Longitudinal Analyses of Obesity Determinants and Associated Health Outcomes in the U.S. Middle-Aged and Older Adults

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Introduction

Obesity Prevalence & Trends

By General Population

2009-2010 National Health and Nutrition Examination Survey (NHANES)

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Overweight</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-29.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

68.8%
Overweight (33.1%)
Obese (35.7%)

Among Age Groups

The highest obesity rates: 40-59 and above 60 year-old

Source: Flegal et al., 2012; 2009-2010 NHANES

Between Genders

Adults aged 20 and over (1999–2010 NHANES)

By Different Race/Ethnicity

The highest obesity rates: non-Hispanic black females & Mexican American females (40-59 year-old)

Source: Flegal et al., 2012; 2009-2010 NHANES
Introduction

Why Study Middle-Aged & Older Adults

Age ≥ 65

40.2 million (2010)

88.7 million (2050)

Aging population

Sources:
Census Bureau, 2009
Sturk et al., 2009
CBO, 2010

Healthcare Costs

Healthcare Costs

5.7 trillion (2010)

0.5 trillion (2015)

More visits due to chronic conditions (47.3%)

2001
2005
2020

Obesity & Aging

Doctor’s Visits (%)

Introduction

Objective 1.

This study aims to investigate the association of the individual’s demographics (e.g., SES) and neighborhood characteristics on weight change over time among middle-aged and older adults.

Objective 2.

This study aims to examine the association between the implementation of Medicare Part D and the quality of life (i.e., health status & life satisfaction) among obese older adults.

Introduction

Gaps in the Literature

- Individual Sociodemographics and Obesity
  - Mixed conclusions of gender variation
  - Variant influence by education and race/ethnicity
- Inconsistent findings on the independence of individual’s socioeconomic status (SES) and neighborhood effects on obesity risk
- Lack of studies using longitudinal approaches to project the trends of BMI with the influences from individual/neighborhood socioeconomic position, and social factors
- Limited studies specifically for the middle-aged & elderly
- Little is known about the health impact of obese older adults from the Medicare Part D

Introduction

Hypotheses for Objective 1

Hypothesis 1.1
Body weight changes over time with variations in sociodemographics.

Hypothesis 1.2
Neighborhood SES and individual SES have cross-level interaction and relate to the individual’s body weight.

Introduction

Hypotheses for Objective 2

Hypothesis 2.1
The implementation of Medicare Part D (MPD) is associated with the increase of life satisfaction among obese Medicare beneficiaries.

Hypothesis 2.2
MPD is associated with the reduction of comorbidities among obese Medicare beneficiaries.

Hypothesis 2.3
MPD is associated with the increase of self-rated general health status among obese Medicare beneficiaries.

Hypothesis 2.4
MPD is associated with the increase of mental health status among obese Medicare beneficiaries.
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- Expected Contributions

Discussion
- Study Limitations
- Expected Contributions

Core Dataset - Health and Retirement Study (HRS)
- Ongoing nationally representative panel survey in the U.S. since 1992
- Conducted by the Institute for Social Research (ISR)
- Supported by the National Institute of Aging (NIA U01 AG099740)
- HRS Core Survey Categories are as follows:
  1. **Demographics**
     - Age, gender, education, household income, marital status, census region, etc.
  2. **Income**
     - Household income, poverty threshold, etc.
  3. **Family Structure**
     - # of people (parents/children, siblings) living in the household
  4. **Physical & Mental Health**
     - BMI, depression index, physical & mental health, etc.
  5. **Health Insurance**
     - Characteristics of health insurance programs to government-sponsored plans such as Medicare, Medicaid, and Veterans Affairs.
  6. **Psycho-social Measures**
     - Life satisfaction, chronic illness, etc.

Other Data Sources & Linkages
- Census Tract (Restricted Data)
- HRS Core Survey Data
- Medicare and Medicaid dual eligible beneficiaries
- HRS Geographic Information (Census Tract, Restricted Data)
- HHID (Household Identifier)
- PN (Person number)
- Other Data Sources & Linkages

Restricted Data Application Timeline
- Request Letter for Non-Study Researcher Submission
- Data Use Agreement (SIGNED Agreement)
- DIR Submission
- CMS Approved (SIGNED Agreement)
- IRB Agreement
- HRS DDC Agreement
- HRS Data Acquisition

Methods

Methods

Sample Selection for Objective 1

New participants added since 2004 (N = 3330)
- HRS Core Survey Data
- HRS Geographic Information (Census Tract, Restricted Data)
- Household Respondents who live at only one location during 2000-2010

Final Dataset for Analysis

Methods

Sample Selection for Objective 2

- HRS Core Survey Data
- HRS respondents who do not consent to share claims data

- Individuals in Veteran Affairs
- Recipients of state and other government subsidies
- Medicare and Medicaid dual eligible beneficiaries

BMIs 

BMI > 27 & BMI < 29.9 with at least one obesity related comorbidity

Treatment Group (2004-2008)
- Part D (No)
- Part D (Yes)

Control Group (2004-2008)
- Part D (No)
- Part D (Yes)
Methods

Study Variables for Objective 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>Brief Introduction</th>
<th>Dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
<td>BMI</td>
<td>Self-reported weights and heights from the respondents during each wave</td>
</tr>
<tr>
<td>Level-1 Covariate</td>
<td>Year (Time)</td>
<td>Time: distance (in years) between the measuring time point and the baseline (2000) time point (i.e., 0, 2, 4, 6, 8, 10)</td>
</tr>
<tr>
<td>Level-2 Covariates</td>
<td>Age</td>
<td>From the wave of 2000 HRS core survey</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>Male/Female</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>Number of years of schooling completed</td>
</tr>
<tr>
<td></td>
<td>Race/Ethnicity</td>
<td>No-Hispanic white, non-Hispanic black, Hispanic, and others</td>
</tr>
<tr>
<td></td>
<td>Health status</td>
<td>Physical and mental</td>
</tr>
<tr>
<td></td>
<td>Income</td>
<td>Total household income</td>
</tr>
<tr>
<td></td>
<td>Marital status</td>
<td>Coded by a dichotomous variable</td>
</tr>
<tr>
<td></td>
<td>Stress</td>
<td>Center for Epidemiological Studies Depression (CES-D) Scale</td>
</tr>
<tr>
<td></td>
<td>Metropolitan</td>
<td>Coded by a dichotomous variable</td>
</tr>
<tr>
<td></td>
<td>Census division</td>
<td>Northeast, Midwest, South, and West</td>
</tr>
</tbody>
</table>

Methods

Study Variables for Objective 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>Brief Introduction</th>
<th>Dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variables</td>
<td>Life Satisfaction</td>
<td>Measured by D 8-item scale (Cronbach’s alpha = .89)</td>
</tr>
<tr>
<td></td>
<td>Self-rated Health</td>
<td>Assessed as a reverse coding of a single-item rating of the respondent’s health</td>
</tr>
<tr>
<td></td>
<td>Mental Health</td>
<td>Measured by CES-D</td>
</tr>
<tr>
<td></td>
<td>Comorbidity</td>
<td>Charlson Comorbidity Index (summary score of overall disease burden)</td>
</tr>
<tr>
<td>Covariates</td>
<td>Age</td>
<td>From the wave of 2004 HRS core survey</td>
</tr>
<tr>
<td></td>
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Methods

Statistical Analyses for Objective 1: Hierarchical Linear Modeling (HLM)

Level-1: \[ Y_{ij} = \beta_{00} + \beta_{01} X_{ij} + \epsilon_{ij} \]

<table>
<thead>
<tr>
<th>Definition</th>
<th>( Y_{ij} )</th>
<th>Intercept of BMI for an individual ( i ) measured at time ( t ) with neighborhood characteristics ( j )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta_{00} )</td>
<td>Change rate of BMI for an individual ( i ) over time with neighborhood characteristics ( j )</td>
<td></td>
</tr>
<tr>
<td>( \beta_{01} )</td>
<td>Time: distance (in years) between the measuring time point and the baseline time point in 2000 (i.e., 0, 2, 4, 6, 8, 10)</td>
<td></td>
</tr>
<tr>
<td>( X_{ij} )</td>
<td>Random error term in BMI for an individual ( i ) measured at time ( t ) with neighborhood characteristics ( j )</td>
<td></td>
</tr>
</tbody>
</table>

Level-3: \[ 0ij = 00j + 01j X_{ij} + u_{ij} \]

<table>
<thead>
<tr>
<th>Neighborhood Built Environment</th>
<th>Number of recreation facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people who walk to work</td>
<td></td>
</tr>
<tr>
<td>Number of &amp; density of fast food restaurants</td>
<td></td>
</tr>
<tr>
<td>Median household income</td>
<td></td>
</tr>
</tbody>
</table>

Methods

Statistical Analyses for Objective 1 (cont.)

Level-2: \[ \pi_{ij} = \pi_{00j} + \pi_{01j} X_{ij} + r_{ij} \]

<table>
<thead>
<tr>
<th>Definition</th>
<th>( \pi_{ij} )</th>
<th>( \pi_{00j} )</th>
<th>( \pi_{01j} )</th>
<th>( r_{ij} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \pi_{ij} )</td>
<td>Time-invariant covariates (e.g., age at the baseline, gender, race/ethnicity, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \pi_{00j} )</td>
<td>Random error term at the individual level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \pi_{01j} )</td>
<td>Neighborhood characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( r_{ij} )</td>
<td>Random error term at the neighborhood level</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Methods**

**Statistical Analyses for Objective 1 (cont.)**

\[
Y_{ij} = \gamma_{000} + \gamma_{001}(X_{ij}) + \gamma_{010}(X_{ij}) + \gamma_{100}(X_{ij}) + u_{0j} + r_{ij} + \epsilon_{ij}
\]

Random effect

\[
BMI_{ij} = \gamma_{000} + \gamma_{001}(Neighborhood) + \gamma_{010}(Demographics) + \gamma_{100}(Time) + u_{0j} + r_{ij} + \epsilon_{ij}
\]

Level-3 random error

Level-2 random error

Level-1 random error

**Statistical Analyses for Objective 2 (cont.)**

\[
\text{Outcome}_{it} = \beta_0 + \beta_1(MPD) + \beta_2(Yr) + \beta_3(MPD \times Yr) + \beta_4(X'_{it}) + \epsilon_{it}
\]

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   - Statistical Analyses

3. Discussion
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   - Expected Contribution

**Discussion**

Study Limitations

- **BMI**
  - Self-reported weight and height: Under estimated weight
  - BMI is not the only measurement to determine obesity status

- Age-related loss of height between 70- and 80-year-old

- More years needed for significant improvements of chronic conditions (Objective 2)

- Study results may be affected by selection bias (Objective 2)
  - Healthier people many have less interest in participating health surveys

**Expected Contribution**

- Contribute additional knowledge of obesity trends and factors among understudied populations with longitudinal analytic approaches

- Provide stronger evidence in the variations of the relationships between sociodemographics and obesity

- First few studies that take into account both individual and environmental factors for obesity over a long period of time

- The policy and interventions related to the attenuation of obesity can be re-evaluated and changed based on new findings