Self-Reported Health: Potential Life Underwriting Tool?

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Any approach that adds speed and efficiency to the underwriting process provides a competitive edge in today's fast changing financial services industry. The acquisition of data for medical underwriting has always been a challenge, with the traditional attending physician statement process adding time, real costs, and opportunity costs to manufacturing life products. Is there any potential for the use of self-reported medical and health history data in medical underwriting assessment? This article reviews published research on the uses and the validity of self-reported health data as it has been applied in current medical and public health practices. Whether self-reported medical history is valid data that can be applied in the underwriting context remains an open question.

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Self-reported health data research has largely focused on public or population health uses of data collection. These data are primarily used to make conclusions and decisions about the health of a group rather than individuals. Results have been used to assess population risk for cancer or heart disease, measure health plan performance and outcomes, and for long-term health system planning. Uses of these data for decision-making at the individual level include patient eligibility for clinical research studies, and development of self-assessment tools for personal disease risk (such as breast cancer). An individual’s self-reported perception of health or functional status can be used to guide care of chronic illnesses.

Self-reported health data is collected by direct interview, written, or telephonic completion of a questionnaire. The most effective method in terms of response rate, time, and cost is telephone contact. Generally, these ask a small set of simple, easily understood questions seeking medical history of specific diseases. Often questions are phrased like this: “Have you ever had ——?” Further detail such as date of diagnosis or place of care can be added. Population self-reported health surveys seek information about chronic medical conditions or the long-term consequences of an acute event, such as a myocardial infarction.

Many population health researchers have questioned the accuracy and validity of self-reported health when used for population research. A number of published studies have been designed to address these questions. These analyses of self-reported health data measure validity in terms of sensitivity, specificity, and other statistical measures of agreement between 2 data sources. The “gold standards” of “true” status for comparison in these analyses include medical records, cancer registries, and medical claims databases.
Table 1. Overview of Validity Studies for Self-Reports by Disease/Condition (with reported ranges for sensitivity and specificity)

<table>
<thead>
<tr>
<th>Disease/Condition</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Study Group</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>0.79-0.93</td>
<td>0.98</td>
<td>Cancer registry study</td>
<td>6</td>
</tr>
<tr>
<td>Cancer</td>
<td>0.61</td>
<td>N/A</td>
<td>Surveyed known cancer cases in a registry</td>
<td>3</td>
</tr>
<tr>
<td>Cancer</td>
<td>0.23</td>
<td>1.00</td>
<td>HMO members</td>
<td>1</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>0.51</td>
<td>0.98</td>
<td>Elderly community group</td>
<td>7</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>0.21</td>
<td>0.90</td>
<td>Elderly community groups in Taiwan</td>
<td>4</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>0.57</td>
<td>0.99</td>
<td>HMO members</td>
<td>1</td>
</tr>
<tr>
<td>Heart Disease</td>
<td>0.77/0.62</td>
<td>N/A</td>
<td>For MI in Men/Women over age 65</td>
<td>8</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.81</td>
<td>0.99</td>
<td>HMO members</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.73</td>
<td>0.88</td>
<td>Elderly HMO subscribers</td>
<td>9</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.90</td>
<td>0.98</td>
<td>HMO members</td>
<td>1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.83</td>
<td>0.81</td>
<td>Elderly HMO subscribers</td>
<td>9</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.68</td>
<td>0.94</td>
<td>Review of multiple validity studies</td>
<td>11</td>
</tr>
<tr>
<td>Depression</td>
<td>0.44</td>
<td>0.52</td>
<td>Hereditary breast &amp; ovarian cancer registry</td>
<td>13</td>
</tr>
<tr>
<td>Oral Steroid Therapy</td>
<td>0.66</td>
<td>0.96</td>
<td>Pre-operative cataract surgery patients</td>
<td>10</td>
</tr>
<tr>
<td>Hypertension Therapy</td>
<td>0.88</td>
<td>0.89</td>
<td>Pre-operative cataract surgery patients</td>
<td>10</td>
</tr>
</tbody>
</table>

Sensitivity is the proportion of cases of actual disease identified by self-report. Sensitivity can range between 0% to 100%. Sensitivity of 90% means that 90% of cases were identified by self-report and that 10% were not (false negative rate = 1 - sensitivity). Specificity is a measure of how accurately a test identifies cases without disease. Specificity can also range from 0% to 100%. A specificity of 80% means that 80% of the time cases without disease will have a negative self-report while 20% of the time, the self-report will be falsely positive (false positive rate = 1 - specificity). The reader should keep in mind that "acceptable" sensitivity and specificity is relative to the context in which the data will be used.

Results from studies evaluating self-reported history of cancer, heart disease, other chronic conditions, and medication use are summarized here, and an overview is provided in Table 1.

CANCER

Sensitivity of self-reported cancer for an exact match to cancer site and year of diagnosis was 0.79 and for any match to a report of cancer was 0.93 in a national study prospectively analyzing cancer risk factors 65,000 survey responses. Sensitivity varied by cancer site and was highest for breast, prostate, and lung cancer, and lowest for rectal cancers and melanoma. In another survey involving only 263 known cancer patients in a 5,000 participant community health program, sensitivity of a positive report of cancer was 0.61. This means that 39% of this known "true positive" group actually provided false-negative responses. In a third, involving a sample (213) of survey respondents enrolled in a large HMO, sensitivity of a self-report of cancer was 0.23 when ambulatory medical records were used for comparison. This study involved a small number of respondents, and a smaller number of individuals that were
true positives (31) for cancer or tumor, limiting conclusions from this analysis.
These 3 examples are illustrative of the variety and range of published sensitivity measures for cancer self-report. Study population characteristics, cancer type, and the “gold standard” applied are among the reasons for variation in these studies. In general, accuracy of cancer self-report is relatively high, but significant “non-reports” (or in other terms, false negatives) occur.

HEART DISEASE
The sensitivity of self-report of hospitalization for myocardial infarction (MI) was 51% in a telephone survey of 3809 participants in a community senior program (age 65 and over) carried out over 6 years.7 Older age and low educational level of the survey population (about 70% below high school level) were felt to be responsible for a high false-negative rate and low sensitivity in this study. On the other hand, participants often misinterpreted hospitalizations for other cardiovascular conditions as MI, leading to many false positives. Myocardial infarction could not be confirmed in 47% of the “yes” respondents, leading to low specificity in this study, as well.

A direct interview of elderly residence in a community in Taiwan indicated an even lower sensitivity of MI self-report of 0.21.4 The “gold standard” applied in this study was clinical evidence of heart disease on any test (ie, chest x-ray, ECG, echocardiogram), or current treatment indicative of heart disease. Sensitivity of self-report of “heart trouble or angina” was 0.57 and for congestive heart failure 0.29, in a sample of survey respondents in a large HMO using documentation in clinical records as the “gold standard.”7

Twenty-three percent of men and 38% of women did not report myocardial infarction in a survey of cardiovascular disease prevalence in adults over age 65 that used electrocardiographic evidence of MI as the comparison standard.4 Using the population of the longitudinal Cardiovascular Health Study, underreporting of angina pectoris, congestive heart failure, peripheral artery disease, stroke, and transient ischemic attack were also noted. This study also noted that the proportion of unreported disease increases with age (from age 65 to age >85 in this study).

Based on this selection of studies, underreporting of heart disease may be an even larger concern than underreporting of cancer.

OTHER CHRONIC CONDITIONS
Several published studies have assessed validity of self-report for other chronic diseases.1,4,8,10 While there are significant differences between study populations and comparison standards, several trends are evident. Self-report of the common chronic impairments diabetes and hypertension generally have high sensitivity in the range of 0.70 to 0.90 across a number of studies (Table 1).1,2,8,10 This may reflect the fact that these are well-defined diseases that usually require daily self-participation in a specific therapeutic routine.

Self-report of asthma compared to a clinical diagnosis of asthma had a mean sensitivity of 0.68 (range 0.48 to 1.00) in a review of multiple validity studies.11 Largely involving European populations, questionnaire structure, access to health care, and the “gold standard” used are reasons for variation. Validation versus a diagnostic standard, bronchial challenge testing, yielded a lower sensitivity, 0.36. Recently, U.S. state specific prevalence of self-reported asthma prevalence data was published to assist monitoring trends for state public health managers.12 Unfortunately, validity of self-reports in this most current survey was not assessed.

The validity of self-reported depression was studied to assess the use of a brief questionnaire as a follow-up to a detailed clinical interview. The sensitivity of self-reported depression compared to results of a clinical interview conducted 1 year before was 0.44.13 There was a correspondingly low specificity (0.52) that improved when “yes” responses were refined by a question concerning psychologic treatment (specificity 0.78) or medication treatment (specificity 0.86). However,
sensitivity declined (0.34 and 0.27, respectively) with these questions. The investigators concluded that their brief questionnaire was not a useful tool for their purpose, monitoring a group of women involved in the Hereditary Breast and Ovarian Cancer Study. They noted that the “gold standard” applied was not clinical records, pointing out that for depression adequate clinical documentation is often unavailable to clinicians. This circumstance is similar to that which often faces underwriters.

There have studies reporting the validity of self-reported alcohol and substance abuse in clinical settings. One indicated that most non-dependent patients with unintentional injury acknowledged drinking before the injury.\textsuperscript{14} Self-report of cocaine and alcohol use correlated with quantitative measures in a study involving a small group of individuals participating in study of cocaine behavioral changes who received payment for participation.\textsuperscript{15} Self-report of substance use by veterans seeking care for post-traumatic stress disorder had a sensitivity of 93% when compared to urine testing results.\textsuperscript{16} The absence of connection to a negative consequence was suggested as the reason for the high rate of valid reports in this study. The relation between negative self-report of alcohol use and various “alcohol markers” has been the subject of numerous life insurance industry studies.

In a validity study of self-reported AIDS and its related conditions, sensitivity was 0.91.\textsuperscript{17} Self-report was compared to AIDS registry data. The study group was HIV-infected women who were recruited to participate in a natural history study of HIV infection. A false-negative rate of 8% (respondent not reporting any AIDS diagnosis) seems surprisingly high in the context of a voluntary clinical study.

**SELF-REPORTED FUNCTIONAL STATUS**

A great deal of research has been performed with respect to self-reported functional status. Functional assessment focuses on an individual’s ability to perform basic personal care, daily living, and work activities from physical and mental health perspectives. There are a number of commonly applied and extensively validated methods for performance of functional assessment. Examples include the “SF-36” instrument, the Functional Status Questionnaire, and the Karnofsky activities scale. The SF-36 (for “short form” consisting of 36 items) is perhaps the most popular and extensively validated self-report measurement instrument. It provides information about 8 health domains and can generate physical and mental component scores.\textsuperscript{18} Research has evaluated the use of self-reported functional status as an additional means of monitoring disease progress, assessing outcomes of care, and guiding medical care decisions for individuals with chronic diseases. Several studies have identified a relationship between self-reported functional status and mortality in several impaired populations. Studies involving elderly individuals in community, hospital, or nursing home settings confirm a direct relationship between self-reported decreased functional status and increased mortality. This relationship is seen with self-reported functional deficits at all activity-of-daily-living levels (Table 2). Self-reported functional status is predictive of mortality independent of other factors. In one such study, even after controlling for age, gender, and medical condition, poor rat-
Table 2. Levels of Activities of Daily Living

<table>
<thead>
<tr>
<th>Level</th>
<th>Typical Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>Eating, Dressing, Standing, Bathing, Toileting, Transferring</td>
</tr>
<tr>
<td>Instrumental</td>
<td>Taking medications, doing laundry, using the telephone, managing money, traveling into the community</td>
</tr>
<tr>
<td>Advanced</td>
<td>Higher level physical and social functions that are patient specific (work, intellectual, sports and recreational activities)</td>
</tr>
</tbody>
</table>

ings on the global measure of perceived ability to function independently nearly doubled the risk of death during the 3-year follow-up period.21

Several studies have demonstrated a strong association between self-assessed functional status measures and mortality in end-stage renal disease (hemodialysis) patients.23 Hemodialysis patients with physical functioning scores below the median on the SF-36 were twice as likely to die and 1.5 times more likely to be hospitalized.24 In another study using a different functional assessment questionnaire, both self-assessed physical and mental functional scores were associated with increasing odds of death independent of age and other clinical measures.25 Though predictive value of self-reported functional status data for mortality is established, the usefulness of these data in life underwriting would be limited. A relatively high “yield” of true-positive, functionally impaired individuals would be limited to applicant groups with medical impairments, or an increased expected prevalence of functional impairments, such as the elderly. The “yield” of true-positive self-reported functional status findings in a group that is young, with a low expected prevalence of medical impairments will approach nil.

SUMMARY

Self-report of diagnosis, medication use, and functional status can be valuable and reasonably accurate sources of health data when used for assessment of population health, and for guiding certain medical care decisions for individuals. Self-reported data can be very useful when collected with the proper methods and used to address personal or public health questions in which the limitations of these data do not interfere with making valid conclusions. When self-reported data is used for individual medical decision-making, the availability of comparisons to well-established population standard “normals” is extremely important. There are studies that establish a direct relationship between mortality and self-reported functional level in individuals with underlying impairments.

Meaning to Underwriting

That said, it is important to re-emphasize that all of the published studies reviewed evaluate patient self-reports obtained in the medical care setting. The settings include ongoing personal medical care, a community health effort, or participation in a medical research study. Notably, significant “non-reports” of disease and medications occur (false negatives), with a frequency that varies upon a number of factors including the specific diagnosis, age of the individual, and other demographic attributes of the participants. In the medical care context, there is no connection between a self-report and a personal loss or gain. Self-report sensitivity, in a situation where the responses have direct impact on price or policy issue, would have to be assessed in relationship to the degree of potential personal gain derived from the responses provided. An opportunity to understand the accuracy of self-report in the insurance context could involve comparison of application health question responses to attending physician’s statement (APS) or claims data.

Self-reported health data generated in the course of personal medical care, and included as part of an APS, can be regarded as valid for underwriting purposes, taking into consideration the sensitivity and specificity of similar self-reports in published studies eval-
uating validity in the medical care context. However, the likelihood of finding reports from formal self-reported health questionnaires in an APS is low.

Use of self-reported health data as a non-traditional underwriting technique has intriguing potential. Understanding the validity of self-reports obtained for the purpose of underwriting insurance coverage, and the relationship of self-report data collected in this context to mortality, are essential steps before self-report can be applied as a successful underwriting tool.

REFERENCES


