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Labor supply responses to government subsidized health insurance: evidence from kidney transplant patients

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Abstract Between 1993 and 1995 Medicare increased the coverage of immunosuppression medication for kidney transplant recipients from 1 to 3 years following transplantation. The universal Medicare eligibility among kidney transplant patients provides a unique opportunity to explore labor supply responses to public insurance provision among a large number of men and women of prime working age and of all income levels. Although these patients are likely to be less healthy than the general population, upon receiving a kidney transplant, the main health problem of an individual with kidney failure, the lack of functioning kidneys, is removed. The income effects associated with the large transfer payment may discourage labor supply, while the potential health benefits of the coverage extension may promote labor supply. Results indicate that Medicare's increased medication coverage led to decreases in labor force participation among part time workers. These results suggest that potential labor supply reducing income effects should be taken into account when discussing the possibility of expanded public health insurance coverage, particularly for other groups of individuals with high expected medical expenditures, such as the elderly, or those with chronic conditions, such as diabetes. These results are useful considering the forthcoming expansion of government aid to purchase health insurance.

Keywords Public policy · Evaluation · Health insurance

JEL Classification I0 · I1 · J2

Introduction

Between 1993 and 1995 Medicare increased the coverage of immunosuppression medication for kidney transplant recipients from 1 year following transplantation to 3 years following

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transplantation. These medications, which are necessary for the long term survival of a transplanted kidney, cost an average of $10,000 per year.[1] Therefore, this policy change provides a sharp, exogenous increase in public insurance benefits depending on the year in which an individual received a kidney transplant. Those transplanted before July 1, 1993 received only a 1-year benefit, while those transplanted after July 1, 1995 received a 3-year benefit. These medications are covered by Medicare Part B, which reduces the out-of-pocket cost to the individual by 80%, or approximately $8,000 per year. This exogenous source of variation in public insurance benefits permits a study of the labor supply effects associated with the provision of public insurance.

This component of the Medicare program has characteristics that allow for a more comprehensive analysis of labor supply effects than other insurance programs administered by the government. Other government sponsored insurance programs, such as Medicaid, federal Disability Insurance, and Medicare for the elderly, are either means tested or targeted at very specific groups, including low income women, children, the elderly, or the disabled. Medicare's coverage of individuals with end stage renal disease (ESRD, or kidney failure) is universal. This universal eligibility provides a unique opportunity to explore labor supply responses to the provision of public insurance among a more demographically heterogeneous population.

Kidney transplant recipients may not be entirely representative of the general population, but these individuals are relatively healthy. While the ESRD population as a whole is less healthy than the general population, this study focuses only on transplanted individuals. Patients who receive transplants are those individuals whose quality of life would improve the most by receiving a transplant and thus are highly selected on health status. In the year 2000 there were approximately 220,000 patients undergoing dialysis treatment for ESRD, of which only 9,000 (roughly 4%) received a transplant from a deceased donor (United States Renal Data System 2000 Annual Data Report). The current kidney shortage results in the healthier patients receiving transplants. Further, the study sample is limited to individuals whose kidneys are functioning at the time of data collection.[2] However, despite the improved quality of life resulting from transplantation, co-morbidities, such as diabetes, may reduce the probability that a patient is able to work. Therefore, employment rates among this population are slightly lower than employment rates in the general population.[3]

Medicare's increased medication coverage for kidney transplant recipients does not create certain empirical difficulties typically encountered in studies of Medicaid expansions, such as endogenous participation. Immunosuppression medications are necessary for the long term success of kidney transplant outcomes, so examining kidney transplant patients circumvents the problems of low take up rates and endogenous selection. This policy change creates conflicting labor supply incentives. The income effect associated with the large transfer payment

[1] Danovitch (2005) reports the average cost of medications in 2003 was $10,000 per year. The least expensive regimen costs $6,000 while the most expensive costs $17,500. During the period studied, the typical cost range was $7,000–$12,000.

[2] Among the entire sample used in this study, 91% of the patients with functioning transplanted kidneys report "no activity limitations". Ogutmen et al. (2006) find that transplant recipients report significantly better quality of life after transplantation than individuals on dialysis, while Ichikawa et al. (2000) find that patients with functioning transplants report quality of life measures "nearly similar" to the general population. Neumann's catalogue of preference scores (expressed on a scale of 0–1) lists dialysis dependent renal failure as 0.68 and functioning kidney transplant as 0.9.

[3] According to United States Renal Data System (USRDS) data, in the year 2000, 65% of transplanted individuals ages 25–55 with functioning kidneys at 3 years following transplantation were employed. According to data from the Current Population Survey (CPS), the employment rate for the overall population age 25–55 in the year 2000 was 78%.

discourages labor supply, while the potential health benefits of the increased duration of medication coverage may promote labor supply.

In the current study, descriptive labor supply evidence and difference-in-differences estimation of employment rates reveal that overall labor force participation rates were lower after the policy change. The decrease in labor force participation resulted from a large reduction in the number of individuals working part time after transplantation. Although this evidence comes from a segment of the population that is not entirely representative of the general population, these estimates may be representative of individuals with chronic conditions, such as diabetes, or the elderly due to the fact that these groups also have above average medical expenses. Similar income effects must be considered when analyzing the economic effects of the recently passed healthcare reform package. Despite the large decrease in the number of part time workers that led to an overall decline in labor force participation during the first year following transplantation, the number of full time male workers increased in the third year following transplantation. This may be a result of the health improvements associated with the extended coverage. Therefore, while there was a decline in employment during the period of extended coverage, this policy does not appear to have any lasting negative employment effects beyond the 3-year coverage period.

Background on kidney transplantation and medicare policy

ESRD is the clinical term for chronic kidney disease, or kidney failure.[4] According to Danovitch's (2005) *Handbook of kidney transplantation*, in 2000 there were 275,000 individuals receiving dialysis for ESRD.[5] Due to the increase in obesity and diabetes this number is expected to reach 520,000 by 2010. Approximately half of the patients on dialysis are over age 65, and the average age of patients receiving kidney transplants has increased over time. Fifty three percent of patients with ESRD are male and 37% are black. In 2004, there were 60,000 patients on the kidney transplant waiting list.

Transplantation rates are lower for older individuals due to the risks associated with transplanting older patients, and transplantation rates are lower among blacks due to the lower availability of suitable donor organs. Patients that are not considered to be good transplant candidates and therefore not among those on the transplant waiting list include elderly patients, morbidly obese patients, smokers and drug users who refuse to quit, and patients with multiple chronic co-morbidities such as diabetes, cardiovascular disease, and the HIV virus. In general, patients that are not considered for transplantation are patients with "limited or irreversible rehabilitative potential" (Danovitch 2005).[6]

Transplanted patients who do not experience any surgical complications leave the hospital within 1 week. Among all recipients, mortality in the first year following transplantation is about 5%, with most mortality occurring in the first 3 months. Stable patients are discharged from the hospital 4–10 days following transplantation and many return to work after 4–6 weeks. However, it is not uncommon for individuals to remain out of work for up to 3 months. After receiving a transplant, ESRD patients no longer require dialysis treatment. Rather, patients return for annual follow up visits. Thus, after the initial period spent

[4] All of the clinical information presented in this section is taken from Danovitch (2005).

[5] This estimate is different from the 220,000 figure reported by the USRDS.

[6] The criteria for the allocation of kidneys from deceased donors are determined by the Organ Procurement and Transplantation Network (OPTN). The OPTN was established by the U.S. Congress in 1984 as a private, not-for-profit organization under contract with the federal government.

recovering from the surgery, transplantation removes a large obstacle to being able to work (Danovitch 2005).

The first year following a kidney transplant is the most costly. Costs during the first year following transplantation are $100,000, but after the first year the cost falls to $10,000 per year (this is the cost of the immunosuppression medications) (Danovitch 2005). According to calculations performed with USRDS data, in the year 2000, 65% of transplanted individuals ages 25–55 with functioning kidneys at 3 years following transplantation were employed. According to data from the CPS, the corresponding employment percentage for the overall population in the year 2000 was 78%. Therefore, while overall less healthy than the general population, the majority of patients with functioning transplanted kidneys appear to be healthy enough to work.

Following the transplant, immunosuppression medications are necessary for the survival of the transplanted kidney. Schweizer et al. (1990) discuss the factors that lead to transplant failure and conclude that the leading cause of organ failure is non-compliance regarding medications needed after the transplant. Results indicate that 91% of the non-compliant transplant recipients experience graft failure. During the 1970s, graft survival rates at 1 year following transplantation were only 50%. By the 1990s, graft survival rates at 1 year increased to 90%. Danovitch (2005) attributes this increase to the development of better immunosuppression medications. Between 1993 and 1995, Medicare increased the duration of immunosuppression medication coverage from 1 to 3 years following transplantation for all transplant recipients. Woodward et al. (2001) used data from the USRDS to find evidence that the increase in the duration of Medicare's coverage of immunosuppression medication improved the graft survival of low income kidney transplant patients by approximately 4 percentage points.

Materials and methods

Given that immunosuppression medications are necessary for the survival of a transplanted kidney and that transplant recipients have close contact with their physicians, it is likely that individuals without private insurance will utilize the benefit.[7] Therefore it is possible to view the increase in Medicare coverage as an increase in an individual's non-labor income. Immunosuppression medications cost an average of $10,000 per year, so the policy change generates an income effect that should act to discourage labor supply. The coverage increase may also affect the average health status of the kidney transplant population. If individuals were healthier during this period as a result of avoiding the health complications and medical treatment leading up to graft failure, this health improvement would increase the likelihood that a transplant recipient would decide to work. The income effect is present among the entire sample, while the health effect is present for the small number of individuals who experienced a graft survival benefit according to the estimates found in Woodward et al. (2001).

A possible quasi experimental approach to isolate the labor supply effects of the policy change would be to consider those who use Medicare's coverage the treatment group, while those who have private insurance and do not use Medicare's coverage the control group. Unfortunately, the USRDS began collecting information on insurance payers in 1994, so

[7] One of the difficulties associated with studying the Medicaid program is that not all individuals are aware of their eligibility for the program, and therefore many who are eligible do not enroll. Because transplant recipients are being treated by physicians who understand the importance of the immunosuppression medications, the chance of a transplant patient being unaware of the Medicare benefit is highly unlikely.

information during the "before" period of this study is unavailable. As a proxy for insurance status, I use the median family income of the residential zip code taken from the 2000 U.S. Census. Roughly 65% of individuals residing in low income zip codes transplanted between 1995 and 2001 report Medicare as the primary payer for their care compared to only 30% of those living in high income zip codes. This insurance information was collected at the time of transplantation from the data file of transplant recipients (rather than the more general population of those with ESRD). Therefore this variable reflects the insurance status specifically of those who received a transplant and does not vary with labor supply decisions following transplantation.[8] Also, because the medications comprise a smaller percentage of an individual's budget as income increases, the value of the medication as a percentage of total income will be greater for low income patients, and therefore the response, if any, should be greater for this group.[9] Further, the effect of health improvements is likely to be greater for this group since 3 year graft survival rates improved by 5.16 percentage points for low income patients and by 1.7 percentage points for high income patients (Woodward et al. 2001).[10]

Although the definition of treatment and control groups is not perfect, as Lewbel (2007) describes, given that information on insurance status is available for a different time period, it is possible to use this information from the 1995–2001 data to weight the estimated policy effects found when using the imperfect treatment-control definitions. This method, also used in Kutinova (2008) will be described in greater detail in the "Results" section.

To test for a differential impact of Medicare's extended coverage on the low income treatment group, I estimate difference-in-differences equations at 1 year after transplantation. Before the policy change, coverage would have expired by this point, whereas after the policy change patients had two additional years of medication coverage remaining. The equation for the difference-in-differences estimator has the form:

$$P(LFP = 1) = \beta X + \gamma_1 LowY + \gamma_2 Post + \gamma_3 (LowY * Post) \quad (1)$$

[8] Although eligibility for Medicare's coverage is universal, some transplant recipients find their private coverage to be more generous than the Medicare Part B coverage, which requires a monthly premium and 20% coinsurance from the patient.

[9] Eissa (1995), Eissa and Liebman (1996), and Gruber and James (1994) also define treatment and control groups on the basis of income. These studies examine responses to changes in income tax rates and use the fact that higher income individuals experience a greater treatment effect than lower income individuals to justify their treatment-control group definitions. Although USRDS data do not contain individuals' incomes, I use income of the zip code as a proxy.

[10] The models estimated in the current study are identified by the assumption that non-insurance factors that could affect employment status are similar across treatment and control groups. It is possible that changes in transplant outcomes, medical technology, or immunosuppression medications could affect high and low income patients differently. Based on the findings in Woodward et al. (2001), these do not appear to be problematic. Graft survival rates at 1 year following transplantation improved 3.6 percentage points for high income patients and 3.9 percentage points for low income patients between the "before" and "after" periods. Changes in the types of immunosuppression medications used also appear similar among high and low income patients. The use of cyclosporine declined 12.6 percentage points for high income patients and 13.1 percentage points for low income patients. The use of tacrolimus increased by 6.9 percentage points for high income patients and 7.4 percentage points for low income patients. The use of azathioprine declined by 42.2 percentage points and 41.8 percentage points for high and low income patients, respectively. Mycofenolate mofetil, not available in the "before period", was used by 42% of high income patients and 38.2% of low income patients in the "after" period. These findings suggest that changes in transplant outcomes, medical technology, and immunosuppression regimens were similar among high and low income groups and therefore should not confound the estimation.

In Eq. 1, *LFP* is an indicator variable equal to 1 if the individual is working or looking for work, *LowY* indicates that the individual is in the low income treatment group. *Post* denotes the post 1995 period (although in the estimation it is subsumed by the state * year fixed effects) and *X* is a vector of demographic controls, including age, race, gender, and county unemployment rates. The γ_3 coefficient gives the difference-in-differences estimate designed to isolate the policy effect, assuming that the treatment and control groups are valid and that time varying factors specific to the low income group that affect labor supply are controlled for.

There are several identification issues that should be discussed. Medicare is not the only public insurance program for which transplant recipients are eligible in order to pay for their immunosuppression medications. Patients may also qualify for either federal or state disability benefits. Slakey and Rosner (2007) point out the lack of uniformity with regard to state Medicaid disability rules but find that disability status is not correlated with either education or ethnicity. In order to control for possible changes to federal disability rules over time as well as for state differences in Medicaid generosity regarding disability, I include the full set of "state * year" interactions to capture differences in both federal and state level policies (such as the changes caused by welfare reform during this period) across the years of the study. Because the treatment and control groups are defined at the zip code level within each state, these interactions do not subsume the estimated policy effect.

A possible concern in defining groups based on median income of the zip code is that trends in labor market opportunities might be different for high and low income zip codes before and after the policy change. To account for potential differences in labor market opportunities between high and low income zip codes over time, I include county unemployment rates in the models using data from the Area Resource File (ARF). If the relevant labor market is larger than the zip code but smaller than the state, this variable should capture the relevant regional labor market conditions to which individuals are exposed.

The study sample consists of transplant records from the USRDS for individuals transplanted between 1991 and 1997. The before period covers transplants occurring from January 1, 1991 to July 1, 1993. The after period covers transplants occurring between July 1, 1995 and December 31, 1997. The transplants performed between July 1, 1993 and July 1, 1995 were omitted because this was the time period in which the policy was gradually phased in. The unit of observation in this study is the patient follow-up visit, recorded at 1 year following transplantation. To focus on individuals of prime working age, patients less than 25 years old or greater than 55 years old are excluded from the sample. The USRDS data do not contain certain variables that are usually of interest in these types of studies, such as the individual's education level and information on spouses, so the study will not account for changes in these variables that are not captured by the use of a control group that may affect labor supply behavior. The data also do not contain a variable for hours worked. Instead, the data contain a variable that classifies individuals as working either part time or full time.

Individuals are coded as participating in the labor force if they are listed as working full time, working part time, or seeking employment. Individuals are assigned to either the low income treatment group or the high income control group based on the median income of their residential zip code taken from the 2000 US Census. The low income group consists of individuals in the first, second, and third income deciles. The high income group consists of individuals in the ninth and tenth income deciles. The maximum zip code income of the low income group is $30,094, while the minimum income of the high income group is $48,715. Income defined at the zip code level is likely to be a better proxy for insurance status in the tails of the zip code income distribution. That is, individuals residing in the lowest income zip codes should be more likely to rely on publicly provided insurance than individuals in higher

Table 1 Descriptive statistics for study sample

Variable	Low income before	Low income after	High income before	High income after
Labor force participation rate	0.790	0.596	0.867	0.730
Proportion working part time	0.315	0.085	0.164	0.061
Proportion female	0.375	0.400	0.405	0.410
Proportion black	0.428	0.443	0.104	0.144
Age	40.58	41.83	41.43	42.34
Median income of zip code	$24,870	$24,867	$62,418	$62,647
N	1,609	1,653	1,925	2,224

Notes: This sample includes follow up visits recorded at 1 year after transplantation for individuals between the ages of 25 and 55. "Before" refers to individuals transplanted between 1/1/1991 and 7/1/1993 and "After" refers to individuals transplanted between 7/1/1995 and 12/31/1997

income zip codes, who are probably more likely to be privately insured. This is supported by the data from 1995 to 2001 that show 65% of patients in these low income zip codes report Medicare as the primary payer for their care compared to only 30% of patients in the high income zip codes. The included deciles were chosen to provide somewhat equal numbers of observations in the low and high income groups while remaining in the tails of the zip code median income distribution.[11]

Table 1 gives descriptive statistics for the treatment and control groups. Overall labor force participation rates dropped between the before and after periods of the study. The decrease was larger for the low income patients. Most of the declines for both the high and low income groups resulted from a reduction in the number of individuals working part time. For both high and low income groups, the proportion female and black increased. Also, the average age of the sample increased slightly between the before and after periods of the study.

Results

In order to confirm the magnitude and test the statistical significance of the descriptive estimates, I estimate the difference-in-differences regressions with linear probability models.[12] Table 2 contains estimation results of participation equations estimated for follow up visits recorded at 1 year following transplantation. I estimate pooled regressions and then stratify by gender, controlling for gender, race, age, and county unemployment rates. Regression results support the information conveyed by the simple difference-in-differences calculations, although the estimated policy effects are slightly larger in magnitude with the inclusion of the control variables. At 1 year following transplantation there is an approximate 8 percentage point relative participation decrease for the low income treatment group. At 1 year following transplantation, the estimated policy effect for men (–8.0 percentage points) is slightly

[11] Results are not sensitive to different cohort definitions. Comparing deciles one and two to nine and ten, comparing deciles one and two to ten, or comparing deciles one, two, and three to deciles eight, nine, and ten return similar results.

[12] Given the difficulty in interpreting interaction terms in standard logit and probit models outlined in Ai and Norton (2003), I do not attempt to estimate an ordered probit or multinomial logit model for the no work–part time–full time decision.

Table 2 Regression results of labor force participation equations

Variable	Pooled	Men	Women
Low income	−0.068***	−0.069***	−0.071**
	(4.01)	(3.14)	(2.54)
Low income * post	−0.079***	−0.080***	−0.077**
	(3.56)	(2.83)	(2.12)
Female	−0.051***	–	–
	(5.09)		
Black	−0.016	−0.015	−0.009
	(1.28)	(0.96)	(0.44)
County unemployment	−0.006***	−0.006*	−0.007*
	(2.60)	(1.92)	(1.69)
Age	−0.013	−0.074	0.079
	(0.27)	(1.13)	(0.95)
Age^2	4.11e−4	0.002	−0.002
	(0.32)	(1.22)	(0.98)
Age^3	−4.46e–6	1.79e–5	1.64e–5
	(0.43)	(1.33)	(0.96)
State * year fixed effects	Yes	Yes	Yes
N	7,409	4,463	2,946

Notes: Results are from linear probability models
*, **, *** Denote statistical significance at the 10, 5, and 1% level, respectively. Absolute values of *t*-statistics are in parentheses. Predicted probabilities fall between zero and 1 for 100% of observations. Models were estimated for follow up visits recorded at 1 year following transplantation

larger than the estimated policy effect for women (–7.7 percentage points). These decreases occurred mainly among part time workers. All three policy coefficients are significant at the 1% level.[13]

Coefficient estimates on the control variables have the expected signs. Coefficients on the low income variable are negative and significant ($P < 0.01$ in the pooled and male regressions, $P < 0.05$ in the female regression). Coefficients on county unemployment rates are negative and significant at the 1% level in the pooled model and at the 10% level in the male and female regressions. The coefficients on the Black variable are negative but insignificant. Also, none of the age coefficients are significant, either when considered individually with a *t*-test or jointly with an *F* test. This is expected given that the sample is restricted to those of prime working age.

As mentioned previously, there is known mis-assignment of individuals into the treatment and control groups because zip code income is not a perfect proxy for insurance status. Lewbel (2007) shows that in this type of situation, an unbiased estimate can be obtained by

[13] In alternative models estimated for follow up visits recorded at 2 and 3 years after transplantation, the policy coefficients become slightly positive but insignificant as the expiration of coverage approaches ($P = 0.933$ and $P = 0.173$ in pooled models at 2 and 3 years post transplant, respectively). This is due to the increase in full time employment among males offsetting the decrease in part time employment. The disappearance of the income effect in year 2 rather than year 3 is consistent with the Unemployment Insurance literature, which finds individuals typically begin their job search prior to the expiration of benefits (see, for example, Meyer 1990; Katz and Meyer 1990; Rogers 1998).

dividing the biased estimate of the policy effect by the sum of the proportion of truly treated individuals in the treatment and the proportion of unaffected individuals in the control group, less 1. According to USRDS data from 1995 to 2001, when information on insurance payer is available, 65% of individuals in the low income group were Medicare patients, while only 30% of high income individuals were coded as Medicare patients, meaning that 70% were privately insured. According to Lewbel (2007) method, using, for example, a biased estimate of an 8 percentage point relative decrease, I would divide 8 by $((0.65 + 0.7) - 1)$ to obtain an unbiased estimated policy effect of 22.85.[14] This dramatic increase is a product of the fact that zip code incomes are only a weak proxy for insurance status. Because it is certain that at least a portion of the control group is affected by the policy and a portion of the treatment group is not, the estimated policy effects generated from the high and low income comparisons are likely biased towards zero. Therefore, the actual policy effect probably lies somewhere in between the baseline and misclassification corrected estimates.

Despite the large decrease in the number of part time workers that caused the decline in labor force participation during the first year following transplantation, the number of full time male workers was greater the third year following transplantation after the policy change compared to before. I estimate models using full time work as the dependent variable. While not significant in the pooled regression or the female regression, the policy coefficient estimating the probability of full time work in the male regression is positive and significant at the 10% level (point estimate 0.072, $P = 0.073$) for models estimated using the third year follow up visit (Table 3).

This could be a result of improved health among those eligible for the 3 year benefit. Policy coefficients estimated at 1 and 2 years following transplantation were not statistically significant in any of the full time work models. Applying the Lewbel correction to the estimate at 3 years gives an adjusted estimated policy effect of 0.206. This policy does not appear to have any long term negative consequences on the labor force participation of kidney transplant recipients, measured by the insignificant overall labor force participation coefficients measured at 2 and 3 years following transplantation. However, there was a significant reduction in overall employment rates during the period of extended coverage, measured by difference-in-difference estimates of employment rates at 1 year following transplantation, resulting from a large drop in the number of part time workers.

Discussion

If we consider the percentage change in the amount of insurance coverage to be 100% (with the change in coverage was an additional 2 years measured over the midpoint of 1 and 3 years), these results suggest magnitudes similar to those found by Winkler (1990), who found that a 10% increase in the value of Medicaid benefits reduces a household head's probability of working by 0.9–1.3 percentage points, and Moffitt and Wolfe (1992), who found that a 10% increase in the value of Medicaid leads to a 1.7 percentage point decline in labor force participation. The estimates of the current study suggest that overall, for men and women combined, a 10% increase in the amount of medication coverage leads to a 0.8–2.3 percentage point decline at 1 year following transplantation and thus the results are consistent with those estimates previously found in studies of the Medicaid program. Although there was a statistically significant reduction in labor force participation during the period in which

[14] Intuitively, if there were zero misclassification, the weight would be 1 and the estimates would be unchanged. In the case of complete misclassification, where treatment is 50% in each group, the weight approaches infinity and the treatment effect is undefined.

Table 3 Regression results of full time work equations

Variable	Pooled	Men	Women
Low income	−0.174***	−0.195***	−0.160***
	(7.36)	(6.25)	(4.18)
Low income * post	0.037	0.072*	−0.003
	(1.21)	(1.79)	(0.07)
Female	−0.063***	–	–
	(4.60)		
Black	−0.054***	−0.059**	−0.049*
	(3.01)	(2.53)	(1.68)
County unemployment	−0.008**	−0.013***	−0.001
	(2.37)	(3.11)	(0.14)
Age	−0.071	−0.094	−0.056
	(0.99)	(1.00)	(0.47)
Age^2	0.002	0.002	0.002
	(1.02)	(0.93)	(0.58)
Age^3	1.59e–5	1.74e–5	1.67e–5
	(1.08)	(0.91)	(0.69)
State * year fixed effects	Yes	Yes	Yes
N	4,986	2,946	2,040

Notes: Results are from linear probability models
*, **, *** Denote statistical significance at the 10, 5, and 1% level, respectively. Absolute values of *t*-statistics are in parentheses. Predicted probabilities fall between zero and 1 for 100% of observations. Models were estimated for follow up visits recorded at 3 years following transplantation

coverage was available, the negative effect on employment did not persist beyond the 3-year coverage period, and full time employment actually increased for men at 3 years following transplantation.

This study has a few limitations. The approach used in this study accounts for the fact that these patients may have lower labor force participation rates overall, but it does not account for the fact that they may be more responsive than the general population to the income effects created by public insurance provision. However, if these patients are more responsive than the general population, then the estimates found in this study could represent possible upper bounds on the responsiveness of the general population.

Another limitation is the use of zip code median incomes to assign individuals into the treatment and control groups. While zip code incomes are an imperfect proxy for insurance status, I attempt to correct the estimates to take into account the misclassification as described in Lewbel (2007). This correction produces estimates that are three times as large due to the weakness of zip code incomes as a proxy for insurance status. Another potential problem with using zip code incomes is that the observed effect of the policy change might reflect changes in labor market opportunities over time between high and low income zip codes. However, to control for this I include county level unemployment rates in the models. The decrease in participation is not mirrored by trends from the overall population. According to CPS data, participation increased steadily over the 1990–2000 period from 73 to 78% among individuals age 25 to 55.

Conclusion

I find evidence to suggest that Medicare's increased medication coverage led to significant decreases in labor force participation. Descriptive evidence suggests that this drop occurred mainly among part time workers. These results suggest that the observed labor supply responses among low income women found in studies of Medicaid expansions are also present among other demographic groups, even without means testing or endogenous participation. The decrease in labor force participation 1 year after transplantation suggests dominant income effects, even in the presence of other factors that could be expected to increase labor supply, such as health improvements and possible wage increases due to a lower reliance on employer provided health insurance.

Medicare's coverage of immunosuppression medications for kidney transplant recipients provides a unique opportunity to explore labor supply responses to the provision of public insurance among a large number of relatively healthy men and women of prime working age and of all income levels. This particular policy is also free from other problems that affect existing studies of behavioral effects related to public insurance programs, such as low take up rates and endogenous selection into the Medicaid program. The observed responses suggest that labor supply discouraging income effects are important among a more heterogeneous population than those usually studied in other public health insurance programs. Although there was a decrease in participation during the 3-year coverage period, this study did not find any long term negative effect on employment rates once coverage expired. Further, the fact that the participation decline prior to the second year following transplantation was found exclusively among part time workers suggests that the economic impact of this decline may be outweighed by the positive impact on the long term outcomes of the transplant recipients. Although there was an overall decline in labor force participation, the percentage of those working full time actually increased in the low income treatment group relative to the high income control group during the third year following transplantation. However, the results suggest that the increased government subsidies to purchase health insurance found in the recent health care reform package could provide disincentives for employment, particularly among those with high medical expenditures or chronic conditions.

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