Journal of Public Health | Vol. 29, No. 1, pp. 53–56 | doi:10.1093/pubmed/fdl088 | Advance Access Publication 18 December 2006

Obesity and use of acute hospital services in participants of the Renfrew/Paisley study

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ABSTRACT

Background Because overweight and obesity are associated with comorbidities, increasing levels of overweight and obesity may impact on hospital use.

Methods Body mass index (BMI) in middle age was related to acute hospital use in 7036 men and 8327 women from the Renfrew/Paisley prospective cohort study in Scotland. Participants in this general population study were examined between 1972 and 1976 when aged 45–64 years. Acute hospital admissions and bed days per 1000 person-years were calculated by the World Health Organization BMI categories in the follow-up period to 31 March 2004.

Results Underweight and normal weight men had lower-than-expected admission rates, and overweight and obese men had higher-than-expected admission rates. Obese men had higher-than-expected bed day rates. For women, there was a U-shaped relationship with admission rate, with normal weight women having the lowest admission rate and underweight and obese women having similar high rates. Underweight and obese women had higher-than-expected bed day rates.

Conclusions Participants who were obese in midlife had more-than-expected acute hospital admissions and in particular more bed days. With levels of obesity increasing since this study was started in the 1970s, if these patterns persist, there may be increasing demand on health service resources.

Keywords epidemiology, obesity, public health

Introduction

Because obesity is associated with health problems, such as diabetes and cardiovascular disease,[1] one consequence of the emerging obesity epidemic may be increased hospital use. Studies, largely from the United States, suggest that this is the case and also suggest that overweight and obesity are associated with high healthcare costs.[2–4] However, there is little information from the United Kingdom on the association between overweight and obesity and hospital admissions. Data on participants from the Renfrew/Paisley prospective cohort study were analysed to see whether obese or overweight participants had more acute admissions or bed days than normal weight or underweight participants.

Methods

The Renfrew/Paisley study was conducted between 1972 and 1976 on 15 402 men and women aged between 45 and 64 years who lived in the two towns, with a response rate of ~80%.[5] The study included a physical examination where height and weight were measured, enabling body mass index (BMI) (defined as height divided by weight squared in kg/m^2) to be calculated.[5] World Health Organization (WHO) categories were used to define underweight (BMI < 18.5 kg/m^2), normal weight (18.5 to <25 kg/m^2), overweight (25 to <30 kg/m^2) and obese (≥30 kg/m^2). Excluded from the study were 24 participants who were lost to follow-up and 15 participants with missing data on BMI, leaving 7036 men and 8327 women in the study.

Ethical permission was given by the Privacy Advisory Committee of NHS Scotland Information Services to link the participants to their acute hospital discharge data from

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1972. This is a computerized record of all acute hospital discharges in Scotland, known as the Scottish Morbidity Records system (SMR1).[6] Discharges were available until the end of March 2004, and any discharges occurring before screening were excluded. Data were available on dates of admission and discharge and the type of admission. For the calculation of number of admissions per person, transfer admissions, where the participant was transferred to another specialty within the episode, were excluded. All other admissions were summed for each person. Bed days were calculated by subtracting the date of admission from the date of discharge and adding 1. The addition of 1 was to ensure not losing day cases. In the case of transfer admissions, the 1 was not added to ensure no double counting. Total bed days per person were calculated by summing the bed days for each admission for each participant.

Survival time in days was calculated to the end of March 2004 or to the date of death or the date of embarkation from the United Kingdom. Survival time and total number of admissions and bed days were calculated for each BMI category. From these, the admissions and bed days per 1000 person-years for each BMI category were calculated. This was done for all men and women separately and by 5-year age group at screening. BMI at screening was related to acute admissions and bed days from screening to the end of March 2004. Observed admissions (or bed days) were compared with expected admissions [defined as the rate of admissions (or bed days) assuming no difference between BMI categories], with 95% confidence intervals calculated assuming a Poisson distribution for the observed.[7]

Results

There were 49% of men who were overweight, 11% were obese and 1% underweight. A smaller proportion of women than men were overweight (37%), but more were obese (15%) and underweight (2%).

Underweight and normal weight men had lower-than-expected admission rates, whereas overweight and obese men generally had higher-than-expected admission rates (Table 1). Of all men, underweight men had the lowest acute admission rate and obese men had the highest. Overweight men had a similar admission rate to obese men, and normal weight men had an intermediate rate between the underweight and the overweight. Each age group broadly followed the general pattern, with the exception of 45- to 49-year-old obese men who had a lower admission rate than overweight men and 55- to 59-year-old obese men who had a lower admission rate than both overweight and normal weight men.

Underweight, overweight and obese women had higher-than-expected admission rates. For all women, there was a U-shaped relationship with admission rate, with normal weight women having the lowest admission rate and underweight and obese women having similar high rates. In the youngest age group, obese women had a higher admission rate than underweight women, but for the age groups >50 years at screening, underweight women had higher rates than obese women. Fig. 1 shows the causes of admission for overweight and obese men and women.

Obese men had higher-than-expected bed day rates. Acute bed days per 1000 person-years for men were lowest for underweight men and highest for obese men. They were particularly high for 60- to 64-year-old obese men. For the youngest men, there was little difference between the BMI categories. Underweight and obese women and the youngest overweight women had higher-than-expected bed day rates. Obese women had the highest bed day rate, followed by underweight women and then overweight and normal weight women. Bed day rates were especially high for 60- to 64-year-old underweight women. Within each BMI category, bed day rates generally increased with age group for men and women.

Excluding the first 5 years or the first 10 years of admissions did not change the results substantially (not shown).

Discussion

Main findings of this study

In this cohort, obese men and women had high rates of acute hospital admissions and bed days. Overweight men also had high rates of admissions. Underweight women had an excessive rate of admissions and bed days but not underweight men. Underweight at baseline could be caused by existing illness, but removing admissions occurring in the first 5 or 10 years of follow-up did not change the pattern seen in the women.

What is already known on this topic

Other studies have found excess admissions and bed days in underweight and obese patients. In a Spanish study of men and women aged >60, obese men were more likely to be hospitalized for at least 6 days than non-obese men, and men and women who had lost weight in a 2-year period were more likely to be admitted to hospital than those who had not changed weight.[8] In a study of Medicare beneficiaries in the United States, aged >65 years, there was a higher risk of hospitalization in men and women with BMI (based on self-reported height and weight) ≥ 35 kg/m^2, compared with normal BMI.[2] In the age range 65–75 years, the underweight had a higher risk of hospitalization, but this was not seen in the

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Table 1 Acute admissions and bed days per 1000 person-years by body mass index (BMI) category in men and women of the Renfrew/Paisley study

Age at screening			*BMI category (kg/m²)*			
			Underweight <18.5	*Normal weight 18.5–24.9*	*Overweight 25–29.9*	*Obese ≥30*
Men	Number	Total admissions	Acute admissions per 1000 person-years; observed/expected (95% CI)			
45–49	1812	10 434	187.0; 0.77 (0.55–1.06)	219.3; 0.91 (0.88–0.94)	260.4; 1.08 (1.05–1.11)	240.5; 1.0 (0.94–1.06)
50–54	1977	9962	126.7; 0.52 (0.34–0.77)	234.7; 0.96 (0.93–0.99)	242.3; 0.99 (0.97–1.02)	288.7; 1.18 (1.12–1.25)
55–59	1676	7874	186.8; 0.71 (0.52–0.95)	243.9; 0.93 (0.90–0.97)	281.7; 1.08 (1.05–1.11)	234.9; 0.90 (0.83–0.97)
60–64	1571	5604	153.7; 0.61 (0.40–0.89)	250.2; 0.99 (0.95–1.03)	250.0; 0.99 (0.95–1.03)	283.0; 1.12 (1.04–1.21)
All	7036	33 874	165.6; 0.67 (0.56–0.79)	234.2; 0.94 (0.93–0.96)	258.0; 1.04 (1.02–1.05)	261.8; 1.05 (1.02–1.09)
Women						
45–49	2029	10 502	206.3; 1.03 (0.90–1.17)	181.1; 0.90 (0.88–0.93)	219.8; 1.10 (1.06–1.13)	222.8; 1.11 (1.05–1.17)
50–54	2286	11 104	249.6; 1.23 (1.07–1.41)	191.3; 0.94 (0.92–0.97)	206.9; 1.02 (0.99–1.05)	233.3; 1.15 (1.09–1.21)
55–59	2043	9485	245.3; 1.15 (0.99–1.32)	207.6; 0.97 (0.94–1.0)	209.5; 0.98 (0.95–1.01)	240.6; 1.12 (1.07–1.18)
60–64	1969	8176	253.2; 1.13 (0.97–1.30)	214.1; 0.95 (0.92–0.99)	224.8; 1.0 (0.97–1.03)	245.1; 1.09 (1.04–1.14)
All	8327	39 267	234.9; 1.12 (1.05–1.20)	195.6; 0.94 (0.92–0.95)	214.8; 1.03 (1.01–1.04)	235.7; 1.13 (1.10–1.16)
Men	Total person-years	Total bed days	Acute bed days per 1000 person-years; observed/expected (95% CI)			
45–49	43 207	84 344	2028; 1.04 (0.94–1.14)	1894; 0.97 (0.96–0.98)	1977; 1.01 (1.0–1.02)	2059; 1.05 (1.03–1.08)
50–54	40 847	91 094	1312; 0.59 (0.52–0.66)	2344; 1.05 (1.04–1.06)	1997; 0.90 (0.89–0.90)	2942; 1.32 (1.30–1.34)
55–59	30 108	99 417	2360; 0.71 (0.66–0.77)	3386; 1.03 (1.02–1.04)	3230; 0.98 (0.97–0.99)	3412; 1.03 (1.01–1.05)
60–64	22 163	90 240	2624; 0.64 (0.59–0.71)	3683; 0.90 (0.89–0.91)	3923; 0.96 (0.95–0.97)	6264; 1.54 (1.51–1.56)
All	136 325	365 095	2081; 0.78 (0.74–0.81)	2641; 0.99 (0.98–0.99)	2581; 0.96 (0.96–0.97)	3326; 1.24 (1.23–1.25)
Women						
45–49	52 451	90 988	1852; 1.07 (1.02–1.11)	1497; 0.86 (0.85–0.87)	1849; 1.07 (1.05–1.08)	2397; 1.38 (1.36–1.40)
50–54	54 656	116 947	2882; 1.35 (1.29–1.40)	1974; 0.92 (0.91–0.93)	2121; 0.99 (0.98–1.0)	2759; 1.29 (1.27–1.31)
55–59	44 289	149 288	4177; 1.24 (1.20–1.28)	3032; 0.90 (0.89–0.91)	3161; 0.94 (0.93–0.95)	4756; 1.41 (1.40–1.43)
60–64	36 351	196 365	8607; 1.59 (1.55–1.63)	5099; 0.94 (0.94–0.95)	5045; 0.93 (0.93–0.94)	6520; 1.21 (1.20–1.22)
All	187 747	553 588	3993; 1.35 (1.33–1.38)	2573; 0.87 (0.87–0.88)	2919; 0.99 (0.99–0.99)	4135; 1.40 (1.39–1.41)

CI, confidence interval.

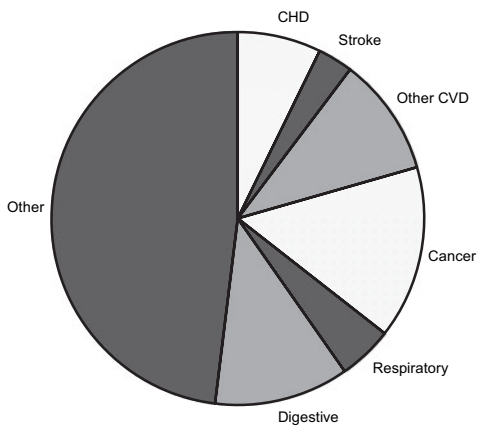

Fig. 1 Principal diagnoses of hospital admissions in overweight or obese men and women.

older age groups. The underweight also had a higher rate of bed days than the normal weight group. A large study of 17 118 adults in a health maintenance organization in the United States found that greater BMI was associated with greater annual rates of inpatient days, greater number and costs of outpatient visits, greater costs of outpatient pharmacy and greater use of laboratory services.[3] In a study of men and women aged ≥60 in Brazil, those with BMI <20 kg/m^2 had double the risk having of two or more hospitalizations versus no hospitalizations, compared with those with BMI 20–24 kg/m^2.[9] Studies have also shown longer stays and poorer outcomes amongst already admitted hospital patients according to BMI categories based on weight and height assessed at entry to hospital.[10–13]

What this study adds

Our findings add to these studies from other countries with very different health services and different population distributions of BMI, by showing an association between being obese in middle age and increased rates of hospital admissions and days spent in hospital over the next 30 years in a UK population. This work also adds to a previous early publication using the Renfrew/Paisley data, which found increased admissions

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for various cardiovascular diseases over 20 years of follow-up in obese compared with normal weight participants.[14]

Limitations of this study

We have used one measure of weight and height taken at the baseline examination and have related this to all acute hospital admissions over the follow-up period up to 30 years. Thus, we are unable to determine the effect of any changes in weight on hospital admissions. Another limitation is that hospital discharge data are only available for hospitals in Scotland, so participants who moved away from Scotland did not have subsequent hospital admissions counted.

This study has shown that people who are obese in midlife place an excessive burden on the health services as they have more-than-expected acute hospital admissions and in particular more bed days. With levels of obesity increasing since this study was started in the 1970s, if these patterns persist, there may be increasing demand on health service resources.

Acknowledgements

Victor Hawthorne conducted the original Midspan studies and Pauline MacKinnon is the Midspan administrator. We thank Harper Gilmour for statistical advice. This study was supported by the Chief Scientist Office of the Scottish Executive, Grant CZH/4/203. D.A.L. is funded by a UK Career Scientist Award.

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