Relationship between Body Mass Index and the Use of Healthcare Services in Australia

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Abstract

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Objective: To examine the relationship between body mass index (BMI) and the use of medical and preventive health services.

Research Methods and Procedures: This study involved secondary analysis of weighted data from the Australian 1995 National Health Survey. The study was a population survey designed to obtain national benchmark information about a range of health-related issues. Data were available from 17,033 men and 17,174 women, ≥20 years or age. BMI, based on self-reported weight and height, was analyzed in relation to the use of medical services and preventive health services.

Results: A positive relationship was found between BMI and medical service use, such as medication use, visits to hospital accident and emergency departments (for women only); doctor visits, visits to a hospital outpatient clinics; and visits to other health professionals (for women only). A negative relationship was found in women between BMI and preventive health services. Underweight women were found to be significantly less likely to have Papanicolaou smear tests, breast examinations, and mammograms.

Discussion: This research shows that people who fall outside the healthy weight range are more likely to use a range of medical services. Given that the BMI of industrialized populations appears to be increasing, this has important ramifications for health service planning and reinforces the need for obesity prevention strategies at a population level.

Key words: body mass index, medical-service use, preventive screening, Australia, obesity

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Introduction

The prevalence of obesity in industrialized countries is high and rising (1). In Australia, for instance, it is estimated that more than half the population is overweight or obese (2). The high prevalence of overweight and obesity in Australia is paralleled in other industrialized settings such as Canada (3), the United States (4), and Europe (5). This "obesity epidemic" carries with it the associated problems of the rising rates of its comorbidities (1). Obesity-related diseases include non-insulin-dependent diabetes mellitus, coronary heart disease, hypertension, and various cancers including breast, cervical, ovarian, gall bladder, prostate, and colon cancer (4,6,7). Beyond the rising incidence of conditions associated with obesity is the broader issue of the burden that obesity places on health services in general.

Most research examining the burden of obesity on health services have analyzed it in terms of economic cost (3,6–11). One approach to estimating the cost of obesity has been to estimate the direct cost to the healthcare system, such as the approach of Segal et al. (7) who estimated the direct costs of obesity to the Australian healthcare system, or Colditz (9) who estimated the direct costs to the United States healthcare system. For example, in 1995 Colditz estimated the direct cost of obesity to be $70 billion. An alternative approach is to consider the economic burden of obesity factoring in the direct costs of healthcare, as well as the indirect costs of lost productivity (12). However, regardless of how one calculates these costs, obesity and the conditions related to it account for substantial healthcare dollars.

Unfortunately, the dollar-cost of obesity reveals little about the day-to-day impact of obesity on the healthcare system. This is better captured by statistics on health-service use. Surprisingly, the relationship between weight and health-service use has received relatively little attention, although there are a few exceptions. These exceptions have been discussed in two recent reviews by Fontaine and Bartlett (13) and Zayat et al. (14), one on the use of preventive health services by obese patients (13) and the other on the use of medical care by patients with obesity (14). One case-control study based in a primary-care setting

(n = 194), for instance, observed higher healthcare use with increasing BMI (15). This relationship was also observed in a much larger study (n = 17,118) based on a survey of members of a health-service organization (16). It is noteworthy that there are few large survey studies using representative samples (17–19). Where the studies do exist, they are limited geographically and often, though not exclusively, limited to a subpopulation. Fontaine et al. (19), for example, studied only women, and Brown et al. (17) limited their study to women 45 to 49 years of age. The study by Trakas et al. (18) is the only existent study of health-service use based on a nationally representative sample, and this study did not include the use of preventive health services.

Improved knowledge about the impact of obesity on health services requires more research based on nationally representative samples that specifically examine health-service use. This would supplement and enhance the economic analyses that already exist. The aim of the present study is to examine the relationship between BMI and the use of medical and preventive health services based on data from the 1995 Australian National Health Survey (20).

To understand the context of the present study, one needs to understand that Australia uses a primary-healthcare model. Visits to specialists occur generally with only a referral from general (medical) practitioners; costs are subsidized (sometimes up to 100%) through a universal healthcare system ("Medicare") that covers all citizens, permanent residents, and some temporary residents. The healthcare is partially funded through a national levy on income and covers such things as essential drugs, nonelective medical procedures in public hospitals, and visits to medical practitioners.

Research Methods and Procedures

Data

This study involved a secondary analysis of data from the 1995 Australian National Health Survey (20). The survey was the most recent in a series of health surveys conducted by the Australian Bureau of Statistics. It utilized a multistage cluster sample of households in all six Australian states and two territories. Information was obtained by personal interviews. The total survey sample was 53,790 individuals (26,434 men and 27,356 women) representing a response rate of ~97%. The present study was limited, however, to adults ≥20 years of age (n = 37,616). With the exclusion of the 6.4% of cases with missing information regarding height, weight, and/or income data, the working sample was 35,207 (17,033 men and 17, 174 women).

Measures

National Health Survey participants were asked for their height and weight. Continuous BMI was calculated by dividing a participant's self reported weight (kilograms) by the square of their self-reported height (meters). A categorical measure of BMI was also derived according to specifications defined by the Australian National Health and Medical Research Council (21). The four BMI categories were: underweight ($<$20 kg/m^2); normal weight (20 to 25 kg/m^2); overweight ($>$25 to 30 kg/m^2); and obese ($>$30 kg/m^2).

Participants in the National Health Survey were asked about their use of a range of health services in the 2 weeks before the interview, including hospitalization, admission to a hospital accident and emergency department, visits to outpatient clinics (i.e., a visit to a hospital clinic that does not involve admission, such as attendance at a pain management clinic, or attendance at a hospital clinic to receive physical therapy), visits to doctors, and visits to other health professionals. Participants also reported whether they had used any medications in the last 2 weeks. Women were additionally asked about their use of preventive health services including mammography, manual breast examination, and Papanicolaou (pap) smears. Responses to these latter questions were reduced to binary outcomes according to whether a woman had a pap smear or a breast examination in the last 2 years. Mammography outcomes were similarly classified, but only for women ≥50 years of age.

Age was recorded by the Australian Bureau of Statistics categorically in 5-year blocks. Estimated continuous age was calculated by adjusting each participant's age to the midpoint of his or her age block.

A measure of income was calculated, which estimated the income of the highest-earning individual in each participant's family. Because income figures were recorded categorically in $5000 blocks in the survey, it was necessary to adjust income to the midpoint of the income block.

Statistical Analysis

The relationship between measures of health-service use and BMI was tested using logistic regression models. Separate models were developed using the continuous or the categorical measure of BMI as the predictor variables. Age and estimated income were included in all models as control variables. We developed separate models using continuous and categorical BMI because of some evidence suggesting that analyses using categorical BMI (unlike continuous BMI), based on self-reported height and weight, may have unreasonably high levels of systematic error (22–25).

In the regression models using categorical BMI, the normal-weight group (BMI, 20 to 25 kg/m^2) was used as the reference category. In the regression models using continuous BMI, participants with a BMI of $<$20 kg/m^2 were excluded, because of the anticipated nonlinear relationship (17).

Results

The percentage of men and women in this Australian study that reported using the medical or preventive health

Table 1. Percentage of people that reported using medical or preventive health services

	n (%)	
	Men	**Women**
Medication use	12,135 (54.1)	17,391 (63.6)
Hospitalization	190 (0.7)	236 (0.9)
Accident and emergency room visits	262 (1.0)	192 (0.7)
Outpatient clinic visits	567 (2.1)	637 (2.3)
Doctor visits	4652 (17.6)	6211 (22.7)
Other health professional visits	2272 (8.6)	3163 (11.6)
Regular pap smear tests		5667 (64.3)
Regular breast examinations		3105 (33.1)
Regular mammograms		2347 (29.4)

Table 2. Distribution of BMI category by sex

	n (%)		
BMI category	**Females**	**Males**	**Total**
Underweight (BMI < 20)	2396 (14.0)	664 (3.9)	3060 (8.9)
Acceptable (BMI 20 to 25)	8284 (48.2)	7287 (42.8)	15,571 (45.5)
Overweight (BMI 25 to 30)	4335 (25.2)	7042 (41.3)	11,377 (33.3)
Obese (BMI >30)	2159 (12.6)	2040 (12.0)	4199 (12.3)

BMI, body mass index.

services is shown in Table 1. Medication was the most frequently used form of health service by both men (54%) and women (64%). Visits to a doctor were also relatively common events with ~18% of men and ~23% of women having visited a doctor in the 2 weeks before interview. Table 1 shows that in the 2 years before interview, large numbers of women >50 years of age (67 to 71%) had neither a breast examination nor a mammogram. A surprisingly large number of the women sampled had not had a pap smear in the 2 years before the interview (36%).

Self-reported height and weight data were used to estimate BMI. A summary of the distribution of BMI is shown in Table 2. It was more common for men (~43%) and women (48%) to be of normal weight than of any other weight category. This notwithstanding, a similar proportion of men were overweight and of normal weight. This was not the case for women, who were half as likely to have been overweight than of normal weight. Approximately 12% of people were obese, and it was almost as common among men (12%) as it was among women (~13%).

The relationship between BMI and health-service use was, in the first instance, examined by BMI categories (underweight, normal weight, overweight, and obese) in logistic regression, controlling for age and income. Normal weight was treated as the reference category, and data were analyzed separately for men and women (Table 3).

Among men, as BMI increased so too did the use of medical services in the 2 weeks before interview. This was true for medication usage [overweight, odds ratio (OR) = 1.13; obese OR = 1.46], visits to outpatient clinics (obese, OR = 1.62) and visits to a doctor (obese, OR = 1.20). Being under weight was also significantly associated with hospitalization (OR = 2.83) and visits to outpatient clinics (OR = 2.13).

A similar, though not identical, pattern of medical service use was observed in women. Overweight (OR = 1.32) and obese (OR = 1.68) women were more likely to have taken medication in the 2 weeks before interview than women of normal weight. Obese women were also more likely to have visited a hospital outpatient clinic (OR = 1.80) than were normal-weight women in the 2 weeks before interview. Compared with normal-weight women, those who were overweight and obese were more likely to have made a visit to a doctor (OR = 1.15 and OR = 1.30, respectively) or other health professional (OR = 1.17 and OR = 1.27, respectively).

An association between BMI in women and the use of preventive health services was only observable in underweight women. Underweight women were significantly less likely than normal-weight women to have regular pap smears (OR = 0.81), regular breast examinations (OR = 0.74), and, among women >50 years of age, to have a regular mammogram (OR = 0.67).

Because the BMI data analyzed here were based on self-reported heights and weights, and the estimated BMI category is less stable than estimated continuous BMI, the analyses were repeated using continuous BMI. Only individuals with an estimated BMI of ≥20 were included in the analyses (Table 4).

In men, increasing BMI was significantly associated with medication usage (OR = 1.03) and visits to a doctor (OR = 1.02) in the 2 weeks before the interview. Although the ORs were much smaller than the equivalent ORs in the comparison of BMI category, it should be remembered that these differences related to increases in single BMI units. Thus, compared with a man who had a BMI of 23, a man who had a BMI of 28 was 15% more likely to have taken medication.

In women, increasing BMI was significantly associated with the use of a range of medical services. This included medication usage (OR = 1.04), admission to a hospital accident and

Table 3. Tabulation of relative ORs among subjects in different BMI categories using NHS subjects' self-reported height and weight and controlling for age and income

	Underweight BMI (<20)	CI	Normal* BMI (20 to 25)	Overweight BMI (25 to 30)	CI	Obese BMI (>30)	CI
Men							
Medication use†	0.93	0.78 to 1.10	1	1.13†	1.05 to 1.22	1.46†	1.30 to 1.64
Hospitalization†	2.83†	1.46 to 5.51	1	1.14	0.74 to 1.76	1.05	0.56 to 2.01
Accident and emergency room visits	0.80	0.29 to 2.24	1	1.14	0.76 to 1.71	1.42	0.83 to 2.44
Outpatient clinic visits†	2.13†	1.39 to 3.25	1	1.25	0.98 to 1.60	1.62†	1.17 to 2.23
Doctor visits†	0.93	0.76 to 1.15	1	1.06	0.97 to 1.16	1.20†	1.06 to 1.36
Other health professional visits	1.02	0.76 to 1.37	1	1.02	0.90 to 1.16	1.07	0.89 to 1.29
Women							
Medication use†	1.03	0.92 to 1.14	1	1.32†	1.20 to 1.45	1.68†	1.48 to 1.91
Hospitalization	1.21	0.75 to 1.95	1	0.95	0.63 to 1.45	1.46	0.93 to 2.30
Accident and emergency room visits	0.94	0.48 to 1.84	1	1.49	0.90 to 2.48	1.70	0.94 to 3.09
Outpatient clinic visits†	1.01	0.73 to 1.40	1	1.24	0.96 to 1.60	1.80†	1.36 to 2.37
Doctor visits†	1.06	0.95 to 1.18	1	1.15†	1.05 to 1.26	1.30†	1.16 to 1.45
Other health professional visits†	1.09	0.94 to 1.26	1	1.17†	1.04 to 1.32	1.27†	1.09 to 1.47
Regular pap smear tests†	0.81†	0.68 to 0.96	1	0.90	0.79 to 1.03	0.88	0.74 to 1.04
Regular breast examinations†	0.74†	0.63 to 0.87	1	0.99	0.87 to 1.12	0.99	0.84 to 1.16
Regular mammograms†	0.67†	0.48 to 0.94	1	0.87	0.70 to 1.08	0.87	0.67 to 1.15

OR, odds ratio; BMI, body mass index; NHS, National Health Survey; CI, confidence interval.
* Reference group.
† $p < 0.05$ in logistic regression model.

emergency department (OR = 1.05), a visit to a hospital outpatient clinic (OR = 1.03), a visit to a doctor (OR = 1.02), and a visit to a non-medically trained health professional (OR = 1.02). There was no significant association in women between BMI and the use of preventive health services when underweight women were excluded from the analysis.

Discussion

This study is important because it provides nationally representative data on the impact of obesity on medical and preventive health services. It shows that among women in Australia, there is a clear relationship between BMI category and medical-service use. Increasing BMI was associated with an increased use of medical services. Specifically, women who were overweight had a greater likelihood of medication use, visits to outpatient clinics, and consultations with doctors and other health professionals. Health-service use increased along with severity of overweight, being higher in those who were obese compared with those overweight, a finding that is consistent with Quesenbury et al. (16), in their study of health maintenance organization members. The relationship between service use and BMI was not as clear among men as it was among women in our study. Here, increasing BMI was associated with greater medication use and frequency of doctor visits. However, being underweight was found to be associated with a greater likelihood of hospitalization. A curvilinear relationship was found for visits to outpatient clinics, with both underweight and obese men having the highest rates of outpatient clinic visits. The present findings are consistent with the previous literature as it relates to women but less so for men (15–17,19). The findings also reinforce the need for more international data.

Table 4. Tabulation of ORs when considering BMI (continuous) with health behaviors using NHS subjects' self-reported height and weight and controlling for age and income

	OR	CI
Men		
Medication use*	1.03	1.02 to 1.04
Hospitalization	1.01	0.95 to 1.06
Accident and emergency room visits	1.03	0.98 to 1.08
Outpatient clinic visits	1.04	1.01 to 1.07
Doctor visits*	1.02	1.00 to 1.03
Other health professional visits	1.01	0.99 to 1.02
Women		
Medication use*	1.04	1.03 to 1.05
Hospitalization	1.03	0.99 to 1.07
Accident and emergency room visits*	1.05	1.01 to 1.10
Outpatient clinic visits*	1.03	1.01 to 1.06
Doctor visits*	1.02	1.01 to 1.03
Other health professional visits*	1.02	1.01 to 1.03
Regular pap smear tests	0.99	0.98 to 1.00
Regular breast examinations	1.00	0.98 to 1.01
Regular mammograms	0.99	0.97 to 1.01

Individuals with an underweight BMI were excluded from this analysis.
OR, odds ratio; BMI, body mass index; NHS, National Health Survey; CI, confidence interval.
* $p < 0.05$ in logistic regression model.

In the analysis of the data using a measure of continuous BMI, the statistically significant ORs were small, in the range of 1.02 to 1.05. Individuals more familiar with the larger ORs typical of clinical research may be inclined to dismiss these results as statistically significant but of little practical interest. It must be noted, however, that these data relate to populations, and in an environment of increasing weight, the implications for healthcare use are of real public-health significance. An increase of one BMI unit in the population of men ≥20 years of age represents, for example, a potential 4% increase in the use of medication and a 5% increase in the use of emergency medical services. Thus, even these small increases in the odds of health services use may, in populations like Australia that are gaining in weight, have an enormous impact on health-service delivery. This pessimistic possibility needs to be tempered with the realization that the relationship may not be a causal one, and increasing population weight need not necessitate a greater use of health services. Greater use is nonetheless a realistic possibility and needs to be monitored.

Unlike previous studies, the present study did not find that obese or overweight women were any less likely to have utilized preventive health services than were normal-weight women. Instead, women in the underweight category were significantly less likely to have regular screenings than normal-weight women. Health insurance status is a potentially plausible explanation for differences among the obese participants in this study and previous studies, particularly given that Australia had a successful universal healthcare scheme whereas the United States, where the other significant population-based study was conducted, did not (19). The United States study specifically adjusted for health insurance status; however, it left no immediately clear explanation for the differences among obese women, creating an important avenue of research inquiry.

One possible explanation for the finding that underweight women were less likely to use preventive health services than were normal-weight women relates to their health status. It may be that they have serious medical conditions that not only lead to them being underweight but that these conditions take priority over routine preventive health screening. This explanation is unfortunately not supported by the medical-use data. If the illnesses of underweight women interfered with the attendance for preventive screening, one would expect to see them over represented in the medical service-use data, and this was not the case. An alternative explanation is that underweight women are more concerned with dieting and body image than other women and, therefore, more reluctant to participant in procedures that involve disrobing. This is, however, only speculative and requires further investigation.

There are three limitations to the findings discussed here. First, and perhaps most importantly, the analyses are based exclusively on Australian data. The degree to which the results bear on other healthcare systems will depend 1) on the general pattern of health-service use shown in the populations in question and 2) on where the country lies in the epidemiological transition. The results will, therefore, have more relevance to those countries with similar health profiles to Australia and similar background health-service use patterns. That our results have generally agreed with the results from other international studies bolsters the observation that increases in BMI are associated with increasing health-service use. However, it would be useful to have more population based data on this relationship from other countries. A second limitation relates to the study design. The analyses are based on data from a cross-sectional survey, a fact that imposes limitations on inferences of causal relationships. A third limitation relates to the fact that the height and weight data are self-reported (2,23,25). The "gold standard" is measured height and weight data, which is, unfortunately, usually impractical for large population-based surveys. It is known, however, that self-reported weight tends to be underestimated with greater underestimation by those who weigh more. There is also a tendency (particularly among men) to overestimate height. The underestimation of weight and overestimation of height will result in the BMI being an underestimate (more so among those who weigh more). Thus, the ORs reported here are also likely to be underestimates, with the association between BMI and use of health services even stronger. The use of continuous data in some analyses was to "smooth out" the bias over the distribution, rather than containing it within discrete categories. Although this does not overcome the bias, it provides an alternative way of approaching the data.

Although economic analyses have shown that overweight and obesity have a significant impact on health costs, there has been very little data showing the actual impact of overweight and obesity on health-service use. This research shows that people who fall outside the healthy-weight range are more likely to use a range of medical services. Given that the BMI of industrialized populations appears to be increasing, this has important ramifications for health-service planning and reinforces the need for obesity prevention strategies at a population level.

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