Applying Survival Analysis to Health Risk Assessment Data to Predict Time to First Hospitalization

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Research Objective: The decrease in Medicare reimbursement rates has forced most Medicare HMOs to intensify their various cost-containment strategies, such as to reduce capitation rates to providers, further restrict drug formularies, bolster utilization review, and develop disease-specific management programs to improve patients' self-management of their chronic diseases. Arguably, these cost-saving efforts would be enhanced by systematically identifying members at risk of utilizing resource-intensive health services so that they could be directed into programs appropriately designed to maintain or improve current health status. While several health assessment tools have been developed to identify individuals in the senior population at risk for high utilization and expenditures, no tool has provided information as to *when* a provider or health plan can expect utilization to begin for the different risk categories. This paper examines the use of survival analysis for determining timelines to first hospitalization using risk classification established by the P_{RA} (*p*robability of *r*epeated *a*dmission) instrument, which is considered by many to be the best method currently available for screening older populations.

Study Design: At baseline, new health plan enrollees completed a mailed survey that included a P_{RA} assessment. Scores were used to classify members into both high/low-risk groups and decile risk categories, then used to estimate the probability of hospitalization, based on admission data collected up to 25 months following completion of the survey. A survival analysis was developed to plot the probability of first hospitalization from time of survey completion.

Population Studied: 12,240 Medicare enrollees of a medium-sized HMO in Southern California.

Principal Findings: Using the high/low cut-off method, the likelihood of admission in the high-risk group was more than double that of the low-risk group at 25 months, with a 5-month shorter mean timeline to first hospitalization (16.12 versus 21.14 months, respectively). In the decile-ranking method, all the high-risk members from the 0.50 cut-off method fell into the highest decile. Similarly, the highest decile group exhibited the lowest mean number of months to first hospitalization (16.99).

Conclusions: Both methods of classifying members into risk categories proved effective, with the decile-ranking method providing more detailed information. Survival analysis proved effective in comparing risk groups for their likelihood of admission, and estimating the number of months to first hospitalization.

Implications for Policy, Delivery, or Practice: Based on the expected number of months until first hospitalization, a health care organization may determine the level of intervention needed for members identified for risk of hospitalization. HMOs may choose to implement intensive interventions to anticipate or obviate future probable hospitalizations for those members expected to be hospitalized within a short period of time, while implementing lower level interventions as the likelihood of hospitalization decreases. Additionally, HCFA now requires every Medicare-risk Health Plan to use screening tools to establish treatment plans for new enrollees. The data derived from the present study lay the foundation for the introduction of specific risk-level interventions that may improve health-status of the senior membership while allocating limited resources in an appropriate and cost-effective manner.

Primary Funding Source: None.