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# Utilization of Home Healthcare Service by Medicare-Medicaid Dual Eligibles

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This study explores the characteristics of Medicare-only beneficiaries and Medicare-Medicaid dual eligibles in comparison, assess what factors determine the dual eligibility status, and examine the association between dual eligibility status and home healthcare service use. Using retrospective observational study of the U.S. 1996-2000 Medical Expenditure Panel Survey, we find that dual eligibles are disadvantaged in various personal characteristics compared to Medicare-only beneficiaries. The major predictors of dual eligibility status are race/ethnicity, family income and health conditions. Dual eligibles are likely to use more of both paid and unpaid home healthcare service, and subsequently induce higher total expenditures on home healthcare. As dual eligible population may be one contributor to the rapid growth in utilization and spending on home healthcare service in Medicare and Medicaid programs, policy makers need to precisely assess the medical need among the beneficiaries to efficiently coordinate Medicare and Medicaid programs. 

*Key Words*: Utilization; Healthcare.
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## 1. INTRODUCTION

It has been an important financial issue in the U.S. Medicare system that healthcare expenses of Medicare-Medicaid dual eligibles (MMDEs) are much higher than those of Medicare-only beneficiaries (MOBs). Dual eligibles, who are covered by both Medicare and Medicaid, represent only one-fifth of each program's enrollment, about 7 million in 1997, but account for a much larger share of each program's spending (Komisar et al., 2000).



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In 1999, dual eligibles accounted for about $50 billion in Medicare expenditures (24 percent of total Medicare spending) and $63 billion in Medicaid expenditures (35 percent of total Medicaid spending) nationwide, reflecting their relatively greater medical and long-term care demands (Ryan and Super, 2003). Dual eligibles are the most costly population being served by publicly funded healthcare programs (Centers for Medicare and Medicaid Services, 2002).

Health expenditures for the Medicare-Medicaid dual eligibles are more than double those of the Medicare-only beneficiaries. In 1999, total annual health expenditures (including Medicare, Medicaid, private, and out-of-pocket spending) averaged $16,278 for each dual eligible person compared with $7,396 on average for those who are not dually eligible (Centers for Medicare and Medicaid Services, 2002). According to Ryan and Super (2003), the dually eligible population is more likely to be disabled and either younger (under age 65) or older (over age 85) than the majority of Medicare beneficiaries. Over half of the dual eligibles are in poor or fair health, while only one quarter of non-dual eligibles reports their health as fair or poor. In particular, dual eligibles are more likely to suffer from chronic and serious health conditions such as diabetes, pulmonary disease, and stroke. Over 40 percent of dual eligibles have a cognitive or mental impairment, compared with 9 percent of Medicare-only beneficiaries (Health Care Financing Administration, 1997). Dual eligible population is culturally more diverse than Medicare-only population. Over 42 percent of dual eligibles represent minority populations, compared with 16 percent of Medicare-only beneficiaries (Ryan and Super, 2003). As the pattern of healthcare use possibly depend on an individual's racial or cultural background, non-white concentrated ethnicity distribution among dual eligibles may induce racial disparity in healthcare provision among them.

Known for their high cost and complex health needs, dually eligible individuals have been the center of debate in both programs and neither Medicare nor Medicaid wants to take full responsibility to face the medical needs of dual eligibles. Dual eligibles are still a heavy liability to public insurers (Ryan and Super, 2003). In spite of its importance in the efficient implementation of public healthcare system, only limited numbers of studies have been performed.

This study focuses on the effect of dual eligibility on the use of *home healthcare* service. The coverage for home healthcare in Medicare is limited to skilled nursing facility and home health benefit for persons in need of part-time skilled nursing care, physical or other therapy services at home bound. Medicaid extensively covers home healthcare service including nursing home care. Consequently, total expenditures by Medicare for home care services represent only 20% of total payment in 1998, which is 40% in Medicaid (Feder, Komisar and Neifeld, 2000). Since 1998 when the revisions

of the Health Insurance Manual 11(HIM-11) are issued, Medicare home healthcare spending has grown dramatically. Though Medicare coverage for long-term care is largely insufficient to meet the substantial care needs of elderly population, yet the increase in home healthcare expenditures by Medicare has been accelerated during last decade; In 1989, the annual percent change in Medicare home healthcare payment was 8.6%, which became 44.6% in 1991 (Bishop and Skwara, 1993). Ongoing expansion of Medicare home healthcare spending is anticipated due to three factors; (1) the shifting age distribution of the U.S. population as the baby-boom generation is ready to retire, (2) the implementation of hospital prospective payment system in Medicare, which results in shorter stays and quicker discharges of patients, subsequently greater needs for home healthcare, and (3) the limited access to nursing home beds. These factors may contribute the long-run growth in the demand for Medicare home healthcare. Additionally, the recent effort to expand Medicare coverage for home healthcare may enable dual eligibles to use more home healthcare service than medically necessary. In this regard, it is important to understand the role of dual eligibility in home healthcare use to assure adequate access to services at an affordable cost, and to define balanced coordination of Medicare and Medicaid in providing home healthcare services.

## 2. METHODS

### 2.1. Data

We use data from the 1996-2000 waves of the Medical Expenditure Panel Survey (MEPS). MEPS is a nationally representative survey conducted by the U.S. Agency for Health Care Policy and Research (AHCPR, now the Agency for Healthcare Research and Quality, AHRQ) and the National Center for Health Statistics (NCHS). This ongoing survey collects detailed information on health status, healthcare service use, medical expenditures, and insurance coverage as well as various socioeconomic and demographic characteristics for the U.S. civilian non-institutionalized population.

The population of interest for this study is Medicare beneficiaries. During 1996-2000, MEPS interviews total 130,938 individuals; among them, we select 8,262 individuals as they reported to have Medicare benefit throughout the entire calendar year. We exclude individuals who have private health insurance coverage supplemental to Medicare during a given year to avoid the potential complicating factor of private-public dual coverage. 22.8% of our sample (1,181 among 8,262 Medicare beneficiaries) has Medicare-Medicaid dual coverage.

Our primary dependent variables are the use of home healthcare services. They are measured as *total* number of home health provider days received either by paid or unpaid caregivers (HHTOTD) in a given year.

**TABLE 1.**

Definition of Dependent Variables

| Variable | Definition |
|---|---|
| HHTOTD | Total home health provider days |
| HHAGD | Agency-sponsored home health provider days (paid) |
| HHINFD | Informal home health provider days (unpaid) |
| HHAEXP | Total expenditure on agency-sponsored home healthcare services |

HHTOTD is decomposed by the provider type; agency-sponsored home health provider days (HHAGD) by paid caregivers such as hospitals or nursing homes and informal home health provider days (HHINFD) by unpaid caregivers who do not live with the respondent. Total expenditure for agency-sponsored home healthcare (HHAEXP) is also examined to test the hypothesis that if dual eligibles use more of home healthcare service, its impact is sufficiently large to induce higher total spending on home healthcare.

Information on home healthcare use is collected on a monthly basis. By adding up the number of provider days per month for all providers seen, total number of home health provider days in a given year is obtained. For example, if a person received care in one month from one provider on two different days, the number of provider days would equal two. The number of provider days would also equal two if a person received care from two different providers on the same day. However, if a person received care from one provider two times in the same day, then the provider days would equal one. Table 1 summarizes the definition of dependent variables for home healthcare service examined in this paper.

### 2.2. Statistical Analysis

Measures for home healthcare use (denoted by $y$) have three fundamental statistical properties: (1) to be nonnegative ($y \geq 0$); (2) to have nontrivial fraction of zero outcomes (Table 3); and (3) to follow a positively-skewed empirical distribution of the nonzero realizations. These unique data structures enforce our empirical investigation to rely on different alternative estimation strategies as illustrated below.

*Model 1:* The sample selection model (SSM) assumes that there are two linear equations determining the observed outcome:

$$\ln(y) = x\beta_1 + \upsilon \tag{1}$$

$$D_y = z\beta_2 + \upsilon \tag{2}$$

where $y > 0$ if $D_y = 1$ and $y = 0$ otherwise. Error terms $(\nu, \upsilon)$ are typically assumed to follow a bivariate normal distribution. In this model,

the outcome $\ln(y)$ is observed only if $D_y = 1$ in Equation (2) or equivalently $y > 0$. Equation (1) is identified only for strictly positive observations of $y$ using Heckman's approach (Heckman, 1979). He suggests an inverse Mills-ratio-corrected estimation of $\ln(y)$ on explanatory covariates $x$ for $y > 0$ only. The major shortcoming of this model is loss of possibly meaningful information of zero outcomes by truncating them in equation (1). Also by assuming bivariate normal distribution on errors, it requires large enough sample size to have nice asymptotic properties in the case of count data analysis. We implement the normality test for equation (1) to avoid the possible distributional misspecification.

*Model 2:* The generalized linear model (GLM) relates an outcome ($y$) on exogenous covariates $x$ as follows:

$$g(E(y)) = x\beta, y \sim F \tag{3}$$

where $g(.)$ is called the link function and $F$ the distributional families. Substituting various specifications for $g(.)$ and $F$ results in an array of models. For instance, if we assume $F$ to be a Poisson or negative binomial (NB) distribution, it gives us a log-linear model of a count data:

$$\log(E(y)) = x\beta, y \sim \text{Poisson/Negative Binomial (NB)} \tag{4}$$

In Poisson regression, it is assumed that the dependent variable $y$, the number of occurrences of an event, has a Poisson distribution given the independent variables $x$,

$$P(y = k|x) = e^{-\mu}\mu^k/k!, \quad k = 0, 1, 2, \ldots \tag{5}$$

It can be easily shown that the mean and variance of this distribution are equivalent to $\mu$, or $E(y) = var(y) = \mu$. Then, equation (4) can be rewritten as a log-linear function of the independent variables $x$ given as

$$\log(\mu) = x\beta \text{or equivalently}, \mu = \exp(x\beta). \tag{6}$$

The maximum likelihood method is used to estimate the parameters of a Poisson regression model. From equation (4), the log-likelihood function is given as

$$\log L(\beta) = \sum_i \{y_i \log(\mu_i) - \mu_i\}, \tag{7}$$

where $\mu$ follows equation (6) for all $i$.

Poisson and negative binomial regressions both are standard count models used to deal with the number of occurrences (counts) of an event. The

restrictive condition of the equality of mean and variance in the Poisson distribution is one reason that the negative binomial model is often preferred. In negative binomial regression, it is assumed that the dependent count variable $y$ follows a negative binomial distribution given the independent variables $x$,

$$P(y = k|x) = \frac{\Gamma(k + 1/\alpha)}{\Gamma(k + 1)\Gamma(1/\alpha)} \frac{(\alpha\mu)^k}{(1 + \alpha\mu)^{k+1/\alpha}}, \; k = 0, 1, 2, \ldots \tag{8}$$

where $\alpha$ is a dispersion parameter, measuring the extent of overdispersion. From equation (8), the log-likelihood function for the negative binomial maximum likelihood estimation is given as

$$\begin{aligned} \log L(\mu) &= \sum_i l_i \text{ where} \\ l_i &= y_i \ln(\alpha\mu_i) - (y_i + 1/\alpha) \ln(1 + \alpha\mu_i) + \log\left(\frac{\Gamma(y_i + 1/\alpha)}{\Gamma(y_i + 1)\Gamma(1/\alpha)}\right), \end{aligned} \tag{9}$$

Since the Poisson regression model excludes the possibility of the prevalent zero outcomes (no overdispersion assumed), we employ the Deviance-Pearson Chi-square goodness-of-fit test to detect overdispersion in the Poisson regression. Also, the likelihood ratio test for the overdispersion parameter $\alpha$ gives the appropriateness of the Poisson specification compared to the negative binomial specification.

*Model 3:* The zero-inflated count model is a modification of the standard count model by Mullahy (1986). In this model, we assume that there is the parent distribution function, denoted by $\phi$, for outcome realizations. In one regime (Part 1), outcomes are always zero. In the second regime (Part 2), outcomes are nonzeros. For each regime, the probability density function is a weighted average of the parent density given as

$$\phi_1 = \omega + (1 - \omega)\phi, (\text{Part } 1) \tag{10}$$

and

$$\phi_2 = (1 - \omega)\phi, (\text{Part } 2) \tag{11}$$

where $\omega$ is a weight parameter to let the integral of equations (10) and (11) be equal to 1. Then, the log-likelihood function $\Lambda$ is specified from $\phi_1$ and $\phi_2$ as follows.

$$\Lambda = \sum_{zeros} \log\{\omega + (1 - \omega)\phi\} + \sum_{nonzeros} \log\{(1 - \omega)\phi\}. \tag{12}$$

If we assume a Poisson distribution for $\phi$ (zero-inflated Poisson (ZIP) model), the equality of the mean and variance assumed in *Model 2* no longer binds, allowing overdispersion. The detailed discussion on *Model 3* is found in Greene (1997). Vuong test provides the appropriateness of ZI model over the standard count model.

*Specification Tests:* In our study, home healthcare use is measured as the number of home health provider days. A large portion of respondents report zero days of home heath provider services as noted in Table 3. Zero outcomes of total home health provider day account for 86.1% for the whole sample. The number gets upto 91.3% for dual eligible Asians. Dual eligible Afro-Americans are most likely to use at least one day of home healthcare. Yet, the frequency of zero outcomes is 67%. Similar statistics are calculated for agency-sponsored home health provider days (total 88.5% are zero observations), informal home health provider days (97.3%) and total expenditures on agency home healthcare (88%). To verify our observational hypothesis that a modified count model with overdispersion is the adequate specification for our analysis, we implement three specification tests for alternative models; (1) normality test against *Model 1*, (2) Deviance-Pearson goodness-of-fit test of a Poisson distribution against a negative binomial distribution, and (3) Vuong test of a standard count model against a zero-inflated count model. The results reject the assumption of the normal distribution, reject the Poisson specification, and reject the standard count model. Thus, we conclude that the zero-inflated negative binomial (ZINB) model, where the parent distribution is specified to follow a negative binomial distribution described in equation (8), is best fit for our data. The test statistics are available upon request to the authors.

In ZINB regression, we express the count outcomes $y$ as a function of various explanatory variables $X$, including demographic and socioeconomic characteristics, health conditions and insurance coverage status as follows.

$$\phi(y_i, \theta|X) = \phi\left(y_i, \mathrm{B}, \gamma\,|Z_i\ , Dual\_Eligible_i)\right) \tag{13}$$

where $\phi$ is a negative binomial probability density function. $i$ denotes the index for an individual. $y_i$ is total number of home healthcare use in a given year for an individual $i$. $Z_i$ represents a set of explanatory variables such as age, gender, marital status, education, race/ethnicity, employment, family income, region of residence, self-reported health status, number of co-morbidities, limitations to activities, diagnosed chronic diseases and dummies for survey year. Our key control variable is a binary variable of $Dual\_Eligible_i$ , which is equal to 1 if an individual $i$ is a dual eligible and 0 otherwise. $B$ and $\gamma$ indicate the corresponding coefficients for $Z_i$ and $Dual\_Eligible_i$, respectively. Multivariate logit regression is

performed as our preliminary analysis to examine which factor determines Medicare-Medicaid dual eligible status.

## 3. EMPIRICAL FINDINGS

Our sample is primary white, moderately educated individuals with family income above the poverty line. They are mostly in good/very good or excellent health condition. Most of the sample live in urban area and are not employed; the average age of 69.3 implies that high rate of unemployment is due to the retirement (more than 80 percent of the sample is aged over 65).

### 3.1. Who are dual eligibles?

Table 2 and 3 document the demographic, socioeconomic characteristics and health conditions of Medicare only beneficiaries compared to dual eligibles (MMDEs). About 66.7% of the MMDEs are aged 65 and over. This number gets much higher (84%) among the MOBs. Compared with the MOBs, the MMDEs are more likely to be younger (64.1 versus 70.9), to be female (67.6% versus 56.9%), to be unmarried (77.4% versus 53.4%), to be less educated (4.3% versus 12.6% of college graduation and more), and not to be employed (4.4% versus 13%). The family income is more likely to be below the federal poverty line for the MMDEs (44.9% versus 18.9%). These figures correctly reflect the eligibility criterion in Medicaid supporting children and pregnant women with low-income. Compared to Asian and Hispanic dual eligible, Afro-American dual eligibles present the least tendency of being over age 65, being married, and highest percent of family income below poverty line. This implies that dual eligible Afro-Americans include more children and unmarried persons and they are eligible for Medicaid due to low family income. Hispanic dual eligible are most likely to be less than high school educated (86.4%). Overall, racial minorities represent lower socioeconomic status than white population.

More than half of dual eligibles are in fair/poor health condition while only one third of MOBs are in the same condition (Table 3). MMDEs are more likely to have medical conditions in a priority list; about 50.6% of the MMDEs suffer from priority list conditions such as arthritis, asthma, cancer, diabetes mellitus, hypertension, and cardiac problems, compared to the MOBs (47.7%). Also, dual eligibles tend to have larger number of co-morbidities on average (6.47 versus 5.44). Limitations to activities of daily living (ADL) such as eating, bathing, dressing, getting into and out of bed or a chair and using the toilet are more prevalent among dual eligibles (20.3%) than among MOBs (8.6%). Similar result is found for limitations to instrumental activities of daily living (IADL), such as preparing meals, managing medications, and shopping for groceries (32.7% for MMDEs ver-

**TABLE 2.**

Description of the Medicare Beneficiaries

| Variable | Total | MOB | MMDE | | | |
|---|---|---|---|---|---|---|
| | | | Total | Asian | Black | Hispanic |
| N | 8,262 | 6,381 | 1,881 | 92 | 475 | 513 |
| (% of total sample) | | (77.2) | (22.8) | (4.9) | (25.3) | (27.3) |
| Age (mean) | 69.3 | 70.9 | 64.1 | 71.1 | 63.5 | 67.1 |
| Elderly (age 65 and over) | 0.801 | 0.84 | 0.667 | 0.88 | 0.653 | 0.77 |
| Male | 0.407 | 0.431 | 0.324 | 0.38 | 0.307 | 0.326 |
| Married | 0.411 | 0.466 | 0.226 | 0.435 | 0.149 | 0.308 |
| College and more (age≥20) | 0.127 | 0.126 | 0.043 | 0.122 | 0.033 | 0.018 |
| High school graduation (age≥16) | 0.404 | 0.4 | 0.237 | 0.122 | 0.245 | 0.123 |
| Less than high school | 0.474 | 0.474 | 0.732 | 0.761 | 0.737 | 0.864 |
| Employed | 0.11 | 0.13 | 0.044 | 0.022 | 0.032 | 0.029 |
| Urban | 0.727 | 0.736 | 0.698 | 0.957 | 0.72 | 0.819 |
| Family income below poverty line | 0.248 | 0.189 | 0.449 | 0.326 | 0.526 | 0.38 |

Note: The data are from Medical Panel Survey Expenditure (MEPS) 1996-2000 waves. The sample includes Medicare beneficiaries without any private health insurance coverage.

**TABLE 3.**

Health-Status and Utilization of Home Healthcare Services

| Variable | | Total | MOB | MMDE | | | |
|---|---|---|---|---|---|---|---|
| | | | | Total | Asian | Blacks | Hispanic |
| **Health Status** | | | | | | | |
| Poor health | | 0.361 | 0.320 | 0.501 | 0.359 | 0.499 | 0.524 |
| Having a medical condition in priority list | | 0.483 | 0.477 | 0.506 | 0.359 | 0.577 | 0.507 |
| Number of co-morbidities | | 5.67 | 5.44 | 6.47 | 4.15 | 5.8 | 6.4 |
| Having limitation(s) to ADL | | 0.112 | 0.086 | 0.203 | 0.141 | 0.219 | 0.222 |
| Having limitation(s) to IADL | | 0.194 | 0.154 | 0.327 | 0.239 | 0.361 | 0.296 |
| **Home Healthcare Use and Expenditure** | | | | | | | |
| Total home health | Zero | 86.1% | 89.7% | 74.1% | 91.3% | 67% | 78.3% |
| provider days | Any | 109.8 | 80.6 | 149.6 | 80 | 146.9 | 198.2 |
| Agency-sponsored home health | Zero | 88.5% | 91.8% | 77.2% | 93.5% | 72.1% | 80.8% |
| provider days | Any | 103.1 | 71 | 142.3 | 77.3 | 146.5 | 188.9 |
| Informal home health | Zero | 97.3% | 98% | 95.2% | 97.8% | 93.8% | 96.4% |
| provider days | Any | 92.9 | 79.4 | 112.1 | 88 | 101.8 | 162.1 |
| Total expenditures | Zero | 88% | 91.3% | 76.6% | 93.5% | 71.6% | 79.9% |
| on agency home healthcare ($) | Any | 7404.9 | 4464.1 | 11099.2 | 4479 | 9951.3 | 11801.9 |

sus 15.4% for MOBs). These statistics reflect more disability and consequently, more needs for personal assistance on daily basis among dual eligibles. Among MMDEs, Afro-Americans and Hispanics share the most deteriorated health conditions; Afro-Americans have largest likelihood of having a medical condition in the priority list and limitations to IADL. Hispanics have largest number of co-morbidities and strongest tendency to self-rate their health condition as fair/poor and have limitations to ADL. Compared to White population, racial minorities seem to suffer from more and worse health problems. This suggests that more complex and urgent medical needs are solicited among racial minorities and the possible healthcare disparity against them may intensify the problem.

### 3.2. How much home healthcare do they use?

We find the frequency of nonzero use of home healthcare is substantially larger for MMDEs across all measures (for example, 25.9% versus 10.3% for MOBs in total home healthcare provider days). If any use of services occurs, the average length of provider days is longer for MMDEs. Accordingly, total expenditure on paid home healthcare service is more than twice for dual eligibles ($11,099.2) than for MOBs ($4464.1).

Among dual eligibles, Afro-Americans represent the lowest tendency of zero utilization of home healthcare service for all measure. For example, only 67% of them report zero days compared to over 90% of Asians. Interestingly, Hispanics, not Afro-Americans, use the longest home healthcare provider days for all measures (total 198.2 days) and consequently, incur the highest spending ($11,801.9). This represents racial differences in home healthcare use among dual eligibles; *more* Afro-Americans depend on home healthcare, but Hispanics depend on it *more frequently* once they receive any home healthcare.

### 3.3. Why are they dual eligibles? A logistic analysis

The dual eligibility status is associated with disadvantaged conditions in both demographic/socioeconomic and health-related characteristics (Table 4). It is noteworthy that the largest predictor of dual eligibility status is race/ethnicity; being Asians has more than twice large effect on dual eligibility status than being Hispanics, which is the second largest predictor. As Medicaid program targets low-income families, family income level being below the federal poverty line appears to be an important factor for having dual coverage. Given the family income level controlled, the large effect of race/ethnicity on determining dual eligibility status implies that racial minorities may be lack of alternative source to obtain proper medical care other than Medicaid benefit. They may have relatively strong reluctance to purchase a private insurance for their children. Prevalent single parenting by unmarried women can be another reason. Other dis-

ability factors such as HIV/AIDS and diabetes that are prevalent among racial minorities (Bell et al., 1995; Williams, 2003; Siegel et al., 2004) allow them to be eligible for Medicaid benefit. Also, these diseases are found to be positively associated with low income level (Bachmann et al., 2003; Gulliford et al., 2003), which is another condition for Medicaid benefit. The psychological pressure from the social stigma of depending on public support may be less serious among racial minorities than Whites so that racial minorities are more willing to apply and receive dual coverage. Poor health status, having a medical condition or chronic disease and having limitations in activities increase the likelihood of being dually eligible, but with much smaller extent than race/ethnicity and poverty status. This indicates that given the same income level and race/ethnicity, health conditions play relatively small role in making a person eligible for Medicaid benefit. As race/ethnicity, family income and education level are important factors for dual eligibility status, it is a reasonable argument that socioeconomic disparity across race/ethnicity is compensated by improved access to healthcare for the disadvantaged group through Medicaid.

**TABLE 4.**

Logistic Regression of Dual Eligibility Status

| Variable | Odds Ratio | Std. Dev |
|---|---|---|
| Age | 0.974* | 0.002 |
| Male | 0.738* | 0.051 |
| Married | 0.416* | 0.029 |
| Less than high school | 2.03* | 0.133 |
| Employed | 0.513* | 0.066 |
| Asian | 5.53* | 0.986 |
| Afro-American | 1.75* | 0.140 |
| Hispanic | 2.57* | 0.210 |
| Family income below poverty line | 2.29* | 0.153 |
| Urban | 0.815* | 0.058 |
| Poor health | 1.26* | 0.084 |
| Having a medical condition in priority list | 1.09 | 0.068 |
| Number of co-morbidities | 1.05* | 0.008 |
| Having limitation(s) to ADL | 1.43* | 0.150 |
| Having limitation(s) to IADL | 1.62* | 0.143 |

Note: Robust standard errors are reported. * indicates significant at 0.01 level, two tailed test. The dependent variable is a binary indicator equal to 1 if an individual is Medicare-Medicaid dual eligible (MMDE) and equal to 0 if she is covered by Medicare only (MOB).

**TABLE 5.**

Zero-Inflated Negative Binomial Regressions of Home Healthcare Use

| Variable | HHTOTD | HHAGD | HHINFD |
|---|---|---|---|
| Age | 1.00 (0.003) | 1.00 (0.003) | 0.998 (0.006) |
| Male | 1.06 (0.094) | 1.04 (0.094) | 1.08 (0.207) |
| Married | 0.766 (0.071)*** | 0.709 (0.071)*** | 1.15 (0.281) |
| Less than high school | 1.04 (0.093) | 0.967 (0.086) | 1.51 (0.261)** |
| Asian | 0.322 (0.169)** | 0.03 (0.018)*** | 0.511(0.402) |
| Afro-American | 1.67 (0.215)*** | 1.93 (0.284)*** | 2.02 (0.572)** |
| Hispanic | 1.20 (0.179) | 1.29 (0.209) | 0.741(0.274) |
| Urban | 0.774 (0.061)*** | 0.694 (0.060)*** | 0.959 (0.166) |
| Poor health | 0.985 (0.074) | 0.972 (0.080) | 1.16 (0.194) |
| Having a medical condition in priority list | 0.790(0.057)*** | 0.726 (0.058)*** | 1.14 (0.188) |
| Number of co-morbidities | 1.02 (0.008)** | 1.02 (0.009)** | 0.962 (0.016)** |
| Having limitation(s) to ADL | 1.99 (0.172)*** | 2.02 (0.192)*** | 1.51 (0.278)** |
| Having limitation(s) to IADL | 2.01(0.181)*** | 1.90 (0.190)*** | 1.11 (0.217) |
| Dual eligibility | 1.62 (0.168)*** | 1.69 (0.193)*** | 1.56 (0.349)** |
| Dual Asian | 2.34 (1.57) | 36.0 (27.7)*** | 1.14 (1.26) |
| Dual Afro-American | 0.748 (0.130)* | 0.694 (0.133)* | 0.491(0.193)* |
| Dual Hispanic | 1.29 (0.262) | 1.31(0.283) | 1.93 (0.942) |
| LR statistic $\chi^2(27)$ | 431.74 | 433.50 | 49.11 |
| N (Nonzero observations) | 8,156 (1,130) | 8,176 (941) | 8,198 (218) |

Note: Incidence rate ratios and robust standard errors for each explanatory variable are reported. *, **, and *** denote statistical significance at 0.10 level, 0.05 level and 0.01 level, respectively. Dependent variables are: (1) total home health provider days (HHTOTD), (2) agency-sponsored home health provider days (HHAGD), (3) informal home health provider days (HHINFD).

### 3.4. Does dual eligibility have any impact on the use of the home healthcare service?

Table 5 reports the estimation results from the zero-inflated negative binomial regression for the effect of dual eligibility on home healthcare services use. Demographic conditions such as age, gender, and education level have insignificant effect on the use of home healthcare service. However, being married has a statistically significant reduction effect on total provider days and total agency home healthcare days. This can be interpreted that by having a stable family structure through marriage, individuals in need may have necessary medical assistance without depending on formal care givers, in particular, institutional paid providers.

Asians are likely to use less home healthcare while Afro-Americans are likely to use more of any kind of home healthcare service. This may reflect differences in family structure and relationship among family member. Due to historical and cultural reasons, Asian families may be of more extensive

range compared to Afro-Americans. They keep stronger binding among family members and across generations. Hence, they provide the necessary care for each other within family, showing reduced dependency on any home healthcare providers. Weak family structure like single parenting with large number of children and high rate of teenage pregnancy may explain increase in the utilization of home healthcare service among Afro-Americans.

It is interesting that having a chronic medical condition and having large number of co-morbidities show significant but either small increasing effect or even decreasing effect on the use of home healthcare service. This result can be attributed to restricted coverage of Medicare benefit for home healthcare, especially limited number of days covered and defined scope of eligibility. Medicare coverage for home healthcare is particularly limited for patients in postacute recovering stage. Though relatively light health limitations like ADL and IADL are supported by Medicare benefit, home healthcare to overcome more serious health problem from chronic diseases and associated complication would fall outside of the scope of Medicare home healthcare coverage. In this case, intensive and expensive specialty care may be required in hospital settings rather in homebound. The significant and increasing effect of ADL and IADL disabilities suggest that home healthcare in Medicare provides necessary assistance mostly for patients who are homebound and need to have daily assistance of living, therapy service, or durable medical equipment support during the recovery period rather than for patients with chronic serious medical problems.

When other factors are controlled, additional coverage of Medicaid supplemental to Medicare allows eligible population to use more of home healthcare service. It is possible that increased utilization among dual eligibles represents insufficiency of the sole coverage of Medicare for home health benefit to meet their medical need. Column 3 in Table 5, however, show that dual eligibles tend to use more unpaid informal care as well. Since financial burden is not an issue for the receipt of unpaid home healthcare, it is reasonable to say that supplemental coverage by Medicaid would have no significant impact on the utilization level. Thus, the observed positive relationship between dual eligibility and informal home healthcare use suggests that unobservable factors lead dual eligibles to have inherently stronger tendency to depend on any type of home healthcare. In this case, the concern is the possible overutilization of home healthcare among dual eligibles, rather than insufficient coverage of Medicare.

Among dual eligibles, Afro-Americans use less of any type of home healthcare service compared to other ethnicities. Our descriptive comparison in Tables 2 and 3 reveals deteriorated health conditions and disadvantaged economic status of dual eligible Afro-Americans, implying higher need for home healthcare service. However, when all other factors, especially income level and health conditions, are controlled, the use of home

healthcare service is reduced among dual eligible Afro-Americans. This suggests racial disparity against Afro-American in home healthcare provision.

**TABLE 6.**

Zero-Inflated Negative Binomial Regression of Home Healthcare Expenditure

| Variable | HHAEXP |
|---|---|
| Age | 0.996 (0.003) |
| Male | 1.00 (0.093) |
| Married | 0.743 (0.078)** |
| Less than high school | 0.995 (0.086) |
| Asian | 0.053(0.036)*** |
| Afro-American | 1.98(0.290)*** |
| Hispanic | 1.49(0.229)*** |
| Urban | 0.746(0.065)*** |
| Poor health | 0.911 (0.077) |
| Having a medical condition in priority list | 0.829 (0.065)** |
| Number of co-morbidities | 1.02(0.008)** |
| Having limitation(s) to ADL | 1.71(0.162)*** |
| Having limitation(s) to IADL | 1.44 (0.143)*** |
| Dual eligibility | 2.41(0.289)*** |
| Dual Asian | 9.47(7.89)*** |
| Dual Afro-American | 0.486(0.095)*** |
| Dual Hispanic | 0.811(0.174) |
| LR statistic $\chi^2(27)$ | 350.66 |
| N (Nonzero observations) | 8,250 (992) |

Note: Refer to Table 5. The dependent variable is total expenditure on agency-sponsored home healthcare (HHAEXP).

Table 6 documents similar results for total spending on agency-sponsored home healthcare service. Racial minorities such as Afro-Americans and Hispanics spend more on home healthcare. Having limitations to both ADL and IADL increase the home healthcare expenditure. Again, dual eligibility is responsible for increase in home healthcare spending in Medicare while dual eligible Afro-Americans spend less than other dual eligible ethnic groups. In sum, we find that dual eligibility raises the utilization of home healthcare services and this impact contributes to the recent growth in Medicare and Medicaid home healthcare spending in a significant way. Among dual eligibles, racial disparity against Afro-Americans is observed indicating unequal distribution of home healthcare service across race/ethnicity.

## 4. CONCLUSIONS AND DISCUSSION

This study uses a nationally representative sample of individuals with Medicare coverage to (1) empirically explore the characteristics of Medicare-only beneficiaries and dual eligibles in comparison, (2) assess what factors predict dual eligibility status, and (3) determine the effect of dual eligibility and its racial variation on the use of home healthcare services.

From the zero-inflated negative binomial regressions, we find stronger association with dual eligibility and the use of *paid* home healthcare services. In general, two possible interpretations on this finding can be drawn; Medicaid pays almost all financial burdens from home healthcare services while Medicare does not. Thus, the supplemental support from Medicaid additional to Medicare benefit for MOBs may result in overutilization. On the other hand, unmet demands under only Medicare benefit may be realized as increase in use of home healthcare when Medicaid benefit becomes available, indicating underutilization among MOBs due to insufficient coverage of Medicare. Though this study is limited to provide any conclusive suggestion on which must be the basis for reforming the public health insurance systems, we are able to provide supporting evidence for 'overutilization' among dual eligibles; the positive association between dual eligibility status and the use of *unpaid* informal home healthcare service suggests that dual eligibles use more of home healthcare even when the insurance coverage does not restrict or expand their access and affordability to home healthcare. Though we should not neglect the possibility that more generous coverage from Medicare and Medicare may lead to unnecessary and excessive use of home healthcare services, further research on dual eligible population needs to focus on factors other than insurance coverage to understand why they depend more heavily on home healthcare services compared to Medicare-only beneficiaries.

The negative association between being Afro-American or being dual eligible Afro-Americans and the use of home healthcare service suggests improper access to care among racial minorities. Healthcare professionals' attitudinal differences towards racial minorities in home healthcare provision is noted as one reason (Lakhan, 2002; Atkin, 2003)); Individual healthcare professionals are mostly Whites and racial minorities often feel it hard to establish trustful relationships with physicians of different race/ethnicity. Discomfort in the relationship between physicians and patients may lead to unfair prescription and limited access to home healthcare service.

In order to have efficient public healthcare delivery systems designed to deal with increased home healthcare utilization among dual eligibles and racial disparity among them, a precise assessment of their medical service needs is a prerequisite. Based on properly collected information

about healthcare needs, we may be able to provide optimally coordinated healthcare services between Medicare and Medicaid systems.

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