Income Growth Trajectory for Parents of Children with Down Syndrome in the United States

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ABSTRACT

The study objective is to determine whether the rate of income growth among parents of children with DS differs from that among parents of children without chromosomal conditions. Parents whose child had a DS diagnosis and who had consecutive years of income data were identified from a large insurance claims database. Propensity scores were used to match these parents to control parents of children without chromosomal conditions, and log annual income growth between cohorts was compared. After matching, parents of children with DS had an average annual income growth rate of 4.0% compared to 4.1% in matched control parents (p=0.115). Parents of children with DS experience no significant difference in annual income growth compared to their matched controls.

1. INTRODUCTION

In the workforce, women are often financially penalized for having children whereas men frequently experience a boost to their incomes, the so called "motherhood penalty" and "fatherhood bonus" (Anderson, Binder, & Krause, 2003; Avellar & Smock, 2003; Budig, 2014; Budig & England, 2001; Budig & Hodges, 2010; Glauber, 2007; Hodges & Budig, 2010; Waldfogel, 1997). Hodges and Budig found that fatherhood increases a man's earnings, on average, by about 6% annually in comparison to childless men; the difference even more pronounced for white men and Latinos, professional workers, the highly educated, and those whose occupations involve higher levels of cognitive complexity (Hodges & Budig, 2010). The researchers suggest that "fatherhood is a valued characteristic of employers, signaling perhaps greater work commitment, stability, and deservingness" (Budig, 2014). In contrast, motherhood decreases a woman's earnings, on average, by at least 4% annually per child in comparison to childless women, with the gap ranging from a 6% annual penalty among low-wage workers to a 5% annual bonus among the top-wage workers (Budig, 2014). Childless, unmarried women earn 96 cents to a man's dollar in 2012, whereas full-time working married mothers earn only 76 cents to a married father's dollar (Budig, 2014).

When expectant parents receive a prenatal diagnosis of Down syndrome (DS), many questions are often asked as they contemplate pregnancy decisions. For some expectant couples, the financial impact of a child with DS is a consideration. To date, no research that we are aware of has looked at the impact of having a child with DS on parental income. In this manuscript, we measure the income effects for mothers and fathers who are the primary earners in their families, using a large database that includes medical claims identifying children who have DS.

2. MATERIALS AND METHODS

2.1. Data

This retrospective cohort study utilized data from the Optum Health Reporting Insights database, which has been utilized in many previous studies (Loftus et al., 2014; Rice et al., 2014; Shei et al., 2015). This database includes medical and pharmaceutical claims for over 18 million privately insured individuals, covered by 82 self-insured Fortune 500 companies across the U.S. Included companies cover all geographical regions and span a variety of industries. Claims data are available both for primary subscribers and for any dependents. Annual income data are available for a subset of primary subscribers. Data range from Q1 1999 to Q4 2015.

2.2. Patient Selection

Parents were assigned to the study cohort if they had a child with at least one medical claim associated with a diagnosis of DS (ICD-9-CM code: 758.0x). Parents were assigned to the control cohort if they had one or more children, all without any diagnoses for chromosomal anomalies (ICD-9-CM code: 758.xx) in their observable medical claims.

Parents were included in this analysis if they were enrolled as a plan subscriber and had discernible demographic information for use in our matching algorithim, such as age at their child's birth, region where they live, and work industry. Parents were also required to have populated income data for two consecutive years while their child was under age 18. A year of populated income data was defined as a year with at least six months of consecutive income data. Parents with income data spanning more than two consecutive years were included multiple times in our panel data, with separate data for each pair of consecutive years of income data where their child was under 18 (Figure I). Parents in the control cohort who had multiple children were included multiple times within the panel for each child.

To control for observable confounding factors, propensity score matching was used to match parents within the study panel to parents within the control panel. The propensity score was estimated using an unconditional logistic regression controlling for the individual's region and health insurance plan type. In addition to the propensity score, observations from the study panel were matched exactly on gender, parental age at time of child's birth, child's age at the beginning of the two-year income observation period, and work industry.

2.3. Outcomes

Difference in log-annual income was calculated for each period of two consecutive years of income data. All annual incomes were adjusted to 2015 U.S. dollars using the U.S. all items CPI.

2.4. Statistical Analyses

Descriptive characteristics were compared between study and control data, before and after propensity score matching. Comparisons employed chi-square tests and Wilcoxon rank-sum tests before matching, and McNemar tests and Wilcoxon signed-rank tests after matching. Income growth was compared using Wilcoxon signed-rank tests. All analyses were performed using SAS Version 9.2 (SAS Institute, Cary, NC), and statistical significance was evaluated at the 0.05 level (two-sided).

3. RESULTS

3.1. Patient Selection and Characteristics

A total of 4,065 parents of individuals with DS and 1,522,496 parents of children without chromosomal anomalies were initially selected after all inclusion/exclusion criteria were applied, contributing 17,063 study observations and 5,475,884 control observations to the panel (Table I). Parents who had children with DS in the original study panel were older at the time of their

child's birth compared to that of the initial control group (34.3 versus 29.3 years, $p < 0.001$) (Table II). The two panels also differed on a number of other demographic factors, such as region, insurance plan type, and child's age at the time of observation. Following our matching process, the study and control panel were statistically similar on almost all dimensions (Table II).

3.2. Income Growth

Parents of children with DS experience no significant difference in annual income growth compared to their matched controls. (4.0% annual growth versus 4.1%, $p = 0.115$) (Table III). The 95% confidence interval for the difference in income growth was -0.27% - +0.09% (Table III). When stratified by gender, the difference is also not statistically significant for fathers of children with DS (3.9% annual growth versus 4.1%, $p = 0.062$) (Table III) or mothers (4.0% annual growth versus 4.0%, $p = 0.722$) (Table III). The 95% confidence interval for the difference in income growth for mothers was -0.23%–+0.29%, and for fathers was -0.46%–+0.05% (Table III).

The difference in average income growth between parents of children with DS and their matched controls was not found to be statistically different by age for any gender combined or individually. That is, for mothers, fathers, and mothers and fathers combined, the interaction of child's age and whether or not a parent's child had DS was found to be statistically indistinguishable from 0 ($p = 0.857$, $p = 0.772$, and $p = 0.739$, respectively) (Table IV).

4. DISCUSSION

In this study, we compared the annual income changes of mothers and father who have children with DS compared to parents who have children without chromosomal conditions. No statistical differences emerged for mothers, fathers, or parents combined, regardless of the age of

their child with DS. Put simply, the fact that a child has DS does not seem to change the annual income trajectory for parents.

For their primary analysis, Budig used the National Longitudinal Survey of Youth 1979, which "follows the lives of a sample of American youth born between 1957–64" and asks them questions annually from 1979 to 2012 about their employment, marriage, and family life, among other topics (Budig, 2014). Regrettably, we were not able to use this survey since no information is collected on whether respondents' children have DS. The U.S. Bureau of Labor and Statistics also provides annual estimates on income by gender, but no data is collected about DS. As such, we utilized the OptumHealth Reporting and Insights database, not only because of its comprehensive and robust scope, but because the database included medical claims, enabling us to identify dependents with DS. As far as we can tell, this is the first study to quantify the annual income growth of parents who have children with DS.

Our study is not without limitations. The OptumHealth Reporting and Insights database is not US general population based and covers a commercially insured population. As a result, conclusions may not extrapolate to all families with children with DS. However, OptumHealth Reporting and Insights captures approximately 3% of the total estimated U.S. population with DS under the age of 19 (Table V) and is similar to the overall U.S. population with regards to population share by age group, gender, and U.S. Census division (Table VI). Likewise, the data do not capture families covered by Medicaid or Medicare or provide information on race and ethnicity. Moreover, the population studied is restricted to parents who were the primary subscriber for their family; thus our study cannot speak to the effect of having a child with DS on the salary progression of the secondary earner. To that extent, the only women that are included in our analysis are the primary subscribers for their family. They might not represent an entirely

typical population of mothers, but rather the ones with better-than-average jobs where the family is opting to have the child with DS enrolled in her plan rather than the father's. Finally, our study is restricted to measuring the income effects on parents who chose not to terminate a pregnancy because of a DS diagnosis. Parents whose income growth may be more negatively affected may be more likely to terminate their pregnancies. Thus, the result found above may underestimate the impact of having a child with DS on income growth. The database does represent, however, more than 18 million employees who work in a range of industries representing all geographic regions of the U.S.

Our study compares the income trajectories of employees who have children; however, we did not compare parents who have children with DS to their childless counterparts. We did not feel that the OptumHealth Reporting and Insights database could accurately answer this question, as we did not want to assume that a subscriber with no dependents necessarily meant he or she was childless. For example, such a subscriber might have chosen to include a child as a dependent on a spouse's or partner's separate insurance plan. We are unaware of any current database with the necessary data to compare the annual income changes of parents who have children with DS to childless counterparts. A longitudinal case-cohort prospective study would need to be established.

With recent advances in prenatal genetic testing, more U.S. expectant couples are learning prenatally about DS. For some couples, pregnancy decisions involve complex considerations, including the impact on one's career. Based on the data presented in this study, parents, on average, should not expect to see a significant impact on their annual income trajectory if their child were to have DS.

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TABLES

Table I. Selection of parents of individuals with Down syndrome (DS) and parents of individuals without chromosomal anomalies

Selection Criteria		Count	
Selection of individuals with DS (pre-match study group)			
Step 0.	All beneficiaries	19,144,931	
Step 1.	Identify parents of individuals with at least one diagnosis for DS[a,b,c,d,e]	Mother	Father
		4,952	4,689
Step 2.	Identify parents with at least two consecutive years of income data while their child is under age 18[f]	2,025	2,040
Step 3.	Include parents with >2 years of consecutive income data multiple times in the panel[g]	8,371	8,692
Selection of individuals without DS (pre-match potential control group)			
Step 0.	All beneficiaries	19,144,931	
Step 1.	Identify parents of individuals with no diagnoses for chromosomal anomalies.[a,c,d,e,g]	Mother	Father
		2,632,154	2,477,300
Step 2.	Identify parents with at least two consecutive years of income data while their child is under age 18[f]	766,260	756,236
Step 3.	Include parents with >2 years of consecutive income data multiple times in the panel[h]	2,698,063	2,777,821

Abbreviations: DS = Down syndrome.

Notes

[a] Diagnoses assessed in medical claims from Q1 1999 to Q1 2013.

[b] DS was defined as ICD-9-CM: 758.0x.

[c] Individual was classified as a plan subscriber on their insurance enrollment.

[d] The oldest woman/man classified as a subscriber or spouse on a family insurance enrollment is assumed to be the mother/father (respectively).
[e] Individuals are also required to have identifiable information used in matching, including gender, date of birth, region, insurance plan type, and parent work industry.

[f] Six months of >$100 income is considered valid income data for a given year.

[g] Chromosomal anomalies were defined as ICD-9-CM: 758.xx.
[h] Patients with more than two consecutive years of income information are included in the panel once for each pair of consecutive years of income information.

Table II: Baseline characteristics among parents of individuals with Down syndrome (DS) and controls included in panel (using 1 control)

	Pre-Match				Post-Match			
	DS study panel N = 17,063	Control panel N = 5,475,884	P-Value[a]		DS study panel N = 17,062	Control panel N = 17,062	P-Value	
Descriptive characteristics								
Female, n (%)	8,371 (49.1)	2,698,063 (49.3)	0.58		8,371 (49.1)	8,371 (49.1)	1.00	
Age at child's birth (years), mean (SD)	34.3 (6.3)	29.3 (6.4)	<.0001	*	34.3 (6.3)	34.3 (6.3)	0.72	
Region, n (%)								
Midwest	4,615 (27.0)	1,273,517 (23.3)	<.0001	*	4,614 (27.0)	4,614 (27.0)	1.00	
Northeast	2,619 (15.3)	880,675 (16.1)	0.009	*	2,619 (15.3)	2,615 (15.3)	0.41	
South	6,403 (37.5)	2,032,013 (37.1)	0.26		6,403 (37.5)	6,399 (37.5)	0.32	
West	3,249 (19.0)	1,182,962 (21.6)	<.0001	*	3,249 (19.0)	3,257 (19.1)	0.005	*
Insurance Plan Type, n (%)								
HMO	1,812 (10.6)	782,635 (14.3)	<.0001	*	1,812 (10.6)	1,808 (10.6)	0.51	
Indemnity	1,082 (6.3)	329,050 (6.0)	0.07		1,082 (6.3)	1,070 (6.3)	0.18	
POS	3,683 (21.6)	1,049,818 (19.2)	<.0001	*	3,683 (21.6)	3,679 (21.6)	0.58	
PPO	9,751 (57.1)	2,946,803 (53.8)	<.0001	*	9,750 (57.1)	9,779 (57.3)	<.0001	*
Other	735 (4.3)	367,578 (6.7)	<.0001	*	735 (4.3)	726 (4.3)	0.25	
Work industry, n (%)								
Financial Services	930 (5.5)	410,549 (7.5)	<.0001	*	929 (5.4)	929 (5.4)	1.00	

Healthcare	1,241 (7.3)	470,977 (8.6)	<.0001	*	1,241 (7.3)	1,241 (7.3)	1.00
Manufacturing/Energy	2,807 (16.5)	816,358 (14.9)	<.0001	*	2,807 (16.5)	2,807 (16.5)	1.00
Retail/Consumer Goods	918 (5.4)	427,007 (7.8)	<.0001	*	918 (5.4)	918 (5.4)	1.00
Shipping/Transportation	5,234 (30.7)	1,503,797 (27.5)	<.0001	*	5,234 (30.7)	5,234 (30.7)	1.00
Technology	4,698 (27.5)	1,503,807 (27.5)	0.84		4,698 (27.5)	4,698 (27.5)	1.00
Other	1,235 (7.2)	343,389 (6.3)	<.0001	*	1,235 (7.2)	1,235 (7.2)	1.00
Child's age at time of study, n (%)							
< 3 years	2,184 (12.8)	492,475 (9.0)	<.0001	*	2,184 (12.8)	2,184 (12.8)	1.00
3-5 years	3,324 (19.5)	820,454 (15.0)	<.0001	*	3,323 (19.5)	3,323 (19.5)	1.00
6-9 years	4,292 (25.2)	1,209,769 (22.1)	<.0001	*	4,292 (25.2)	4,292 (25.2)	1.00
10-15 years	5,676 (33.3)	2,125,185 (38.8)	<.0001	*	5,676 (33.3)	5,676 (33.3)	1.00
> 15 years	0 (0.0)	0 (0.0)	--		0 (0.0)	0 (0.0)	--

Abbreviations: HMO = health maintenance organization, POS = point of service, PPO = preferred provider organization.

Notes

* P-value <0.05.

[a] P-values before matching were calculated using Wilcoxon rank-sum tests for continuous variables and chi-square tests for categorical variables. P-values after matching were calculated using McNemar tests and Wilcoxon signed-rank tests.

Table III: Mean annual growth rate in incomes among parents of children with DS and matched controls (using 1 control)

	DS study panel [A]	Control panel [B]	Difference [A] - [B]	95% CI	P-Value[a]
Overall	N = 17,062	N = 17,062			
Mean log difference in annual income, mean (SD)	0.039 (0.082)	0.040 (0.091)	-0.001	(-0.003 – 0.001)	0.115
Average change in annual income (%)[b]	4.0%	4.1%	-0.09%	(-0.27% – 0.09%)	
Mothers	N = 8,371	N = 8,371			
Mean log difference in annual income, mean (SD)	0.040 (0.084)	0.039 (0.089)	0.000	(-0.002 – 0.003)	0.723
Average change in annual income (%)[b]	4.0%	4.0%	0.03%	(-0.23% – 0.29%)	
Fathers	N = 8,691	N = 8,691			
Mean log difference in annual income, mean (SD)	0.039 (0.080)	0.041 (0.094)	-0.002	(-0.005 – 0.000)	0.062
Average change in annual income (%)[b]	3.9%	4.1%	-0.22%	(-0.46% – 0.05%)	

Abbreviations: CI = confidence interval, SD = standard deviation.

Notes

[a] P-values were calculated using Wilcoxon signed-rank tests.

[b] Percentages calculated from log differences using the following equation: average change = $e^{\text{mean log difference}} - 1$.

Table IV. Regression results on the differential effect of time after birth for parents of children with DS

Variable	Estimate	Standard Error	P-value	
Mothers				
Intercept	0.046	0.001	<0.001	*
Time After Birth (years)	-0.001	0.000	<0.001	*
Time After Birth × Sample (years)	0.000	0.000	0.857	
Fathers				
Intercept	0.050	0.001	<0.001	*
Time After Birth (years)	-0.001	0.000	<0.001	*
Time After Birth × Sample (years)	0.000	0.000	0.772	
Combined				
Intercept	0.048	0.001	<0.001	*
Time After Birth (years)	-0.001	0.000	<0.001	*
Time After Birth × Sample (years)	0.000	0.000	0.739	

Abbreviations: DS = down syndrome.

Notes:

* P-value <0.05

Table V. Comparison of patients with DS in OptumHealth[a] compared to estimated total population with DS, by age category

Age group	2000			2005			2010		
	Optum DS population	Estimated DS population[b]	Percent of total	Optum DS population	Estimated DS population[b]	Percent of total	Optum DS population	Estimated DS population[b]	Percent of total
Total	2,286	75,986	(3.0%)	3,062	82,897	(3.7%)	3,465	88,604	(3.9%)
0 - 4	704	21,014	(3.4%)	957	23,812	(4.0%)	774	25,448	(3.0%)
5 - 9	753	19,719	(3.8%)	916	20,565	(4.5%)	1,182	23,528	(5.0%)
10 - 14	510	19,267	(2.6%)	753	19,541	(3.9%)	916	20,382	(4.5%)
15 - 19	319	15,986	(2.0%)	436	18,979	(2.3%)	593	19,246	(3.1%)

Abbreviations: DS = Down syndrome.

Notes

[a] Patients with DS in OptumHealth Reporting and Insights database were defined as any patient with a diagnosis for DS (ICD9 code 758.0x) at any point in their medical history.

[b] Data on estimated population with DS in the U.S. taken from (de Graaf, Buckley, & Skotko, 2016)

Table VI. Comparison of OptumHealth population to overall population

	OptumHealth 2014[a]		U.S. Population 2014	
	N	**(%)**	**N**	**(%)**
Age[b]				
Under 18 years	2,070,784	(20.3%)	73,583,618	(23.1%)
18 to 24 years	1,157,138	(11.3%)	31,464,158	(9.9%)
25 to 44 years	2,754,524	(27.0%)	84,029,637	(26.4%)
45 to 54 years	1,474,159	(14.4%)	43,458,851	(13.6%)
55 to 64 years	1,398,411	(13.7%)	40,077,581	(12.6%)
65 years and over	1,352,248	(13.3%)	46,243,211	(14.5%)
All	10,207,264	(100.0%)	318,857,056	(100.0%)
Gender[b]				
Male	5,047,371	(49.5%)	156,936,487	(49.2%)
Female	5,159,893	(50.6%)	161,920,569	(50.8%)
All	10,207,264	(100.0%)	318,857,056	(100.0%)
Census division[c]				
New England	921,637	(9.0%)	14,680,722	(4.6%)
Middle Atlantic	1,443,301	(14.1%)	41,471,611	(13.0%)
South Atlantic	1,685,289	(16.5%)	62,514,615	(19.6%)
East North Central	1,571,681	(15.4%)	46,739,039	(14.7%)
East South Central	439,255	(4.3%)	18,806,265	(5.9%)
West North Central	864,595	(8.5%)	21,006,069	(6.6%)
West South Central	1,029,071	(10.1%)	38,451,054	(12.1%)
Mountain	780,008	(7.6%)	23,197,119	(7.3%)
Pacific	1,203,835	(11.8%)	49,834,269	(15.6%)
Hawaii and Alaska	268,592	(2.6%)	2,156,293	(0.7%)
All	10,207,264	(100.0%)	318,857,056	(100.0%)

Abbreviations:

Notes:

[a] Includes all beneficiaries eligible at any time between 2010 and 2014.

[b] Taken from: Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States, States, Counties, and Puerto Rico Commonwealth and Municipios: April 1, 2010 to July 1, 2014 ; released on June 2015; U.S. Census Bureau, Population Division. (United States Census Bureau- Population Division, 2014a)
[c] Taken from: Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014; released on December 2014; U.S. Census Bureau, Population Division.(United States Census Bureau- Population Division, 2014b)

FIGURES

Figure 1. In this example, parents with four years of consecutive income data were included as three observations: once from Age 2 – Age 4, again from Age 3 – Age 5, and finally from Age 4 – Age 6. Parents with more than two consecutive periods of income data where their child is under 18 were included multiple times.

Figure 1: Study schematic