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Comparative Effectiveness Research/HTA

Evaluating Direct Medical Expenditures Estimation Methods of Adults Using the Medical Expenditure Panel Survey: An Example Focusing on Head and Neck Cancer

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ABSTRACT

Objective: To inform policymakers of the importance of evaluating various methods for estimating the direct medical expenditures for a low-incidence condition, head and neck cancer (HNC). **Methods:** Four methods of estimation have been identified: 1) summing all health care expenditures, 2) estimating disease-specific expenditures consistent with an attribution approach, 3) estimating disease-specific expenditures by matching, and 4) estimating disease-specific expenditures by using a regression-based approach. A literature review of studies (2005–2012) that used the Medical Expenditure Panel Survey (MEPS) was undertaken to establish the most popular expenditure estimation methods. These methods were then applied to a sample of 120 respondents with HNC, derived from pooled data (2003–2008). **Results:** The literature review shows that varying expenditure estimation methods have been used with MEPS but no study compared and contrasted all four methods. Our estimates are reflective of the national treated prevalence of HNC. The upper-bound estimate of annual direct

medical expenditures of adult respondents with HNC between 2003 and 2008 was \$3.18 billion (in 2008 dollars). Comparable estimates arising from methods focusing on disease-specific and incremental expenditures were all lower in magnitude. Attribution yielded annual expenditures of \$1.41 billion, matching method of \$1.56 billion, and regression method of \$1.09 billion. **Conclusions:** This research demonstrates that variation exists across and within expenditure estimation methods applied to MEPS data. Despite concerns regarding aspects of reliability and consistency, reporting a combination of the four methods offers a degree of transparency and validity to estimating the likely range of annual direct medical expenditures of a condition. **Keywords:** direct medical expenditures, econometrics, head and neck cancer, matching, Medical Expenditure Panel Survey.

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Introduction

State and federal health policy makers often seek some estimate of the economic burden of a disease to inform decisions regarding resource allocation for prevention or treatment. With different budgetary responsibilities, the needs for and uses of such data will vary. Regardless, a cost-of-illness (COI) study is the main vehicle for arriving at such estimates [1]. These studies usually include a combination of health care and related resource use, productivity losses, and “intangible” burden related to quality of life [2]. The perspective and methodology used can greatly affect cost estimates [3] and varies between studies. The specification of what constituted “cost” is an important consideration—Does cost translate to “charges” from providers or “expenditures” reimbursed by payers? [4] In the absence of guidelines or well-accepted standards on the methods for COI studies, there is a clear need to inform policymakers and other researchers of the

different approaches and the subsequent interpretation of results [4]. Indeed, a review of asthma cost studies in the United States shows that a 10-fold range in medical and nonmedical estimates has been reported [5]. Despite numerous limitations, COI studies remain popular and are often quoted in the mass media to highlight the magnitude of a particular problem.

This article focuses on analyzing the direct medical expenditures component of a COI estimate for a relatively low-incidence, but topical condition—head and neck cancer (HNC). Because a subset of HNCs is caused by the human papilloma virus (HPV), the economic burden of HNC is likely to contribute to the HPV vaccination debate [6]. Previous economic studies of HNC were derived from nonnationally representative sources—Surveillance, Epidemiology, and End Results–Medicare [7] and managed-care population [8].

The Medical Expenditure Panel Survey (MEPS), with a nationally representative respondent population, is commonly used for the purpose of generating a COI estimate [9]. Based on

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1098-3015/\$36.00 – see front matter Copyright © 2014, International Society for Pharmacoeconomics and Outcomes Research (ISPOR).

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<http://dx.doi.org/10.1016/j.jval.2013.10.004>

recommendations set out in Clabaugh and Ward's review [4], the MEPS is an appealing data source for analysts intent on informing public policy. The MEPS can link information on individuals and households to their use of and expenses for health care. That the data is publicly available, components of care are often verified, and a standardized metric of cost is used make MEPS particularly useful [4]. A systematic review of COI studies suggests a typology to describe the direct medical expenditures of any disease: 1) the sum of all medical expenditures; 2) the sum of all disease-specific expenditures for a person with the disease; 3) the difference in total expenditures between a group of individuals with a disease and a matched sample of those with similar characteristics; and 4) the incremental expenditures associated with a disease estimated by using a regression-based approach that includes an indicator comparing individuals with and without the disease [1]. Staff members at the Agency for Healthcare Research and Quality (AHRQ), which conducts the MEPS, have previously discussed methodological issues related to estimating the COI of diabetes [10] and obesity [11]. Given the lack of strict COI guidelines when using the MEPS, we undertook a literature review of recent MEPS studies to instruct our estimation methodology.

Literature Review

This review of the MEPS literature pertains to studies that report health care expenditure estimates. The following search terms were used: In PUBMED: (“methods” [MeSH terms] OR “method” [text word] OR “economics” [Mesh] AND [“Medical expenditure panel survey” OR “MEPS”]) and EMBASE: (“cost analysis”/exp OR “cost analysis” AND “Medical expenditure panel survey”). Other databases searched were Econlit, Web of Science, and Tufts CEA Registry. Our inclusion criteria consisted of articles that reported an annual per-respondent direct medical expenditure for a specific disease/condition between 2005 and 2012. The information elicited from available articles included the following: 1) direct medical expenditure estimating method as a subject of “validity,” 2) model specification/diagnostic tests as a subject of “reliability,” and 3) comorbidity measure as a subject of “consistency.”

Thirty-eight studies met our inclusion criteria [5,10,12–47]. The review highlighted considerable heterogeneity in the methods used to estimate the direct medical expenditures associated with a condition. A detailed systematic review of COI studies that use the MEPS is warranted. No MEPS health care expenditure study reported a range of estimates using all four COI methods. Only eight studies reported estimates using more than one of these methods [10,14,17,19,24,40,41,47]. Regression models were the most popular method (31 studies) of estimating the effect of a condition on health care expenditures [5,10,12–46]. Five studies reported condition-specific expenditures [14,18,39–41] (attribution approach), and two studies used disease-related events to identify patients [13,31]. Three studies used just a matching approach [25,34,35], and five studies reported the summation of all medical expenditures associated with a condition approach [17,20,21,23,24]. There was considerable methodological heterogeneity among the regression models. For just positive expenditures, the generalized linear model (GLM) log link and gamma distribution [5,12,14,17,18,32,36,40–46] (14 studies) was the most popular method followed by the logarithm of expenditures in an ordinary least squares regression (9 studies) [10,13,20,30,31,37,38,42,43]. Of the GLM studies, only eight made reference to model specification and diagnostic tests [5,14,17,32,33,36,44,46].

In total, 26 studies accounted for comorbidities or made some type of risk adjustment [5,10,13,14,16,18,20,22–46]. Such methods

included accounting for specific medical conditions, creating a count of chronic diseases, or using the Charlson comorbidity index. It has also been argued that theoretically comorbidities should be equally prevalent in populations of people with and without certain stand-alone diseases [40].

In conclusion, this literature review highlights issues with the validity of the estimation methods used, the reliability of the models developed in the absence of specification tests, and the lack of consistency in accounting for comorbidity. Methodologies, however, are becoming more sophisticated—use of instrumental variables [46] and the combination of matching and regression [5] to derive an estimate are novel and likely to be replicated with future MEPS expenditure estimation studies.

Case Study: HNC and the MEPS

A detailed description of the survey can be found elsewhere [48] and on the MEPS Web site. Briefly, the MEPS collects data on expenditures related to medical events such as inpatient stays, outpatient, emergency room and ambulatory visits, and prescribed medicines. In addition to household interviews, the MEPS includes a medical provider component, a follow-back survey that collects expenditure data from a sample of medical providers used by survey participants and is considered to be more accurate than a household survey and given priority in expenditure estimation [49]. Information on specific medical conditions is obtained in the MEPS interview by asking respondents which “health problems” had “bothered” each household member during the observation period. Also, respondents report the reason for each medical event. This method identifies respondents with HNC, which results in an estimate of the annual “treated prevalence.” This would be distinct from incidence (establishing phase-of-care expenditures) and prevalence (which includes long-term survivors expenditures) cost-of-care estimates. The Clinical Classification Software system, a tool for clustering the approximately 17,000 *International Classification of Diseases, Ninth Revision* condition codes into 285 mutually exclusive and homogeneous categories, was used to identify respondents with HNC (Clinical Classification Software = 11).

As the annual number of cases of HNC in MEPS is smaller than the 100 observations that the AHRQ suggests for making national estimates, 6 years of data (2003–2008) were pooled to generate an analytic sample [50]. In this case, the “pooled weight” is the yearly person weight divided by the number of years (i.e., 6). All expenditures were inflation adjusted to 2008 dollars by using the medical component of the Consumer Price Index. MEPS pooled data produce “average annual” estimates based on “person-years.” This is because the same respondent can be observed in 2 years of consolidated year files. Total expenditures for a medical event are defined as the sum of direct payments made by all payers.

SAS software, version 9.3 (SAS Institute, Inc., Cary, NC), and Stata software, version 11.2 (StataCorp, College Station, Texas), were used for statistical analyses. The analyses incorporated MEPS person-level weights and variance adjustment weights (strata and primary sampling unit) that enable estimates to be nationally representative.

Method 1: Identify All Patients with Diagnosis and Sum Medical Expenditures

The objective is to identify respondents with the condition and sum their medical expenditures. We considered the “treated prevalence” as being those who have a diagnosis of HNC with any medical event. We consider this to be the middle ground between respondents who have reported a diagnosis of HNC

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