

Measuring state Medicaid home care participation and intensity using latent variables

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Abstract

Population aging and policies to redirect long-term care towards home and community-based services have led to increases in Medicaid home care spending in most states. Changes in state Medicaid home care policy generosity may result from changes in the number of persons served (i.e. Participation) and/or changes in quantities of services covered (i.e. Intensity). This study measures state Medicaid home care Participation and Intensity comprehensively using latent variables, and uses those latent variables to describe changes in Medicaid home care policy

generosity over time and across states. Yearly state-level data from the Medicaid Statistical Information System (1999-2012) are analyzed using exploratory and confirmatory factor analyses. Between 1999 and 2012, twenty-nine states expanded both Participation and Intensity, while six states reduced both. In the remaining states, a trade-off occurred. Distinguishing between Medicaid home care Participation and Intensity deserves attention, as expansions along these two dimensions represent potentially different implications for beneficiaries.

Keywords: state Medicaid home care policy, home care, comprehensive measure, latent variable, latent construct, factor analysis

Introduction

States can increase their Medicaid home care policy generosity in two main ways: by expanding access to home care programs and/or by providing larger quantities of care to home care users, once access is granted (Kemper, Weaver, Short, Shea, & Kang, 2008). Stated differently, states can increase generosity in the Participation and/or Intensity dimensions of Medicaid home care policy.

Medicaid-funded home care mainly includes home health and personal care services provided under states' Home Health Plans, Personal Care Plans, and several waivers and demonstrations. Home care services represent the bulk of Medicaid home- and community-based services (HCBS) (Harrington, Ng, Laplante, & Kaye, 2012; Konetzka, 2014). Home care services continue to expand and represent increasing proportions of Medicaid long-term services and supports (LTSS), in part as a result of the provisions in the Affordable Care Act (ACA) that promote such home-based services. Comparing the generosity of Medicaid home care policy across states and over time is needed to inform policy decisions. Doing that requires measures of state Medicaid home care policy that capture the strategies adopted by each state as comprehensively as possible.

One indicator of overall Medicaid home care policy generosity commonly found in the literature is states' Medicaid home care expenditures per capita. Variants of this indicator include Medicaid home care expenditures per enrollee, HCBS or home care expenditures per elderly individual, and Medicaid 1915(c) Waiver expenditures per eligible or enrolled elderly individual in each state (Eiken, Sredl, Burwell, & Woodward, 2017; Gardner & Gilleskie, 2012; Kemper et al., 2008; Kenney & Rajan, 2000; Muramatsu & Campbell, 2002; Muramatsu, Yin, Campbell, Hoyem, Jacob, & Ross, 2007; Muramatsu, Hoyem, Yin, & Campbell, 2008; Muramatsu, Yin, &

Hedeker, 2010; Ng, Harrington, & Musumeci, 2011; Pezzin & Kasper, 2002; Rahman, Tyler, Thomas, Grabowski, & Mor, 2015). Another common indicator is the percentage of LTSS expenditures allocated to home care or HCBS. This can be viewed as a measure of the degree of priority given to home care or HCBS over institutional LTSS (Blackburn, Locher, Morrisey, Becker, & Kilgore, 2016; Borck, Schmitz, Doty, & Drabek, 2016; Burr, Mutchler, & Warren, 2005; Eiken et al., 2017; Gardner & Gilleskie, 2012; Konetzka, Karon, & Potter, 2012; Miller, 2011; Mor, Zinn, Gozalo, Feng, Intrator, & Grabowski, 2007; Muramatsu et al., 2007, 2008; Ng et al., 2011; Pezzin & Kasper, 2002; Rice, Kasper, & Pezzin, 2009; Thomas & Mor, 2013; Wenzlow, Eiken, & Sredl, 2016). Some studies report the number of participants on Medicaid HCBS programs per capita, or the percentage of Medicaid LTSS beneficiaries who receive home care/HCBS rather than institutional services. Both of these can be seen as indicators of participation in Medicaid home care programs (Borck et al., 2016; Eiken, 2017a; Eiken, 2017b; Kitchener, Ng, & Harrington, 2007a, 2007b; Ng et al., 2011). Finally, a few studies present indicators of intensity of use of HCBS services provided under different Medicaid programs, namely expenditures per participant in 1915(c) Waivers, Personal Care Plans, and Home Health Plans, and total HCBS spending per HCBS user (Borck et al., 2016; Ng, Harrington, Musumeci, & Ubri, 2016; Rice et al., 2009).

The literature relies on the above observed indicators of home care use to capture an inherently latent concept —Medicaid home care policy generosity— because states’ policies are challenging to measure. As noted for example by Borck et al. (2016), within the federal guidelines, states have considerable latitude to design their Medicaid systems. For instance, under Section 1915(c) waiver programs, states can provide a large range of services and supports, limit those services to specific populations or geographic locations, and limit the numbers of

participants and operate waiting lists. The criteria regarding the level of care needs to be eligible for certain services vary considerably across states. In short, states use diverse provisions and strategies to provide home care. Observed indicators, based on expenditures or numbers of participants, are the results of those provisions and strategies and can be used to capture states' generosity. Nevertheless, the choice of indicator(s) is somewhat arbitrary, subject to measurement errors, and gives a partial view of generosity.

Many studies rely on one indicator to capture states' Medicaid home care policy generosity. Kemper et al. (2008) suggest decomposing Medicaid home care expenditures into number of users and expenditures per user, as a way to capture separately participation in Medicaid home care programs and intensity of use by participants. This approach is practical as well as conceptually appealing. Conditional on financial resources, a state may want to serve more people with lower level of home care services or provide a comparatively smaller share of its population with higher level of care, depending on the goals of the expansion. For example, serving more people may achieve the goal of reducing unmet need in the community among individuals with less severe needs. Increasing spending per person, on the other hand, may be a better strategy to reduce institutionalization among individuals with higher level of needs. These two dimensions of state Medicaid home care policy, Participation and Intensity, are seldom explicitly considered in prior studies, although they may evolve differently over time, have different implications for beneficiaries, and impact differently health care use and health outcomes.

The objectives of this study are twofold: to measure the Participation and Intensity dimensions of state Medicaid home care policy comprehensively as latent variables, and to describe Medicaid home care policy generosity over time and across states based on those latent variables.

Compared to observed indicators, such latent constructs have three main advantages: they provide more comprehensive measures of state Medicaid home care Participation and Intensity, overcome measurement errors inherent to observed indicators, and prevent the subjective selection of specific indicators as proxies for state Medicaid home care policy.

Using factor analysis, we develop a measurement model of state Medicaid home care policy in which Participation and Intensity are two latent variables. In such measurement models, observed correlated indicators are assumed to be reflections of the same underlying latent variable —i.e. dimension of state Medicaid home care policy. Figure 1 illustrates the measurement model where the Participation and Intensity dimensions (in ellipses) are measured by three indicators each (in rectangles). The arrows pointing at the indicators from the right-hand side represent indicator-specific measurement errors —i.e. this measurement strategy takes measurement errors explicitly into account. The two latent dimensions may be correlated, as indicated by the curved double-sided arrow between them. Starting with all available indicators that potentially reflect states' Medicaid home care Participation and Intensity, factor analysis helps select a final set of indicators that best measure each dimension. The selection is based on the strength of the relationships between the indicators and the latent dimensions, preventing arbitrary selection of indicators. Thus, states' Medicaid home care Participation and Intensity are measured comprehensively by the best set of available indicators.

In addition, we consider the types of home care services regardless of the specific Medicaid mechanisms under which they are provided; i.e. State Plans or waivers/demonstrations. This approach differs from what has been done in the literature so far and may provide new insights, as looking at a specific mechanism in isolation may miss an important proportion of home care received (Konetzka et al., 2012).

Method

Data

We draw data from the Medicaid Statistical Information System (MSIS) State Summary Datamarts. The datamarts provide a state-level aggregation of eligibility and claims data submitted by states to the Centers for Medicare and Medicaid Services (CMS) through MSIS — i.e. aggregation of Medicaid Analytic eXtract (MAX) data. We use yearly data for the 51 states from 1999 to 2012 (including the District of Columbia). There are 685 observations (2 states are missing in 2011 and 27 states in 2012).

We consider fourteen indicators available in MSIS that potentially capture the Participation and Intensity dimensions of state Medicaid home care policy (Table 1). We distinguish between the two main types of home care: home health and personal care. We include not only those services provided under states' mandatory Home Health Plans and optional Personal Care Plans but also home health and personal care services provided under Sections 1915(c), 1915(i), and 1915(j) waivers and demonstrations, among others. Below, total home care (HC) refers to the sum of home health (HH) and personal care (PC). Long-term care (LTC) includes home care and nursing home care. Potential indicators of state Medicaid home care Participation are home health, personal care, and total home care users per capita, as well as total home care users per LTC user. Potential indicators of state Medicaid home care Intensity are home health, personal care, and total home care expenditures per user. We construct analogous indicators for persons 65 years and older (65+) because they represent more than 50% of Medicaid LTSS users (Reaves, 2013). A person who receives both home health and personal care services in any given year is intentionally counted twice in the home care users total. Expenditures are adjusted for inflation

and purchasing power differences between states, using the implicit regional price deflator (Bureau of Economic Analysis [BEA], 2014).

Our focus is Medicaid home care, distinguishing between the main types of home care services, home health and personal care. Nevertheless, at least in some states, most home health users are short-term users. Thus, it may not be fully appropriate to consider home health services to be LTC. With this in mind, we conduct a sensitivity analysis excluding Medicaid home health.

MSIS is the only source of Medicaid data rich enough to provide all the indicators considered. As happens with any Medicaid data source, it has some limitations. We employed a number of strategies to guarantee the quality of the data.¹ Overall, our measurement model of Medicaid home care Participation and Intensity takes measurement errors in each indicator explicitly into account. This is an advantage of measuring states' generosity using latent variables that helps limit potential issues with the data. As some states do not report data for managed LTSS programs through MSIS, we conduct a sensitivity check where we reproduce our analyses on the subset of states without managed LTSS programs.² We conduct two additional sensitivity checks where we exclude one state or one year of data at a time to see whether it has an impact on our measurement model of state Medicaid home care Participation and Intensity.

Table 1 shows the summary statistics of all available indicators. Overall, there are wide variations over time and across states. For example, nearly 0% of Tennessee's population in 2011 uses Medicaid home care services, compared to 2.96% in Minnesota in 2011. Medicaid home care expenditures per user vary between 101 dollars (Alabama, 1999) and 37,720 dollars (Tennessee, 2009).

[Table 1 about here.]

Factor analyses

We conduct exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Jöreskog, 1969; Spearman, 1904). In EFA, all possible relationships between the latent dimensions and available indicators are estimated; i.e. no structure is imposed. In CFA, only the relevant relationships are taken into account, based on EFA results. Those relationships are measured by coefficients called ‘factor loadings’ or simply ‘loadings’. Indicators with loadings above 0.7 are typically considered relevant measures of one latent dimension. Smaller loadings mean that the latent dimension accounts for less than 50% of the variation in the indicator (0.7^2). As a preliminary step, one typically starts with EFA of all available indicators. EFA shows whether the two dimensions we are interested in —Participation and Intensity— truly exist and are reflected by the available indicators. CFA is then used to validate and evaluate the measurement model established in our conceptual framework and initially informed by EFA results (Brown, 2006). It is considered good practice to conduct the EFA and CFA using distinct samples, sometimes called the derivation and validation samples (e.g. Moyo, Huang, Simoni-Wastila, & Harrington). For this purpose, we split the sample in two (twenty-five/six states each).

The goal is to achieve a final CFA model with good fit. Therefore, first we estimate a CFA model using all indicators with loadings above 0.7 in the EFA, and then we drop indicators until we achieve a good fitting model. Once the best CFA model is obtained in the validation sample (twenty-five states), it is applied to all fifty-one states. This is a way to verify external consistency. Relying on current best practice, the following indices are used to evaluate the CFA model fit: χ^2 statistic, root mean square error of approximation (RMSEA), standardized root mean squared residual (SRMR), Tucker-Lewis Index (TLI), and Comparative Fit Index (CFI).³

The full information maximum likelihood estimator is used, as it relies on all available information without deleting observations with missing values. Standard errors are clustered at the state level.

Lastly, to assess internal consistency of the final latent constructs, we use Cronbach's alpha (Cronbach, 1951). Internal consistency is considered good if Cronbach's alpha exceeds 0.8. The final optimal CFA model is used to estimate the values of the latent dimensions for each state in each year —i.e. factor scores. These values are used to classify states by their levels of generosity in Medicaid home care Participation and Intensity; factor scores have no numeric meaning *per se*.

Results

Measurement of state Medicaid home care Participation and Intensity

EFA results, based on the first half of the states and all fourteen indicators considered, are reported in Table 2. As expected, we get two latent dimensions that correspond to the Participation and Intensity dimensions of state Medicaid home care policy, based on the indicators that reflect them. The Participation dimension is reflected by five indicators with large loadings, above 0.7. They are personal care users per capita, personal care users per 65+ persons, home care users per 65+ persons, home care users per LTC user, and home care users per 65+ LTC user. The Intensity dimension is reflected by four indicators: home health expenditures per user, home health expenditures per 65+ user, home care expenditures per user, and home care expenditures per 65+ user. The two dimensions are independent, as indicated by a non-significant correlation.

[Table 2 about here.]

To conduct CFA on the second half of the states, we start with the nine indicators with loadings above 0.7 in the EFA. In subsequent CFA, we drop three additional indicators until we achieve the best fitting CFA model. This best fitting CFA model includes three indicators per dimension. It is applied to the entire country; the results are presented in Figure 1. The model has good or at least reasonable fit, depending on the criterion —e.g. RMSEA=0.05, TLI=0.94. Interpreting the loadings, standardized to lie between zero and one, is straightforward: the participation dimension accounts for 67% of the variation in personal care users per capita (0.82^2), 88% of the variation in home care users per 65+ persons (0.94^2), and 67% of the variation in home care users per LTC user (0.82^2); similarly for Intensity. As suggested by the EFA results, the correlation between the two dimensions is set to zero, i.e. they are independent. Cronbach's alpha takes values 0.89 for the Participation dimension, and 0.94 for the Intensity dimension; i.e. the model has good internal consistency.

[Figure 1 about here.]

Trends and geographic variations in state Medicaid home care Participation and Intensity

The measurement model in Figure 1 is used to estimate the values of state Medicaid home care Participation and Intensity. These values are standardized to have mean zero over all 685 state-year observations. Thus, a negative value indicates that, in the year considered, the state has a level of generosity (in the Participation or Intensity dimension) below the 1999-2012 sample mean; the opposite for a positive value. Globally, if generosity steadily increases over time,

negative values would be concentrated in the earlier years of the sample. The estimated levels of generosity in each dimension in 1999 and 2012 are reported in Table A1 in the Appendix. When generosity is higher in 2012 than in 1999, the 2012 values are highlighted in gray. Generosity in the Participation dimension of state Medicaid home care policy increased in thirty-four of the fifty-one states between 1999 and 2012. Generosity in the Intensity dimension increased in forty states during the same period. Overall, twenty-nine states expanded both Medicaid home care Participation and Intensity over the fourteen years, while six states reduced generosity in both dimensions. A trade-off seems to have occurred in five states that expanded Participation but reduced Intensity (e.g. Tennessee, Texas) and in eleven states that expanded Intensity but reduced Participation (e.g. Oregon, West Virginia).

To illustrate geographic patterns in addition to the time trends, Figures 2 and 3 map the different levels of generosity in state Medicaid home care Participation and Intensity in 1999 and 2012. We group states into quintiles based on the distribution of each latent construct (see Table A1 in the Appendix for the actual estimated values). In the maps, darker shades of gray represent higher quintiles of the distribution of generosity, based on the entire 1999-2012 sample. Globally for Participation, generosity increased in many states during the 1999-2012 period, but the increases are not large enough to be clearly visible. Still, the 2012 map has a few more states with a darker shade of gray than the 1999 one (e.g. Michigan, Washington; Figure 2). In 2012, there is limited geographic clustering in the Participation dimension of state Medicaid home care policy. The ten states in the top quintile are distributed across all the US census regions (e.g. California, Michigan, New York, Oklahoma). The same happens with the twelve states in the bottom quintile, which include for example Arizona, Florida, Kansas, and New Hampshire.

[Figure 2 about here.]

The increases in state Medicaid home care Intensity are stronger (Figure 3). For the Intensity dimension, the 2012 map has several more states with a darker shade of gray than the 1999 one (e.g. Rhode Island, Washington). Turning to geographic clusters, in 2012 the highest levels of generosity in the Intensity dimension are found in the Northeast and in the West. In these two regions, most states are in the two upper quintiles. In contrast, most Southern states have comparatively low Medicaid home care Intensity.

[Figure 3 about here.]

In sum, while generosity in both dimensions of Medicaid home care policy increased in most states between 1999 and 2012, the expansions in Intensity were much more pronounced. This result indicates that states have increased home care use among those with access to Medicaid home care services. The Northeast and the West are easily identified as generous regions in the Intensity dimension in 2012. States with comparatively high or low levels of generosity in the Participation dimension are spread out across all regions.

Comparison of states' generosity based on the latent constructs and observed indicators

To show the importance of measuring state Medicaid home care Participation and Intensity comprehensively, we contrast the rankings of states by quintiles of generosity in each latent dimension to the rankings resulting from two observed indicators found in the literature: percentage of Medicaid LTSS beneficiaries who received HCBS (Eiken, 2016) and total

Medicaid HCBS expenditures per participant (Ng et al., 2016). As a reminder, home care is the main type of HCBS. These comparisons are presented in Table 3. Differences in states' generosity of three or four quintiles between the latent dimension and the observed indicator are highlighted in gray. In some cases, whether we use the comprehensive latent measure or the observed indicator gives a very different perception of states' generosity. For example, there are striking differences in Participation in Oklahoma, and in Intensity in Tennessee and New Mexico. Overall, the correlation between the quintile groupings of states by each latent construct and observed indicator is only 0.34 for Participation and 0.28 for Intensity.

[Table 3 about here.]

Sensitivity analyses

As discussed, we cannot distinguish between Medicaid home health services provided for rehabilitation or chronic needs; thus, it may not be appropriate to consider all Medicaid home health services to be LTC. To explore whether the Participation and Intensity dimensions still emerge when excluding home health care, we conduct EFA and CFA on indicators of personal care only, namely personal care users per capita/per 65+ persons, personal care users per LTC user, and personal care expenditures per (65+/) user. Here, LTC users include only personal care and nursing home care users. Results reveal that the two dimensions do emerge and each one is reflected by the expected indicators (Figure A1 in the Appendix). Interestingly, in this case the two dimensions are positively correlated, suggesting a tendency of states to expand generosity in both dimensions simultaneously. The measurement model of Medicaid personal care generosity has good fit and good internal validity as measured by Cronbach's alpha (0.96 for Participation;

0.87 for Intensity).

As mentioned above, some states provide LTSS under managed care programs, but not all report managed LTSS data through MSIS. In our next sensitivity check, we investigate whether excluding states with managed LTSS programs impacts our measurement model and the resulting ranking of states by their generosity in the Participation or Intensity latent dimensions. Globally, our model is robust to the exclusion of those states, with most loadings remaining virtually the same. All model fit criteria are about the same values as before (Figure A2 in the Appendix). We also use this model, estimated on the restricted sample, to predict generosity. The state rankings by their level of generosity in any given year is practically the same (see e.g. 2010 in Table A2 in the Appendix).

In our last sensitivity check, we exclude one state or one year of data at a time to see how the estimated factor loadings change. In this way, we can investigate how sensitive the measurement model may be to potential outlier states/years. The results are presented in Figures A3 and A4 in the Appendix. Only one factor loading—the one associated with home health expenditures per 65+ user—varies by more than +0.05 or -0.05 from the median value of all fifty-one estimates, when Alaska or Tennessee are excluded, respectively (Figure A3). Overall, the measurement model is robust to the exclusion of each state. The exclusion of any year of data has very limited impact on the estimated factor loadings (Figure A4).

Discussion and conclusions

This study measures comprehensively the Participation and Intensity dimensions of state Medicaid home care policy and uses those comprehensive measures to describe Medicaid home care policy generosity over time and across states.

Our results suggest that the Participation and Intensity dimensions exist and are independent. This independence is consistent with the fact that there are states that increased or decreased both Participation and Intensity over time but also states that increased generosity in one dimension at the expense of the other.

Overall in the US, the main trend has been towards an increase in generosity in both dimensions (twenty-nine states), with increases in Intensity being much more pronounced. The rebalancing of the LTSS market towards home care may help explain the expansions in Medicaid home care Intensity, as more users with high levels of care needs may move to or stay in the community. For example, over the sample period, additional states initiated Personal Care Plans and started to provide personal care under different waivers and demonstrations. This may explain the increase in Intensity, as personal care services are usually provided over a longer period of time than home health services —i.e. personal care tends to be more intensive. The larger numbers of Waiver programs may also translate into more generous eligibility criteria and, consequently, higher Participation. In most states, home care policy generosity has continued to increase after 2012, as a result of the ACA provisions. Ongoing efforts to redirect LTSS towards HCBS and expansions in Medicaid eligibility resulted in further increases in Medicaid home care Intensity and Participation.

This study also shows that using the comprehensive latent measures or observed indicators gives different impressions of states' Medicaid home care policy generosity. The choice of one indicator to capture generosity in a particular dimension is very important and may have a large impact on results.

Our measurement strategy requires a rich dataset with many indicators. In addition, results based on latent constructs may sometimes be difficult to communicate, because latent variables have no

inherent scale. Yet, even when using observed indicators is preferred, factor analysis can help motivate their selection by revealing which indicators have the largest loadings, i.e. the best at capturing the underlying latent Medicaid home care policy dimension.

In possible extensions to our approach, factor analysis has a variety of potential applications in this field. For instance, it can be used to model home care policy in other countries where such policy is also decentralized, such as Canada or Switzerland (e.g. Gonçalves & Weaver, 2017; Stabile, Laporte, & Coyte, 2006). It may also be applied to measure other policies, such as nursing home policy. Future research aiming to explain variations in Medicaid home care policy generosity across states and over time may rely on structural equations models (SEM) to measure such policy as latent variables. For example, changes in participants' case mix may help explain variations in Medicaid home care Intensity. It is possible that by expanding generosity in the Participation dimension, some states start to serve participants with lower level of needs, bringing down the average intensity of services. Such reductions in Intensity would not correspond to lower generosity of the state in question. Similarly, programs such as Money Follows the Person, in which the goal is to move nursing home residents into the community with home health care and other supports, may increase the average intensity of home care in a way that does not correspond to higher intentional generosity (e.g. Robison, Porter, Shugrue, Kleppinger, & Lambert, 2015).

Although progress has been made, there are still important gaps in home care and HCBS data, which limits the ability to evaluate policy and ultimately design evidence-based policy (Newquist, DeLiema, & Wilber, 2015). Our paper has two main implications for the field. The first is conceptual. Policy and research discussions often refer to HCBS expansion as a unified concept. Yet, separating and contrasting the Participation and Intensity dimensions of state

Medicaid home care policy is important, as expansion along these two dimensions represents different strategies and potentially different implications for beneficiaries. Increasing the Participation and/or Intensity of Medicaid home care programs is an important policy decision made by states that entails tradeoffs. It is important for state policymakers to be aware of the decisions that other states have made about this tradeoff and to assess the two dimensions explicitly. It is also important for researchers to monitor Medicaid home care Participation and Intensity across the US states and over time. For example, such analyses may be relevant to inform whether the rebalancing of LTSS toward HCBS achieves its objectives. Second, our results have implications for measurement and future empirical research. Our approach improves measurement of states' generosity of Medicaid-funded home care, a dominant part of the home care industry, demonstrating that appropriate measurement makes a difference. After several decades of expansion of HCBS by individual state Medicaid programs, there is still remarkably little evidence of the effects of these expansions on costs, quality, and outcomes. As researchers embark on filling this gap, mismeasurement of the policies could lead to incorrect conclusions. The measurement strategy presented in this study is a useful tool for these critical analyses and their input into evidence-based policy.

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Notes

1. First, we replaced negative expenditure amounts, which may occur due to adjustments to prior year expenditures, with missing values. Second, when decompositions of users or expenditures by age groups had proportions of ‘unknown age group’ above 5%, we also replaced the user or expenditure amounts with missing values. Third and last, for each state, we plotted user and expenditure amounts over time and looked for sudden surges followed by abrupt drops, or vice versa. When such peaks or troughs occurred, the values for that year were replaced with missing. Missing values don’t undermine our analyses because we can still use the observations, by relying on the full information maximum likelihood estimator. As argued in other studies that use MAX data, although there may be differences between MAX data and Medicaid data from other sources, without further research we don’t know which source is more accurate. Actually, the better source may vary by state and type of service (Eiken, 2017b).
2. The states with managed LTSS programs are Arizona since 1988, California since 1985, Delaware since 2012, Florida since 1998, Hawaii since 2009, Massachusetts since 2004, Michigan since 1998, Minnesota since 1997, New Mexico since 2008, New York since 1998, North Carolina since 2005, Pennsylvania since 2009, Tennessee since 2010, Texas since 1998, Washington since 2006, and Wisconsin since 1996 (Saucier, Kasten, Burwell, & Gold 2012).
3. The following cutoffs have been proposed as indicators of good model fit: RMSEA<0.06, CFI>0.90, TLI>0.90, and SRMR<0.08 (e.g. Bentler, 1990; Hu & Bentler, 1999).

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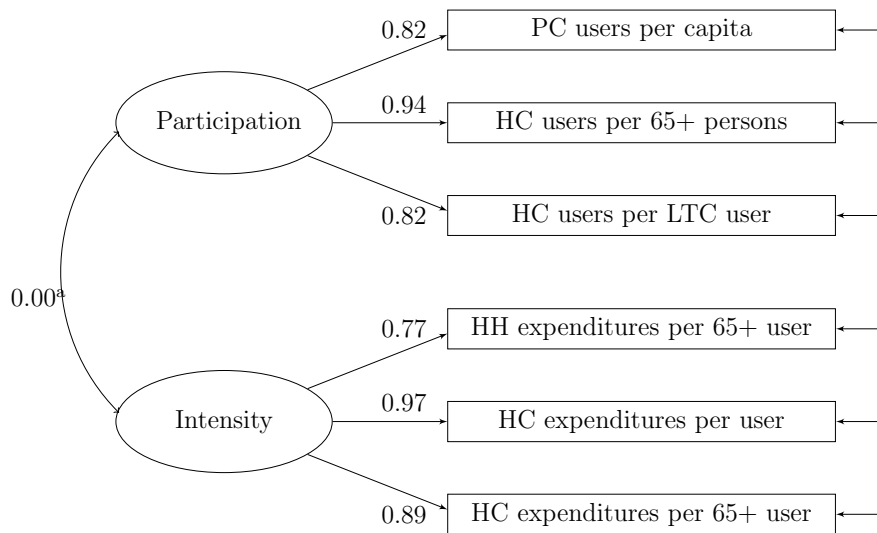
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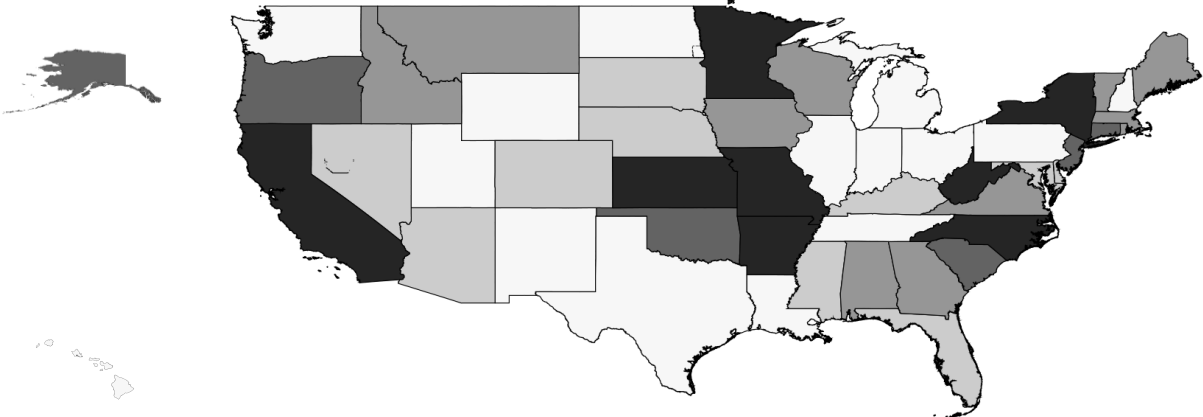
Figures and Tables

Figure 1 Model of state Medicaid home care Participation and Intensity: confirmatory factor analysis

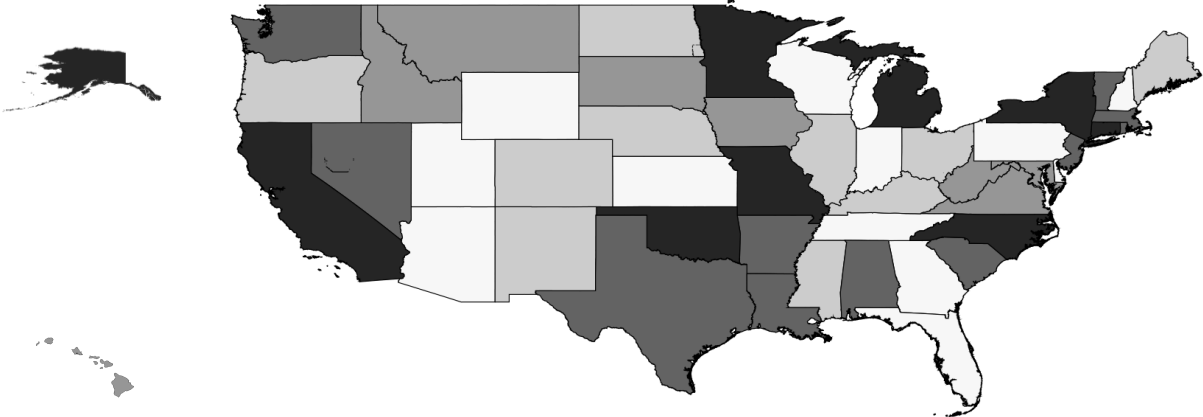


PC = personal care; HH = home health care; HC = total home care. ^aCorrelation between the two dimensions set to zero. Standardized loadings. All loadings statistically significant ($p < 0.01$). Sample includes all states. Model fit: $\chi^2 = 40.770$ ($p = 0.000$), RMSEA = 0.050, CFI = 0.942, TLI = 0.942, and SRMR = 0.095.

Figure 2 Maps of generosity in state Medicaid home care Participation in 1999 and 2012



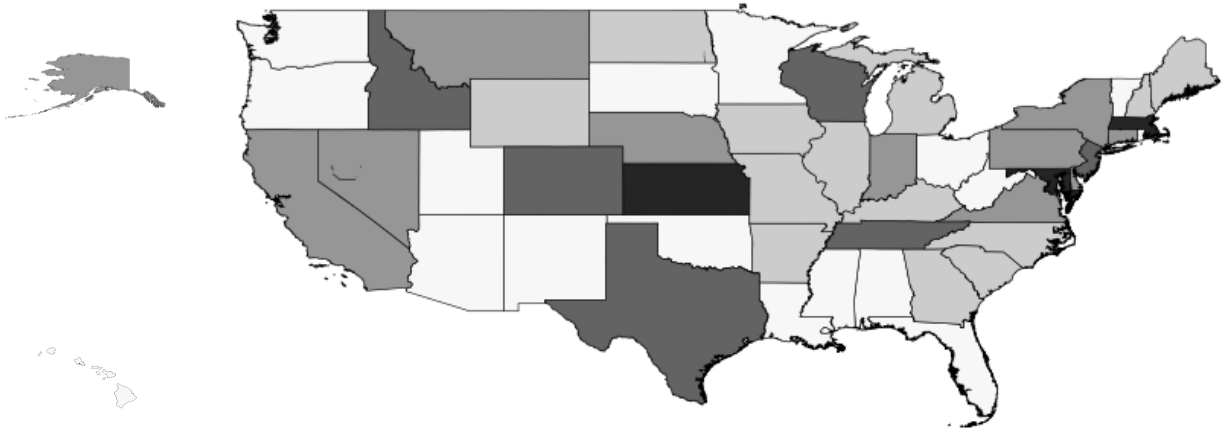
(a) 1999



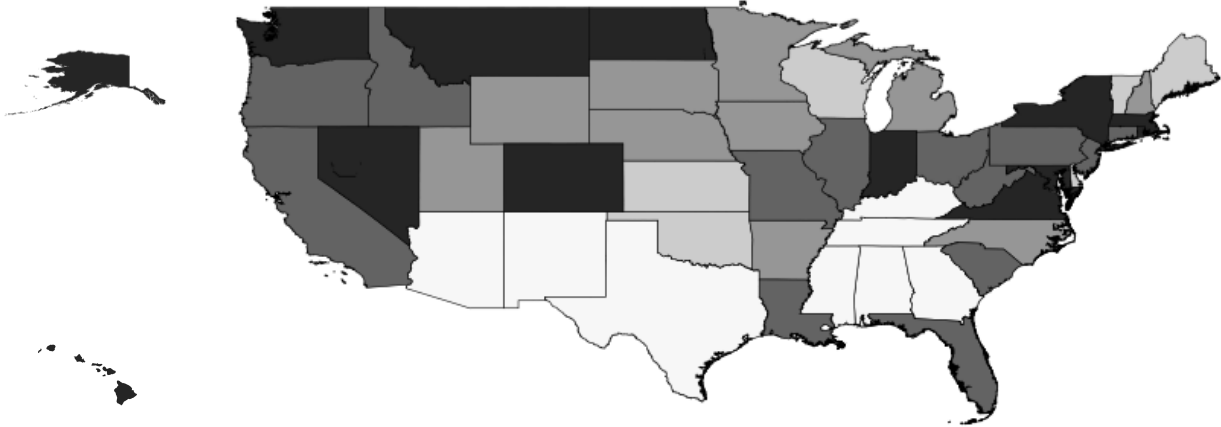
(b) 2012^a

Darker shades represent higher Participation; the 1999-2012 distributions are cut into quintiles. ^a2012 or last year available.

Figure 3 Maps of generosity in state Medicaid home care Intensity in 1999 and 2012



(a) 1999



(b) 2012^a

Darker shades represent higher Intensity; the 1999-2012 distributions are cut into quintiles. ^a2012 or last year available.

Table 1 Summary statistics of available indicators of state Medicaid home care Participation and Intensity

	Mean	Std. Dev.	Min.	Max.
Potential indicators of Medicaid home care Participation (%)				
HH users per capita	0.33	0.37	0.00 ^a	2.13
			(WA, 2009)	(MN, 2011)
HH users per 65+ persons	0.68	0.88	0.00 ^a	4.66
			(WA, 2009)	(DC, 2011)
PC users per capita	0.23	0.28	0.00 ^b	1.34
				(WA, 2005)
PC users per 65+ persons	0.92	1.29	0.00 ^b	6.78
				(CA, 2009)
HC users per capita	0.56	0.47	0.00 ^a	2.96
			(TN, 2011)	(MN, 2011)
HC users per 65+ persons	1.54	1.50	0.00 ^a	8.88
			(TN, 2011)	(DC, 2011)
HC users per LTC user	44.03	18.82	0.28	88.49
			(TN, 2011)	(AK, 2012)
HC users per 65+ LTC user	29.82	17.96	2.39	72.72
			(HI, 1999)	(DC, 2011)
Potential indicators of Medicaid home care Intensity (\$)				
HH expenditures per user	4,667.04	5,444.98	58.71	37,720.02
			(WA, 2008)	(TN, 2009)
HH expenditures per 65+ user	4,391.74	4,904.50	55.21	37,276.33
			(WA, 2008)	(TN, 2007)
PC expenditures per user	6,568.85	7,378.90	0.00 ^b	54,496.00
				(KS, 2005)
PC expenditures per 65+ user	5,341.30	5,912.55	0.00 ^b	28,755.48
				(NH, 2007)
HC expenditures per user	6,648.40	5,236.16	100.62	37,720.02
			(AL, 1999)	(TN, 2009)
HC expenditures per 65+ user	6,382.37	4,830.79	99.75	37,276.33
			(TN, 2012)	(TN, 2007)

State and year in parentheses. HH = home health care; PC = personal care; HC = total home care; HC = HH + PC; LTC = HC + nursing home care. ^aRounds to zero. ^bVarious state-year observations, as some states don't provide PC.

Table 2 Exploratory factor analysis results (unstructured model): factor loadings and dimensions

	Participation dimension	Intensity dimension
HH users per capita	0.040	-0.109
HH users per 65+ persons	-0.026	-0.072
PC users per capita	0.941*	-0.004
PC users per 65+ persons	0.938*	0.047
HC users per capita	0.646*	-0.089
HC users per 65+ persons	0.855*	-0.001
HC users per LTC user	0.715*	0.151
HC users per 65+ LTC user	0.781*	-0.174
HH expenditures per user	-0.351*	0.872*
HH expenditures per 65+ user	-0.436*	0.821*
PC expenditures per user	0.367*	0.083
PC expenditures per 65+ user	0.601*	0.209
HC expenditures per user	0.014	0.980*
HC expenditures per 65+ user	0.132	0.855*

HC = total home care; HH = home health care; PC = personal care; HC = HH + PC; LTC = HC + nursing home care.
*p<0.05. Geomin-rotated loadings. Sample includes half the states.

Table 3 Comparison of states' generosity in the Participation and Intensity latent dimensions and observed indicators (quintiles)

States	Participation dimension ^a	Home care users per LTSS user ^b	States	Intensity dimension ^a	Home care expenditures per user ^b
Arizona	1 st	n/a	Texas	1 st	1 st
Wisconsin	1 st	n/a	Vermont	1 st	1 st
Tennessee	1 st	n/a	Mississippi	1 st	1 st
Kansas	1 st	n/a	Georgia	1 st	2 nd
Delaware	1 st	1 st	Kentucky	1 st	2 nd
Indiana	1 st	1 st	Kansas	1 st	3 rd
Utah	1 st	2 nd	Maine	1 st	3 rd
Georgia	1 st	2 nd	Arizona	1 st	4 th
Florida	1 st	2 nd	Alabama	1 st	4 th
Pennsylvania	1 st	3 rd	Tennessee	1 st	5 th
Wyoming	1 st	3 rd	New Mexico	1 st	5 th
Maine	2 nd	n/a	North Carolina	2 nd	1 st
Mississippi	2 nd	1 st	Michigan	2 nd	1 st
Kentucky	2 nd	1 st	Arkansas	2 nd	1 st
Nebraska	2 nd	2 nd	Oklahoma	2 nd	1 st
Ohio	2 nd	2 nd	Iowa	2 nd	2 nd
New Hampshire	2 nd	2 nd	South Dakota	2 nd	2 nd
North Dakota	2 nd	3 rd	Utah	2 nd	3 rd
Illinois	2 nd	4 th	New Hampshire	2 nd	4 th
Colorado	2 nd	5 th	Wisconsin	2 nd	4 th
Oregon	2 nd	5 th	Delaware	2 nd	5 th
New Mexico	3 rd	n/a	Missouri	3 rd	1 st
Maryland	3 rd	1 st	California	3 rd	1 st
South Dakota	3 rd	1 st	Ohio	3 rd	2 nd
Virginia	3 rd	2 nd	Nebraska	3 rd	3 rd
West Virginia	3 rd	3 rd	New Jersey	3 rd	3 rd
Iowa	3 rd	4 th	Oregon	3 rd	3 rd
Hawaii	3 rd	4 th	Wyoming	3 rd	3 rd
Montana	3 rd	4 th	District of Columbia	3 rd	4 th
Nevada	3 rd	4 th	Minnesota	3 rd	4 th
Idaho	3 rd	5 th	West Virginia	3 rd	5 th
Texas	4 th	n/a	Idaho	4 th	1 st
New Jersey	4 th	n/a	Rhode Island	4 th	1 st
Alabama	4 th	n/a	Illinois	4 th	2 nd
Louisiana	4 th	1 st	Nevada	4 th	2 nd
Arkansas	4 th	1 st	Florida	4 th	2 nd
South Carolina	4 th	3 rd	Louisiana	4 th	2 nd
Massachusetts	4 th	3 rd	South Carolina	4 th	3 rd

Rhode Island	4 th	3 rd	Montana	4 th	3 rd
Vermont	4 th	5 th	Connecticut	4 th	4 th
Washington	4 th	5 th	Pennsylvania	4 th	5 th
Oklahoma	5 th	1 st	Colorado	5 th	2 nd
Connecticut	5 th	2 nd	Washington	5 th	3 rd
Michigan	5 th	3 rd	Massachusetts	5 th	4 th
New York	5 th	3 rd	Indiana	5 th	4 th
District of Columbia	5 th	4 th	Hawaii	5 th	4 th
Missouri	5 th	4 th	North Dakota	5 th	5 th
North Carolina	5 th	4 th	Virginia	5 th	5 th
Alaska	5 th	5 th	New York	5 th	5 th
Minnesota	5 th	5 th	Alaska	5 th	5 th
California	5 th	5 th	Maryland	5 th	5 th
Correlation	0.34		Correlation	0.28	

^a2012 or last year available. ^bPercentage of Medicaid LTSS beneficiaries who received HCBS, 2012 (source: Eiken, 2016) and Total Medicaid HCBS expenditures per participant served, 2012 (source: Ng et al., 2016). HC = home care. Higher quintiles mean higher generosity. Gray cells highlight states with quintile differences of 3 or more between the latent measure and the observed indicator.

Appendix

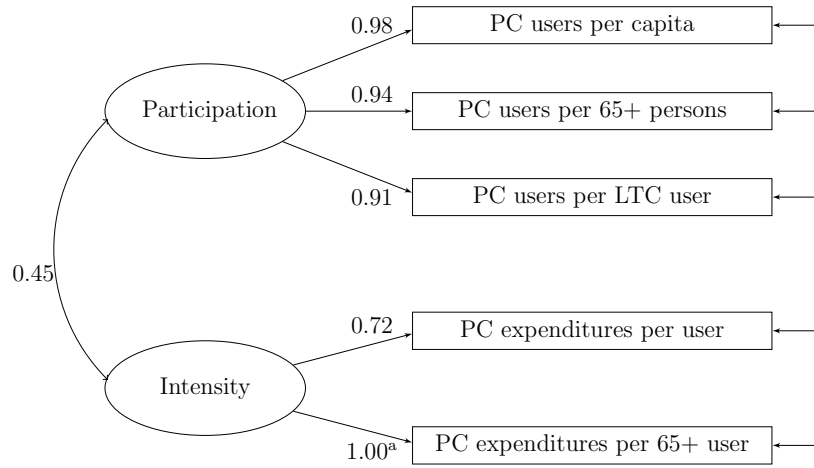
Table A1 Estimated values of Medicaid home care Participation and Intensity

States	Participation		Intensity	
	1999	2012 ^a	1999	2012 ^a
Alabama	-0.33	0.39	-0.90	-0.84
Alaska	0.67	1.87	-0.15	1.82
Arizona	-0.56	-0.92	-0.64	-0.72
Arkansas	1.74	0.45	-0.50	-0.18
California	0.98	2.59	-0.29	0.18
Colorado	-0.36	-0.48	0.24	0.92
Connecticut	0.12	1.2	-0.21	0.32
Delaware	-0.65	-0.81	-0.15	-0.35
District of Columbia	-0.09	3.34	0.02	-0.03
Florida	-0.60	-0.85	-0.61	0.34
Georgia	-0.23	-0.88	-0.33	-0.80
Hawaii	-1.26	-0.27	-0.85	2.72
Idaho	-0.10	-0.15	0.12	0.25
Illinois	-0.75	-0.51	-0.48	0.21
Indiana	-0.80	-0.70	-0.08	1.66
Iowa	-0.14	-0.01	-0.43	-0.23
Kansas	0.72	-0.78	0.78	-0.52
Kentucky	-0.46	-0.59	-0.35	-0.62
Louisiana	-0.80	0.10	-0.58	0.34
Maine	-0.18	-0.65	-0.51	-0.44
Maryland	-0.38	0.01	1.13	2.25
Massachusetts	-0.19	0.32	0.72	1.15
Michigan	-0.77	1.44	-0.48	-0.23
Minnesota	1.19	1.01	-0.56	-0.04
Mississippi	-0.65	-0.59	-0.82	-0.68
Missouri	0.79	0.96	-0.49	0.00
Montana	-0.03	-0.14	-0.13	0.44
Nebraska	-0.62	-0.48	-0.11	-0.14
Nevada	-0.36	0.04	-0.31	0.43
New Hampshire	-0.74	-0.69	-0.52	-0.30
New Jersey	0.07	0.41	0.09	0.17
New Mexico	-0.90	-0.46	-0.55	-0.81
New York	0.96	1.79	-0.08	1.06
North Carolina	1.39	1.28	-0.37	-0.16
North Dakota	-0.88	-0.63	-0.35	0.47
Ohio	-0.74	-0.52	-0.50	0.08

Oklahoma	0.04	0.71	-0.54	-0.35
Oregon	0.07	-0.60	-0.89	0.04
Pennsylvania	-0.82	-0.79	-0.27	0.31
Rhode Island	-0.29	0.24	-0.56	0.36
South Carolina	0.58	0.26	-0.38	0.23
South Dakota	-0.37	-0.11	-0.60	-0.19
Tennessee	-1.23	-0.78	0.25	-0.95
Texas	-0.97	0.39	0.08	-0.57
Utah	-0.81	-0.69	-0.56	-0.15
Vermont	-0.10	0.09	-0.63	-0.43
Virginia	-0.26	-0.19	-0.04	0.70
Washington	-0.88	0.16	-0.74	0.49
West Virginia	0.92	-0.21	-0.67	0.04
Wisconsin	-0.25	-0.97	0.03	-0.32
Wyoming	-0.98	-0.83	-0.39	-0.15

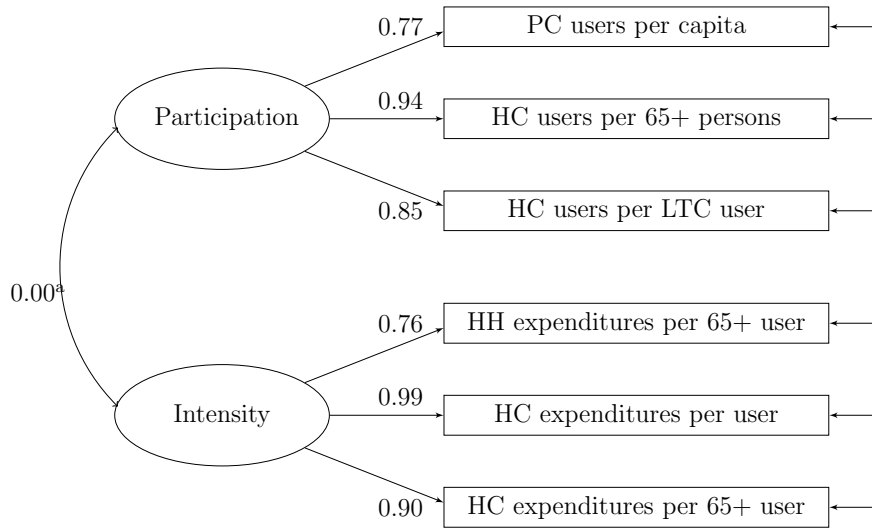
^a2012 or last year available. States ordered alphabetically. Gray cells highlight values that are higher in 2012 than in 1999.

Figure A1 Sensitivity check: exclusion of Medicaid home health care. Model of state Medicaid home care Participation and Intensity



PC = personal care. LTC users include only personal care users and nursing home residents. ^aResidual set to zero. Standardized loadings. All loadings statistically significant ($p < 0.01$). Model fit: $\chi^2 = 7.053$ ($p = 0.720$), RMSEA = 0.000, CFI = 1.000, TLI = 1.031, and SRMR = 0.024.

Figure A2 Sensitivity check: exclusion of states with managed LTSS programs. Model of state Medicaid home care Participation and Intensity



PC = personal care; HH = home health care; HC = total home care. ^aCorrelation between the two dimensions set to zero. Standardized loadings. All loadings statistically significant ($p < 0.01$). Sample excluded states with managed LTSS programs. Model fit: $\chi^2 = 33.077$ ($p = 0.005$), RMSEA = 0.047, CFI = 0.935, TLI = 0.935, and SRMR = 0.099.

Table A2 Sensitivity check: exclusion of states with managed LTSS programs. State rankings by increasing generosity in Medicaid home care Participation and Intensity in 2010^a

States	Participation		States	Intensity	
	All states	States with managed LTSS programs		All states	States with managed LTSS programs
Wisconsin	1		Alabama	1	1
Arizona	2		Georgia	2	2
Georgia	3	1	New Mexico	3	
Florida	4		Oregon	4	3
Wyoming	5	2	Arizona	5	
Kansas	6	3	Mississippi	6	4
Delaware	7	4	Kentucky	7	5
Indiana	8	5	Arkansas	8	6
Pennsylvania	9		Kansas	9	7
Oregon	10	6	Texas	10	
New Hampshire	11	8	Idaho	11	9
Utah	12	9	Maine	12	8
Maine	13	10	New Hampshire	13	12
North Dakota	14	7	Wyoming	14	10
Tennessee	15		Vermont	15	13
Ohio	16	12	Iowa	16	11
Colorado	17	13	Oklahoma	17	14
Illinois	18	11	Michigan	18	
Mississippi	19	15	Delaware	19	15
Kentucky	20	14	Utah	20	19
Nebraska	21	16	South Dakota	21	16
Hawaii	22		North Carolina	22	
West Virginia	23	17	West Virginia	23	17
Montana	24	18	Missouri	24	20
Virginia	25	20	Minnesota	25	
South Dakota	26	19	Nebraska	26	18
Maryland	27	21	Ohio	27	21
Nevada	28	23	Rhode-Island	28	22
New Mexico	29		California	29	
Vermont	30	22	District of Columbia	30	23
Massachusetts	31		New Jersey	31	24
Rhode Island	32	25	Florida	32	
Louisiana	33	24	Pennsylvania	33	
South Carolina	34	26	Connecticut	34	26
Washington	35		South Carolina	35	25
Texas	36		Nevada	36	27
Iowa	37	28	Wisconsin	37	
New Jersey	38	27	Illinois	38	28
Alabama	39	29	Virginia	39	29
Michigan	40		Louisiana	40	30
Oklahoma	41	30	North Dakota	41	31

Minnesota	42		Montana	42	32
New York	43		New York	43	
Idaho	44	31	Washington	44	
Missouri	45	32	Colorado	45	33
Arkansas	46	33	Tennessee	46	
Connecticut	47	34	Massachusetts	47	
North Carolina	48		Indiana	48	34
Alaska	49	35	Alaska	49	35
California	50		Maryland	50	36
District of Columbia	51	36	Hawaii	51	

^a2010 is the last year for which data exists for all states. States ordered by increasing level of generosity.

Figure A3 Sensitivity check: impact of excluding each state on the estimated factor loadings

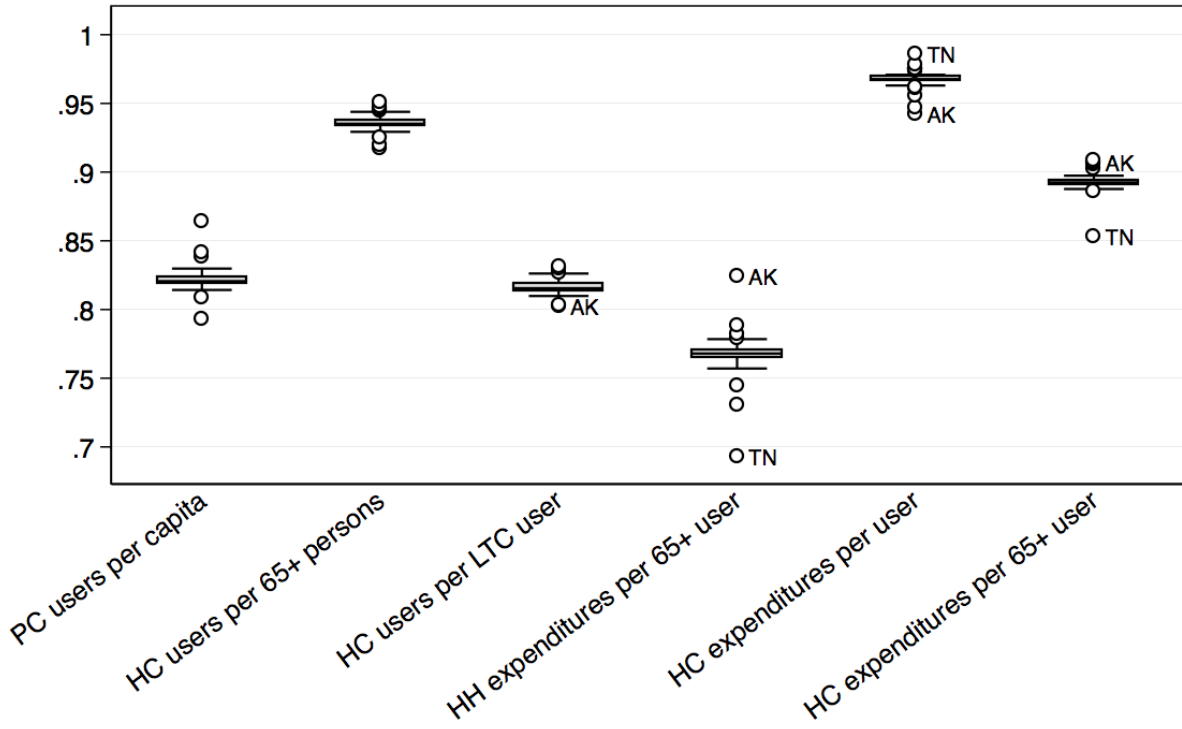


Figure A4 Sensitivity check: impact of excluding each year of data on the estimated factor loadings

