ORIGINAL ARTICLE

Annals of Agricultural and Environmental Medicine 2014, Vol 21, No 3, 557–561
www.aaem.pl

Thirty years of evolution of oral health behaviours and dental caries in urban and rural areas in Poland

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Gaszyńska E, Wierzbicka M, Marczak M, Szatko F. Thirty years of evolution of oral health behaviours and dental caries in urban and rural areas in Poland. Ann Agric Environ Med. 2014; 21(3): 557–561. doi: 10.5604/12321966.1120601

Abstract

Introduction and objective. 34 years ago, children living in rural areas had almost 2 more teeth affected by decay than those living in cities. Environmental differences are being reduced along with Poland's civilization development. The aim of the study is to assess the extent to which the differences in the intensity of caries and oral health behaviours between the urban rural environment have been reduced have been reduced in the past 3 decades.

Materials and methods. The data from 9 national surveys of 14,338 children aged 12 years and 5,425 adults aged 35–44 who lived in the city and in the countryside were analysed. Mean number of decayed (D), missing (M) and filled (F) teeth (DMFT) was determined during the examination, as well as oral health behaviours.

Results. During the past 3 decades, in the statistical 12-year-old Polish child, tooth decay has been reduced from 7.3 to 3.6 teeth, and the environmental difference between the town and village children is now almost 5 times smaller. A similar trend is observed in children's dental behaviours. Improving the oral health status and levelling of the environmental differences in the population aged 35–44 is much slower than in children.

Conclusions. In the last three decades, the level of tooth decay has been reduced by half, but it is still 3 times higher than in other European countries. Environmental differences have been reduced particularly in children. Both the oral health status and urban/rural environment differences in the intensity of tooth decay may be regarded as one of the many measures of Poland's social and civilization development. However, the analysed process is not monotonic; instead, it has some turning points.

Key words

health inequalities, oral health status, rural/urban environment, oral health behavior

INTRODUCTION

In their attempts to solve major health problems, the focus of the Council of the European Union has been to reduce health inequalities, not only at international level but also those between urban and rural areas [1]. Socio-medical science suggests a direct relationship: the intensity of health inequalities depends on the degree of socio-economic and cultural development of the population [2]. The process of socio-political transformation started in Poland 30 years ago has resulted in numerous social, economic, organizational and cultural changes positively affecting health, such as an almost four-fold increase of GDP (Gross Domestic Product), decreased purchasing power disparity between urban and rural residents, while, on the other hand, the *per capita* income in the rural areas continues to be about 30% lower than in the cities [3]. The proportion of rural inhabitants with the primary (lowest-grade) education fell from 43% to 26.5%, but it is still twice as high as in urban areas [4]. Especially in the last 10-year period there have been a number of phenomena contributing to the de-agrarisation of the rural milieu, i.e. nearly 30% of rural residents have broadband Internet access and more than 1,300,000 households have benefited from EU funding for rural development [5, 6].

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Received: 24 March 2013; accepted: 21 May 2013

These changes resulted in an increase in positive health behaviours in rural areas, but health awareness of the rural population is still poorer than that of urban residents [7, 8, 9]. There has been improvement in a number of indicators describing the health status of rural residents, such as average life expectancy, infant mortality which, for several years already, have tended to become similar to those of the urban population [10, 11]. However, other indices, such as the mortality rate of children and young people, are still higher in rural than urban areas [12].

Those phenomena give rise to the following questions:

- What is the extent to which the differences in the intensity of caries in the past 3 decades between the urban and rural environment have been reduced?,
- To what extent were the considerable differences in the oral health behaviours of people living in the two environments reduced?,
- What is the time gap separating the current caries epidemiological image of Polish society compared to that typical of developed countries, assuming a steady rate of growth?

Lalond's universal adaptation scheme indicates that the onset and course of a conventional civilization disease, like tooth decay, in up to 80% depends on the lifestyle of the individuals and the characteristics of the system. It is these two 'fields' that comprise the factors responsible for the inequalities in dental caries between the rural and urban environments.

Objectives. The aim of the study is to assess the extent to which the differences in the intensity of caries and oral health behaviours in the past 3 decades between the urban rural environment have been reduced.

MATERIALS AND METHOD

Data for the analysis were obtained from national comparative socioepidemiologic studies (Tab. 1). The first two, supervised by the World Health Organization, conducted in 8 countries, including Poland, were: Oral Health Care Systems – An International Collaborative Study 1978–1981; and Comparing Oral Health Care Systems – A Second International Collaborative Study performed in 1989–1994 under the leadership of Professor Franciszek Szatko [13, 14]. A more recent study, funded by the Polish Ministry of Health, a long-term project – Monitoring Oral Health and its Determinants, was conducted by Prof. Maria Wierzbicka in 1997–2012. A 4-stratified random sampling (8 provinces, 2 urban and rural districts, 4 municipalities/districts, streets/schools, households for adults and classes for 12-year-olds) was performed in the territory of Poland. Results of logical and statistical analysis reported in the presented study focusing on the 7 stages of the study conducted in 1997, 1998, 2000, 2002, 2005, 2010, 2012, include a total of 14,338 children and 5,425 adults [15, 16, 17, 18, 19, 20, 21].

Table 1. Population of studied 12-year-old children and 35 – 44-year-old adults: number of participants

	12-year-old			35–44-year-old		
Study year	Total	Urban area	Rural area	Total	Urban area	Rural area
1978	2071	840	1231	779	316	463
1988	–	–	–	844	371	473
1989	1,216	479	737	–	–	–
1997	1,743	924	819	–	–	–
1998	–	–	–	829	344	485
2000	2,223	950	1,273	–	–	–
2002	–	–	–	815	423	392
2005	2,435	1,210	1,225	–	–	–
2010	2,782	1,637	1,145	2,158	1,265	893
2012	1,868	1,058	810	–	–	–
Total	14,338	7,098	7,240	5,425	2,719	2,706

Each study, conducted in parallel, contained evaluation of dental health status, and an extensive interview including information about the behaviours leading to the development of dental caries. The development of the stomatognathic system means that it is advisable to conduct such studies at intervals of several years in the standard age groups 6, 12, 18, 35–44, 65–74. In the presented study, however, the focus was only on 12-year-old children and adults aged 35–44 years. In order to identify differences in the dental status of rural and urban inhabitants, the DMFT caries intensity index was used, representing the total number of teeth with active caries focus (D), extracted due to untreated caries (M) and filled (F) and, for the children, also the percentage of subjects free from decay. The analysed dental behaviours included cleaning the teeth at least twice a day, flossing, visits to the dentist in the past 12 months. 20–30 thirty years ago, flossing was very rare; therefore, questions about flossing or the use of fluorinated toothpaste have not been included in early questionnaires, which is the reason that relevant data in some Tables are missing.

Owing to socio-economic transformations initiated 3 decades ago, Poland has become a medium-developed country. To highlight the differences in the trend of dental caries, relevant data was also quoted for Sweden, a typical developed country that, like Poland, frequently performs studies on oral health status among children and adults. In Sweden, as in most developed countries, environmental (town/village) differences in tooth decay are not significant [22].

In the statistical analysis, using Statistica v. 10.0 No. AXAP202E504303AR-A software, the test was applied for the 2 structure indicators to compare the data collected in urban and rural environments, and test for 2 mean values to compare the significance of changes in each of the communities between successive stages of the study. The calculations have been made at the level of significance of $p < 0.001$.

RESULTS

Evolution of oral health status and dental behaviours in 12-year-old children.

During the analysed period, both in children from urban and rural areas, the intensity of caries significantly decreased ($p < 0.001$) (Fig. 1). The contemporary statistical Polish child at the age of 12 years has more than 3 teeth affected by caries (DMFT = 3.5); less than 34 years ago, the intensity was almost twice as high (DMFT = 6.3). As a result of a rapid decrease in the decay rate in rural areas compared to urban, in 2005, rural children 'caught up' with their urban peers. Unfortunately, the results of studies conducted during subsequent editions 5 and 7 years later have not confirmed this positive trend. Figure 1 also shows the trend of the decrease in the intensity of decay in Sweden. It should be emphasized that in Sweden, representative of the group of developed countries, 30–40 years ago caries was as frequent as it is now in Poland (DMFT = 6.3). However, effective prevention programmes resulted in a much faster reduction of dental caries [22]. The statistical child now in developed countries has only 1 tooth affected by decay – 3 times less than in Poland [23, 24].

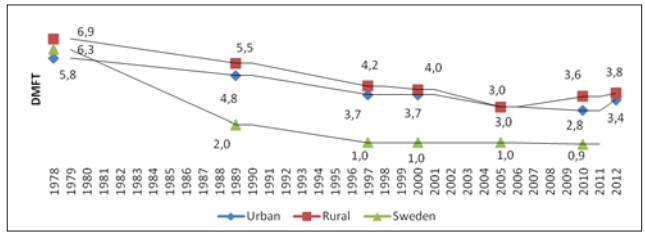

Figure 1. Intensity of caries (DMFT) in the population of Polish 12-year-old children in urban/rural areas and respective values for their Swedish peers. Data for Sweden: Oral Health Country/Area Profile Programme, WHO Collaborating Centre, Malmo University, Sweden, www. whocollab.od.mah.se (accessed January 2013)

Another measure of oral health status is the percentage of children free of caries (DMFT = 0). 34 ago, only 1% of children in the rural environment and about 3% in the urban setting,

were free of tooth decay. Currently, the corresponding values are 12.2% and 20.8%, respectively. In developed countries (e.g. Sweden, where also in 1976 about 1% of children had no caries) in 2005 over 58% of children in this age group were free of caries [22].

In the analysed period, there was a considerable improvement in dental behaviour, both in the rural and urban population. For example, 3 decades ago, only every third rural child (34.2%), cleaned his/her teeth at least twice a day, while in 2012 that basic requirement of oral hygiene was complied with by 1 in 2 children (54.8%) (Fig. 2). There has been a very large increase in the percentage of children deliberately using toothpaste with fluoride, from 19% in 1978 to 84% in 2010, and the percentage of children using dental floss increased from 1.5% in 1989 to 20.9% in 2012 (Fig.3). There was also a considerable increase in the percentage of rural schoolchildren regularly (at least once within 12 months) visiting the dentist, from 39% in 1978 to 58.6% in 2010 (Fig. 4).

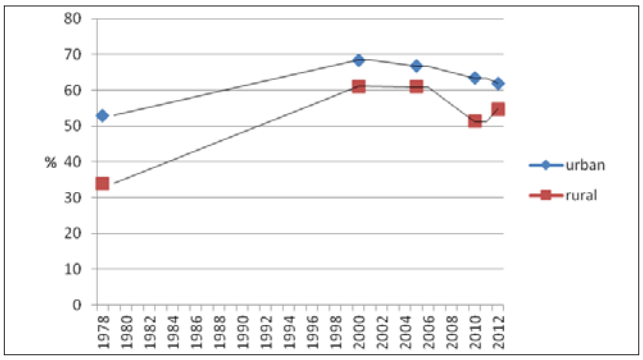

Figure 2. Percentages of children cleaning their teeth at least twice a day. Statistically significant differences (p <0.0001) between urban and rural areas in study years 1978, 2000, 2010, 2012

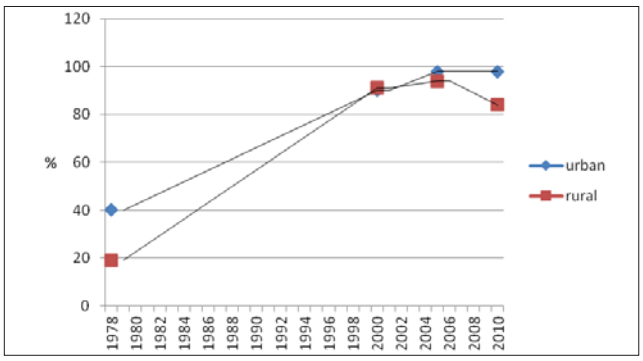

Figure 3. Percentages of children cleaning their teeth with fluoridated toothpaste. Statistically significant differences (p <0.0001) between urban and rural areas in study years: 1978, 2010

Still, the children of the rural environment significantly less (p <0.001) than urban children exhibit positive behaviour, such as twice daily brushing their teeth, and flossing. The highest positive growth rate in the rural OHB leading to reduced environmental differences occurred before 2000. In the last decade, there has been an increase in unhealthy behaviours of rural children which resulted in the re-occurrence of significant differences (p <0.001) similar to those prevailing 34 years ago (Figs. 2, 3, 4).

At the same time, the positive tendency to a very similar frequency of visits to the dentist within 12 months among

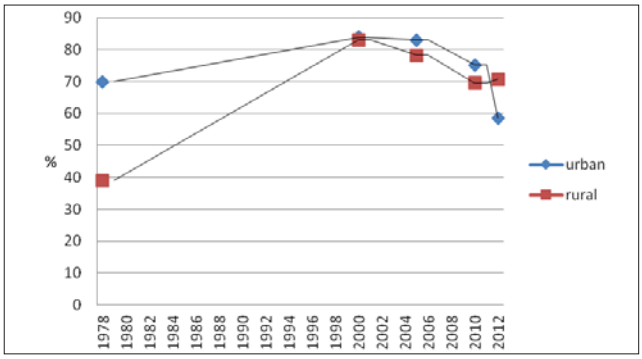

Figure 4. Percentages of children visiting a dentist at least once during 12 months. Statistically significant differences (p <0.0001) between urban and rural areas in study years 1978, 2010, 2012

children from the rural and urban areas continues – in 2010, 69.6% and 75.3%, respectively. Because of the accumulation of adverse events due to the systemic transformation in the first decade of the 21st century, such as almost complete elimination of dental services from schools in the urban environment, a slightly higher frequency of visits to the dentist can now be observed in rural areas (Fig. 4).

It seems worth mentioning here the behaviour patterns of children covered by the mandatory dental monitoring system in developed countries, where about 98% of children visit (is invited to visit) the dentist at least once a year [24].

The evolution of oral health status and dental behaviours in adults. A statistical Polish citizen aged between 35–44 years, 3 decades ago had nearly 25 teeth affected by caries or its effects, of which 13 were removed due to untreated tooth decay. The results of the 2010 survey show an improvement – a contemporary Pole in that age group has almost 17 teeth affected by caries, and of those, less than 5 have been removed because of tooth decay. This alarmingly bad epidemiological situation, although slightly better than 3 decades ago, persists in both urban and rural areas. Environmental urban/rural difference in the intensity of caries in adults is small and does not exceed the threshold of statistical significance.

Slightly more positive changes have occurred in the past 3 decades for dental behaviours. The proportion of adults (12.7 percentage points) of the rural environment cleaning their teeth at least twice a day continues to grow (Fig. 5). The proportion of people consciously cleaning their teeth with a fluoride toothpaste increased by as much as 72 points (Fig. 6). Three decades ago, dental flossing was an almost unknown hygienic practice (4.3% urban and 1.3% rural citizens used dental floss at least once a week). Currently, about 40% of

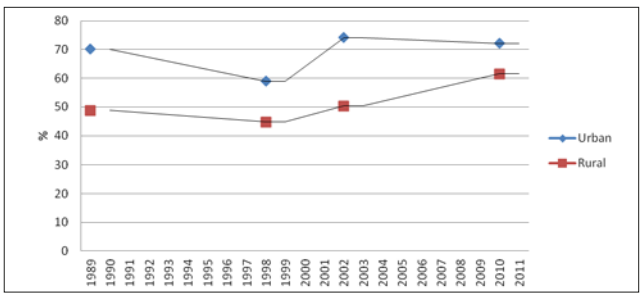

Figure 5. Percentages of 35–44-year-old adults cleaning their teeth at least twice a day.
Statistically significant differences (p <0.0001) between urban and rural areas in study years 1989, 1998, 2002, 2010

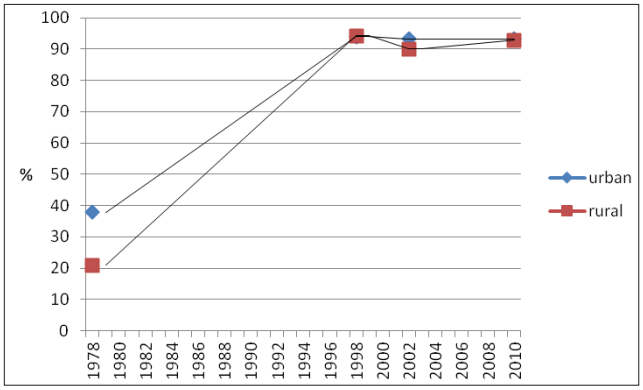

Figure 6. Percentages of 35–44-year-old adults in urban/rural areas cleaning their teeth with fluoridated toothpaste.
Statistically significant differences (p <0.0001) between urban and rural areas in study year 1978

adult Poles (24.4% in urban areas and 20.9% in rural areas) declare its use, although it is usually occasional. There is also a slow but steady increase in the percentage of adult residents of the village visiting dentist at least once during 12 months (Fig. 7). In the rural and small-town residents, some patterns of dental behaviour continue to be significantly poorer, for example, significantly lower percentages of people cleaning their teeth at least twice a day and using dental floss (p <0.0001). Positive phenomena include almost equal frequencies of visits the dentist and use of fluoride toothpaste among urban and rural residents (Figs. 5, 6, 7).

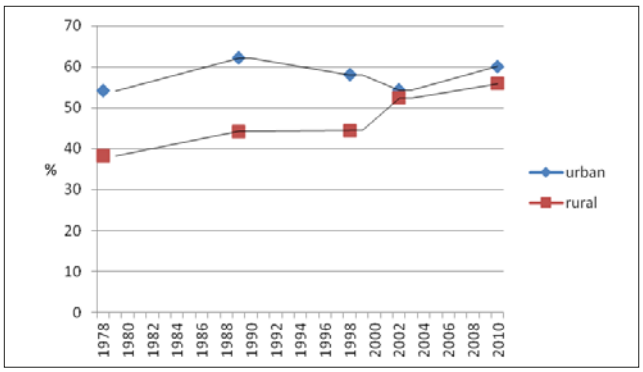

Figure 7. Percentages of 35–44-year-old adults in urban/rural areas visiting a dentist at least once during 12 months.
Statistically significant differences (p <0.0001) between urban and rural areas in study years 1978, 1989, 1998, 2010

DISCUSSION

Systemic political, social, economic and cultural transformations over the past 34 years have contributed to a significant levelling of health inequalities between city and village. The levelling has taken place due to a much faster increase in positive OHB and improved oral health status in rural compared to urban areas. Levelling of the differences in the state of teeth and dental behaviour is much higher in the paediatric population than in adults. Preventive dental programmes have been addressed primarily to children. Children and young adults are also more active than adults in the use of a wide variety of contemporary information sources promoting healthy behaviours and dental care, not only with respect to the functionality, but also the aesthetics of the teeth. The current comparative analysis conducted in a population of 14,338 children and 5,425 adults – next to the above-mentioned positive phenomenon, i.e. a significant reduction in environmental (urban/rural) variation in tooth decay – also revealed a very alarming epidemiological phenomenon: namely, the alarmingly poor oral health status in children and adults, both rural and urban residents. Although the value of the intensity ratio of dental caries in 12-year-olds fell from 6.3 to 3.5, it is still more than 3 times higher than in developed European countries [23, 24]. The dental health status of Poles aged 35–44 years is very similar to that of 60 year-old Swedes.

The relatively long time, 34 years, for which the comparative analysis has been continued, has disclosed another disturbing phenomenon, i.e. the collapse of these positive developments that have taken place up to 2005. For 7 years already, the dental health of children has continued to deteriorate, with the DMFT index increasing significantly from 3.0 in 2005, through 3.3 in 2010 to 3.6 in 2012. Such alarming data has not been reported by any European country except Poland. This negative trend is the result of drastic reductions in the availability of public free-of-charge dental services. Limited state expenditures on health care (one of the lowest in Europe) resulted in a severe reduction of available free of charge dental procedures and reduction of the number of public dental outpatients, e.g. an almost total reduction of dental surgeries in schools. In 1978, there were 5.4 dentists employed in the public service per 10,000 people, while in 2010 the rate fell to 0.4 dentist per 10,000 people. Thus, a growing number of Poles are forced to use fully-paid services in private dental surgeries. However, children and adolescents up to the age of 18 remain entitled to preventive and curative care in public service free of charge (with the exclusion of removable appliances over the age of 12 and fixed orthodontic appliances), actual accessibility of these guaranteed procedures is low mainly due to the above-mentioned organizational reasons and lack of a motivating system. In developed countries, children under 18 years of age are ensured free-of-charge access to all preventive and curative dental services, with the exception of the use of advanced orthodontic appliances, which must be paid for in part by the user. In the Polish health care system, almost every second child (46%) and every second adult (58%) is forced to use fully-paid dental services [20].

In the adult population, the oral health status has continued to be poor – in the discussed period the pace of the improvement was much slower than in children. Still less than 60% of adults at least once a year visit the dentist, while in Sweden 90% of the adult population visit a dental surgery a minimum of once in 12 months [25].

Dentistry is one of the few medical disciplines that uses simple but very reliable indices characterizing the development of dental caries, based on quantitative scales. Those unified measures make it possible to assess both the dental health of an individual or of any population, for example, 12 year-old children from urban and rural environments in any of the time periods and any location – at a national or international level. Data systematically collected during dental socio-epidemiologic studies are increasingly taken into account in the assessment of the overall health status of the population in each country, in addition to indicators such as the average life expectancy, infant mortality rate, incidence of tuberculosis.

CONCLUSIONS

1. Started in the 70's of the 20th century, the positive trend in reducing environmental town/village differences of dental caries, systematic improvement of the oral health status of children in both rural and urban areas, and improvement in dental behaviour was stopped in the first decade of the 21st century. The collapse of this positive trend was due to a build-up of negative systemic circumstances (elimination of school dental care, reduction of the availability of free dental care for families of low socio-economic status of the rural environment, very limited dental coverage and poor effectiveness of prevention programmes).
2. The trend of caries, with particular emphasis on its different intensity in rural and urban areas, is useful in the analysis of the overall health status of a population in addition to such indices as the average life expectancy, infant mortality and the incidence of tuberculosis.
3. The intensity of tooth caries – a classical civilization disease – can be used in parallel with many other measures, such as economic indicators, in an attempt to estimate Poland's delay in the civilization and the economic development relative to developed countries. Assuming uniformity and linearity of the processes, dental epidemiology data seem to indicate that the delay is within the range of 20–30 years.

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