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Unemployment, underweight, and obesity: Findings from *Understanding Society* (UKHLS)

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ABSTRACT

Elevated morbidity and mortality among jobseekers may be partly explained by adiposity, but previous studies of unemployment and body mass index (BMI), which have usually modelled associations as linear, have produced inconsistent results. However, both underweight and obesity are associated with mortality, and both weight loss and weight gain associated with a stressful environment. If unemployment is associated with both underweight and obesity for different subgroups, these associations may previously have masked each other, whilst affecting health through divergent pathways. We investigated whether there is a previously overlooked U-shaped association of unemployment and BMI, which could help explain jobseekers' elevated morbidity and mortality, and identify groups vulnerable to underweight and obesity during unemployment.

We used multinomial models to simultaneously investigate associations of unemployment with BMI-defined underweight, overweight, and obesity in 10,737 working-age UK adults from Understanding Society (UKHLS) in 2010–12. Moderating impacts of unemployment duration, demographic factors and smoking were explored.

Current jobseekers were more likely to be underweight (Odds ratio (OR): 4.05, 95% confidence interval (CI): 2.12–7.73) and less likely to be overweight (OR: 0.71, CI: 0.55, 0.92) adjusted for gender, age, education, health, smoking and physical activity, while unemployed non-smokers had increased odds of obesity (OR: 1.52, CI: 1.06–2.18). Underweight and overweight associations were more apparent for longer-term jobseekers, men, and jobseekers from lower-income households.

We conclude that unemployment is associated with underweight and, in nonsmokers, obesity. Results show the unemployment-adiposity relationship cannot be properly studied assuming unidirectionality of effects, and suggest unemployment may affect health of different groups via divergent adiposity-mediated pathways.

1. Introduction

There is an established association of unemployment with increased risk of both ill-health and mortality (Jin et al., 1997; Roelfs et al., 2011a). These associations may occur in part through adverse health-related behaviours – principally smoking, diet, exercise, and alcohol consumption – caused by the restricted income, altered daily routine, and psychosocial stress which typically accompany job loss. While there is evidence for increases in smoking following unemployment (Arcaya et al., 2014; Falba et al., 2005; Hammarstrom and Janlert, 1994), the association of unemployment with other health behaviours, and with markers such as body mass index and obesity, is poorly understood. Thus, while there are reports of an increase in weight associated with unemployment, these may be gender specific (Monsivais et al., 2015; Marcus, 2014) or dependent on pre-unemployment body mass index (Marcus, 2014; Deb et al., 2011); other studies suggest a fall in BMI ranking during unemployment (Montgomery et al., 1998; Jonsdottir and Asgeirsdottir, 2014) but associations may again be gender specific (Montgomery et al., 1998; Jonsdottir and Asgeirsdottir, 2014). The reasons for these mixed findings are unknown, but equivocal results could be explained by a previously overlooked 'U-shaped' association of unemployment and BMI, such that jobseekers at increased risk of both underweight and obesity. Both underweight and obesity are associated with psychosocial stress, of which unemployment is an established source (Jahoda, 1981; Warr, 1987). Further, both underweight and obesity are associated with elevated risk of mortality (Aune et al., 2016), which is repeatedly observed among jobseekers. Such bidirectional responses in BMI have been previously demonstrated in a UK cohort, where self-reported job strain at baseline predicted weight gain for men in the highest quintile of BMI, but weight loss for

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Table 1
UKHLS participants at BMI measurement in 2010–12 (weighted proportions, analytic sample) stratified by unemployment. N = 10,737.

Unemployment categories		Not during follow-up N = 9629 %	Formerly unemployed N = 550 %	Currently unemployed N = 558 %
Age (years)	22–35	29.1	48.1	41.2
	36–50	36.7	28.0	29.7
	51–65	34.2	24.0	29.1
Sex	Male	43.3	50.3	57.2
	Female	56.7	49.7	42.8
BMI (kg/m^2) categories	Recommended weight (18.5–24.99)	31.8	30.5	33.0
	Overweight (25.0–29.99)	37.8	39.1	28.4
	Obesity (≥30)	29.7	28.3	34.6
	Underweight (<18.5)	0.7	2.0	3.9
Highest educational qualification	Degree/higher degree	42.8	32.8	21.6
	A-level	20.5	19.8	18.4
	O-level	21.2	28.6	23.1
	Other qualification	8.9	9.3	17.9
	No qualification	6.6	9.4	19.0
Long-term illness	No	72.1	71.4	61.5
	Yes	27.9	28.6	38.5
GHQ score	0–3	83.3	76.1	66.3
	4+	16.7	23.9	33.7
Smoking	Never	43.3	34.8	30.2
	Ex	36.8	30.3	20.2
	Current, ≤10/day	10.3	18.8	23.3
	Current, 11–20/day	8.4	14.1	20.4
	Current, >20/day	1.3	2.1	5.9
Frequency of moderate leisure-time activity	Never	25.5	29.0	46.3
	<1/week	35.9	37.3	27.0
	1–3 times/week	22.1	18.9	13.6
	>3 times/week	16.6	14.8	13.1
Frequency of walking for 10 min continuously	Never	10.0	9.1	12.5
	1 day in 4	22.4	22.4	19.3
	>1, ≤3 days in 4	30.7	28.4	29.1
	>3 days in 4	36.8	40.1	39.0
Frequency of alcohol consumption in past 7 days	Not at all	24.1	25.3	30.2
	1–2 days	35.2	36.0	31.3
	3–4 days	19.9	17.2	13.7
	≥5 days	14.2	11.7	12.1
	Missing	6.6	9.7	12.7

men in the lowest quintile (Kivimaki et al., 2006). A similar process during unemployment may not have been detected in earlier analyses, since many have used linear regression methods to investigate average BMI effects (Monsivais et al., 2015; Jonsdottir and Asgeirsdottir, 2014; Schunck and Rogge, 2010).

Previous research suggests a number of key modifiers of the association of unemployment and adiposity such as age (Roelfs et al., 2011b) and duration of unemployment (Schunck and Rogge, 2010). A modifying influence of household income is plausible for two reasons. Firstly, an individual's financial resources during unemployment (for instance, from resource pooling within a couple or family) may lessen financial restrictions on dietary quality; secondly, any impact on BMI mediated by psychological health may be modified by differences in individual economic need (Frese and Mohr, 1987; Kessler et al., 1987; White, 1991; Nordenmark and Strandh, 1999). Since smoking, widespread among jobseekers (Montgomery et al., 1998) may decrease BMI with other factors held constant (Winslow et al., 2015), unemployment-BMI associations may also differ by smoking status.

This paper aims to address gaps in the literature by investigating associations of unemployment and BMI in a large, nationally-representative study of UK adults, whilst allowing for heterogeneity in effects and investigating moderating factors. We hypothesize that if unhealthy weight loss occurs with unemployment for some individuals, but unhealthy weight gain for others, these effects may have obscured each other, leading to systematic underestimation of a key causal pathway contributing to jobseekers' elevated mortality.

2. Methods

2.1. Participants

The UKHLS is an annual longitudinal survey of over UK 40,000 households. It consists of a larger General Population Sample (GPS), a stratified clustered random sample of households representative of the UK population which joined in 2009–10, and a smaller component from the pre-existing British Household Panel Survey (BHPS) (Knies, 2015). Sociodemographic information was obtained at annual interviews, and biomedical measures including BMI taken during a nurse visit approximately 5 months (4–6 months in 92.4% of cases) after the main wave 2 interview (GPS participants) or wave 3 interview (BHPS participants) (McFall et al., 2014). Respondents were eligible to participate at the nurse visit if they had taken part in the corresponding main interview in English, were aged 16+, lived in England, Wales or Scotland, and were not pregnant. Of these 35,875, 57.5% took part. Further detail of the sampling and timelines associated with data collection can be found at www.understandingsociety.ac.uk/documentation.

This analysis used both GPS and BHPS participants who were aged 22–64 and not out of the labour force due to sickness/disability when BMI was measured. At the nurse visit when BMI was measured, the newer GPS component had been in the survey for two complete waves; analyses therefore defined the start of exposure period as two annual interviews before BMI measurement. Retrospectively-given data from the annual interview following the nurse visit was also used to determine employment status at the nurse visit itself. Information for this analysis was therefore collected between 2009 and 2013.

19,541 participants were present at the nurse visit and the following annual interview, of whom 13,820 were aged 22–65 at BMI measurement. 681 participants not working due to sickness/disability were excluded, resulting in an initial sample of 13,139. Adequate employment history information to classify participants as currently, formerly or never unemployed during follow-up was lacking for 1178 participants, and with 224 were missing BMI. Further missingness for covariates resulted in a final sample of 10,737.

2.2. Measures

2.2.1. Unemployment

At each annual interview, participants chose their current economic status from the following list: self-employed; in paid employment (full or part time); unemployed; retired; on maternity leave; looking after family or home; full-time student; long-term sick or disabled; on a government training scheme; unpaid worker in a family business; doing something else. At each annual interview participants also reported non-current activity spells since the last interview. Information from the wave before and the wave following the nurse visit was therefore used to identify unemployment in the month of BMI measurement itself, since the nurse visit fell between two annual interviews. This analysis specifically considers BMI in relation to *unemployment* – defined as being in the labour force and available for work, but currently without work (ILO, 1982). Importantly, this excludes periods of 'non-employment' such as homemaking, retirement, long-term sickness and full-time education, which were distinct options for self-defined economic status. Participants who at BMI measurement were out of the labour force due to sickness or disability were excluded from analysis entirely.

Exposure groups were categorised as currently unemployed, formerly unemployed, and not unemployed during follow-up. Since only 75.1% of currently unemployed participants had sufficient information to calculate duration of current unemployment, the role of unemployment duration (<10 months/10 months or more) was investigated in additional analyses using this subsample.

2.2.2. Body mass index (BMI)

BMI was calculated from height and weight measured by a nurse. Height was measured using a portable stadiometer with the Frankfort plane in the horizontal position, and weight using the Tanita BF522 digital floor scale. Participants gave estimated weights if heavier than 130 kg, where the scales become inaccurate (McFall et al., 2014). BMI was classified using WHO categories of recommended weight (18.5–24.9), overweight (25.0–29.9), obesity (≥30), or underweight (<18.5).

2.2.3. Covariates

Age and gender were obtained by questionnaire at the nurse visit. Information on most other covariates was obtained by questionnaire at the annual interview preceding the nurse visit, with some exceptions. Questions on smoking, alcohol consumption, and physical activity were not included at wave 3 and therefore came from wave 2 interviews for all participants.

Mental health was indexed using the 12-item General Health Questionnaire (GHQ) designed to capture depressive and anxiety symptoms, from which an overall score of 0–36 was calculated. For long-term illness, participants answered yes or no to the following: 'Do you have any long-standing physical or mental impairment, illness or disability? By 'long-standing' I mean anything that has troubled you over a period of at least 12 months or that is likely to trouble you over a period of at least 12 months.' Highest educational qualification was categorised as degree or equivalent, A-levels (high school qualifications taken at age 18, usually necessary for college admission), O-levels (high school qualifications taken at 16), other qualifications, or no qualifications. Analysis was therefore restricted to participants aged 22 or over, likely to have completed full-time education.

Smoking was classified as never smoker, ex-smoker, current smoker (up to 10/day), current (10–20/day), and current (≥21/day). Alcohol consumption was indexed firstly by the number of days in the past week on which an alcoholic drink was consumed, classified as none, 1–2, 3–4, and ≥5, and secondly by the maximum units consumed on a single day in the past week, categorised as none, 0.01–2.00, 2.01–4.00, 4.01–6.00, 6.01–8.00, 8.01–10.00, 10.01–15.00, and >15. Leisure-time physical activity considered a range of moderate-intensity activities, with frequency classified as never, less than once a week, 1–3 times per week, or >3 times per week. Questions on active transport such as cycling were only asked of employed participants, so we included on how many days of the past month participants had walked for 10 min continuously, classified into never/one day in four/2–3 days in four/more often.

2.3. Statistical analysis

This analysis used multinomial logistic regression, which simultaneously compares between exposure groups the odds of multiple, mutually-exclusive outcomes using a single chosen reference group. As per convention, we used BMI 18.5–24.99 kg/m^2 as the reference group.

All analyses adjusted for age and gender. Education was added, followed by health factors (GHQ and long-term illness), and finally smoking and physical activity. The impact of alcohol consumption was considered in a sensitivity analysis, given substantial missingness in this measure which would have reduced the final sample by an additional 6.5%. Similarly, unemployment duration was considered separately for the 75.1% of unemployed participants for whom this could be determined. Interaction terms were used to explore moderation of associations of unemployment with BMI by dichotomized age group (22–45/46–65), gender, current smoking and household income (above/below the sample median). Where interaction terms were significant, group-specific estimates are presented.

All analyses were weighted to account for non-random participation at the nurse visit, and took account of clustering by primary sampling unit and household with robust standard errors.

3. Results

The analytic sample (N = 10,737) is described in Table 1. Compared to participants not included due to missing data, those retained were older but not significantly different by gender or BMI. Due to exclusion of participants who were not currently unemployed, but whose incomplete employment history information meant they could not be classified into either remaining group, currently unemployed participants were slightly over-represented in the final sample. Retained participants were less likely to have no educational qualifications or a long-term illness, had lower GHQ scores, were more likely to be ex-smokers, and more physically active.

A priori, we sought to examine whether there was a non-linear association of unemployment and adiposity. Nonlinearity of this relationship was supported by significant quadratic term for centred BMI and current unemployment ($p = 0.004$) in a multinomial, age-and gender-adjusted logistic model with unemployment as the outcome. The non-linearity is apparent in the graphical representation of unemployment by BMI in the sample (Fig. 1).

3.1. Multinomial models

In age- and sex-adjusted multinomial models currently unemployed participants were more likely to be underweight, and less likely to be overweight, than participants not unemployed during follow-up (Table 2). Both associations were robust to full adjustment, and were not substantially altered when alcohol consumption was considered (Table 3). The multinomial models contrast with results of models assuming unidirectional effects, where an association of current

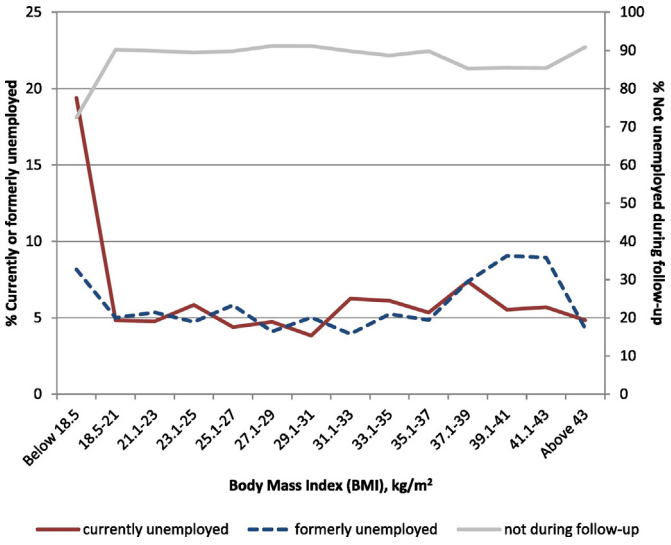

Fig. 1. Percentage of those currently, formerly and not unemployed during follow-up by body mass index in UKHLS, 2010–12.

unemployment with adiposity was not supported by a linear regression of BMI (coefficient: −0.30, CI: −0.90–0.31), nor by a logistic model of obesity (OR: 1.15, CI: 0.92–1.43).

Associations were primarily driven by longer-term unemployed participants (Table 4). At all levels of adjustment, associations were seen for participants unemployed for 10 months or longer, but weaker and non-significant associations were apparent for more recently unemployed participants.

Interaction tests were conducted for gender, age group (22–45/46–65), household income, and current smoking. Associations of current unemployment and adiposity did not differ by age band, but differed by gender for overweight ($p = 0.06$), by household income for overweight ($p = 0.02$) and underweight ($p < 0.001$) and by smoking for obesity ($p = 0.001$). Group-specific estimates from models including interaction terms (Table 5), show reduced odds of overweight were restricted to male jobseekers, who also had a stronger underweight effect (OR: 5.99, CI: 2.27–15.80 for men vs OR: 2.81, CI: 1.17–6.75 for women). The positive underweight and negative overweight associations were restricted to jobseekers from less affluent households. Lastly, smoking jobseekers had decreased odds of obesity (OR: 0.67, CI: 0.46–0.98) but non-smoking jobseekers had increased odds of obesity (OR 1.52, CI: 1.06–2.18).

Table 3
Addition of alcohol to fully-adjusted[a] models of body mass index (BMI) and unemployment among UKHLS participants in 2010–12.

	Odds ratio	95% CI
Frequency of drinking in past 7 days (N = 10,040)		
Underweight (BMI < 18.5 kg/m^2)		
Formerly unemployed	2.42	0.92, 6.37
Currently unemployed	4.91	2.51, 9.61
Overweight (BMI 25.0–25.99 kg/m^2)		
Formerly unemployed	1.25	0.95, 1.64
Currently unemployed	0.72	0.55, 0.95
Obesity (BMI ≥ 30.0 kg/m^2)		
Formerly unemployed	1.17	0.88, 1.55
Currently unemployed	0.95	0.72, 1.26
Maximum units consumed on a single day of past 7 days (N = 9847)		
Underweight (BMI < 18.5 kg/m^2)		
Formerly unemployed	2.42	0.91, 6.40
Currently unemployed	4.97	2.50, 9.85
Overweight (BMI 25.0–25.99 kg/m^2)		
Formerly unemployed	1.19	0.91, 1.56
Currently unemployed	0.76	0.58, 1.00
Obesity (BMI ≥ 30.0 kg/m^2)		
Formerly unemployed	1.13	0.86, 1.49
Currently unemployed	0.99	0.74, 1.31

[a] Adjusted for age, gender, education, long-term illness, General Health Questionnaire score, smoking status, physical activity.

4. Discussion

The positive association of unemployment with underweight and negative association with overweight across the whole population, but positive association with obesity among non-smokers, may help to explain inconsistencies in the literature. Neither a linear model of BMI nor a logistic model of obesity found evidence of these associations. Results therefore demonstrate that investigating associations of unemployment with average BMI or BMI change using linear regressions, as previous studies have done (Monsivais et al., 2015; Jonsdottir and Asgeirsdottir, 2014; Schunck and Rogge, 2010) may obscure multiple groups at risk of adverse health outcomes.

This non-linearity in the relationship of unemployment and BMI suggests the relationship of unemployment with diet, physical activity, and other factors mechanistically linked to adiposity, is also heterogeneous. If associations are explained by a causal influence of unemployment on BMI, results accord with several lines of evidence suggesting both the psychosocial stress and financial restriction associated with unemployment could have heterogeneous effects on energy balance. The tendency towards 'stress eating' varies considerably between individuals, with variation attributed to both psychological and genetic

Table 2
Associations of body mass index (BMI) with unemployment among UKHLS participants in 2010–12 (N = 10,737).

Adjustment level	Model 1: Age and sex		Model 2: Age, sex, education		Model 3: Age, sex, education, LTI[a] and GHQ[b]		Model 4: Age, sex, education, LTI and GHQ, smoking, physical activity	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Underweight (BMI < 18.5 kg/m^2)								
Formerly unemployed	2.32	0.95, 5.67	2.27	0.93, 5.54	2.24	0.91, 5.56	2.05	0.81, 5.17
Currently unemployed	4.68	2.59, 8.46	4.71	2.50, 8.88	4.57	2.40, 8.72	4.05	2.12, 7.73
Overweight (BMI 25.0–25.99 kg/m^2)								
Formerly unemployed	1.19	0.92, 1.53	1.17	0.91, 1.51	1.16	0.90, 1.49	1.18	0.91, 1.52
Currently unemployed	0.72	0.56, 0.93	0.70	0.54, 0.90	0.68	0.53, 0.88	0.71	0.55, 0.92
Obesity (BMI ≥ 30.0 kg/m^2)								
Formerly unemployed	1.16	0.89, 1.50	1.07	0.83, 1.39	1.02	0.79, 1.33	1.07	0.82, 1.39
Currently unemployed	1.19	0.93, 1.53	1.04	0.81, 1.34	0.93	0.72, 1.20	1.00	0.77, 1.30

[a] LTI: long-term illness.
[b] GHQ: General Health Questionnaire score.

Table 4
Associations of body mass index (BMI) with unemployment among UKHLS participants in 2010–12, by unemployment duration (N = 10,598).

Model 1: Age and sex	Model 1: Age and sex		Model 2: Age, sex, education		Model 3: Age, sex, education, LTI[a], GHQ[b]		Model 4: Age, sex, education, LTI, GHQ, smoking, physical activity	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Underweight (BMI < 18.5 kg/m²)								
Formerly unemployed	2.32	0.95, 5.66	2.28	0.94, 5.55	2.25	0.91, 5.56	2.06	0.82, 5.18
Current, <10 months	2.80	0.77, 10.12	2.79	0.77, 10.13	2.73	0.77, 9.65	2.44	0.68, 8.78
Current, ≥10 months	6.89	3.47, 13.68	6.88	3.24, 14.63	6.67	3.07, 14.50	5.76	2.61, 12.68
Overweight (BMI 25.0–25.99 kg/m²)								
Formerly unemployed	1.19	0.92, 1.53	1.17	0.91, 1.51	1.16	0.89, 1.49	1.17	0.91, 1.52
Current, <10 months	0.87	0.54, 1.39	0.85	0.53, 1.37	0.84	0.52, 1.35	0.86	0.54, 1.39
Current, ≥10 months	0.61	0.43, 0.86	0.57	0.40, 0.82	0.56	0.39, 0.80	0.59	0.41, 0.84
Obesity (BMI ≥ 30.0 kg/m²)								
Formerly unemployed	1.16	0.90, 1.50	1.07	0.83, 1.40	1.02	0.79, 1.33	1.06	0.82, 1.39
Current, <10 months	1.18	0.70, 1.97	1.12	0.66, 1.89	1.04	0.61, 1.77	1.10	0.66, 1.85
Current, ≥10 months	1.08	0.76, 1.52	0.90	0.64, 1.28	0.82	0.57, 1.17	0.90	0.63, 1.29

[a] LTI: Long-term illness.
[b] GHQ: General Health Questionnaire score.

factors (Schepers and Markus, 2015). Secondly, while energy-dense, nutrient-poor foods are often deliberately chosen to stretch a restricted food budget (Drewnowski and Specter, 2004), the UK's Low Income Diet and Nutrition Survey found reduced overall energy intake for low-income men compared to the general population, suggesting a severely restricted income can lead to less food being consumed overall.

Meanwhile, although there is a documented positive association of leisure-time physical activity with socioeconomic position (Lindstrom et al., 2001; Parks et al., 2003), research into leisure-time activity and unemployment itself is extremely scarce (Ali and Lindstrom, 2006). Meanwhile in the British Time Use Survey, participants not in employment were more likely to engage in active transport and less likely to have access to a car (Adams, 2010), suggesting jobseekers could expend more energy through transport. However in this analysis, neither the reduced overweight nor the increased underweight among jobseekers was explained by addition of physical activity to models. Since the physical activity measures available were fairly crude, this may reflect failure to adequately capture caloric expenditure. Alternatively, it may indicate that associations are primarily driven not by energy expenditure but by differences in energy intake, for which information was not available in this dataset.

Importantly, a cross-sectional association of unemployment with elevated odds of both underweight and (for non-smokers) obesity could also reflect a non-linear impact of BMI on likelihood of unemployment. Negative impacts of obesity on employment participation are well documented, and typically attributed both to discrimination by employers against obese candidates and obesity-associated health problems (Puhl and Heuer, 2009; Dackehag et al., 2015). However, these analyses often use an outcome of any non-employment, including non-work due to ill-health, where a sizeable impact of obesity-associated health problems would be unsurprising (Larose et al., 2016; Greve, 2008). Since determinants of unemployment and disability may differ substantially, such an approach may conflate distinct processes, and a recent study which separated non-employment types supports an impact of obesity on disability, but not unemployment (Kinge, 2016). Meanwhile, chronic illness associated with underweight (Aune et al., 2016) could also influence job loss or impede re-employment.

Our adjustment for contemporaneous chronic illness and depressive/anxiety symptoms will have minimised such 'health-selection' with respect to both obesity and underweight; indeed, given a likely impact of unemployment on depressive/anxiety symptoms (Paul and Moser, 2009), this approach is conservative, and likely to over-adjust with respect to effects of unemployment on BMI mediated by mental health. Nevertheless, since pre-unemployment BMI is not known, residual health selection and employer discrimination cannot be ruled out.

That increased underweight and decreased overweight among jobseekers was more apparent for longer-term unemployed participants therefore has two possible interpretations. If associations are primarily causal, a dose-response relationship is an indicator of adiposity change with increased unemployment duration. If associations instead result largely from selection processes - for example, if people with a lower BMI are more likely to lose jobs, or less likely to be hired - this would indicate dose-response selection processes. However, the dose-response decrease in overweight with unemployment duration

Table 5
Fully-adjusted[a] associations of body mass index (BMI) with current unemployment among UKHLS participants in 2010–12, stratum-specific estimates.

Subgroup by		Odds ratio	95% CI	Odds ratio	95% CI
Gender		Men N (unemployed) = 305		Women N (unemployed) = 253	
	Underweight	5.99	2.27–15.80	2.81	1.17–6.75
	Overweight	0.58	0.41–0.82	0.94	0.65–1.35
	Obesity	0.87	0.60–1.24	1.18	0.82–1.70
Household income		Above median N (unemployed) = 90		Below median N (unemployed) = 468	
	Underweight	0.0[b]		3.79	1.88–7.63
	Overweight	1.56	0.85–2.89	0.69	0.52–0.92
	Obesity	1.54	0.77–0.34	0.98	0.74–1.30
Current smoking		No N (unemployed) = 282		Yes N (unemployed) = 276	
	Underweight	4.76	1.96–11.55	2.96	1.21–7.27
	Overweight	0.84	0.58–1.20	0.77	0.54–1.10
	Obesity	1.52	1.06–2.18	0.67	0.46–0.98

Underweight: BMI < 18.5 kg/m², overweight: BMI 25.0–25.99 kg/m², obesity: BMI ≥ 30.0 kg/m².
[a] Adjusted for age, gender, education, long-term illness, General Health Questionnaire score, smoking status (except smoking-stratified analyses), physical activity.
[b] An odds ratio could not be calculated, since not a single underweight unemployed person came from a household above median income.

suggests an influence of unemployment on adiposity, rather than vice versa. Unlike with a very low or a very high BMI, it is unclear how selection processes affecting job loss or re-employment could lead to an over-representation of recommended weight persons among jobseekers. Of note, in this sample as a whole, overweight was the most prevalent BMI category – weighted proportions of overweight and 'normal' weight were 31.8% and 37.2% respectively. In this context the increased odds of 'normal' weight for jobseekers reflect, along with increased underweight, a non-standard outcome.

Increased underweight and decreased overweight of jobseekers was more apparent for men, consistent with a recent cross-sectional analysis using UK data of associations of obesity with different non-employment outcomes. Briefly considering other BMI categories, this found a significant positive association between underweight and jobseeker status which was not explained by health, but only for men (Kinge, 2016). More generally, the present study's results are consistent with literature on unemployment and mortality reporting stronger associations for men (Roelfs et al., 2011a), and may reflect a typically smaller impact of women's own unemployment on living standards, since men still usually contribute more to household income than their female partners. It has also been suggested that the homemaker role, traditionally not available to men, may to some extent reduce psychologically-mediated health impacts of joblessness for women by providing a legitimate alternative identity to fall back on during unemployment (Paul and Moser, 2009). This may apply even to unemployed women in the sample who described themselves firstly as unemployed, since women often occupy multiple roles (McMunn et al., 2006). Alternatively, impact of past pregnancies on both labour market status and BMI of women could have modified associations, and if social desirability bias leads female more than male individuals seeking work to identify firstly as homemakers, presence of more women seeking work in the 'never unemployed' comparison group would lead to greater underestimation of associations for women. Meanwhile the positive association of unemployment with obesity for non-smokers, but negative association of obesity with unemployment for smokers, suggests widespread smoking among jobseekers may, despite numerous health risks, be protective against obesogenic effects of unemployment. This is consistent both with the well-documented appetite-suppressing effects of nicotine (Audrain-McGovern and Benowitz, 2011; Mineur et al., 2011) and evidence that smoking also raises resting metabolic rate (Audrain-McGovern and Benowitz, 2011). However, it may also reflect competing priorities between tobacco, food, and other essentials in the context of a severely restricted budget. Finally, that increased underweight and reduced overweight were not seen for more affluent jobseekers suggests household income may buffer against possible weight-loss impacts of unemployment.

The increased odds of obesity among non-smoking jobseekers are consistent with the increased adiposity following unemployment reported by some previous studies (Monsivais et al., 2015; Marcus, 2014; Deb et al., 2011). Meanwhile the increased underweight and decreased overweight among jobseekers as a whole are consistent with studies suggesting unemployment can cause weight loss (Montgomery et al., 1998; Jonsdottir and Asgeirsdottir, 2014).

Further, our results are relevant to the debate concerning the increased mortality risk associated with underweight. This is often attributed largely to residual confounding by pre-existing poor health and smoking (Aune et al., 2016), but our study suggests an additional explanation: the causal effects of psychosocial stress, dietary restriction, and other correlates of extreme socioeconomic marginalisation not adequately captured by typical SEP controls such as education.

4.1. Limitations

The foremost limitation of this study is that participants' pre-unemployment adiposity, implicated by previous studies as an important modifier, cannot be considered. The single BMI measurement also means selection effects cannot be definitively ruled out, although the negative overweight association cannot be easily explained in terms of these mechanisms. In recognition of potential confounding by social and health factors, adjustments were made for education, long-term illnesses and GHQ. Nevertheless, an influence of adiposity on unemployment in the absence of associated illnesses may have contributed to estimates. Exclusions for missing data may also have produced bias.

Information on smoking, drinking, and physical activity measures came from wave 2 for all participants. For a quarter of the sample, this was over a year before BMI and unemployment were measured, and may not give a completely accurate picture of post-unemployment health behaviours. Finally, comparable employment history data across the whole sample was available for only two waves before BMI measurement. Hence, while our results implicate duration of unemployment as a key modifier of associations with adiposity, the impact of longer unemployment durations could not be fully investigated.

5. Conclusion

In a large contemporary UK sample, unemployment was positively associated with underweight and negatively associated with overweight, with effects more apparent for longer-term jobseekers, men, and jobseekers from lower-income households. Meanwhile, unemployment was positively associated with obesity among non-smokers, but negatively associated with obesity among smokers. Results therefore identify groups especially vulnerable to underweight and its associated health risks, and to obesity and its associated health risks, during unemployment. To the extent that associations can be interpreted as causal, results suggest failure to document non-linear and weight loss effects may have led to systematic underestimation of a key pathway linking unemployment with chronic disease and mortality.

Longitudinal work in the UK and elsewhere comparing pre- and post-unemployment adiposity, and explicitly considering heterogeneity in effects between demographic groups, is now needed.

Ethical approval for the UKHLS nurse health assessment was obtained from the National Research Ethics Service (Understanding Society - UK Household Longitudinal Study: A Biosocial Component, Oxfordshire A REC, Reference: 10/H0604/2).

Ethical approval for the ongoing mainstage survey is detailed in the wave 1–5 user guide, available at https://www.understandingsociety.ac.uk/documentation/mainstage.

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Conflicts of interest

None.

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