Obesity, disability, and the labor force

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Introduction and summary

In this article, we investigate how the rise in obesity over the past three decades is related to non-employment. In recent years, unemployment rate figures—joblessness among those actively seeking work—have been low by historical standards. At the same time, however, there has been a rise in the fraction of men who are not actively seeking work.[1] The labor force participation of men of prime working age is low by historical standards, and this has coincided with an expansion in the Social Security Disability Insurance (SSDI) program.

A number of researchers studying the increase in men's non-employment have pointed out that it takes place against a backdrop of improving health (Juhn, Murphy, and Topel, 2002; and Autor and Duggan, 2003). However, these improvements in health are typically measured by mortality rates, which have been declining over time (Cutler and Richardson, 1997). Obesity rates, on the other hand, have climbed dramatically during the past 30 years. To put the increase in perspective, the median male in 2002 would have been heavier than 75 percent of the male population in 1976, using a body mass index (BMI) distribution.

There are a number of reasons that increases in obesity might be linked to decreases in employment. Increases in obesity might affect the ability to work—for example, obese people are more likely than others to have health problems—or the willingness to work, depending on the availability of alternatives to working. We call these "supply side" factors—those factors that affect whether or not an individual is willing and able to take a job. There may also be "demand side" factors at play. If employers think that obese workers are likely to be less productive or likely to be more expensive to employ because of health care costs, then obese workers may have a more difficult time finding a job than similarly qualified workers who are not obese.

In this article, we examine both self-reported health and disability outcomes and employment outcomes to try to distinguish between supply side and demand side explanations. If, for example, there is no change in the relationship between obesity and health outcomes, but there is a change in the relationship between obesity and employment outcomes, that would suggest that demand side factors might play an important role in non-employment among the obese.

We are also interested in whether the changes we observe over time in health and employment outcomes are due to changes in the underlying population characteristics, such as a rising incidence of obesity, or due to an increase in the differences in outcomes between the obese and the nonobese. For example, if in every period the obese are more likely to be in poor health than the nonobese, then an increase in the proportion of the population that is obese will likely lead to a larger proportion of the population that does not work. On the other hand, the *propensity* to report poor health, disability, or non-employment among the obese compared with the nonobese may also have changed over time. This change in propensities may be due to either supply side or demand side factors that are shaped by changes in health policies and/or labor market policies. For example, in 1984 there was a substantial change in disability insurance (SSDI) criteria that may have made it more likely that someone with obesity-related

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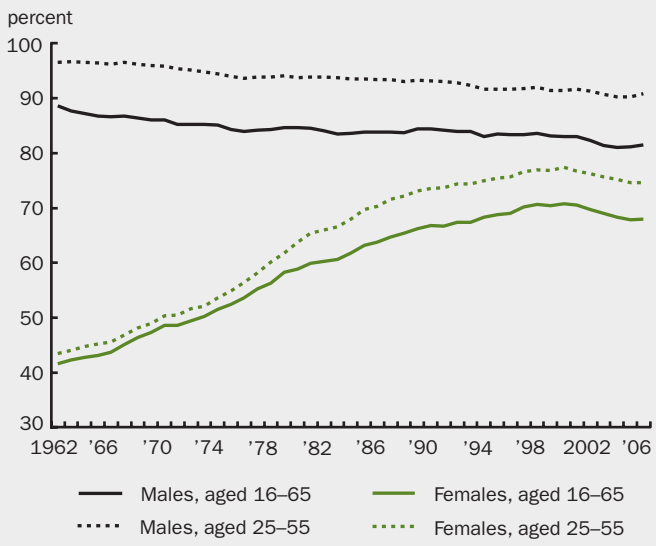
FIGURE 1

Labor force participation, by gender and age group



Source: Authors' calculations based on data from the U.S. Census Bureau, March *Current Population Surveys*.

health conditions could qualify for SSDI. This change, combined with subsequent changes in the wage structure that made SSDI benefits more generous relative to low-wage jobs, may have made some obese people more likely to opt out of the labor market. Thus, an increase in the number of obese people in the population would have a different effect on outcomes, depending on the period in which the change is evaluated.

We find that, although those who are heavier have always had worse self-reported health outcomes and employment outcomes, there is not much evidence that the propensity for the obese to have poor outcomes has changed over time. Non-employment among men of prime age increased from 10 percent in 1984–85 to 12.5 percent in 2004–05. Increases in obesity alone can explain about 3 percent to 12 percent of that increase. In addition, population changes in age, race, and ethnicity, combined with changes in obesity, can explain between 34 percent and 47 percent of the increase in men's non-employment. These results suggest that deterioration in underlying health has played an important role in the decrease in men's labor force participation and that these population changes would have had similar effects whether evaluated in the mid-1980s or early 2000s.

In the next section, we describe recent trends in non-employment and labor force participation, age, obesity, and disability insurance receipt. We examine whether the propensity for the morbidly obese to self-report musculoskeletal conditions and routine needs disability (defined as requiring the assistance of another person in handling routine tasks, such as personal care, housework, or shopping) and to apply for disability insurance has changed over time. Then, we analyze how much of the change in non-employment can be explained by changes in obesity and other demographic characteristics.

Changes in non-employment, age, obesity, and disability insurance

First, we look at the changes in labor force participation by gender and age group from 1962 through 2006, using the March *Current Population Survey* (CPS), which is conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics (figure 1). Clearly, labor force participation among women rose dramatically from the 1960s through the 1990s and leveled off in the 2000s. The change has been less dramatic for men, but over the same period, we have seen a continuous decline in men's labor force participation. Note that this is the case even for relatively young men (aged 25–55).

If we look at the share of survey respondents who reported that they had not worked the previous week (we call this the share "not working last week")—which includes nonparticipants and the unemployed—we see a similar pattern (figure 2). While the share not working has declined for women, it has risen for men. Again, this is true even among relatively young men.

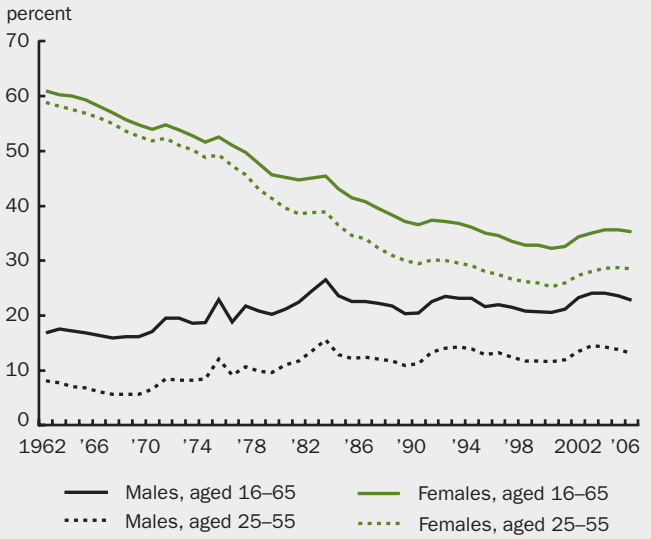
Changes in the age distribution

Some of the changes in the labor supply documented in the previous section may be related to changes in the age distribution. Figure 3 shows the shift in the age distribution among all 25–54 year olds between 1976–80 and 1999–2002. As the baby boom generation ages, there is a change in the average age among 25–54 year olds. For women, labor supply peaks prior to childbearing and again once their children are older. For men, Barrow and Butcher (2004)[2] show that in both 1978–79 and 1999–2000 periods, the fraction of men who did not work at all in the previous year increased monotonically across age groups for those above age 40. Since morbidity increases with age, it seems likely that the aging of the population—even among men aged 25–54—would lead to increases in non-employment.

Barrow and Butcher (2004) point out that there have been other demographic changes, for example,

FIGURE 2

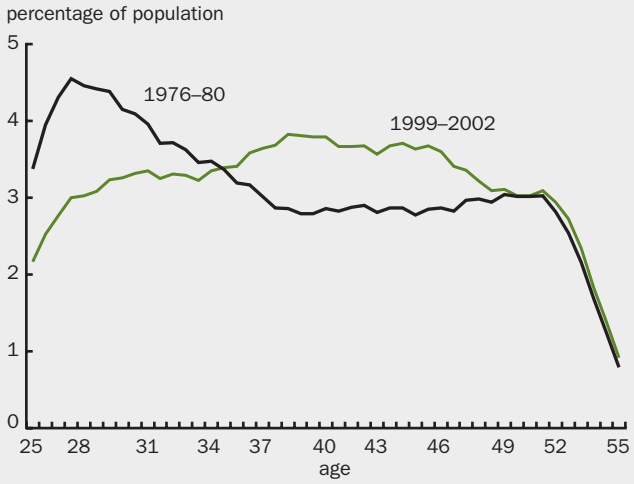
Share not working last week, by gender and age group



Source: Authors' calculations based on data from the U.S. Census Bureau, March *Current Population Surveys*.

FIGURE 3

Age distribution



Note: The distribution is among those aged 25–54.

Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health and Nutrition Examination Survey*.

changes in the racial and ethnic mix of the population, that may also be correlated with deteriorating health. Their analysis, which does not control for obesity, finds that 14 percent to 33 percent of the increase in men's full-year non-employment that occurred between 1978–79 and 1999–2000 can be attributed to changes in age, race, and ethnicity alone.

Changes in obesity

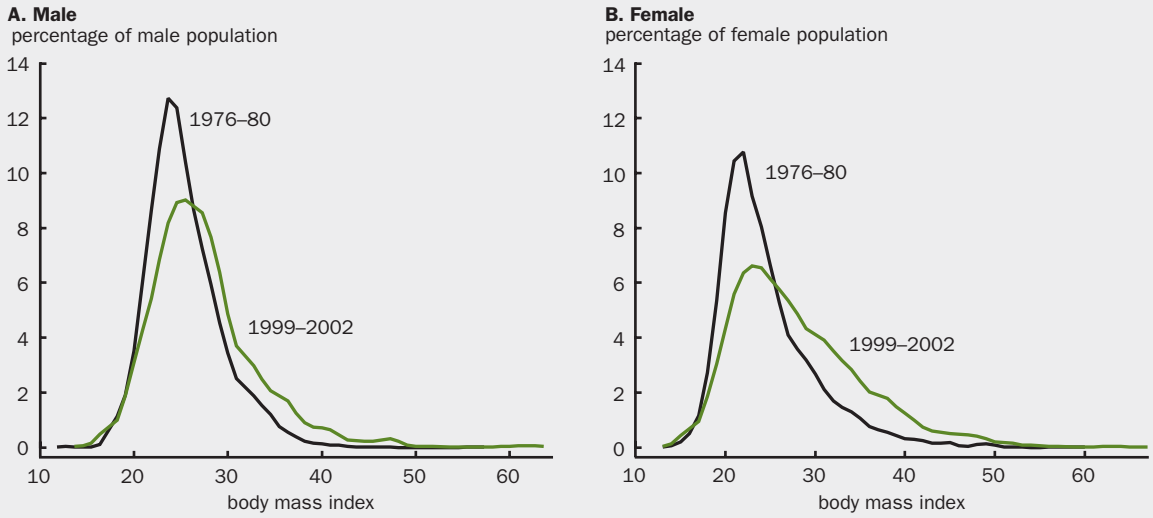
Although many of the demographic changes over the past 30 years might lead us to expect a deterioration of health in the working age population, many health indicators suggest improvements in health or improvements in individuals' quality of life, even when they have a health problem (Cutler and Richardson, 1997). However, obesity has become increasingly common during this period. Obesity is typically defined using the body mass index.[3] A BMI lower than 18.5 is considered underweight; a BMI lower than 25 (but not lower than 18.5) is considered a healthy or normal weight; a BMI greater than or equal to 25 is deemed overweight; a BMI greater than or equal to 30 is deemed obese; and a BMI greater than or equal to 40 is considered morbidly obese.

Figure 4 shows the probability density function for BMI for men and women aged 25–54 years old in the 1976–80 and 1999–2002 *National Health and Nutrition Examination Surveys* (NHANES), which are conducted by the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. These distributions show the rightward shift in the BMI distribution over time.

Although there has been an increase in median BMI, a significant feature underlying the obesity epidemic is that the variance in BMI has increased. The heavy have gotten much heavier over time. Panels A and B of figure 5 highlight these changes in the distribution of BMI, using NHANES data for men and women, respectively. Note the median male in 1999–2002 would have been heavier than nearly three-quarters of the population in the earlier period 1976–80. A male just on the cusp of obesity (75th percentile) in the 1999–2002 BMI distribution would have been heavier than 90 percent of the earlier period's population. For females, we also see dramatic changes in the BMI distribution in the heaviest portions of the distribution.

FIGURE 4

Body mass index density

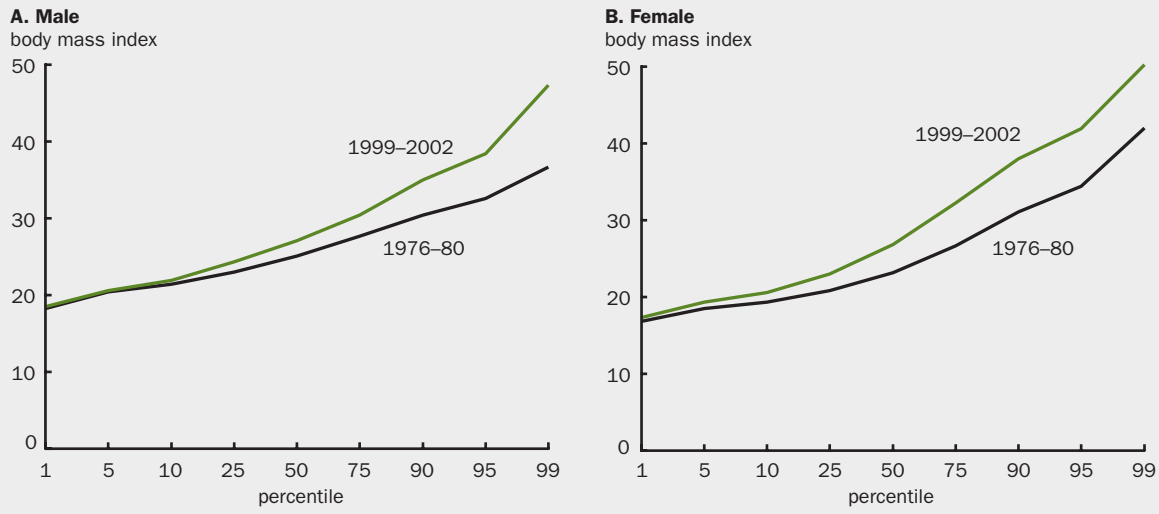


Notes: The density is calculated for those aged 25–54. A body mass index lower than 18.5 is considered underweight; 18.5–24.9, normal weight; 25.0–29.9, overweight; 30.0–39.9, obese; and 40.0 or higher, morbidly obese.

Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health and Nutrition Examination Survey*.

FIGURE 5

Body mass index distribution



Note: The distribution is among those aged 25–54.

Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health and Nutrition Examination Survey*.

If it is the very heavy who are most likely to suffer ill health from obesity, then the population at risk of obesity-related health conditions has increased. Further, if being heavy is more likely to cause one health problems as one ages, then we would expect that as these heavier cohorts age, they will experience more weight-related health problems than previous, slimmer cohorts.

Figures 1 through 5 demonstrate that non-employment among men of prime age has increased.

They also document shifts in the population—namely, the population is older and more likely to be obese—that are consistent with a health-based reason for this decline in work among men.

Changes in disability insurance

Figure 6 shows that the percentage of the population receiving disability benefits has risen substantially since the early 1980s and that the increase seems to have begun after 1984.[4] Changes to the disability insurance eligibility rules in 1984 appear to have increased the likelihood that an SSDI applicant would receive payments. As Autor and Duggan (2003) explain, the awards criteria now give more weight to an individual's pain and ability to function in the work place; prior to 1984, eligibility was determined by "continuous disability reviews" by third party physicians. In addition, rising wage inequality during the 1980s and 1990s increased the value of SSDI payments relative to wages for many individuals. Many observers have linked these changes in the SSDI program to increases in disability insurance receipt and decreases in employment.

Coinciding with these programmatic changes, there have been changes in the primary diagnoses among recipients. Table 1 documents the share of disability awards attributed to different disorders. In 1981, prior to the new disability insurance eligibility criteria, 17 percent of all awards were for musculoskeletal disorders; by 2003, this figure had risen to 26.3 percent. Mental disorders have also accounted for an increased share of SSDI awards since 1981.

Figure 7 demonstrates how SSDI awards for various causes have changed on a population basis (per 10,000 individuals, aged 16–64). Heart disease and cancer have held steady as reasons for disability insurance claims, but musculoskeletal conditions, mental illness, and other sources have increased.[5] This shift in the reasons documented for disability receipt is often seen as being due to changes in the criteria used to judge whether an individual is disabled. Diseases that are easily verifiable by a physician—for example, cancer and heart disease—have declined as a share of all disability awards. This is not to say, however, that there have not also been changes in underlying health that would contribute to these shifts in disability insurance payments.

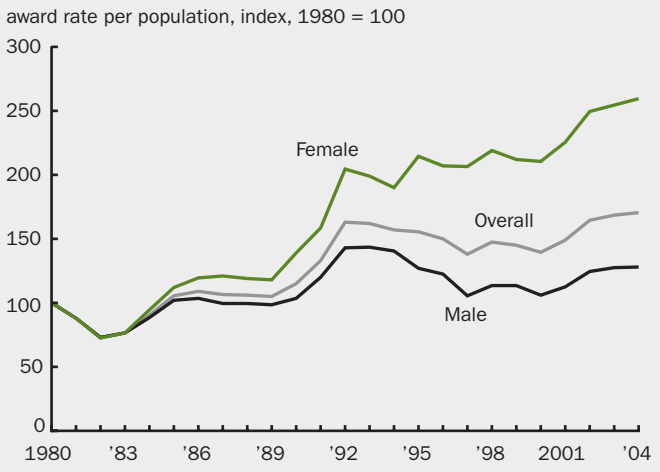
For example, there are many ways that the increase in obesity may be related to the increase in the share of disability awards for musculoskeletal disorders. It may be that the increase in obesity has led to more musculoskeletal disorders, in turn leading to more disability claims. In this case, the driver of the increase is the change in obesity rates leading to more musculoskeletal disorders. On the other hand, changes in disability insurance rules—which now give more emphasis to an individual's report of pain—may have also given those who are obese, and thus have a better basis for making a claim of musculoskeletal pain, a better chance to qualify for SSDI. Changes in wages relative to SSDI payments may have given workers an increased incentive to apply for disability insurance.

In the next section, we examine whether the propensity of the obese to claim various health ailments, to self-report routine needs disability, or to apply for SSDI has changed over time. The 1984 change in the SSDI rules does not fall in the span of our data on self-reported health, so this exercise does not shed light on how that policy change may have affected behavior. Instead it allows us to answer the following question: During the period after 1984 when awards for musculoskeletal disorders continue to rise, do we see a rise in the propensity of the obese to report these ailments?

In the rest of this article, we focus only on men aged 25–54 years old, since it is this group that has shown a rising

FIGURE 6

Social Security Disability Insurance award rate per population



Note: The sample population is made up of those aged 30–54.
Sources: Authors' calculations based on data from the U.S. Social Security Administration, *Annual Statistical Supplement to the Social Security Bulletin, 2005*; and Haver Analytics.

TABLE 1

Share of total Social Security Disability Insurance awards, by diagnosis

Diagnosis	Total 1981	Total 2003	Males 1981	Males 2003	Females 1981	Females 2003
	(percentage)					
Heart disease	24.9	11.4	27.9	14.4	18.0	7.8
Cancer	16.3	9.4	15.1	9.1	19.1	9.7
Mental disorders	10.5	25.4	10.2	23.0	11.2	28.2
Musculoskeletal disorders	17.0	26.3	15.6	24.7	20.1	28.2
Nervous system	8.3	8.5	7.9	8.2	9.1	8.9
Respiratory system	6.2	4.2	6.5	4.1	5.5	4.4
Endocrine system	4.3	3.1	3.8	3.1	5.5	3.1
All other	12.5	11.6	12.9	13.5	11.5	9.9
Total	100.0	99.9	100.0	100.1	100.0	100.2

Note: Columns may not total because of rounding.
Sources: Authors' calculations based on data from the U.S. Social Security Administration, *Annual Statistical Supplement to the Social Security Bulletin, 1981*, and *Annual Statistical Report on the Social Security Disability Insurance Program, 2003*.

trend in non-employment over this period. The underlying health conditions have changed in similar ways for women, making their large increase in labor force participation even more striking.

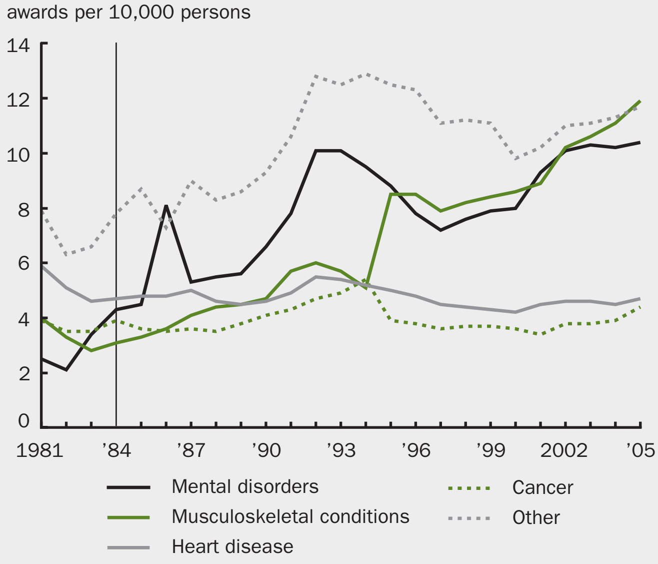
Self-reported health conditions, disability, SSDI receipt, and obesity

Since one can report a health condition without claiming to be disabled by it and since one can claim to have a disability without applying for disability insurance, we examine the relationship between obesity and each of these outcomes separately. We show how the relationship has changed over time. We are particularly interested in whether the propensity for those who are heavy to report poor health outcomes has increased over time, which would be consistent with changes in the incentives of the obese to apply for SSDI and leave the labor force.

Figure 8 shows the unadjusted prevalence of musculoskeletal disorders for men who are underweight, normal weight, overweight, obese, and morbidly obese. From 1984 through 1996, those who are heavier are more likely to report a musculoskeletal problem. There is an increase in reports of musculoskeletal problems among the morbidly obese from 1984 through 1988, but there is a decline in later years. In general, there is little evidence of an increase in the propensity for the obese and morbidly obese to report a musculoskeletal problem. This finding may be somewhat misleading, however, because it does not control for other demographic differences that may be correlated with obesity and with reports of musculoskeletal problems. To address this, we use regression

FIGURE 7

Social Security Disability Insurance awards per population, by diagnosis



Notes: The sample population is made up of those aged 16–64. Changes to the disability insurance eligibility rules were made in 1984. See the text for further details.
Source: Authors' calculations based on data from the U.S. Social Security Administration, *Annual Statistical Report on the Social Security Disability Insurance Program, 2005*.

analysis, which allows us to hold constant other demographic differences and examine whether the likelihood of reporting a given health issue has changed over time by weight category.

The *National Health Interview Survey* (NHIS)—conducted by the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics—asks a series of health questions that allow us to examine components of musculoskeletal disorders. Figure 9 presents differences in reporting of lower back pain between morbidly obese men and those of normal weight in the 1997–2005 *National Health Interview Surveys*. We calculated these differences by running a linear probability model on whether the individual reports lower back pain, controlling for indicator variables for underweight, overweight, obese, and morbidly obese. Normal weight is the omitted category. Only the morbidly obese were statistically significantly more likely to report these ailments. We ran separate regressions without any controls, as well as controlling for age alone and then controlling for age, race, and Hispanic ethnicity.[6] We ran a separate regression for each year, thus allowing the effect of the regressors to differ each year. (Figures 9, 10, and 11 also include the 95 percent confidence intervals for the difference in reporting between the morbidly obese and those of normal weight.)

We see that over this period, those who are morbidly obese are more likely to report lower back pain, although for some years this difference is not statistically significantly different from zero. Although the point estimate for the difference in reporting lower back pain is higher later in the period, the difference in the effects between the two periods is not statistically significant. Thus, there is little evidence of an increase in the difference in reports of lower back pain between the morbidly obese and those who are of normal weight during this period. Also, note that our estimates do not vary substantially as we add control variables. The results are similar for

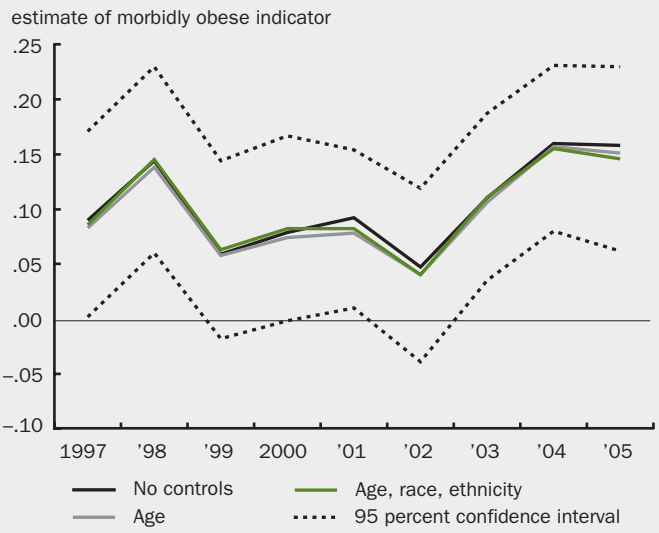
FIGURE 8

Prevalence rates of chronic musculoskeletal conditions among males

Note: The sample population is made up of males aged 25–54.
Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey*.

FIGURE 9

Incidence of lower back pain: Morbidly obese vs. normal weight males



Note: The sample population is made up of males aged 25–54.
Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey*.

other components of musculoskeletal disorders, such as reported arthritis or other joint pain.

Figure 10 examines whether the morbidly obese have become relatively more likely over time to report routine needs disabilities. The data are from the NHIS from 1984 through 2005. There were significant changes in sequence and wording of the disability questions between 1996 and 1997, and thus, we show a break in the series.[7] The figures are based on linear probability models that are analogous to those described for figure 9.

Again, we see that the morbidly obese are more likely to report a routine needs disability; and controlling for age, race, and ethnicity makes little difference in the size of that effect. However, there is no statistically significant difference in the size of the effect of morbid obesity across time periods.

Finally, figure 11 shows the difference in the probability of ever having applied for disability insurance between the morbidly obese and those categorized as having normal weight, controlling for age, race, and ethnicity. Information on applications for disability insurance are only available after 1996, and all respondents are asked if they have "ever applied for" disability insurance. While the morbidly obese have always been statistically significantly more likely to have applied for disability insurance than those of normal weight, this difference is stable over the period observed.

Table 1 (p. 7) and figures 6 (p. 6) and 7 (p. 7) in the previous section showed that disability awards have been increasing since the mid-1980s, particularly for musculoskeletal ailments. In this section, we examined the relationship between obesity, health, disability, and application for SSDI. The evidence shows that obesity has increased, with morbid obesity having increased in particular. In addition, since the mid-1980s the morbidly obese, in particular, have reported worse health outcomes than their nonobese counterparts. However, over this period we have not seen an increase in the propensity to report worse health outcomes by the morbidly obese, nor an increase in the likelihood of their applying for SSDI. What we have seen is that there are now more of the category of people—very obese people—who have always reported worse health outcomes, but not much evidence of an increase in the likelihood of reporting worse health outcomes among the very obese.

Non-employment and obesity

In this section, we examine the relationship between obesity and employment. This relationship may be different from the relationship between obesity

FIGURE 10

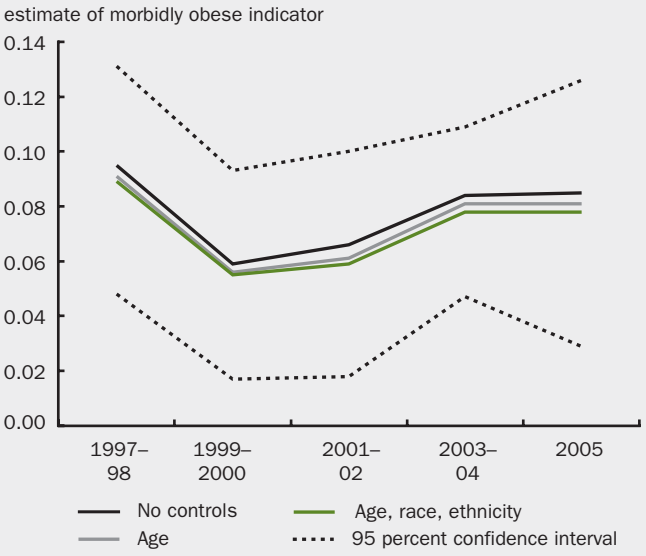
Routine needs disability: Morbidly obese vs. normal weight males

Notes: The sample population is made up of males aged 25–54. Routine needs disability is defined as requiring the assistance of another person in handling routine tasks, such as personal care, housework, or shopping. There were significant changes in sequence and wording of the disability questions between 1996 and 1997, and thus, we show a break in the series. See note 7 for further details.

Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey*.

FIGURE 11

Ever applied for Social Security Disability Insurance: Morbidly obese vs. normal weight males



Note: The sample population is made up of males aged 25–54.
Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey*.

and self-reported health measures. For example, across a number of periods, an increase in obesity may affect health in a similar way. However, the employment response to that change in health may differ, depending on both demand side (from the employers' perspective) and supply side (from the workers' perspective) changes in the employment–obesity relationship.

First, there is some debate about the ways in which changes in employment itself may have contributed to the rise in obesity (Philipson and Posner, 1999). For many of us, technological changes have tended to reduce the calories we expend at work by letting us spend more time at our desks. This is true even in employment sectors that typically required more physical activity, as more and more processes in industrial and manufacturing environments have become automated. This trend may have contributed to the long-term increase in BMI, although much of the recent rise in obesity seems to have begun in the 1980s, when one might argue that the transition from hard physical labor to sedentary work had already happened. Nonetheless, that transition may have important implications for the effect of obesity on one's ability to work—if most people at work are engaged in sedentary tasks that require little physical exertion, then the effect of obesity on the ability to perform a job may be smaller in the current technological era than it would have been when heavy physical exertion was a frequent requirement at work.

In addition, there is some evidence of discrimination against obese people (see Carpenter, 2006, and Cawley and Danziger, 2004). Suppose there are two equally productive individuals—one obese and one not obese—and employers are less willing to hire the obese individual. If that preference for the nonobese was constant over time, the increase in the obese population could lead to an increase in the fraction of individuals who are not working. In addition, however, employers' "preference" for hiring nonobese people could change over time. On the one hand, technological changes that reduce the physical requirements of jobs would seem to narrow any perceived productivity gap between obese and nonobese workers. On the other hand, even if productivity is not a concern, the rising costs of employer-provided health insurance may make employers less inclined to hire those they perceive as being costly employees over time.

Finally, of course, those who are obese may be less likely to work than individuals of normal weight for other, more personal reasons. They may be in poorer health, making work more difficult, or they may find work less enjoyable than their counterparts of normal weight. Changes in working conditions may also have an impact on obese workers. These conditions could include demand side factors, discussed previously, or supply side factors. If, for example, wages for the obese fall or SSDI becomes either easier to get or more generous relative to the wages they could likely command, then the obese might change their propensity to work in a given period.

In the analysis that follows, we want to disentangle the increase in non-employment that has arisen because there are more obese people, and particularly more *morbidly* obese people, today than there were 20 years ago from any increase that has occurred because the effect of obesity on non-employment has changed.[8]

We focus on measures of non-employment that are available in the data sets that also track obesity over time. The two main data sets are the *National Health Interview Survey* and the *National Health and Nutrition Examination Survey*. Note that the information available in the data set usually used to track labor

market statistics (CPS) and the information available in the data sets usually used to track health statistics (NHIS and NHANES) are not the same. In particular, the data sets that contain information on BMI and obesity have less detailed information on whether one is working. In the CPS, one can examine the fraction of the year spent not working, for example, or the fraction of the population that is not employed for the entire year (see Barrow and Butcher, 2004). In the health data sets, the available data restrict us to classifying people as non-employed if they report not working in the previous one to two weeks. Table 2 compares the health and labor force data available in the *Current Population Surveys*, *National Health Interview Surveys*, and *National Health and Nutrition Examination Surveys*.

Table 3 shows the differences in the reported share of non-employed by year using the different data sets. We see that the NHIS closely tracks the non-employment figures calculated from the CPS. In contrast, the NHANES overstates the growth in non-employment among men in the prime age category by more than twofold. For this reason, we focus on the NHIS in the analysis that follows.

In order to examine how much of the change in non-employment can be explained by changes in obesity, we use an Oaxaca–Blinder multivariate decomposition (see Oaxaca, 1973, and Blinder, 1973). Here, we run linear probability regressions with not working in the past one to two weeks as the outcome variable. We control for underweight, overweight, obese, and morbidly obese as the weight categories, with the normal weight category omitted. In some regressions, we also control for age, race, and ethnicity, as well as for pairwise interactions between weight categories and age and race. We run these regressions in both the early (1984–85) and later (2004–05) years of our data series:

$$1) \quad Y_{84-85} = \beta^0_{84-85} + \beta^1_{84-85} X_{84-85} + \varepsilon_{84-85};$$

$$2) \quad Y_{04-05} = \beta^0_{04-05} + \beta^1_{04-05} X_{04-05} + \varepsilon_{04-05}.$$

Typically, these equations are then rearranged to examine how much of the difference in outcomes between the two years is due to differences in the explanatory (X) variables, and how much is due to differences in the effects of these variables on the outcomes, the β values. Differences attributable to changes in the

TABLE 2

Comparison of labor force and health data, by data source

Labor force data	CPS March	NHIS 1984–96	NHIS 1997–2005	NHANES 1976–80	NHANES 1999–2002
Worked last 1–2 weeks	X	X	X	X	X
Reason not working last week	X		X	X	X
Class of worker	X	X	X	X	X
Hours worked last week	X		X		X
Full/part time	X		X	X	X
Weeks worked	X				
Months worked	X		X		X
Wage data	X				
Industry	X	X	X	X	X
Occupation	X	X	X	X	X
Health data					
Body mass index or weight/height		X	X	X	X
Disability/physical limitations	X	X	X	X	X
Conditions causing disability		X	X	X	X
Ever applied for Social Security Disability Insurance		X	X		

Notes: CPS means *Current Population Survey*. NHIS means *National Health Interview Survey*. NHANES means *National Health and Nutrition Examination Survey*. In the NHIS 1984–96 and NHANES 1976–80, the employment status question asks whether or not the respondent has worked in the past two weeks, while the NHIS 1997–2005 and NHANES 1999–2002 ask about employment status in the past one week. The March CPS employment status variables (*esr* and *mlr*) also ask about employment status in the past one week. The March CPS also asks questions related to disability status. One variable notes whether or not "health or disability limits kind or amount of work." Another records whether someone left a job for health reasons. Finally, the data include a variable indicating whether or not the household receives disability income.

Sources: U.S. Census Bureau, March *Current Population Surveys*; and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey* and *National Health and Nutrition Examination Survey*.

TABLE 3

Comparison of share of non-employed males, by data source

	CPS	NHIS
	(- - - - - - - - percentage - - - - - - -)	
2004–05	13.4	12.5
1984–85	11.5	10.3
Change	2.0	2.2
	CPS	**NHANES**
1999–2002	11.9	12.0
1976–80	9.8	7.5
Change	2.1	4.6

Notes: The sample population is made up of males aged 25–54. Columns may not total because of rounding. CPS means *Current Population Survey*. NHIS means *National Health Interview Survey*. NHANES means *National Health and Nutrition Examination Survey*.

Sources: Authors' calculations based on data from the U.S. Census Bureau, March *Current Population Surveys*; and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey* and *National Health and Nutrition Examination Survey*.

X variables are attributable to changes in obesity, age, race, and ethnicity.[9] Differences attributable to changes in the coefficients, on the other hand, are attributable to the supply side and demand side factors described previously.

$$3)\quad Y_{04-05} - Y_{84-85} = \beta^1_{04-05}(X_{04-05} - X_{84-85}) + (\beta^1_{04-05} - \beta^1_{84-85})X_{84-85} + (\beta^0_{04-05} - \beta^0_{84-85}).$$

The first term after the equals sign is the difference attributable to changes in the X values, and the second two terms are the differences attributable to changes in the coefficients. As written out in equation 3, the change in individual characteristics between the two periods is evaluated using the "returns" to these characteristics that prevailed in the later period. If we had done the subtraction the other way, we would get a different answer.

Our approach is to examine how the changes in individual characteristics that actually occurred between 1984–85 and 2004–05 would have been expected to change the fraction of the population that was not working, given the "conditions" that prevailed in both the earlier and later periods. We can use equations 1 and 2 to predict how people with the characteristics of those who existed in 2004–05 would have "behaved" in 1984–85:

$$\beta^1_{84-85}X_{04-05}.$$

And we can use those same equations to predict how people with the characteristics of those who existed in 1984–85 would have "behaved" in 2004–05:

$$\beta^1_{04-05}X_{84-85}.$$

Suppose we imagine that the only thing that explains the increase in men's non-employment is that non-employment is higher among the morbidly obese and that, in the later period, more men are morbidly obese. Then, evaluating the effect of the increase in morbid obesity using the "returns" to morbid obesity that prevailed in the earlier period should yield the exact increase in non-employment that we observe in the data. Since, in fact, conditions, or "returns to characteristics," may have changed, we can think of this exercise as answering the following question: How much of an increase in non-employment would we have expected in 1984–85 if morbid obesity had increased to today's levels under those conditions?

We present these calculations, allowing age, race, and ethnicity characteristics to change in addition to obesity measures, and we allow for pairwise interactions in these characteristics. Age may exacerbate the health problems associated with obesity—for example, the knees of 30 year olds may not hurt among either those of normal weight or the obese, but the knees of 50 year olds may have suffered more wear and tear among the obese but still be fairly pain free among those of normal weight. And thus, we would find that adjusting the data from the two periods to have the same age–obesity profile explains more of the change in non-employment over time. Obesity may have different effects in different populations as well as for different age groups. If obesity-related health problems are more prevalent among blacks and Hispanics, for example, then adjusting for the obesity–age–race/ethnicity profile may explain more of the changes over time. We present the results for these different adjustments separately.

Our decompositions are similar to those presented in Lakdawalla, Bhattacharya, and Goldman (2004). They examine how much of the increase in *disability rates* across different age groups between 1984 and 1996 can be explained by the rise in obesity. They decompose the change in disability rates between 1984 and 1996 into:

$$[(O_{96} - O_{84}) * (D^O_{90} - D^{NO}_{90})] + [O_{90} * \{(D^O_{96} - D^O_{84}) - (D^{NO}_{96} - D^{NO}_{84})\}],$$

where O_{yr} is the obesity rate in a given year and D_{yr} is the disability rate in a given year, and where the superscripts denote whether the disability rate is measured among the obese (*O*) or the nonobese (*NO*).

The first term in this expression is the amount of increased disability we would have expected had obesity risen as it did between the two periods, but the effect of obesity on disability was as it was in the interim year—1990. The second term is the amount of increase in disability that is due to the fact that disability among the obese rose, holding constant obesity rates at the level of the interim period. Using this decomposition, Lakdawalla, Bhattacharya, and Goldman (2004) find that 50 percent of the rise in disability for 18–29 year olds; 25 percent for 30–39 year olds; 10 percent for 40–49 year olds; and nearly all for 50–59 year olds can be explained by increases in obesity.[10]

This calculation combines the rise in disability that comes from the increase in obesity and the rise in disability that comes from changes in the *effect* of obesity on disability. In our analysis that follows, we focus on numbers that are similar to the first component—the amount by which *non-employment* would have risen had obesity rates risen—but we show this effect under the conditions of the earlier and later periods—that is, holding constant the effect of obesity on non-employment at its level in the earlier period and then at its level in the later period.

Table 4 presents the results of these simulations. The first row shows actual non-employment rates, which increased 2.2 percentage points, from 10.3 percent to 12.5 percent between 1984–85 and 2004–05. The second row shows predicted non-employment rates given the BMI distribution that existed in the other period, using the coefficients for the period listed in the column heading. For example, looking at the second row of numbers, the first column tells us that had the weight distribution that existed in 2004–05 occurred in 1984–85, we would have seen a non-employment rate of 10.4 percent in 1984–85—slightly higher than the actual non-employment rate in that period. Similarly, if the weight distribution that existed in 1984–85 occurred in 2004–05, we would expect a non-employment rate of 12.3 percent—slightly lower than the actual non-employment rate in that period. The last two columns show us how much of the actual change in non-employment between the two periods can be explained by evaluating the change in characteristics listed on the leftmost column using the returns to those characteristics in the years given in the column headings. So, about 3 percent of the increase in non-employment can be explained by the rise in obesity alone using the "returns" to obesity that prevailed in 1984–85. About 13 percent of the rise in non-employment would be attributed to the increase in obesity if we evaluated that increase using the "returns" that prevailed in 2004–05.[11] This is consistent with a story in which either supply side or demand side deterrents to working for the obese are stronger in 2004–05 than in 1984–85. For example, this could occur if disability insurance takeup rates are higher among the obese in the later period. However, if there are other characteristics of obese workers that are also correlated with non-employment but are not held constant in these regressions, then those effects will load onto the obesity coefficients here, leading us to attribute either too little or too much of the changes to changes in obesity. Furthermore, changes in the characteristics we use in our analysis—age, race, and ethnicity—may also be linked to changes in underlying health. Finally, as discussed earlier, we want to include interactions between age, race, ethnicity, and weight

TABLE 4

Actual and simulated average share of non-employed males and the percent of actual change explained by given characteristics

			Percent of actual increase explained by characteristics under conditions in:	
	1984–85	2004–05	1984–85	2004–05
	(percentage)			
Actual non-employment	10.3	12.5		
Characteristics used in simulation				
Weight categories	10.4	12.3	3.4	12.5
Weight categories, age polynomial	10.7	11.8	14.3	31.6
Weight categories, age, race, ethnicity (all interactions)	11.4	11.8	46.8	33.9

Notes: The sample population is made up of males aged 25–54. The normal weight category is excluded from the weight categories. See the text for further details.

Source: Authors' calculations based on data from the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, *National Health Interview Survey*.

measures. If it is not just the fraction of the population that is morbidly obese that matters for non-employment, but rather the fraction that is older and morbidly obese, we want to capture that in our simulations.

Including a polynomial in age in our simulations increases the amount of the increase in non-employment that we can explain to 14 percent using the earlier period and 32 percent using the later period. Once we include age, race, and ethnicity in the models, more of the increase in non-employment can be explained using the returns to characteristics that prevailed in 1984–85 than those in 2004–05. Changes in these characteristics can explain from 34 percent (using 2004–05 returns to characteristics) to 47 percent (using 1984–85 returns to characteristics) of the increase in the non-employment rate.[12]

Changes in age, race, and ethnicity—which may themselves be markers of changes in underlying health—explain a larger share of the increase in non-employment between 1984–85 and 2004–05 than do changes in obesity measures alone. However, (in results not shown) adding obesity measures to simulations that include age, race, and ethnicity controls increases the amount of the predicted increase in non-employment by 10 percentage points, regardless of which period we use to evaluate the change.

These results suggest that changes in underlying population characteristics may have played an important role in the increase in non-employment among men of prime working age over the past 30 years.

Conclusion

This article examines the role of the increase in obesity in changes in non-employment. Men of prime working age have increased their non-employment rates over the past 30 years, and disability rates have also increased. Many have noted that this increase has happened against a backdrop of generally improving health in the U.S. population. However, obesity has increased substantially over this period. Here, we have tried to disentangle the changes that occurred in heath and employment because of the increase in the fraction of the population that is obese from the changes that are due to changes in the differences in outcomes between obese and nonobese individuals. We find that, while the morbidly obese have always been more likely to report musculoskeletal ailments and more likely to report being disabled, their propensity to report ailments and disability has not statistically significantly increased over time.

The results for non-employment are consistent with those for health and disability. If the results had shown that increases in obesity had little effect on health and disability rates but had a large effect on employment, this would have pointed toward the importance of demand side factors—such as efforts by employers to avoid higher health care costs—in employment outcomes for the obese. However, since the results are consistent for health, disability, and non-employment, we cannot use these differences to infer the relative importance of demand side or supply side effects.

For men of prime working age, changes in their characteristics—including age, race, ethnicity, and obesity levels—can explain a large portion (around 40 percent) of the increase in non-employment over the period. The portion of the change in non-employment that is explained by changes in these characteristics is similar regardless of whether we evaluate the change in characteristics using the returns to characteristics that prevailed in either the earlier period (1984–85) or the later period (2004–05). This means that under either the earlier or later labor market conditions, we would expect that these changes in characteristics would lead to a substantial increase in non-employment. Similar to Lakdawalla, Bhattacharya, and Goldman (2004), we find that the obesity epidemic may be playing an important role in changing labor market outcomes.

NOTES

[1]See Barrow (2004); Anderson, Barrow, and Butcher (2005); and Aaronson, Park, and Sullivan (2006) for trends in unemployment rates and labor force participation.

[2]A 2006 revision to Barrow and Butcher (2004) is available from the authors upon request.

[3]Body mass index = (weight in kilograms)/(height in meters squared).

[4]Disability benefit award numbers are from the Social Security Administration's (SSA) *Annual Statistical Supplement to the Social Security Bulletin, 2005*, and the noncivilian population figures come from the monthly household data in Haver Analytics. Note that disability awards have risen particularly among women. Disability insurance pays benefits to an individual and certain family members, provided that the individual is "insured"—meaning that the person has worked long enough and paid social security taxes. The increase in women's labor supply presumably increased the pool of eligible workers. See www.ssa.gov/disability/.

[5]The substantial increase in musculoskeletal conditions in 1995 is due to a different sampling methodology used by the Social Security Administration. Prior to 1995, the SSA only included awards allowed after the initial determination. Since many musculoskeletal conditions are denied initially and awarded later after an appeals process, the pre-1995 sample understates the share of musculoskeletal awards relative to the post-1995 sample that includes awards granted after the appeals process.

[6]Specifications include age and age squared, as well as indicator variables for black, other, and Hispanic ethnicity.

[7]Prior to 1997, only respondents who had a major activity limitation were asked if they needed assistance with personal care or routine need tasks. Individuals older than 60 years, however, were not screened and were automatically asked about any potential disability. In 1997, respondents were no longer screened and everyone was asked about personal care or routine needs disability. In 1997, the wording of the disability question also changed. Previously the personal care question read, "Because of any impairment or health problem, does ___ need the help of other persons with personal care needs, such as eating, bathing, dressing, or getting around this home?" After 1996, however, the question read, "Because of a mental, physical, or emotional problem, does ____ need the help of other persons with personal care needs, such as eating, bathing, dressing, or getting around this home?"

[8]The former will be changes in the characteristics of the population (the Xs) and the latter changes in coefficients (the βs).

[9]Specifically, weight categories (underweight, overweight, obese, and morbidly obese), age, age squared, black, other, Hispanic ethnicity, and interactions between the weight categories and the other demographic variables (age and race) are included in the X values.

[10]Their analysis also includes women.

[11]This is because the point estimate for the coefficient on morbid obesity is higher in the later years; however, just as in the results for health conditions presented earlier, this difference is not statistically significant.

[12]We find similar results if we decompose the change in routine needs disabilities. Because of the change in survey questions regarding routine needs disabilities, we perform this analysis for changes from 1984–85 through 1995–96 and from 1996–97 through 2004–05. Changes in weight categories, age, race, and ethnicity can explain about a third of the increase in routine needs disabilities between 1984–85 and 1995–96, using the "returns" to these characteristics that prevailed in either time period. Changes in these characteristics between 1996–97 and 2004–05 explain about 33 percent of the increase in routine needs disabilities using the "returns" to characteristics that prevailed in 1996–97 and about 42 percent of the increase using "returns" that prevailed in 2004–05.

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