THE ROLE OF SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS IN EXPLAINING DENTAL HEALTH INEQUALITIES

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ABSTRACT

This paper aims to investigate the effect of socio-economic and institutional factors on dental health outcomes and inequalities among countries. By applying the oral health status indicator DMFT 12-year-olds index, 117 countries were classified into three dental health groups. The analysis of variance (ANOVA) was employed to examine the relations among a set of socio-economic and institutional variables and dental health inequalities. Variables included are GDP per capita, current health expenditures, number of dentists, Corruption Perceptions Index, quality of health services, unemployment rate, internal conflict, Gini index, UHC service index, and general government health expenditures. The results showed that higher corruption prevalence in a country is associated with poor outcomes in a nation's dental health. In countries with the highest satisfaction with the quality of health services, this may be attributed to substantial public health expenditures. The size of health expenditures and the number of dentists available to the country's population do not necessarily grant advanced dental health, even in economically prosperous countries. Indicators of social inequality do not explain the dental health outcomes, suggesting there are other factors describing better the disparities among low- and higher- DMFT index country groups. Inequalities in dental health are explained by institutional factors, corruption prevalence, and public health funding being important ones. Policy implications towards more generous public funding of health services and implementation of anti-corruption measures could contribute to seizing dental health inequalities worldwide.

KEY WORDS: dental health, inequalities, corruption, public health, health expenditures

1. INTRODUCTION

The observed oral health inequalities among countries, regions, and individuals are related to their socioeconomic status and arise from social stratification and poor social capital in a country (Watt, 2007). Corruption-free environment stands as a building block of social capital which in turn promotes oral health (Watt, 2002) and despite the need to pursue relevant research, corruption is neglected in investigating the social determinants of oral health and its inequalities. Corruption impedes social progress and is associated with lower levels of economic and human development (Dimant & Tosato, 2017). The presence of corruption in the health sector has been recognized as a huge problem primarily by international organizations such as Transparency International[1] and to a lesser extent by governments putting specific anti-corruption policies in place (Hutchinson et al., 2020; Vian, 2020). Rather ample research exploring corruption and health outcomes offers evidence of the worldwide spread of corruption in health, exhibited in various forms (Vian, 2020). Corrupt behavior is well-hidden in complex interactions between health service providers, patients, health organizations, the business sector, and government agencies (Moszynski, 2006), and the reluctancy to talk about corruption by actors inside the health sector is astonishing (Hutchinson, Balabanova & McKee, 2018; Garcia, 2019). Due to the intertwined

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[1] This paper is based on the dissertation: Makgopa. S. S. (2020) The influence of service innovation practices on business performance. (Doctoral dissertation, University of Pretoria).

and hidden nature of corruption networks, it is hard to put effective anticorruption measures in place (Vian et al., 2011) leaving corruption as a persistent threat to human health. Past research agrees on the adverse impact of corruption on health outcomes. Corruption worsens various health indicators such as life expectancy, mortality and immunization rates, and mental health indicators (Azfar & Gurgur, 2007; Factor & Kang, 2015; Lio & Lee, 2015; Li et al., 2017; Achim, Văidean & Borlea, 2019). The prevalence of corruption is seen as an obstacle to implementing universal health coverage (Garcia, 2019) and limits the (equal) access to public health services. Corruption can mitigate the positive relationship between health expenditures and health outcomes (Factor & Kang, 2015).

Studies on corruption and health outcomes are focused on general health indicators and according to our best knowledge do not assess the corruption and oral health nexus. The importance of oral health was recognized by WHO and the poor oral status of countries as a severe public health issue (Petersen & Kwan, 2011). Studies contributing to the understanding of determinants of oral health explore inter alia socioeconomic antecedents such as lifestyle, health promotion and education, disease prevention, poverty, country development level, income and education level of citizens (Watt, 2002; 2007; Sabbah et al., 2007; Petersen & Kwan, 2011). The objective of this research differs from the numerous studies on the unethical behaviour of medical doctors and dentists (Reid, Mueller & Barnes, 2007). Using the holistic and interdisciplinary approach (as suggested by Hutchinson et al., 2017) the problem is assessed on the macro-level, and findings could be applied to improve the oral health outcomes of the society as a whole.

The study aims to investigate the effect of socio-economic and institutional factors, including the prevalence of corruption on dental health outcomes and inequalities among countries, thus filling the gap in the existing literature.

The paper is structured as follows. Literature describing variables used is explained in the next chapter, and the results of the analysis presented in chapter 3. In the last chapter the main findings are discussed and put in the policy recommendations context, concluding on the streams of the future research.

2. LITERATURE REVIEW

In order to investigate the impact of social, economic, and institutional factors of oral health outcomes, the analytical concept is developed by employing a set of variables from the literature. Bhandari, Newton and Bernabé (2014) showed that the use of dental services is positively associated with GDP per capita, the number of dentists per population size, and health expenditures, and negatively correlated with the GINI coefficient. However, having dental problems does not imply the patient will visit the dentist so the synthesised indicator of dental service use does not depict the dental health outcomes of the nation.

The dependent variable is DMFT 12-year-olds index. DMFT (Decayed, Missing and Filled Teeth) index captures the status of dental health in a country and is taken as a proxy for the oral health of an individual nation. The explanatory variables in the analysis represent social conditions, sources of inequalities, health system characteristics, and the country's attained economic development level. Institutional quality is primarily depicted by including corruption in the analysis since corruption prevalence is a good indicator of the (poor) institutional quality in a country (Bjørnskov, 2011). Corruption Perceptions Index (CPI) denotes perceived corruption prevalence in a country where higher values of CPI denote a more clean country. Corruption is included in the analysis because it deprives access to public health infrastructure (Tiongson, Davoodi & Gupta, 2000) and deteriorates the quality of health services (Holmberg & Rothstein, 2010). Besides the increased cost of health services, corruption is associated with the unfair allocation of medical supplies, low quality of used materials, illegal distribution of drugs, and other disruptions in health care provisioning (Teremetskyi et al., 2020). As in other health services, corruption in dental care is assumed to prevent the implementation of preventive measures and to deprive patients of dental visits. It is reasonable to believe that due to its discriminatory nature, corruption leads to more inequalities in dental care provided and thus contributes to the inequalities in national dental health status. Wealthier nations could mitigate these effects with generous funding for the health systems, depending on the strength of the economy and health policies put in place. Economic development is captured by GDP per capita, and including this variable is in line with previous findings that health outcomes are lower in less developed countries (James et al., 2012). Although higher GDP might result in higher health expenditures, it does not as such necessarily lead to better health outcomes (Deaton & Schreyer, 2021).

Health infrastructure, specifically in dental care ensures quality prevention and dental interventions so the number of dentists per capita (DENT) is included as well as health expenditures as a percentage of GDP. Higher relative health expenditures (HealthEXP) enable the implementation of programs such as education, prevention, and oral health promotion policies aiming to improve the population's dental health from an early age. However, the allocation of resources to preventive healthcare varies among countries depending on the national strategies, and priorities change in times of crisis (Wang, Wang & Huang, 2016).

In assessing what factors stand behind inequalities in dental health worldwide, more 'soft' indicators might explain the disparities among nations. Studies show that dental decay has a negative effect on the quality of life (Bukhari, 2020), therefore the estimated quality of health services (HealthSER) as a substantial component of people's life satisfaction might contribute to better dental health. Patients who are more satisfied with the health services provided would be encouraged to undergo preventive examinations and behave more responsibly toward their dental health.

Social factors delineating inequalities in a society are captured by the GINI index, a standard measure of inequality in a country. Income inequality is associated with poor health outcomes (Pickett & Wilkinson, 2015) and is expected to generate more dental health inequalities. Further, the unemployment rate (UNEMPLOY) is included since the population with no job income would have limited access to health services and, therefore, tend to neglect their health problems. Unemployed people often have no medical and dental insurance coverage, particularly in countries with prevalent private health insurance. Dental health worsens in political violence, crises, war, and post-war periods (Janković et al., 2004), so the internal conflict indicator (CONFLICT) is also included in the analysis.

Finally, access to the essential health services measured by the Universal Health Coverage index (UHC) captures the general availability of health care to a country's population. The availability beyond essential health services depends on the funding sources for a set of health services. Countries with predominately public funding might provide a larger set of preventive and medical care services to their citizens paid by government health expenditures. If a larger proportion of health services must be paid by private expenditures of patients via private health insurance or out-of-pocket, it might seriously prevent them from using certain health services, and dental care is one of them. On the other hand, public funding (GGHE) is often seen as granted and 'for free', so it is reasonable to assume people would care more about preserving their health if they bear the costs privately. Variables included in the analyses are described in Table 1.

Table 1. Variables definitions and data sources

Variable	Definition	Source
DMFT	Mean number of Decayed, Missing, and Filled Permanent Teeth (mean DMFT) among the 12-year-old age group.	The WHO Oral Health "Country/Area Profile Programme" https://capp.mau.se/
DENT	Number of dentists per 10 000 population.	World Health Organization https://www.who.int/data/gho/data/indicators/indicator-details/GHO/dentists-(per-10-000-population)
GDP	GDP per capita (gross domestic product divided by midyear population) in current U.S. dollars.	The World Bank https://data.worldbank.org/indicator/NY.GDP.PCAP.CD
HealthEXP	Level of current health expenditure expressed as a percentage of GDP.	The World Bank https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS
CPI	Corruption Perceptions Index scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be by experts and business executives. The results are given on a scale of 0 (highly corrupt) to 100 (very clean).	Transparency International https://www.transparency.org/en/cpi/2021
HealthSER	Quality of health services as a component of the overall quality of life in a country. Aggregate index ranges from 0 to 100, higher values indicating higher quality.	World Data https://www.worlddata.info/quality-of-life.php?expats=0&stabilty=50&rights=1&health=50&safety=1&climate=1&costs=1&popularity=1#ranges
UNEMPLOY	Unemployment rate refers to the share (%) of the labor force that is without work but available for and seeking employment.	The World Bank https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS
CONFLICT	Internal conflict indicator is an assessment of political violence in the country and its actual or potential impact on governance. A score of 4 points equates to very low risk of conflict and a score of 0 points to very high risk.	The World Bank https://govdata360.worldbank.org/indicators/hec4bcc54?country=BRA&indicator=41950&viz=line_chart&years=1975,2020

GINI	Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. Thus, a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.	The World Bank https://databank.worldbank.org/source/world-development-indicators#
UHC	Universal Health Care service coverage index for essential health services on a scale of 0 to 100.	The World Bank https://databank.worldbank.org/source/world-development-indicators#
GGHE	Domestic General Government Health Expenditures as % of current health expenditure; values over 50% indicate prevalent public vs. private health expenditures.	World Health Organization https://apps.who.int/nha/database/Select/Indicators/en

3. RESULTS

By applying the most recent DMFT index from 2000 onwards, the set of 117 countries worldwide were grouped in very low group (DMFT <1.2), low group (DMFT 1.2≤2.6) and higher group (DMFT ≥2.7). The very low DMFT group comprises 40 countries with the best dental health, followed by the low DMFT index group of 54 countries. The rest of 23 countries in the sample has poor dental health presented by moderate, high and very high values of DMFT index. The distribution among three groups is made according to the standard interpretation of the DMFT index values (World Health Organization, 2013).

The analysis of variance (ANOVA) was employed to explore and describe the relations among variables (Table 2).

Table 2. Results of ANOVA (mean values and p-values)

	DMFT groups			Total sample	p
	1-very low	**2-low**	**3-higher**		
DENT	**3.202474**	**5.848400**	**5.580000**	**4.886973**	**0.006344**
GDP	**19904.26**	**18550.32**	**7739.26**	**16873.62**	**0.035723**
HealthEXP	6.192821	7.036667	6.453478	6.626726	0.261023
CPI	**51.10526**	**48.21154**	**37.86957**	**47.07965**	**0.023047**
HealthSER	**55.51429**	**67.72917**	**62.76190**	**62.61538**	**0.059775**
UNEMPLOY	6.543333	7.720000	9.389565	7.653125	0.109175
CONFLICT	0.685714	0.644565	0.759545	0.683107	0.293841
GINI	36.57500	36.06829	37.10455	36.47895	0.872112
UHC	**66.84615**	**72.39216**	**67.82609**	**69.54867**	**0.097122**
GGHE	**49.65789**	**60.30000**	**57.63636**	**56.09091**	**0.047094**

Source: Authors' calculation

For all three groups, number of dentists per 10 000 inhabitants, GDP per capita, prevalence of corruption, quality of health services, universal health coverage and government health expenditures significantly explain differences in dental health measured by DMFT index among groups of countries. Countries in 1-very low DMFT group are economically the most developed ones, however with the lowest UHC and far the lowest number of dentists per population size. The quality of health services rating is below sample average as well. These results could be explained by the share of government health expenditures below 50 percent of current health expenditures. These countries tend to be corruption-clean ones since CPI mean value is above 50.

The 3-higher DMFT group of countries shows the opposite results/characteristics. Poor dental health is associated with prevalent corruption and economic development seriously lagging behind other countries in the sample. However, these are countries with relatively good dental and health infrastructure measured by the number of dentists and UHC. Citizens are on average relatively satisfied with the quality of health services. The domestic health expenditures are in 57 % financed by the general government so public funding slightly prevails.

The most interesting is the 2-low DMFT index group. These countries have a rather high GDP per capita and the highest number of dentists per size of the population. Quality of health services is rated the highest in the sample, probably connected to the highest UHC coverage as well. Corruption prevalence corresponds to the overall sample average, being slightly below the threshold of 50 and classifying these countries as moderately corrupt. The distinctive characteristic of the 2-low DMFT index group is the prevalence of public funding of health expenditures.

4. DISCUSSION AND CONCLUSION

Higher corruption prevalence in a country is associated with poor outcomes in the dental health of a nation, measured by the DMFT index. In countries with the highest satisfaction with the quality of health services, this may be attributed to substantial public health expenditures. The size of health expenditures ensuring the health infrastructure including the number of dentists available to the country's population is not necessarily granting advanced dental health. Even in countries demonstrating economic prosperity, the number of dentists per size of the population does not guarantee better dental health, and health expenditures as a percentage of GDP are not a significant explanatory variable for dental health outcomes. Exactly the opposite, in the economically most developed countries where the number of dentists per size of population is far below the world average, the dental health status of the nation is very good.

Further interesting finding is that standard indicators of social inequality (GINI index) and unemployment rate do not affect the dental health of a nation, suggesting there are other factors explaining better the disparities among low- and higher- DMFT index country groups.

Therefore, the main strength of the research is including a novel set of institutional variables in the analysis of dental health status of nations worldwide. The time span of DMFT variable (from 2000 to 2020) might be considered as one of the limitations of our study, but studies show DMFT index for 12-year-olds depends mostly on oral hygiene habits which need a course of time and preventive programs to be changed (Andrysiak-Karmińska et al., 2022). As epidemiological studies on dental health are not performed annually in some countries, these values represent the best information available to this date. Most dental health databases are based on subregional research, the number of which correlates to the proportion of the dental academic sector in different regions. The diversity of countries might also be considered as another possible source of limitations of our study since different groups of countries might have different paths of achieving their DMFT score. Thus, a study or a set of studies might be conducted separately for more homogeneous groups of countries with similar paths of achieving their DMFT score. Therefore, this study might be considered as exploratory in nature. As this research is based on secondary data, more in-depth studies might be conducted with primary data specifically collected for one country or a small group of countries, including attitudes of both patients and dentists in explaining the DMFT score of a specific country.

Findings suggest that inequalities in dental health among countries are explained by institutional factors, whereas corruption prevalence and public health funding are important ones. Policy implications towards more generous public funding of health services and implementation of anti-corruption measures could contribute to seizing dental health inequalities worldwide.

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NEJEDNAKOSTI U DENTALNOM ZDRAVLJU: ULOGA SOCIOEKONOMSKIH I INSTITUCIONALNIH ČIMBENIKA

SAŽETAK

Cilj rada je istražiti utjecaj socioekonomskih i institucionalnih čimbenika na ishode dentalnog zdravlja i nejednakosti među zemljama. Primjenom pokazatelja oralnog zdravstvenog stanja (DMFT indeks 12-godišnjaka), 117 zemalja klasificirano je u tri skupine dentalnog zdravlja. Analiza varijance (ANOVA) korištena je za ispitivanje odnosa između niza socioekonomskih i institucionalnih varijabli s jedne strane, i nejednakostima u dentalnom zdravlju nacija s druge strane. Uključene varijable su BDP po stanovniku, tekući izdaci za zdravstvo, broj stomatologa, indeks percepcije korupcije, kvaliteta zdravstvenih usluga, stopa nezaposlenosti, unutarnji sukobi, Ginijev indeks, pokrivenost osnovnim zdravstvenim osiguranjem i izdaci za zdravstvo opće države. Rezultati su pokazali da je veća prevalencija korupcije povezana s lošim ishodima u dentalnom zdravlju zemlje. U zemljama gdje je zadovoljstvo kvalitetom zdravstvenih usluga najveće, to se može pripisati znatnim izdacima za javno zdravstvo. Visina izdataka za zdravstvo i broj stomatologa dostupnih stanovništvu pojedine zemlje ne osiguravaju nužno napredno dentalno zdravlje, čak ni u ekonomski prosperitetnim zemljama. Pokazatelji socijalne nejednakosti ne objašnjavaju ishode dentalnog zdravlja, što upućuje na to da postoje i drugi čimbenici koji bolje opisuju razlike među skupinama zemalja s niskim i višim indeksom DMFT-a. Nejednakosti u dentalnom zdravlju objašnjavaju se institucionalnim čimbenicima, prevalencijom korupcije i financiranjem javnog zdravstva. Mjere politike usmjerene ka izdašnijem javnom financiranju zdravstvenih usluga i provedbi antikorupcijskih mjera mogle bi doprinijeti uklanjanju nejednakosti u dentalnom zdravlju u svijetu.

KLJUČNE RIJEČI: dentalno zdravlje, nejednakosti, korupcija, javno zdravstvo, izdaci za zdravstvo