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Variation in tonsillectomy rates by health care system type

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ABSTRACT

Objective: To analyze variation in tonsillectomy procedure rates between health care system types around the world.*Study design:* International database analysis.*Methods:* The 2015 Organization for Economic Co-operation and Development (OECD) Health Statistics surgical procedures database was used to ascertain tonsillectomy procedure volumes for 31 countries. Each country's health system type and structure were classified by overall system type, and by health care regulation, financing, and provision methods. Each system type and structure variable were compared using the rate of tonsillectomy procedures per 100,000 citizens.*Results:* 10.5 million tonsillectomy procedures completed between 1993 and 2014 were analyzed. Overall, social health insurance system types had higher total tonsillectomy rates versus other health care system types ($p < 0.05$ for each comparison). Health systems with private care provision had a higher procedure rate versus state provided care (159.1 vs. 131.1 per 100,000 citizens; $p = 0.002$). Health care systems with societal regulation and financing had a higher procedure count versus state regulated or financed care (regulation 193.3 vs. 139.7 per 100,000 citizens, $p < 0.0001$; financing 168.2 vs. 135.0 per 100,000 citizens, $p = 0.0004$).*Conclusions:* The volume of tonsillectomy procedures is associated with a health care system's overall structure, regulation, financing, and provision methods. International health care systems with state mediated provision, regulation, and financing had lower tonsillectomy rates versus systems with private provision, and societal regulation or financing. Further study is needed to determine differences in indications for tonsillectomy between countries, but these results underscore potential variation in health care delivery in different systems.

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1. Introduction

Tonsillectomy has been one of the most frequent surgical procedures performed in the United States [1]. Typical indications for both adult and pediatric patients are either recurrent or chronic tonsillitis, or sleep disordered breathing where tonsillar hypertrophy is thought to contribute to the obstructive process [2].

Otolaryngologists and pediatricians have become interested in the variation in tonsillectomy both in the United States as well as world-wide. In the United States, regional variability in tonsillectomy rates with or without adenoidectomy has been influenced by geographic location of patients, patient age, as well as medical indication [3]. International investigations into regional variation of

tonsillectomy rates have demonstrated that the relative proportion of children in the population, gender, health insurance status, parental education attainment and patient age all influence tonsillectomy rates [4,5]. Tonsillectomy rate variability has also been shown to be influenced by non-patient or non-disease factors such as access to surgeons with the ability to perform the procedure [6].

Health services research as a field has increasingly relied upon large datasets to address health care delivery questions of interest to different stakeholders. The Organization for Economic Co-operation and Development (OECD) is one such database that includes longitudinal economic, health care, and industrial variables. This database has been used to compare health care systems' resources, capacity, outcomes, effectiveness, efficiency, and productivity [7–12]. Tonsillectomy rates by country is one of the productivity measures captured by the OECD dataset. To our knowledge, little has been published on tonsillectomy rate variability related to the structure of a health care system. The objective of our study was to analyze variation in tonsillectomy procedure

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rates between health care system types around the world.

2. Methods

Prior to the initiation of this study, the research protocol was reviewed by the Duke University Internal Review Board (IRB; Protocol ID # Pro00073287), and deemed exempt from full review.

2.1. OECD database search

The 2015 Organization for Economic Co-operation and Development (OECD) Health Statistics surgical procedures database was used to ascertain tonsillectomy procedure volumes for 31 countries using ICD-9-CM codes (28.2–28.4) from 1993 to 2014. Each country submitted annual tonsillectomy procedure volumes to the OECD through their respective health agencies (Supplementary Table 1). The tonsillectomy procedure counts represent the number of patients who have received a tonsillectomy procedure in order to avoid double-counting. These codes comprise tonsillectomy with or without adenoidectomy, and do not include lingual tonsillectomy. In cases where a country had a proprietary system for procedure coding, the country's codes were mapped to the common ICD-9-CM code terminology. The tonsillectomy database provided variables for year, country, percent of procedures performed as day cases, percent of procedures performed as inpatients, day cases per 100,000 citizens, inpatient cases per 100,000 citizens, total procedure volumes, and total procedure volumes per 100,000 citizens. The dataset does not differentiate between adult or pediatric patient populations undergoing tonsillectomy.

In addition to the tonsillectomy volume variables, additional economic measures were obtained for each country including health expenditures such as the share of gross domestic product, annual gross domestic product per capita (in U.S. dollars), annual percent of total population over age 65, and the annual percent of total population self-reporting as overweight or obese (Supplementary Table 2). The percent of the population below 18 years-old was not available in the OECD dataset.

2.2. Health system classification

Each country's health system type and structure was classified by overall system type, and by health care regulation, financing, and provision methods using a previously published classification system (Table 1) [13]. Each system type and structure variable was then compared using the rate of tonsillectomy procedures per 100,000 citizens.

According to the health system classification system, there are six plausible health system types within the group of OECD countries including national health service, national health insurance system, statist social health insurance system, a social health insurance system, social-based mixed system, and a private system [13]. Although several health system types and structures may be found in a country, each country is classified according to its predominant, overall health system type. These over-arching systems' classifications are defined by combinations according to which entity controls each of the three necessary system components including regulation, financing, and provision methods [13]. The control classification system categorizes these components as having predominantly private, societal, or state control. The health system classification defines private regulation and financing as systems in which these aspects are completely controlled by for-profit, private entities within a country [13]. Societal regulation and financing denotes a system in which regulation and finances are controlled by entities in society outside direct government control (i.e. agreements and policies set through collective

bargaining agreements, and society-sourced fund distributions that the government does not determine) [13]. State financed and regulated systems include hierarchies that are staffed and/or controlled by the government, and health care funds that are directly sourced through taxation.

After each system component was assigned a control type, the structure of the resulting over-arching health system was then able to be defined [13]. National health service systems are dominated by state control of all three components. National health insurance system types employ state control of financing and regulation, but rely on private provision. Statist social health insurance systems are the only true 'mixed' type where the state provides regulation, financing is completed by societal players, and provision of care is through private means. Social health insurance systems are organized such that societal stakeholders control the regulation and financing of health care, but the services are delivered by for-profit providers [13]. Lastly, a private health system is such that private entities control all three components of the system.

2.3. Statistics

All statistical analyses were completed using JMP Pro 11 (Cary, North Carolina, USA). Standard least squares linear regression models, ANOVA, and Tukey's analyses of multiple means were utilized to compare variances and means where appropriate. P-values were reported with statistical significance fixed at $p = 0.05$.

3. Results

Across 31 countries, 10.5 million tonsillectomy procedures completed between 1993 and 2014 were analyzed (Table 2). As every country reported total tonsillectomy procedures per 100,000 citizens, the remainder of our analyses utilized this variable. Of note, the United States only reported one year of data for total tonsillectomies per 100,000 citizens. The reason for the lack of data from the United States was not determined. When comparing all countries, Luxembourg had the highest tonsillectomies per 100,000 citizens of all countries (293.3/100,000 citizens; each $p < 0.05$), however, this was not statistically significant compared to the other countries with high tonsillectomy rates (Netherlands, Norway, and the United States) (Table 3). Mexico had the lowest tonsillectomy rate out of all the countries, but this was not significantly different than Slovenia, Portugal, Spain, and Poland ($p > 0.05$).

To determine if health care system type was associated with variance in total tonsillectomies per 100,000 citizens, we utilized a previously published system that categorized OECD countries' health care systems into six health care system types with a sub-analysis based on the provision, regulation, and financing of each system [13]. When considering a general health care system type, social health insurance system types had higher total tonsillectomy rates versus other health care system types ($p < 0.05$ for each comparison) (Table 4). While private health insurance type had the highest raw value, this type is represented by one country with only one data point – the United States of America.

Health care systems with societal regulation and financing had a higher tonsillectomy procedure rate versus state regulated or financed care (regulation 193.3 vs. 139.7 per 100,000 citizens, $p < 0.0001$; financing 168.2 vs. 135.0 per 100,000 citizens, $p = 0.0004$) (Table 4). However, there was no significant difference between systems with societal and private regulated or financed care ($p > 0.05$ for each). With regard to the provision of health care, the countries analyzed had either private or state-provided care. In health systems with private care provision, there was a higher tonsillectomy procedure rate versus state provided care (159.1 vs. 131.1 per 100,000 citizens; $p = 0.002$).

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