A Screening System for Michigan’s Home- and Community-Based Long-Term Care Programs

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Purpose: To develop a screening system for Michigan’s MI Choice publicly funded home- and community-based services programs, to aid in identifying both individuals eligible for services and their most appropriate level of care (LOC). Design and Methods: Identify assessment items from the Minimum Data Set for Home Care (MDS-HC) assessment instrument that are predictive of five LOCs determined by expert care managers: nursing home, home care, intermittent personal care, homemaker, and information and referral (without services). Results: The algorithm based on approximately 30 client characteristics agrees with expert opinions substantially better ($\kappa = .62$) than systems based on activities of daily living and instrumental activities of daily living only ($\kappa < .40$). Implications: The screening algorithm can be used both over the telephone to identify clients who will not be fully assessed (as they are unlikely to receive services) and in person to recommend the appropriate LOC.

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Since the 1970s, policymakers in the United States have been concerned with the increasing cost of long-term care (LTC). Initially these concerns were focused on nursing home care, as state-run Medicaid programs have remained the primary payers. More recently, the rapid growth of home care has gained significant attention. Approximately 14.7% of all home care is paid for by Medicaid (National Association for Home Care, 2000), whereas between 1994 and 1997, Medicaid home care expenditures increased from over $7 billion to over $12 billion (Health Care Financing Administration [HCFA] Division of Medicaid Statistics, 1999).

Growing concerns about placing many elderly and disabled persons in institutions have also been a factor in encouraging the expansion of home- and community-based services (HCBS). It has become standard to screen individuals seeking nursing home care to determine whether this placement is appropriate. Formalized preadmission screening (PAS) to determine eligibility for reimbursement of LTC has become an important component of states’ LTC systems. These issues have been highlighted by the recent U.S. Supreme Court Olmstead ruling, requiring that states administer their services, programs, and activities “in the most integrated setting appropriate” for the treatment of qualified individuals with disabilities (Olmstead v. L.C., 1999, p. 5).

Minimum screening requirements, as mandated by the Social Security Act, had eligibility determined by a physician who certified the need for nursing home care at the time of admission or application for Medicaid payment (Harrington & Curtis, 1996). These minimal criteria led to inconsistent and poor control of limited resources. Categorical eligibility criteria alone (i.e., age or financial status) were insufficient to determine who could receive services; rather, eligibility for LTC had to be based on demonstrated need (Binstock, 1994).

Addressing concerns about inappropriate institu-
tionalization, a U.S. General Accounting Office report (1979) argued that a significant number of nursing home residents could be better served in the home or community. The Omnibus Budget Reconciliation Act of 1981 responded to this claim by allowing the HCFA to grant Medicaid waivers to states to expand HCBS. The goal driving this waiver program was to prevent or delay nursing home admission by substituting less costly HCBS that is often preferred by the individual and family. By 1997, all states supported waiver programs for at least one subgroup of individuals with disabilities.

Given the expanding population in need of LTC and the reality of constrained budgets, states were primarily motivated to initiate these programs under the assumption that home care would provide LTC services in more cost-effective ways than would institutional care. However, over 2 decades of research and evaluation in the area has not supported this assumption (Feldman, Latimer, & Davidson, 1996; Hughes, 1985; Kemper, Applebaum, & Harrigan, 1987; U.S. Government Accounting Office, 1996; Weissert, Cready, & Pawelak, 1988). The inability to reach the appropriate population, namely those “who but for HCBS” would actually move to a nursing home, has been cited as a reason that home care has not been the financially positive alternative originally posited. Large demonstration projects, including the National Long Term Care Demonstration (also known as the “Channeling” Demonstration) and state evaluations, have suggested that a screening process is critical to successful use of home care to reduce nursing home admissions, provide control costs, and so forth (Cargano & Kemper, 1988; Kemper et al., 1987; Nocks, Learner, Blackman, & Brown, 1986; Weissert et al., 1988; Yeatts, Capitman, & Steinhardt, 1987).

Clearly, the choice of screening criteria has a significant impact on how many elderly and disabled individuals are deemed eligible for services (Jackson, Burwell, Clark, & Harahan, 1992; Spector, 1991; Stone & Murtaugh, 1990). Activities of daily living (ADLs) are the foundation of PAS described in the literature (Applebaum, Baxter, Callahan, & Day, 1985; Branch & Stuart, 1984; Kane, Saslow, & Brundage, 1991; Leutz, Abrahams, & Capitman, 1993; Morris, Sherwood, & Mor, 1984; Stone & Murtaugh, 1990). The Pepper Commission in the late 1980s recommended that LTC eligibility be based on a criterion of dependency in three out of five ADLs (Kane et al., 1991). Although ADLs are strongly associated with the use and costs of HCBS (Liu & Cornelius, 1991), it has been argued that they alone are not sufficient (Leutz et al., 1993). Instrumental activities of daily living (IADLs)—measures of higher level functioning in such tasks as shopping, meal preparation, housework, and transportation—along with cognition, medical diagnoses, available informal support, living arrangements, and behavioral problems, have all been cited as additional and important components of a PAS system (Applebaum et al., 1985; Branch & Stuart, 1984; Kane et al., 1991; Leutz et al., 1993; Morris et al., 1984; Spector, 1991).

Studies of the efficacy of PAS confirm what evaluators of the demonstration projects and state programs concluded: Currently implemented PAS systems do not identify accurately the appropriate population to be served by HCBS (Jackson, Eichorn, & Blackman, 1992; Kemper et al., 1987; Polich & Iversen, 1987; Spector & Kemper, 1994; Weissert et al., 1988). Only a few PASs have been developed empirically (Branch & Stuart, 1984; Kane et al., 1991; Morris et al., 1984) and none has actually been designed specifically for and implemented as part of a state HCBS program. In fact, in a survey of state PAS practices from the early 1990s, Luehrs and Ramthun (1991) noted that all were developed in house through nonempirical means and adjusted over time to reflect changing policy goals.

Recognizing the design limitations in prior PAS efforts, administrators of Michigan’s publicly funded HCBS sought a screening algorithm based on empirical design. The system in Michigan was to have individuals requesting service call a central phone number or set of local numbers. These contracted agencies would make an initial determination whether care was likely needed and would authorize a fuller in-person assessment of the individual. As the result of this more comprehensive assessment, a decision would be made on an appropriate level of care (LOC). There were two identified needs. The first was for a telephone-based, short screen along with an algorithm to be used on the initial request for services. This screen would be used to determine the necessity for the longer, more expensive in-person assessment. The second was an algorithm to assist case managers in identifying the most appropriate LOC for an individual. In Michigan, these LOCs were identified as nursing home care, home care, intermittent personal care services, homemaker services, or no formal services.

Michigan had already decided to use the Minimum Data Set for Home Care (MDS-HC) for ongoing assessments in its HCBS program, called MI Choice. We suggested that a single screening algorithm could be used for both purposes and that the items necessary for the algorithm would form the telephone screen instrument.

In describing the development of the MI Choice screen, we first provide background on home care services in the State of Michigan and the MI Choice initiative. This is followed by a description of the analytic development of the screening system, results, and conclusions.

**HCBS in Michigan**

Michigan operates two community-based LTC programs for persons at high risk of nursing home placement: the Medicaid HCBS Waiver for the Elderly and Disabled (Waiver) and the Care Management (CM) program. Michigan has been operating the CM program since 1983, and the Waiver since 1992. The Waiver was originally approved by HCFA for a 3-year period, but subsequently has been extended, as well as expanded statewide in the spring of 1998. The
Waiver and CM programs are managed by separate agencies housed in the Michigan Department of Community Health (MDCH): the Medical Services Administration and the Office of Services to the Aging (OSA). There is a long history of collaboration between the two agencies, and each program uses the same information system, assessment tools, and service standards.

The MDCH contracts with Organized Health Care Delivery Systems, including regional Area Agencies on Aging (AAA), to screen and provide case management to eligible participants in both programs. The care plan, developed jointly by a nurse/social-worker team and the participant, can include a variety of services, such as homemaker services, respite services, adult day care, environmental modifications, transportation, medical supplies and equipment not covered elsewhere, chore services, personal emergency response system, private duty nursing, counseling, home delivered meals, physical/occupational therapy, and personal care supervision.

The population eligible for Waiver services must be 18 years of age or older, whereas the CM program serves only those over 60 years of age. Both programs use the same functional eligibility criteria. Participants for both programs are referred by their family, their physician, a hospital, a nursing home, or a home health agency. Once referred, previous protocols included an initial telephone screen to identify those who were not eligible for services (such callers were usually provided with information or a referral to other community resources). Those who “passed” the telephone screen were then assessed in person to determine if they met the criteria for nursing home care. Financial eligibility for the Waiver is also, but separately, determined. Financially eligible groups include persons currently receiving Supplemental Security Income or those with income at or below 300% of this income level.

In the mid-1990s, Michigan policymakers recognized that there needed to be a statewide effort to allocate LTC services more equitably and rationally and, by doing so, to moderate the growth in LTC expenditures. These goals were to be accomplished in part by the development of consistent eligibility criteria for enrollment in LTC programs, an integrated data system, and an improved statewide screening capability.

The original statewide screens to identify individuals meeting the state’s criteria for nursing home placement followed a medical model. Nursing facility staff documented an individual’s medical necessity for nursing home placement on an R-19 form. Nurses at the state level then administratively reviewed each R-19 form, typically after the person had already been institutionalized. In 1 year during which approximately 30,000 reviews occurred, only 56 R-19s were rejected by state nursing staff; clearly this was an inefficient (if not ineffective) process. In lieu of using the R-19 process for HCBS, OSA developed a telephone screening process that was used in the joint Waiver and CM programs. This OSA Screen was a list of questions that were based on a composite of the literature of nursing home use and institutional risk. The number of criteria met was counted and compared with a (subjectively determined) threshold. Although quantification was an improvement over the R-19, the OSA Screen still was flawed. It penalized potential participants with cognitive impairment or with stressed caregivers, it was easy to assign “points” to an individual to achieve the thresholds, and there was no empirical basis for either the independent contribution of the individual items or the selection of the threshold.

**MI Choice Initiative**

In the summer of 1997, the State of Michigan decided to implement significant changes for both the Waiver and CM programs. First, the decision was made to expand the Waiver statewide. Second, the state upgraded its standardized assessment system, adopting the RAI for Home Care (RAI-HC®). The change was selected both to take advantage of the care-planning capability of the RAI-HC system (Morris et al., 1997) and to improve the State’s LTC information infrastructure. The RAI-HC is a comprehensive assessment system including a detailed assessment instrument—(MDS-HC®)—and care-planning guidelines. The MDS-HC is compatible with the nationally mandated nursing home RAI Minimum Data Set (MDS) and thus would permit comparisons between individuals in nursing homes and home care. For example, the state has developed the capacity to track changes in health and functional status over time between these settings. Finally, the state decided to improve its LTC screening system. A project was contracted jointly with the University of Michigan and the Hebrew Rehabilitation Center for Aged (Boston, MA) to develop an empirically based screen drawing on MDS-HC assessment information.

The structure of the screening system that was jointly designed by the state and the research team (and is currently implemented) is shown in Figure 1. The process begins with a call from the potential participant (or their representatives—family members, hospital discharge planners, etc.) requesting services. Currently, this call goes to the local CM or Waiver program, although the possibility of a central screening capability is being considered. A 15 to 20 min telephone screen is then used to identify those who are eligible for further assessment and possible program enrollment. Persons performing screening have varied educational backgrounds, but all screeners are trained by the state in use of the protocols to enhance reliability across program sites. The primary purpose of the telephone screen is to identify those individuals for whom a full assessment is warranted, that is, persons who are most likely to meet the state’s medical eligibility criteria for the Waiver or CM. Those not deemed in need of services are provided information and referral (I&R) to other community resources. Those individuals who pass the telephone screen receive an in-person assessment, which generally occurs in the potential participant’s home (a small number of...
potential participants, however, may be assessed in the hospital or nursing home). A team composed of a registered nurse and licensed social worker, again trained by the state, performs the in-person assessments. Those not found eligible for a full assessment may appeal this decision: this path is shown in this figure by the arrow pointing from “I&R Referral” to “In-Person Evaluation.”

The in-person assessment consists of the MDS-HC assessment items plus additional items defined by the state. It serves two purposes. First, it provides information for the screening algorithm, to determine more accurately the eligibility of the participant for several levels of HCBS. Currently, state policy considers persons categorized in the nursing home or home care LOCs as medically eligible to enroll in the Waiver or CM programs, whereas persons who are categorized in the intermittent personal care LOC may be enrolled in these programs at the discretion of the local program. Second, if it is determined that the participant is eligible to receive HCBS, the assessment provides the basis for care planning, using the RAI-HC methodology. This methodology includes care-planning protocols in 30 domains, ranging from functional limitations (ADL and IADL) and cognitive deficit to social isolation and elder abuse. A domain is “triggered” using an algorithm applied to the MDS-HC that indicates whether a participant has a potential problem in that domain. The 30 Client Assessment Protocols provide guidelines for further assessment, assistance in determining whether the client has a particular problem, and suggestions for addressing care planning for each particular issue. For a fuller description of the RAI-HC, see Morris and colleagues (1997). Use of the RAI-HC, with its comparability with the nursing home RAI, has the additional benefit of integrating the home care and institutional LTC assessment processes. The state is evaluating whether to implement this kind of assessment/care-planning system in other settings, such as licensed residential care.

It is important to recognize that the screening algorithm prediction is the starting point of the process; the individual’s actual placement depends on not only the screening algorithm but also a variety of other factors. For several reasons, a major decision was to exclude the availability of informal care from the screening algorithm itself. First, federal law on medical necessity speaks only to the individual's condition, not to the circumstances of his or her living arrange-
decisions, including preferences of the participants, availability of services, a disagreement between the assessor and the agency determination, and so forth.

For the screening algorithm development, the multiple categories of LOC were collapsed to five: nursing home, home care, intermittent personal care services, homemaker services, and I&R. Table 1 describes the specific LOCs available for describing both the agency and gold standard decisions. The nursing home category included all individuals who were recruited into the study at the time they were being discharged from home care services and being admitted to a nursing home. The home care services category consisted of persons needing intensive skilled nursing care or therapy services (three or more times a week), minimal skilled nursing care or therapy services (one to two times a week), or intensive personal care services (daily assistance for multiple tasks). The third category is composed of persons who needed intermittent personal care (less than daily care or for a single task; e.g., bathing). Those in the homemaker services category required only homemaker services such as meals, housecleaning, transportation, and so forth. Finally, the I&R category included those who were found ineligible for services through current agency screening practices.

Data were collected in the 14 AAA regions of Michigan with operating Waiver and/or CM programs between November 1996 and October 1997. The regions are representative of the geographic diversity of the state. Each regional agency selected one or two case managers (either registered nurses or social workers)—persons acknowledged as the best assessors in the agency—to collect data for this study. These case managers participated in a day-long training session on the use of the MDS-HC that was conducted by a registered nurse who participated in the instrument’s development. Prior to the start of data collection, case managers were required to complete two MDS-HC assessments on potential participants to familiarize themselves with the assessment instrument.

In addition to training on the MDS-HC, assessors were trained to make the gold standard judgments. A clinical team of physicians and nurses developed a series of 12 vignettes. Each vignette described a fictional person for whom the clinical team also made a gold standard LOC judgment. The case managers evaluated each vignette and then participated in a debriefing with clinical staff.

The trained assessors collected full assessments on three groups of individuals: those who were screened and determined eligible through the current screening process, program participants being discharged to enter a nursing home, and individuals who applied for but were not found eligible for services (I&R). Together these three groups roughly represented the range of disability likely found among applicants to the MI Choice program. For most data sites, all potential participants who called to request services from a local agency were included in the study; in a few large sites, a systematic sample of every other caller was taken. Potential study participants (or their proxy caregiver) were informed that additional information would be collected from them that was separate from current agency protocols, but that their decision to participate would not affect the care they received. The same procedure applied to recruiting those being discharged from the program into nursing homes.

Multiple MDS-HC assessments were completed for each individual agreeing to participate in the study. The baseline assessment was completed within 4 calendar days of the agency’s initial assessment, to ensure that the participant’s condition did not change significantly from the time at which the agency began its end-of-the-agency determination, to ensure that the participant’s condition did not change significantly from the time at which the agency began its own admission process (or in the case of nursing home-bound participants, the discharge process). Follow-up assessments were also completed, but only the baseline information is used in this study; follow-up data will be important in a future evaluation of the program.

**Analytic Methods**

The goal of the analysis was to determine groups of participants, on the basis of their clinical characteristics, that would most closely match the five levels of care recommended by the expert assessors. The approach of using groups was, in part, to distance this effort from the prior index system but also to recognize that the levels of care were not necessarily scaled on a single dimension (such as an IADL).

Multiple criteria were used to evaluate the proposed screening system. Statistically, the screening groups developed empirically should match with those recommended as the gold standard. We used the kappa statistic (Fleiss, 1973) as the primary measure of agreement, as it also accounted for differences in the baseline prevalence of the different categories (run in SAS [SAS Institute, 1999], we used the Fleiss–Cohen weights option). Usually agreements that achieve kappas in excess of 0.4 are considered acceptable.

We do not know from a pragmatic point of view whether any particular kappa is achievable or reasonable. Thus, we calibrated the system we would derive

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<thead>
<tr>
<th>Level of Care Category</th>
<th>Description</th>
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<tr>
<td><strong>Nursing Home</strong></td>
<td>Institutional care</td>
</tr>
<tr>
<td><strong>Home Care</strong></td>
<td>Intensive skilled nursing care/therapy services (3 + times per week; may be with personal or homemaker services) or Minimally skilled nursing care/therapy services (1 or 2 times per week; may be with personal or homemaker services) or Intensive personal care services (daily assistance for multiple tasks; may be with homemaker services)</td>
</tr>
<tr>
<td><strong>Intermittent Personal Care</strong></td>
<td>Minimal personal care services (less than daily or for single task; e.g., bathing; may be with homemaker services)</td>
</tr>
<tr>
<td><strong>Homemaker Services</strong></td>
<td>Homemaker services primarily (not personal or skilled home care)</td>
</tr>
<tr>
<td><strong>Information and Referral</strong></td>
<td>Remain in current setting with no formal services</td>
</tr>
</tbody>
</table>
against a series of alternative systems used by other jurisdictions. First, we modeled three screening systems used by other states (New York, Connecticut, and Oregon) and one Canadian province (Ontario) on the MDS-HC research data. These systems were designed to determine eligibility for a nursing home LOC. We derived the criteria each of the U.S. state systems used to determine eligibility from the study by Jackson, Eichorn, and Blackman (1992), whereas the criteria for the Ontario system were derived from the study by Miller (1997). A crosswalk was developed to map the eligibility criteria for each of these systems with the data available in the MDS-HC. In most cases, the wording was similar between the criteria listed and our data; however, we found that some of the variables necessary for these systems (such as measures of the availability of housing or behavioral history) were not available in the MDS-HC assessment. In these cases, we attempted a “good-faith” effort to develop a reasonable alternative. In addition to the challenges to coding the state/province systems in the MDS-HC data, we must also acknowledge that other governments incorporate their own system and policy goals into their eligibility determination, which make direct comparisons difficult. As a result, we urge readers to be cautious in interpreting our results as truly representing how well those systems would work if all items were available. These systems neither addressed the range of the five levels of care nor clearly specified what was included in a level (e.g., any services versus the provision of some services, or whether personal care was included in home care). Thus, to compare the predictive capability of each eligibility system (including ours), we computed kappa statistics for dichotomies within the data. Three dichotomies were modeled: eligible for a nursing home level of care versus some or no care, nursing home and home care versus a lesser level of care or no care, and I&R versus receipt of any services.

Second, we considered the entire class of screening algorithms, used by many states, which incorporate only ADLs and IADLs. To be eligible for services, many of these screening systems require a dependency in X or more ADLs/IADLs. We parameterized these systems on three dimensions: (a) which ADLs or IADLs would be included, (b) the level at which a person could be considered dependent (e.g., being totally dependent or requiring extensive/minimal assistance/supervision), and (c) the threshold X for the number of dependencies. We modeled multiple options for all of these dimensions—close to 100 algorithms. For each LOC dichotomy (nursing home vs. all others, nursing home plus home care vs. all others, and I&R vs. all others [any services]), we identified the two systems with the highest kappa. Our approach is likely to exploit some serendipity in the data, thus we recognize that it will overestimate and provide at best an upper bound on how well any such ADL/IADL system of this type can perform.

Third, although kappa addresses the match of all categories, it is appropriate to examine how well a system identifies specific categories of individuals for services (or for further assessment, such as in a telephone screen). A large kappa statistic may reflect high sensitivity or high specificity, and although both may be increased, the statistic likely reflects a tradeoff between the two (Uebersax, 2001). Thus, we also evaluated the sensitivity and specificity of each LOC and of successive sets of LOCs (e.g., nursing home plus home care vs. all other levels, etc.) to determine the extent to which the algorithm identifies false positives and false negatives. Generally, there is a trade-off in any assessment system between sensitivity and specificity, and one must decide which is more important. From a policy perspective, the state may be more willing to sacrifice specificity for sensitivity in identifying those in need of substantial services such as nursing home or home care. In other words, eligibility determination should cast a wider net (e.g., find an individual eligible by the telephone screen when in fact he/she may not be found eligible on further assessment) rather than find an individual ineligible who rightly needs services.

We used other criteria in addition to the consideration of kappa agreement and sensitivity/specificity. We sought a system that predicted the five LOCs in approximately the same prevalence as that found by the gold-standard assessors, so that there would be no major fiscal impact on the state. We also wanted a system that made clinical sense, was parsimonious in the number of participant characteristics involved, and avoided eligibility determination based on diagnoses or the availability of informal care (as discussed earlier).

Our initial analyses—using multiple (polychromic) logistic regression on the entire sample to predict, simultaneously, all five LOCs—was not successful. As the model moved down the LOC hierarchy, different variables entered to differentiate between categories. The resulting model was complex, interactive, and nonlinear. We found that once a set of variables had been included to differentiate one LOC from the pool of all other LOCs, those variables were not able to further differentiate across the residual pool of LOC categories. We therefore considered classification analyses based on branching logic and considered the differentiation of LOCs in a series of more restricted subsamples.

We first considered the subsample of observations classified only into the nursing home or home care LOCs, and used logistic analysis to identify the MDS-HC variables predictive of that dichotomy. We then considered differentiating home care from intermittent personal care, and so forth in this same method. Eventually, we discovered that an approach likened to “peeling the onion” worked best: identify the most intense (nursing home) LOC from all others, then the least intense (I&R), then the next most intense (home care), and finally differentiate the two remaining LOCs: intermittent personal care and homemaker.

The analysis was conducted using multiple logistic regression and PC-Group software (Austin Data Management, 1992), which uses classification analysis to construct decision or classification “trees” using Automatic Interaction Detection. The software identifies
variables as candidates on the basis of the degree of variance explanation (VE) of the dependent variable. In this case, separate trees were built for each LOC in the manner of peeling the onion (e.g., nursing home versus all else, then I&R versus the remaining sample, and so forth). In each case, the MDS-HC items with the highest VE were selected. This same software has been used to develop other classification systems, including the Resource Utilization Groups (Fries et al., 1994) and the Cognitive Performance Scale (Morris et al., 1994).

Independent variables considered for inclusion in the screening algorithm were organized under a series of conceptual domains: ADLs, IADLs, measures of cognition, clinical complexity, and so forth. Relevant MDS-HC items in each domain were selected and allowed to compete freely within PC-Group. Variables found to be predictive in each category were summed, and threshold levels of the summed array were tested to maximize the predictive ability within each LOC. These individual amalgams composed the algorithm's decision rules.

With an algorithm in hand, we then went back to reassess participants who were misclassified, that is, to look for clues to algorithm “mistakes” in the original assessments—either specific participant characteristics, service variables, or possible assessor biases (as indicated by disagreements between the agency and the assessor's recommended LOC). A technical advisory panel was convened to provide clinical and experiential insight to further refine the algorithm.

Results

A total of 895 individuals were recruited into the study. We excluded from analyses 82 participants not residing in the community at the time of the baseline assessment; thus the screening algorithm was developed on the basis of the slightly smaller sample of 813 individuals. The gold standard assessors categorized each study participant into one of the five LOCs, as shown in Figure 2. The distribution of the gold standard is similar to that of the larger elderly and disabled populations. For example, in 1997, the state's institutionalization rate for elders 65 years of age and older was 3.5% as compared with 4.7% in our sample (Michigan Department of Community Health, 2001). A slightly higher rate of institutionalization in our sample suggests that our sample may be somewhat more impaired than the larger institutionalized population. Not surprisingly for this program, most participants were determined to need some level of home care services, but 10.3% were deemed not in need of any formal services.

We began by testing existing screening systems. As modeled on our data, the state/province systems triggered from 38% (Connecticut) to virtually everyone (Ontario, 99.3%) as eligible for services, even when only 4.7% of the sample was deemed by the gold standard assessors to be at the nursing home LOC (Table 2). The kappas for predicting the nursing home LOC were extremely low (.14 or below) among the external screening systems. Even if broadened to include nursing home or home care, the best result, achieved by the Connecticut system, produced a kappa of .37.

We then turned our attention to the families of screening systems on the basis of a count of the number of ADL and IADL impairments. The best combination for predicting a nursing home LOC was six or more of a list of eight ADLs (mobility in bed, transferring, locomotion in home, dressing, eating, toileting, use, personal hygiene, and bathing), each counted if the ADL was scored as totally dependent (Table 3). This system produced a kappa of only .23. Somewhat higher kappa statistics were generated for predicting the split for nursing home and home care LOCs (versus intermittent personal care, homemaker, and I&R). Here, the best algorithm achieved a kappa of .40. Predictions of the receipt of any services (versus I&R) were somewhat less effective, with the best achieving a kappa of .36.

Thus, neither any existing screening systems (Table 2) nor the most effective combinations of ADLs or IADLs (Table 3) exceeded kappa scores of .40.

The best screening system we developed, using the sequential peeling the onion approach described earlier, is shown in Table 4. The first “peel” is the nursing home LOC, indicated by a score of 7 or more, counting 13 items (with the last, “moved in with others in the last 90 days,” counting 2 points toward the total). Participants not classified in this LOC are then tested against the criteria for the I&R LOC: four or more of a list of five characteristics. The system then pulls out from the participants yet unclassified those persons eligible for home care (having received either daily nurse monitoring in the 2 weeks prior to assessment or meal preparation by others along with no independence in locomotion within the home). Finally, those persons in the intermittent personal care LOC are separated from the residual group (homemaker LOC). The former group is indicated by either difficulty in five of six ADLs/IADLs, or two or more of a list of three service characteristics: (a) use of a home health aide, physical therapist, or social worker in the 2 weeks prior to assessment; (b) the indication that the participant or caregiver feels the participant would be
The MI Choice algorithm is highly sensitive and specific in identifying those in need of nursing home care (82% and 95%, respectively), that is, it is adept at identifying both those who need this care and those who do not (Table 6). For home care, the algorithm is somewhat less sensitive and specific (67% and 75%, respectively), but is more sensitive in identifying those who would qualify for either the nursing home or home care level (76%). (It should be noted that for the lower LOCs such as homemaker or I&R, it is desirable to have higher specificity than sensitivity, as we wish to be sure to identify those at the higher LOCs.)

An important decision for the state was whether an individual was likely to need at least personal care services. This was the planned criterion that would trigger the decision to perform an in-person assessment. The algorithm worked as desired: it was quite sensitive (95%) to making this decision correctly, with a greater risk of performing unneeded assessments (specificity of 68%).

When individuals are misclassified, they are more often classified into a more intensive LOC. For example, of the 211 individuals in Table 5 classified by the gold standard assessors as eligible for intermittent personal care, only 102 (48%) were correctly identified as such by the algorithm; however, 89 (42%) were classified as eligible for a higher LOC and only 20 (9%) were classified in a lower LOC. As a screening tool, the algorithm appears to achieve the policy goal of being more inclusive than exclusive.

Table 2. Comparison of State Screening Systems and the MI Choice Screening Algorithm

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<thead>
<tr>
<th>Screening Systems</th>
<th>% Triggered</th>
<th>NH vs. Other</th>
<th>NH + HC vs. Other</th>
<th>Services vs. I&amp;R</th>
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<td>Comparisons</td>
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</tr>
<tr>
<td>New York</td>
<td>43.5</td>
<td>.09</td>
<td>.34</td>
<td>.10</td>
</tr>
<tr>
<td>Oregon</td>
<td>80.1</td>
<td>.02</td>
<td>.26</td>
<td>.26</td>
</tr>
<tr>
<td>Connecticut</td>
<td>38.1</td>
<td>.14</td>
<td>.37</td>
<td>.11</td>
</tr>
<tr>
<td>Ontario, Canada</td>
<td>99.3</td>
<td>.00</td>
<td>.01</td>
<td>.03</td>
</tr>
<tr>
<td>MI Choice Screen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH vs. Other</td>
<td>4.3</td>
<td>.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH + HC vs. Other</td>
<td>52.6</td>
<td>.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services vs. I&amp;R</td>
<td>89.2</td>
<td>.40</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: NH = nursing home; HC = home care; I&R = information and referral.

The New York, Oregon, and Connecticut systems derived from Jackson, Eichorn, and Blackman (1992) and the Ontario, Canada system derived from Miller (1997).

The levels of care were dichotomized to compare the MI Choice level of care to each of the state screening systems.

This value for the screening system is adjusted for the miscoding of informal care; otherwise 8.6% are triggered for nursing home and the kappa is .48; for NH + HC, 53.1% are triggered and the kappa is the same (.48).

Table 3. Kappa Statistics for the Best Two Activity of Daily Living (ADL) and/or Instrumental ADL Counting Systems for Three Eligibility Scenarios

<table>
<thead>
<tr>
<th>Measure</th>
<th>ADL/IADL System</th>
<th>Level of Self-Performance/Difficulty</th>
<th>Kappa</th>
<th>MI Choice Kappa</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH vs. Others</td>
<td>3+ (out of 8) ADLs</td>
<td>Total Dependence</td>
<td>.23</td>
<td>.76</td>
</tr>
<tr>
<td></td>
<td>6+ (out of 8) ADLs</td>
<td>Requiring Extensive Assistance or Totally Dependent</td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td>NH + HC vs. Others</td>
<td>1+ (out of 5) ADLs</td>
<td>Requiring Limited/Extensive Assistance or Totally Dependent</td>
<td>.40</td>
<td>.48</td>
</tr>
<tr>
<td></td>
<td>1+ (out of 8) ADLs</td>
<td>Requiring Extensive Assistance or Totally Dependent</td>
<td>.39</td>
<td></td>
</tr>
<tr>
<td>Receipt of Services vs. I&amp;R</td>
<td>3+ (out of 7) IADLs</td>
<td>Requiring Some/Full Help or Totally Dependent</td>
<td>.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2+ (out of 7) IADLs</td>
<td>Having Great Difficulty in Performing Task</td>
<td>.32</td>
<td></td>
</tr>
</tbody>
</table>

Notes: NH = Nursing Home; HC = Home Care; I&R = Information and Referral.

The levels of care were dichotomized to compare the MI Choice LOC to each of the state screening systems.

"Eight ADLs include mobility in bed, transferring, locomotion in the home, dressing, eating, toileting, personal hygiene, and bathing.

Subgroup of five ADLs includes: eating, transferring, toileting, dressing, and bathing.

Seven IADLs include meal preparation, ordinary housework, managing finances, managing medications, phone use, shopping, and transportation."
Table 4. The MI Choice Screening Algorithm

Eligibility for Nursing Home LOC
7 or more of the following 13 characteristics (note that last counts as “2”):
- severely impaired decision making (b2 = 3)
- agitated or disoriented (b3b = 1)
- making self understood (c2 = 2,3)
- verbal abuse (e3b = 1,2)
- never/hardly ever left alone (f3a = 0)
- dependent in bed mobility (h2a > 0)
- dependent in dressing (h2b > 0 or h2f > 0)
- dependent in bathing (h2j > 0)
- uses wheelchair or does not ambulate indoors (h4a = 4,5)
- flare-up of current problem (k8c = 1)
- nutrition/hydration care or turning/positioning (n5d = 1)
- peripheral intravenous infusion (p2i > 0)
- moved in with others (counts as “2”) (o2a = 1)

Eligibility for Information and Referral LOC
4 or more of the following:
- independent decision making (b2 = 0)
- no difficulty with ordinary housework (h1bb = 0)
- independent in bathing (h2j = 0)
- 2+ hours physical activity in last week (h6b = 0)
- no new skin problem in last 30 days (n1 = 0)

Eligibility for Homemaker LOC
Either registered nurse monitoring daily/less than daily (p2v > 0 or p2w > 0) or
meal preparation by others (h1a = 3) and dependent in locomotion in home (h2c = 0)

Eligibility for Intermittent Personal Care LOC
Either difficulty in five or more of the following six ADLs/IADLs:
- meal preparation (h1ab > 0)
- ordinary housework (h1bb > 0)
- managing medications (h1db > 0)
- shopping (h1bb > 0)
- transportation (h1gb > 0)
- assistance in bathing (h2j > 1)

Two or more of the following five characteristics:
- current use of home health aide (p1aa > 0)
- current use of physical therapist (p1fa > 0)
- current use of social worker (p1ja > 0)
- client/caregiver feels client better off elsewhere (o2b = 1,2,3)
- difficult access to home (o1g = 1)

Eligibility for Home Care LOC
All remaining clients

Notes: Corresponding Minimum Data Set for Home Care (Version 2.0) variables in parentheses. LOC = level of care; ADLs = activities of daily living; IADLs = instrumental ADLs.

Table 5. Comparison of the MI Choice Screening Algorithm With the Gold Standard Level of Care Determination

<table>
<thead>
<tr>
<th>MI Choice Algorithm</th>
<th>NH</th>
<th>HC</th>
<th>IPC</th>
<th>HM</th>
<th>I&amp;R</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing Home (NH)</td>
<td>31</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>38</td>
<td>4.7</td>
</tr>
<tr>
<td>Home Care (HC)</td>
<td>30</td>
<td>254</td>
<td>76</td>
<td>5</td>
<td>14</td>
<td>379</td>
<td>46.6</td>
</tr>
<tr>
<td>Intermittent Personal Care (IPC)</td>
<td>9</td>
<td>80</td>
<td>102</td>
<td>13</td>
<td>7</td>
<td>211</td>
<td>26.0</td>
</tr>
<tr>
<td>Homemaker (HM)</td>
<td>0</td>
<td>12</td>
<td>19</td>
<td>43</td>
<td>27</td>
<td>101</td>
<td>12.4</td>
</tr>
<tr>
<td>Information and Referral (I&amp;R)</td>
<td>0</td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>40</td>
<td>84</td>
<td>10.3</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>362</td>
<td>214</td>
<td>79</td>
<td>88</td>
<td>813</td>
<td>100.0</td>
</tr>
<tr>
<td>Percentage</td>
<td>8.6</td>
<td>44.5</td>
<td>26.3</td>
<td>9.7</td>
<td>10.8</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Note: Kappa = .62.
LOC; Table 5). With the adjusted algorithm controlling for the presence of informal care, 35 individuals are recommended for nursing homes, of which 28 (80%) are in agreement with the assessors (results not shown). Overall, the kappa for the modified full five-category system increases slightly to .63.

We do not suggest the use of this modified algorithm, as it was designed to evaluate the effects of miscoding (i.e., using informal care as a criterion) by the assessors. Users should apply the original algorithm given in Table 4 to determine eligibility (without considering the availability of informal care).

We also checked the performance of the screen across the several agencies/assessors, and for one significant subpopulation—those under the age of 55. Individual kappas could be estimated in only 9 of the 14 agencies for which there were full 5 × 5 tables such as Table 5. All these agencies had adequate agreement scores, with kappa statistics ranging from .44 to .82 (results not shown). Although there are clearly differences across the agencies, they may be the result of differences in the population across regions rather than a result of differences across assessors.

Although the screen performed acceptably for disabled persons under 55, it did not do as well as it did for the older population. For the 52 individuals in the sample under age 55, the kappa was .47 (results not shown). The major disagreements between the gold standard assessment and the MI Choice algorithm were between the home care and intermittent personal care LOCs. The agreement on the nursing home LOC was excellent: out of three individuals classified by the screen as at the nursing home LOC, there was an agreement on two—all those classified as nursing home by the gold standard assessors.

With any system that is relatively parsimonious in the number of variables used to identify (screening) groups, there is always the concern that factors not appearing explicitly in the model may cause a subpopulation in need of care to be ignored. One example was a concern that the MI Choice screen did not adequately address cognitive impairment (O’Keeffe, 1999), as only decision making was included in the algorithm (in predicting the nursing home and home care LOCs). We used the MDS Cognitive Performance Scale (CPS) to explore this potential problem (Morris et al., 1994). The CPS algorithm uses five MDS-HC items to produce seven performance categories, ranging from intact to very severely impaired. It has been shown in nursing homes to be highly predictive of Folstein Mini-Mental State Examination (MMSE) scores (Morris et al., 1994). For the purposes here, we clustered the seven CPS levels into three: intact/borderline intact; mild, moderately, and moderately severely impaired; and severely and very severely impaired (corresponding to MMSE scores of 21.9–24.9, 6.9–19.2, and 0.4–5.1, respectively). Figure 3 displays the frequency of these three clusters within each of the five LOCs determined by the MI Choice algorithm. Moving from the I&R level sequentially to the nursing home level,

<table>
<thead>
<tr>
<th>Comparison (vs. All Others)</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing Home (NH)</td>
<td>81.6</td>
<td>95.0</td>
</tr>
<tr>
<td>Home Care (HC)</td>
<td>67.0</td>
<td>75.1</td>
</tr>
<tr>
<td>Intermittent Personal Care (IPC)</td>
<td>48.3</td>
<td>81.4</td>
</tr>
<tr>
<td>Homemaker</td>
<td>42.6</td>
<td>94.9</td>
</tr>
<tr>
<td>Information and Referral</td>
<td>47.6</td>
<td>93.4</td>
</tr>
<tr>
<td>NH + HC</td>
<td>76.3</td>
<td>71.2</td>
</tr>
<tr>
<td>NH + HC + IPC</td>
<td>93.5</td>
<td>68.1</td>
</tr>
</tbody>
</table>

Note: All data are percentages.
the percentage of intact/borderline intact individuals declines monotonically while the percentage of severely/very severely impaired increases (see Figure 3, $p < .001$).

With the MI Choice screen, the state intended to develop an eligibility system that would be blinded to diagnosis and instead define eligibility on the basis of demonstrated functional need. Figure 4 presents a distribution of different disease diagnosis groupings across the five LOCs. This figure clearly shows that the MI Choice algorithm is not influenced by diagnosis—there appears to be no substantial relationship between level of care and heart/circulatory problems, musculoskeletal problems, and cancer. Although the population as a whole seeking LTC services from the state has a relatively high degree of disease burden, disease diagnoses alone do not predict the need for services.

**Discussion**

This article presents the results of the empirical development of a screening algorithm to determine eligibility for LTC services in Michigan. The screening system uses a new methodology. Not only does this system determine if a participant is eligible for services, but it also goes further to assist the screener to determine the level of care the participant might need. The screening algorithm demonstrates good prediction of expert clinical opinion and achieves the state’s goals of being relatively parsimonious, making clinical sense, being insensitive to disease diagnoses, and performing favorably in comparison with other screening systems.

The state uses the MI Choice algorithm for two decisions. First, the 30 MDS-HC items necessary to determine LOC were translated into questions that could be asked over the telephone and form MI Choice’s telephone screen. The screen can be completed in 15 to 20 min. Currently, the state has decided not to perform in-person assessments on those who meet the criteria for homemaker services or I&R. By doing this, the state has reduced by approximately one quarter the number of in-person assessments it performs.

It would be efficient if screening could be performed fully on the telephone and eligibility could be determined without an in-person assessment. We do not yet know whether this can be done reliably. MDS-HC items have good reliability when used as part of an in-person, face-to-face assessment that uses all available sources of information (Morris et al., 1997). However, these same items may not work well over the telephone, when there is no visual collaboration, only one source of information—a person providing information who may not be knowledgeable about all the characteristics of the client (or, if the individual him- or herself may have cognitive problems that would lead to misunderstanding of the questions). There are probable incentives for misreporting, as well. We will examine these issues in future research, contrasting the telephone screens with in-person assessments of the same individual. Nevertheless, it should be noted that even if the system is imperfect, the state has relied in the past on telephone screens to make these same decisions, and the new system is becoming well accepted by users as superior to that formerly in place.

The second state use of the algorithm is after the completion of the in-person assessment, to guide the selection of an appropriate LOC.

In both cases, the availability of an empirically derived screen has laid the foundation for more accurate and appropriate decisions. Still, the screening system

---

**Figure 4. Disease diagnosis by level of care.**

- Heart/Circulatory Problems
- Musculo-Skeletal Problems
- Cancer

- Percentage

- Nursing Home
- Home Care
- Intermittent Personal Care
- Homemaker
- Information & Referral
is still being refined. At issue are a few significant predictors of LOC that elicit concern from clinical staff. In particular, eligibility for the home care LOC is indicated for those whom nurses monitor daily or less than daily. Many of the participants who seek LTC services from the state are recently discharged from a hospital or have some type of acute condition that requires medical monitoring; clinicians assert receipt of such monitoring alone may not make these persons eligible for continued care. In addition, eligibility for the nursing home LOC can be achieved in part if the person has recently moved in with others, and this item has the potential to be purposely misreported. The research team continues to work with the state and the technical advisory group to identify alternative items that might improve the algorithm. Finally, we also are gathering information to examine longitudinal outcomes among individuals and to link them to the LOC decisions—and cases in which clinical staff recommended a different LOC—to improve the screening algorithm. We hope to report on these efforts in the future.

It is important to consider carefully whether the MI Choice algorithm can be generalized. This study was performed only in Michigan, using study participants from the Medicaid Waiver and CM programs. Due to eligibility criteria outside of the algorithm (e.g., financial, age, etc.), the population served in Michigan may have levels of need different than those of elders and disabled persons in other states. In addition, the Michigan program only screens and serves those who make contact with the agencies who run the Waiver and CM programs. Therefore, there may be biases in the sample used to develop the algorithm. Future efforts to validate will have to address different subpopulations that may be more or less prevalent in the larger elderly/disabled population.

It is also not clear to what extent the decisions made by the case managers who determined the gold standard level of care in Michigan would be the same as those made by case managers elsewhere. The policy goals of Michigan may also differ from those in other states. Additionally, differences across states in the availability of LOC alternatives may affect the population that seeks home care services from the state. As a result, we cannot be certain that the results of our efforts in Michigan can be generalized to other states. However, every state now runs a Medicaid Waiver program with a similar minimum package of services available to those deemed eligible. States considering adoption of the screening algorithm may want to conduct validation studies to test the performance of the screen in their HCBS.

The MI Choice screening algorithm described here has been adopted by the Department of Veterans Affairs for nationwide implementation and is being considered for adoption by several other states and nations. Michigan has implemented the telephone screen, in-person assessment, and screening algorithm using optical scanning methodology. Hand-completed forms are rapidly scanned in each agency, where errors are resolved and the algorithm computed. Daily, the agency computers upload new assessments to the state database, which can then be used to maintain longitudinal records on individuals, to profile participants and agencies, and to perform policy and other research. For example, we are currently working with the state and international colleagues, using these data, to develop quality indicators for home care. In addition, we are using these data and the state's nursing home MDS data to contrast persons receiving services under these programs with residents in nursing homes, to understand whether, in fact, this program is substituting for institutionalization. The availability of compatible data sets, and scales and algorithms such as the MI Choice screen, enable the development of efficient and effective statewide long-term care systems.

References


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