Surgery for Otitis Media in a Universal Health Care Model: Socioeconomic Status and Race/Ethnicity Effects

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Abstract

Objectives. (1) To determine the association between socioeconomic status (SES), race/ethnicity, and other demographic risk factors in surgically managed otitis media within a model of universal health care. 2) To determine quality of life (QOL) outcomes of surgically managed otitis media in this model.

Setting. Tertiary academic medical center.

Study Design. Prospective cohort study.

Methods. A prospective study was conducted between June 2011 and December 2012 with dependent children of military families. TRICARE provides equal access to care among all beneficiaries regardless of a wide range of annual incomes. Caretakers of children scheduled for bilateral myringotomy and tympanostomy tube (BMT) placement were administered a demographic survey, as well as OM-6 QOL instrument preoperatively and 6 weeks postoperatively. A control group who did not undergo BMT was also administered both the survey and OM-6 for comparison.

Results. Two hundred forty patients were enrolled (120 surgical patients and 120 controls). Logistic regression demonstrated age younger than 6 years old ($P < .001$), day care attendance ($P < .001$), and non-Hispanic Caucasian race ($P = .022$) to be associated with surgery. Surgical QOL outcomes demonstrated a significant improvement in otitis media-6 (OM-6) scores after surgical management from 3.00 (95% confidence interval [CI], 2.79-3.20) to 1.35 (95% CI, 1.22-1.47).

Conclusion. In a universal health care model serving more than 2 million children, previously reported proxies of low SES as well as minority race/ethnicity were not associated with surgically managed otitis media contrary to reported literature. Caucasian race, young age, and day care attendance were associated with surgery. Surgery improved QOL outcomes 6 weeks postoperatively.

Keywords

otitis media, universal health care, TRICARE, CHAMPUS, race, ethnicity, socioeconomic status

Introduction

Otitis media is a common disease of childhood, with more than 80% of children afflicted with acute otitis media before their third birthday.¹ Bilateral myringotomy with tympanostomy tube placement is the most common ambulatory surgery performed in the United States.² In the United States, the annual cost of treatment for otitis media to include medical and surgical intervention is estimated between $3 billion and $5 billion.¹,²

Previously reported intrinsic otitis media risk factors include low birth weight, male gender, and age younger than 7 years old. Extrinsic risks have included day care attendance, presence of siblings in the household, smokers in the household, and lack of breastfeeding.³-⁵ There has been conflicting literature on the role of minority race and ethnicity, low socioeconomic status (SES), and insurance status or lack of coverage in otitis media risk.³-⁵

TRICARE is a universal health care system for all active duty and retired military servicemembers as well as their dependents. More than 2 million children worldwide are currently served by TRICARE, which provides pediatric primary and subspecialty care, prescriptions, surgeries, and hospitalizations with no out-of-pocket expense.⁶

In the current political environment, health care reform has become increasingly focused on ensuring expanded access to care. Other countries, notably Canada and Great Britain, have experienced variable success in providing quality care universally to their population. Although there are numerous differences between American health care systems and the systems of other countries, the TRICARE

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system represents an opportunity as a proxy of universal health care due to the socioeconomic composition of the population, equal access to health care providers, and robust availability of primary care services that largely does not exist outside of this system in the United States. Notably, the TRICARE system differs from other subsidized children’s health insurances, such as Medicaid and Children’s Health Insurance Programs (CHIP)—all of which still incur annual premiums as well as copayments for prescriptions and hospital services rendered.5,7 The population served represents a diverse demographic background to include race and ethnicity as well as a wide range of household incomes. The 2011 military demographic data show Hispanic/Latino ethnicity at 11.2% and non-Hispanic racial demographics to include Caucasian (62.8%), Black/African American (16.2%), Asian/Pacific Islander (4.2%), Native American/Alaskan (1.3%), and mixed racial backgrounds (4.3%).8 This shows a diverse military force comparable with recent ethnic and racial statistics from the 2010 census (Table 1).9 The current military basic pay scale shows a wide range of income from junior enlisted (E-1) to senior officer (O-6) at $17,730 to $128,830.10

The Pediatric Otolaryngology practice at Naval Medical Center San Diego is the only current military active duty surgery subspecialty service of its type in the Pacific Southwest. The catchment area for routine surgeries includes military bases from all military branches in California, with advanced pediatric head and neck pathology presenting from US Navy and Marine Corps facilities worldwide.

### Methods

This study was performed at a tertiary academic medical center and approved by the Naval Medical Center San Diego Clinical Investigation Division Institutional Review Board (CID# 2011.0077). The primary objective for this study was to determine the role of SES, race/ethnicity, and other demographic risk factors in surgically managed otitis media within a universal health care model. The secondary objective was to measure quality of life outcomes for children and caregivers afflicted with otitis media using the previously validated otitis media-6 (OM-6) questionnaire11 in this same model of health care.

This was a prospective study conducted between June 2011 and December 2012 with dependent children of military families through the Pediatric Otolaryngology practice at Naval Medical Center San Diego.

Inclusion criteria, predating the current AAO-HNS Clinical Practice Guidelines for tympanostomy tube placement, consisted of pediatric patients younger than 18 years meeting criteria for the first set of tympanostomy tubes for recurrent acute otitis media (ie, 3 documented occurrences of acute otitis media over the course of 6 months, or 4 over the course of 1 year) or chronic otitis media with effusion (ie, serous otitis media for greater than 3 months with associated hearing loss).

Exclusion criteria included predisposing syndromes, concurrent additional surgical procedures, history of adenoidectomy, immunocompromised state, middle ear pathology other than mentioned in inclusion criteria to include cholesteatoma, and limiting factors that would include proper evaluation of the OM-6 (eg, caregiver language not primarily English, patient with psychiatric diagnoses, etc).

Caretakers of children scheduled for bilateral myringotomy and tympanostomy tube (BMT) placement were administered a demographic survey that encompassed proxies for SES and risk factors for otitis media.

Demographic data included questions investigating details for both children and caregivers. Childhood data included gender, gestational age, current age, history of breastfeeding, current enrollment in day care, number of total children living in household, and race/ethnicity. Caregiver data included active smoking, highest level of caregiver education, aggregate income before taxes, and military-specific information of the sponsor servicemember branch and rank.

The previously validated OM-6 QOL instrument was administered upon enrollment and 6 weeks postoperatively.11 The survey and OM-6 were also administered to a control group of children referred to the otolaryngology clinic who did not undergo BMT.

The control group was chosen to represent a broad cross section of children undergoing evaluation in a pediatric

### Table 1. Ethnicity/Race Representation.

<table>
<thead>
<tr>
<th>2011 Military Demographic Data8</th>
<th>2010 National Census Data9</th>
<th>Combined Experimental &amp; Control Subject Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td>Ethnicity</td>
<td>Ethnicity</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>11.20%</td>
<td>Hispanic/Latino</td>
</tr>
<tr>
<td>Race (non-Hispanic)</td>
<td>88.80%</td>
<td>Race (non-Hispanic)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>62.75%</td>
<td>Caucasian</td>
</tr>
<tr>
<td>Black/African American</td>
<td>16.24%</td>
<td>Black/African American</td>
</tr>
<tr>
<td>Asian &amp; Pacific Islander</td>
<td>4.22%</td>
<td>Asian &amp; Pacific Islander</td>
</tr>
<tr>
<td>Native American &amp; Alaskan</td>
<td>1.34%</td>
<td>Native American &amp; Alaskan</td>
</tr>
<tr>
<td>Multiethnic or other</td>
<td>2.02%</td>
<td>Multiethnic or other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.20% Hispanic/Latino</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16.34% Race (non-Hispanic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55.09% Caucasian</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.80% Black/African American</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.75% Asian &amp; Pacific Islander</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.51% Native American &amp; Alaskan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.94% Multiethnic or other</td>
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<tr>
<td></td>
<td></td>
<td>23.14% Hispanic/Latino</td>
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<tr>
<td></td>
<td></td>
<td>76.86% Race (non-Hispanic)</td>
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<tr>
<td></td>
<td></td>
<td>49.59% Caucasian</td>
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<td></td>
<td></td>
<td>7.85% Black/African American</td>
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<tr>
<td></td>
<td></td>
<td>4.96% Asian &amp; Pacific Islander</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.24% Native American &amp; Alaskan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.22% Multiethnic or other</td>
</tr>
</tbody>
</table>

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Table 2. OM-6 Quality of Life Instrument Scores.

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Surgical Group</th>
<th>Statistical Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Physical suffering</td>
<td>1.41 (1.09)</td>
<td>3.29 (1.80)</td>
<td></td>
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<tr>
<td>Hearing loss</td>
<td>1.23 (0.81)</td>
<td>3.13 (1.62)</td>
<td></td>
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<tr>
<td>Speech impairment</td>
<td>1.78 (1.62)</td>
<td>2.99 (2.11)</td>
<td></td>
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<tr>
<td>Emotional distress</td>
<td>1.38 (1.21)</td>
<td>2.91 (1.71)</td>
<td></td>
</tr>
<tr>
<td>Activity limitations</td>
<td>1.27 (1.00)</td>
<td>2.23 (1.48)</td>
<td></td>
</tr>
<tr>
<td>Caregiver concerns</td>
<td>1.40 (1.30)</td>
<td>3.42 (1.83)</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>1.41 (0.79)</td>
<td>3.00 (1.03)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; OM-6, Otitis Media-6.

Demographic Data Associations

Logistic regression demonstrated age younger than 6 years old ($P < .001$), day care attendance ($P < .001$), and non-Hispanic Caucasian race ($P = .022$) to be associated with surgery. As noted in Supplemental Table S1 (available at www.otojournal.org), there were insufficient Native American subjects to be included in the regression model. When collapsed into the binary non-Hispanic Caucasian race versus all other ethnicities/races, an odds ratio of undergoing surgery was 2.12 (95% confidence interval [CI], 1.08-4.17; $P = .028$). Gender, breastfeeding history, day care attendance, presence of smokers in the household, number of children living in the household, level of parental education, level of household income, time from referral to evaluation, military branch of service, and military rank were not associated with children undergoing surgery.

OM-6 Data

Surgical QOL outcomes demonstrated a significant improvement in mean OM-6 score from preoperative assessment to 6 weeks after surgical management from 3.00 (95% CI, 2.79-3.20) to 1.35 (95% CI, 1.22-1.47) ($P < .001$). As noted in Table 2, the improvement was significant in all 6 domains of the OM-6. Furthermore, there was no demonstrated difference between postoperative overall OM-6 mean score and the OM-6 mean score for the control group, 1.41 (95% CI, 1.27-1.55; $P = .613$). This lack of a difference was maintained across all domains of the OM-6.

Discussion

TRICARE is a model of universal health care serving more than 2 million children of military servicemembers worldwide. The method of delivering care with no out-of-pocket expense for pediatric health services allows data collected in this study to be independent of insurance status and reduces confounding secondary to income level. Given the current political environment regarding health care reform and access, improving the knowledge base on strategies that are successful in improving access and reducing disparities may provide useful insight toward policy development. As
such, investigation of societally pertinent aspects of subspecialty surgical health care systems is useful when approaching health care reform.

There are limited data regarding otitis media risk in other countries with universal health care. There is literature from Canada, which uses a universal health care system, demonstrating that individuals of low SES are less likely to visit subspecialty care. However, the racial/ethnic demographics of the United States differ significantly from those of other industrialized nations with universal health care systems.

In the TRICARE model, previously reported proxies of low SES (presence of smokers in the household, low levels of parental education, and low household income) as well as minority racial and ethnic backgrounds were not associated with an increased frequency of surgically managed otitis media. In particular, minority backgrounds (Hispanic/Latino ethnicity and Black/African American race) previously associated with otitis media were not associated with undergoing surgery.

Variability in SES and minority race/ethnicity have been well-reported risk factors for health disparities to include cardiovascular and colorectal disease, as well as diabetes. Paradise et al reported a prevalence study of 2254 Pittsburgh-area infants and found a higher incidence of cumulative middle ear effusion in Black/African American infants than in white infants in the first year of life, as well as low level of maternal education and Medicaid health insurance compared to private between the first and second years of life; additional risk factors included male gender, lack of breastfeeding, presence of smokers in the household, and degree of exposure to other children in the household or in day care. More specifically, these racial/ethnic and socioeconomic risk factors have been reported in multiple prospective and retrospective studies.

Our study identified non-Hispanic Caucasians as having an increased association of undergoing surgery for otitis media. Several studies have also demonstrated similar findings, divergent from the traditional SES and racial/ethnic risk factors. A National Health Insurance Survey (NHIS) by Vakharia et al of more than 7 million American children demonstrated a higher prevalence of frequent ear infections (greater than 3 acute otitis media episodes over the course of 1 year) in white children when compared with Black/African American and Hispanic/Latino children. An older NHIS study by Lanphear et al also demonstrated similar results with respect to race/ethnicity, as well as poverty status, in terms of its association with less frequent recurrent acute otitis media. Auinger et al showed a higher prevalence of otitis media in Caucasian children based on the Third Nutritional Health and Nutrition Examination Survey. A systematic review by Smith and Boss demonstrated that Caucasian children were more likely to undergo tympanostomy tube placement when compared with the aforementioned minority races. Many of these studies have qualified these differences by owing to a differential access to health care, provider likelihood to make the diagnosis, and caregiver level of education.

Review of the racial/ethnicity distribution in the study population reveals a higher representation by self-reported Hispanic and multiethnic heritage. The increased Hispanic representation is likely a function of our population being located in the southwestern United States, which is home to a large Hispanic culture base. Although military members may be stationed anywhere worldwide, individual preferences often influence where they are stationed. Furthermore, the marked increase in subjects being identified as multiethnic is likely associated with the fact that our survey was designed to identify the race/ethnicity of the child. As such, a parent with a spouse or partner of different ethnicity may be more likely to identify a child as being multiethnic than the child may self-identify later in life.

There were no differences in military rank or branch of service in terms of surgical otitis media risk. These demographics also served as proxies for income, race, and local geographic variation based on their branch of service. Military officers’ basic pay in this study differed upward of a factor of 7 in some instances when compared to junior enlisted servicemembers. Further, the military racial/ethnic demographics also differ from officer to enlisted ranks. Military officers make up 16.9% of the active duty military population, with non-Hispanic Caucasian numbers relatively higher at 69.43% when compared with 61.47% for enlisted servicemembers. Navy, Army, and Marine Corps bases demonstrated diversity in their geographic variation. Navy bases from our catchment were located in the coastal areas of San Diego County, California. Army dependent enrollees were largely recruited inland from San Bernardino County, California. Marine Corps dependent enrollees were scattered between coastal San Diego County, inland San Bernardino and Imperial Counties in California, and Yuma County in Western Arizona. There were no Air Force dependents enrolled during the course of this study.

The OM-6 data in our study demonstrated a significant mean decrease of 1.65 from preoperative to postoperative scoring at 6 weeks. The original validation study by Rosenfeld et al was graded on a 1 to 7 scale. Their data demonstrated a mean change in surgery scores of 1.7 following tympanostomy tubes. Our surgical group had a comparable change following surgery.

Limitations of this study include small numbers by comparison with national database studies; recruitment from a single center Pediatric Otolaryngology practice, which introduces the potential for selection bias as well as the variation in race/ethnicity from national data; and the limits of the pay ranges of military servicemember families. Specifically, the lower limit of annual military basic pay does not include additional provided housing and subsistence allowances that provide for military families across the board to live above the poverty level; this subsequently limits generalizability of families living in a lower SES. Further, it should be noted that the QOL gains achieved at 6 weeks postoperatively must be tempered by the lack of a longer follow-up period as the OM-6 gains of tube placement are sustained only until approximately 9 months.
Conclusion
Our study demonstrates in a universal health care model that non-Hispanic Caucasian children, younger than 6 years, and day care attendance were associated with surgically managed otitis media. Further, preoperative OM-6 data in this model also demonstrated a similar decrease in scores following tympanostomy tube placement to its original validation study.

Authors’ Note
The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, the Department of Defense, or the United States Government.

Author Contributions
Art Ambrosio, study conception and design, data acquisition and analysis, article draft and revision, and final approval of the version to be published; Matthew T. Brigger, study conception, data acquisition and analysis, article revision, and final approval of the version to be published.

Disclosures
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Supplemental Material
Additional supporting information may be found at www.otojournal.org/supplemental.

References