

The Impact of Disability on Household Services: Evidence from the American Time Use Survey

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Abstract. Individuals with disabilities typically endure both reduced employment opportunities and lower wages than individuals without disabilities. In addition to these losses, individuals with disabilities experience a decline in their ability to perform household services, displayed by both reduction of hours spent performing household services and relative productivity during completion of household tasks. This article examines a data-based approach to measuring the impact of partial disability on household services through the use of American Time Use Survey (ATUS) data.

There are two facts that hold for disabled individuals, on average: they suffer reduced employment levels and earn less in the labor market than their counterparts without a disability. In addition to suffering a loss of earning capacity, individuals with permanent cognitive or mobility impairments often experience a decline in their ability to perform household services. This decline is exhibited in two forms: a reduction in the hours spent on household services and a reduction in the productivity of the hours expended in performing household services. Available data only allows us to measure the first form of the decline since the productivity effect cannot be objectively measured. As a result of this limitation, previous literature has primarily focused on evaluating the loss of household services in only cases of total disability (i.e. catastrophic injuries). This paper seeks to provide a data-based approach to measuring the impact of partial disability on household services through the use of American Time Use Survey (ATUS) data.

Background Information

Household services represent a concept that is hard to precisely define. This paper defines household services as the work done by an individual to maintain his or her household, and includes housework, cooking, yard care, pet care, vehicle maintenance and repair, and home maintenance, repair, decoration, and renovation. Also included in this paper's construct of household services are caring for and helping household children and activities related to the household children's education and health. Ireland (2014) provides an excellent analysis of the concept from the per-

spective of both an economist and a life care planner. As Ireland points out, the majority of economists utilize a replacement cost methodology in measuring household services by figuring how much it would cost to obtain the lost household services in the labor market.

The Dollar Value of a Day: 2013 Dollar Valuation by Expectancy Data is the primary source of values utilized by forensic economists who employ the replacement cost methodology, and as such, it provides a great wealth of information in valuing household services in cases of total disability or death. However, this annual publication does not consider the loss of household services by the various types of disability that the ATUS considers. Clauretie (2010) provided the only analysis known to the author utilizing the ATUS data and considering disability status in a household services analysis. Nevertheless, at the time of his analysis there was only a generic disability variable that was not impairment or severity specific.

One method to value household services in the case of partial disability is for a vocational expert to gather information about the disabled individual through interviews and evaluations that allows him or her to establish a reasonable approximation of the percentage reduction in household services that is likely over the lifespan. This expert would then be able to easily compute the lifespan value of household services from *Dollar Value of a Day*, and figure the loss of household services by multiplying the lifespan value by the percentage reduction in household services. Another approach is to calculate the value of household services across the lifespan and simply present that the value

of household services loss lies somewhere between \$0 and the full lifespan value.

The preferable approach should reflect a data-based approach that utilizes information gathered about the disabled individual and how individuals most like the disabled individual being considered fare on average. Thus, a data-based approach that utilizes the best available data in the best possible way is required. The decline in household services for a disabled individual will be exhibited in two forms, on average: a reduction in the hours spent on household services and a reduction in the productivity of the hours expended in performing household services. The productivity component is impossible to measure since the individuals are not observed pre- and post-injury, however data from the ATUS are available to measure the reduction in hours spent on household services. This number should serve as a lower bound for the reduction of household services for the statistically average disabled individual that suffers from a particular impairment.

American Time Use Survey Data

The U.S. Bureau of Labor Statistics has published results from the American Time Use Survey (ATUS) since 2003. The ATUS is a time diary study that provides nationally representative estimates on how Americans spend their time on a daily basis. Since 2008, the ATUS public microdata files have included several constructs of disability since they can be linked with the CPS supplement files (the same currently employed by both the ACS and CPS). ACS and CPS data are frequently used by researchers interested in the impact of disability on earnings and employment levels (Gamboa & Gibson, 2010). The various impairment specific constructs of disability available in the ATUS are displayed in Table 1.

Reflections on the Model

The 2008-2013 data include a total of 66,198 usable observations from individuals responding to the ATUS. Since we are interested in the effect of disability on household services, we utilize multivariate regression in order to discover this partial effect. In addition to information on hours spent performing various household activities, the survey also identifies respondents by age, gender, employment status, whether they have a spouse, and whether there are kids in the household.

We specify our econometric model utilizing ordinary least squares (OLS) estimation:

$$HHS_i = Age_i + Age^2_i + Gender_i + Employed_i + Spouse_i + Child_i + Disability_i$$

where the variables are defined as:

Our dependent variable, HHS, represents the amount of household services (measured in minutes per day) done by the respondent to maintain his or her household, and includes housework, cooking, yard care, pet care, vehicle maintenance and repair, and home maintenance, repair, decoration, and renovation. Also included in our measure of household services is caring for and helping household children and activities related to the household children's education and health.

The key independent variable in our study is Disability. We utilize several constructs of disability (the same currently employed by both the CPS and ACS) and present the results for each of these. We create nine binary variables to be utilized in separate regressions:

- (i) individuals that answer YES to any of the six questions in Table 1
- (ii) individuals that answer YES to the hearing question
- (iii) individuals that answer YES to the vision question

Table 1
ATUS Disability Criteria 2008-2013

Is this person deaf or does he/she have serious difficulty hearing?	Hearing
Is this person blind or does he/she have serious difficulty seeing even when wearing glasses?	Vision
Because of a physical, mental, or emotional condition, does this person have serious difficulty concentrating, remembering, or making decisions?	Cognitive
Does this person have serious difficulty walking or climbing stairs?	Mobility
Does this person have difficulty dressing or bathing?	Self-Care
Because of a physical, mental, or emotional condition, does this person have difficulty doing errands alone such as visiting a doctor's office or shopping?	Go Outside Home

- (iv) individuals that answer YES to the cognitive question
- (v) individuals that answer YES to the mobility question
- (vi) individuals that answer YES to the self-care question
- (vii) individuals that answer YES to the go outside home question
- (viii) individuals that answer YES to the cognitive question and YES to the self-care and/or go outside home question
- (ix) individuals that answer YES to the mobility question and YES to the self-care and/or go outside home question

Controls are included for age, gender (female = 1), the respondent's employment status (employed = 1), if there is a child in the household under the age of 18 (yes = 1), and whether a spouse or cohabitating partner is present (yes = 1). In addition, a quadratic term for age is included to capture the non-linear effect that aging displays with the performance of household services.

We are especially interested in the regression results when the indicator variables (iv), (v), (viii), and (ix) are included in the regression specification as each being the respective disability variable of interest. When utilizing the indicator variable (iv) in our regression specification, we can derive an estimate of the impact of cognitive impairment on the number of minutes per day that an individual spends performing household services. Similarly, when we utilize the indicator variable (v) in our regression specification, we can derive an estimate of the impact of mobility impairment on the number of minutes per day that an individual spends performing household services. A severe impairment can best be defined as existing when an individual has one of the base impairments (cognitive or mobility) as well as trouble in either self-care or going outside the home (or both).

Aging plays a role in the impact of disability on household services. Namely, we would expect that an 80-year old individual with disability would experience a larger decline in household services as a result of both aging and the interplay between aging and disability, when compared to a 35-year old with disability. Vocational rehabilitation theory tells us that the aging process helps to exaggerate the effect of disability in performing household tasks. However, the largest component of the aging and disability interplay comes from the productivity component that cannot be measured in the ATUS. As a result, we do not include an interaction term for disability and aging. Our estimates are conservative since they cannot control for this productivity component that would certainly cause the estimate of the effect of disability on house-

hold services to be stronger (a larger reduction) if it could be included.

Results of an Analysis

The results conform to intuition. Females devote more time to household services than do males (almost an hour more per day), household services increase over the lifespan and then begin to decline at a certain point, employed individuals perform less household services than do unemployed, having a child in the household increases household services substantially, and disabled individuals perform less household services than do non-disabled.

Tables 2-4 present the impact of disability on household services (in minutes per day) for both genders (Table 2), males (Table 3), and females (Table 4). The interpretation of the disability coefficient is as follows: "On average, an individual with "X" impairment is likely to experience a reduction of "Y" minutes of household services per day when compared to their counterparts without such an impairment *ceteris paribus*". The *ceteris paribus* qualifier establishes that a regression coefficient measures a partial effect of an independent variable on the dependent variable while holding "all else equal". This means that the effect of age and employment status, for instance, are not interacted with disability in order to establish a partial effect.

We know that both age and employment status should play an effect in magnifying or diminishing the effect that disability has on household services. However, when the effect of disability on future lifetime household services is being measured, it is a reasonable assumption to hold these factors constant since both an individual's employment status cannot be forecasted into the future with certainty and because holding age constant allows an average disability effect over the lifespan (i.e. as we age, the effect of disability on household services magnifies). This approach provides a very conservative estimate because it does not consider (i) the relationship between aging and disability and how it relates to household services and (ii) the productivity effect that is not measurable.

On average, an individual with a cognitive impairment is likely to experience a reduction of 19.24 minutes of household services per day when compared to their counterparts without such an impairment *ceteris paribus*. The effects for mobility, severe cognitive, and severe mobility impairments are 35.96, 38.09, and 50.04 minutes per day decline, respectively.

The sample size in our regression for both genders is 66,198 individuals. The F-statistic is very high indicating that the regression coefficients are jointly significant and that the regression predicts better than the mean.

Table 2*The Impact of Disability on Household Services (in minutes per day) – Both Genders*

<i>Dep: HHS</i>	Any	Hearing	Vision	Cognitive	Mobility	Self-Care	Going Outside Home	Severe Cognitive	Severe Mobility
<i>Age</i>	3.68	3.60	3.61	3.68	3.74	3.69	3.64	3.67	3.66
<i>Age</i> ²	-.032	-.032	-.032	-.033	-.033	-.033	-.032	-.033	-.032
<i>Gender</i>	57.36	57.58	57.63	57.54	57.85	57.59	57.89	57.65	57.89
<i>Employed</i>	-59.81	-56.33	-56.67	-57.33	-59.95	-58.03	-58.83	-57.26	-58.69
<i>Spouse</i>	30.71	32.66	32.38	32.03	30.57	31.75	31.42	32.11	31.45
<i>Kid < 18</i>	91.83	91.77	91.78	91.69	91.78	91.77	91.81	91.66	91.82
<i>Constant</i>	15.34	13.53	13.72	13.31	13.47	13.17	14.80	13.18	13.98
<i>Disability</i>	-25.63 (-13.1)	-2.50* (-0.7)	-22.85 (-5.0)	-19.24 (-5.6)	-35.96 (-15.4)	-56.89 (-12.8)	-46.2 (-14.2)	-38.09 (-7.36)	-50.04 (-14.5)
<i>N</i>	66198	66198	66198	66198	66198	66198	66198	66198	66198
<i>F-Stat</i>	1752	1724	1728	1729	1764	1752	1758	1734	1759
<i>R</i> ²	.1564	.1542	.1545	.1546	.1572	.1563	.1568	.1549	.1569

Table 3*The Impact of Disability on Household Services (in minutes per day) – Males*

<i>Dep: HHS Males</i>	Any	Hearing	Vision	Cognitive	Mobil-ity	Self-Care	Going Outside Home	Severe Cognitive	Severe Mobility
<i>Age</i>	3.49	3.40	3.42	3.48	3.55	3.48	3.47	3.46	3.48
<i>Age</i> ²	-.029	-.029	-.029	-.030	-.030	-.030	-.029	-.029	-.029
<i>Employed</i>	-36.44	-33.37	-33.72	-34.68	-36.66	-34.74	-35.37	-34.25	-35.28
<i>Spouse</i>	15.91	17.08	16.84	16.48	15.73	16.58	16.46	16.70	16.45
<i>Kid < 18</i>	65.06	64.87	64.93	64.88	65.20	65.02	64.97	64.86	65.02
<i>Constant</i>	17.92	16.77	16.88	16.84	16.35	16.49	17.28	16.73	16.73
<i>Disability</i>	-19.86 (-6.9)	-0.49* (-0.1)	-18.23 (-2.6)	-21.91 (-4.3)	-29.77 (-8.1)	-41.65 (-6.8)	-35.32 (-6.6)	-36.64 (-4.5)	-38.57 (-6.8)
<i>N</i>	29046	29046	29046	29046	29046	29046	29046	29046	29046
<i>F-Stat</i>	363	355	356	358	367	361	363	358	363
<i>R</i> ²	.0698	.0683	.0685	.0689	.0704	.0695	.0697	.0689	.0698

Table 3 displays the impact of disability on household services for males. On average, a male with a cognitive impairment is likely to experience a reduction of 21.91 minutes of household services per day when compared to their counterparts without such an impairment *ceteris paribus*. The effects for mobility, severe cognitive, and severe mobility impairments are 29.77, 36.64, and 38.57 minutes per day decline, respectively.

Table 4 displays the impact of disability on household services for females. On average, a female with a cog-

nitive impairment is likely to experience a reduction of 14.29 minutes of household services per day when compared to their counterparts without such an impairment *ceteris paribus*. The effects for mobility, severe cognitive, and severe mobility impairments are 35.93, 35.48, and 52.27 minutes per day decline, respectively.

All coefficients in Tables 2-4 are significant at the 1% level, except as noted with a "*". The coefficient for the effect of hearing disability on household services is not significant at any reasonable level in any of Tables

Table 4*The Impact of Disability on Household Services (in minutes per day) – Females*

Dep: HHS Females	Any	Hearing	Vision	Cognitive	Mobil-ity	Self- Care	Going Outside Home	Severe Cognitive	Severe Mobility
Age	3.66	3.60	3.60	3.67	3.72	3.70	3.62	3.68	3.65
Age ²	-.030	-.030	-.030	-.031	-.030	-.031	-.030	-.031	-.030
Employed	-68.52	-65.11	-65.42	-65.79	-68.70	-66.93	-67.81	-66.03	-67.66
Spouse	43.39	45.66	45.44	45.18	43.36	44.54	44.19	45.07	44.24
Kid < 18	114.52	114.71	114.67	114.56	114.33	114.48	114.57	114.48	114.54
Constant	57.35	55.37	55.64	54.95	55.87	55.06	57.34	54.88	56.43
Disability	-26.63 (-10.0)	-4.34* (-0.8)	-24.00 (-4.0)	-14.29 (-3.1)	-35.93 (-11.7)	-61.81 (-10.7)	-48.38 (-11.7)	-35.48 (-5.3)	-52.27 (-12.0)
N	37152	37152	37152	37152	37152	37152	37152	37152	37152
F-Stat	1221	1201	1205	1203	1229	1224	1229	1207	1230
R ²	.1648	.1625	.1629	.1627	.1656	.1651	.1656	.1632	.1657

2-4. T-statistics (in parentheses) are presented for the disability variables only.

The regression equations can be used to determine both the pre- and post-injury values of household services over time. For example, for a 35-year old female with a child age 10 and not employed, the equation can be used for the next eight years when it could be assumed in a particular case that the individual would not work for the next eight years and the child remains in the household. Then, the equation can be modified for when the child leaves the house and individual goes back to work. The age variables will pick up the change in hours as a function of age. The negative coefficient on disability can be added to the post-injury equation. However, this method requires quite a few assumptions on the part of the vocational or economic expert about the individual. It may be preferable to use a statistical average across the lifespan.

Case Studies – Performing an Analysis

Case Study #1: 35-Year Old Male with a Mobility Impairment: What is the reduction in lifetime household services for a 35-year old male with a mobility impairment?

First, we recognize that the reduction in lifetime household services found by utilizing the ATUS data cannot measure the decline in productivity that the individual will likely suffer as a result of his mobility impairment. This means that our estimate is likely to be very conservative and should serve as a lower bound for the reduction in household services. Our approach to the data is not age-specific but is very reasonable and conservative to use for individuals across the lifespan.

ATUS data shows us that, on average, a male with a mobility impairment is likely to experience a reduction of 29.97 minutes of household services per day when compared to his counterparts without such an impairment *ceteris paribus*. This translates into a 182.44 hours reduction of household services per year. A 35-year old male has a life expectancy of 42.9 additional years. Thus, the lifetime loss of household services is approximately 7,827 hours. If we assume it would cost between \$12 and \$15 per hour to hire an individual to provide these household services, the lifetime loss can be stated in a range from \$93,924 to \$117,405. This is a very conservative estimate since it does not consider the productivity decline that an individual would likely experience as a result of disability.

Case Study #2: 40-Year Old Female with a Severe Mobility Impairment: What is the reduction in lifetime household services for a 40-year old female with a severe mobility impairment?

First, we recognize that the reduction in lifetime household services found by utilizing the ATUS data cannot measure the decline in productivity that the individual will likely suffer as a result of her severe mobility impairment. This means that our estimate is likely to be very conservative and should serve as a lower bound for the reduction in household services. Our approach to the data is not age-specific but is very reasonable and conservative to use for individuals across the lifespan.

ATUS data shows us that, on average, a female with a severe mobility impairment is likely to experience a reduction of 52.27 minutes of household services per day when compared to her counterparts without such an impairment *ceteris paribus*. This translates into a

318.19 hours reduction of household services per year. A 40-year old female has a life expectancy of 42.3 additional years. Thus, the lifetime loss of household services is approximately 13,460 hours. If we assume it would cost between \$12 and \$15 per hour to hire an individual to provide these household services, the lifetime loss can be stated in a range from \$161,520 to \$201,900. This is a very conservative estimate since it does not consider the productivity decline that an individual would likely experience as a result of disability.

Summary

The data provided by the ATUS presents vocational and economic experts with a wonderful source by which to estimate a lower bound of the probable replacement cost of household services that a partially disabled individual with a permanent impairment would require across their lifespan. This paper represents the first contribution to providing a data-based approach to quantifying the loss of household services in cases of permanent partial disability.

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Endnotes

- ¹ The use of the statistical average is an acceptable if not preferred method because even when we know the specifics of, say, a 35 year-old female, there is no way to predict her household services when she would be 60.
- ² The standard errors of these estimates can be computed from the regression results and would satisfy the Daubert standards.

Author Note

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