Projections of State and County-Level Long Term Care Use and Need in Vermont, 2007-2017:

Methods and Selected Findings

Prepared for:
Vermont Department of Disabilities, Aging and Independent Living

Submitted by:
The Lewin Group, Inc.

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I. Introduction

In collaboration with the Vermont Department of Disabilities, Aging and Independent Living (VDAIL), The Lewin Group developed county-level estimates and projections of the need for and use of long term care services in Vermont. These estimates and projections assist VDAIL staff in making policy decisions regarding funding and technical assistance needs for the counties. The key estimates include:

- Estimated and projected long term care need in 2007, 2012, and 2017 – The number of people of all ages in the given year with a level of disability likely to indicate a need for long term care services (excluding individuals with mental retardation or developmental disabilities (MRDD)). Estimates for people living in the community are provided by county, age group and income. Estimates for people residing in nursing facilities are provided by county only.

- Projected long term care use in 2012 and 2017 – The number of people estimated to use selected long term care services in 2012 and 2017. Projections are trended forward based on the actual number of users of these services in 2007 as reported by VDAIL and calculated use rates by age and county.

The estimates were derived by combining data from several sources because no single data source provides county level detail for impairments with activities of daily living (ADLs). They build upon The Lewin Group's *Home and Community-Based Services (HCBS) Population Tool* which is described in detail in **Appendix A**. Combining data sources from the 2000 Decennial Census, the nationally representative Survey of Income and Program Participation (SIPP), and data about the use of publicly funded services in Vermont provided by VDAIL required assumptions based on a variety of sources, including analyses published in the literature, original data analysis conducted by Lewin, and consultation with staff at the Vermont Department of Disabilities, Aging and Independent Living (VDAIL).

This document describes how the model operates. We first describe the key definitions for the estimates and the data sources used. We next describe the principle assumptions that drive the output. We then provide a step-by-step description of how the data were combined to produce the output. Finally, we highlight the key changes made to the model from its previous version, which was used to produce estimates for 2006-2016.

II. Definitions

"Disability" and "Long Term Care Need"

The model uses the terms "disability" and "long term care need" interchangeably. Disability is defined as requiring assistance with two or more Activities of Daily Living (ADLs), *excluding* individuals with mental retardation and developmental disabilities (MR/DD). These estimates are based primarily on self-report from national survey data (Survey of Income and Program Participation), applied to demographic and general disability data at the state and county level.

Lewin's HCBS Population Tool estimates of the disability rate among community residents measured as any ADL compares favorably with a number of comparable national survey estimates (see *Appendix A, Exhibits A-1 to A-3*). Any ADL measure that excludes the MR/DD population substantially reduces the percentage of people with disability among those under age 65. The HCBS Population Tool estimates that about one quarter of individuals with some level of ADL or IADL impairment have MR/DD, mostly among those under age 65.

"Low-Income"

Low income is defined as having family income below 175% of the Federal Poverty Guideline (referred to as the Federal Poverty Level or FPL). We chose 175% of the poverty guideline to match, as closely as possible, the income criteria used in Vermont for publicly-funded long term care services.

"Nursing Facility Use"

We measure nursing facility use as the average number of people residing in nursing facilities at a given point in time. This allows for direct comparison to total population counts and to the number of people with disabilities, unlike, for example, a count of nursing facility days used.

We calculated an average nursing facility resident count for 2007 based on the mean of the daily census counts at the end of each of the four quarters of the State Fiscal Year, using county-level nursing facility MDS data by age group supplied by VDAIL. All nursing facility use data include the Wake Robin facility but exclude Arbors and Mertens which only accept private pay patients.

"Home and Community Based Service Use"

The model projects the use of *formal* home and community based services. The estimates exclude informal care provided by family members or other unpaid individuals not associated with an organized program. Home and community based services encompass all alternatives to nursing facilities, including residential care homes and assisted living, adult day care, and services provided in the home.

"Point-in-Time" Estimates of Disability and Service Use

The model reports disability and long term care service use at a point in time. Disability estimates represent the number of people with disabilities on a given day, and nursing facility use represents an average daily census, as described above. For most home and community based services, however, we report the number of individuals using the service at any point during a one-month period. HCBS services estimated include:

- Enhanced Residential Care – Medicaid Choices for Care

- Residential Care – Assistive Community Care Service (Medicaid State Plan)

- Residential Care -- Private Pay

- Assisted Living - All payers

- Personal Care – Medicaid Choices for Care

- Respite/Companion – Choices for Care

- Traumatic Brain Injury – Medicaid Waiver

- Case Management -- Medicaid Choices for Care

- Case Management – Older Americans Act

- Attendant Services Program (ASP)

- Adult Day - All payers

- Homemaker Services

- Home Delivered Meals – Vermont Center for Independent Living (VCIL) (age <60)

- Mental Health and Aging

We defined point-in-time use as one month because VDAIL collects program data on a monthly basis, and because eligibility and resource planning for public programs tends to be determined on a monthly basis. The two exceptions were Residential Care–Private Pay and Assisted Living, for which we used an estimated daily census measure because of data availability.

Fiscal Year Estimates

All estimates are meant to reflect Vermont's state fiscal year (SFY). The model uses historical utilization data based on the state fiscal year. Estimates of need for long-term care services are based on Census data that are reported for calendar years, however, the need measure itself represents a point-in-time measure and is consistent with the use measures.

III. Data Sources

The model relies on a number of data sources for its 2007 estimates, and its projections to 2012 and 2017. This section lists the main data sources used, and briefly explains how each is used.

- Disability prevalence from the Lewin HCBS Population Tool (see *Appendix A*), which is based primarily on the 1996 Panel of the Survey of Income and Program Participation (SIPP)[1] and the 2000 Census Public Use Microdata Sample (for broad disability and demographics). The HCBS Population Tool is itself a model that produces state-level disability estimates for the non-institutionalized population for 2000. These estimates are used as the denominator in developing use rates for each of the services.

- County-level population counts and actuarial projections (including institutionalized), by detailed age group, for 2000, 2007, 2012, and 2017 from the Massachusetts Institute for Social and Economic Research (MISER).

- County-level institutionalized population by facility type (nursing facilities, correctional facilities, and other), by broad age group (18-64, 65+), for 2000 from the Census Bureau. We needed these data to adjust the 2000 MISER population counts to be consistent with the 2000 non-institutionalized population counts from the HCBS Population Tool and the 2000 nursing home resident counts by county supplied by VDAIL.

- County-level quarterly nursing facility use data by age group, from VDAIL. For 2007 nursing facility resident counts, we used the MDS nursing facility census, averaged over the four quarters of state fiscal year (SFY) 2007. To inform our future trending assumptions, we analyzed state-level average quarterly nursing facility census counts for state fiscal year 1993 to 2007. All nursing facility use data include Wake Robin, but exclude Arbors and Mertens, which are private pay only[2]. These estimates are used as the numerator to develop use rates for nursing facilities.

- County-level utilization data for SFY 2007 for selected home and community based long term care services (HCBS) in Vermont. These estimates are used as the numerator to develop use rates for home and community-based services.

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[1]   Wave 11 of the 1996 SIPP Panel was used and it represents adult disability prevalence between December 1998 and March 1999, closely matching the 2000 Census timeframe. We explored using the most recent SIPP Panel, Wave 8 of 2001 Panel, collected from June 2003 to September 2003, but found that , with the exception of children with MR/DD which are excluded from this model's analysis, the disability prevalence rates of adults were very similar to the 1996 Panel data.

[2]   The model excluded Arbors and Mertens because the state has no information about them except total number of beds. Since Arbors and Mertens do not receive either Medicare or Medicaid, they are under no obligation to report MDS data to the state.

IV. Key Trending Assumptions

Two assumptions drive the results of this model, 1) the disability rate trend and 2) the nursing facility use rate trend. The first is a major determinate of long term care need, and the second influences the level of services required in the community. These assumptions can be adjusted over time as expected trends change.

The ASSUMPTIONS sheet of the model allows the user to vary these two sets of assumptions over time. The model also relies on a host of other assumptions. These assumptions are described briefly in the footnotes to the tables produced by the model. The discussion below provides a more complete description of each assumption.

Disability Rate Trend Assumptions

The model uses the default assumption that the disability rate for individuals younger than 65 will grow 3.9% per year between 2000 and 2007, 2.2% per year between 2007 and 2012, and 1.3% per year between 2012 and 2017 (*Exhibit 1*). These assumptions are consistent with those used by the Social Security Administration for the increase in the percentage of workers receiving Disability Insurance benefits.[3] We applied this trend to the disability rates for all individuals under 65, including children, because projections for individuals younger than age 18 are not available.

For people age 65 and older, the model assumes an annual decline in the disability rate in the community of 0.9% from 2000 to 2007, 0.9% from 2007 to 2012, and 0.8% from 2012 to 2017. This assumption is derived from an analysis of non-institutionalized individuals from the 1999 National Long Term Care Survey (NLTCS).[4] Using a definition of disability based on difficulty with one or more ADLs, that analysis showed a decline in the age-adjusted rate of disability of about 1% per year between 1989 and 1999.[5] Earlier analyses of the NLTCS by The Lewin Group

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[3] *The 2007 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds*, accessed on March 1, 2008 at http://www.ssa.gov/OACT/TR/TR06/tr06.pdf.

[4] Manton, Kenneth F, and Gu, XiLiang, Changes in the Prevalence of Chronic Disability in the United States Black and Nonblack Population above Age 65 from 1982 to 1999. *Proceedings of the National Academy of Sciences*, Vol. 98, No. 11, 2001. This paper defines disability as having difficulty with one or more activities of daily living (ADLs). We apply these age-adjusted trends to our estimates of disability, which we define as requiring assistance with two or more ADLs. Separate analysis of National Long Term Care Survey data performed by The Lewin Group indicates that these two measures of disability, while different, experienced similar trends from 1982 to 1999.

[5] From 1989 to 1999, Manton reports a decline in the prevalence of disability (defined as difficulty with 1+ ADL) from 14.3% to 12.9% excluding the institutionalized (N.B., we derive these non-institutionalized disability prevalence estimates by adjusting the estimates in Table 2 from the May 2001 Manton and Gu article, excluding institutionalized individuals from the denominator). This represents a 1% annual decline in the disability rate. This 1% does not represent a *percentage point* decline, but rather the *proportional* change in the rate. The proportional change over the 10 year period

indicate a similar trend using the definition of disability used in the model (i.e., requiring assistance with two or more ADLs). We assume a slightly smaller and flattening decline for our projections (i.e., 0.8% annually from 2012 to 2017 compared to 0.9% annually from 2000 through 2012) because there is debate as to whether these declines will continue into the future.

Exhibit 1: Default Assumptions for Projected Change in Disability Rates

Age	2000-2007	2007-2012	2012-2007
0-64	3.9%	2.2%	1.3%
65+	-0.9%	-0.9%	-0.8%

These trend assumptions are applied to disability rates through multiplication. Thus, if the disability rate in 2000 for a certain subgroup is 4.0% and we assume a disability decline of 0.9% per year, then the disability rate in 2001 would be 4%*(1-0.009), or 3.96%.

Nursing Facility Use Trend Assumptions

The model uses default assumptions for the decline in nursing facility use in the future that are informed by historical trends. *Exhibit 2* presents the annual change in nursing facility use rates between 1993 and 2007 and the cumulative change since 1993. With the exception of those under age 65 as a group and those 35-54, the overall trend within age groups over the period since 1993 has been a decline in nursing home use rates. This decline likely reflects several nursing home closures and concerted efforts the State has made to shift long term care resources toward community-based services and transition individuals out of nursing facilities. The recent increase in the use rate of nursing facilities among those under age 65 and those under 35-54 coincides with the increasing average age among those under age 65 as the baby boomers move into older age cohorts. As shown in *Figure 1*, baby boomers move into the higher end of the 35-54 age group and are no longer in the lower end of the age group starting in 2000 so the probability of using a nursing home for that age group starts to increase relative to the 1993 probability. The increase in the nursing facility use rate for the 18-64 age group is largely driven by the nursing facility use rate increase witnessed in the 35-54 age group which constitutes almost half of the population age 18-64 in 2007 and whose number of nursing facility residents grew faster than the population growth. During the period of our observation 1993-2007, the number of 35-54 year old nursing facility residents increased by 32% while the population grew by 16%, which resulted an overall upward trend for the nursing facility use rate.[6]

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is (12.9/14.3), or 0.902. Annualized, this becomes $0.902^{(1/10)}$, or 0.9897. To express as a percent change, we subtract 1, yielding an annual percent change of -1.03%, or about a 1% annual decline.

[6] For the 55-64 age group, the number of nursing facility residents increased by 13% from 1993-2007 and the population grew by 67%, generating the overall downward trend of the nursing facility use rate. For the 18-34 age group, the number of nursing facility residents decreased by 56% from 1993-2007 and its population decreased at a slower rate, by 10%, which makes the overall downward trend even steeper than that of 55-64 age group, as shown in the third chart in *Exhibit 2*.

Figure 1. Baby Boomers Aging Over the Trend Assumptions Period, 1993-2007
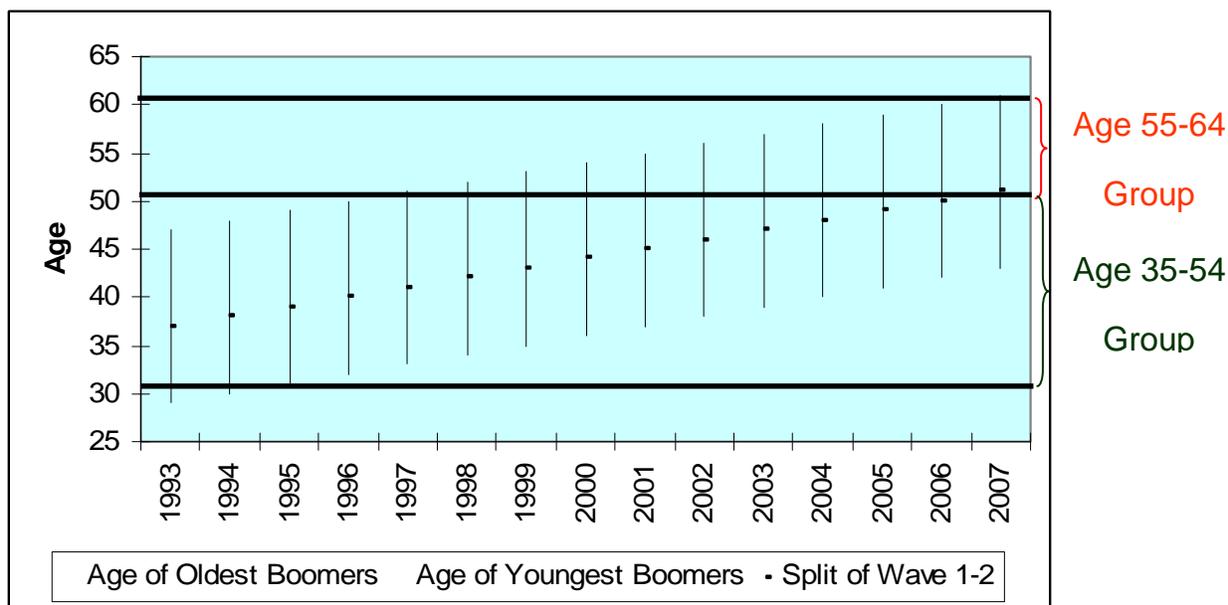
Exhibit 2: Annualized Change and Cumulative Change in Nursing Facility Use Rates[7]

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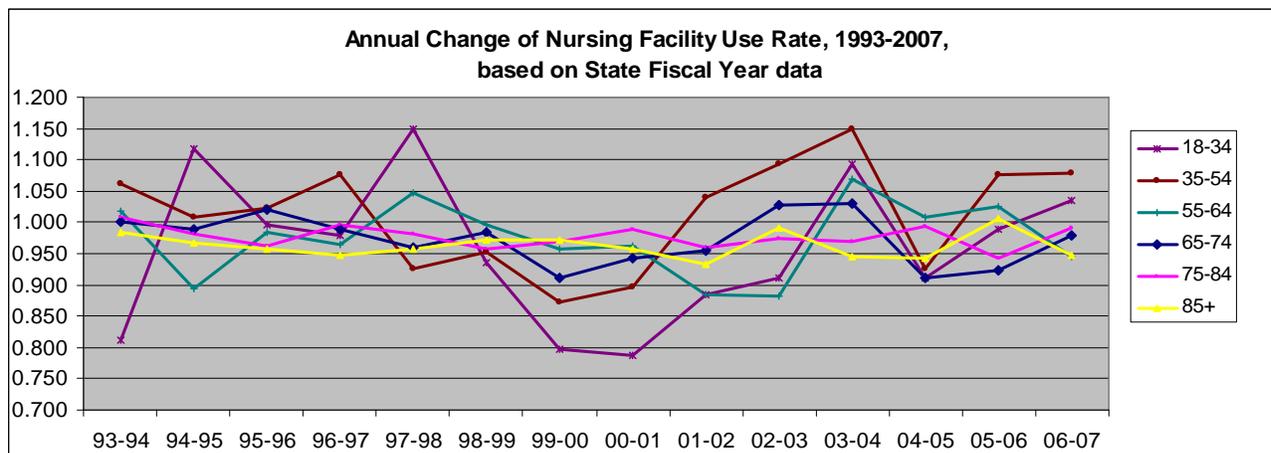
[7] The population numbers used to calculate the nursing facility use rates from 1993-1999 are based on the Vermont Department of Health and the University of Vermont Center for Rural Studies' adjustment of the 1990-2000 intercensal estimates by calendar year. The model used population estimates by calendar year from the Massachusetts Institute for Social and Economic Research (MISER) to calculate the nursing facility use rates from 2000-2007. The nursing facility data is based on the State's fiscal year.

Cumulative Change in Age Adjusted Nursing Facility Use Rate from 1993 Use Rate
Formula: Age-adjusted Nursing Facility Use Rate at Year T minus Use Rate in 1993

Change Rate from 1993 Base Year
Formula:(Age adjusted Nursing Facility Use Rate at Year T Divided by 1993 Use Rate) minus 1
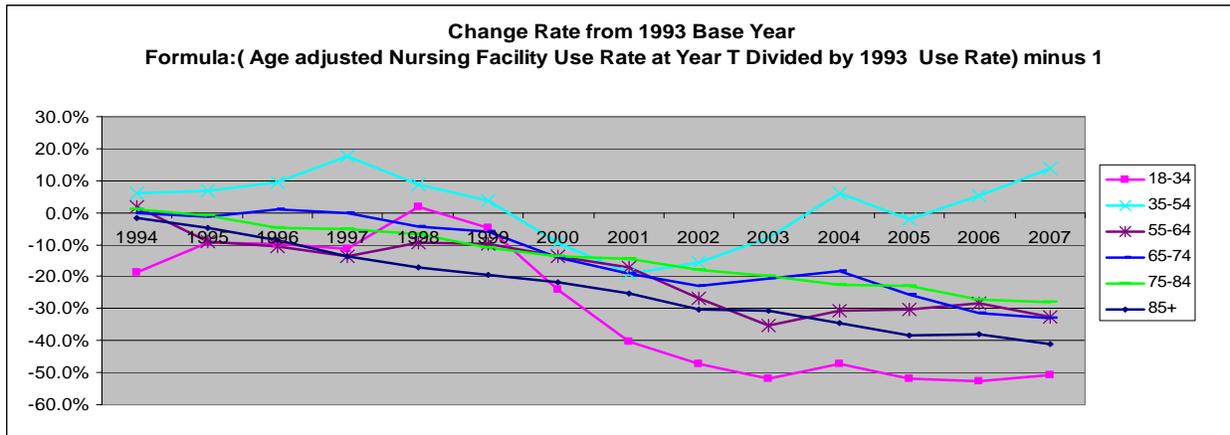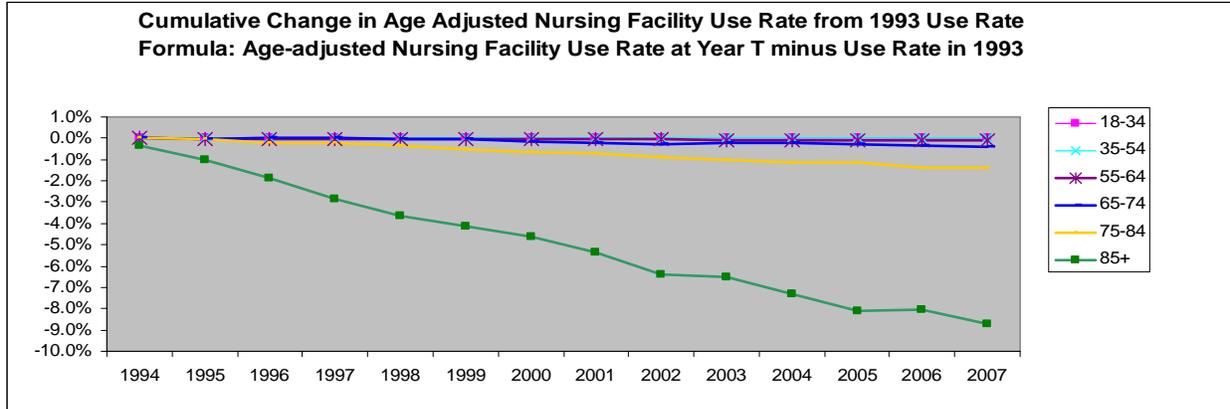
In order to mitigate the variability, we used the fifteen-year historical trend (1993-2007) for years beyond 2007, assuming that the future trend will tend toward the long-term historical trend. The resulting default assumptions appear in *Exhibit 3*.

Exhibit 3: Default Assumptions for Projected Change in Nursing Facility Use Rates

Age	2007-2017
18-34	-5.1%
35-54	1.1%
55-64	-3.4%
18-64	0.2%
65+	-2.6%
65-74	-2.8%
75-84	-2.3%
85+	-3.7%

It is important to understand that these default assumptions reflect the efforts the State has made over the past decade to shift services away from the nursing home and into the community. They also reflect the decline in disability that occurred over the period. Because we generally assume similar disability declines over the next ten years as occurred during the previous decade, we have left this assumption as the combined effect of use patterns changes and disability changes. The default assumptions assume that Vermont will continue its efforts to shift resources to the community, but that the effect of these efforts will not be as large as they have been in the past.

Determinants of Long Term Care Need in the Community

Three factors affect the model's estimates of the number of people in need of long term care services:

- the expected age trends by county, because older people are more likely to have disabilities requiring long term care services;

- the assumed trends in disability *rates* in the state, that is, the percent of people in a given age group who are expected to have a disability requiring long term care services; and

- the assumed trend in nursing facility use in the state, because decreases in nursing home use mean increases in the number of people with a nursing home level of care living in the community.

The first two of these – age and disability trends – are straightforward. The third – assumed nursing facility use trends – requires some explanation. This assumption also turns out to be the most important of the three drivers of long term care need in the community during the model's projection period.

The model assumes that all individuals diverted from institutions as a result of the decline in facility use will have long term care needs (i.e., 2+ ADLs) in the community. Thus, the assumed declines in nursing facility use increase long term care need in the community. At the same time, they will have no effect on long term care need overall (i.e., community and institutions combined).

The model must also translate the overall statewide nursing home trend assumptions into county-level impacts. That is, in which county would an individual who would have lived in a nursing facility now reside? First of all, we want to be able to distinguish between diversions to the community resulting from the NF use rate decline versus NF closures where many of the NF residents transfer to other NFs rather than to the community. We compared NF resident declines in counties having NF facility closures between SFY 2000 and SFY 2006 with statewide overall NF declines before and after the closures. If the statewide NF resident decline is less than that of the county where the closure occurred, we assume some of the diverted NF residents went to other nursing facilities in that county or other counties. Closures in three counties met this criterion: Addison, Orange & Windham. In these counties, the difference between the statewide and county NF decline was excluded from the population diverted to the

community because of transfers to other nursing facilities. We assume the excluded residents' ages mirror the NF statewide age distribution for that state fiscal year.

Rutland and Lamoille Counties also had NF closures between 2000 and 2006. When Sager (Rutland) closed, VDAIL staff indicate that most of the NF residents transferred to a border NF in New York State. When Morrisville (Lamoille) closed, VDAIL staff tracked the 64 total residents and found that 39 transferred to NF's in other counties and 20 transferred to The Manor's ERC in Lamoille to receive nursing home care. As a result, 59 people are excluded and a net of five people were diverted to the community in Lamoille as a result of Morrisville's closure.

For the nursing facility residents diverted to the community, the model assumes they remain in the same county, based on the assumption that people originated from that county.

Determinants of Home and Community Based Service Use

Three factors affect the model's estimates of the number of people using specific home and community based services:

- the expected age trends by county, because older people tend to use more long term care services;

- the assumed trend in nursing facility use in the state, because decreases in nursing home use mean increases in the number of people living in the community who are likely to use HCBS; and

- each county's specific rate of use of the selected service in 2007 (the most recent year observed) among those with two or more ADLs.

Similar to the model's estimates of long term care *need*, the *use* estimates reflect the assumed disability trends because the use rates from 2007 are calculated using the estimated number of individuals with two or more ADLs as the denominator. As a result, the disability rate trend (a decline among those age 65 and over and an increase among those under age 65) means fewer HCBS users for those age 65 and over and more users for those under age 65 than if the use rate were based on the total non-institutionalized population (rather than those with two or more ADLs).

The way the model distributes those who would have used a nursing home ("new" HCBS users) by county reflects the historical rates of use of the particular service. Like the county-level estimates of long term care *need*, county-level impacts on HCBS *use* are a function of both the location of the nursing facility from which people are "diverted" and the overall population of each county. However, it would be unreasonable to assume that all of those "diverted" from nursing homes would use HCBS. Some would not qualify for the services listed, most of which are means tested. Others would use only some of the listed services. Still others would receive only informal care from family members or other unpaid helpers. Instead, the model assumes that individuals diverted from nursing facilities (i.e., those who would have used a nursing facility if the nursing facility use rate had remained the same) are twice as likely as individuals in the community to use a specific home or community based service. .

Because the model uses historical 2007 county-level service use rates, low use counties continue to use fewer services and high use counties continue to use more services. This illustrates why counties should not construe these projections of HCBS use as "targets." If they were targets, one might set them higher for counties with relatively low rates of HCBS use, in order to promote growth in HCBS infrastructure.

The following examples illustrate how the various factors can work to influence estimates of HCBS use in a county:

- **County X** expects large growth in its 85+ population from 2007 to 2017. County X currently has a very high rate of use of most HCBS programs, particularly in its 85+ population. In 2017, the growth in the overall size of the 85+ population will cause the number of HCBS users in County X to grow even higher.

- Like County X, **County Y** expects large growth in its 85+ population from 2007 to 2017. However, unlike County X, County Y currently has very low rates of use of its HCBS programs, even among its 85+ population. In 2017, the growth in the 85+ population in County Y will cause HCBS use to increase, but County Y will still have much lower rates of HCBS use than County X.

In addition, the State's overall expected trend in nursing home use will affect counties somewhat differently. For example:

- Like County Y above, County Z reports low rates of use of its HCBS programs. However, County Z has a larger population and a larger percent of that population in nursing facilities. Thus, County Z will account for a larger share of the statewide nursing facility decline and will therefore see a larger increase in its number of people in the community in need of and using long term care services.

Intensity of Use of Long Term Care Services

The model provides projections of the number of *people* using long term care services. While this is a good indicator of the expected trend in the amount of services used, it is not a direct measure of utilization growth. Examples of more direct measures include total hours or total days of a particular service used. These more direct measures would better capture any changes in the average intensity of use over time – for example, an increase in the average number of Homemaker hours received per user. If the intensity of use of long term care services increases over the projection window, total utilization will increase faster than the number of users.

V. Modeling Approach

This section describes the steps used to produce the estimates and projections of long term care need and use, using the data and assumptions described above. We first estimate disability in 2000 at the state and county level, by age and income group. Next, we project disability to 2007 using actual nursing home use data and disability trend assumptions, and then to 2012 and 2017 using the user-specified disability and nursing home trend assumptions. We then project use of long term care services for selected programs.

Estimating Disability in 2000

Before we addressed disability, we had to produce the necessary total population counts by county and age group. We adjusted the county-level population projections provided by VDAIL from total to non-institutionalized by subtracting the number of people institutionalized by county per Census 2000 data.[8] We used Census Bureau data here rather than the nursing facility use data supplied by VDAIL because: 1) the Census data also includes individuals in institutions other than nursing facilities, such as correctional facilities, and 2) the Census Bureau institutional data is more consistent with the population projections, which were also based on Census Bureau data.

We then stratified the population by income group (<100% poverty threshold, 100%+ poverty threshold) and detailed age group using the Lewin HCBS Population Tool[9] and county-specific data from the Census 2000 County Profiles.[10] We did this by first applying to each county the Vermont-wide proportion below 100% of the poverty threshold by detailed age group (from HCBS population tool), and then calibrating this to the number below 100% of poverty in each

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[8]   The U.S. Census Bureau defines institutionalized persons as "persons under formally authorized, supervised care or custody in institutions at the time of enumeration. Such persons are classified as 'patients or inmates' of an institution regardless of the availability of nursing or medical care, the length of stay, or the number of persons in the institution. Generally, institutionalized persons are restricted to the institutional buildings and grounds (or must have passes or escorts to leave) and thus have limited interaction with the surrounding community. Also, they are generally under the care of trained staff who have responsibility for their safekeeping and supervision." Institutions include correctional facilities, nursing homes, hospices, psychiatric hospitals, and juvenile facilities. (2000 Public Use Microdata Samples, Technical Documentation. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census, 2003.)

[9]   As described above, the Lewin HCBS Population Tool is a model that combines several data sources to produce state-level estimates of the number of community residents with disabilities. The tool also produces age and income distribution data for all community residents, regardless of whether they have a disability. See *Appendix A* for a description of the HCBS Population Tool and the assumptions and data sources it uses.

[10] Table Series DP-3. "Profile of Selected Economic Characteristics: 2000." These tables are based on a one-in-six sample of individuals who received the Census long form. These tables provide information about the number of individuals with household incomes above and below 100% of the Federal Poverty Threshold.

county by broad age group from published 2000 Census data. This approach allowed us to reflect each county's unique income distribution among their non-elderly and elderly populations, and within these groups to further reflect the typical relationship between income and age (e.g., among the 65+, older individuals tend to have lower incomes). Note that we used 100% poverty as a break point for this adjustment because that was the only break available from the published 2000 Census data at the county level. The adjustment was applied to a more detailed state-level income distribution for Vermont which included breaks at 100% poverty and 175% poverty, allowing us to produce estimates above and below 175% of the poverty threshold.

With the basic population data in place, we then applied the Vermont-specific disability rates by age group and income group for 2000 from the HCBS Population Tool to each county.[11] This approach ensures that the following variations by county are reflected in counties' disability estimates:

- age – counties with older populations have higher disability rates than the state as a whole.

- income – counties with a larger percentage of individuals below 175% of poverty have higher disability rates than the state as a whole.

Projecting Disability from 2000 to 2007

First, we derived the non-institutionalized population using the same approach as for 2000 but with the 2007 population projections. We then added to this the number of people "diverted" from nursing homes according to actual nursing home use data for 2000 to 2007. All individuals who were institutionalized were assumed to have 2+ ADLs. Thus, assuming a nursing facility use decline produces an increase in disability in the community. This approach will also have an (usually small) effect on the age distribution of the non-institutionalized population when nursing facility trend assumptions differ by age group, as under the default assumptions. However, we assume the income distribution in the community remains the same, as we have no data on which to base an alternative assumption.

Next, we adjust the resulting estimates of disability in the community by applying the disability trend assumption from the ASSUMPTIONS sheet[12].   The resulting final estimates appear on Tables 2 and 3 of the model's output.

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[11]   For the <18 age group, we applied the disability rate from HCBS Population Tool for people age 6-17, because the HCBS Population Tool excludes children younger than age six. ADL-based measures are generally not used for young children. Our approach allows us to reflect the fact that children younger than six with long-term care needs exist, and assumes that their prevalence rate is similar to that for older children.

[12]   Specifically, the calculation for 2007 is: $(1+T)^6 * DIS_{2000}$, where T is the disability trend assumption on the ASSUMPTIONS sheet and DIS_{2000} is the unadjusted disability rate in 2000. This calculation is performed separately by age group.

Projecting Disability from 2007 to 2012 and 2017

To project the number of people with disabilities from 2007 to 2012 and 2017, we used essentially the same approach we used for 2000 to 2007, but used disability trends and nursing facility use trends more in line with observed long-term trends. The nursing facility trend shown in *Exhibit 3* was used to reduce the number of nursing facility residents that results from simply assuming an age-specific use rate, and the size of the reduction became the number "diverted" from nursing facilities. These individuals, now living in the community, were assumed to have 2+ ADLs. Then the community disability rates are adjusted for the assumed disability trends.

Estimating and Projecting LTC Use

We produced county-level long term care use projections, displayed in Tables 4 and 5 of the model's output which show the number of users for each specific long term care program in Vermont. These projections assume that historical county-level use patterns persist. Tables 4 and 5 of the model's output present projected use by program. There are two assumptions that drive the trends in the number of users over time:

- First, for the majority of individuals, we assume that the age-specific rates of use of a given service in a given county will remain the same as observed in the latest year available (i.e., 2007).

- Second, we assume that individuals "diverted" from nursing facilities have a greater probability of using the service than other people in the community.

For the first assumption, we calculated use rates by age group for each service for each county, using the following age breaks: <18, 18-54, 55-84, and 85+. We chose these age groups because they best captured the age shifts expected to occur in Vermont between 2007 and 2017 while allowing us to limit the number of age groups for computational simplicity. Individuals age 85 and older have the highest rates of use of long term care services. In addition, many baby-boomers move into the 55-84 age group during the projection period, continuing a trend observed before the projected period.

For the second assumption, individuals "diverted" from nursing facilities refers to people in 2012 or 2017 who would have been classified as nursing facility residents if the nursing facility trend assumption from 2007 were zero (i.e., the use rate remained the same on an age-specific basis). As explained earlier, these individuals would have a higher likelihood of needing and using HCBS than the typical community dweller. Assuming that individuals with 2+ ADLs are twice as likely as the average community dweller to use paid helpers of some kind[13], we adjusted the age-specific use rates for "diverted" individuals, capping the probability at 100% so that we would not assume more users than diverted individuals.

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[13] Based on an analysis of the 1994 National Long Term Care Survey, in: Korbin Liu et al., The Urban Institute, January 2000.

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VI. Changes from the Previous Model

Several major changes to the methodology used in the 2006-2016 model were implemented for this year's estimates and projections.

1. **Nursing Facility Use: Lamoille County Adjustment for Last Two Quarters** - As in past versions of the model, we use the average of four quarters of MDS nursing facility census for all counties. For Lamoille County's third and fourth quarters, we added approximately 20 NF residents. These 20 NF residents came from the Morrisville Center Nursing Facility which closed on January 31, 2007. This closure left only one small 40 bed nursing facility in Lamoille County so the State agreed to let this facility (The Manor) serve 20 NF residents from the closed facility in its unused Enhanced Residential Care (ERC) beds. Those 20 ERC beds received a "special rate" which was a nursing facility reimbursement rate.

   We also capped the NF residents at 72 when projecting NF use for Lamoille County in 2012 and 2017. The Manor received Certificate of Need approval in April 2008 for 32 new NF beds. Including the 32 new beds, Lamoille County now has a total of 72 licensed NF beds. We capped the 2012 and 2017 projected number of NF residents in Lamoille County at 72 because no facility's occupancy rate can exceed 100%.

2. **Exclude nursing facility transfers due to closures** - It is important to distinguish between community diversions resulting from the NF use rate decline versus NF closures where many of the NF residents transfer to other NFs rather than the community. We compared NF resident declines in counties having NF facility closures between SFY 2000 and SFY 2006 with statewide overall NF declines before and after the closures. If the statewide NF resident decline is less than that of the county where the closure occurred, we assume some of the diverted NF residents went to other nursing facilities in that county or other counties. Three counties had closures that met this criterion: Addison, Orange & Windham. In these counties, the difference between the statewide and county NF decline was excluded from the population diverted to the community because of transfers to other nursing facilities. We assume the excluded residents' ages mirror the NF statewide age distribution for that state fiscal year.

   Rutland and Lamoille Counties also had NF closures between 2000 and 2006. When Sager (Rutland) closed, VDAIL staff indicated that most of the NF residents transferred to a border NF in New York State. When Morrisville (Lamoille) closed, VDAIL staff tracked the 64 total residents and found that 39 transferred to NF's in other counties and 20 transferred to The Manor's ERC in Lamoille County to receive nursing home care. As a result, 59 people are excluded and a net of five people were diverted to the community in Lamoille County as a result of Morrisville's closure.

3. **Residence of NF Residents Diverted to the Community** - From this version of the model forward, all diverted individuals in each county remain in the same county, based on the assumption that people originated from that county. In prior years, 67% of

diversions related to nursing facility closures were distributed across all counties based on population and 33% remained in the county of the nursing facility.

4. **Project Disability from 2007 to 2012 and 2017** – We adjusted the disability rate for 2012 and 2017 to reflect the assumed disability trends that occurred between 2000-2007. In previous versions of the model, we only adjusted the disability trends between 2007-2012 for 'Cnty_2012' sheet and the trends between 2007-2012 and 2012-2017 for 'Cnty_2017' sheet. However, since the model began in 2000, the model should include the disability trends between 2000 and the base year (2007) for all projection years. These changes were applied in this version of the model resulting in slightly fewer individuals with disabilities in the projection years.

5. **Exclude Traumatic Brain Injury (TBI) from the List of HCBS Programs to which the Model Distributes the Diverted Individuals from NFs** - People have to be diagnosed with a moderate to severe brain injury to qualify for the TBI Program. The eligibility requirement does not rely on ADLs as is the case for the other HCBS programs. Also, the number of people in the TBI Program has steadily increased over the last few years due to the Iraq War and combat in Afghanistan, confirming that the use trend for this program is not driven by baseline population changes, disability trends, or nursing home use trends.

Appendix A: The HCBS Population Tool

2000 Census Public Use Microdata Sample (PUMS) – The PUMS data is at individual level and includes actual responses to the 2000 Census questionnaire for a 5 percent sample of the population. Each PUMS must meet a minimum population threshold of 100,000. PUMS may not cross state boundaries and states are entirely comprised of PUMS (i.e. there is no territory that is not assigned to a PUMS). PUMS can be defined in terms of counties. Large urban counties are typically subdivided into multiple. In less populated rural areas PUMS are typically comprised of multiple smaller contiguous counties.

The PUMS data contain responses for three broad questions about disability for all persons aged 15 and older. The three questions are:

- Does this person have a physical, mental, or other health condition that has lasted for 6 or more months and which limits the kind or amount of work this person can do? ("work limitation")

- Because of a health condition that has lasted for 6 or more months, does this person have any difficulty . . .

    Going outside the home alone, for example, to shop or visit a doctor's office? ("mobility limitation")

    Taking care of his or her own personal needs, such as bathing, dressing, or getting around inside the home? ("personal care limitation")

1996 panel of the Survey of Income and Program Participation (SIPP) -- A nationally representative longitudinal survey of the community-dwelling population. The SIPP includes two sets of questions about disability, a childhood disability module (Wave 5, collected in 1997), and an adult disability module (Wave 11, collected in 1999). The SIPP provides greater detail about disability by asking many more questions than the decennial census instrument. However, the SIPP data do not support state level analyses.

Tool Exclusion

The HCBS Tool excludes individuals residing in institutions, which include nursing facilities, psychiatric inpatient hospitals, and Intermediate Care Facilities (ICF-MRs).[14]

Modeling Methods

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[14] The U.S. Census Bureau defines institutionalized persons as "people under formally authorized, supervised care or custody in institutions at the time of enumeration; such as correctional institutions, nursing homes, and juvenile institutions." (2000 Public Use Microdata Samples, Technical Documentation. Washington, DC: U.S. Dept. of Commerce, Bureau of the Census, 2005. B-13. at http://www.census.gov/prod/cen2000/doc/pums.pdf)

We began with a sample of residents of all 50 states and the District of Columbia from the 2000 Census Public Use Microdata Sample (PUMS) and the three broad disability questions it asks. However, these types of limitations are not good measures for assistance needs. More commonly used to define disability are the so-called functional limitations, usually defined as requiring the help of another person in order to perform any of a number of Activities of Daily Living (ADLs) or Instrumental Activities of Daily Living (IADLs).

ADL limitations were defined as *requiring the help of another person to perform* the following activities:

- bathing,
- dressing,
- eating,
- transferring,
- using the toilet, and
- getting around inside the house.

Similarly, IADL disabilities were defined as needing the help of another person with the following six activities:

- paying bills,
- taking medication,
- using the telephone,
- getting around outside the house,
- doing light housework, and
- preparing meals.

In order to generate estimates of the numbers of persons with functional limitations, we employed a non-parametric mapping technique that assigned each individual in our PUMS data set a set of probabilities of having different functional limitations, conditional on the individual's age and his or her answers to the PUMS disability questions. We initially experimented with a multinomial logistic regression framework for assigning individual probabilities of functional disability levels. The results of this investigation showed that *conditional on PUMS disability and age*, other demographic factors did not play a statistically or practically significant role in predicting functional disability. However, there were significant interactions between the PUMS disability measures, so we decided to use a simple non-parametric table function to assign disability.

Our data sources were the 1996 panel of the Survey of Income and Program Participation (SIPP) disability modules. We constructed two sets of disability measures:

- a set of three questions almost identical in wording to the PUMS disability questions (see Appendix A), and

- a hierarchical set of mutually exclusive classes of disability (MR/DD, 3+ ADLs, 2 ADLs, 1 ADL, IADLs only, and none).

We first considered whether an individual had MR/DD, regardless of his or her ADL and IADL status. Then, if an individual did *not* have MR/DD, we assigned them to one of the functional (ADL/IADL) categories. Individuals were considered to have MR/DD if they (or a proxy) responded "yes" to questions of whether he or she had mental retardation or "a developmental disability such as autism or cerebral palsy." Individuals were also considered MR/DD if they reported any of the following conditions:

- Cerebral palsy;

- Mental retardation; or

- Autism.

Note that in defining disability, MR/DD was considered to be the primary diagnosis; an individual with ADL or IADL disabilities was included in the MR/DD group rather than one of the functional disability groups.

For each possible combination of age (arranged into discrete categories, e.g. 65-74) and of answers to the PUMS disability questions (e.g. personal care = no, mobility = yes, work = yes), we generated the distribution of hierarchical disability levels observed in the SIPP data. This allowed us to assign each community record in the PUMS data a probability of being in each of the mutually exclusive disability classes. Letting bold letters denote vectors and letting i be a vector of ones, we then have

$$P(d^{SIPP}) = f(d_i^{Census}, age_i) \quad \text{where} \quad P'i = 1.$$

The poverty level used for the Tool is based on the U.S. Census Bureau money income thresholds that vary by family size and composition. If a family's total income is less than that family's threshold, then that family, and every individual in it, is considered poor. The poverty thresholds do not vary geographically, but they are updated annually for inflation using the Consumer Price Index (CPI-U). In 2000, the federal poverty threshold for a single person was about $8,794 per year, while the corresponding amount for a family of four with two children was about $17,463.[15]   The official poverty definition counts money income before taxes and does not include capital gains and noncash benefits (such as public housing, Medicaid, and food stamps). *Appendix C* presents the federal poverty threshold levels in more detail.

The Census Bureau poverty thresholds are used mainly for statistical purposes — for instance, preparing estimates of the number of Americans in poverty each year. Poverty guidelines are

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[15]   Source: U.S. Bureau of the Census, 2000 Current Population Survey.

the other version of the federal poverty measure. They are issued each year in the *Federal Register* by the Department of Health and Human Services (HHS). The guidelines are a simplification of the poverty thresholds for use for administrative purposes — for instance, determining financial eligibility for certain federal programs – and are available at http://aspe.hhs.gov/poverty/poverty.htm.

A more extensive discussion of poverty thresholds and poverty guidelines is available on the Institute for Research on Poverty's Web site.

To construct weights for the years,2003, 2004, 2005, 2006, 2007, 2010, and 2015 we applied Census Bureau projections of state- and age-specific growth rates to the 2000 weights.[16]

Because trends in disability prevalence are a subject of some contention, we employed a conservative strategy of assuming constant disability prevalence, conditional on age and income relative to poverty. In other words, any trends in disability observed in the model are functions of improving economic conditions and/or demographic shifts. An ambitious user could simulate disability trends by multiplying the Tool's population estimates by the ratio of the new disability prevalence (as assumed by the user) to the original disability prevalence implied by the model estimates.

To create counts of the number of community individuals with different levels of disability, we summed the individual-level functional disability probabilities across age and income groups. If we let a subscript i denote an individual record, and let

y_i = family income as a percentage of the poverty threshold for individual i,

a_i = age group for individual i,

$\mathbf{d}_i$ = a vector representing individual i's responses to the PUMS disability questions,

w_i^{00} = the 2000 PUMS population weight for individual i,

r_i^t = the year "t" re-weighting for individual i (depends on age, income : poverty),

k = a specific type of functional disability ($k = 1, ..., K$),

P_{ik} = the probability that person i falls into disability category k (depends on age, income : poverty, and PUMS disability), and

$N_k^t(A=a, Y=y)$ = the total state-wide count of individual's with functional disability k in year "t", for the age group a and income : poverty group y.

then,

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[16] State-level projections are available on the Census Bureau web site at http://www.census.gov/population/www/projections/stproj.html.

$$N_k^t(A = a, Y = y) = \sum_{i:a_i=a, y_i=y} w_i^{00} \cdot r^t(a_i, y_i) \cdot P_k(a_i, y_i, d_i)$$

The state-level counts of community residents with some type of functional disability thus represent a weighted sum of the individual probabilities of having that type of functional disability.

Adjustment to Working Age Adults

Because the prevalence of "Census-like" disability among working-age adults was considerably higher in the PUMS data than in the SIPP data (see *Table A3* in *Appendix B*), we made an *ex post* adjustment to the numbers of adults with functional disabilities. The numbers were adjusted downward for the adult group to match the national prevalence rates observed in the SIPP and National Health Interview Survey on Disability (NHIS-D).

Consistency with Other Sources of Disability Data

Exhibits A-1 to *A-3* below compare estimates of the national prevalence of different types of disability from a variety of sources, including the Lewin model. Separate tables are presented for each of the major age groups (children, adults, and the elderly). They show that the Lewin model estimates correspond closely to those from other popular surveys.

**Exhibit A-1: Comparison of Prevalence of Disabilities
among Children Age 6-17 in the Community (%)**

Source*	MR/DD	One or more ADLs
Lewin Model (2004)	1.6	0.2
Lewin Model (2000)	1.6	0.4
SIPP (1997)	1.4	0.1
NHIS-D (1994-95)	3.2	0.8
MMWR (1993)	1.1	N/A
MEPS (1998)	N/A	0.5

**Exhibit A-2: Comparison of Prevalence of Disabilities
among Adults Age 18-64 in the Community (%)**

Source*	MR/DD	One or more ADLs	Any ADL or IADL
Lewin Model (2004)	1.0	0.9	2.1
Lewin Model (2000)	0.9	0.9	2.2
SIPP (1997)	1.0	0.9	2.1
NHIS-D (1994-95)	0.9	0.9	2.1
MMWR (1993)	0.7	N/A	N/A
MEPS (1998)	N/A	0.8	1.9

**Exhibit A-3: Comparison of Prevalence of Disabilities
among Elderly Adults Age 65 and Older in the Community (%)**

Source*	MR/DD	One or more ADLs	Any ADL or IADL
Lewin Model (2004)	0.4	7.6	17.0
Lewin Model (2000)	0.5	6.9	16.6
SIPP (1997)	0.5	7.3	16.7
NHIS-D (1994-95)	0.4	6.2	12.3
MCBS (1998)	N/A	7.1	17.6
NLTCS (1999)	N/A	7.0	11.3
MEPS (1998)	N/A	6.9	12.7

* Description of Sources:

MCBS – Medicare Current Beneficiary Survey (1998)

MEPS – Medical Expenditure Panel Survey (1998)

MMWR – *Mortality and Morbidity Weekly*, Jan. 26, 1996 / 45(03): 61-65. Available online @ http://www.cdc.gov/mmwr/preview/mmwrhtml/00040023.htm

NHIS-D – National Health Interview Survey Disability Supplement (1994-95)

NLTCS – National Long-Term Care Survey (1999), as reported in *Table A-1* of Spillman, Brenda, 2002, "Changes in Elderly Disability Rates and the Implications for Health Care Utilization and Cost."

SIPP – Survey of Income and Program Participation, 1996 Panel, Wave 11 Adult Disability Module (1999)

In general, the Lewin estimates are very similar to those derived from other sources, but a couple of exceptions are worth noting. First, as is evident from *Table 1*, estimates of MR/DD prevalence among children 6-17 vary greatly by source. This variation appears to be due primarily to the way in which different researchers have operationalized the definition of MR/DD. In the case of the *MMWR* estimates, the prevalence (1.14 percent) is relatively low because it only counts individuals receiving special education or other MR/DD-related services

are counted. On the other hand, the NHIS-D estimates are relatively high (3.17 percent) because researchers have used very inclusive definitions of these conditions.[17]

Second, Lewin estimates of "any ADL or IADL" tend to be slightly higher than their counterparts from some other surveys. This is partly because the Lewin model uses a relatively inclusive definition of ADLs and IADLs, including six of each while many of the other surveys use only five of the six. However, the National Long-Term Care Survey (NLTCS) uses the most inclusive ADL and IADL definitions of any survey presented and still finds the lowest rate of IADL disabilities. In contrast, previous versions of this survey have consistently found significantly higher rates of IADL disability (see Spillman, 2002).

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[17] See Larson, Lakin, Anderson, and Kwak, 2001, Demographic characteristics of persons with MR/DD living in their own homes or with family members: NHIS-D Analysis, *MR/DD Data Brief* (University of Minnesota: Minneapolis, Institute on Community Integration), 3(2).

Appendix B: Disability Definitions in the 2000 Census and their SIPP Counterparts (Age 15+ Only)

Exhibit B-1 illustrates the common disability questions in the SIPP and PUMS that we used to match data from the two sources.

**Exhibit B-1: Comparing 2000 Census PUMS,
1996 SIPP Wave 11 Disability Module**

2000 Census PUMS (Age 15+)	SIPP Adult Disability Module (Age 15+)
17. Because of physical, mental, or emotional condition lasting 6 months or more , does this person have any difficulty doing any of the following activities	
b. Dressing, bathing, or getting around inside the home?	EDRESSD: Dressing? *or* EBATHDIF: Taking a bath or shower? *or* EINDIF: Getting around inside the home?
c. Going outside alone to shop or visit doctor's office?	EOUTDIF: Going outside the home, for example, to shop or visit a doctor's office?
d. Working at a job or business?	EJOBDIF: Does/Do ... have a long-lasting physical or mental condition that has made it difficult to remain employed? *or* to find a job? *or* EDISABL: Does … have a physical, mental, or other health condition that limits the kind or amount of work … can do? *or* EDISPREV: Does ... health or condition prevent ... from working at a job or business?

   Note: All italics are this author's.

Exhibit B-2 shows which disability questions were used for specific age groups.

Exhibit B-2: Age Groups 2000 and Census Disability Questions Used in Mapping

Age Group	2000 Census Disability Questions Used		
	"Mobility"	"Personal Care"	Work
Child: 6-14*	No	No	No
Child: 15-17*	Yes	Yes	No
Adult: 18-64	Yes	Yes	Yes
Elderly: 65+	Yes	Yes	No

*   2000 Census disability questions were only available for those youths age 15 and older, so functional limitations were assigned to younger children (age 6-14) on a purely probabilistic basis.

Note: A "mobility limitation" is defined as difficulty going outside of the home alone, e.g. to shop or visit a doctor's office. A "personal care limitation" is difficulty dressing, bathing, or getting around inside the house. Work disability was coded as "yes" if the respondent reported difficulty holding a job and/or impossibility of holding a job.

Exhibit B-3 compares the proportion of respondents reporting the three different types of disability measured by the Census in both the PUMS and the SIPP. While the prevalence rates are relatively close for the elderly, among adults, the PUMS respondents report far more mobility limitation than their SIPP counterparts. The HCBS Population Tool was adjusted in order to account for this discrepancy.

**Exhibit B-3: Comparing the Prevalence of 2000 Census Disability
in the 2000 PUMS and SIPP**

Age Group	Disability	Prevalence (% of community)	
		2000 PUMS	**SIPP**
	Work	N/A	N/A
Child 6-17	Mobility	N/A	0.6
	Personal Care	0.9	0.6
	Work	12.0	10.2
Adult 18-64	Mobility	6.4	1.9
	Personal Care	1.8	1.4
	Work	N/A	N/A
Elderly 65+	Mobility	20.4	15.1
	Personal Care	9.7	10.6

Appendix C: Detailed Federal Poverty Guidelines, 2007

Exhibit C-1: Poverty Thresholds in 2007, by Size of Family and Number of Related Children Under 18 Years

Size of family unit	Weighted average thresholds	Related children under 18 years								
		None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person (unrelated individual)	$8,794									
Under 65 years	$8,959	$10,787								
65 years and over	$8,259	$9,944								
Two persons	$11,239									
Householder under 65 years	$11,590	$13,884	$14,291							
Householder 65 years and over	$10,419	$12,533	$14,237							
Three persons	$13,738	$16,218	$16,689	$16,705						
Four persons	$17,603	$21,386	$21,736	$21,027	$21,100					
Five persons	$20,819	$25,791	$26,166	$25,364	$24,744	$24,366				
Six persons	$23,528	$29,664	$29,782	$29,168	$28,579	$27,705	$27,187			
Seven persons	$26,754	$34,132	$34,345	$33,610	$33,098	$32,144	$31,031	$29,810		
Eight persons	$29,701	$38,174	$38,511	$37,818	$37,210	$36,348	$35,255	$34,116	$33,827	
Nine persons or more	$35,060	$45,921	$46,143	$45,529	$45,014	$44,168	$43,004	$41,952	$41,691	$40,085

Source: U. S. Bureau of the Census, Current Population Survey at http://www.census.gov/hhes/www/poverty/threshld/thresh07.html.

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