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Workforce requirements for keratinous cysts: clinicians expend 1200 full-time effort years annually

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Abstract

Keratinous cysts are amongst the 10 most common dermatologic ambulatory diagnoses. Thus, we aimed to estimate the time and cost spent annually on management of keratinous cysts. We conducted a cross-sectional study using the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey between 2007 and 2018 (most recent years available). Conservatively, \$2.1 billion per year was spent on healthcare for keratinous cysts. On average, the full-time work of 1200 (840-1800) physicians and non-physician providers are required to manage keratinous cysts yearly in the outpatient and emergency departments. We used Medicare reimbursement rates for the cost analysis which provides a conservative estimate of the total cost. Keratinous cysts impose a significant time and cost burden on the healthcare system. Treating inflamed, draining, or painful keratinous cysts or ones that occur in undesirable locations such as the face are likely of high-value due to the quality of life impact. Managing asymptomatic keratinous cysts may be of lower value. Given this burden, clinicians should continue to evaluate the value they are providing to the patient when managing keratinous cysts.

Keywords: cyst, epidermoid, NAMCS, NHAMCS, pilar, sebaceous

Introduction

Keratinous cysts are amongst the 10 most common dermatologic ambulatory diagnoses [1]. Keratinous

cysts, which include epidermoid and pilar cysts, are generally considered to be benign subepidermal nodules filled with keratin and lipid-rich debris and encapsulated by a thin layer of epidermis-like epithelium [2]. Unlike the United States, some countries such as the United Kingdom do not routinely remove keratinous cysts unless they are symptomatic and larger than one centimeter or on the face [3]. Although Medicaid and Medicare dictate that keratinous cysts must be painful, obstructive, or infected in order for therapy such as excision to be covered by insurance, other private U.S. insurers will cover therapy in the absence of these symptoms [4]. With recent health policy emphasis on providing more high-value care as a mechanism of decreasing the cost of U.S. healthcare, it is important that we investigate the time and cost spent caring for common yet benign conditions such as keratinous cysts [5]. Therefore, we aimed to estimate the time and cost spent per year on the management of keratinous cysts.

Methods

The National Ambulatory Medical Care Survey (NAMCS) provides objective and reliable data about non-hospital-based office-based medical services in the United States. The American Medical Association (AMA) and the American Osteopathic Association (AOA) define office-based as all specialties providing ambulatory care, excluding radiology, anesthesia, and pathology [6]. The National Hospital Ambulatory Medical Care Survey (NHAMCS) provides data on ambulatory care services in hospital-based

emergency and outpatient departments [7]. Both surveys are conducted yearly by the Division of Health Care Statistics at the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC).

During a randomly selected week of the year, non-federally employed office-based physicians and non-physician providers (i.e., nurse practitioners and physician assistants) document patient demographic information, diagnoses, medications prescribed, and procedures performed for each visit sampled. The random selection process is comprised of three stages. First, 112 geographic areas (counties, townships, or equivalents) in the U.S. are sampled. From these geographic areas, physicians and non-physician providers are selected from AMA and AOA master files. For each selected provider, a one-week period from the year is sampled from which a proportion of visits are systematically chosen. Visit sampling rates depend on the number of patients seen per practice, ranging from 20% for busy practices to 100% for less busy practices. For each office or emergency department sampled in a year, about 20-30 visits are selected.

Weighting factors are applied to every patient visit to account for time and geographic variability. Unbiased national estimates are derived via a multistage estimation procedure which includes i) inflation by reciprocals of the probabilities of selection, ii) nonresponse adjustment, ii) a ratio adjustment to fixed totals, and iv) weight smoothing [8]. Since the NAMCS and NHAMCS receive high-response rates from a generalizable sample, these surveys are valuable for understanding how physicians and non-physician providers care for patients with skin disease [6,7,9–11].

Study population

We utilized NAMCS and NHAMCS from 2007 to 2018, the most recent years available. Specifically, we used the NAMCS and NHAMCS emergency department (ED) dataset between the years 2009 and 2018, the most recent and only years available, and the NHAMCS outpatient dataset between the years 2007 and 2011, which are the most recent years available. We evaluated all visits with International Classification of Diseases, 9th Revision, Clinical

Modification (ICD9) code 706.2 and 704.41 and ICD10 codes L72.0, L72.11, and L72.3 were a primary through quinary diagnosis.

Variables

In order to assess the three most common treatment modalities for keratinous cysts, excision, incision and drainage, and intralesional injection of corticosteroids, we utilized the NAMCS/NHAMCS defined variable 'excision' and the ICD9 and 10 procedure codes 8604 and 9923 [12]. The NAMCS/NHAMCS variable 'senbefor' was used to differentiate between new and return office visits.

To provide the most conservative estimates, cost of care was derived using non-facility Medicare reimbursement rates. The following current procedural terminology codes were employed: new patient office visit (99202 and 99203), return patient office visit (99213 and 99214), excision of a benign lesion (11421), incision and drainage procedure (10060), and intralesional injection (11900), [13]. The average Medicare reimbursement rate between the years included in the study period was used to calculate the total cost of care. Specifically, the number of visits fitting each current procedural terminology code listed above was multiplied by the average Medicare reimbursement rate for the visit over the study interval.

The NHAMCS emergency department data did not include the variables 'senbefor' and 'excision' and therefore we were unable to use data from the NHAMCS to calculate cost. Instead, we used data from NAMCS and extrapolated to describe the cost for keratinous cysts in the NHAMCS emergency department data set. Specifically, we multiplied the proportion of each visit type in the NAMCS by the total number of visits in the NHAMCS. After deriving the approximate frequency of for each visit type in the NHAMCS, we multiplied by the average non-facility Medicare reimbursement rate for the visit over the study interval. Given that visits to the emergency department are typically more costly than visits to the outpatient department, and the fact that we used non-facility rates for all calculation methods, this estimation method was conservative.

The NAMCS variable 'timemd' and NHAMCS emergency department data set variable 'lov' were

used to estimate the time in minutes devoted by a physician or non-physician provider to each patient visit with a diagnosis of keratinous cyst [9,10]. These variables are self-reported by the provider and denote the time s/he spent in the patient room only. They do not represent time caring for the patient outside the patient room reviewing medical records, billing, or charting. These variables also do not reflect time spent by medical assistants, nurses, or other healthcare team members caring for the patients.

Outpatient data from the NHAMCS did not include a variable documenting the time devoted to a patient visit. We extrapolated the NHAMCS outpatient data using data from the NAMCS. In order to derive these estimates, we multiplied the average minutes per visit for keratinous cysts from the NAMCS by the average number of visits per year for keratinous cysts in the NHAMCS.

Physician and non-physician provider full-time effort years were computed by dividing the total time physicians or non-physician providers spent with a patient with a diagnosis of keratinous cyst by the average number of weeks per year (49 weeks) and hours per week (40.8) that physicians spend in direct patient care in the United States [14]. Although the average physician or non-physician provider is present at work 51 hours per week, we excluded 20% or 10.2 hours. A recent study demonstrated that physicians spend 20% of their time at work on tasks such as transportation, meetings, personal breaks, scheduling, and speaking to colleagues [14,15]. Thus,

we excluded time spent on other tasks not related directly to patient care from our calculations. If there was one diagnosis for a single patient visit, the entirety of the time and cost was attributed to keratinous cysts; if there were two diagnoses half of the time and cost was attributed to keratinous cysts, and so on. We used the procedures PROC SURVEYFREQ, PROC SURVEYMEANS, and PROC SURVEYLOGISTIC in SAS v9.4 (SAS Institute Inc., Cary, NC, USA). Significance was set at $P < 0.05$.

Results

Between 2007 and 2018, \$19 billion or approximately \$2.1 billion per year was spent on healthcare for keratinous cysts. Excisions of keratinous cysts, the most costly visit type, accounted for 40% of the total cost or approximately \$830 million per year (**Table 1**). If the number of visits per year remained stable, the projected cost of keratinous cysts in 2021 would be \$2.5 billion (**Table 1**). On average, 39,000 (95% Confidence Interval: 27-56) hours per week and 1.9 million (1.3-2.7) hours per year are expended by clinicians caring for keratinous cysts. A total of 1200 (840-1800) physician and non-physician provider full-time effort years are devoted to keratinous cyst management annually (**Table 2**).

Discussion

For a benign condition, keratinous cysts impose a significant time and financial burden on the

Table 1. Healthcare expenditure in billions of U.S. dollars for keratinous cysts between 2007 and 2018 using visit estimates from the NAMCS, healthcare expenditure in millions of U.S. dollars for keratinous cysts between 2009 and 2018 using visit estimates from the NHAMCS emergency department dataset, and healthcare expenditure in millions of U.S. dollars for keratinous cysts between 2007 and 2011 using visit estimates from NHAMCS outpatient dataset.

Keratinous cyst visit type	Estimated total cost in billions derived from NAMCS visits	Estimated total cost in millions derived from NHAMCS ED visits	Estimated total cost in millions derived from NHAMCS outpatient visits
New office visit	\$2.1	\$47	\$14
Return office visit	\$8.0	\$170	\$75
Excision	\$7.2	\$190	\$120
Incision and drainage	\$0.88	\$24	\$16
Intralesional injection of steroids	\$0.072	\$1.9	\$1.4
All visits	\$18	\$440	\$230
Cost per year	\$2.0	\$48	\$46
2021 total cost estimate	\$2.4	\$57	\$55

ED, emergency department; NAMCS, National Ambulatory Care Survey; NHAMCS, National Hospital Ambulatory Care Survey.

Table 2. Work force requirements in the United States for keratinous cysts between 2007 and 2018 in the NAMCS, 2009 and 2018 in the NHAMCS Emergency Department dataset, and 2007 and 2011 in the NHAMCS Outpatient dataset.

	Hours per year in millions (95% CI)	Hours per week in thousands (95% CI)	Physician and non-physician provider full-time effort years (95% CI)	Percentage of total time (95% CI)
NAMCS	1.6 (1.2-2.0)	33 (25-41)	1000 (770-1300)	0.50% (0.38%-0.62%)
NHAMCS emergency department	0.19 (0.048-0.35)	4.0 (0.99-7.2)	120 (30-220)	0.070% (0.02%-0.13%)
NHAMCS outpatient department	0.097 (0.066-0.360)	2.0 (1.4-7.4)	61 (42-230)	0.030% (0.020%-0.11%)
Total	1.9 (1.3-2.7)	39 (27-56)	1,200 (840-1800)	0.20% (0.14%-0.29%)

CI, confidence interval; ED, emergency department; NAMCS, National Ambulatory Care Survey; NHAMCS, National Hospital Ambulatory Care Survey.

healthcare system. The exclusive work of approximately 1200 full time physicians and non-physician providers are required annually to care for keratinous cysts in the outpatient and emergency department settings. As the estimated price of care was derived from Medicare reimbursement rates, the actual cost of keratinous cyst management is likely higher. For reference, the estimated cost of care for skin cancer, a condition with a much greater potential for morbidity and mortality, is \$8.1 billion annually [16].

Keratinous cysts are generally considered benign with a risk of malignancy transformation around 2%. Some keratinous cysts can become inflamed and infected or can drain rancid material [17]. Other keratinous cysts can be asymptomatic or cosmetically undesirable. Excision of the keratinous cyst, the definitive treatment for the condition, is time consuming and expensive and recurrence, infection, bleeding, and scarring is possible after the procedure [17].

The substantial time and cost spent on management of keratinous cysts warrants the attention of physicians managing skin disease. Recent healthcare policy has emphasized the importance of identifying low-value care within the U.S. healthcare system in an effort to reduce healthcare expenditure, improve health outcomes, and reduce physician shortages [5]. Low-value care is defined as a healthcare service in which the costs or potential harms outweigh the benefits [5]. Low value care is associated with excessive and wasteful healthcare spending and increased cost of care for patients and the healthcare

system [18]. Although there is no objective measurement for defining low versus high-value care, examples of low-value care include routine antibiotics for acute sinusitis, early imaging for low back pain, or annual electrocardiograms [19]. Americans spend 20% of the U.S. gross domestic product on healthcare; more than a quarter of which, about \$750 billion a year, are for low-value services [19].

Treating inflamed, painful, or draining keratinous cysts or ones that occur in undesirable locations such as the face are likely of high-value due to the quality-of-life impact. A proportion of excisions are medically necessary and of high-value whereas another proportion of excisions is likely for cosmetic purposes and may be of lower value. The United Kingdom's National Health Service has developed a treatment policy for keratinous cysts that reflects this idea and helps physician determine low versus high-value care. The policy states that keratinous cysts should not routinely be surgically removed unless either the cyst occurs on the face and is greater than one centimeter in diameter or if the keratinous cyst is on the body, greater than one centimeter, and is associated with significant pain, loss of function, or recent trauma [3]. Physicians should continue to evaluate the value they are providing to the patient by treating the keratinous cyst.

Limitations

Using the data in this study, one cannot differentiate between keratinous cysts which are of high-versus-low value to treat. If the overwhelming majority of lesions identified in this study were inflamed, painful,

or obstructive, then they are of high value to treat and we should continue managing keratinous cysts in this same way. Regardless of identifying high-versus-low treatment value, this study identifies that management of keratinous cysts requires a significant amount of time and money to manage in the U.S.

An additional limitation of this study is that it provides a conservative estimate for the cost and time devoted to management of keratinous cysts. Medicare reimbursement rates are amongst the lowest of all insurance types, thus providing conservative estimates for cost spent on keratinous cysts. Additionally, the variables 'lov' and 'timemd' do not reflect time caring for the patient outside of direct patient contact. Thus, our estimates do not represent time for patient care activities such as pre-charting, reviewing results, electronic medical record note writing, current procedural terminology coding, and all other care provided to the patient by other healthcare staff members.

Another limitation is that our estimation procedure assumed that if there were two diagnoses for a patient visit, half the time/cost was attributed to the first diagnosis and the other half of time/cost to the second diagnosis. This assumption does not likely reflect every patient visit. We extrapolated NAMCS data to estimate cost of keratinous cyst management in the emergency department and the time spent

managing keratinous cyst in hospital-based outpatient clinics.

Conclusion

Keratinous cysts require a significant amount of time and money to manage in the U.S. Given this burden, it is important that physicians and non-physician providers continue to evaluate the amount of value they are providing to the patient when managing keratinous cysts. A proportion of excisions are medically necessary and of high-value due to the positive quality of life impact, whereas another proportion of procedures are likely for cosmetic purposes and may be of lower-value. Our study cannot differentiate which procedures were of high or low value. Future research and policy efforts should be directed at better determining the value of care provided for management of keratinous cysts, given the significant time and cost burden this condition imposes on the healthcare system.

Potential conflicts of interest

Gabrielle Rivin has no conflicts of interests to disclose. Dr. Fleischer is a consultant for Boehringer-Ingelheim, Incyte, and QuriEnt. He is an investigator for Galderma and Trevi.

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