HEALTH SERVICES RESEARCH

Inequalities in Dental Attendance throughout the Life-course

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Abstract: *The purpose of this study was to identify socio-economic inequalities in regular dental attendance throughout the life-course. The analyses relied on data from SHARE (waves 1 to 3 of the Survey of Health, Ageing, and Retirement in Europe), which includes retrospective information on life-course dental attendance of 26,525 persons currently aged 50 years or greater from 13 European countries (Austria, Poland, Spain, Italy, the Netherlands, Belgium, Greece, the Czech Republic, France, Denmark, Switzerland, Germany, and Sweden). Inequalities in dental attendance were assessed by means of Concentration Indices. Socio-economic disparities in regular dental attendance were identified as early as childhood. Moreover, higher educational attainment resulted in increased probabilities of regular dental attendance throughout subsequent life-years in all nations. In most countries, inequality levels remained relatively inelastic throughout the life-course. These findings suggest that a considerable proportion of inequalities in dental care use is already established at childhood and persists throughout the life-course.*

Key Words: socio-economic disparities, dental care use, lifecycle analysis, elderly populations, health policy, health care economics and organizations.

Introduction

Socio-economic inequalities in oral health remain a major challenge for health policy and public health (Marmot and Bell, 2011; Williams, 2011). In particular, the general demographic transition and its impact on oral health (Harford, 2009) have attached special importance to tackling inequalities among elderly generations (Tsakos, 2011). Although the existence of such inequalities has been well-documented for many years (Watt and Sheiham, 1999; Locker, 2000; Gilbert *et al.*, 2003; Sanders *et al.*, 2006; Watt, 2007; Holst, 2008; Tsakos *et al.*, 2009), we still do not comprehensively understand how such inequalities can best be reduced. Strategies for tackling oral health inequalities are increasingly being discussed within the context of a 'common-risk factor' approach (Sheiham and Watt, 2000; Sanders *et al.*, 2005), which aims at addressing the joint causes of multiple common diseases, oral health impairment being just one of them (Marshman and Robinson, 2009). Policy areas generally relevant to oral health promotion are use of fluoride, food and health policies to reduce sugar consumption, community approaches to improve body hygiene (including oral cleaning), smoking cessation, policies on reducing accidents, and ensuring access to appropriate preventive care (Sheiham, 1995). In relation to the latter, dental attendance patterns have been proposed as one specific pathway contributing to oral health inequalities (Newton and Bower, 2005). Despite some concern about limited effectiveness of health care interventions (Gulliford, 2009), regular dental attendance has been shown to be associated with better oral health and to be more common among individuals at the upper end of the socio-economic scale (Donaldson *et al.*, 2008).

For health-care decision-makers, it is essential to know whether socio-economic disparities in dental attendance among late-middle-aged and elderly generations are readily responsive to contemporaneous institutional arrangements, or whether such disparities rather reflect a continuation of health behaviors acquired in early life. On the one hand, it has been suggested that accessibility features of health care systems, such as health insurance coverage, may be relevant determinants of simultaneous inequalities in health care use (van Doorslaer *et al.*, 2004). On the other hand, the lifecycle approach provides a suitable conceptual framework for explaining a potential perseverance of socially determined dental attendance behaviors throughout

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the life-course. In particular, it has been proposed that, in the sense of an *accumulation of risk model* (Kuh and Ben-Shlomo, 2004), children growing up in a social environment in which regular dental attendance is the norm are more likely to adhere closely to a pattern of routine dental visiting in adulthood than peers growing up in settings in which an example is set of problem-oriented dental visiting (Nicolau *et al.*, 2007). Therefore, if socio-economic disparities in adults' dental attendance primarily reflect a continuation of earlier acquired health behaviors, such inequalities may be relatively unresponsive to contemporaneous health policy interventions.

A recent paper (Listl, 2011) has documented income-related inequalities in dental service utilization for several elderly generations in Europe. While inequalities were evident for all countries examined, these could not be explained by contemporaneous differences in health care systems. Moreover, the results of another recent study based on the same study population (Listl *et al.*, 2011) are indicative of a potentially large impact of childhood socio-economic status on dental care use in early life. The purpose of the present paper is, therefore, to extend previous work on inequalities in dental service utilization among elderly Europeans by tracking the corresponding socio-economic disparities back into childhood and forward into the further life-course.

Materials & Methods

Data Source

The present study is based on data from waves 1 to 3 of the Survey of Health, Ageing, and Retirement in Europe (SHARE). SHARE represents the first European dataset with detailed cross-national information about health, socio-economic conditions, and family backgrounds of the elderly population. The initial wave of SHARE included 11 countries and was conducted in 2004, followed by wave 2 in 2006-2007, which incorporated three additional countries. Wave 3 (referred to as SHARELIFE) was designed to collect detailed retrospective life-histories during 2008-2009. SHARE data are collected on the basis of computer-assisted personal interviews and self-completed paper & pencil questionnaires. Study participants are representative of the European population aged 50 and over in Scandinavia (Denmark and Sweden), Central Europe (Austria, France, Germany, Switzerland, Belgium, and the Netherlands), and the Mediterranean (Spain, Italy, and Greece), as well as two transition countries (the Czech Republic and Poland). Eligible as study participants are all household members aged 50 yrs and over. A detailed description of the SHARE and SHARELIFE methodology is available in the literature (Börsch-Supan *et al.,* 2008; Schröder, 2008) and on the SHARE Web site (www.share-project.org).

Measures of Dental Attendance

SHARELIFE provides retrospective information about regular dental attendance throughout the life-course of 26,525 persons from 13 European countries. Based on the questions (see Appendix for details), a series of variables was constructed for depicting whether respondents had or had not regularly visited a dentist throughout their life history. These are:

- regular dental attendance between life-years 0 and 15 (childhood);
- regular dental attendance between life-years 16 and 25;
- regular dental attendance between life-years 26 and 40;
- regular dental attendance between life-years 41 and 55;
- regular dental attendance between life-years 56 and 65;
- regular dental attendance between life-years 66 and 75;
- regular dental attendance from life-year 76 onward.

Measures of Socio-economic Conditions

Two frequently applied socio-economic measures are income and education. While SHARE contains information about respondents' current income at the time of interview, *i.e.,* at age 50+, the information in SHARELIFE about the income situation in earlier life-years is relatively limited. However, SHARE provides detailed information about respondents' education. Importantly, educational attainment has been shown to have a strong impact on income level (Ashenfelter and Krueger, 1994). In accordance with human capital theory, education provides the skills and knowledge needed in the workplace. The more human capital an individual obtains, the more valuable (s)he is in the labor market, which then results in higher earnings (Mincer, 1958; Schultz, 1961).

In SHARE, respondents were asked about their highest educational attainment upon their first participation in the survey, *i.e.*, either in wave 1 or in wave 2. Thereby, educational attainment was measured according to the International Standard Classification of Education [ISCED] (UNESCO, 1997; see Appendix for the definition of ISCED levels). Using educational attainment as a socio-economic measure is particularly appealing within a lifecycle framework. Its informative content already applies to the age at which education is usually completed, *i.e.,* late adolescence and early adulthood. Moreover, it holds effective throughout the subsequent life-course, particularly due to its strong associations with income (see above). However, 'educational attainment accomplished' does not directly apply to socio-economic conditions in childhood and early adolescence.

SHARELIFE, fortunately, provides information about the number of books *per* household during childhood. As suggested in the social science literature, the number of books *per* household is a powerful proxy for the educational, social, and economic background during childhood and adolescence (Schütz *et al.,* 2008). Moreover, the number of books at home has been shown to be the single most important predictor of educational attainment (Wößmann, 2003). In SHARELIFE, the relevant socio-economic measure was evaluated by asking "*Approximately how many books*

Table 1.
Summary Statistics – Population Proportions of Persons Who Have Ever Visited the Dentist Regularly, Number of Books *per* Household during Childhood, and Educational Attainment (ISCED levels)

		Number of Books in Household during Childhood			Highest Educational Attainment (ISCED levels)		
	Ever Visited the Dentist Regularly	0-10	11-100	➢100	level 0-1	level 2-3	level 4-6
Austria	74.8%	45.8%	46.4%	7.8%	19.6%	57.6%	22.8%
Germany	80.2%	31.2%	53.8%	15.0%	0.8%	71.4%	27.8%
Sweden	95.4%	20.0%	56.2%	23.8%	34.8%	35.4%	29.8%
Netherlands	85.0%	31.1%	53.6%	15.3%	16.1%	62.2%	21.7%
Spain	43.1%	63.6%	30.0%	6.4%	64.1%	28.0%	7.4%
Italy	47.4%	75.2%	21.2%	3.6%	53.2%	38.2%	8.6%
France	71.0%	45.8%	40.9%	13.3%	42.9%	37.8%	19.3%
Denmark	90.4%	21.6%	52.1%	26.3%	15.9%	48.6%	35.5%
Greece	41.7%	63.3%	34.8%	1.9%	48.9%	32.6%	18.5%
Switzerland	81.0%	30.2%	48.8%	21.0%	15.8%	55.3%	28.9%
Belgium	65.1%	46.3%	41.3%	12.4%	26.5%	49.7%	23.8%
Czech Republic	88.8%	16.8%	66.9%	16.3%	18.1%	69.6%	12.2%
Poland	43.8%	60.8%	33.6%	5.6%	47.2%	40.4%	12.4%

NB: For reasons of clarity and comprehensibility of the Table, "number of books" and "ISCED levels" are consolidated into three categories each.

were there in the place you lived in when you were 10?" With the additional reference that magazines, newspapers, or school books should not be counted, respondents could answer this question according to the following categories: "*None or very few (0-10 books)*", "*Enough to fill one shelf (11-25 books)*", "*Enough to fill one bookcase (26-100 books)*", "*Enough to fill two bookcases (101-200 books)*", and "*Enough to fill two or more bookcases (more than 200 books)*".

Identification of Socio-economic Inequalities

Inequalities in dental attendance were identified by means of the Concentration Index (CI). The CI quantifies the degree of relative socio-economic inequality in a health variable and is increasingly being used in the dental literature (Perera and Ekanayake, 2008; Somkotra and Detsomboonrat, 2009; Do *et al.,* 2010; Listl, 2011). The construct of the CI relates directly to the so-called 'concentration curve' (see Appendix for a detailed explanation). Formally, the CI can be expressed with reference to the covariance between a health sector variable and the fractional rank within the socio-economic distribution (Kakwani *et al.,* 1997). An according formal definition of the CI for purpose of this study, *i.e.,* identification of socio-economic inequalities in dental attendance, is given in formula 1 (Appendix). Generally note that the value of the CI is bounded between – 1 and +1, and a positive (negative) value of the CI means dental attendance is higher among the better (worse) off.

In the present paper, CIs were first calculated for all countries and for all different life periods. Statistically significant differences in CIs between different life periods and between countries were then identified by means of pairwise t tests. Moreover, cross-country socio-economic influences on CI level were assessed by means of linear regression. All data analysis in the present study was carried out with the software package STATA/SE 11 (StataCorp, College Station, TX, USA). The level of statistical significance was generally set at 5%.

Results

Table 1 shows summary statistics for population proportions of persons who have ever visited the dentist regularly throughout the life-course, and for the distribution of socio-economic stratification variables by respondents' country of residence. Data in column 1 indicate considerable cross-country differences in the level of regular dental attendance. Similar variations between nations are displayed for socio-economic status, *i.e.,* for number of books in

Table 2.
Concentration Indices (CI) for Inequalities in Regular Dental Attendance throughout the Life-course

		Age (yrs)						
		0-15	16-25	26-40	41-55	56-65	66-75	> 75
Country	AT	**0.134** (0.101; 0.166)	**0.077** (0.049; 0.105)	**0.082** (0.054; 0.110)	**0.081** (0.053; 0.108)	**0.080** (0.052; 0.108)	**0.086** (0.050; 0.121)	**0.078** (0.024; 0.132)
	GE	**0.139** (0.114; 0.164)	**0.054** (0.035; 0.073)	**0.044** (0.028; 0.060)	**0.038** (0.023; 0.053)	**0.031** (0.015; 0.046)	**0.027** (0.006; 0.049)	**0.019** (–0.019; 0.058)
	SE	**0.050** (0.036; 0.060)	**0.037** (0.026; 0.048)	**0.029** (0.020; 0.039)	**0.027** (0.018; 0.035)	**0.024** (0.015; 0.032)	**0.023** (0.013; 0.034)	**0.032** (0.014; 0.049)
	NL	**0.104** (0.088; 0.119)	**0.079** (0.065; 0.093)	**0.082** (0.069; 0.096)	**0.076** (0.063; 0.089)	**0.083** (0.068; 0.097)	**0.100** (0.078; 0.121)	**0.122** (0.089; 0.155)
	SP	**0.357** (0.295; 0.419)	**0.284** (0.236; 0.332)	**0.252** (0.212; 0.292)	**0.221** (0.186; 0.256)	**0.188** (0.153; 0.224)	**0.124** (0.079; 0.170)	**0.079** (0.006; 0.153)
	IT	**0.181** (0.136; 0.225)	**0.173** (0.137; 0.209)	**0.165** (0.133; 0.196)	**0.132** (0.105; 0.159)	**0.120** (0.093; 0.147)	**0.120** (0.086; 0.154)	**0.105** (0.042; 0.167)
	FR	**0.199** (0.173; 0.224)	**0.127** (0.105; 0.148)	**0.109** (0.089; 0.128)	**0.109** (0.090; 0.128)	**0.107** (0.086; 0.127)	**0.092** (0.065; 0.119)	**0.130** (0.091; 0.168)
	DN	**0.122** (0.107; 0.138)	**0.079** (0.066; 0.091)	**0.070** (0.059; 0.082)	**0.069** (0.057; 0.080)	**0.074** (0.061; 0.086)	**0.092** (0.072; 0.111)	**0.124** (0.092; 0.156)
	GR	**0.281** (0.243; 0.320)	**0.243** (0.209; 0.278)	**0.205** (0.173; 0.236)	**0.182** (0.153; 0.211)	**0.147** (0.117; 0.178)	**0.111** (0.067; 0.156)	**0.096** (0.035; 0.158)
	SW	**0.118** (0.097; 0.138)	**0.059** (0.039; 0.079)	**0.058** (0.040; 0.076)	**0.057** (0.039; 0.074)	**0.057** (0.038; 0.076)	**0.079** (0.051; 0.106)	**0.091** (0.046; 0.136)
	BE	**0.249** (0.224; 0.274)	**0.178** (0.157; 0.200)	**0.156** (0.136; 0.176)	**0.150** (0.131; 0.169)	**0.149** (0.129; 0.170)	**0.164** (0.135; 0.193)	**0.184** (0.141; 0.227)
	CZ	**0.055** (0.043; 0.066)	**0.038** (0.027; 0.048)	**0.027** (0.017; 0.038)	**0.023** (0.013; 0.034)	**0.019** (0.008; 0.030)	**0.032** (0.013; 0.050)	**0.039** (0.002; 0.076)
	PL	**0.227** (0.194; 0.261)	**0.203** (0.169; 0.237)	**0.183** (0.149; 0.218)	**0.203** (0.167; 0.238)	**0.199** (0.160; 0.240)	**0.187** (0.124; 0.250)	**0.229** (0.127; 0.331)

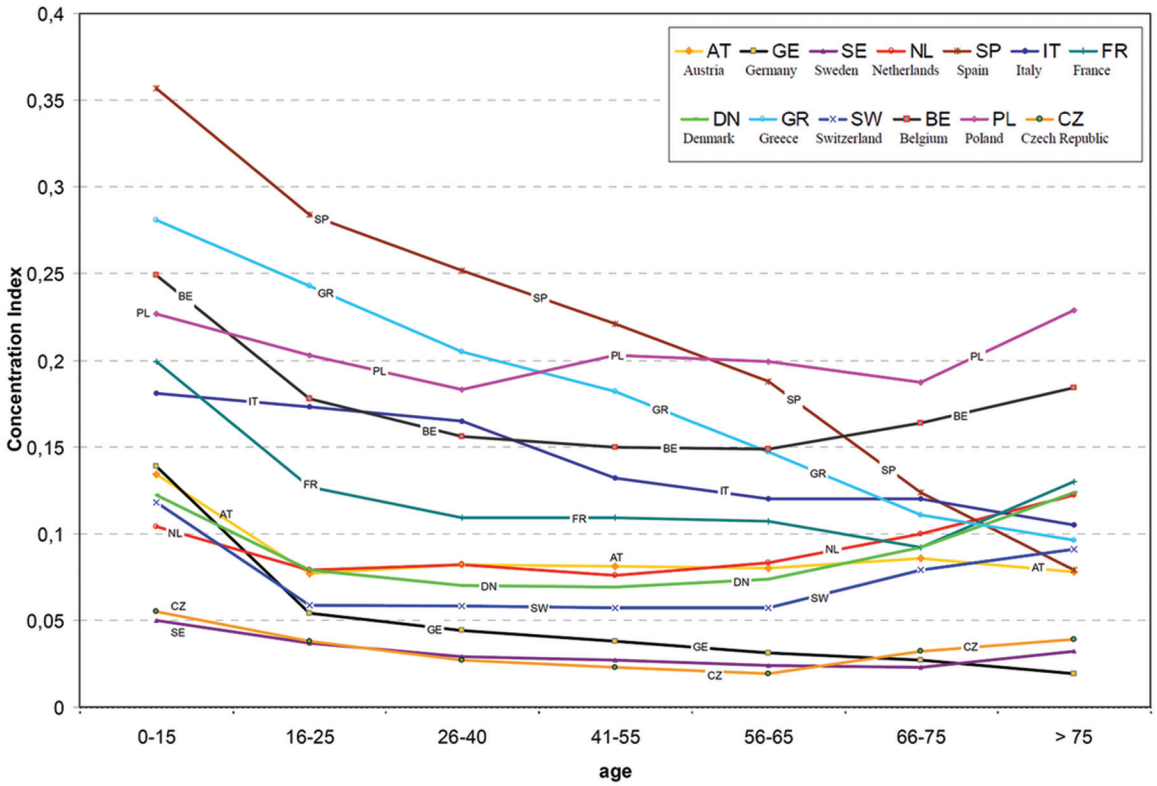
NB: 95% confidence intervals in parentheses; values in **bold** indicate statistical significance at the 5% level; socio-economic stratification relies on number of books *per* household during childhood (age group 0-15) and on educational attainment according to the International Standard Classification of Education; results are weighted (adjustment for age & sex); AT = Austria, GE = Germany, SE = Sweden, NL = Netherlands, SP = Spain, IT = Italy, FR = France, DN = Denmark, GR = Greece, SW = Switzerland, BE = Belgium, CZ = Czech Republic, PL = Poland.

household during childhood (column 2), and for highest educational attainment (column 3). Countries exhibiting relatively high levels of socio-economic status are shown to have higher levels of dental attendance in comparison with nations representing lower socio-economic status.

Table 2 presents CIs for inequalities in regular dental attendance throughout the respondents' life-course and according to country of residence. The according CIs are also visualized in the Fig. CIs are generally positive and statistically significant throughout the full age range, the only exception being Germany, which displays a non-significant CI for age 75+. As indicated by pairwise t tests (Appendix Table 1), the majority of within-country comparisons of CIs between different life periods is statistically non-significant. In Poland, CI differences are statistically non-significant throughout the full age range. In Austria, Germany, Sweden, France, Switzerland, and Belgium, CIs at ages 0-15 are significantly higher than in later life periods, but no significant within-country differences exist after childhood. A similar pattern is found for the Czech Republic, where, additionally, CIs at ages 16-25 are significantly higher than at ages 56-65. The Netherlands and Denmark display CIs in childhood and late life periods which are significantly higher than in middle life. Spain, Italy, and Greece are the only countries displaying a gradual CI decline throughout the entire life-course, though corroboration of statistical significance is mostly lagged by at least one life period.

Statistical significance regarding cross-country differences in CIs is presented in Appendix Table 2. For the majority of comparisons between countries, pairwise

Figure.
Inequalities in regular dental attendance throughout the lifecycle.



t tests indicate significant CI differences, albeit the number of significant cross-country differences is reduced in late life. Finally, Appendix Table 3 presents parameter estimates from regression analyses for cross-country socio-economic influences on CI level. The results show that inequality decreases with increasing socio-economic status. Coefficients are highest for childhood and decline incrementally throughout subsequent life periods. Statistical significance corroborates until age yrs 56-65 but not thereafter.

Discussion

The findings of the present paper indicate disproportionate concentrations regarding regular dental attendance throughout the life-course among the better-off individuals in Spain, Greece, Poland, Italy, Belgium, the Netherlands, France, Denmark, Austria, Switzerland, the Czech Republic, Germany, and Sweden.

In comparison with the magnitude of *cross*-country variations, *within*-country variations in inequalities throughout the life-course appeared to be relatively low. The inequalities in most nations may, accordingly, be considered comparatively inelastic throughout the lifecycle. Moreover, the described cross-country differences in inequalities were shown to be associated with cross-country variations in socio-economic status. That is, countries with comparably high standards in terms of number of books in household during childhood and in terms of highest educational attainment turned out to have smaller inequality levels than nations with lower socio-economic standards, and *vice versa*. The observation that such an association between socio-economic and inequality measures is statistically significant until age yrs 65+ but not thereafter may, at least partially, be attributable to the age-related inequality decline in Spain, Greece, and Italy. One explanation for the specific inequality pattern in these countries could rest on a potentially increased appreciation of oral health care during the past decades. Given the high early-life disparities in dental attendance between the better- and worse-off, such a temporal trend may have had a particularly strong impact on inequalities in these countries.

In comparison with previous literature about relative income-related inequalities in dental service use by elderly Europeans (Listl, 2011), there are notable congruities. Above all, both income-related inequalities at age 50+ and socio-economic inequalities throughout the lifecycle were evident for many European countries. It should be noted, however, that the analyses are not directly comparable, because they are based on different socio-economic and utilization measures. Further limitations of the present paper should be mentioned. First, SHARELIFE data are based on a retrospective survey, and this

may raise some concern of recall bias. However, a recent paper (Mazzonna and Havari, 2011) suggests that respondents well remember their health status and living conditions in early life. Second, educational attainment was used as a measure of socio-economic status at different life stages. But in the absence of more accurate socio-economic variables throughout the lifecycle, this appears to be a suitable approximation. Third, the number of observations became relatively small for older age groups, which is due to survey design. Therefore, the results may be interpreted with caution. Nevertheless, SHARE and SHARELIFE have the unique advantage of being representative of many European countries and, thus, of enabling cross-country comparisons to be made on the basis of a standardized survey.

Within the limitations of the present study, the findings suggest that a considerable proportion of inequalities in regular dental attendance is already established in childhood and persists throughout the life-course. Inequalities in later life-years may, thus, be relatively unresponsive to contemporaneous health policy interventions.

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