

A national study of medical care expenditures for respiratory conditions

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A national study of medical care expenditures for respiratory conditions. E. Yelin, L. Trupin, M. Cisternas, M. Eisner, P. Katz, P. Blanc. ©ERS Journals Ltd 2002.

ABSTRACT: This study was undertaken to estimate the magnitude of medical care expenditures among persons with respiratory conditions in the USA in 1996, and the increment in expenditures attributable to these conditions.

The study data were derived from the 1996 Medical Expenditure Panel Survey, a national sample of 21,571 persons. Of the 21,571, 1,027 reported one or more respiratory condition. After weighting, the individuals may represent about 12.1 million persons in the USA. All medical care expenditures of these individuals were tabulated, stratified by comorbidity status, and then compared to those among persons with nonrespiratory conditions or with no conditions. Regression techniques were then used to estimate the increment of healthcare expenditures attributable to the respiratory conditions.

From a national total of \$45.3 billion, medical care expenditures averaged \$3,753 among persons with respiratory conditions. Hospital stays comprised the largest component (45%). The per capita increment in total expenditures attributable to respiratory conditions ranged from \$1,003–2,588, from a national total ranging from \$12.1–31.3 billion.

The total medical care expenditure of persons with respiratory conditions was estimated to be \$45.3 billion, of which \$12.1–31.3 billion represents an increment in expenditures associated with the conditions themselves.

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Cost of illness studies are a common method of documenting the impact of medical conditions. In recognition of the increased prevalence, severity, and mortality of chronic respiratory conditions in recent years [1, 2], there have been a large number of studies documenting the costs of specific upper and lower respiratory tract conditions, especially asthma and chronic obstructive pulmonary disease (COPD) [3–28]. Although many of the studies in the literature are based on clinical [12, 16, 19, 26] or local [20, 26], population-based data, a few integrate data from several national surveys [4, 27–29]. Several studies make national estimates from the 1987 National Medical Expenditures Survey, a national, population-based survey [10, 11, 15]. However, none of the studies used a national, population-based survey to estimate medical care expenditures for the entire respiratory condition category, including chronic bronchitis, emphysema, asthma, and COPD, as well as several less prevalent conditions. Moreover, prior national, population-based studies of specific disease entities [4, 10, 11, 15, 27–29] may be outdated because they are based on data that precede much of the growth in the prevalence of asthma and chronic bronchitis, two of the most common respiratory conditions.

The present study was designed to present more contemporary national estimates of medical care

expenditures for the entire respiratory condition category. Prior studies [13, 30, 31] predate the development of methods to estimate the increment in expenditures specifically attributable to a condition, methods which can provide more conservative estimates of the economic impact of respiratory conditions.

The specific goals of the present study were to: 1) provide estimates of all medical care expenditures on behalf of persons with chronic respiratory conditions in the USA in 1996; and 2) estimate the increment in expenditures specifically attributable to the respiratory conditions among such persons.

Methods

Data Source

The present study used data from the Medical Expenditure Panel Survey (MEPS), a joint endeavour of the Agency for Health Care Research and Quality and the National Centre for Health Statistics. MEPS is designed to provide data on healthcare use, medical care expenditures, sources of payment, and insurance coverage for a representative sample of the non-institutionalized population of the USA. The full MEPS data include survey responses from this sample

of households (hereafter, MEPS-H), information about the specifics of their health plans provided by the plans themselves, and a separate sample of nursing home residents [32]. The MEPS-H sample derives from the prior year's National Health Interview Survey (NHIS) respondents, who are, in turn, derived from a clustered, random sample of the civilian noninstitutionalized population, with an oversample of African-Americans and Hispanics. In the present paper, data from the first year of MEPS-H, 1996, was used. To establish the MEPS-H, a subset of households from the 1995 NHIS were targeted for inclusion in MEPS, 77.7% (10,639) of which were enrolled. These 10,639 households included 22,601 persons, of whom 21,571 provided data throughout 1996 (95.4%).

MEPS-H data were collected through six rounds of interviews over a 2.5-yr period. The first three interviews, covering expenditures over an entire year, provided the data used in the analysis for this paper. The interviews were used to collect information on health status, healthcare utilization and expenditures, as well as basic demographic information. The health status section elicited data on the specific medical conditions each respondent self-reported. These were then coded to three-digit levels using the International Classifications of Diseases-ninth revision (ICD-9) system. Such self-reports may not perfectly conform to diagnoses made by physicians. The utilization and expenditure sections elicited information on healthcare episodes since the prior interview. The frequency of interviews was designed to improve the reliability of responses.

In the MEPS, expenditure data derive from a combination of the MEPS-H interviews and information provided by insurance plans. Expenditures in MEPS are defined as the actual expenditures for the medical care services used, regardless of the source of payment [32, 33]. In studies on medical care expenditures, the analyst studies the actual exchange of money which contrasts with studies on the costs of illness, in which costs are tabulated even if uncompensated care is provided on the assumption that resources are being consumed regardless of payment. Because MEPS is based on expenditures rather than costs, there are healthcare encounters for which no expenditures are made.

In an entirely fee-for-service system, all expenditures among respondents could be tracked. However, in many forms of managed care, charges are not rendered when services are provided and, hence, there are no expenditures specific to medical care encounters. Accordingly, in such instances, MEPS-H imputes expenditures based on the charges incurred within the fee-for-service sector for similar services provided to similar individuals.

Analyses

Data partitions. In the analyses for this report, estimates of the expenditures of persons with respiratory conditions are presented. The specific conditions included were ICD-9 codes 491 (chronic bronchitis), 492 (emphysema), 493 (asthma), 494 (bronchiectasis),

496 (chronic airway obstructive disease, not elsewhere classified), 500 (coal worker's pneumoconiosis), and 501 (asbestosis). The entire MEPS-H data file was then partitioned into the following condition groups on the basis of ICD-9 codes: persons with only respiratory conditions, persons with both respiratory and non-respiratory chronic conditions, persons with one nonrespiratory condition, persons with two or more nonrespiratory chronic conditions, and persons with no chronic conditions. Owing to the sample size of the MEPS, some respiratory conditions were not reported by any MEPS respondent. Others, such as COPD, were reported by relatively few respondents, precluding reliable estimates of their national economic impact. For this report, chronic conditions were defined by the protocol devised by HOFFMAN *et al.* [34].

General considerations. Because MEPS-H is based on a two-stage cluster sample rather than a true random sample of the noninstitutionalized population, it was necessary to weight the data to make inferences for the USA population. In MEPS-H, the sampling weights also take into account nonresponses in the households targeted for inclusion and omission among respondents, after completion of the first interview [35]. Software was used to account for the cluster-sampling design in the calculation of the SE of parameters.

Description of utilization and expenditures. Initially, the sizes of the five condition groups were enumerated (persons with respiratory conditions, persons with and without nonrespiratory conditions, persons with one, or more than one nonrespiratory chronic condition, and persons with no chronic conditions). The frequency with which each major category of healthcare was used by persons in the condition groups was then shown, including ambulatory visits to physicians and nonphysicians, prescription medications, home-health days (days in which health providers assist in daily activities), and hospital admissions. Subsequently, medical care expenditures of persons in the condition groups (and within the respiratory condition group, for those with the most prevalent specific diseases, including chronic bronchitis, emphysema, and asthma) were estimated by category of health services, and the distribution of total healthcare expenditures among persons with all forms of respiratory disease was shown. In the foregoing analysis, all expenditures among persons in the condition groups were tabulated, regardless of whether or not the condition in question accounted for the expenditures. The results indicate those estimates with low statistical reliability (estimates with a relative standard error of >30%).

Analysis of increment in healthcare expenditures. In order to assess the incremental contribution of respiratory conditions to healthcare expenditures, a series of regressions were estimated separately for persons with and without respiratory conditions. Because the two demographic variables used in these regressions (education and marital status) are not applicable to children, data on these characteristics

were obtained from the adults in each child's family. In addition, since missing values for any of the independent variables in a regression will cause observations to be deleted, the data was subset only to those observations with values present. This resulted in two and 311 observations being deleted from the respiratory and nonrespiratory categories, respectively. The characteristics of persons with respiratory conditions were then substituted into the regression models developed for those without respiratory conditions. This technique allowed simulation of the level of expenditures that persons with respiratory conditions would experience in the absence of these conditions. The increment was then calculated as the difference between the simulated amount and the predicted expenditures from the respiratory group [36]. To make these calculations with respect to ambulatory care, in-patient, and prescription drug expenditures, the two-stage method outlined by DUAN *et al.* [37] was followed. DUAN *et al.* [37] developed this method because many persons have relatively low health expenditures, or none, while a small proportion have very high expenditures, primarily due to hospital admissions. In this method, logistic regression is used to estimate the probability that an individual has any expenditures, followed by ordinary least squares regression to estimate the level of expenditure among those with expenditures.

The incremental contribution of respiratory conditions to total expenditures was estimated by a four-stage model, using separate logistic procedures to predict the probability of any hospital and medical expenditures. Separate ordinary least squares procedures were estimated to predict the level of total costs (including ambulatory and in-patient care, prescription drugs, and a residual category that included services such as home healthcare and medical devices) among persons with and without hospitalizations. In the ordinary least squares regressions, a log transformation was used to account for the skewed distribution of expenditures. In both the logistic and ordinary least squares procedures, the dependent variable was regressed on indicator variables for the presence or absence of respiratory conditions and the following major chronic conditions: hypertension,

other forms of heart disease, stroke, other neurological conditions, diabetes, cancer, musculoskeletal conditions, and mental illness.

In addition to the model including only the indicator variables for conditions, a separate model was estimated, which included the condition variables and a count of chronic conditions. In the latter model, the parameter estimates indicated the magnitude of the effect of a condition after taking into account the extent of comorbidity. Models were also estimated which, in addition to the condition indicator variables, controlled for demographic characteristics (age, by categories; sex; White *versus* non-White race; Hispanic status; marital status; level of formal education), and overall health status (one item measurements of perceived physical and mental well-being [38, 39] singly and combined). The parameter estimate for the respiratory condition variable in the latter models indicated the magnitude of the effect of that condition on expenditures, after taking into account the difference between persons with and without respiratory conditions in demographic characteristics and health status.

The mean expenditures controlling for the covariates described earlier were calculated by exponentiating the predicted values for each observation, multiplying the result by a "smearing" coefficient (the sum of the exponentiated residuals divided by the sample size pooled from the respondents with and without respiratory conditions), and then averaging the observations.

Results

Prevalence of respiratory conditions

After applying the sampling weights, it was estimated that there were ~12.1 million persons (4.5% of the population) with at least one respiratory condition. Of these, it was estimated that there were ~9.7 million (3.6% of the entire population and 80.2% of all persons with respiratory conditions) with one or more nonrespiratory conditions (table 1). In addition, it was estimated that there were 163.5 million persons

Table 1. – Number and per cent of the noninstitutionalized population, by condition status, USA, 1996 (authors' analysis of Medical Expenditures Panel Study)

Condition status	n (in millions)	Total population	Persons with respiratory conditions
All respiratory conditions	12.1	4.5	100.0
Respiratory conditions only	2.4	0.9	19.8
Respiratory and other chronic conditions	9.7	3.6	80.2
Asthma	10.4	3.9	85.6
All nonrespiratory conditions	163.5	60.8	
One nonrespiratory condition only	63.1	23.5	
Two or more nonrespiratory conditions	100.4	37.3	
No chronic/comorbid conditions	93.3	34.7	

Data are presented as % unless otherwise stated. Respiratory conditions included in the rubric are International Classification of Diseases-ninth revision codes 491 (chronic bronchitis), 492 (emphysema), 493 (asthma), 494 (bronchiectasis), 496 (chronic airway obstruction, not elsewhere classified), 500 (coal worker's pneumoconiosis) and 501 (asbestosis). Respondents may have had more than one of the following respiratory conditions: chronic bronchitis, emphysema, and asthma.

(60.8%) with nonrespiratory chronic conditions in the absence of respiratory conditions and another 93.3 million (34.7%) with no chronic conditions. Among the ~12.1 million persons estimated to have one or more respiratory conditions, ~10.4 million were estimated to have asthma (individuals, however, could report more than one respiratory condition).

Description of utilization and costs

Table 2 tabulates medical care utilization by condition group. A significantly larger proportion of persons with respiratory conditions reported ambulatory physician visits, prescription medications filled, and hospital discharges than persons with nonrespiratory conditions or those with no chronic conditions. In addition, a significantly larger proportion of persons with respiratory conditions reported ambulatory nonphysician visits and home healthcare days than those with no chronic conditions but such persons did not differ from those with nonrespiratory conditions in the proportion using medical care of this type. Among those using each kind of service, persons with respiratory conditions had higher utilization rates of ambulatory physician visits and prescription medications filled than those with nonrespiratory conditions. They also had higher utilization rates of each kind of service, other than home healthcare, than persons with no chronic conditions.

Persons with all forms of respiratory conditions had substantially larger average total medical care

expenditures than persons with nonrespiratory chronic conditions; \$3,753 versus \$2,624, respectively (table 3). Persons with respiratory and nonrespiratory conditions reported larger average total expenditures than persons with two or more nonrespiratory conditions (\$4,465 versus \$3,443), but persons who reported only having respiratory conditions had average total expenditures less than two-thirds of those of persons with one nonrespiratory condition (\$843 versus \$1,321). Among all persons with respiratory conditions, hospital stays accounted for 45% of total expenditures. Other large components included physician visits (18%) and prescriptions (17%). Total expenditures averaged \$2,973 among all persons with asthma.

Overall, persons with respiratory conditions accounted for \$45.5 billion in annual expenditures, representing the equivalent of ~0.6% of the Gross Domestic Product for the USA in 1996 [40]. However, all but \$2.0 billion of the expenditures were from persons with both respiratory and nonrespiratory conditions.

Table 4 shows the distribution of medical care expenditures among persons with respiratory and nonrespiratory chronic conditions and among those with no chronic conditions. Among persons who only had respiratory conditions, median annual medical care expenditures were only \$189, and even at the 75th percentile, these expenditures only reached \$452. Among persons with both respiratory and nonrespiratory chronic conditions, expenditure levels were much higher: median expenditures were \$1,308 and

Table 2. – Annual healthcare utilization (by type) of the noninstitutionalized population, by condition status, USA, 1996 (authors' analysis of Medical Expenditures Panel Study)

Kind of health service	Condition status	Among all persons % with any	Among those using this service	
			Mean±SE	Median
Ambulatory physician visits	RC	86.5*	7.0±0.31*	5
	NRC	82.4*	5.7±0.09*	3
	CC	43.3*	2.6±0.07*	2
Ambulatory nonphysician visits	RC	41.2 [#]	6.3±0.63 [#]	2
	NRC	38.0 [#]	5.3±0.20 [#]	2
	CC	11.7 [#]	2.7±0.22 [#]	1
Prescription medication filled	RC	93.0*	21.0±1.13*	10
	NRC	82.3*	13.4±0.31*	6
	CC	35.0*	3.7±0.23*	2
Home healthcare days	RC	5.4 [#]	83.3±20.00	28
	NRC	3.6 [#]	79.0±5.42	28
	CC	0.6 [#]	46.4±20.21	6
Hospital discharges	RC	14.7*	1.6±0.07 [#]	1
	NRC	9.3*	1.4±0.03 [#]	1
	CC	2.6*	1.1±0.04 [#]	1

RC: all with respiratory conditions; NRC: all with nonrespiratory conditions; CC: all with no chronic conditions. Respiratory conditions included in the rubric are International Classification of Diseases-ninth revision codes 491 (chronic bronchitis), 492 (emphysema), 493 (asthma), 494 (bronchiectasis), 496 (chronic airway obstruction, not elsewhere classified), 500 (coal worker's pneumoconiosis) and 501 (asbestosis). Estimates of the home health days among persons with no chronic conditions are statistically unreliable (relative SE of >30%). *: p<0.05 between the two condition groups, and between each group and the no condition group. [#]: p<0.05 between each condition group and the no condition group.

Table 3. - Estimated annual healthcare expenditures (by type) of the noninstitutionalized population, by condition status, USA, 1996 (authors' analysis of Medical Expenditures Panel Study)

Condition status	Total all services	Hospital stays	Physician visits	Nonphysician visits	ER visits	Prescriptions filled	Home health-care services	Other	Total \$ (in billions)
All respiratory conditions	3,753	1,679 (45)	658 (18)	255 (7)	102 (3)	653 (17)	292 (8)	115 (3)	45.5
Respiratory conditions only	843	365 (43) [#]	176 (21)	32 (4)	53 (6)	198 (24) [#]	2 (0)	17 (2) [#]	2.0
Respiratory and other chronic conditions	4,465	2,001 (45)	776 (17)	310 (7)	114 (3)	764 (17)	362 (8)	139 (3)	43.5
Asthma	2,973	1,207 (41)	597 (20)	228 (8)	96 (3)	586 (20)	173 (6)	85 (3%)	30.8
All nonrespiratory conditions	2,624	1,126 (43)	600 (23)	210 (8)	77 (3)	372 (14)	188 (7)	51 (2)	428.9
One nonrespiratory condition	1,321	741 (56)	278 (21)	83 (6)	61 (5)	114 (9)	29 (2)	15 (1%)	83.4
Two or more nonrespiratory conditions	3,443	1,368 (40)	801 (23)	290 (8)	87 (3)	535 (16)	289 (8)	73 (2)	345.6
No chronic conditions	365	137 (38)	113 (31)	34 (9)	33 (9)	26 (7)	11 (3) [#]	9 (3) [#]	34.0
Total	1,891	808 (43)	433 (23)	151 (8)	63 (3)	265 (14)	132 (7)	39 (2)	508.5

Data are presented as mean US Dollars (\$) or \$ (%) unless otherwise stated. ER: emergency room. #: estimates are statistically unreliable (relative SE of >30%). Respiratory conditions included in the rubric are International Classifications of Diseases-ninth revision codes 491 (chronic bronchitis), 492 (emphysema), 493 (asthma), 494 (bronchiectasis), 496 (chronic airway obstruction, not elsewhere classified), 500 (coal worker's pneumoconiosis) and 501 (asbestosis). Respondents may have more than one of the following respiratory conditions: chronic bronchitis, emphysema, and asthma. The total national cost in billions was calculated by multiplying the total of all services (this table) by the prevalence in millions (from table 1).

expenditures at the 75th percentile were \$4,253. Median medical care expenditures among persons with one or two or more nonrespiratory chronic conditions were \$184 and \$977, respectively. The latter figure is considerably lower than the \$1,308 expenditure of persons with respiratory and non-respiratory conditions.

Analysis of the increment in expenditures

The \$45.5 billion in annual expenditures among persons with respiratory conditions was only partially attributable to the respiratory conditions themselves. A significant fraction was due to other chronic conditions and to acute and preventative care. Table 5 presents the results of several sets of analyses intended to calculate the magnitude of the increment in medical care expenditures directly attributable to respiratory conditions. The results of the first set of analyses present estimates of the magnitude of the increment in ambulatory and in-patient care, and prescription drugs and total expenditures attributable to respiratory conditions, when taking into account the other conditions that the MEPS respondents reported. Respiratory conditions were responsible for annual per capita increments of \$239 in ambulatory care expenditures, \$358 in prescription drugs, \$616 in in-patient expenditures, and \$1,583 in overall expenditures (the latter figure is smaller than the sum of the prior three because persons with respiratory conditions have a negative increment in the residual category, indicating lower expenditures).

When the estimate of the increment in per capita total expenditures (\$1,583) was multiplied by the estimated number of persons with respiratory conditions (12.1 million) the total increment amounted to ~\$19.2 billion a year. The \$1,583 figure represented more than two-fifths of the average total expenditures of \$3,753 among persons with respiratory conditions (latter datum from table 3). The annual per capita increment in total expenditures actually increased after controlling for the total number of chronic conditions (\$1,862) and demographic characteristics (\$2,588), but was slightly smaller when controlling for health status (\$1,003). After controlling for all of these sets of variables, the increment was \$2,579 per capita. When the latter estimate was multiplied by the estimated number of persons with respiratory conditions, the total increment amounted to ~\$31.2 billion. However, even when the smallest estimate of the per capita increment (\$1,003) was multiplied by the estimated number of persons with respiratory conditions, the total increment remained a substantial \$12.1 billion.

Discussion

Two kinds of estimates of the economic impact of respiratory conditions have been made. In the first, the magnitude and distribution of all medical care expenditures among the estimated 12.1 million persons with respiratory conditions was recorded and the

Table 4.—Distribution of estimated annual total health expenditures of the noninstitutionalized population, by condition status, USA, 1996 (authors' analysis of Medical Expenditures Panel Study)

	Min.	5%	25%	Med.	75%	95%	Max.	Mean
All respiratory conditions	0	19	273	913	3,083	17,268	114,120	3,753
Respiratory conditions only	0	0	57	189	452	5,311	19,951	843
Respiratory and other conditions	0	55	452	1,308	4,253	20,522	114,120	4,465
All nonrespiratory conditions	0	0	141	517	1,779	10,685	471,159	2,624
One nonrespiratory condition	0	0	49	184	534	3,886	471,159	1,321
Two or more nonrespiratory conditions	0	39	325	977	2,769	14,372	405,510	3,443
No chronic conditions	0	0	0	22	157	1,262	59,582	365
Total	0	0	32	238	1,078	7,819	471,159	1,891

Data are presented as US Dollars. Min.: minimum; Med.: median; Max.: maximum. Respiratory conditions included in the rubric are International Classifications of Diseases-ninth revision codes 491 (chronic bronchitis), 492 (emphysema), 493 (asthma), 494 (bronchiectasis), 496 (chronic airway obstruction, not elsewhere classified), 500 (coal worker's pneumoconiosis) and 501 (asbestosis).

authors found that such persons experience per capita total expenditures of \$3,753, or \$45.5 billion overall. Although these expenditures are substantial, because the distribution of expenditures is highly skewed, most individuals avoided such high levels of expenditures. Nevertheless, expenditures incurred by persons with respiratory conditions represent a substantial drain on the nation's economy. In the present study, it was found that total direct medical expenditures in 1996 were equivalent to 0.6% of the Gross Domestic Product for that year [40]. The national economic impact of respiratory conditions is likely to increase in years to come because of the rising prevalence of asthma and chronic bronchitis.

In the second set of analyses, the authors estimated the increment in expenditures attributable to respiratory conditions. When adjusting only for the other medical conditions, respondents reported an annual per capita increment of \$1,583, or \$19.2 billion overall. After adjustment for the other specific chronic conditions reported, the total number of conditions the respondent had, demographic characteristics and health status, the per capita increment was \$2,579 and, when summed across all persons with respiratory conditions, amounted to \$31.2 billion nationally. Even the smallest estimate of the increment amounted to \$12.1 billion on a national basis. With respect to specific components, the estimated increment in

in-patient costs (\$496–1,473, depending upon the model) indicated higher usage of hospitals among persons with respiratory conditions than would be expected on the basis of their other characteristics.

The present study may have improved upon previous estimates of the national economic impact of respiratory conditions because it combined a systematic, community-based sampling frame with the prospective tracking of expenditures and applied the same methodology to all conditions within the respiratory disease rubric. It indicates that healthcare expenditures on behalf of persons with respiratory conditions have a substantial impact on the nation's economy, and that the increment specifically attributable to these conditions, albeit a smaller amount, nevertheless raises total expenditures among persons with respiratory conditions, substantially higher than the figure expected of such persons in the absence of these conditions. Because the present study tabulated only those medical care expenditures associated with self-reported conditions and omitted indirect costs altogether, it may underestimate the total economic impact of respiratory disease in the nation. The results may be specific to the USA because of the nature of the healthcare system in this nation, with a large proportion of the population without health insurance, and a large proportion of those with insurance in managed care plans. Therefore, despite

Table 5.—Incremental expenditures attributable to respiratory conditions, with and without adjustments for chronic condition counts, demographic characteristics and health status, USA population, 1996 (authors' analysis of Medical Expenditures Panel Study)

Model description	Increment			
	Ambulatory	Prescription drugs	In-patient	Total
Disease indicators	239	358	616	1,583
Disease indicators, chronic condition count	166	373	605	1,862
Disease indicators, demographics	305	561	1,315	2,588
Disease indicators, health status	183	273	496	1,003
Disease indicators, chronic condition count, demographics, health status	178	489	1,473	2,579

Data are presented as US Dollars. Respiratory conditions included in the rubric are International Classifications of Diseases-ninth revision codes 491 (chronic bronchitis), 492 (emphysema), 493 (asthma), 494 (bronchiectasis), 496 (chronic airway obstruction, not elsewhere classified), 500 (coal worker's pneumoconiosis) and 501 (asbestosis).

the methodological advantages of MEPS, including population-based sampling and prospective monitoring of expenditures, results cannot be compared directly with studies from other nations.

The present study's estimates of expenditures for specific conditions would appear to be greater than prior studies. For example, SMITH *et al.* [10] calculated that the direct cost of asthma was \$5.1 billion in 1994. In contrast, in the present study it was found that expenditures of persons with asthma amounted to \$30.8 billion. Thus, the pandemic of asthma and other respiratory conditions of increasing prevalence and severity may be causing an increase in costs, although methodological improvements implemented in MEPS may also account for part of the increase. Because MEPS is designed to be an ongoing survey, it will be possible to track changes in the expenditures associated with specific conditions over time, to determine whether the increases described here continue or are a one-time artefact of the methodological innovations in MEPS. It should be pointed out, however, that although the estimates of total healthcare costs from MEPS are lower than in other sources, such as the National Health Accounts, once differences in the scope of the expenses and in the populations covered by the two sources are taken into account, the estimates from MEPS are only slightly lower [41].

The data on the distribution of costs previously presented shows that relatively few individuals with respiratory conditions incur high levels of expenditures. Indeed, individuals with the highest 5% of expenditures account for 45% of total expenditures of respiratory conditions. Thus, interventions that can reduce the frequency of high expenditure levels, such as increased utilization of asthma action plans and more effective self-management strategies [42], can alter the national economic impact of respiratory conditions profoundly, by preventing hospital admissions and the use of emergency departments. In the interim, respiratory conditions will continue to represent a substantial drain on the nation's economy.

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