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# Evaluating the Predictive Validity of Nursing Home Pre-Admission Screens

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*This article demonstrates a method for evaluating the predictive validity of nursing home pre-admission screens (PAS) by using measures of predictive validity adapted from the field of epidemiology. Our approach estimates how well a PAS performs in identifying the "who but for" population of the Medicaid home and community-based services waiver programs for the frail elderly. The methodology's usefulness in screen revision is also illustrated.*

## INTRODUCTION

Nursing home pre-admission screening has evolved as an integral component of State Medicaid home and community-based services waiver programs for the elderly. The Health Care Financing Administration (HCFA) requires that services provided under the auspices of this program be targeted to those at risk of nursing home admission. Pre-admission screens are supposed to identify those "who but for" waiver services would be at high risk of institutionalization.

But how well do pre-admission screens actually perform in identifying this at-risk population? According to a 1987 U.S.

General Accounting Office (GAO) report, targeting efforts were not resulting in the kind of cost-effectiveness originally envisioned when the waiver programs were implemented (U.S. General Accounting Office, 1987). GAO voiced concern that community-based services were being provided to persons who were supplementing their care in the community with waiver services, rather than using waiver services as a substitute for nursing home care. As a result of their investigation, GAO recommended that HCFA fund research to find better ways of discriminating between those who authentically substitute waiver services for institutionalization and those who use such services as an add-on to their current community-based service package and who are therefore not at risk of imminent institutionalization.

How might a State evaluate the ability of its screen to target the intended population? What method might a State, considering a series of alternative screen decision rules, use in assessing them relative to each other? This article proposes a method for evaluating the predictive validity of nursing home pre-admission screens by using measures of predictive validity adapted from the field of epidemiology. Our approach estimates how well a PAS performs in identifying the "who but for" population. We also demonstrate this methodology's usefulness in screen revision.

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## METHODS

### Analytic Approach

We rely on epidemiological techniques traditionally used to assess the efficacy of screening for disease. This approach relies on a series of measures that relate screen-detected disease to disease which is subsequently identified through diagnostic evaluation. Our analytic framework considers the outcome of a PAS—either eligible or ineligible for services—as analogous to a positive or negative screen for disease. Using longitudinal data, we apply a screen's decision rules to baseline measurements, and track the eligible and ineligible groups for 6 months to determine the proportion of each group that eventually enters a nursing home.

Figure 1 graphically depicts our analytic approach. Sample members were classified by screen decision rules (Screen Outcome) and by whether they had been admitted to a nursing home at any point within 6 months. The contingency table presented in Figure 1 includes four cells, two representing "correct" screen predictions, (*a* and *d*), and two representing "incorrect" screen

predictions (*b* and *c*). The concordant cells represent true positives and true negatives, i.e., those deemed in need of nursing home care (eligible) who actually enter a nursing facility (cell *a*), and those deemed ineligible for admission who remain in the community (cell *d*), respectively. Discordant cells (*b* and *c*) denote false negatives and false positives, i.e., persons classified by the screen as ineligible but who are admitted to a nursing home (*b*), and those deemed eligible but who remain in the community (*c*), respectively.

For the purpose of estimating predictive validity, nursing home utilization is used as a proxy for "need" for nursing home care. There may not be a one-to-one correspondence between admission and need; however, to our knowledge there is no universally accepted objective criteria for the need for nursing home care that we could have employed. Furthermore, because the purpose is to test how well a PAS identifies those "who but for" augmented community-based long-term care (LTC) services would be institutionalized, we believe the proxy measure is appropriate.

Four measures derived from the formula are used to assess the predictive validity of a PAS. The first measure, sensitivity, refers to the proportion of those who were admitted to a nursing home within 6 months who were also identified by the screen as eligible for services. Specificity, on the other hand, indicates the proportion of those who were not admitted to a nursing home within 6 months who were also identified by the screen as being ineligible for services. Associated with these two measures are their complements, the proportion of false negative and false positive screens.

Figure 1

#### Framework for Predictive Validity Analyses

		Screen Outcome	
		Eligible	Not Eligible
Nursing Home Admission Within 6 Months	Yes	<i>a</i>	<i>b</i>
	No	<i>c</i>	<i>d</i>

#### Screening Measures:

Sensitivity =  $a/(a + b)$

Specificity =  $d/(c + d)$

Proportion False Positives =  $c/(c + d)$  or (1 - specificity)

Proportion False Negatives =  $b/(a + b)$  or (1 - sensitivity)

SOURCE: Jackson, M.E., and Eichorn, A., 1993.

## Connecticut Screen

Connecticut's nursing home PAS is used in conjunction with its waiver program for the elderly. The Connecticut screen is utilized in this particular exercise to demonstrate the "sensitivity and specificity" approach in evaluating the predictive validity of an established screen, as well as in assessing alternatives for screen revision. The Connecticut screen was especially suited to this approach because it is based on objective decision rules.

The sensitivity and specificity methods require that objective decision rules be specified, so that the eligible and non-eligible groups in the sample data set can be identified. While many States have implemented pre-admission screening, not all employ objective decision rules. Traditionally, the need for services has been determined by a physician or other health professional, and many State screens are based on this tradition. Evaluating the predictive validity of this type of screening instrument is hampered by an inability to quantify and replicate professional judgment. However, screens which employ objective decision rules, as does Connecticut's, are better suited to evaluation because they rely not only on a uniform set of information on each applicant, but use this information in a pre-determined fashion to ascertain eligibility.<sup>1</sup>

The Connecticut screen collects information on the applicant's activities of daily living (ADLs) and instrumental activities of daily living (IADLs), cognitive impairment, selected behavior problems, and the availability of informal supports. Table 1 displays Connecticut's decision rules

<sup>1</sup>Clinical overrides of decision rule outcomes may still be invoked under such systems.

**Table 1**

### **Connecticut Nursing Home Pre-Admission Screen Decision Rules**

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5-6 ADL Dependencies (Total or Partial)
or
Available, willing and able caregiver, but caregiver's age is age 75 or over
and
One of the following:
2-4 (out of 6) ADL <sup>1</sup> dependencies (Total or Partial)
4-8 (out of 8) IADL <sup>2</sup> dependencies (Total or Partial)
4-10 errors on the MSQ <sup>3</sup>
Wandering
or
No caregiver present or caregiver is not available, willing or able to provide for all of applicant's needs
and
One of the following:
2-4 (out of 6) ADL dependencies (Total or Partial)
4-8 (out of 8) IADL dependencies (Total or Partial)
4-10 errors on the MSQ
Wandering
or
Abusive/assaultive behavior
and
One of the following:
2-4 (out of 6) ADL dependencies (Total or Partial)
4-8 (out of 8) IADL dependencies (Total or Partial)
4-10 errors on the MSQ

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<sup>1</sup>Bathing, dressing, toileting, transferring, incontinence, eating.  
<sup>2</sup>Shopping, using transportation, medication management, laundry, meal preparation, light housework, using the telephone, managing finances.  
<sup>3</sup>Modified ten-item mental status questionnaire (MSQ) (Kahn et al., 1960).

NOTES: ADL is activities of daily living. IADL is Instrumental activities of daily living.

SOURCE: Department of Income Maintenance: State of Connecticut.

as they were implemented at the beginning of the statewide waiver program in 1987—the original Connecticut algorithm. Applicants may qualify for nursing home admission or its community equivalent in one of four ways. One scenario is that the applicant be dependent in at least 5 out of 6 ADLs.<sup>2</sup> A second way of qualifying is for an applicant to lack an informal support system capable of providing for

<sup>2</sup>ADLs included in the Connecticut screen are bathing, dressing, toileting, transferring, incontinence, and eating. Evidence of any human assistance, including stand-by assistance or caring, is considered as evidence of dependency.

all of the applicants care needs, and to have at least a moderate level of disability as indicated by one of the following: (a) 2-4 ADL dependencies; (b) at least 4 out of 8 IADL dependencies<sup>3</sup>; (c) moderate to severe cognitive impairment as measured by a score of 4 or more on a 10-item modified mental status questionnaire (MSQ) (Kahn et al., 1960); or (d) wandering. A third route to eligibility is to demonstrate at least moderate disability as indicated by one of the four parameters just described and have an intact, but potentially frail support system; a tenuous support system is defined as one that reports the ability to provide all the care the applicant needs, but where the caregiver is 75 years of age or over. A final pathway to eligibility is to exhibit moderate disability in combination with evidence of either abusive or assaultive behavior, regardless of how intact the informal care system is. Fulfilling any one of these four criteria is sufficient grounds for eligibility.

In addition to its use of objective decision rules, the Connecticut screen was also a good candidate for study because its content was consistent with data elements available in our analytic data set, which we describe next. Also, at the time we were conducting our study, the Connecticut Department of Income Maintenance was in the process of exploring alternative screen decision rules, and this analysis provided an opportunity to assist them in evaluating a series of potential modifications.

Data used to evaluate the predictive va-

lidity of the Connecticut screen were originally collected for three separate community-based LTC demonstration projects: the National Long-Term Care Channeling Demonstration, the South Carolina Community Long-Term Care Project (CLTC), and the Georgia Alternative Health Services Project (AHS). These three demonstrations shared the goal of evaluating the impact of enhanced case-managed community-based LTC on nursing home utilization. Those in the experimental groups in each study received augmented services, while those in the control groups did not. Only the control groups were used in this study; they were considered appropriate for our study as they had known LTC needs, and could be tracked to determine any subsequent nursing home utilization.

By themselves, none of these data sets provided the range of disability likely to be present among applicants to a pre-admission screening program. For example, the CLTC sample was very disabled with nearly all persons being dependent in at least one ADL, whereas more than one-third of the AHS sample were completely independent in all ADLs (but most had IADL disability); the Channeling sample more closely resembled the CLTC sample, with about 86 percent having at least one ADL disability. A single data set was created by combining the three separate data sets. The goal achieved was the creation of a sample representative of a range of elders as broad as the group likely to present themselves for screening. This strategy also provided the advantage of a larger sample size. We used this sample to test the predictive validity of Connecticut's original decision rules, and

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<sup>3</sup>IADLs included in the Connecticut screen are shopping, using transportation, medication management, doing laundry, meal preparation, doing light housework, using the telephone, and managing personal finances.

to estimate improvements in predictive validity that could be attained with revised algorithms.

Analytic files were created from random 50 percent subsamples of the CLTC and Channeling control groups, and the entire AHS control group. These three data sets were then combined to form a single analytic file, with a sample size of 1,076. All variables were recoded uniformly to conform to the Connecticut screening items.

Sample members in a nursing home at baseline were excluded from analysis, as were those under age 65. Also dropped from the analytic file were sample members for whom admission status 6 months post-baseline was unknown.

All persons admitted to a nursing home at any point between baseline and 6 months thereafter were considered nursing home utilizers, regardless of length of stay. Those who died before the end of the 6-month study period are included in the analyses according to their status as nursing home utilizers between the time of their entry into the study and death. The rate of nursing home admission within the 6-month study period was 20.2 percent for the entire study sample.<sup>4</sup>

Demographic and functional characteristics of persons included in the combined analytic sample are presented in Table 2. Close to one-half (46.9 percent) of the sample falls within the 75-84 age

**Table 2**  
**Selected Frequencies: Connecticut PAS/CBS Cohort and Combined Analytic Sample**

Item	Percent Connecticut PAS/CBS Cohort N = 2,401	Percent Analytic Sample N = 1,076
<b>Age</b>		
65-74	24.4	28.9
75-84	47.2	46.9
85 or over	28.3	24.2
<b>Sex</b>		
Male	29.1	28.8
Female	70.9	71.2
<b>Race</b>		
White	90.9	70.2
Other than white	9.1	29.8
<b>ADL disabilities</b>		
0	5.2	15.4
1	7.3	16.2
2	12.1	9.9
3	7.0	8.6
4	13.2	12.5
5	17.4	17.7
6	37.8	19.6
<b>IADL disabilities</b>		
0	0.2	0.9
1	0.2	1.9
2	0.5	3.2
3	0.8	7.8
4	4.0	10.4
5	10.9	13.4
6	9.5	162.3
7	15.6	—
8	58.3	—
<b>MSQ errors</b>		
0-3	47.0	54.5
4-6	16.0	32.7
7-10	37.0	12.8

<sup>1</sup>The number of IADL items included in each of the component data sets comprising the combined analytic data set varied. CLTC contained 6 items, Channeling 7 items, and AHS 8 items. Thus, we report the percent with 6 or more IADL dependencies among sample members in the combined data set.

NOTES: PAS is pre-admission screening. CBS is community-based services. ADL is activities of daily living. IADL is instrumental activities of daily living. MSQ is mental status questionnaire.

SOURCES: Department of Income Maintenance; State of Connecticut; National Long-Term Care Channeling Demonstration; South Carolina Community Long-Term Care Project; and the Georgia Alternative Health Services Project.

<sup>4</sup>Access to a nursing home bed in the communities from which the three control group subjects came varied. In the three South Carolina counties included in the CLTC the number of beds per 1,000 persons age 65 or over was relatively low, ranging from 31 to 42. On the other hand, in the Georgia sample the number of beds was considerably higher—64 per 1,000. The 10 Channeling sites varied considerably. Four were considered to have a low number of beds and four to have a moderate number of beds—22-25 beds and 45-57 beds per 1,000 respectively; two sites had a relatively high number of beds—more than 63 beds per 1,000. Thus, the data sets together represent a relatively wide range of access to nursing home care.

group. Nearly 29 percent are age 65-69, and the remaining 24 percent are 85 or over. The majority of the sample (71.2 percent) is female and of the white race (70.2 percent). Approximately 68 percent

have two or more ADL dependencies, and nearly 20 percent have dependencies in all six ADLs. More than three-fourths are dependent in five or more IADLs, with less than 1 percent reporting no IADL dependencies. Slightly less than one-half demonstrate some cognitive deficits as measured by an MSQ.

In addition to using the combined analytic sample described above, we also utilized data from the Connecticut program. Although the Connecticut program data are not suitable for evaluating predictive validity,<sup>5</sup> they do present us with an opportunity for assessing the impact that alternative decision rules would have on program applicants. Specifically, they allow us to estimate the proportion of Connecticut nursing home and waiver applicants who would be judged eligible under revised screening algorithms.

The Connecticut program data contain information from the PAS for a cohort of 2,401 persons who applied to the Connecticut Pre-admission Screening and Community-Based Services (PAS/CBS) Program between January and June 1988. Table 2 shows that almost one-half of program applicants are between 75 and 84 years of age (47.2 percent), with slightly more than one-fourth 85 years of age or over (28.3 percent), and the remaining proportion between 65 and 74 years of age. About seventy percent are female (70.9 percent) and about 91 percent (90.9 percent) are of the white race. It is apparent from Table 2 that the Connecticut cohort is a very disabled group. Approximately

88 percent of the Connecticut cohort are dependent in two or more ADLs. Thirty-eight percent are dependent in all six ADLs. Eighty-three percent are dependent in six or more IADLs; 58 percent are dependent in all eight IADLs. A substantial portion of this cohort, 37 percent, are severely cognitively impaired, and another 16 percent are moderately impaired in cognition.

## RESULTS

### Predictive Validity of the Original Screen

As indicated by Table 3, 85 percent of the combined analytic data set met Connecticut's original screen's eligibility criteria (Algorithm A). The sensitivity value was estimated at 0.95, but specificity only attained a value of 0.18. Consequently, the proportion of false negative screens was only 5 percent, but the proportion of false positive screens was about 82 percent. Kane and Kane (1981) have suggested that a PAS should be designed so that it holds to a minimum the number of persons denied eligibility who truly need services. The original Connecticut screen certainly attained this criterion as evidenced by its high level of sensitivity and very low false negative rate; we estimated that the original screen incorrectly identifies only 1 in 20 of those who would become institutionalized. However, the associated trade-off of a highly sensitive screen, in this case, is a very low specificity value of 0.18; this translates to the screen's incorrectly identifying persons not entering a nursing home 82 percent of the time.

### Screen Revision

In revising the Connecticut decision rules we sought to increase specificity

<sup>5</sup>The Connecticut data are not suitable for an analysis of predictive validity because there is no outcome measure of nursing home utilization that is independent of a screening decision, as was the case with the control groups from the analytic data sets.

**Table 3**  
**Predictive Validity Measures for Alternative Nursing Home Pre-Admission Screening**  
**Criteria: Connecticut**

Algorithm	Eligibility Criteria			CT Cohort Eligible	Analytic Sample Eligible	Sensitivity	Specificity	Proportion False (+) Screens	Proportion False (-) Screens
	ADL	IADL	MSQ Errors						
				Percent					
A	<sup>1</sup> 2 or more of 6 (T or P)	<sup>2</sup> 4 or more of 8	4 or more	99.0	85.0	0.95	0.18	0.82	0.05
B	<sup>1</sup> 2 or more of 6 (T or P)	4 or more of 8	7 or more	98.8	82.1	0.94	0.21	0.79	0.06
C	<sup>3</sup> 2 or more of 5 (T or P)	4 or more of 8	7 or more	98.7	78.2	0.94	0.26	0.74	0.06
D	2 or more of 5 (T or P)	Medication management	7 or more	91.5	63.9	0.85	0.41	0.59	0.15
E	2 or more of 5 (T or P)	7 or more of 8	7 or more	89.9	51.9	0.83	0.47	0.53	0.17
F	2 or more of 5 (T or P)	—	7 or more	86.1	55.7	0.80	0.50	0.50	0.20
G	3 or more of 5 (T or P)	—	7 or more	73.6	47.4	0.71	0.58	0.42	0.29
H	1 or more of 5 (T) or 3 or more of 5 (P)	—	7 or more	76.3	50.1	0.68	0.46	0.54	0.32
I	1 or more of 5 (T)	—	7 or more	54.6	52.1	0.69	0.52	0.48	0.31

<sup>1</sup>Six ADLs: Bathing, dressing, toileting, transferring, incontinence, and eating.

<sup>2</sup>Eight IADLs: Shopping, using transportation, doing housework, preparing meals, doing laundry, telephoning, managing medications, and managing personal finances.

<sup>3</sup>Five ADLs: Bathing, dressing, toileting, transferring, and eating.

NOTES: ADL is activities of daily living. IADL is instrumental activities of daily living. MSQ is mental status questionnaire. CT is Connecticut. T is total dependence. P is partial dependence.

SOURCES: Department of Income Maintenance, State of Connecticut; National Long-Term Care Channeling Demonstration; South Carolina Community Long-Term Care Project; and the Georgia Alternative Health Services Project.

without seriously attenuating the high level of sensitivity realized with the original algorithm. By making some informed choices about changes in eligibility criteria, we sought to develop a series of decision rules from which the State could choose. The goals of screen revision were twofold: a more efficient screen and a screen with greater predictive validity. A more efficient screen would require only the most useful and important data items. A more valid screen would result in fewer false positive errors, i.e., an increased

level of screen specificity. This would enable the State to identify the program's intended target population as accurately and simply as possible.

In devising a series of alternative decision rules we relied on three sources of information. First, in examining pre-admission screens from other States that had higher specificity levels (Jackson et al., 1992), we found that Connecticut was unusual in considering disability in the IADLs. This suggested that perhaps the false positive rate could be reduced if the

IADL domain was excluded from the eligibility criteria.

Our second source of information was a group of nurses from the Connecticut PAS/CBS Program who are responsible for applying decision rules to completed screens. The primary revisions suggested by these nurses were increasing the required number of MSQ errors from 4 or more to 7 or more, and eliminating the IADLs from the decision rules, with the exception of medication management. In addition to these suggestions, the research team and administrators in the Connecticut program suggested excluding the incontinence item from the ADL listing.<sup>6</sup> Another suggestion was to explore the effect of differentiating between partial and total dependence in the ADLs.

A third influence in altering the decision rules was the Connecticut Partnership for Long-Term Care (CPLTC), a public-private financing program in its development phase during the time the PAS/CBS decision rules were being revised. The CPLTC model permits individuals who would otherwise be ineligible for Medicaid to access publicly funded LTC benefits once they exhaust private LTC insurance benefits. For equity's sake, the State considered it crucial that individuals who seek Medicaid LTC benefits through the conditions set forth in the CPLTC be subject to the same objective, functionally oriented eligibility criteria that are used to trigger benefits for traditional Medicaid clients. The definition of the CPLTC insured event includes two

cognitive triggers: 7 or more errors on the MSQ or 4 or more MSQ errors in conjunction with evidence of behavior problems. These criteria were adopted subsequent to discussions with the insurance industry, and reflect criteria that was acceptable to the industry and also compatible with the intent of the PAS.

A series of alternative screen decision rules were developed. We confined our manipulations to the ADL, IADL, and MSQ components of the screen. Below, we list a series of modifications made to the decision rules during the revision phase. This listing represents a hierarchy of sorts, with each change after the first including those which precede it:

- Increase the required number of MSQ errors from 4 to 7 (Algorithm B).
- Exclude the incontinence item from the ADL items used for decisionmaking (Algorithm C).
- Restrict eligibility based on IADLs to disability in medication management only (Algorithm D).
- Restrict eligibility based on IADLs to 7 or more IADL dependencies (Algorithm E).
- Eliminate all IADLs from eligibility determination (Algorithm F).
- Increase the required number of ADL disabilities for eligibility from 2 (partial or total) to 3 (partial or total) (Algorithm G).
- Require at least 1 total or 3 partial ADL disabilities for evidence of eligibility on ADL grounds (Algorithm H).
- Require at least 1 total ADL dependency for eligibility on ADL criteria (Algorithm I).

Generally speaking, this hierarchical listing reflects an increasing level of screen restrictiveness.

<sup>6</sup>When the incontinence item is included in the ADL list, it is possible for an applicant to become eligible by reporting incontinence and only one other ADL disability. Given what we know about the ADL hierarchy (Katz and Akpom, 1976), the one other ADL is likely to be bathing or dressing. It was not thought that this combination of disability, all things being equal, would correlate highly with nursing home admission.



## Predictive Validity of Alternative Algorithms

These changes in eligibility criteria are displayed in Table 3 along with their associated measures of predictive validity. Also presented are the proportion of persons in the analytic data set and the proportion of the Connecticut cohort who would be program-eligible under each of the alternative decision rules. In addition, it should be noted that informal support criteria and behavior problem criteria have not been adjusted, and remain as presented in the original decision rules. Thus, the results in the proportion eligible and changes in measures of predictive validity reflect alterations in the ADL, IADL, and MSQ domains only.

The first set of eligibility criteria presented in Table 3, Algorithm A, mirror the original screen decision rule. Under these criteria 85 percent of the analytic sample were found eligible and virtually all (99.0 percent) of the Connecticut applicant cohort would be deemed eligible. The discrepancy between the two proportions eligible reflects the differences in the characteristics of sample members. Table 2 shows that the Connecticut cohort is substantially more disabled than the analytic sample. The increasing stringency of successive algorithms is reflected in the decreasing proportion who would be eligible under the various criteria. For example, when the eligibility criteria are restricted to those who have disability in 3 or more ADLs out of 5 or 7 or more errors on the MSQ (Algorithm G), only 73.6 percent of the Connecticut cohort and 47.4 percent of the analytic sample would be eligible.

Information on changes in the proportion eligible under varied decision rules is

useful for program planning and budgeting as States endeavor to direct limited resources to persons more likely to require institutional care. However, a State could also manipulate program access and expenditures through the selection of eligibility criteria. For example, compared with Connecticut's original screen algorithm (Algorithm A), one could realize about a 50-percent decrease in program-eligibles by excluding the IADLs from the decision rule, manipulating the number and type of ADLs required, and requiring greater severity in cognitive impairment (Algorithm I).

A State might implement cost-savings by tightening up its eligibility criteria, but how do such constrictive actions affect the ability of the decision rules to accurately predict risk of institutionalization? What one sees in Table 3 is an emerging trade-off between increasing specificity and decreasing sensitivity. If we compare, once again, Algorithm A—the original screen decision rule—with Algorithm I, we witness a substantial increase in specificity from 0.18 to 0.52. However, the increase in specificity is at the expense of a decrease in sensitivity. If risk of institutionalization among Connecticut's applicants is similar to the risk experienced by analytical sample members, then one could expect an increase in the proportion of false negative screens from 5 per 100 to 31 per 100 in moving from Algorithm A to Algorithm I. This means that for each 100 applicants, an additional 26 would now be denied eligibility erroneously, using institutionalization as the standard of measurement.

On the other hand, the false positive rate decreases with increasingly stringent rules. Still comparing Algorithm A with Algorithm I, we witness a consider-

able increase in specificity from 0.18 to 0.52, and a concomitant attenuation of the proportion of false positive screens from 82 percent to 48 percent. By decreasing false positives, the State reduces the number of people it serves who are not within the program's "who but for" target population, thereby decreasing State expenditures.

In reviewing results from these analyses, Connecticut decided upon a screen revision which did not unduly compromise sensitivity, but did enhance specificity. The State chose to revise its decision rules consistent with Algorithm E as presented in Table 3. These criteria have excluded incontinence from the ADL criteria; 2 out of 5 ADL disabilities are required for eligibility determination on ADL grounds, thus eliminating from eligibility those who are incontinent and have only one other ADL disability. Under the revised criteria applicants can only qualify for Medicaid LTC services based on IADLs if they are unable to perform independently seven or more IADLs. Eligibility on cognitive impairment grounds requires 7 or more errors on the MSQ.

Settling on this particular revision allowed Connecticut to reduce the chance of making false positive errors from 82 percent to 53 percent while still keeping the proportion of false negative screens relatively low (17 percent). By decreasing the number of clients enrolling in the program by about 10 percent, the State could potentially realize some savings. The associated trade-off of these savings, however, is a potential increase in the number of persons who might be mistakenly denied access to the program, i.e., would-be nursing home admissions. The increase in false negatives was considered relatively small and defensible, especially

given additional protections that the State has built into the process. First, there is a centralized nurse consultant who may be consulted by PAS/CBS nurses to discuss individual cases and who may authorize overriding the decision indicated by an algorithm when additional objective information documents that the individual is in need of nursing home placement.<sup>7</sup> Second, a well-publicized appeals process is available to denied applicants. An additional advantage of this particular algorithm was that it was consistent with the Connecticut Partnership's definition of an insured event.<sup>8</sup>

## DISCUSSION

The targeting potential of nursing home PASs can be evaluated with epidemiologic techniques if eligibility determination is based on objective criteria. Increasingly, States are amassing data bases that could be used to evaluate the targeting components of their PAS programs. To evaluate predictive validity a State would require data similar to that produced by the controlled experimental studies reported on in this study—where nursing home utilization is independent of any nursing home PAS criteria. However, short of such data, States may take advantage of national data bases and control for level of home and community-based service use, to identify how well its screening criteria predict nursing home admission. Most States using objective pre-admission screening rules could also use data from screened clients to test

<sup>7</sup>This constitutes a clinical override of the decision rules.

<sup>8</sup>The Connecticut Partnership also defined an additional cognitive trigger which has subsequently been accepted as part of the PAS. Applicants may be found eligible if they score four or more errors on the MSQ and evidence behavior patterns.

how alternative decision rules would affect the eligibility pool, as was demonstrated with Connecticut's data in this study. Also, to the extent that States move beyond HCFA's "who but for" criteria in funding community-based LTC, the sensitivity and specificity approach can be used to evaluate outcomes other than nursing home admission, e.g., dollars expended, rehospitalization, quality of life.

In the context of the study presented in this article, the sensitivity and specificity approach provides program administrators with information on how well a screen identifies those at risk and not at risk of institutionalization. It also provides data on the types and magnitude of errors a screen produces in its attempts to identify the intended population. Virtually no screen, even in the medical sciences, is error-free. Screens are meant to be efficient mechanisms for the quick identification of an at-risk population. Brevity and ease of administration are attributes of good screens. Instruments that are short and which do not go into great detail sometimes will not pick up crucial information on some persons, and thus will lead to erroneous decisions. Good screens minimize such errors. Screen items should be chosen very carefully, and decision rules developed assiduously (Weissert, 1991).

Developing a nursing home PAS which minimizes both false positive and false negative errors is particularly difficult. In general, this is because the research community has not been particularly successful in identifying the predictors of institutionalization. Studies in this area have consistently failed to identify factors which, taken together, account for more than modest amounts of variance in nursing home admission (Hanley et al., 1990;

Cohen, Tell, and Wallack, 1988; Branch and Jette, 1982). PASs are even more handicapped than the empirical approach taken by researchers because screening algorithms cannot reasonably include factors which unfairly discriminate among applicants. The predictive validity of a PAS could be improved, for example, by including such factors as race and sex, but this would be unacceptable in a public entitlement program such as Medicaid.

In most instances good screening criteria will be accurate enough so that few false negative errors are made. However, from a programmatic and client perspective it is important that institutionalized mechanisms be established that provide protection for the false negative cases. The direction that Connecticut has taken, by incorporating a mechanism for consistently evaluating additional relevant information, recognizes that fact while attempting to maintain a systematic framework for uniform decisionmaking.

If Federal regulations continue to tie the definition of need for community-based services to risk of institutionalization, screening will be limited by our circumscribed ability to predict nursing home admission. Policymakers devising eligibility criteria will inevitably have to decide, consciously or not, between screening criteria with higher false negative rates on the one hand, and higher false positive rates on the other. In other words, one will almost always have to decide between mistakenly identifying as eligible persons who would not otherwise enter a nursing home, and failing to identify those who would. By accepting a higher rate of false positive errors one errs on the side of greater accessibility because liberal screens are less likely to

exclude by mistake those in need. On the other hand, by opting for lower rates of false positives, the cost associated with caring for false positives is diminished. The ultimate trade-off becomes one of access versus cost.

The ongoing interest in, and study of, objective screening decision rules raises important questions about their role in the allocation of resources, particularly given the budget constraints influencing all levels of government. In these times there is a temptation to utilize these rules not to identify persons who require an institutional level of care, as they were originally intended, but rather to control expenditures. Although fiscal impact is a constant consideration, it would be unfortunate if the lessons of pre-admission screening were used solely to restrict access to services, and their value in identifying frail elderly people with significant unmet needs were overlooked.

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