iranian dentists by number of children and offspring sex ratio according to parents' job

	All dentists	Number (%) of dentists			Number (%) boy	Number (%) girl	Sex ratio
		No child	1 child	≥2 children			
	501	104 (21)	122 (24)	275 (55)	416 (54)	352 (46)	1.17
Father dentist	324	43 (13)	55 (17)	226 (70)	313 (53)	282 (47)	1.13
Mother dentist	122	46 (38)	45 (37)	31 (25)	67 (60)	45 (40)	1.50
Both parents dentists	55	15 (27)	22 (40)	18 (33)	36 (59)	25 (41)	1.44

Table 3 Distribution of 501 dentists' number of children and offspring sex ratio by age and practice-related factors

	All (n)	% Dentists			Children (n)	% Boy	Sex ratio
		No child	1 child	≥2 children			
	501	21	24	55	768	54	1.17
Age groups ^a							
<35	90	54	39	7	47	68	2.1
35–44	140	24	36	40	175	49	1.0
45–50	181	6	12	82	370	55	1.2
>50	51	4	12	84	117	54	1.1
Clinical work (years) ^b							
<11	190	36	29	35	222	56	1.3
11–16	183	14	24	62	302	54	1.2
>16	120	7	18	75	229	51	1.0
Average no. of radiograph/day ^b							
0	88	24	22	54	132	53	1.1
1–5	256	17	25	58	422	53	1.1
>5	149	26	25	49	203	57	1.3
Dentist's specialty ^c							
No	431	18	24	58	695	54	1.2
Yes	63	41	32	27	59	49	0.96

^a Missing data due to no answer = 39

^b Missing data due to no answer = 8

^c Missing data due to no answer = 7

very difficult to measure the level of exposure of occupational factors and timing of the exposures accurately. Moreover, other environmental factors, ones not considered here, may impact these dentists' children's sex ratios.

The great number of studies evaluating the association of parents' job and offspring sex ratio include a wide range of occupations [1], reflecting the importance of the effect of job conditions on gender of professionals' children. On the other hand, comparison between offspring sex ratio among these various structurally different professions is difficult. Consistent with our findings, a higher proportion of boys than girls have appeared among children of radiologists [9] and navy submariners [10], while in children of a group of cardiologists [11], orthopedic and gynecologist surgeons [12], personnel of stressful jobs including health-related jobs [3], pilots [13], and divers [14], girls have been more numerous than boys.

Dentistry has been considered a stressful profession [5], so one would expect to find an effect of stress in the offspring sex ratio. The link between job-related stress and offspring sex ratio is difficult to explain. Some evidence shows a skewed offspring sex ratio among stressful jobs like health-related jobs [3], cardiologists [11], orthopedic and gynecological surgeons [12], pilots [13], and divers [14] with a higher probability of having daughters than sons. We, however, found the opposite; dentists reported more boys than girls. This may be due to difficulty in gathering precise information about stress in terms of its severity, longevity, inherent qualitative nature, and level at the time of fertilization.

That younger women produce more boys than girls [15, 16] may in part explain the difference in the offspring sex ratio of female dentists (1.5) and male dentists (1.13), since in this study younger dentists were more often women than men.

Comparing the findings of this study with those for the whole Iranian population may provide new ideas for more research in this field. The offspring sex ratio here (1.17) was higher than that of the whole population in Iran (1.04) [17]. This difference may be due to the unique characteristics of the dental profession, although explaining any effect of job type on children's sex ratio is very difficult. Other interesting findings of this study are the percentage of dentists without any children (21 %) and of dentists' being single (9 %), which are both higher than in the whole population: 14 % and 4 % [18]. This difference needs to be studied at a deeper level from the sociological point of view.

Conclusion

Demographic and practice-related factors showed some impact on offspring sex ratio among these Iranian dentists. Sex ratio in their children differed from that of the whole population, a fact which needs further and deeper study.

Acknowledgments The idea for this study originated from a conversation with Dr. Shahrokh Alizadeh; we thank him. Special thanks to Carolyn Brimley Norris, Ph.D., from the University of Helsinki for language editing. We thank all participating dentists for their cooperation.

Compliance with ethical standards

Conflict of interest No conflict of interest exists.

Author contribution statement HG contributed to the whole project from conception of the idea, writing the proposal, preparing the questions, supervising the implementation, doing the statistical analysis, and writing the manuscript. SRM performed the telephone interviews and helped in writing the manuscript. MN mainly performed the statistical analysis, and also helped in drafting the manuscript. FB contributed to the design of the study, prepared the list of dentists, and helped in implementation of the project.

References

1. Terrell L, Hartnett P, Marcus M. Can environmental or occupational hazards alter the sex ratio at birth. A systematic review. *Emerg Health Threats J.* 2011;20(4):7109. doi:10.3402/ehjt.v4i0.7109.

2. James WH. Behavioural and biological determinants of human sex ratio at birth. *J Biosoc Sci.* 2010;5:587–99. Epub 2010 Jun 3. doi: 10.1017/S002193201000012X.
3. Ruckstuhl KE, Colijn GP, Amiot V, Vinish E. Mother's occupation and sex ratio at birth. *BMC Public Health.* 2010;2010(10):269. doi:10.1186/1471-2458-10-269.
4. James WH. How studies of human sex ratios at birth may lead to the understanding of several forms of pathology. *Hum Biol.* 2013;5:769–88.
5. Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a review. *Ind Health.* 2007;5:611–21.
6. Ayers MS, Thomson WM, Newton JT, Rich AM. Job stressors of New Zealand dentists and their coping strategies. *Occup Med.* 2008;4:275–81. Epub 2008 Feb 22. doi:10.1093/occmed/kqn014.
7. Kay EJ, Lowe JC. A survey of stress levels, self-perceived health and health-related behaviours of UK dental practitioners in 2005. *Br Dent J.* 2008;11:E19. Epub 2008 Jun 6. doi:10.1038/sj.bdj.2008.490.
8. ISPM-University of Bern. c2009. STROBE Guidelines. <http://www.strobe-statement.org/index.php?id=available-checklists>. Accessed 11 November 2015.
9. Hama Y, Uematsu M, Sakurai Y, Kusano S. Sex ratio in the offspring of male radiologists. *Acad Radiol.* 2001;5:421–4.
10. Volk B. Evaluating the sex ratio in the offspring of U.S. Navy submariners. *Mil Med.* 2004;11:890–3.
11. Choi JW, Mehrotra P, Macdonald LA, Klein LW, Linsky NM, Smith AM, et al. Sex proportion of offspring and exposure to radiation in male invasive cardiologists. *Proc (Bayl Univ Med Cent).* 2007;3:231–4.
12. Zadeh H, Briggs W. Ionising radiation: are orthopaedic surgeons' offspring at risk. *Ann R Coll Surg Engl.* 1997;3:214–20.
13. Irgen A, Irgens LM. Male proportion in offspring of military air pilots in Norway. *Nor Epidemiol.* 1999;1:47–9. <http://www.ntnu.no/ojs/index.php/norepid/article/download/442/414>. Accessed 11 November 2015.
14. Lyster WR. Altered sex ratio in children of divers. *Lancet.* 1982;17(2):152.
15. Braza F. Human prenatal investment affected by maternal age and parity. *Hum Ecol.* 2004;32:163–75.
16. Almond D, Edlund L. Trivers–Willard at birth and one year: evidence from US natality data 1983–2001. *Proc Biol Sci.* 2007;7:2491–6.
17. Iran National Annual Statistics. c2002. Statistical center of Iran. http://amar.sci.org.ir/index_f.aspx. Accessed 11 November 2015.
18. Iran National Registration. C2008. National Organization for Civil Registration. <https://www.sabteahval.ir/Upload/Modules/Contents/asset99/1393kht.pdf>. Accessed 11 November 2015.