OBES SURG (2018) 28:963–969
https://doi.org/10.1007/s11695-017-2963-4

ORIGINAL CONTRIBUTIONS

Occupational Outcomes of Obesity Surgery—Do the Employed Return to Work, and Do the Unemployed Find Work?

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Published online: 3 November 2017

Abstract
Background Bariatric surgery offers excellent weight loss results and improvement in obesity-associated comorbidities. Many patients undergoing surgery are of working age, and so an understanding of any relationship between occupational outcomes and surgery is essential. The aim of this study was to ascertain the occupational outcomes of patients undergoing bariatric surgery at a high-volume centre.
Methods A retrospective search was performed of a prospectively maintained consecutive electronic database. We collected data on patient demographics and employment status before and after bariatric surgery. All patients with a documented employment status within 30 months of surgery were included. Patients were divided into three groups: within 6 months post-operatively, 7–18 months post-operatively, and 19–30 months post-operatively.
Results A total of 1011 patients were included. Median age was 47 years (range 18–78). Pre-operatively, 59.5% (444/746) were employed compared to 69.9% (707/1011) post-operatively ($p < 0.05$). The number of unemployed fell from 36.6% (273/746) pre-operatively to 21% (212/1011) post-operatively. The improvement in employment status was seen at all durations of follow-up. For those in employment pre-operatively, approximately 90% were still in employment at each subsequent follow-up. For those patients who were unemployed pre-operatively, approximately 40% were in employment at each subsequent follow-up. A significant improvement in the percentage employed was seen in all working age groups ($p < 0.05$).
Conclusion This is the largest study worldwide looking at employment outcomes following bariatric surgery. It demonstrates a significant increase in number of employed patients following bariatric surgery. Interestingly, it also showed that some patients employed pre-operatively become unemployed afterwards.

Keywords Occupation · Employment · Obesity surgery · Bariatric surgery · Surgical outcomes · Quality of life

Introduction

Along with associated comorbidity, obesity has impacts on many other social factors for both individuals and wider society. Whilst a causal relationship is difficult to establish between obesity and unemployment [1], several studies have suggested an association between the two [2–4]; given the high prevalence of obesity in the working age population, this translates into a large problem for patients (and their families), employers, and the economy. On an individual patient level, along with a lower rate of employment, obesity is thought to result in stigmatisation and discrimination in the workplace [5], disability, and increased sickness absence [6–8]. On a wider scale in the UK, it is estimated that between 1998 and 2007, the indirect (i.e. non-health-related) costs of obesity ranged from £2.6 billion and £15.8 billion per year, and this cost is expected to increase substantially [9]. Treatment of obesity, therefore, has many benefits in addition to the physical health of patients.

Obesity surgery has been shown to improve quality of life and workplace productivity, and decrease sickness absence [10–12]. It has also been shown to be cost-effective [12–14].

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Surprisingly, however, there is little published data into the effect of obesity surgery on employment. A recent systematic review and meta-analysis of five studies (total 1292 patients) showed a tendency towards improvement in employment following bariatric surgery, but not a significant one and recommended a need for further studies [4]. Of the five studies included in this meta-analysis [15–19], all were from Europe and the USA and the largest study included 803 patients. Only one study (59 patients) was from the UK [19].

The aim of this study was to assess the effect of obesity surgery on employment status in a high-volume publicly funded bariatric unit within the National Health Service of the UK.

Methods

Data were collected retrospectively from a prospectively maintained database. We included all patients who underwent bariatric surgery at our centre between 29 May 2013 and 01 September 2016 and had an occupation status documented electronically within 30 months of their surgery (this time period was chosen to capture all routine follow-up appointments of patients wherever possible, as in the UK follow-up after obesity surgery is only commissioned for 2 years).

All bariatric techniques were included. Employment status was recorded as "Employed", "Unemployed", and "Retired". Follow-up was divided into three categories—"Less than six months", "Six to eighteen months", and "Nineteen to thirty months". Where a patient had more than one employment status documented (e.g. had one at less than 6 months and one at 19 to 30 months), the individual statuses were used when analysing each separate follow-up duration, but their overall post-operative employment status was considered as "employed" if documented as employed at any time during follow-up; "unemployed" if documented as both unemployed and retired during follow-up; and "retired" if documented only ever as retired.

Further data extracted were as follows: age, gender, pre-operative body mass index (BMI), ASA score, details of pre-operative comorbidity and functional status (quantified by the number of flights of stairs that the patient could climb categorised into zero, half, one, or three), post-operative percentage excess weight loss (%EWL), and improvement in both comorbidities and functional status.

Pre-operative and post-operative employment statuses were compared using chi-square test ("Retired" was excluded from this analysis as not deemed to be directly associated with surgery), as were comparisons of demographic and comorbidity data. Age, BMI, and %EWL were compared using the two-tailed Student t test. A statistical significance of $p < 0.05$ was used throughout.

Results

A total of 1454 cases were performed between 29 May 2013 and 01 September 2016, of which 1011 (70%) had a post-operative employment status documented within 30 months of surgery (and so were included in the study). The mean age was 46 (range 18 to 78, median 47) of whom 89% were between 20 and 60 years of age (i.e. "working age") (Fig. 1). Mean BMI on the day of surgery was 43 (range 28 to 72, median 42). Pre-operative comorbidity and functional status breakdown is outlined in Table 1. Post-operatively, mean %EWL was 62% (range − 159 to 169, median 61). 29.8% of patients with type 2 diabetes went into remission during follow-up, and a further 31.4% stopped insulin. Thirty-one percent of hypertensive patients stopped antihypertensive medication. 39.9% of patients had an improvement in functional status (Table 2).

Out of 1011 included patients, 746 (74%) had a pre-operative employment status documented. All had a post-operative employment status within 30 months of surgery; 431/1011 (43%) had a status at less than 6 months, 610/1011 (60%) at 7 to 18 months, and 413/1011 (41%) at 19 to 30 months (Fig. 2).

Pre-operatively, 444/746 (59.5%) of patients were employed, compared to 707/1011 (69.9%) post-operatively. The percentage of unemployed fell from 273/746 (36.6%) to 212/1011 (21.0%) whilst those retired increased from 29/746 (3.9%) to 92/1011 (9.1%) ($p < 0.05$). Subgroup analysis revealed the percentage of patients employed ranged from 278/413 (67.3%) to 438/610 (71.8%) at each follow-up duration, with unemployment ranging from 114/610 (18.7%) to 98/431 (22.7%). Retirement gradually increased, as would be expected with time, from 36/431 (8.4%) to 43/413 (10.4%) (Fig. 3). Comparison of the number of employed and unemployed pre-operatively and post-operatively revealed significant difference ($p < 0.05$) at all durations of follow-up.

Overall, for those employed pre-operatively, 401/444 (91.0%) remained in employment (ranging from 134/153 (87.6%) at 19–30 months follow-up to 207/226 (91.6%) at

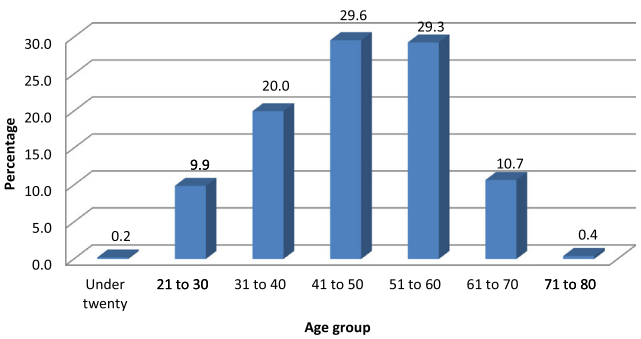

Fig. 1 Percentage of patients in each age group

Table 1 Characteristics of each pre-operative group

	All patients *N* (%)	Employed pre-op *N* (%)	Unemployed pre-op *N* (%)	Retired pre-op *N* (%)	No pre-op status *N* (%)	Difference between employed and unemployed *p* value
Ages (overall)	Range 18–78	Range 18–70	Range 24–70	Range 43–78	Range 20–69	0.15
	Mean 46	Mean 45	Mean 46	Mean 65	Mean 49	
	Median 47	Median 46	Median 48	Median 66	Median 47	
Gender						0.79
Male	249 (24.6)	113 (25.5)	67 (24.5)	8 (27.6)	61 (23.0)	
Female	762 (75.3)	331 (74.5)	206 (75.5)	21 (72.4)	204 (77.0)	
BMI at op date	Range 28–72	Range 30–68	Range 28–72	Range 34–54	Range 32–63	< 0.05
	Mean 43 Median 42	Mean 43 Median 41	Mean 44 Median 42	Mean 44 Median 45	Mean 44 Median 44	
ASA grade						0.30
1	25 (4.7)	16 (5.2)	7 (4.1)	0 (0)	2 (2.4)	
2	423 (79.2)	221 (83.6)	133 (78.4)	6 (46.2)	63 (75)	
3	83 (15.5)	30 (11.2)	29 (17.0)	6 (46.2)	18 (21.4)	
4	3 (0.6)	0 (0)	1 (0.6)	1 (7.7)	1 (1.2)	
Pre-op T2DM						0.58
Y	185 (26.8)	85 (25.1)	61 (27.1)	9 (42.9)	30 (28.0)	
N	505 (73.2)	253 (74.9)	163 (72.9)	12 (57.1)	77 (72)	
Pre-op cardiovascular disease						< 0.05
Y	41 (4.7)	11 (2.8)	15 (6.0)	2 (8)	13 (6.7)	
N	828 (95.3)	389 (97.3)	236 (94.0)	23 (92)	180 (93.3)	
Functional status (flights of stairs able to climb)						< 0.05
0	18 (2.6)	2 (0.6)	13 (5.8)	0 (0)	3 (3.1)	
0.5	78 (11.4)	23 (6.7)	42 (18.6)	5 (25)	8 (8.2)	
1	323 (47.1)	141 (41.0)	114 (50.4)	15 (75)	53 (54.6)	
3	267 (38.9)	178 (51.7)	56 (24.8)	0 (0)	33 (34.0)	
Pre-op arthritis						< 0.05
No symptoms	383 (55.7)	224 (65.5)	103 (45.8)	6 (27.3)	50 (51.0)	
Intermittent symptoms	69 (10.0)	30 (8.8)	25 (11.1)	5 (22.7)	9 (9.2)	
Known arthritis	103 (15.0)	45 (13.2)	49 (21.8)	3 (13.6)	6 (6.1)	
Requiring regular analgesia	109 (15.9)	35 (10.2)	40 (17.8)	4 (18.2)	30 (30.6)	
Required surgery	16 (2.3)	6 (1.8)	4 (1.8)	4 (18.2)	2 (2.0)	
Awaiting surgery	7 (1.0)	2 (0.6)	4 (1.8)	0 (0)	1 (1.0)	
Pre-op analgesia						< 0.05
Y	203 (30.8)	65 (19.6)	88 (41.9)	11 (52.3)	39 (39.4)	
N	457 (69.2)	266 (80.4)	121 (57.6)	10 (47.6)	60 (60.6)	
Pre-op depression						< 0.05
Y	306 (46.3)	131 (39.1)	127 (59.1)	7 (31.8)	41 (46.1)	
N	355 (53.7)	204 (60.9)	88 (40.9)	15 (68.2)	48 (53.9)	

Table 2 Post-operative outcomes according to pre-operative employment status

Outcome	Overall	All pre-op occupations			Employed pre-op			Unemployed pre-op		
	All *N* (%)	Employed post-op *N* (%)	Unemployed post-op *N* (%)	*p* value	Employed post-op *N* (%)	Unemployed post-op *N* (%)	*p* value	Employed post-op *N* (%)	Unemployed post-op *N* (%)	*p* value
%EWL	Range − 159–169 Mean 62 Median 61	Range − 7–169 Mean 65 Median 64	Range − 159–159 Mean 56 Median 55	< 0.05	Range 9–169 Mean 66 Median 65	Range 20–140 Mean 58 Median 52	0.15	Range 11–159 Mean 63 Median 60	Range − 159–122 Mean 55 Median 54	0.08
Change to type 2 DM				< 0.05			0.07*			0.79
Remission	56 (29.8)	32 (26.8)	19 (40.4)		20 (29.9)	3 (30)		6 (21.4)	11 (40.7)	
Stopped medication	59 (31.4)	46 (38.7)	6 (12.8)		26 (38.8)	1 (10)		11 (39.3)	3 (11.1)	
No change	50 (26.6)	28 (23.5)	17 (36.2)		17 (25.4)	6 (60)		8 (28.6)	9 (33.3)	
Progressed	23 (12.2)	13 (10.9)	5 (10.6)		4 (6.0)	0 (0)		3 (10.7)	4 (14.8)	
Change to anti-hypertensives				0.14			0.42*			0.68
Stopped medication	70 (30.7)	49 (34.3)	13 (24.1)		30 (37.0)	3 (27.3)		5 (18.5)	8 (26.7)	
No change	142 (62.3)	82 (57.3)	39 (72.2)		45 (55.6)	8 (72.7)		19 (70.4)	20 (66.7)	
Progressed	16 (7.0)	12 (8.4)	2 (3.7)		6 (7.4)	0 (0)		3 (11.1)	2 (6.7)	
Change to functional status				< 0.05			< 0.05			0.05
Improved	269 (39.9)	190 (39.1)	55 (40.1)		111 (35.7)	7 (29.2)		47 (43.9)	35 (38.9)	
No change	389 (57.7)	294 (60.5)	71 (51.8)		199 (64.0)	15 (62.5)		59 (55.1)	48 (53.3)	
Worsened	16 (2.4)	2 (0.4)	11 (8.0)		1 (0.3)	2 (8.3)		1 (0.9)	7 (7.8)	

*Category containing zero patients excluded from statistical analysis

less than 6 months) (Fig. 4). For those unemployed pre-operatively, 129/273 (47.3%) entered employment (ranging from 50/130 (38.5%) at less than 6 months to 83/170 (48.8%) at 7–18 months follow-up) (Fig. 5). A significant increase in

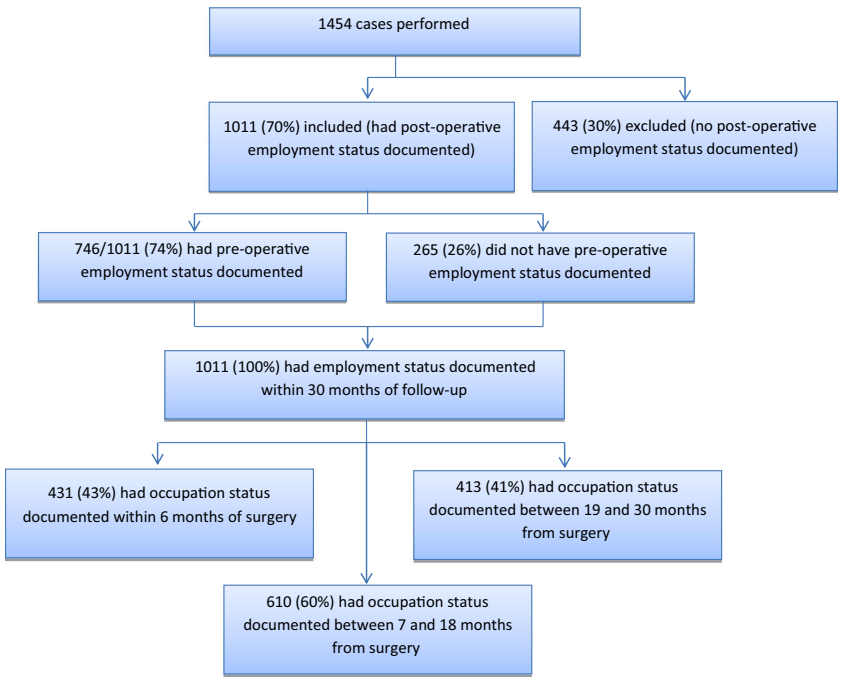

Fig. 2 Flow of patients

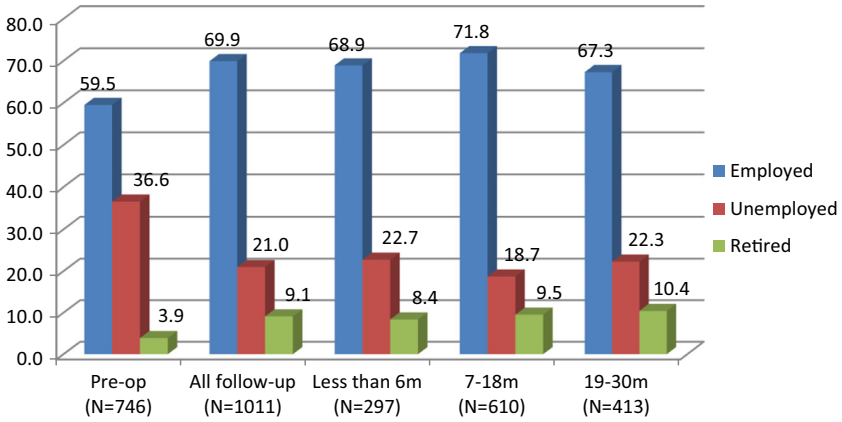

Fig. 3 Percentage of employment status at each duration of follow-up

employment was seen in all "working age (i.e. 20–60 years)" groups (Fig. 6) and also in age sub-groups and follow-up durations except for the following:

1. Those 20–30 years at 19–30 months from surgery and those 30–40 years at less than 6 months, where employment increased although insignificantly.
2. Those 50–60 years, at 19–30 months follow-up. In this group, the percentage in employment was the same as pre-operatively (57.0%). The proportion of unemployed fell, however, from 96/223 (43.0%) to 38/121 (31.4%) ($p = 0.192$). This coincided with an increase in the percentage in retirement from 0 to 14/121 (11.6%).

Between those employed and unemployed both pre- and post-operatively, there were significant differences in pre-operative BMI (less in the employed group), presence of cardiovascular disease (less in the employed group), functional status (better in the employed group), symptoms of arthritis and need for analgesia (less in the employed group), and depression (less in the employed group) (Table 1). In addition, post-operatively, the employed group were significantly younger and had significantly better %EWL, improvement in diabetes and in functional status. For patients who were in employment pre-operatively, those that remained in employment had significantly better pre-operative functional status, less arthritis and analgesic requirement, and type 2 diabetes; they also had significantly better post-operative improvement in functional status, whilst %EWL was not significantly different to those that became unemployed. For patients who were unemployed pre-operatively, those that entered employment were significantly younger and had less cardiovascular disease and arthritis; improvement in function status approached significance ($p = 0.05$) (Table 2).

Comparison between patients with and without a documented pre-operative employment status revealed a significant difference in arthritis and analgesic requirement only. There was no difference in age, gender, BMI, ASA, comorbidity, depression, or functional status (Table 1).

Discussion

This study supports the suggested benefit of obesity surgery on employment status. This benefit appears to be maintained at intermediate duration follow-up and spans all working age ranges. Along with being, to our knowledge, the largest published study, it is also only the second from the UK (the other of which included 59 patients) and fifth from Europe. This

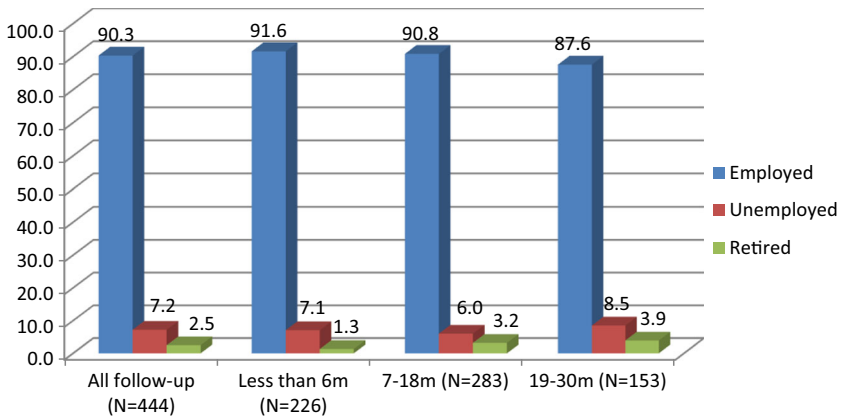

Fig. 4 Percentage of employment status at each duration of follow-up for patients employed pre-operatively

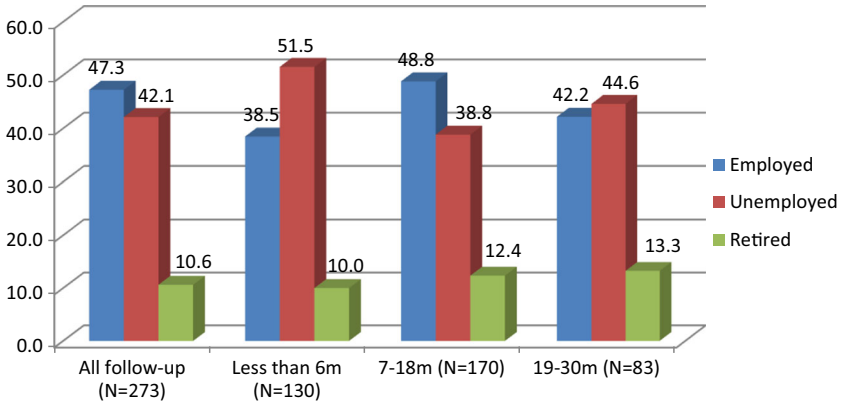

Fig. 5 Percentage of employment status at each duration of follow-up for patients unemployed pre-operatively

implies a benefit of obesity surgery on employment for both patients and the wider economy.

There is a current paucity of data evaluating the impact of obesity surgery on employment status. Recently, Sharples and Cheruvu published a systematic review and meta-analysis of occupational outcomes following obesity surgery [4]; this did not show a significant improvement in employment outcomes. Included in the review were ten studies in total, five of which were similar to our study (comparing percentage of patients employed pre- and post-operatively) and included in a meta-analysis. The methodology of each study including inclusions, follow-up method, and duration differed significantly to each other and, hence, also with this study. The population in our study was much larger than the any of the other studies included in the review (range 50–803), although our follow-up was on average shorter. The pre-operative employment status in our study was comparable to the other studies (59.5%) though post-operatively, ours was higher than all but the other UK study [19] which was 76.3%, which also happened to be the only other study to show a statistically significant improvement in employment status. Inclusion into the study was prospective and unselected, and though likely to be representative of the population in the study region undergoing surgery, it is however not possible to confirm that it is a representative of the wider UK or worldwide population.

The present UK unemployment rate (in people aged 16 years and over) is 4.7% [20]. In the studied group, the percentage of unemployed is much higher than this rate, which supports the association of obesity and unemployment. Another factor to be considered is the population studied. In Sunderland, the unemployment rate in those economically active is higher at 7% [21], and Sunderland and the surrounding area are the 7th and 13th worst areas for employment deprivation [22]. Whilst employment does not improve to near regional or national levels, the significant post-operative improvement (especially for those unemployed pre-operatively) is particularly remarkable given the level of deprivation and the presumably fewer job opportunities that may be present in less deprived areas.

At the study trust, documentation of all clinical encounters (by all team members) both pre- and post-operatively is by means of a standardised pro forma; completion of certain parts of the pro forma are mandatory and others are not. Documentation of employment status is optional; inevitably, this results in incomplete data entry (50–81% in the study group). Similarly, documentation of employment status required the patients to attend clinical follow-up; as expected, some patients did not attend and so percentage follow-up in our study ranged from 51 to 73%. It is not possible with current data to ascertain any difference with the attenders and non-attenders, or with those who had their employment status documented or not. It has previously been postulated that

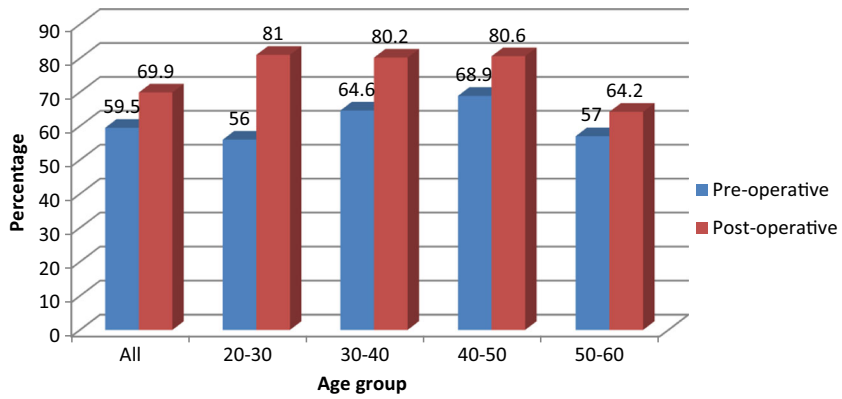

Fig. 6 Percentage of employed pre- and post-operatively according to age group

employment rate per se is not the best indicator of employment outcome as it does not reflect ability to work [4]. Consideration must also be given to the fact that the documented employment status for each patient at the time of clinic follow-up represents a single snapshot in their post-operative life. It does not necessarily reflect employment between clinic appointments or, more importantly, beyond follow-up. Other than retirement, this study did not assess reasons for unemployment pre- or post-operatively; this would be an interesting area for further work. It would appear that those who returned to work in each cohort consistently had a significantly better functional outcome, though this (along with the other presented demographic, co-morbidity, and outcome data) represents association rather than causation. Whilst longer follow-up would be ideal, it is currently practically limited by the commissioned only being for 2 years; although still possible to contact people by other means, it is likely to result in significant selection bias.

This study shows a significant increase in employment at all age groups following obesity surgery. This data is useful for the pre-operative counselling of patients regarding the impact that surgery may have on their employment, an important factor when considering quality of life outcomes. The data also supports the ongoing commissioning of obesity surgery due to economic impact of improving employment in those pre-operatively unemployed whilst maintaining employment in those pre-operatively working.

Conclusion

This is the largest series looking at employment outcomes following bariatric surgery. The study gives reassurance that the vast majority of patients in employment pre-operatively return to work, and that a large proportion of patients out of work pre-operatively enter employment post-operatively. Along with providing useful information for patients on the expected outcomes of surgery, the study highlights well the ongoing socioeconomic benefits of obesity surgery for employers and wider society.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval Not required.

Informed Consent For this type of study, formal consent is not required.

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