Dental health among older Israeli adults: is this a reflection of a medical care model inadequately addressing oral health?

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Objectives: Israel's health-care system is considered as one of the most efficient worldwide. The purpose of the present study was to assess oral health outcomes, dental care use and respective social inequalities among the older segment of the Israeli population. **Methods:** Secondary analyses were conducted of recently available data from the Survey of Health, Ageing, and Retirement in Europe (SHARE Israel, wave 2), which specifically includes information on chewing ability, denture wearing and dental care use obtained from more than 2,400 Israeli people, 50+ years of age. Multivariate logistic regressions and concentration indices were used to analyse determinants of oral health and dental care use. **Results:** Seventy per cent of respondents reported being able to bite/chew on hard foods and 49% of respondents reported wearing dentures. Forty-three per cent of respondents had visited a dentist within the past 12 months, with about half of all dental visits being made for solely nonpreventive reasons. Significant income-related inequalities were identified, with higher income being associated with greater dental care use (particularly preventive dental visits), better chewing ability and less denture wearing. **Conclusions:** For the older segment of the Israeli population and compared with other countries, the findings of the present study suggest a relatively low level of chewing ability, a high extent of nonpreventive dental visiting, as well as considerable inequalities in oral health and care. It seems that the Israeli health-care system may be improved even further by more comprehensive inclusion of dental care into universal health coverage.

Key words: Oral health, dental care use, inequality, older adulthood, Israel

INTRODUCTION

Oral health is an important component of general health and well-being[1–6]. Oral diseases affect almost four billion persons worldwide and are one of the most costly disease entities to treat[7,8]. Older population subgroups are receiving increasingly more attention as a result of changing demographics[9]. However, because resources within and outside health care are limited, careful choices have to be made in order to use whatever resources are available in ways that will produce the greatest impact on oral health outcomes[10,11]. Therefore, relevant health-policy objectives not only comprise high *average population levels* of oral health but also *reduced social disparities* in oral health and care[12]. Across the globe, a large variety of different health-care systems exist, which employ different approaches to resource use in population health and health care. Accordingly, studying a health-care system that uses available resources very efficiently may help in the development of ameliorated health policy practices and in optimising oral health outcomes.

Among all health-care systems worldwide, the Israeli setting is often considered an example of a very efficient health-care system. Israel's health-care system was recently ranked fourth in the world in terms of efficiency, as scored according to life expectancy, per-capita expenditure on health services relative to gross domestic product (GDP) and per-capita expenditure on health services in absolute terms[13]. In addition, Israel was recently ranked high in comparison with other countries according to the Better Life Index of the Organisation for Economic Co-operation and

Development (OECD)[14]. According to the World Health Organisation (WHO), life expectancy in Israel is 81.8 years, an increase of about 10 years since the 1970s, and infant mortality ranks at 4.3 (no. of deaths per 10,000 births), a decrease of about 6.5-fold since the 1970s[15,16]. The population of Israel is 8.2 million, and 23.9% of individuals are older than 50 years of age[17].

Since the 1920s, the Israeli health-care system has been dominated by the National Labor Union's 'General Sick Fund' (GSF). In the 1980s, three smaller funds started to grow and develop, but the GSF remained dominant. Following a State Commission of Enquiry in 1990, National Health Insurance (NHI) legislation was introduced on 1 January 1995[18,19]. The preamble to the NHI law clearly declares that 'Medical insurance, under this law, shall be based on principles of justice, equality and mutual assistance'. NHI services are delivered by the four sick funds. The 'health-care basket' was initially based on the previous 'basket' of the GSF that had never included provision of dental health-care components. Only 15 years later, in 2010, did the Israel Ministry of Health decide to include dental health services within the 'basket'. The dental health services now included are restorative coverage from birth to age 12 years (delivered by the four sick funds) and preventive dental services for children from preschool kindergarten to 9th grade at school (delivered by the local municipalities or their private contractors). At an international comparative level, Israel presents a unique and unprecedented health-care delivery system:

- A country proud of and committed to its national health-care responsibilities
- A national health-care system that has only very recently included a small and limited dental health-care component.

With respect to oral health outcomes associated with the Israeli health-care system, there is a paucity of evidence. In particular, existing data on oral health, dental care utilisation and respective social inequalities among the middle and later adulthood Israeli population, are scarce. As a result of its distinctive situation, investigation of the Israeli dental health-care system is both important and interesting. Benchmarking the performance of the Israeli health-care system, in terms of oral health and dental care, may be particularly appealing because Israel presents a specific setting in which public subsidies for health care are generally very generous, but public subsidies for dental care are minimal[18,19]. This sets a unique example of a system in which 'everything but dentistry' is covered by social health insurance for people in middle and late adulthood, thus emphasising the self-responsibility of adults for their own oral health.

Therefore, the purpose of the present study was to assess oral health outcomes, dental care use and respective social inequalities among the older segment of the Israeli population and to benchmark the findings for oral health in Israel with comparable information from several European countries. It was hypothesised that the notion of a favourable health-care system in Israel is not applicable to oral health and dental care in middle and later adulthood.

METHODS

The present study is based on secondary analysis of data from wave 2 of the Survey of Health, Ageing, and Retirement in Europe (SHARE release 2.6.0). Therefore, approval by an ethics committee or consent from participants specifically for this paper was not required. The data include unique information on the health and living conditions of Israeli people, 50 years of age and older (SHARE Israel). The data were collected in 2009–2010 and became available for research purposes in November 2013. Jewish-Israeli people who immigrated to Israel before 1989 or were born in Israel were interviewed in the Hebrew language, Arab citizens of Israel were interviewed in the Arabic language and immigrants of the Russian immigration to Israel in the 1990s were interviewed in the Russian language. Data were collected by self-completed paper-pencil questionnaires, as well as by computer-assisted personal interviews. Further details regarding methodological aspects of SHARE and SHARE Israel can be found in www.share-project.org and in the literature[20–22].

In addition to the general characteristics (age, sex, subjective health and labour force status) of the respondents, SHARE wave 2 provides information on the oral health status and dental care utilisation of Israeli subjects. With respect to oral health, SHARE provides information on chewing ability (a binary variable assessed through the question '*Can you bite and chew on hard foods such as a firm apple without difficulty?*' – answering categories: '*yes*' or '*no*') and on denture wearing (a binary variable that reports whether an individual has responded with '*yes*' or '*no*' to the question '*Do you use dentures?*'). For various European countries, previous studies have used these SHARE variables as oral health proxies[23–27].

With respect to dental care utilisation, SHARE participants were asked to answer the question '*During the last 12 months, have you seen a dentist or a dental hygienist?*'. If respondents had answered '*yes*' to the above question, more detailed information about the type of care received was obtained using the following question: '*Was that for routine control or prevention, for treatment, or for both?*'. Based on these questions, we derived the following dental care use

variables: (i) any dental care use; (ii) preventive dental care use only; (iii) operative dental care use only; and (iv) preventive and operative care use. Previous studies have used these SHARE variables to analyse dental care use in Europe.[28,29] SHARE also provides information on respondents' dental insurance coverage, which can be considered a relevant determinant of dental care use. The respective information was assessed through the question 'Who finally pays for dental care?' with the possible answer categories 'yourself only', 'mostly yourself', 'mostly your health insurance', or 'your health insurance only'. For purpose of our analyses, and in line with previous studies[29], we constructed a binary control variable which combines the categories 'mostly your health insurance' and 'your health insurance only' versus the categories 'yourself only' and 'mostly yourself'.

Analogous to previous SHARE-based and dentistry-related work for other countries[25,26,28], we relied on net equivalised income as a socio-economic measure according to the definition of the OECD[30]. This measure factors in household size and age of household members (i.e. children 14 years of age or younger are assumed to contribute less to household consumption than the household head or other household members older than 14 years of age). Note that we treated respondents whose net monthly household income exceeded the equivalent of €100,000 as statistical outliers and excluded such observations in our analysis to prevent bias in our sample.

To analyse variations in oral health-related outcomes and dental care utilisation within the Israeli population 50+ years of age, multivariate logistic regressions and concentration indices were used. In logistic regression models for chewing ability and denture wearing, age, sex, equivalised income (in tertiles), dental attendance, subjective general health and labour force status were included as control variables. The same set of control variables, as well as dental insurance coverage and oral-health parameters (chewing ability and denture wearing), were included in regression models for assessing variations in dental care utilisation. In addition to regression models, concentration indices were calculated for more detailed analysis of socio-economic inequalities, using equivalised income as a socio-economic measure. The concentration index has frequently been used previously to quantify the degree of relative socio-economic inequality in a dental (care) outcome[25,26,28,31–34]; it is specified to take on values between −1 and +1, whereby a value of '0' represents perfect equality in the outcome parameter across all socio-economic groups. This measure provides complementary information to parameter estimates obtained from logistic regression modelling and identifies not only linear social gradients but all kinds of deviation from social equality. Note that, in the present study, positive values of the concentration index indicate that population groups with higher income have better chewing ability, are less likely to wear dentures, or have a greater extent of dental care use. Also note that there are subtle differences between weighting variables which are available for Israel and other SHARE wave 2 countries: previous concentration index analyses for European countries relied on design weights, whereas no such variable is available for Israel. Therefore, in the present study, calculation of concentration indices for Israel employed a calibrated individual weight variable. For comparability of concentration indices between Israel and other SHARE countries, concentration indices were analogously computed for European countries also using calibrated individual weight variables (results in Appendix S1). All data analyses were carried out in STATA/SE 12.0 (StataCorp, College Station, TX, USA).

RESULTS

Table 1 displays demographic characteristics of the study sample and selected SHARE variables that were used to explain variations in oral health and dental care use. The study sample included 2,441 persons. Mean respondents' age was 68 years and women comprised 56% of the sample. Average equivalised income was €1,626. For one in 10 respondents, dental

Table 1 Descriptive statistics of the Survey of Health, Ageing, and Retirement in Europe (SHARE) measures employed for Israeli people, 50+ years of age

Variable	Value*	n
Age (years)	68.4 ± 9.6	2,441
Sex		
Female	56.4%	2,441
Male	43.6%	2,441
OECD equivalised income (€)	1,626 ± 2,838	1,762
Dental care is paid for:		
Mostly or fully by insurance	10.0%	2,280
Mostly or fully by respondent	90.0%	2,280
Subjective general health is:		
Excellent	6.0%	2,417
Very good	17.4%	2,417
Good	26.2%	2,417
Fair	31.9%	2,417
Poor	18.5%	2,417
Labour force status		
Employed or self-employed (including working for family business)	31.3%	2,404
Retired	44.9%	2,404
Unemployed and looking for work	1.5%	2,404
Permanently sick or disabled	6.9%	2,404
Homemaker	14.0%	2,404
Other (rent, live off own property, student, do voluntary work)	1.3%	2,404

*Values are given as mean ± standard deviation or percentage.
OECD, Organisation for Economic Co-operation and Development.

care is paid for mostly or fully by health insurance. About half of all respondents reported having excellent, very good or good general health, whereas the other half of the respondents reported having fair or poor general health. At the time of the interview, 31% of respondents were employed or self-employed, 45% were retired, 2% were unemployed, 7% indicated that they were permanently sick or disabled and 14% reported being a homemaker. *Table 2* shows descriptive statistics of SHARE variables for oral health and dental care use in Israeli people 50+ years of age. Seventy per cent of respondents reported being able to bite or chew hard foods, and 49% of respondents indicated wearing dentures. Forty-three per cent of respondents indicated that they had utilised dental care within the past 12 months; 9% of respondents had used only preventive dental care, 22% only operative dental care and 12% had used both preventive and operative dental care.

Table 3 displays the results from multivariate regression analysis on chewing ability and denture wearing. With respect to chewing ability, the following significant parameter estimates were identified: older age was associated with reduced chewing ability; being in the upper tertile of the income distribution increased the odds of being able to bite/chew on hard foods in comparison with being in the lower tertile of the income distribution [odds ratio (OR) = 1.48; 95% CI: 1.11–1.97]; compared with excellent general health, having fair or poor general health was associated with reduced chewing ability; and compared with persons who were employed or self-employed, chewing ability was reduced in retired, permanently sick or disabled persons as well as in

Table 2 Descriptive statistics of Survey of Health, Ageing, and Retirement in Europe (SHARE) variables for oral health and dental care use among Israeli people, 50+ years of age

Variable	Value(%)	*n*
Chewing ability		
Able to bite/chew on hard food	70.3	2,418
Not able to bite/chew on hard food	29.7	2,418
Denture wearing		
Yes	48.7	2,422
No	51.3	2,422
Any dental care use		
Yes	43.1	2,414
No	56.9	2,414
Preventive dental care use only		
Yes	8.7	2,414
No	91.3	2,414
Operative dental care use only		
Yes	22.0	2,414
No	78.0	2,414
Preventive and operative dental care use		
Yes	12.3	2,414
No	87.7	2,414

Table 3 Results from multivariate logistic regression analysis on chewing ability and denture wearing

Variable	Chewing ability		Denture wearing	
	OR	95% CI	OR	95% CI
Age (years)	0.96*	0.95–0.97	1.07*	1.05–1.08
Gender				
Male	1 (ref.)		1 (ref.)	
Female	0.86	90.67–1.08	0.961	0.76–1.21
Income				
Lower tertile	1 (ref.)		1 (ref.)	
Middle tertile	1.31	1.00–1.72	0.87	0.67–1.14
Upper tertile	1.48*	1.11–1.97	0.48*	0.36–0.63
Dental attendance (last year)				
No	1 (ref.)		1 (ref.)	
Yes	1.18	0.93–1.49	0.35*	0.28–0.44
General health				
Excellent	1 (ref.)		1 (ref.)	
Very good	1.05	0.50–2.23	1.05	0.62–1.78
Good	0.51	0.26–1.02	1.43	0.87–2.37
Fair	0.34*	0.17–0.67	1.79*	1.091–2.94
Poor	0.18*	0.09–0.37	1.88*	1.097–3.23
Labour force status				
Employed or self-employed	1 (ref.)		1 (ref.)	
Retired	0.63*	0.44–0.89	1.32	0.97–1.78
Unemployed and looking for work	0.87	0.29–2.59	0.94	0.38–2.33
Permanently sick or disabled	0.35*	0.21–0.57	1.23	0.75–2.01
Homemaker	0.48*	0.31–0.73	1.26	0.86–1.83
Other	0.57	0.23–1.45	1.18	0.46–3.01
Number of observations	1,738		1,741	

*Statistical significance at the level of <5%.
95% CI, 95% confidence interval; OR, odds ratio.

homemakers. With respect to denture wearing, the following significant parameter estimates were observed: older age was associated with a higher probability of denture wearing; being in the upper tertile of the income distribution decreased the odds of denture wearing in comparison with being in the lower tertile of the income distribution (OR = 0.48; 95% CI: 0.36–0.63); compared with excellent general health, having fair or poor general health was associated with a higher likelihood of denture wearing.

Table 4 shows the results from multivariate logistic regression analysis on dental care utilisation. With respect to utilisation of any dental care within the past 12 months, the following significant parameter estimates were identified: women were more likely to have used dental care than men; being in the upper tertile instead of the lower tertile of the income distribution increased the probability of any dental care use (OR = 1.53; 95% CI: 1.16–2.01); compared with persons who were employed or self-employed, the probability of any dental care use was lower for homemakers; wearing dentures reduced the probability of any dental care use. With respect to utilisation of solely preventive dental care, women were more

Table 4 Results from multivariate logistic regression analysis on dental care use items

Variable	Any dental care		Preventive only		Operative only		Preventive + operative	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age (years)	0.99	0.98–1.01	1.02	0.99–1.04	1.00	0.98–1.02	0.97*	0.95–0.99
Gender								
Male	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Female	1.47*	1.18–1.84	1.72*	1.16–2.55	1.23	0.95–1.59	1.09	0.79–1.49
Income								
Lower tertile	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Middle tertile	1.16	0.89–1.52	0.95	0.51–1.77	0.94	0.69–1.27	1.68*	1.10–2.56
Upper tertile	1.53*	1.16–2.01	2.37*	1.40–4.04	0.91	0.66–1.27	1.54*	1.00–2.35
General health								
Excellent	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Very good	0.97	0.60–1.55	0.76	0.39–1.47	1.89	0.96–3.73	0.67	0.37–1.23
Good	0.92	0.59–1.46	0.66	0.34–1.28	2.19*	1.14: 4.21	0.57	0.32–1.02
Fair	0.89	0.56–1.40	0.44*	0.22–0.86	2.24*	1.17–4.29	0.67	0.37–1.20
Poor	0.81	0.49–1.34	0.40*	0.16–0.95	2.02	0.10–4.07	0.65	0.33–1.27
Labour force status								
Employed or self-employed	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Retired	1.10	0.82–1.47	1.26	0.79–2.01	0.97	0.69–1.35	1.13	0.75–1.70
Unemployed and looking for work	1.15	0.45–2.95	0.97	0.11–8.47	2.18	0.89–5.32	†	†
Permanently sick or disabled	0.63	0.37–1.05	0.53	0.11–2.45	0.74	0.41–1.34	0.62	0.30–1.30
Homemaker	0.50*	0.35–0.73	0.57	0.27–1.21	0.77	0.50–1.19	0.47*	0.25–0.87
Other	3.32*	1.21–9.12	6.13*	2.13–17.65	1.41	0.47–4.29	0.92	0.20–4.24
Ability to bite/chew on hard food								
No	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Yes	0.87	0.67–1.13	2.28*	1.20–4.32	0.71*	0.53–0.95	0.85	0.58–1.25
Denture wearing								
No	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Yes	0.33*	0.26–0.42	0.38*	0.24–0.59	0.48*	0.36–0.63	0.49*	0.35–0.69
Dental care is paid for:								
Mostly or fully by respondent	1 (ref.)		1 (ref.)		1 (ref.)		1 (ref.)	
Mostly or fully by insurance	0.85	0.60–1.21	0.81	0.44–1.47	0.81	0.54–1.23	1.18	0.74–1.87
Number of observations	1,669		1,669		1,669		1,646	

*Statistical significance at the level of <5%.
†Dropped because of perfect co-linearity (23 observations were not used).
95% CI, 95% confidence interval; OR, odds ratio.

likely to use such services; being in the upper tertile instead of the lower tertile of the income distribution increased the probability of preventive dental care (OR = 2.37; 95% CI: 1.40–4.04); compared with excellent general health, having fair or poor general health was associated with lower utilisation of solely preventive care; good chewing ability increased, and wearing dentures reduced, the probability of solely preventive dental care use. With respect to utilisation of solely operative dental care, this was increased in subjects with good or fair general health in comparison with those with excellent health; good chewing ability and wearing dentures both reduced the probability of solely operative dental care use. With respect to combined utilisation of preventive and operative dental care, older age was associated with lower utilisation; compared with being in the lower tertile of the income distribution, the probability of using both preventive and operative dental care was higher when being in the middle income tertile (OR = 1.68; 95% CI: 1.10–2.56) or in the upper income tertile (OR = 1.54; 95% CI: 1.00–2.35); in comparison with employed or self-employed respondents, homemakers

Table 5 Concentration indices of income-related inequalities in oral health and utilisation of dental care parameters

	Concentration index	95% CI
Oral health		
Chewing ability	0.09*	0.07 to 0.10
Denture wearing	−0.14*	−0.17 to −0.11
Utilisation of dental care		
Any dental care	0.09*	0.06 to 0.12
Preventive only	0.26*	0.17 to 0.35
Operative only	−0.03	−0.08 to 0.02
Preventive and operative	0.17*	0.11 to 0.24

*Statistical significance at the level of <5%; results are weighted (calibrated individual weights).
95% CI, 95% confidence interval.

were less likely to use combined preventive and operative dental care; wearing dentures also reduced the probability of such dental care use.

Table 5 shows concentration indices for quantifying the degree of relative socio-economic inequalities in oral health and utilisation of dental care parameters. A significantly higher concentration of good chewing

ability was detected towards the upper end of the income scale (concentration index = 0.09; 95% CI: 0.07–0.10). A significantly lower concentration of denture wearing occurred towards the upper end of the income scale (concentration index = −0.14; 95% CI: −0.17 to −0.11). Utilisation of dental care (any type) was more densely concentrated towards the upper end of the income scale (concentration index = 0.09; 95% CI: 0.06–0.12); utilisation of solely preventive care was more likely to occur towards the upper end of the income scale (concentration index: 0.26; 95% CI: 0.17–0.35); finally, combined utilisation of preventive and operative dental care was also more densely concentrated at the upper end of the income scale.

DISCUSSION

In the present paper based on SHARE data, the broad picture of oral health for adult and older Israeli people appeared to be lower in general and in particular when compared with European countries. According to our findings, 70.3% of Israeli people, 50+ years of age, are able to bite/chew on hard food, 48.7% wear dentures and 43% utilise dental care (8.7% preventive only, 22% operative and 12.2% operative and preventive). A consistent and statistically significant association was revealed for income and oral health. Higher-income people reported better chewing ability (OR = 1.48), less denture wearing (OR = 0.48), more total dental care (OR = 1.53), more preventive care (OR = 2.37) and more operative and preventive care (OR = 1.53). The concentration indices for income-related inequalities were all significant (besides only operative care).

Comparing these results with the broader European SHARE database (14 countries), Israeli people revealed the second-lowest (70.3%) reported chewing ability, the sixth-highest (48.7%) proportion of denture wearing, the 10th-highest (43.1%) dental care utilisation and the third-lowest (8.7%) preventive care utilisation[23,24,29]. In addition, Israeli people demonstrated the worst income-related level of inequality for chewing ability (concentration index = 0.09), and the second-worst income-related equality for total treatment use (concentration index = 0.09) and preventive treatment use (concentration index = 0.26)[25,26,28]. These results indicate that, according to most criteria, the status of oral health among Israeli adults and older is far from optimal.

Although, by and large, the Israeli health-care system is socially and morally committed to good health care, the system has not historically included dental care and, at the present time, only includes children until the age of 12 years[18,19]. The present data clearly indicate gross inequalities based on income

and a need to widen the investment and involvement of the government in a wider oral health policy. The wide vision and mission of promoting justice, equality and mutual assistance in health care should recognise oral health as an undivided and integrated component.

The present study has some limitations implied by the underlying data source (SHARE). Notably, all data are survey based and rely upon subjectively reported answers. To some extent, our results may therefore be influenced by response bias in general and on cultural differences in particular. Much has been written about cultural differences in health/disease perception[35–39]. Moreover, applied measures for chewing ability and denture wearing may be considered only proxy variables for oral health. To our knowledge, however, there is currently no other comparable database that would facilitate such investigations. The main advantage of our study is indeed grounded in the fact that the survey methodology and questionnaire items are uniform for all SHARE countries. This supplies and offers a unique opportunity to evaluate and compare results.

CONCLUSIONS

For the older segment of the Israeli population and compared with other countries, the findings of the present study suggest a relatively low level of chewing ability, a high extent of nonpreventive dental visiting, as well as considerable inequalities in oral health and care. It seems that the Israeli health-care system may be improved even further by more comprehensive inclusion of dental care into universal health coverage.

Disclosure of Conflicts of Interests

The authors declare that there is no conflict of interest.

Ethics Statement

This research has been conducted in full accordance with the World Medical Association Declaration of Helsinki.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Concentration indices (95% confidence intervals) for European SHARE countries using the same parameters and methodology as in *Table 5*.

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