

ECONOMIC BURDEN ATTRIBUTABLE TO OBESITY IN ADULT PATIENTS WITH ASTHMA IN THE U.S.

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ABSTRACT

OBJECTIVES: To estimate annual medical and productivity costs attributable to obesity in patients with asthma in the U.S.

METHODS: This study used the 2003-2008 Medical Expenditure Panel Survey. Asthma patients (18-64 years) were identified using ICD-9-CM code 493, clinical classification code 128, or physician diagnosis. Patients were classified as normal (BMI:18.5-<25 kg/m²), overweight (BMI:25-<30 kg/m²) or obese (BMI:≥30 kg/m²). Medical costs were estimated using a generalized linear model (GLM) with a log link function and gamma distribution. Costs associated with productivity loss were calculated based on missed working days due to illness and average hourly wage using a two part model for working adults. In the first part, logistic regression was used to estimate the probability of having missed working days due to illness. In the second part, using patients with missed working days, GLM was used with the estimated probability from first part of model to estimate the cost associated with productivity loss. The costs attributable to obesity were estimated by differences between the observed and estimated cost in obese patients, using a distribution of covariates obtained from normal patients. All costs were converted to 2010 U.S. dollars using price indices. Data were analyzed using SAS and STATA.

RESULTS: A total of 8,775 adults were identified with asthma. The average treatment cost and lost productivity costs of normal patients were \$3,154(95%CI:\$2,689-\$3,620) and \$327(95% CI:\$279-\$375), and those of obese patients were \$5,720(95% CI:\$5,314-\$6,129) and \$699(95% CI:\$608-\$790), respectively. Obese patients had 38% higher medical cost and 53% higher lost productivity costs after adjusting for other study variable(s). Additional medical costs attributable to obesity were calculated to be \$1,087 (95% CI:\$687-\$1,487) and lost productivity costs attributable to obesity were \$279(95% CI:\$191-\$368).

CONCLUSIONS: The economic burden of asthma among U.S. adults is substantial, which is only further amplified by the presence of obesity. This study highlights the importance of obesity control in order to reduce costs of treating asthma patients and enhance productivity.

BACKGROUND

- Asthma is a chronic respiratory disease that inflames and narrows the airways, characterized by episodic and reversible attacks of wheezing, chest tightness, shortness of breath, and coughing
- Obesity is an important factor that affects the progression or deterioration of asthma ¹
- The prevalence of asthma among adults in 2009 was estimated at 7.7% ² and the costs attributable to asthma were \$2,077.50 per patient among adults ³
- A recent study of the US adults indicated that the prevalence of obesity was 33.8% (in 2007-2008). ⁴ Among adults, the medical costs for obese-weight patients were \$1,429 (42%) higher per year than those of normal-weight patients ⁵
- The estimation of costs attributable to disease allows policy makers to acknowledge the problem and pragmatically structure their budget to prevent it ⁶

OBJECTIVES

- To examine the demographic characteristics of obese patients with asthma in the U.S.
- To estimate the differences in annual medical and productivity costs between obese and normal-weighted patients with asthma

METHODS

Data source

- 2003–2008 Medical Expenditure Panel Survey (MEPS)
- MEPS is a nationally representative survey of the US civilian non-institutionalized population starting in 1996, and is designed to collect health care information
- MEPS includes detailed information on health care utilization and expenditures, health insurance, health status, and a variety of demographic, social, and economic characteristics

Study population

Eligible patients were identified if they:

- Had asthma based on an ICD-9-CM code of 493, a clinical classification code of 128, or confirmed diagnosis of asthma by a physician
- Were 18-64 years old
- Did not have pregnancy, malignancy, kidney dialysis, immunodeficiency diseases, or low body-mass-index (BMI)<18.5

Obesity

- BMI was calculated by weight (in kilograms) divided by height squared (in meters) using self-reported weight and height
- Patients were classified as normal weight (BMI:18.5-<25 kg/m²), overweight (BMI:25-<30 kg/m²), or obese (BMI:≥30 kg/m²)

Data Analysis

- Medical costs
 - Included medical services and prescription drug costs incurred for treating patients, excluding costs associated with dental health and injury
 - Were estimated using a generalized linear regression model with log link function and gamma distribution after adjusting for patient characteristics and co-morbidities
- Productivity loss costs
 - Were estimated based on the missed working days due to illness, injury, or mental or emotional problems for one year and valued using the average hourly wage by occupation in the U.S.
 - Were estimated using a two part model for working adults because they included substantial zero costs
 - In the first part, logistic regression was used to estimate the probability of having workdays lost
 - In the second part, using patient who had non-zero costs, a generalized linear model, utilizing the probability of positive value, was used to estimate the productivity loss costs

METHODS

Data Analysis

- Costs attributable to obesity were defined as the average costs per patients, which could be avoided if obese patients were normal
 - Coefficients of covariates were estimated with normal patients
 - In patients with obesity, the mean cost was predicted using the coefficients estimated from the model with normal patients
 - The costs attributable to obesity were then calculated as the mean difference between the actual costs and the estimated costs for patients with obesity
- All costs were converted to 2010 U.S. dollars using price indices.
- All analyses were performed using SAS and STATA statistical software

RESULTS

Table 1. Characteristics of asthma patients in the U.S.

	Normal (18.5≤BMI<25)			Overweight (25≤BMI<30)			Obesity (BMI≥30)			P-value
	Sample	N	%	Sample	N	%	Sample	N	%	
Total Asthma Patients	2,560	4,427,103	31.25	2,731	4,606,639	32.51	3,464	5,134,243	36.24	
Age										
18-30	1,044	1,818,693	41.08	737	1,249,120	27.12	682	960,761	18.71	<0.001
31-40	527	922,281	20.83	568	991,113	21.51	763	1,056,390	20.58	
41-50	449	771,285	17.42	681	1,146,650	24.89	882	1,362,829	26.54	
51-64	540	914,844	20.66	745	1,219,755	26.48	1,157	1,764,263	34.17	
Gender										
Male	1,015	1,791,942	40.48	1,388	2,506,752	54.42	1,160	1,832,549	37.64	<0.001
Female	1,545	2,635,161	59.52	1,343	2,099,886	45.58	2,324	3,201,694	62.36	
Race/Ethnic										
Non-Hispanic White	1,615	3,332,175	75.27	1,604	3,297,368	71.58	1,839	3,346,226	65.17	<0.001
Non-Hispanic Black	364	409,148	9.24	466	550,008	11.94	831	898,200	17.49	
Hispanic	378	404,582	9.14	483	465,279	10.10	629	617,815	12.03	
Others	203	281,198	6.35	178	293,983	6.38	185	272,002	5.30	
Co-morbidities										
Heart diseases	23	35,527	0.80	37	59,179	1.29	108	146,900	2.86	<0.001
Hyperlipidemia	29	50,470	1.14	75	118,943	2.56	127	169,030	3.29	<0.001
Stroke	6	11,423	0.26	6	8,717	0.19	12	13,170	0.26	0.883
Other Anthropathies	35	37,884	0.86	24	30,244	0.66	84	116,229	2.26	<0.001
Anxiety	42	79,264	1.79	42	66,985	1.45	68	96,308	1.88	0.591
Depression	70	117,800	2.66	83	121,674	2.64	154	214,569	4.18	0.007

Figure 1. Medical costs and productivity loss costs in patients with asthma

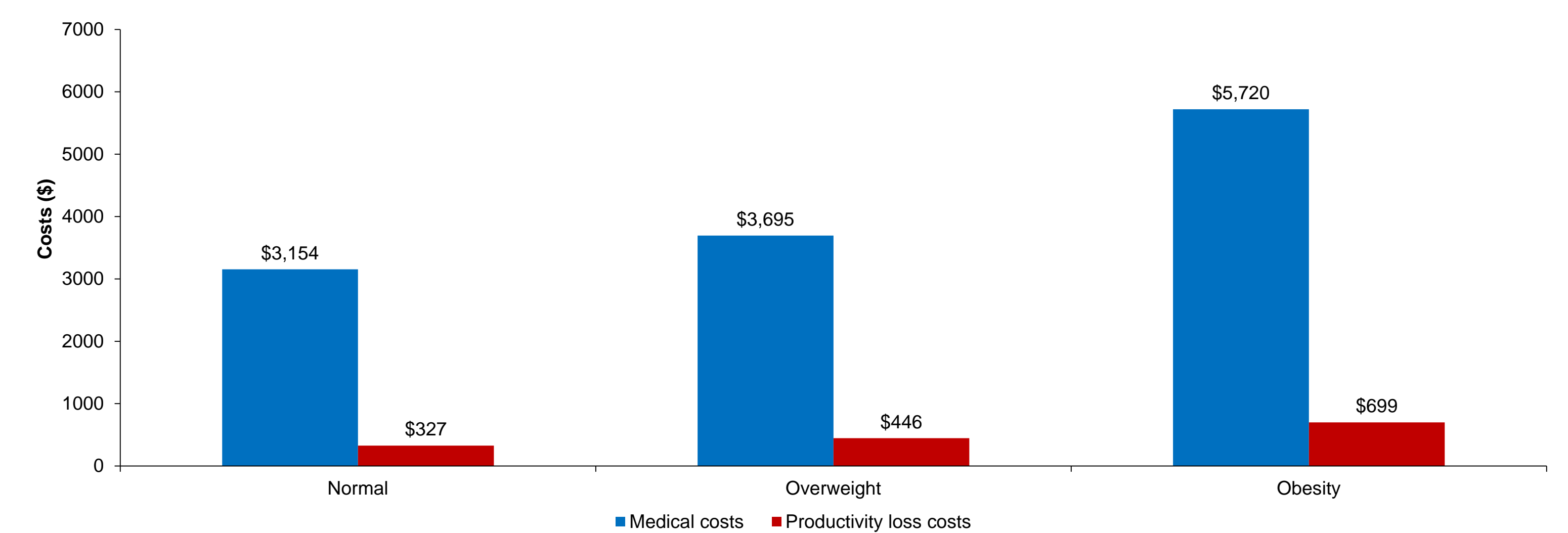
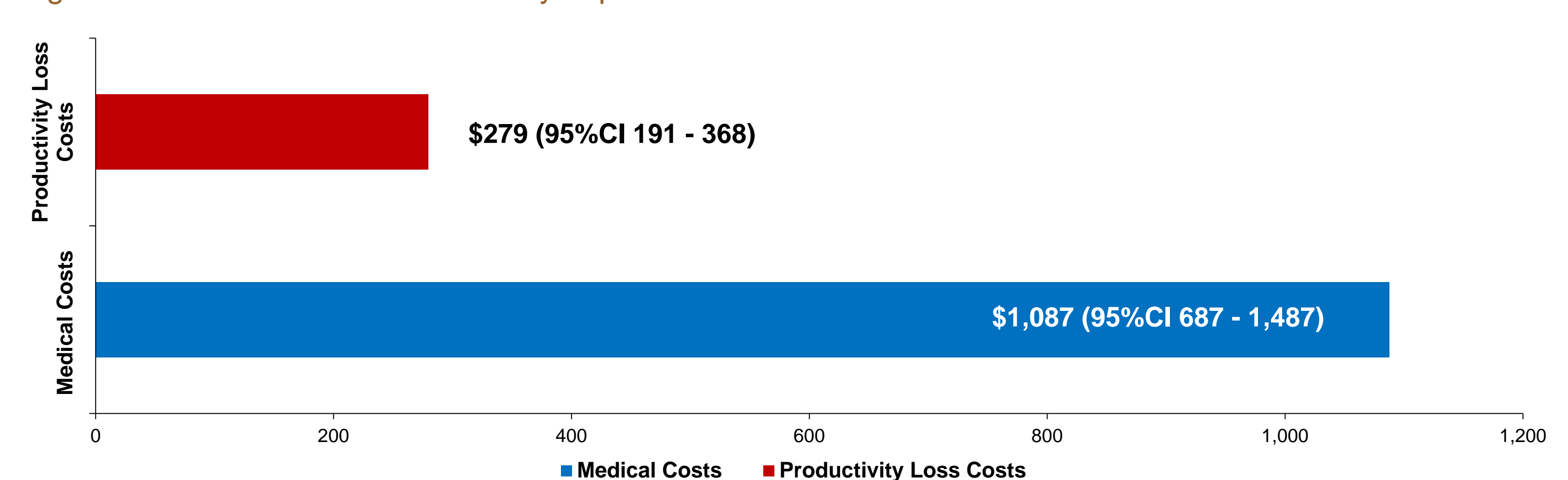


Table 2. Factors influencing to costs in patients with asthma

	Medical Costs			Productivity Loss Costs							
	Cost Rate	95% CI	P-value	Odds Ratio	First part	95% CI	P-value	Cost Rate	Second Part	95% CI	P-value
BMI											
normal	1			1				1			
overweight	1.10	0.95 - 1.26	0.191	1.03	0.87 - 1.21	0.722	1.19	0.98 - 1.45	0.084		
obesity	1.38	1.20 - 1.59	<0.001	1.51	1.29 - 1.77	<0.001	1.53	1.27 - 1.85	<0.001		
Age											
18-30	1			1				1			
31-40	1.51	1.22 - 1.87	<0.001	1.16	0.94 - 1.42	0.159	1.20	0.94 - 1.53	0.149		
41-50	2.29	1.90 - 2.76	<0.001	1.27	1.02 - 1.57	0.033	1.73	1.36 - 2.21	<0.001		
51-64	3.18	2.59 - 3.90	<0.001	1.35	1.09 - 1.66	0.005	1.70	1.29 - 2.23	<0.001		
Gender											
Male	1			1				1			
Female	1.52	1.35 - 1.71	<0.001	1.51	1.31 - 1.74	<0.001	1.11	0.93 - 1.34	0.247		
Co-morbidities											
Heart diseases	2.18	1.62 - 2.94	<0.001	2.07	1.13 - 3.80	0.018	0.72	0.45 - 1.16	0.177		
Hyperlipidemia	1.30	1.06 - 1.59	0.011	0.84	0.66 - 1.06	0.146	0.83	0.57 - 1.20	0.314		
Stroke	1.90	1.36 - 2.65	<0.001	12.76	1.55 - 104.82	0.018	4.38	3.23 - 5.94	<0.001		
Other Anthropathies	1.29	0.73 - 2.26	0.382	1.05	0.63 - 1.75	0.857	2.29	1.15 - 4.57	0.019		
Anxiety	1.37	1.03 - 1.82	0.033	2.14	1.19 - 3.86	0.011	1.50	0.73 - 3.07	0.273		
Depression	1.78	1.42 - 2.23	<0.001	1.44	0.92 - 2.24	0.109	1.02	0.72 - 1.44	0.923		

Figure 2. Costs attributable to obesity in patients with asthma



LIMITATIONS

- Medical costs and productivity loss costs may be affected by the immeasurable confounders
- The number of patients able to be identified from the MEPS database was low and affected the statistical power of the study
- Use of the reported medical conditions in the MEPS (i.e. ICD-9-CM codes, CCC, the question about asthma) tends to underestimate the true prevalence of asthma due to its chronic nature

CONCLUSIONS

- For asthma patients, the medical costs attributable to obesity was estimated at \$1,087(95%CI:\$687-\$1,487) and the productivity loss costs attributable to obesity was estimated at \$279 (95%CI:\$191-\$368)
- The economic burden of asthma among US adults is substantial, which is only further amplified by the presence of obesity
- This study highlights the importance of obesity control to reduce the cost of treating asthmatic patients and to enhance productivity

REFERENCES

1. Sin DD, Sutherland ER. Obesity and the lung: 4. Obesity and asthma. *Thorax*. 2008;63(11):1018-1023.
2. CDC. Asthma prevalence, disease characteristics, and self-management education - United States, 2001-2009. *MMWR*. 2011;60.
3. Kamble S, Bharmal M. Incremental direct expenditure of treating asthma in the United States. *Journal of Asthma*. 2009;46:73-80.
4. Flegal DM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999-2008. *JAMA*. 2011;303(3):235-241.
5. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W. Annual medical spending attributable to obesity: payer and service-specific estimates. *Health Affairs*. 2009;28(5):w822-831.
6. Hartunian NS, Smart CN, Thompson MS. The incidence and economic costs of cancer, motor vehicle injuries, coronary heart disease, and stroke: a comparative analysis. *American Journal of Public Health*. 1980;70(12):1249-1260.