Performance reports should include not only peer comparison data but also absolute thresholds to allow organizations to better target their improvement efforts.

PERFORMANCE MEASURES AND MEASUREMENT

Setting Thresholds for MDS Quality Indicators for Nursing Home Quality Improvement Reports

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A n important area of inquiry in quality measurement when using quality indicators (QIs) lies in determining what thresholds indicate good and poor resident outcomes. In July 1996, a cross-section of 13 clinical care personnel from nursing homes participated on an expert panel for threshold setting of QIs derived from Minimum Data Set (MDS) assessment data.

Panel members met as a group for a day, individually determined good and poor threshold scores for each QI, reviewed statewide distributions of MDS QIs, and completed a follow-up Delphi round of the final results. Reports of MDS scores that are sent to a group of nursing homes in Missouri* now include thresholds established for good and poor scores so the facilities can easily see where they are performing well and where they

need to concentrate quality improvement efforts. This article describes the efforts made to develop and disseminate the thresholds for MDS scores.

Background
MDS
The MDS QIs have been in development since 1990 by a research team at the Center for Health Systems Research and Analysis, at the University of Wisconsin-Madison, as part of the Health Care Financing Administration (HCFA; Washington, DC)-sponsored National

* One-hundred twenty nursing homes in Missouri are participating on a voluntary basis in a randomized three-group study to test the effect of feedback reports to the facility's quality improvement team and feedback reports with onsite clinical consultation on resident outcomes. Control homes in the study are slated to receive feedback reports by late 1998 and early 1999. All of the remaining nursing homes in Missouri are slated to receive feedback reports in 1999.

Article-at-a-Glance

Background: Determining meaningful thresholds to reinforce excellent performance and flag potential problem areas is critical for quality improvement reports. Without thresholds, an organization may interpret its performance as superior to others because it is "better than average" and falsely assume it does not have care problems in certain areas.

Setting thresholds: The Minimum Data Set (MDS) assessment instrument is mandated for use nationwide in all nursing homes participating in Medicaid or Medicare programs. Since 1993 a research team at the University of Missouri-Columbia has been developing and testing quality indicators (QIs) derived from MDS data as a foundation for quality improvement activities. In July 1996, a cross-section of 13 clinical care personnel from nursing homes participated on an expert panel for

threshold setting for QIs derived from MDS assessment data. Panel members individually determined good and poor threshold scores for each QI, reviewed statewide distributions of MDS QIs, and, two weeks later, completed a follow-up Delphi round. Three members of the research team reviewed the results of the expert panel and set the final thresholds. With thresholds established for good and poor scores, MDS QI scores are reported to a sample of Missouri nursing homes using the thresholds.

Conclusions: To ensure that thresholds reflect current practice, threshold setting with another panel of experts will be repeated as needed, but at least biannually. The report format will be revised on the basis of user input, and a statewide study testing different educational support methods for quality improvement using MDS QIs is now underway.

Nursing Home Case Mix and Quality (NHCMQ) demonstration project. Researchers have been developing and testing QIs derived from MDS data to serve as a foundation for quality improvement activities.[1,2] Each indicator uses specific items from the MDS assessment instrument that is mandated for use nationwide in all nursing homes participating in Medicaid or Medicare programs. For example, indicators addressing the prevalence of bladder or bowel incontinence exclude residents who are comatose or have indwelling catheters or an ostomy on the most recent assessment.[3] The QIs, developed through a systematic process involving extensive interdisciplinary input, empirical testing, and field testing,[4,5] are not absolute measures of quality but are markers of potentially poor (or good) care practice and resident outcomes. There are 30 QIs among 12 domains of care—accidents, behavioral and emotional patterns, clinical management, cognitive patterns, elimination and

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continence, infection control, nutrition and eating, physical functioning, psychotropic drug use, quality of life, sensory function and communication, and skin care.[1] Twenty-seven of these QIs can be derived from the standard MDS instrument that the State of Missouri requires.

Thresholds and Reports

As in any care setting, determining thresholds that reinforce excellent performance, as well as thresholds that flag potential problem areas in nursing home care, requires considerable information about the range of possible performance, professional knowledge of clinical care delivery, and professional knowledge of the complex problems residents present. Most important, meaningful thresholds are critical for preparing reports for nursing homes to use in their quality improvement programs.

Thresholds, which are a part of everyday life, are commonly used as decision points to decide when or when not to take action about a real or potential problem. Katz and Green explain that a threshold is a point that distinguishes compliance from noncompliance with written standards.[6] In health care, written standards of clinical care are based on professional standards of care reflected in the literature and professional practice guidelines. Periodic measurements of actual practice are taken to determine whether the care is being delivered within professional standards. The issue of thresholds becomes most relevant when the level of noncompliance that triggers the need for further investigation and possible action needs to be determined. Typically, thresholds are set to be realistic and achievable. In most cases, this means that they are not set so that standards must be achieved 100% of the time. As Donabedian points out, the criteria could be set so strictly "that almost every case falls short or so lenient that almost everything is acceptable."[7(p 105)]

The health care literature is replete with discussions about threshold setting. However, many important discussions about quality improvement projects imply that setting thresholds is integral to the project design, especially when staff are to compare the outcomes they have achieved with those achieved by other health care providers.[8-12] In discussions about benchmarking, emphasis is placed on the importance of understanding the quality of an organization's performance *before* benchmarking to other external providers in an attempt to close the gaps in performance.[13-16] Kane and Kane point out that in long term care, acceptable stan-

dards of performance must be established to define and assess quality.[17] For MDS QIs, specifically, Zimmerman et al suggest that absolute thresholds can be developed through literature review or consensus by experts.[1] They go on to explain that relative thresholds can be set based on peer-group distributions of events across facilities.

Considerable advice has been offered concerning how to go about setting standards. Jaeger discusses who should be making the judgment (that is, who is the expert), how experts should be selected, and how many experts should be used when setting standards.[18-19] Norcini, Shea, and Kanya recommend that performance data be provided during the standard setting process.[20] Such performance data could include summary statistics from a previous round when multiple rounds of data collection are completed by a group for standard setting. Fitzpatrick offers advice about how the group process of standard setting can influence the final outcomes of the process.[21] She suggests that information (data) be provided to those setting standards to minimize the effect of social influences or status on group members. In the case of health care, information about state or national distributions of outcomes would be critical information to provide to a group of clinical experts convened to set standards.

Assuming that one is successful in setting meaningful thresholds, and that data for performance reporting are available, a critical issue is how to design a user-friendly report. Kabcenell et al point out that identifying an appropriate peer group for comparisons, statistics, format, and time frames for reporting may be more challenging than anticipated.[9] Useful reports contain data in a continuous time-ordered format so that organizations can readily compare their performance over time. To make these data more meaningful, community benchmarks should be included.[22] Graphic representations help users readily grasp how well they are performing.[23]

Since 1993 our research team at the University of Missouri-Columbia* (MU) has been using MDS QIs to study quality of care in nursing homes. Using MDS data from all certified nursing homes in Missouri, we determined current levels of facility performance and identified those nursing homes that perform well based on one or more of the QIs.[24] The analysis began with data collected from nursing homes during a three-year period from (January 1993–December 1995). We ex-

amined the statewide distributions of the 27 QIs that we could analyze with Missouri's data set. Given our interest in conducting intervention research to evaluate change in resident outcomes, we narrowed the choice of indicators to those with sufficient variation among facilities for changes to be detectable. For instance, "the prevalence of tube feedings" was not selected because there is such limited use of tube feedings that detecting meaningful changes in practice would be improbable.

Next, we narrowed the choices to those that represent serious quality problems that can affect resident well-being. We selected QIs that are related to well-documented common quality problems in long term care, are representative of diverse aspects of quality care, and are amenable to clinical practice intervention. It was important to select those indicators that are potentially amenable to interventions so that staff in the facilities might attempt to improve resident outcomes. For instance, the prevalence of cognitive impairment is not clearly modifiable by clinical intervention; it is a reflection of clinical status. At the conclusion of this process, we identified 13 indicators as potentially useful for measuring care quality and subsequent resident outcomes for our intervention studies.

Several states are now considering providing feedback reports to nursing homes about their performance on their MDS QIs. Typically, the reports display numerically and/or in bar graph form an individual facility's performance, its percentile ranking, and statewide or vendor-compiled proxy national averages.[25-27] The difficulty with providing feedback by comparing an individual facility's QI performance with statewide averages, medians, or percentile ranking is that the data may be interpreted such that the quality of care quality is *adversely affected.* Comparisons with averages (or similar measures) can create a false impression of good quality. It is possible that an average score actually reflects very poor clinical outcomes. Nursing homes with better-than-average performance in one area may stop attempting to improve care delivery in that area because they believe they exceed the "standard" or have achieved an acceptable level of quality. Facilities may interpret their performance as superior to others because they are "better than average" and falsely assume they do *not* have care problems (or opportunities for improvement) in areas where they *actually do* have problems that need attention. If the objective is to encourage higher levels of performance, it is imperative to place high, but attain-

able, standards for all to achieve. On the basis of our assumptions, then, simply reporting averages, medians, or percentile ranking will not adequately encourage efforts to improve and may in fact discourage some efforts.

Setting Thresholds

In recognition of the importance of thresholds in quality measurement, we undertook a project to set meaningful thresholds for each of the 13 MDS QIs that we are using in research projects in Missouri. Thresholds indicating good and poor resident outcomes were set at an achievable level. Building on our previous experience with MDS QIs,[24] we selected a complete year of MDS data to calculate QI scores for the state. We excluded admissions and readmissions from the data set so as not to measure what happened to nursing home residents when they were cared for in other settings. With current statewide MDS QI calculations, we planned and conducted three phases of research to set good and poor thresholds for each QI to use when providing feedback reports to nursing homes in the state.

Phase I

Using Jaeger's criteria for selection of experts, we invited a cross-section of well-qualified clinical care personnel with nursing home experience to participate on an expert panel. Jaeger points out that experts excel in their field, are able to recognize meaningful patterns in their domain, are able to perform skills quickly, see and analyze problems at a deeper level, and are more accurate at judging problem difficulty.[18] Represented in this group of 13 experts were
■ *four medical directors of nursing homes;*
■ *four directors of nursing;*
■ *three advanced practice nurses; and*
■ *two nursing home consultants who are experienced in the MDS assessment process and consult with a variety of nursing homes statewide.*

Although one of the advanced practice nurses—a state surveyor and the state Division of Aging MDS coordinator—represented the regulatory perspective, the remaining members were from the provider community since we wanted the threshold results to reflect what providers thought nursing homes would be able to achieve.

The panel was scheduled to convene for an entire day. Participants agreed to complete a follow-up, single-round Delphi of the final results approximately two weeks after the group work day.

The room was arranged so each participant could easily see and talk to each other. Furniture was arranged in a semicircle with tables and chairs so panel members could readily view the overhead projector used by the group leader. Overhead slides were prepared in advance of the meeting with definitions for each QI. Each person had access to an MDS instrument and the overhead slide indicated which items were used in calculating each QI. Participants were asked, "Based on your clinical experience in nursing homes and your professional knowledge, what is an achievable score indicating good resident outcomes and good quality care in a general nursing home population?" They were asked to formulate their answers on the basis of their knowledge of clinical research with nursing home residents and their experience and expertise with the general nursing home population (that is, excluding residents in hospital-based or freestanding subacute nursing care units).

Next, they were asked to determine a score they considered would indicate potentially poor resident outcomes and poor care quality. The poor score would be used by staff to target areas of care delivery that need to be closely examined for problems. If problems are discovered in this examination, staff would take corrective steps to improve the care.

The participants discussed each QI separately in terms of what they considered a good score and what they considered a poor score. Five QIs required setting two additional sets of thresholds for low- and high-risk resident populations. The method for calculating low- and high-risk resident groups was explained in detail with the MDS items used in the calculation.[3] For these five QIs the participants set overall thresholds first, then thresholds for residents who meet the low-risk population definitions, then thresholds for residents who meet the high-risk population definitions.

Participants related information from their practice experience and knowledge of research findings with each other. Following discussion, each person recorded his or her judgment on a scoring form. Research staff collected forms at the conclusion of each QI discussion. All QIs were discussed and scored by each participant during the morning session. Research staff then compiled the individual scores for use in the afternoon session.

Phase II

For the afternoon session, research staff recorded each participant's good and poor scores in a scattergram format on an overhead slide. The scattergram was superimposed on a histogram of the distribution of statewide scores for each QI. The overhead slide also contained a table of minimum, 5th percentile, median, 95th percentile, and maximum statewide scores. Data for the overall, low-risk, and high-risk scores were displayed for QIs for which data were risk adjusted. A copy of one of the overhead slides used in the discussion, "Phase II Composite of Expert Panel Results and Statewide Prevalence of Falls," is presented in Figure 1 (p 607).

The composite of the morning scores and the statewide distributions was prepared to help participants compare their clinical judgments with the actual QI distributions. We wanted the experts to make decisions during Phase II based on their practice data from Phase I and statewide QI data. The overhead slides were used in the second round of discussions for each QI. This round, which took place in the afternoon, was important because participants could ground their discussion in the scores from the morning session and data from each statewide QI distribution. Participants discussed what scores they believed were achievable and how their opinions might differ from actual practice or from the morning session. Following these discussions, participants were given a second scoring sheet for each QI and recorded their opinions of both achievable good scores reflecting good resident outcomes and poor scores reflecting poor resident outcomes. Scoring sheets were collected after each QI was discussed.

The day ended with data collected from each expert about each QI. Participants requested a summary of their work and agreed to complete a single-round Delphi to check if their opinions changed when they had more time to reflect on the discussions of the day with their colleagues.

Phase III

Research staff tabulated the results of Phase II and calculated thresholds for good and poor scores using simple means of the scores from each of the experts for each QI. A chart was prepared to send to the experts for the Delphi. Each QI was listed with

■ *statewide distributions of mean, minimum, 5th, 10th, median, 90th, 95th, and maximum percentile scores;*
■ *expert average good score and expert average poor score; and*
■ *two blank boxes for the expert to complete indicating his or her current opinion for the good and poor score.*

Phase II Composite of Expert Panel Results and Statewide Prevalence of Falls

QI 2: Prevalence of Falls

Variable = Q2

Falls

Expert Panel
Phase I Results
GOOD = ●
POOR = ◉

L+H   Low   High
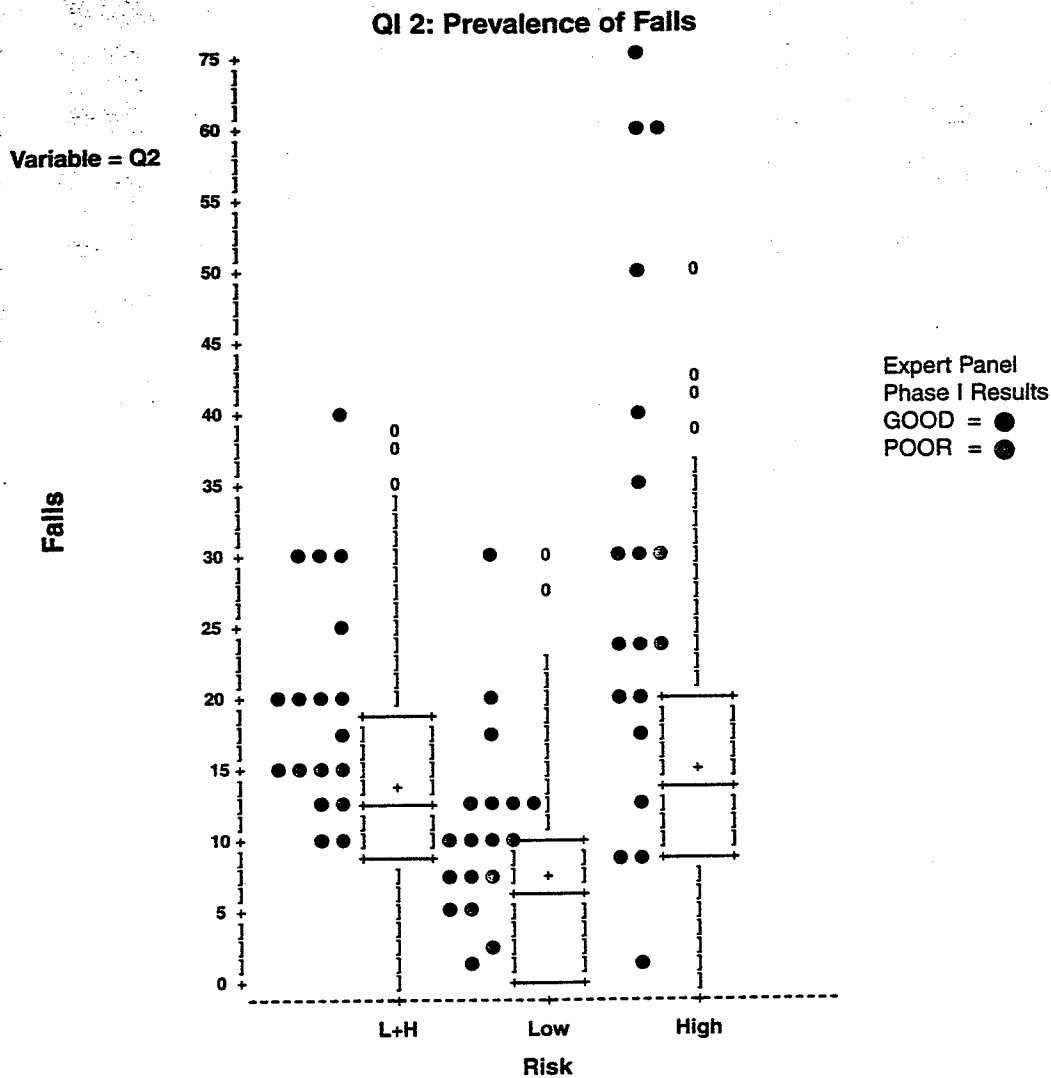
Risk

Quality Indicator 2 — Prevalence of Falls

Risk	Mean (SD)	Minimum	5th Percentile	Median	95th Percentile	Maximum
L+H	13.9 (7.9)	0.0	2.7	13.0	27.1	55.2
Low	7.2 (7.5)	0.0	0.0	5.9	22.2	30.0
High	15.0 (8.6)	0.0	2.5	13.8	29.1	55.2

Figure 1. *The phase II composite of expert panel results are shown for the statewide prevalence of falls (Quality Indicator [QI] 2). The prevalence of falls is shown for high-risk (residents meeting criteria for high risk for falls), low-risk, and all residents (L+H). Information on the distributions of each QI was provided to the panel members in two ways—a table of summary statistics and a display of the data in the form of box plots. The summary statistics included the mean and standard deviation, minimum and maximum values, and the 5th, 50th (median value), and 95th percentiles. The box plots were constructed by positioning the top of the box at the 75th percentile and the bottom of the box at the 25th percentile. Thus each box covers the range of values that make up the middle 50% of the data. The line across the box marks the position of the median value and the plus symbol within the box marks the position of the mean value. The more symmetric the distribution, the closer the mean and median values. The vertical lines (brackets and zeroes; "whiskers") extending above and below the boxes provide information about the data dispersion and symmetry.*

Table 1. Phase III Delphi Questionnaire*

Quality Indicator (QI) 2: Prevalence of Falls

		Missouri Quality Indicator Calendar 1995							Expert panel		Your current opinion	
Risk	Mean (SD)	Minimum	5th Percentile	10th Percentile	Median	90th Percentile	95th Percentile	Maximum	Good Score	Poor Score	Good Score	Poor Score
L+H	13.0 (7.9)	0.0.	2.7	4.8	13.0	24.1	27.1	55.2	5.0	10.0		
Low	7.2 (7.5)	0.0	0.0	0.0	5.9	18.8	22.2	30.0	0.0	5.0		
High	15.0 (8.6)	0.0	2.5	5.2	13.8	26.0	29.1	55.2	8.0	15.0		

*The score for each QI is derived from a simple calculation of the proportion of residents who have the problem defined by the QI (numerator) and the total number of residents who could potentially have developed the problem (denominator). In most cases, the denominator is the total number of residents in the facility or the total number minus some residents who are excluded because they have specific clinical conditions that logically should not be included in the calculation.

Approximately two weeks following the panel, we sent each expert a Phase III Delphi questionnaire. A page from one of these questionnaires is provided in Table 1 (above).

Six of the 13 experts returned the questionnaires. Five others who did not return questionnaires were contacted and confirmed that they agreed with the data as presented. The remaining two experts could not be reached during data analysis. For those experts who did adjust scores in the Delphi round, the magnitude of changes ranged from zero to 48 points for each QI. However, most items were changed 1–4 points. The largest adjustment made by panel members during Phase III was for QI 28 ("prevalence of little or no activity"). Statewide distributions indicate a high prevalence for QI 28 (median, 52.2). In the Phase II discussions the experts expressed their belief that almost all residents "should be or could be" engaged in activities. They set thresholds low during Phase II (4 for a good score and 10 for a poor score). On reflection during Phase III, both the good and poor scores for QI 28 were reset at higher values. If the thresholds remained at 4 and 10, more than 95% of the nursing homes in the state would have had a score that is within the poor threshold. With the reset thresholds, approximately 20% of the facilities are within the good threshold and about 50% are within the poor threshold.

Setting Final Thresholds for Reports

Three members [M.J.R., D.R.M., L.P.] of our research team who had extensive nursing home experi-

ence (both medical and nursing) met to review the results of the expert panel and set the final thresholds. To make final decisions, the research team members considered data from three sources—the Phase II expert clinical opinion, the Phase III Delphi results, and, finally, the statewide distributions for each QI. This step was necessary to ensure that there was a sufficient spread between thresholds for poor and good scores and to allow for rounding to whole numbers. Minor adjustments of less than 5 were made in setting the final thresholds for use. The threshold results for each QI are shown in Table 2 (p 609).

Reporting MDS QIs for Quality Improvement

With thresholds established for good and poor scores, we were now able to incorporate them in reports of MDS QI scores to a sample of Missouri nursing homes. With thresholds to guide interpretations, nursing homes would now be able to see where they are performing well and where they need to concentrate quality improvement efforts.

Reports were designed so quality improvement teams in individual facilities could use them in their own quality improvement programs. The reports were designed by our research team following a review of the literature relevant to report format; certain reports were particularly helpful to the design.[6,8,11,22,23,28,29] We also reviewed sample reports prepared by others for MDS QI reports.[25-27] The draft report formats were reviewed in several rounds by a total of 40 to 45 nursing home

Table 2. Thresholds for Quality Indicators (QIs) Derived from Minimum Data Set (MDS) Data

Quality Indicator	Good Threshold	Poor Threshold
Prevalence of any injury	4	11
Prevalence of falls*	5	15
Prevalence of problem behavior toward others*	11	34
Use of 9 or more scheduled medications	10	30
Prevalence of bladder or bowel incontinence*	37	60
Bladder or bowel incontinence without a toileting plan	7	28
Prevalence of indwelling catheters	2	9
Prevalence of fecal impaction	1	6
Prevalence of weight loss	6	15
Prevalence of bedfast residents*	2	12
Prevalence of daily physical restraint	2	9
Prevalence of little or no activity	20	54
Prevalence of stage 1–4 pressure ulcers*	3	11

Note: Those QIs marked with * have separate thresholds established for low- and high-risk resident populations and are available from the authors on request. These values were set using MDS Version 1.0. Because the QIs are calculated as a proportion of residents with the problem (numerator) as compared with the residents who had the potential to have the problem (denominator), the scores can be thought of as simple percentages. For example, for stage 1–4 pressure ulcers, fewer than 3% of the residents should develop a stage 1-4 pressure ulcer (good score). A poor score would be 11% or greater.

listed because the average score should not be interpreted as a benchmark for determining quality. We believe the thresholds, the best score, and the tenth percentile score are more appropriate for quality improvement teams to use. With thresholds, QI teams have absolute values to use as they target improvement efforts. With the highest and tenth percentile scores, they have relative peer group values they can use to judge their progress.

Dealing with the tough issue of setting meaningful thresholds for MDS QIs for nursing homes has been challenging. However, we anticipate that staff will be better able to use the data in their quality improvement programs. To ensure that thresholds reflect current practice, threshold setting with another panel of experts will be repeated as needed, but at least every other year. As the MDS instrument or recommended calculations for the MDS QIs change, thresholds will be reestablished to assure a fit with the instrument and data. As information from other expert panels setting thresholds for MDS QIs and as research literature becomes available, we will review their results and take appropriate steps to revise the thresholds.

staff and state regulators. We revised the format six times following each round of input.

A sample report of one QI for a quality improvement team to use is provided in Figure 2 (p 610). The thresholds are clearly marked on the graph so staff can interpret how their QI score compares with thresholds. The table includes both the facility and statewide summary statistics. The facility's QI score is listed first; then, the number of residents who were included in the calculation; and the number of residents who actually have the problem indicated by the QI. The statewide summary portion of the table includes the best score attained by anyone in the state for that quarter and the tenth percentile score (that is, the score that 10% of the homes were able to achieve). After much discussion, we decided that the statewide average for each QI *not* be

The report format will be revised on the basis of nursing homes' input to help them use the information contained in the report. A statewide study testing different educational support methods for quality improvement using MDS QIs is now underway. ∎

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Sample Quality Indicator Report for a Quality Improvement Team to Use

Facility Name:
Missouri Facility ID#:
Facility Address:
Facility County:

Report for the Quarter Ending: June 30, 1997

Quality Indicator # 2
Prevalence of Falls

This Quality Indicator (QI) reflects the percent of residents who had falls* as recorded on their most recent MDS assessment. The graph displays several quarters of information for this QI. QI scores that fall below the *good* threshold are thought to reflect good or excellent performance. QI scores that fall above the *poor* threshold may suggest a problem with resident care that needs further attention by your Quality Improvement Team. Focus on trends and examine the residents listed with the problem. The summary table below includes your facility's QI Score and the best statewide scores. Please refer to the cover letter for further explanations.

See attached Resident List for those residents who had falls indicated on their most recent MDS.

Prevalence of Falls
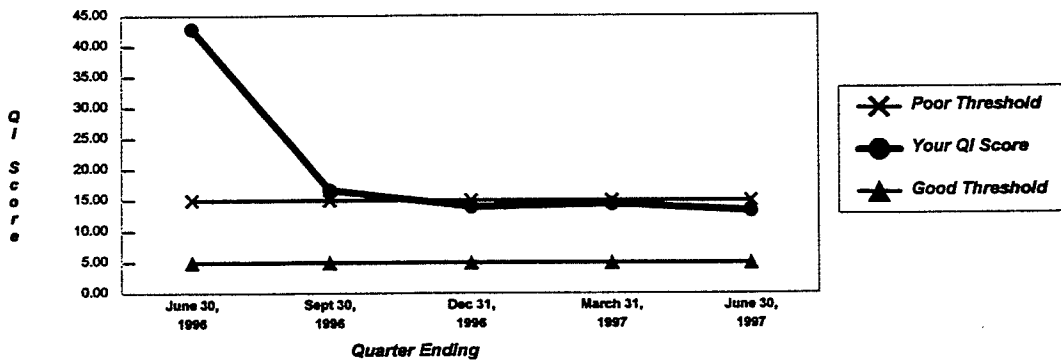
Summary Table for Quality Indicator # 2

Quarter Ending	Your Facility			Statewide Summary	
	Your QI Score	# of Residents with this QI	# of Residents in this Calculation	Tenth Percentile	Best Score
June 30, 1996	42.86	3	7	3.92	0.00
Sept 30, 1996	16.67	2	12	0.00	0.00
Dec 31, 1996	13.95	6	43	5.41	0.00
March 31, 1997	14.42	15	104	6.41	0.00
June 30, 1997	13.33	14	105	5.00	0.00

Figure 2. *Each quality indicator has a separate page and data are displayed for several quarters in a line graph and table.*

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