NIC | MIDDLE MARKET Seniors Housing Study

Methods Supplement

The National Investment Center for Seniors Housing and Care (NIC) provided a grant to NORC at the University of Chicago to fund the research described below.

Data Sources and Model Development

This analysis forecasted the size of the senior population (i.e. individuals age 75+) in 2029 and estimated their demographic, health, cognitive, and functional status, and financial resources.[1] Having examined many possible data sources, this analysis used the Health and Retirement Study (HRS)—a nationally representative, longitudinal survey of individuals aged 50 years and over—conducted by the University of Michigan's Institute for Social Research and funded by the National Institute on Aging. The HRS comprehensively covers the topical areas necessary for the analyses (health status and functioning, financial resources, socio-demographics) and has large sample sizes for individuals 75 and above. Self-reports in many domains of the HRS have been validated using tax records, pension files, clinical assessments, medical claims and other external data sources. The HRS 1994, 1998, and 2014 core survey dataset served as the primary data source for this analysis. The cross-sectional weights[1] in the HRS were used to produce nationally representative estimates of today's (i.e. 2014) senior population and individuals who are projected to be seniors by 2029.

The analytic model was developed in three stages: (1) construction of a per-capita financial resource measure that includes income from several sources and annuitized household assets; (2) forecasting the size and demographic characteristics of the senior population in 2029; and (3) projecting per-capita financial resources and select health and functional characteristics of the forecasted senior population. Below, we present a detailed discussion of the methods for each stage.

Measuring financial resources per-capita

A distinguishing feature of our analytic approach is the measurement of financial resources at the individual level and the inclusion of income, assets, and housing equity in our definition of financial resources. Since women have a longer life expectancy than their male partners, measuring financial resources of seniors at the individual level provides a more accurate estimate of affordability of seniors housing and care. Measuring financial resources at the

[1] The cross-sectional weights were created by combining the community-dwelling, respondent-level weights (xWGTR) and the nursing home sampling weights (xWGTRNH) as per HRS guidelines to represent the national population of seniors residing in the community or a nursing facility.

individual level also allows us to link it to other individual-level measures of health and functional status to understand financial resource availability as it relates to long-term care needs. Most studies related to housing use household income as the measure of financial status. We included annuitized assets, in addition to income, to create a more complete picture of the financial resources on which people may draw from in their post-retirement years. The per-capita financial resource measure included pre-tax income from several sources, such as earnings, capital income, Social Security income, pensions and annuities, unemployment compensation, Veteran's benefits, alimony payments, and income from public programs[2]. Assets reported at the household level, such as vehicles, real-estate, IRAs, stocks and securities, bank accounts, bequests, and lump sum payments were also included in the financial resource measure. Finally, housing equity net of mortgage debt and home loans was tracked to provide a comprehensive picture of financial resource availability. The financial resources from all sources were annuitized and reported at the individual level using the models proposed by Brown (1999), Love (2008), and Poterba (2011). For each individual in the 2014 HRS sample, we annuitized assets and wealth by multiplying total reported assets and wealth and the annualizing factor

$$(Annuitized\ Assets\ and\ Wealth) = a_t * (Total\ Assets\ and\ Wealth)$$

We defined the annualizing factor as

$$a_t = \left[\sum_{i=1}^{T}\left\{\frac{(\alpha * S^f_{t+i} * S^m_{t+i}) + (S^f_{t+i} * (1 - S^m_{t+i}) + (S^m_{t+i} * (1 - S^f_{t+i}))}{(1 + r_{t+i})^i}\right\}\right]^{-1}$$

Where,

$\alpha - Economies\ of\ scale\ for\ individuals\ who\ are\ married\ and\ residing\ with\ their\ spouse$

$t - Age\ of\ the\ respondent$

$T - Maximum\ attainable\ age\ (assumed\ to\ be\ 119\ years\ as\ per\ SSA\ guidelines)$

$S^f_{t+i} - Survival\ probability\ of\ a\ female\ respondent\ of\ age\ t\ to\ live\ an\ additional\ i\ years$

$S^m_{t+i} - Survival\ probability\ of\ a\ male\ respondent\ of\ age\ t\ to\ live\ an\ additional\ i\ years$

$r - Real\ interest\ rate$

The following assumptions were used to annuitize household stocks of assets and wealth into

[2] "Welfare income, food stamps, SSI/SDI, and Worker's compensation," as worded in the HRS questionnaires.

annual income streams measured at the individual level:

- Nominal and real interest rate projections from the Social Security Administration 2016 Trustees report. The rate of return is assumed to be similar for all asset types.
- Actuarial life tables from the Social Security Administration's Office of the Chief Actuary
- Living situation of the respondent (i.e. single or married)
- Age of the respondent and spouse
- Maximum attainable age by an individual (assumption: 119 years)
- Economies of scale factor, which inflates the value of joint financial resources of married respondents who live together (assumption: 1.67 Krueger (2007)).

Forecasting the size and demographic characteristics of the senior population in 2029

We used information on individuals in the HRS who were sampled in 1994 and followed up in each subsequent wave until 2014 to build a regression model to predict `number of years of life remaining'. If the surveyed individuals died prior to 2014, their date of death was recorded. The dependent variable was censored at 20 years for individuals who survived beyond 2014. Using this information, life expectancy was modeled using a multivariate tobit model[3] to control for factors commonly accounted for in other models (Favreault, 2015), such as demographic, socio-economic, education, health, and functional status as predictors.[4]

The observable variable y_i (number of years of life remaining) is defined as

$$y_i = \begin{cases} y_i^* \; if \; y_i^* \leq 20 \\ 20 \; if \; y_i^* > 20 \end{cases}$$

Where y_i^* is a latent variable that is linearly associated with the following base-period predictors:

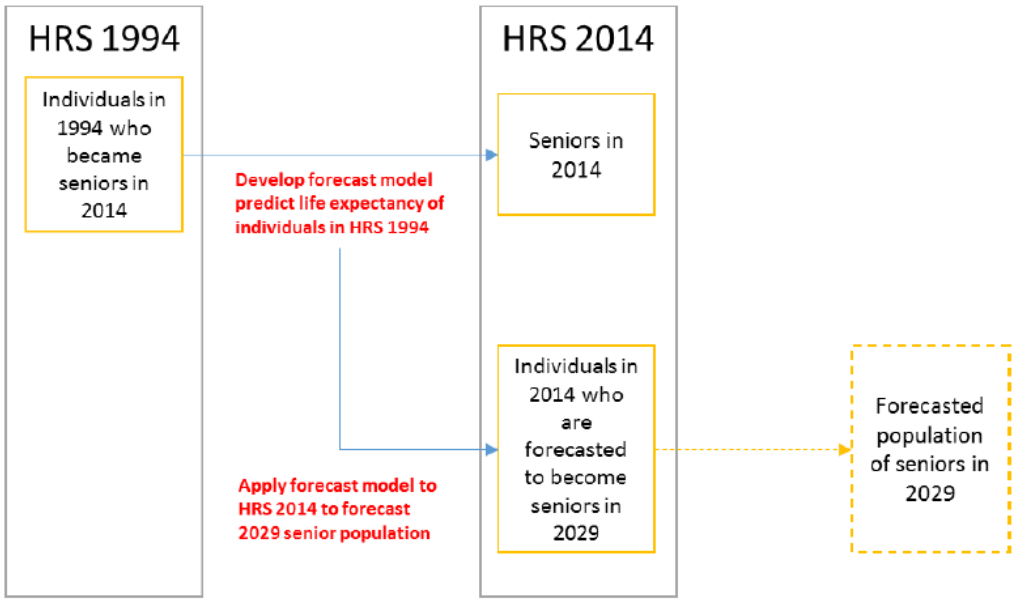
$$y_i^* = \alpha + \beta_1 \, Age_i + \beta_2 \, Gender_i + \beta_3 \, Gender_i * Age_i + \beta_4 \, Race_i + \beta_5 \, Gender_i * Race_i + \beta_6 \, Education_i + \beta_7 \, Self \; reported \; health_i + \beta_8 \, Number \; of \; ADL \; limitations_i + \beta_8 \, Number \; of \; chronic \; conditions_i + \beta_9 \, Mobility \; limitations_i + \mu_i \, , \; \mu_i \sim (0, \sigma^2)$$

After internal validation and calibration to external benchmarks, such as the Census population projections[5], this model was applied to the 2014 HRS data to predict the life expectancy of each

[3] A tobit model was used in the estimation to account for right-censoring; since 2014 HRS is the latest available dataset, the maximum years of life remaining for individuals in the 1994 dataset was 20 years.
[4] The multivariate tobit model included the following covariates: age; gender; race; educational status; race-ethnicity; number of chronic conditions; number of activities of daily living limitations; cognitive status; self-reported health status; and mobility limitations.
[5] Projected 5-Year Age Groups and Sex Composition: Main Projections Series for the United States, 2017-2060. U.S. Census Bureau, Population Division: Washington, DC.

individual in the 2014 sample. To estimate the size of the senior population in 2029, the 2014 cross-sectional weights were applied to the subsample of individuals in 2014 who were forecasted to be age 75+ and alive in 2029 (henceforth, referred to as the forecasted sample of the senior population in 2029).

Exhibit D1. Forecasting the Senior Population in 2029

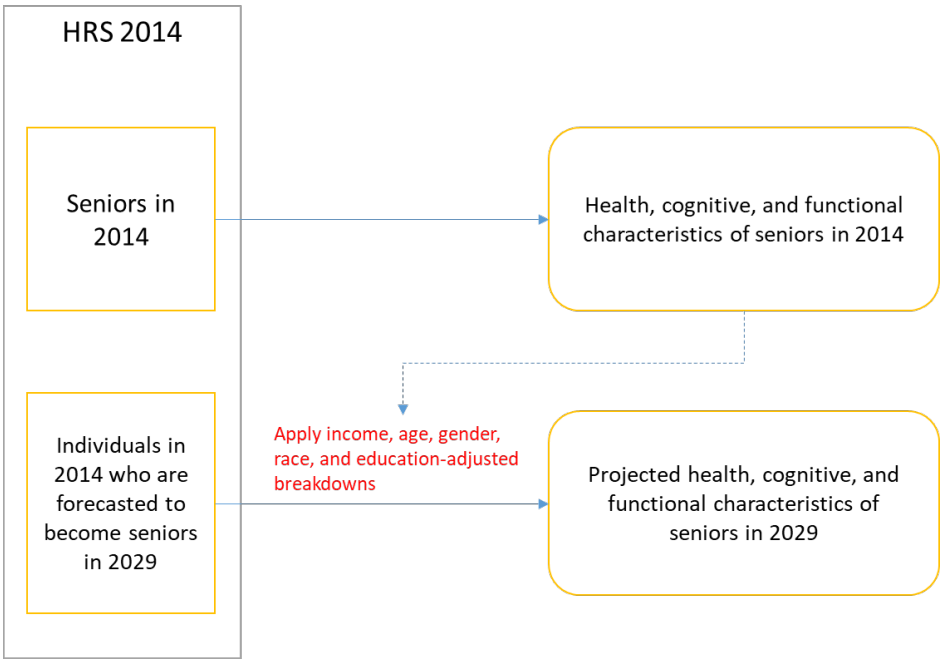


Projecting per-capita financial resources and select health and functional characteristics of the forecasted senior population

Since demographics and certain socio-economic characteristics, such as level of education, can be considered time-invariant for individuals 55 and older, the survey weighted breakdowns of these characteristics for the 2014 subsample representing the forecasted senior population were also applied to the 2029 population. We projected the marital status of individuals to be unchanged from 2014 to 2029, unless they were forecasted to be widowed during that timeframe—we did not assume any new marriages or divorces in the forecast.

Health, cognitive, and functional status of the forecasted senior population in 2029 were estimated based on the prevalence rates of these characteristics for the seniors in 2014. We derived these estimates by segmenting the 2014 sample by income cohort, age group, gender, and race categories. Next, we estimated the health, cognitive, and functional characteristics for each of these sub-populations. Finally, we segmented the forecasted 2029 sample by these same characteristics and applied the estimated group-specific rates to the respective subgroups.

Exhibit D2. Projecting Demographic and Health Characteristics of the 2029 Population

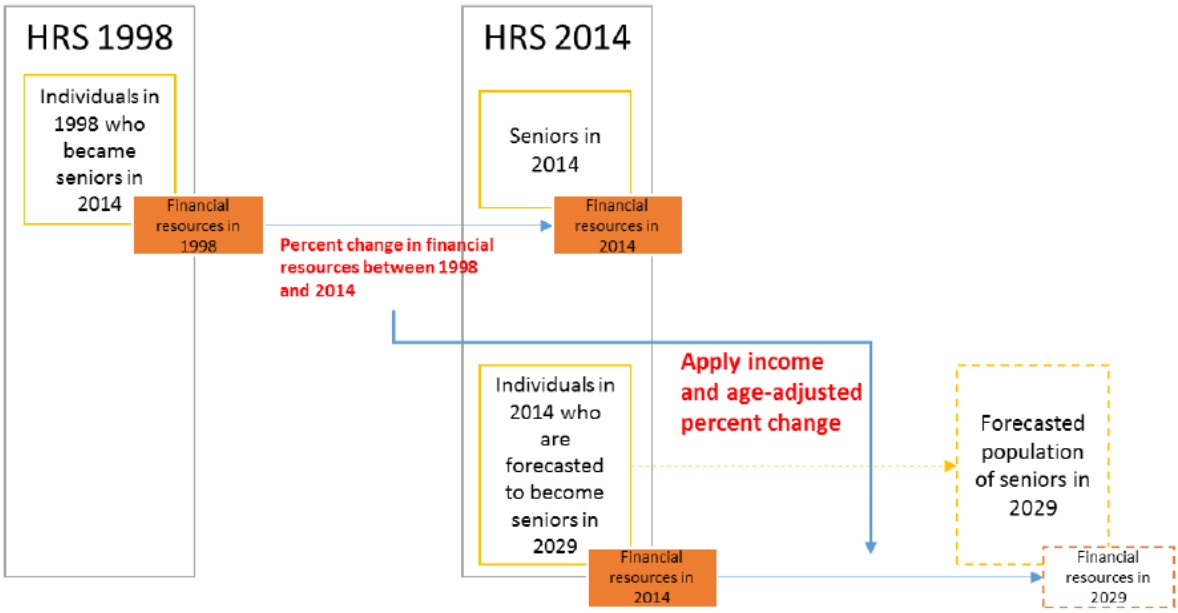


To predict the annuitized individual financial resources (henceforth, referred to as income) of seniors in 2029, we began with a baseline of the actual, total financial resources for the cohort of 2014 individuals who are forecasted to become seniors in 2029. Then, we projected forward the *change* in those total resources between 2014 and 2029, based on the expected percent change (i.e. the trend factor) in income over a fifteen-year period. To do so, we segmented the sample into subgroups by income cohort and age group. For each subgroup, we calculated the inflation-adjusted change for each component of income (i.e. income; annuitized assets; and annuitized housing equity) between 1998 and 2014 for seniors in 2014. The income cohort and age-group specific trend factors were applied to individuals in the 2014 sample who are expected to be seniors in 2029. As such, our approach assumed that the rate of change in assets between 1998 and 2014 and 2014 and 2029 would be the same.

Two particular assumptions may limit the accuracy of our projections. First, the trend factors used in our projection was based on the period 1998-2014, which includes the Great Recession of 2008, potentially leading to under-projection of growth in financial resources from 2014 to 2029. On this point, we note that even including the Great Recession, trends in real income, home prices, and return on financial assets such as securities over the 1998 to 2014 period were similar to longer historical trends such as over the past 50 years. A second potential limitation relates to a significant shift from defined benefit to defined contribution retirement benefits. Traditional theory holds that individuals' savings behavior in their 40s and 50s is based

on their retirement income expectations, which are in turn informed by the type of retirement benefits earned at those middle ages. Since our approach applied asset-specific trend factors to individuals' actual asset holdings in 2014, our estimates should incorporate a meaningful portion of the transition in retirement benefits between the two cohorts of seniors.

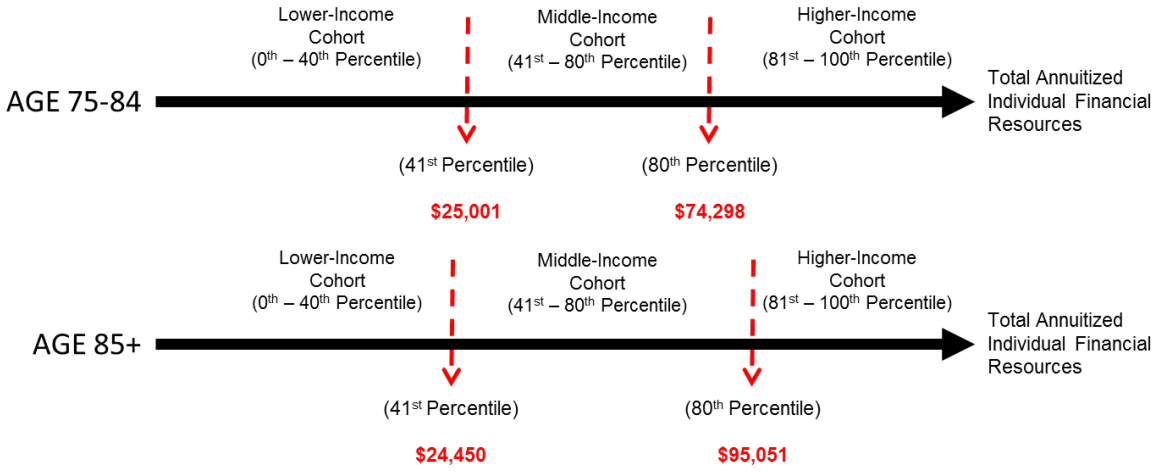
Exhibit D3. Projecting Financial Resources of the 2029 Population



Defining the Middle-Income Cohort

Our analysis focused on middle-income seniors, from the perspective of seniors housing affordability. To define the middle-income cohort, we segmented the 2014 senior population into three groups according to their annuitized individual financial resources (excluding housing equity), defining a "middle-income" cohort as ranging from the 41st percentile to the 80th percentile of the individual financial resource distribution of today's seniors. By default, the lower-income cohort is then the portion of the population with individual financial resources between the 0th and 40th percentiles, while the higher-income cohort is defined as those at the 81st percentile or higher (Exhibit D4).

Exhibit D4. Financial Resource Thresholds and Income Cohorts



Our definition of the middle-income cohort is motivated by (1) its relevance to assessing affordability of seniors housing and (2) feasibility of conducting the analysis within the sample size constraints of the HRS. We considered the following factors to establish middle income cohort thresholds:

- **Categories of options currently available for seniors housing:** We were interested broadly in the middle of the income distribution, but recognized that the tails of the income distribution have options that may be inaccessible to the middle of the distribution. Specifically, we opted for a middle-income definition that would be unlikely to overlap with the Medicaid eligibility that may be available to many low-income individuals. At the same time, we took into account that current market-based seniors housing options are believed to be used primarily by individuals in the upper tail of the income distribution. (Note that in 2014 the average rent for independent living was reported as $46,000 per year, and for assisted living as $57,000 per year. An additional average annual out-of-pocket medical costs of $5,000 per year might give some indication of the annual income at which individuals might make use of available seniors housing options). Our threshold for middle-income extended up to the 80th percentile of the income distribution to broadly encompass the population that lies clearly between Medicaid eligibility and those comfortably accessing the current market offerings for seniors housing.

- **Sample size adequacy in the HRS for each study cohort:** Our analytic approach involved examining the circumstances (demographic, health-related, housing-related) of

different subgroups of seniors today and as predicted in the future. For this purpose, it is important that we had adequate sample sizes of HRS data in order to analyze middle-income individuals aged 85 years and over having different characteristics. Data availability is much more constrained for the oldest seniors, mirroring their smaller numbers in the population as a whole. We identified, as a target, having at least 400 HRS cases for the middle-income 85+ group so that we were likely to generate key estimates of interest. Our proposed segmentation allowed us to generate reliable estimates for each age group and income cohort.

Over the next 10 years, we project that the income distribution of seniors will shift. In order to make direct comparisons between the middle-income cohorts of 2014 and 2029, we projected the 2029 middle-income cohort based on the dollar thresholds used to define the 2014 middle-income group. Applying the 2014 middle-income thresholds to the 2029 income distribution is justified because the projections are presented in constant dollars. In addition, our models assume that seniors housing costs will grow at the rate of inflation. Therefore, the 2014 middle-income thresholds, which were established to assess whether individuals are likely to have sufficient individual, annual financial resources to cover the cost of private pay seniors housing in 2014, can also be applied to the 2029 income projections to assess affordability of seniors housing in 2029. Our approach to defining the middle-income cohort and assessing adequacy of financial resources for seniors housing is based on conservative, baseline assumptions of future seniors housing and out-of-pocket health care costs. The intent is to provide a basis for an informed discussion. If increased demand for seniors housing is not met with a proportionate increase in supply, we can expect seniors housing costs to grow faster than inflation. Rapid growth in out-of-pocket health care costs could also significantly limit the amount of available financial resources that will be available to seniors.

Defining Cognitive Impairment & Mobility Needs

Cognitive Impairment: To assess cognitive impairment using HRS data, we used approaches developed by Herzog and Wallace (1997) and Langa, Kabeto, & Weir (2010) to identify seniors having cognitive impairment other than dementia (Cognitive Impairment Not Dementia (CIND)) and those with dementia.[6] Herzog and Wallace (1997) developed a scale to determine a respondent's level of cognitive impairment. They determined that a score of 8 or less on the composite cognitive measure indicated cognitive impairment. Langa, Kabeto, & Weir (2010) also developed an approach to defining dementia and Cognitive Impairment Not Dementia (CIND) using the HRS data. The Langa, Kabeto, and Weir composite measure is on a scale of 0

[6] While we found the HRS to be the most comprehensive data source for nationally representative information across multiple domains, there are limitations to comparability of questions related to cognitive impairment across settings when compared to more recent research (Kasper, 2009).

to 27. They classify respondents who score from 0 to 6 as demented, 7 to 11 as CIND, and 12 to 27 as normal. In our analysis, we used both methods to determine a respondent's level of cognitive impairment. We used the Langa–Weir cut-points to classify people under age 65 as demented and CIND. For respondents over age 65, we used the Herzog–Wallace thresholds for determining level of cognition.

Mobility Limitations: The HRS measures mobility using a series of questions to gauge a respondent's mobility. The mobility index uses the questions on walking one block, walking several blocks, walking across a room, climbing one flight of stairs, and climbing several flights of stairs—important indices of whether individuals can remain in their home. The mobility index takes the sum of the responses for each of the mobility questions and creates a score to assess the respondent's overall mobility. Any respondent with a score of one or more is coded as having a mobility limitation.

High Needs: Seniors with three or more chronic conditions and at least one Activities of Daily Living (ADL) limitation were defined as having `high needs' (Hayes, 2016).

References:

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