**eSupplement**: Health Insurance and Out-of-Pocket Costs in the Last Year of Life among Decedents utilizing the ICU

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**A. Interview questions used to elicit out-of-pocket cost data**

**Hospital, nursing home, and doctor visits:**

Were the costs for (her/his) [service] completely covered by health insurance, mostly covered, only partially covered, or not covered at all by insurance?

* Hospital stay(s)
* Nursing home stay(s)
* Doctor or clinic visit(s)

About how much did (she/he) pay out-of-pocket for [service] [since the prior interview (month/year)/in the two years before (her/his) death]?

* Hospital bills
* Nursing home bills
* Doctor or clinic visits

**Prescription drugs:**

Were the costs for (her/his) prescription medications completely covered by health insurance, mostly covered, only partially covered, or not covered at all by insurance?

On average, about how much did (she/he) pay out-of-pocket per month for these prescriptions [since the prior interview (month/year)/in the last two years]?

**Other out-of-pocket costs:**

Aside from the medical expenses we already mentioned, did (she/he) have any other out-of-pocket medical expenses, that is, expenses not covered by insurance, such as medications, special food, equipment such as a special bed or chair, visits by doctors or other health professionals, or other costs?

About how much did (she/he) pay out-of-pocket for these expenses [since the prior interview (month/year)/in the last two years]?

**B. Imputation methods**

One-fifth to one-third of respondents, depending on the cost category, were unable to provide an exact dollar amount for OOP costs, including 38% of respondents with any hospital OOP costs, 26% with any nursing home costs, 36% with any doctor visit costs, 20% with any prescription drug costs, and 23% with any other OOP costs. For these respondents, the HRS poses a series of questions to determine an upper and lower limit to the OOP costs, thereby bracketing the estimated spending. We used imputation methods, described below, that are standard for the HRS and described by the RAND Corporation to impute values for respondents who did not provide one.

Ordinal logistic regression was used to impute brackets for respondents who did not complete the entire sequence of bracketing questions. A linear regression model was then fitted to the log-transformed costs for all respondents who reported an exact dollar amount. Predicted values were generated for all respondents and the nearest neighbor within the same cost bracket who provided an actual dollar amount was identified. For each missing observation, the actual amount reported by the nearest neighbor was used as the imputed value. Importantly, we modified the RAND imputation models to account for the different time periods that respondents were reporting on. In our sample, amount of utilization within the cost category was a much stronger predictor of costs than time period. Thus, amount of utilization was included in all imputation models. For example, when imputing hospital OOP costs, we included the number of hospital stays in the imputation models.

**C. eTables and eFigures**

**eTable 1. Significant pairwise comparisons of predicted out-of-pocket costs**a,b

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **<65 years** | | **>=65 years** | | | | **All ages** |
|  |  | **Medicaid** | **Private** | **Medicare Advantage only** | **Medicare FFS only** | **Medicare + Medicaid** | **Medicare + Private** | **Uninsured** |
| **<65 years** | **Medicaid** | -- |  | D | D, O |  | D, O |  |
| **Private** |  | -- | N | H, N, D | N | N |  |
| **>=65 years** | **Medicare Advantage only** | D | N | -- | H, D, T | Rx |  | N |
| **Medicare FFS only** | D, O | H, N, D | H, D, T | -- | H, N, D, Rx, T | H, D, T | N |
| **Medicare + Medicaid** |  | N | Rx | H, N, D, Rx, T | -- | N, Rx, T | N, Rx, T |
| **Medicare + Private** | D, O | N |  | H, D, T | N, Rx, T | -- | N |
| **All ages** | **Uninsured** |  |  | N | N | N, Rx, T | N | -- |

a - Comparisons were significant at p<0.05 level with no adjustment for multiple comparisons

b - Service category: H – Hospital; N – Nursing home; D – Doctor visits; Rx – Prescription drugs; O – Other medical expenses; T – Total medical expenses

**eTable 2: Number of hospital stays and number of nights in hospital summary statistics**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **All subjects**  **(n=2,909)** | **<65 years** | | **>=65 years** | | | | **All ages** |
| **Medicaid**  **(n=200)** | **Private**  **(n=101)** | **Medicare Advantage only**  **(n=310)** | **Medicare FFS only**  **(n=374)** | **Medicare + Medicaid**  **(n=743)** | **Medicare + Private**  **(n=1,126)** | **Uninsured**  **(n=55)** |
| **Number of stays** |  |  |  |  |  |  |  |  |
| mean (sd) | 3.6 (4.9) | 5.7 (9.0) | 3.6 (4.6) | 3.4 (4.5) | 3.1 (2.9) | 4.0 (6.2) | 3.2 (3.4) | 2.9 (2.6) |
| median (iqr) | 2 (1-4) | 3 (2-6) | 2 (1-4) | 2 (1-4) | 2 (1-4) | 2 (1-4) | 2 (1-4) | 2 (1-4) |
| **Number of nights in hospital** |  |  |  |  |  |  |  |  |
| mean (sd) | 30 (45) | 43 (92) | 34 (41) | 26 (31) | 31 (50) | 27 (31) | 29 (42) | 32 (44) |
| median (iqr) | 17 (8-31) | 20 (8-45) | 20 (9-35) | 15 (7-30) | 15 (8-30) | 15 (7-30) | 17 (9-33) | 15 (10-30) |

sd: standard deviation; iqr: interquartile range

**eTable 3. Predicted out-of-pocket costs (and 95% confidence intervals) for the one year prior to death by service category for subjects, 65 years of age and older, continuously covered and those who transitioned to Medicaid**

|  |  |  |
| --- | --- | --- |
|  | **>=65 years** | |
| **Continuously on Medicare + Medicaid**  **(n=450)** | **Transitioned to Medicare + Medicaid**  **(n=293)** |
| **Service category**  Hospital | $556 (100, 1,012) | $3,248 (1,531, 4,966) |
| Nursing home | $1,323 (656, 1,989) | $2,499 (1,443, 3,555) |
| Doctor visits | $226 (88, 364) | $1,449 (722, 2,175) |
| Prescription drugs a | $45  (33, 58) | $144  (96, 192) |
| Other medical expenses b | $520 (168, 872) | $1,020 (49, 1,991) |
| **Total out-of-pocket costs** | $2,409 (1,709, 3,108) | $10,045 (6,534, 13,556) |

a - Prescription drug costs were reported for a one month period.

b - Respondents were asked about any other out-of-pocket medical expenses that were not covered by insurance, such as medications, special food, equipment such as a special bed or chair, visits by doctors or other health professionals, or other costs.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **<65 years** | | **>=65 years** | | | | **All ages** |
| **Medicaid** | **Private** | **Medicare Advantage**  **only** | **Medicare FFS**  **only** | **Medicare + Medicaid** | **Medicare + Private** | **Uninsured** |
| **Service category**  Hospital a | 0.36  (0.23, 0.50) | 0.71  (0.56, 0.86) | 0.41  (0.33, 0.49) | 0.44  (0.36, 0.51) | 0.22  (0.17, 0.27) | 0.30  (0.26, 0.35) | 0.51  (0.30, 0.72) |
| Nursing home | 0.16  (0.01, 0.30) | 0.07  (-0.06, 0.21) | 0.14  (0.09, 0.19) | 0.17  (0.12, 0.23) | 0.12  (0.09, 0.16) | 0.12  (0.09, 0.15) | 0.13  (-0.03, 0.29) |
| Doctor visits a | 0.28  (0.16, 0.40) | 0.62  (0.45, 0.79) | 0.57  (0.49, 0.66) | 0.48  (0.40, 0.56) | 0.25  (0.20, 0.30) | 0.38  (0.33, 0.44) | 0.58  (0.38, 0.79) |
| Prescription drugsa | 0.50  (0.37, 0.64) | 0.70  (0.55, 0.85) | 0.76  (0.68, 0.83) | 0.66  (0.59, 0.73) | 0.48  (0.42, 0.54) | 0.78  (0.73, 0.82) | 0.63  (0.43, 0.83) |
| Other medical  expenses b | 0.21  (0.08, 0.34) | 0.25  (0.09, 0.42) | 0.26  (0.19, 0.33) | 0.25  (0.18, 0.31) | 0.17  (0.13, 0.21) | 0.24  (0.20, 0.29) | 0.26  (0.08, 0.44) |

**eTable 4. Predicted probabilities (and 95% confidence intervals) of having any out-of-pocket costs by service category and type of health insurance coverage among subjects with ICU and life support use**

a - Indicates that type of insurance is a significant predictor of having any out-of-pocket costs in the service category at p<0.001 level

b - Respondents were asked about any other out-of-pocket medical expenses that were not covered by insurance, such as medications, special food, equipment such as a special bed or chair, visits by doctors or other health professionals, or other costs.

**eTable 5. Predicted out-of-pocket costs (and 95% confidence intervals) for the one year prior to death** **by service category and type of health insurance coverage among subjects with ICU and life support use**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **<65 years** | | **>=65 years** | | | | **All ages** |
| **Medicaid** | **Private** | **Medicare Advantage**  **only** | **Medicare FFS**  **only** | **Medicare + Medicaid** | **Medicare + Private** | **Uninsured** |
| **Service category**  Hospital | $1,922 (508, 3,335) | $3,932 (884, 6,979) | $2,929 (1,436, 4,422) | $5,104 (3,028, 7,180) | $1,940 (789, 3,092) | $2,198 (1,326, 3,070) | $17,977  (-3,878, 39,831) |
| Nursing home | $322 (1, 643) | $1 (-1, 3) | $2,316 (-115, 4,747) | $2,449 (1,061, 3,837) | $1,169 (581, 1,756) | $1,711 (764, 2,659) | $10 (-4, 24) |
| Doctor visits | $432 (73, 792) | $692 (158, 1,226) | $1,452 (762, 2,142) | $1,916 (1,054, 2,778) | $1,170 (473, 1,867) | $1,286 (689, 1,883) | $1,351 (300, 2,402) |
| Prescription drugs a | $92  (-11, 195) | $88  (-12, 189) | $189  (-13, 391) | $218  (-20, 456) | $102  (-5, 210) | $205  (-15, 426) | $218  (-32, 467) |
| Other medical  expenses b | $283 (-6, 572) | $218 (-60, 496) | $389 (157, 622) | $913 (298, 1,528) | $664 (93, 1,236) | $562 (303, 820) | $419 (-278, 1,115) |
| **Total out-of-pocket costs** | $5,151 (2,204, 8,098) | $7,037 (2,722, 11,353) | $8,842 (5,020, 12,663) | $11,556 (8,523, 14,590) | $6,255 (3,599, 8,910) | $7,839 (5,754, 9,923) | $22,808 (2,522, 43,095) |

a - Prescription drug costs were reported for a one month period.

b - Respondents were asked about any other out-of-pocket medical expenses that were not covered by insurance, such as medications, special food, equipment such as a special bed or chair, visits by doctors or other health professionals, or other costs.

**D. Technical Appendix**

We modeled the probability of having any OOP costs in each cost category by insurance coverage using logistic regression. We modeled OOP costs using a two-part model with logistic regression and a generalized linear model with gamma family and log link. To generate predicted probabilities of having any OOP costs and predicted OOP costs combining the estimates from each part of the two-part model, we used recycled predictions whereby we used the estimated coefficients and values of independent variables to estimate probabilities and amount of OOP costs. We then (counterfactually) varied the insurance type for every individual. This method removes the individual-level variation in spending from the estimate on costs, since all individuals are used for the estimates for each insurance status studied.

Regression equation for Table 2:

where

Y = a binary variable equal to 1 when costs are greater than zero and equal to 0 when costs are zero

Insurance = a set of dummy variables indicating type of insurance coverage (<65 Medicaid, <65 private, >65 Medicare

FFS only, >65 Medicare Advantage only, >65 Medicare and Medicaid, >65 Medicare and private, uninsured)

X = a vector of coviarates, including

Age at death (years) – continuous

Age at death (years) squared – continuous

Sex – dummy variable for male

Race – a set of dummy variables indicating race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other)

Education – a set of dummy variables indicating highest level of education (less than high school, high school graduate

or GED, some college, college graduate or advanced degree)

Marital status – dummy variable for not married/partnered

Veteran status – dummy variable for past military service

Total household income (2014 dollars) – continuous

Total household assets (2014 dollars) - continuous

Dialysis – dummy variable for use of dialysis during ICU stay

Life support – dummy variable for use of life support during ICU stay

Self-rated health – dummy variable for self-reported health rating of “good, very good, or excellent”

Total number of activities of daily living with which subject reports any difficulty – continuous (range 0-5)

Number of reported chronic conditions – continuous (0-9)

Post 2006 – dummy variable indicating death year of 2006 or later

Number of months in recall period - continuous

Regression equations for Table 3:

Due to limited sample sizes, parsimonious models were required for the two-part models estimating nursing home costs and other medical expenses. For these cost categories, models adjusted only for age, gender, education, marital status, number of chronic conditions, and assets.

Part 1 of two-part model:

where

Y = a binary variable equal to 1 when costs are greater than zero and equal to 0 when costs are zero

Insurance = a set of dummy variables indicating type of insurance coverage (<65 Medicaid, <65 private, >65 Medicare

FFS only, >65 Medicare Advantage only, >65 Medicare and Medicaid, >65 Medicare and private, uninsured)

X = a vector of coviarates as described below

Part 2 of two-part model (only observations where costs are greater than zero are included in this second part of the model):

where

Y = out-of-pocket costs

Insurance = a set of dummy variables indicating type of insurance coverage (<65 Medicaid, <65 private, >65 Medicare

FFS only, >65 Medicare Advantage only, >65 Medicare and Medicaid, >65 Medicare and private, uninsured)

X = a vector of coviarates, including

Age at death (years) – continuous

Age at death (years) squared – continuous

Sex – dummy variable for male

Race – a set of dummy variables indicating race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other)

Education – a set of dummy variables indicating highest level of education (less than high school, high school graduate

or GED, some college, college graduate or advanced degree)

Marital status – dummy variable for not married/partnered

Veteran status – dummy variable for past military service

Total household income (2014 dollars) – continuous

Total household assets (2014 dollars) - continuous

Dialysis – dummy variable for use of dialysis during ICU stay

Life support – dummy variable for use of life support during ICU stay

Self-rated health – dummy variable for self-reported health rating of “good, very good, or excellent”

Total number of activities of daily living with which subject reports any difficulty – continuous (range 0-5)

Number of reported chronic conditions – continuous (0-9)

Post 2006 – dummy variable indicating death year of 2006 or later

Number of months in recall period - continuous