Development of the Senior Health Questionnaire

The Senior Health Questionnaire (SHQ) was developed to assess the health status of seniors using standard risk scores such as the SF-12, the nutritional screening initiative, the probability of readmission, and the body mass index. Other information, such as health history and behavior is also collected in this tool.

The SHQ was developed at Response Technologies (now a subsidiary of HCIA Inc.) over an 8-month period. The chief scientist on the project was James Dewey, Ph.D. Dr Dewey's background is in survey development, validation, and analysis. He was also the acting president of the Society for Prospective Medicine, a health risk appraisal research organization.

Development of a survey prototype took approximately three months. A literature review was conducted to determine the most current knowledge in the field of senior health risk appraisal. The original design of the survey was based on research and tools developed at the Health Institute at New England Medical Center in Boston, the Nutrition Institute, the Council on Aging, and the University of Minnesota. The prototype was developed by Dr Dewey and three Response Technologies researchers: Daniel Malloy, Ph.D., Stephen Ober, M.D., and D.C. Argy, M.D.

The standardized tools chosen for inclusion into the SHQ were the SF-12, and the Body Mass Index, and the Alcohol CAGE score. These tools were chosen given their widespread acceptance and validity as health risk measurements within the senior population. Other measurements chosen to supplement these tools were utilization history, a current health profile, and a health history. An overall risk score was developed that used the composite results of the SF-12, the BMI, health history, and utilization history.

The tool was presented to an expert panel for review. This panel included physicians from family practice and gerontology, health science researchers, and health service administrators. This panel made recommendations on adding items, clinical information as it relates to risk, survey logic and flow of items. A reliability test was then conducted using a sample of 50 seniors.

After testing, the survey was edited by the Response Technologies team. This design was presented to the expert panel for their final approval before release.

Senior Health Questionnaire

The Senior Health Questionnaire is designed to assess the health of seniors. It consists of 50 questions that measure the functional health status, quality of life, health history, utilization of health services, lifestyle, and nutritional status. In includes a number of standard instruments that assess risk, and an overall risk score. The development process is described in a separate document.

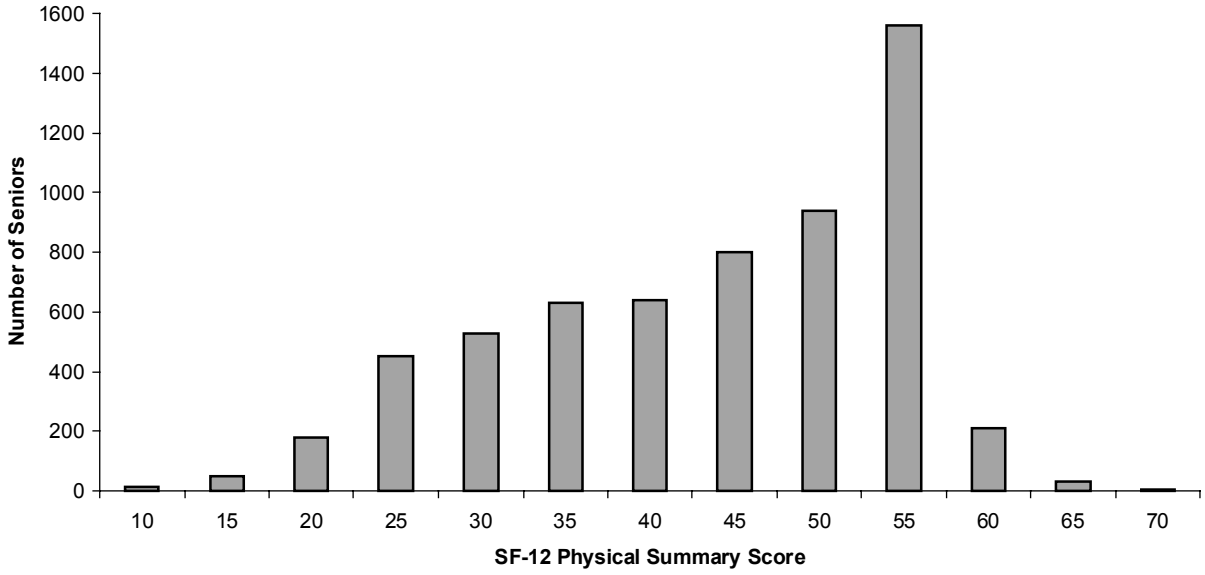
The purpose of this report is to document the performance of the survey as an assessment tool. Presented below are selected health risk profiles for a large cohort of seniors, based on data extracted from the HCIA National Outcomes Warehouse. The cohort is 6,000 seniors enrolled in a Medicare risk product for whom claims data are available. The areas profiled include functional health status, prevalence of health conditions, body mass, utilization of health services, and overall health risk.

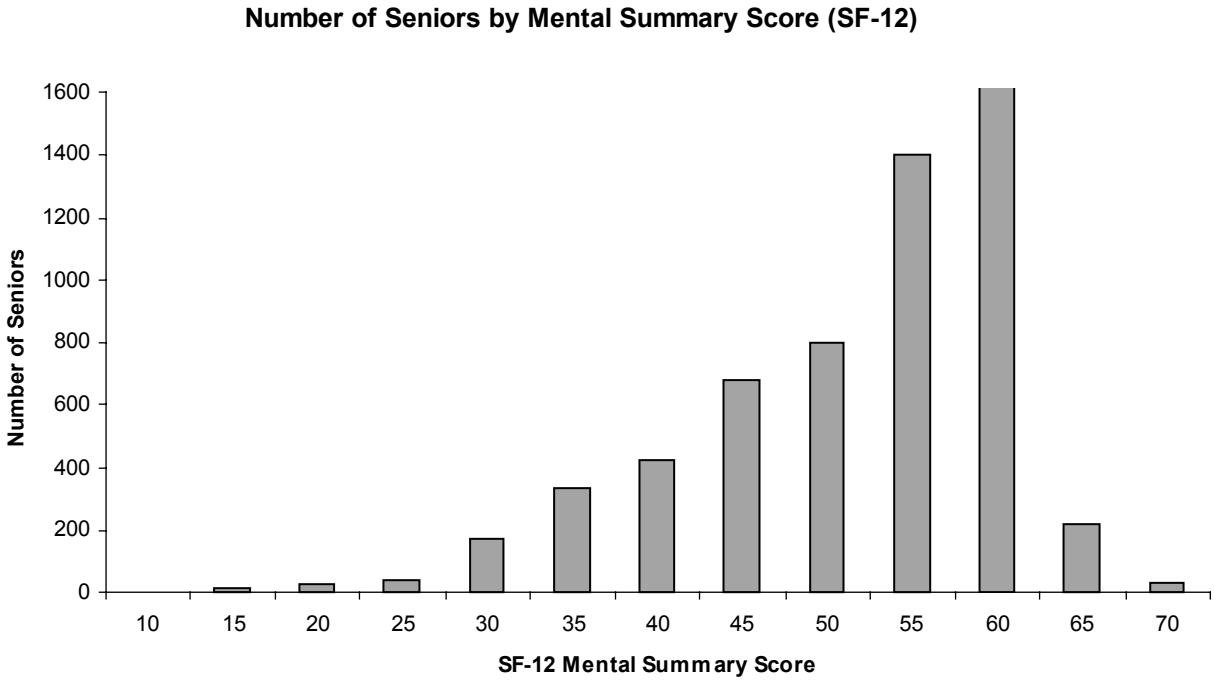
Functional Health Status

The questionnaire begins with the SF-12 instrument, a multipurpose short-form generic measure of health status that includes 12 items measuring eight health concepts. It is scored using a complex algorithm that produces two scales consisting of a physical summary score and a mental summary score. Scores can vary from 0-100, with higher scores indicating better functional status and greater well-being.

For the cohort, the average score for the physical scale was 43.8 (standard deviation of 11.0), and the average score for the mental scale was 51.6 (standard deviation of 9.3). These numbers closely match published norms for persons aged 65-74 in the general population. The graphs below and on the following page display the distribution of seniors based on their physical and mental health status, as measured by the SF-12.

Number of Seniors by Physical Summary Score (SF-12)



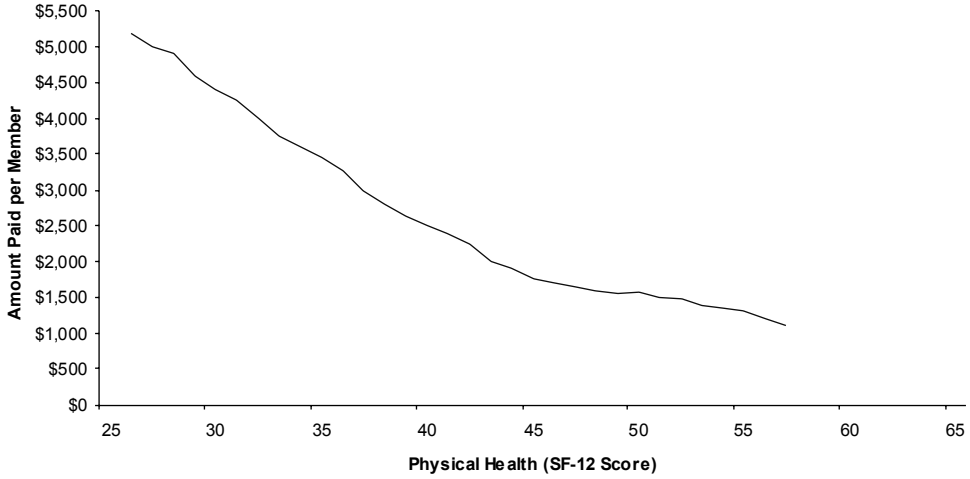


There is a strong relationship between the physical and mental health scores and claims dollars paid. Survey respondents were placed into 10groups of equal size based on ascending values of their physical score or mental score from the SF-12.The average claims dollars paid was calculated for each group. Results are shown in the tables below, with physical health on the left and mental health on the right. All differences are statistically significant. The same results are also shown graphically on the following page.

Deciles of SF-12 **Physical** Function Score	Average Paid per Member
23.0	$5,833
30.2	$4,409
35.3	$3284
39.9	$2658
44.3	$1746
47.9	$1544
51.0	$1689
53.5	$1098
55.3	$1272
57.4	$1036

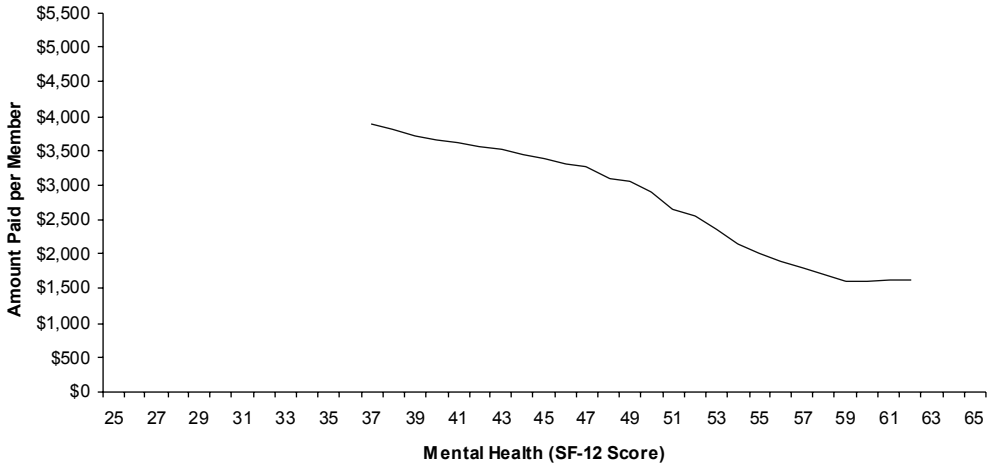
Deciles of SF-12 **Mental** Function Score	Average Paid per Member
32.0	$4,166
40.8	$3,442
45.8	$3195
49.7	$2959
53.0	$2356
55.4	$1780
57.3	$2022
58.6	$1334
60.2	$1358
62.9	$1958

Association of Physical Health With Amount Paid per Member



Physical Health (SF-12 Score)

Association of Mental Health With Amount Paid per Member



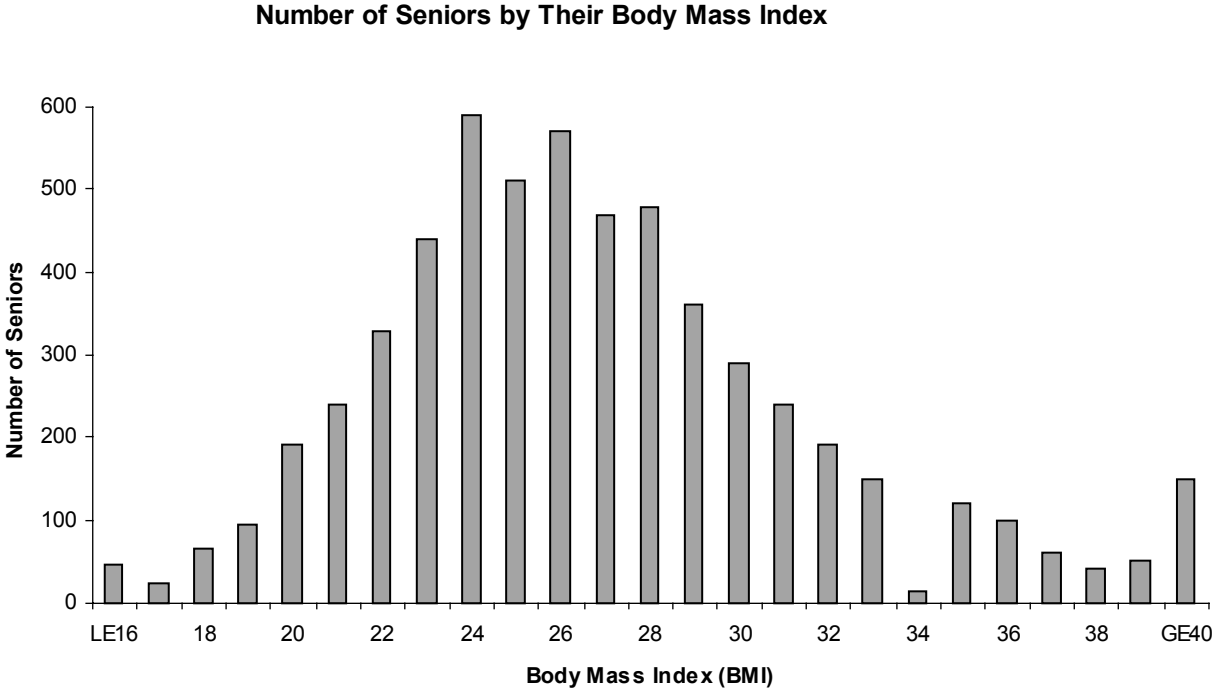
Physical and mental health scores are also associated with other characteristics of seniors measured by the survey. The table below quantifies the strength of association between selected characteristics and physical and mental health. R-squared statistics were calculated for each characteristic, without adjustment for the other characteristics. Note the large proportion of variance in health status scores that is associated with the number of health conditions, risk factors and medications.

Proportion of Variance in SF-12 Scores Associated with Characteristics of Seniors

	Physical Score	*Mental Score*
Age & Gender	2.8%	1.4%
Body Mass Index	2.9%	0.5%
Overnight Hospital Stay	5.4%	2.2%
Number of Medications	17.3%	4.7%
Health Conditions	22.7%	7.8%
Other Risk Factors	25.4%	15.7%

Body Mass (indicator of overweight/underweight)

The body mass index (BMI) is a good predictor of morbidity and mortality within an elderly population. It is calculated as the weight in kilograms divided by the square of the height in meters. The graph below displays the distribution of body mass index across the cohort. The average BMI is 27.0. Note that fewer than half of seniors fall into the low risk range 22-27. (The left-most bar includes values of 16 or less; the right-most bar includes values of 40 or greater; values are rounded to the nearest whole number.)



The following table shows that 13.3% of seniors are at risk due to underweight, and 43.3% are at risk due to overweight. To help interpret the risk categories, body weights are shown for each risk category for a male and female of average height.

Prevalence Among Seniors for Risk Categories of the BMI

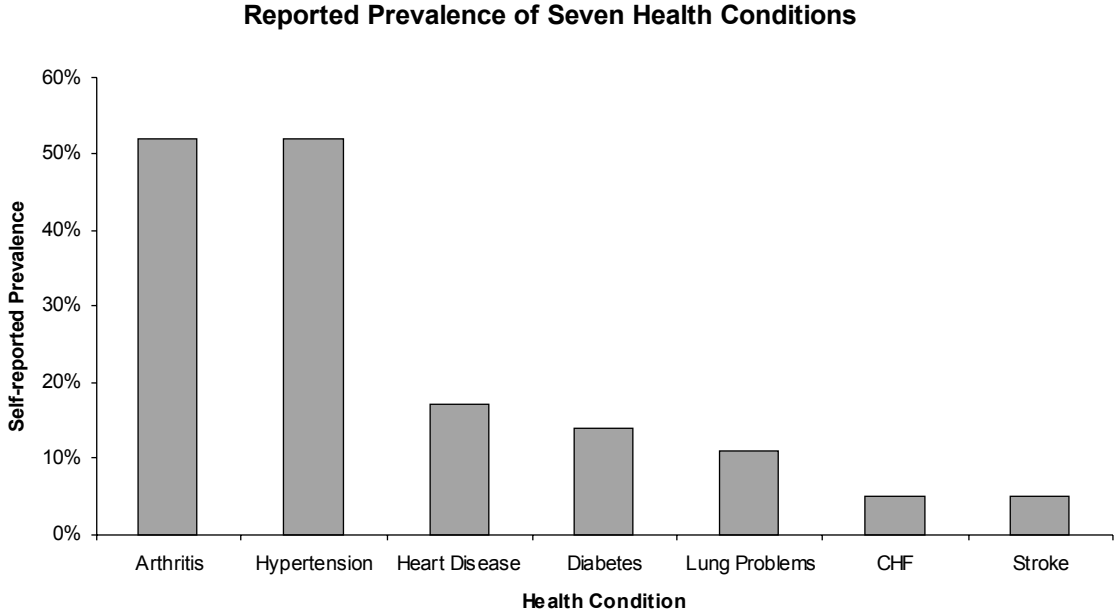
			Weight Range for Typical Senior	
Risk Category:	*BMI Range*	*Prevalence:*	*5 ft 8 in Male*	*5 ft 2 in Female*
High Risk Underweight	BMI<20	5.0%	<131 lbs	<109 lbs
Moderate Risk Underweight	20<=BMI<=22	8.3%	131-144 lbs	109-120 lbs
Low Risk	22<=BMI<=27	43.4%	144-177 lbs	120-147 lbs
Moderate Risk Overweight	27<BMI<=32	28.9%	177-210 lbs	147-174 lbs
High Risk Overweight	BMI>32	14.4%	>210 lbs	>174 lbs

Self Reported Health Conditions

The following table shows the prevalence of health conditions self-reported by the cohort.

Health Condition:	*Prevalence:*	*Health Condition:*	*Prevalence:*
1. Arthritis	52%	5. Serious lung problems	11%
2. Hypertension	52%	6. Congestive Heart Failure	5%
3. Heart disease	17%	7. Stroke	5%
4. Diabetes	14%		

Prevalence rates vary ten-fold across health conditions, as emphasized visually in the following graph.



Many seniors report having multiple health conditions.

	Prevalence:
No Health Condition	28%
Exactly One Condition	32%
Multiple Conditions	39%

The prevalence of health conditions increases with age among the cohort of seniors, with the exception of diabetes (prevalence decreases with age). The prevalence of health conditions is generally slightly higher for males than females, with the exception of hypertension (prevalence moderately higher for females). Since the age and gender effects are modest and similar across health conditions, the effect of adjustment for age and gender differences would be modest.

Utilization History

The survey includes questions about utilization history, such as the number of medications currently taken, overnight hospital stays during the past year, and plans for major surgery during the coming year.

The tables on the following page show that 14% of seniors take five or more medications regularly, and 14% have been hospitalized overnight during the previous year. Two percent (2%) have plans for major surgery (not shown).

Medications Taken:	*Prevalence:*	*Overnight Hospitalizations:*	*Prevalence:*
None	20%	None	86%
1-2	39%	1	8%
3-4	27%	2+	6%
5+	14%		

The numbers of medications taken and hospitalizations are related. For example, among seniors who were not hospitalized or hospitalized once, 12% take five or more medications. Among seniors who were hospitalized multiple times, 44% take five or more medications.

Overall Health Risk Score

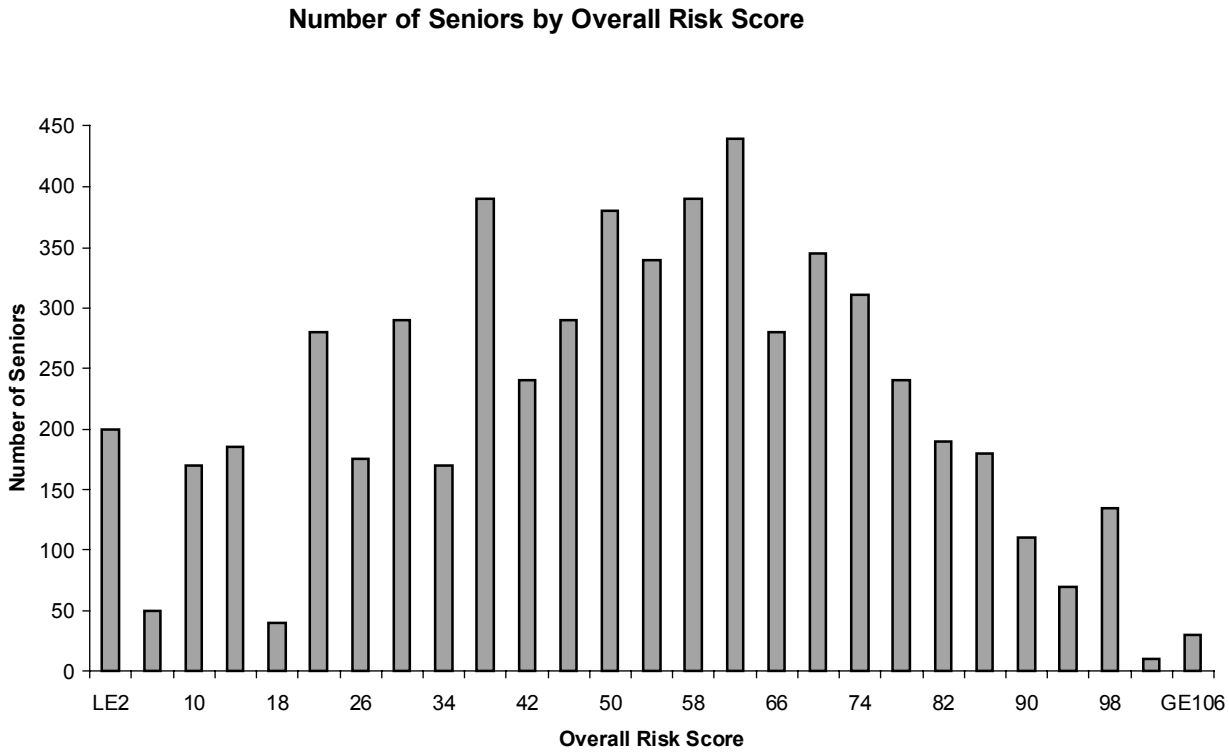
The survey assesses overall risk by combining results from the following five areas.

- *SF-12*: measures well-being and quality of life.
- *Health Conditions*: self-report of comorbid conditions
- *Utilization History*: predicts future utilization
- *BMI*: underweight or overweight is associated with potential health risk.
- *Nutrition Risk*: indicator o inadequate nutrition on a daily basis.

To calculate an index of overall risk, points are awarded based on the risk category for each of the five areas, as shown in the following table. Points are summed across areas to calculate an overall risk score, which can range from 0-150.

	Risk Score:				
Risk Category:	*BMI*	*SF-12*	*Health*	*Nutrition*	*Utilization*
Low	0	0	0	0	0
Moderate	12	18	30	5	25
High	20	30	50	10	40

The following graph shows the distribution of overall risk scores among the cohort of seniors. Note that scores are distributed over a bread range with a modest peak in mid-range. (These results reflect an earlier version of the algorithm for which the overall score ranges from 0-110).



Conclusion

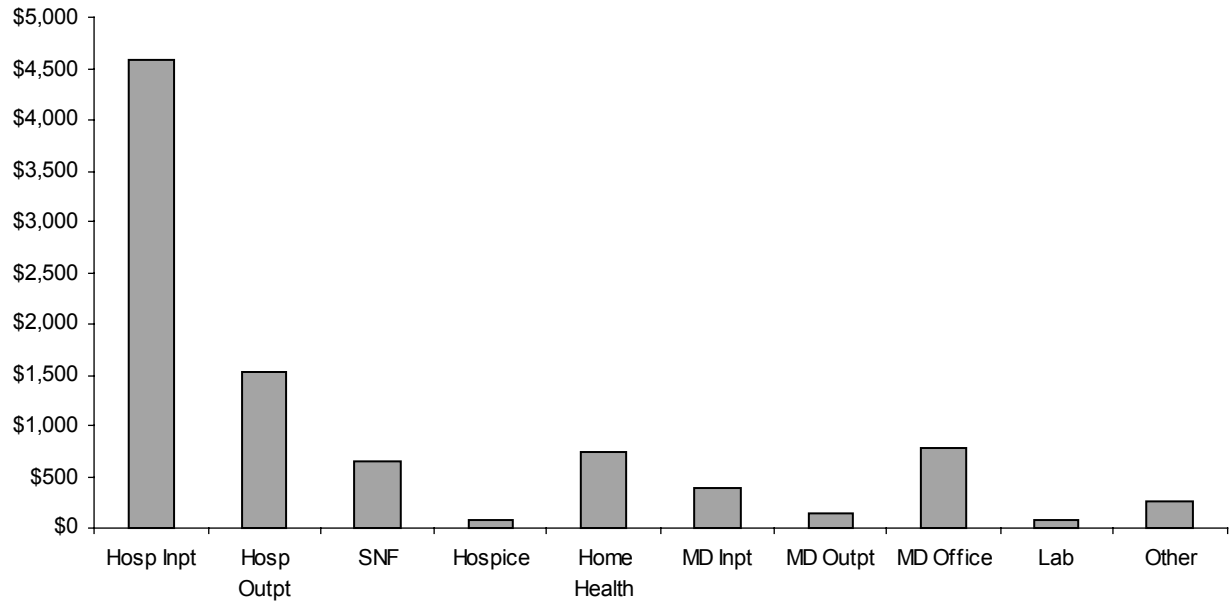
The health risk profiles of seniors presented above for selected components of the Senior Health Questionnaire demonstrate the utility of the survey instrument for measuring and monitoring the health of an elderly population.

Effectiveness of the Pra Survey Instrument in Screening Seniors

The Pra is published, academically-validated formula for calculating the probability of a future hospital admissions for seniors, based on their answers to a handful of questions. The Pra survey instrument is incorporated in the Senior Health Questionnaire. Pra is an acronym for probability of repeat admissions.

Inpatient care is the driver of overall cost for seniors. The graph below and table on the following page present Medicare experience for Florida for the most recent available year. Results are broken out by 10 service settings/types: hospital inpatient, hospital outpatient, skilled nursing facility, hospice, home health, inpatient physician, hospital-outpatient physician, office-based physician, independent laboratory, and other physician or supplier services provided in different settings such as ambulatory surgery centers or skilled nursing facilities. These results represent the experience of 2,672,072 eligible persons across Florida.

Annual Charge per Medicare Eligible by Service Type for the State of Florida



	State of Florida	
Care Setting	*Number of Claims Per 1,000 Eligible*	*Average Charge Per Eligible Person*
Hospital Inpatient	293	$4,584
Hospital Outpatient	2028	$1535
Skilled Nursing Facility	78	$649
Hospice	39	$87
Home Health	429	$738
Physician: Inpatient	4313	$398
Physician: Hospital Outpatient	1462	$133
Physician: Office	17367	$789
Independent Laboratory	4945	$75
Physician/ Supplier: Other	2708	$260

The results show that inpatient car is the driver of overall costs, which emphasizes the relevance of the Pra instrument for predicting these costs.

There is solid research evidence of the predictive validity of the Pra among seniors in managed care. Seniors identified at high risk by the Pra will consume 2-3 times the resources compared to those at lower risk. The attached document lists tow dozen articles about the Pra and provides summarizes of five key articles. Following are highlights from three articles about the relationship between the Pra score and future use of resources:

- High-risk subjects (highest quartile of Pra values) incurred hospital admissions and claims that were 2.5 and 2.7 times greater than those of low-risk subjects (lower than three quartiles).
- One-fifth of the respondents (20.6%) were classified as high-risk at baseline. During the following year, the high-risk subjects used hospitals at approximately twice the rate of the low-risk subjects (4.5 vs 2.4 days/person-year, P=.009).
- 7.2% of the subjects were estimated to have a high probability of repeated admission (Pra>or =0.5). In comparison with subjects estimated to have a low risk (Pra <0.5), this high-risk group's actual experiences included a higher cumulative incidence of repeated admission (41.8% vs 26.2%, P<0.0001), a higher cumulative rate of mortality (44.2% vs 19.0%, P<0.0001), more hospital days per person-year survived (5.2 vs 2.6), and higher hospital charges per person-year survived ($3,731 vs $1,841).

There is good research evidence for the effectiveness of case management in reducing costs for high-risk seniors, although the study designs invariably lack a control group. Dr Chad Boult and associates that the University of Minnesota will be publishing results soon from a study of case management effectiveness using a research design that includes a control group. Following are highlights of one study listed in the attached document.

- Targeted outpatient geriatric evaluation and management was associated with reduced mortality, reduced use of emergency rooms, and a trend toward reduced use of nursing homes. Subjects in the program had lower annual rates of mortality (2.9% vs 19.2%, P= 0.03) and emergency room use (0.6 vs 1.0 visits, P=0.01) that did the controls. The experimental subjects also tended to use nursing homes, but not hospitals, at a lower rate than the controls. All of the experimental subjects rated the program as either excellent (81.0%) or good (19.0%); 100% said they would recommend it to others. Their established primary physicians rated the geriatric evaluation and management services as appropriate and helpful.

Selected Research Summaries and References
About the Effectiveness of the Pra in Screening Seniors

Predictive validity of the Pra instrument among older recipients of managed care.
Pacala JT, Boult C, Reed RL, Aliberti E
Department of Family Practice and Community Health, University of Minnesota, Minneapolis 55414-3034, USA.
J Am Geriatr Soc 1997 May;45(5):612-617

OBJECTIVE: To determine the validity of the Pra instrument in predicting the use of health-related services by older enrollees in a managed care plan.
DESIGN: Cohort study. At baseline, a survey was administered by mail. Responses were entered into the Pra formula to estimate each person's probability of using health-related services heavily in the future. The subjects' use of services during the following year was monitored through claims submitted to their managed care organization.
SETTING: Urban and suburban areas of Southern California.
PARTICIPANTS: Persons aged 65 years and older enrolled in a Medicare risk health plan (n = 6802).
MEASUREMENTS: Baseline data included demographic, health-related, social, functional, and previous-use-of-service characteristics. Follow-up data included the use of and claims for ambulance services, outpatient surgery, and durable medical equipment.
RESULTS: High-risk subjects (highest quartile of Pra values) incurred hospital admissions and claims that were 2.5 and 2.7 times greater than those of low-risk subjects (lower three quartiles).
CONCLUSIONS: The Pra formula is recommended for screening older adults enrolled in managed care organizations (as well as for screening those in the fee-for-service environment). It identifies older people who may benefit from interventions designed to avert health crises and the need for expensive care.

Predictive validity of a questionnaire that identifies older persons at risk for hospital admission.
Pacala JT, Boult C, Boult L
Department of Family Practice and Community Health, University of Minnesota Medical School, Minneapolis, USA.
J Am Geriatr Soc 1995 Apr;43(45):374-377

OBJECTIVE: To determine the predictive validity of a mailed questionnaire designed to measure older adults' risk of repeated hospitalizations.
DESIGN: Prospective cohort study.
SETTING: Ramsey County, Minnesota.
PARTICIPANTS: Medicaid recipients aged 70 and older who completed the questionnaire.
MEASUREMENTS: Responses were used to calculate the subjects' probability of repeated admission (Pra) to hospitals within 4 years. Subjects were classified as low-risk (Pra <0.5) or high risk (Pra > or = 0.5). One year later, Medicaid claims data were analyzed to determine the subjects' actual use of hospitals.
RESULTS: One-fifth of the respondents (20.6%) were classified as high-risk at baseline. During the following year, the high-risk subjects used hospitals at approximately twice the rate of the low-risk subjects (4.5 vs 2.4 days/person-year, P- .009).
CONCLUSIONS: The instrument, which was previously found to be valid in a national sample of Medicare beneficiaries, appears to be valid also in a local sample of Medicaid beneficiaries. Older adults at risk of heavy hospital use can be identified prospectively through their responses to this brief, mailed, self-administered questionnaire. The instrument may be useful in targeting older persons for interventions designed to prevent the need for hospital care.

Selected Research Summaries and References
About the Effectiveness of the Pra in Screening Seniors

Screening elders for risk of hospital admission.
Boult C, Dowd B, McCaffrey D, Boult L, Hernandez R, Krulewitch H
Department of Family Practice and Community Health, University of Minnesota, Minneapolis
J Am Geriatr Soc 1993 Aug;41(8):811-817

OBJECTIVE: To define a set of screening criteria that identifies elders who are at high risk for repeated hospital admission in the future.
DESIGN: Longitudinal cohort study. Logistic regression analysis of data from half of the subjects was used to identify risk factors for repeated hospital admission. The ability of these risk factors to identify elders who are at high risk for repeated hospitalization in the future was then tested using data from the other half of the subjects.
SETTING: United States.
PARTICIPANTS: A subsample (n=5876) of a multistage probability sample of all non-institutionalized U.S. civilians who were 70 years or older in 1984.
MEASUREMENT: At baseline (1984), elderly subjects were asked about their demographic, socioeconomic, medical, and functional characteristics and about their recent use of health services. Their subsequent hospital admissions and mortality were then monitored through the records of the Medicare program and the National Death Index (1985-88).
RESULTS: Among the subjects in the first half of the sample, eight factors emerged as risk factors for repeated admission: older age, male sex, poor self-rated general health, availability of an informal caregiver, having ever had coronary artery disease, and having had, during the previous year, a hospital admission, more than six doctor visits, or diabetes. Based on the presence or absence of these factors in 1984, 7.2% of the subjects in the second half of the sample were estimated to have a high probability of repeated admission (Pra > or = 0.5) during 1985-1988. In comparison with subjects estimated to have a low risk (Pra < 0.5), this high-risk group's actual experiences during 1985-1988 included a higher cumulative incidence of repeated admission (41.8% vs 26.2, P<0.0001), a higher cumulative rate of mortality (44.2% vs 19.0%, P<0.0001), more hospital days per person-year survived (5.2 vs 2.6) and higher hospital charges per person-year survived ($3731 vs $1841).
CONCLUSION: Eight easily ascertained risk factors affect elders' probability of being hospitalized repeatedly within four years. In the future, brief surveys about the presence of these factors could be used to estimate elders' risk of future hospitalization and, thereby, to identify some of those who may derive the greatest benefit from interventions designed to avert the need for hospitalization.

Outpatient geriatric evaluation and management.
Boult C, Boult L, Morishita L, Smith SL, Kane RL
Department of Family Practice and Community Health, University of Minnesota Medical School, Minneapolis
55414-3034, USA.
J Am Geriatr Soc 1998 Mar;46(3):296-302

OBJECTIVE: To describe the development and operation of a practical model of outpatient geriatric evaluation and management (GEM) for high-risk, community-dwelling older adults.
PARTICIPANTS: Community-dwelling Medicare beneficiaries age 70 years and older who were medically stable but had a high probability of repeated admission to hospitals (P(ra) >.40) in the future (n = 248).
INTERVENTION: Outpatient GEM.
MEASUREMENTS: Demographic, clinical, and use-of-hospital characteristics of patients; nature and quantity of GEM services; satisfaction of patients and their established primary physicians.

Outpatient geriatric evaluation and management.
(Continued)

RESULTS: At enrollment, the average patient was 78.7 years old, took 5.0 long-term prescription medications and was unable to perform 0.5 (of six) activities of daily living (ADL) and 1.4 (of seven) instrumental ADL. Many patients (71.3%) reported hospital days during the previous year. Each of three interdisciplinary teams (geriatrician, gerontological nurse practitioner, nurse and social worker) performed comprehensive assessments and then provided primary care and case management to a case load of 45 to 52 patients. On average, GEM required 6 months, during which patients visited the GEM clinic 7.4 times, had 10.4 active problems addressed, spoke to GEM staff members weekly by telephone and were referred to two other providers. Most patients (94.4%) completed the GEM program; 66.7% completed advance directives. Satisfaction with GEM was high among the patients and their established primary physicians. The cost of the GEM personnel averaged about $1540 per patient treated.

A controlled trial of outpatient geriatric evaluation and management.

Boult C, Boult L, Murphy C, Ebbitt B, Luptak M, Kane RL
Department of Family Practice and Community Health, University of Minnesota Medical School, Minneapolis
55414-3034.

J Am Geriatr Soc 1994 May;42(5):465-470

OBJECTIVE: To evaluate the effects of targeted outpatient geriatric evaluation and management (GEM).
DESIGN: Controlled clinical trial. Elderly persons were identified as being at high risk for hospital admission on the basis of their responses to a short, mailed, self-administered questionnaire. The high risk elders who chose to participate in the GEM program were compared to those who continued to receive usual care.
SETTING: Outpatient GEM clinic at an urban university hospital.
SUBJECTS: Elderly Medicaid recipients whose probability of repeated hospital admission (Pra) within 4 years was calculated as 40% or greater (Pra > or = 0.40).
MAIN OUTCOMES MEASURES: Mortality, use of institutional services, satisfaction.
RESULTS: Of the 1210 persons who were sent questionnaires, 624 responded (response rate = 51.6%), of whom 154 (24.7%) were deemed to be a high risk for hospitalization. Of these, 43 received GEM (experimental subjects); 111 received usual care (controls). At baseline, the experimental and control groups' demographic and health-related characteristics did not differ significantly. The average experimental subject was 76.5 years old, had 9.6 significant medical problems, and took 6.7 significant long-term prescription medications. During the program's first 17 months of follow-up, the experimental subjects had lower annual rates of mortality (2.9% vs 19.2%, P =0.03) and emergency room use (0.6 vs 1.0 visits, P – 0.01) than did the controls. The experimental subjects also tended to use nursing homes, but not hospitals, at a lower rate than the controls. All of the experimental subjects rated the program as either excellent (81.0%) or good (19.0%); 100% said they would recommend it to others. Their established primary physicians rated the GEM services as appropriate and helpful.
CONCLUSION: Targeted outpatient GEM was associated with reduced mortality, reduced use of emergency rooms, and a trend toward reduced use of nursing homes.

Selected Research Summaries and References
About the Effectiveness of the Pra in Screening Seniors

Validation of the Pra:

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Selected Research Summaries and References
About the Effectiveness of the Pra in Screening Seniors

Information about programs that have used the Pra:

Boult C, Boult L, Murphy C, Ebbitt, B, Luptak M, Kane RL. A controlled trial of outpatient geriatric evaluation and management. J Am Geriatr Soc 1994; 42:465-470.

Pacala JT, Boult C, Hepburn K, Kane RA, Kane RL, Malone J, Morishita L, Reed R. Case management of older adults enrolled in health maintenance organizations. Final report of a study under contract with the Robert Wood Johnson Foundation. 1994.

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Boult C, Boult L, Morishita L, Smith SL, Kan RL. Outpatient geriatric evaluation and management. Jam Geriatr Soc 1998; 46(3): 296-302.

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