Is income inequality related to childhood dental caries in rich countries?

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The news is replete with stories about the impact of the global recession on the lives of people around the world. For example, a June 7, 2009, article in London's The Observer newspaper reported that a clampdown in Russia on the import of Japanese cars (to protect Russian automakers) had hit car dealers in the far eastern part of the country particularly harshly and that demonstrations against Russian prime minister Vladimir Putin had spread to other parts of the country where factories were closing and people were losing their jobs.[1] Similar stories can be found in both industrialized and industrializing countries in all parts of the world.

This example highlights the way in which the global economy has become truly integrated. The problems in one part of the system are transmitted quickly to the rest of the system. Such was the outcome of the collapse of the housing market in the United States and the issuing of mortgages to people who had little likelihood of making their payments in a time of economic downturn, creating the "toxic debt" that is weighing so heavily on banks, other financial institutions and other businesses around the

A B S T R A C T

Background. The aim of this study was to assess the correlates of income and income inequality with dental caries in a sample of all countries, as well as in rich countries alone.

Methods. In this ecological study, the authors analyzed national data on income, income inequality and dental caries from 48 countries. Of them, 22 were rich countries (according to World Bank criteria). The authors determined income by gross national income (GNI) per capita (formerly known as gross national product) and income inequality by the Gini coefficient (a measure of income inequality on a scale between 0 and 1). They assessed dental caries according to the decayed, missing, filled teeth (dmft) index in 5- to 6-year-old children. The authors used Pearson and partial correlation coefficients to examine the linear associations of income and income inequality with dental caries.

Results. GNI per capita, but not the Gini coefficient, was inversely correlated with the dmft index in the 48 countries. However, the results showed an opposite pattern when analyses were restricted to rich countries (that is, the dmft index was significantly correlated with the Gini coefficient but not with GNI per capita).

Conclusion. These findings support the income inequality hypothesis that beyond a certain level of national income, the relationship between income and the population's health is weak. Income inequality was correlated more strongly with dental caries than was income in rich countries.

Clinical Implications. Among rich countries, income inequality is a stronger determinant of childhood dental caries than is absolute income.

Key Words. Income; income inequality; caries; decayed, missing, filled teeth; dental public health.
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world. The global financial crisis can affect population health by increasing poverty and unemployment rates, by limiting access to and availability of publicly funded health care services, and through behavioral and physiological pathways linked to the psychosocial/stress response.[2-5] Many well-researched reviews in the scientific literature link economic globalization to health.[2-5]

Hobdell[6] hypothesized how economic globalization was affecting or would affect oral health around the world. His basic argument was that both absolute and relative poverty would be significant factors in the prevalence of dental caries and other oral diseases. Other investigators also have contributed to our understanding of the relationship between dental caries and the socioeconomic position of populations.[7-10] All have found significant correlations between dental caries and national socioeconomic factors.

Hobdell and colleagues[11] used international data to explore the relationship between dental caries in children and income inequality. They found that dental caries levels in children correlated with the Gini coefficient (a measure of income inequality)[12] but not with gross national income (GNI) per capita. Ecological studies conducted in Brazilian towns have shown conflicting findings regarding the relationship between measures of income inequality and dental caries in children.[13-15]

Both income and income inequality are related significantly to other health issues. Wilkinson and Pickett[16] recently reviewed much of the literature on this subject that they accumulated during the past 25 years. They made two clear points from the evidence: first, up to a certain level of GNI, population health and health-related indicators improve with increased income. This turning point seems to occur roughly as countries advance from the World Bank's middle-income group of countries to its high-income group of countries.[16] Second, after a certain point, further increases in this absolute income fail to improve health.

What appears to be the key factor is the size of the gap between the wealthiest 20 percent of a population and the poorest 20 percent of the same population—what is now called "income inequality." Wilkinson and Pickett[16] expanded on an earlier work of theirs on the same subject.[17,18] They also showed that it is not only health that suffers as a result of income inequality, but other socially related issues—such as educational performance, prison population size and teenage pregnancies—are affected.[19-21]

The purpose of this study was to determine if similar relationships exist for income, income inequality and dental caries in young children at the population level.

PARTICIPANTS, MATERIALS AND METHODS

Selection of countries. This cross-sectional ecological study included 48 countries with complete and comparable national data on income, income inequality and dental caries levels in 5- to 6-year-old children. We excluded countries with populations of less than 2 million to avoid possible tax havens.[20,21] For the second part of the study, we selected only countries among the richest 50 in the world, on the basis of their GNI per capita at purchasing power parities (PPPs) in 2000.[22] That reduced the number of countries for analysis from 48 to the following 22: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Switzerland, the United Kingdom and the United States. These countries were the richest in the world in 2000 with a population of 2 million or more inhabitants. Several investigators have included this group of rich countries in intercountry comparisons of income inequality and health.[16,19-21] Sweden was the only rich country not included in the analysis because it did not have data on dental caries for the required period.

Data sources. *Absolute income.* We obtained data on absolute income from the World Bank, Washington, as GNI per capita in 2000, expressed as PPP in international dollars.[22] GNI (formerly known as gross national product) is the "sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad."[22] GNI is reported in local or international currencies; however, the latter is preferred for international comparisons because it eliminates the differences in price levels between countries in the process of conversion. We used GNI per capita converted to international dollars

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ABBREVIATION KEY. dmft: Decayed, missing, filled teeth. **GNI:** Gross national income. **PPPs:** Purchasing power parities. **WHO:** World Health Organization.