

# Measuring nursing care quality and using large data sets in nonacute care settings: State of the science

Marilyn J. Rantz, RN, PhD, FAAN  
Robert P. Connolly, MSW

The general state of the science of nursing quality measurement in nonacute care settings has accelerated in the last several years. Examples of current research using large data sets to measure quality of nursing care in nursing homes, home health, and other community-based care delivery are presented. Federally available data sets are reviewed as potential measures of care quality, and accessing these data sets is explained. Large data sets are becoming commonly used in long-term care research. Multiple databases are available for researcher use that can provide measures of nursing care quality. Large data sets in nonacute care hold much potential for measuring quality of care in long-term care settings. Public policy makers must facilitate timely data access so that research can move beyond descriptive studies to interventions that can be tested and proven to improve quality of care and outcomes of those we serve.

## INTRODUCTION

What is nursing care quality, and how can it be measured? These seemingly simple questions have complex answers that have been the focus of much thoughtful debate and research for decades in health care. It is one thing to consider the appropriateness of an outcome measure for quality of care when assessing a single episode of acute illness or injury. The episodic time frame of the event has a clear beginning and potentially a clear end. It is quite another thing when measuring outcomes of care quality for chronic illnesses, primarily managed in nonacute care settings such as nursing homes, home health, and other community-based care. Exactly when does the measurement begin and end? When is death, the ultimate outcome, an appropriate indicator of high quality nursing care, and when is it a consequence of poor quality nursing care? What measures are possible for quality of care provided

Marilyn J. Rantz is a Professor at Sinclair School of Nursing, University of Missouri-Columbia, Columbia, MO.

Robert Connolly is a Health Insurance Specialist at Centers for Medicare and Medicaid Services, Baltimore, MD.

Reprint requests: Marilyn J. Rantz, RN, PhD, FAAN, S406 Sinclair School of Nursing, University of Missouri-Columbia, Columbia, MO.

E-mail: rantzm@missouri.edu

Nurs Outlook 2004;52:23-37.

0029-6554/\$—see front matter

© 2004 Elsevier Inc. All rights reserved.

doi:10.1016/j.outlook.2003.11.002

for in the long-term management of chronic illnesses in nonacute care settings? Are there large data sets that provide opportunities for measurement of nursing care quality without primary data collection in these settings? In this article we discuss these issues in detail, and provide examples of current research using large data sets measuring quality of nursing care in nursing homes, home health, and other community-based care delivery. Federally available data sets are reviewed as potential measures of care quality, and accessing these data sets is explained.

The general state of the science of nursing quality measurement in nonacute care settings has accelerated markedly in the last several years. Nursing-focused research on quality across health care settings rose from 135 studies between 1989–1994 (with 9 each in long-term care and ambulatory care, and 19 in home care)<sup>1</sup> to 314 studies between 1995–2000 (with 55 in long-term care, 21 in ambulatory care, 27 in home health, and 10 in community health).<sup>2</sup> Based on the volume of studies in these two reviews, the issue of nursing care quality is certainly of importance, and the nonacute care settings are of increasing interest.

## MATERIALS AND METHODS

To better understand the use of large data sets for research in nonacute care settings, an expert librarian conducted a search of the past ten years of the health care literature. This search used a targeted strategy to identify recent published studies and current publicly funded studies underway in nonacute care settings that used large data sets in their research design. The search strategy included CINAL, HealthSTAR, Cochrane Database of Systematic Review, Cochrane Controlled Trial Register, Database of Abstracts of Reviews of Effectiveness (DARE), and HSRProj. Table 1 summarizes representative examples of these studies to assist researchers and interested clinicians who are less experienced with large data sets to consider how large data sets could be used in their work. While not meant to be exhaustive, the list reflects the scope of current and recent research about quality of care in nonacute care settings such as nursing homes, community-based care, and home health.

Interviews were conducted with Centers for Medicaid and Medicare Services (CMS) employees who are

**Table 1.** Examples of care quality studies using large data sets in nonacute care settings

Setting	Data set used	Outcomes measured	Citation
Nursing homes	MDS	Resident Assessment Protocols	Hansebo G, Kihlgren M, Ljunggren G. Review of nursing documentation in nursing home wards—changes after intervention for individualized case. <i>Journal of Advanced Nursing</i> 1999;29:1462-73.
	MDS OSCAR	Hospitalization risk	Intrator, O, Castle NG, Mor V. Facility characteristics associated with hospitalization of nursing home residents: Results of a national study. <i>Medical Care</i> 1999;37:228-37.
	MDS	Confusion/delirium items	Mentes J, Culp K, Maas M, Rantz, M. Acute confusion indicators: Risk factors and prevalence using MDS data. <i>Research in Nursing Health</i> 1999;22:95-105.
	MDS Medicare claims	Functional outcomes Therapy use	Moore T, Schmitz R. Abt Associates, Cambridge, MA 02138, USA. Skilled therapy provision under SNF prospective payment: findings from the evaluation of the nursing home casemix and quality (NHCMQ) demonstration (abstract). <i>Abstract Book/Association for Health Services Research</i> . 2000;16:237-8.
	MDS	16 Risk adjusted QIs	Mor V. Benchmarking nursing homes' quality performance (abstract). <i>Abstract Book/Association for Health Services Research</i> 1998;14:111-2.
	MDS Medicare claims	Pain QI	Mor V. Clinical management of cancer pain in US nursing homes. <i>NCI RO1</i> 1998-1999.
	MDS	ADL performance	Morris JN, Fiatarone M, Kiely DK, Belleville-Taylor P, Murphy K, Littlehale S, et al. Nursing rehabilitation and exercise strategies in the nursing home. <i>Journals of Gerontology Series A-Biological Sciences &amp; Medical Sciences</i> 1999;54: M494-500.
	MDS	CHSRA QIs	Rantz M. Nursing processes, outcomes, and costs in nursing homes. <i>NINR R29</i> 1998-2003.
	MDS	CHSRA QIs	Rantz MJ, Mehr DR, Conn V, Hicks LL, Porter R, Madsen RW, et al. Assessing quality of nursing home care: The foundation for improving resident outcomes. <i>Journal of Nursing Care Quality</i> 1996;10:1-9.
	MDS	CHSRA QIs	Rantz MJ, Popejoy L, Petroski GF, Madsen RW, Mehr DR, Zwygart-Stauffacher M, et al. Randomized clinical trial of a quality improvement intervention in nursing homes. <i>Gerontologist</i> 2001;41:525-38.
	MDS	CHSRA QIs	Rantz MJ, Petroski G, Madsen R, Mehr D, Popejoy L, Hicks L, et al. Setting thresholds for quality indicators derived from MDS data for nursing home quality improvement reports: An update. <i>Joint Commission Journal on Quality Improvement</i> 2000;26:101-10.
	MDS	CHSRA QIs	Rantz MJ, Petroski GF, Madsen RW, Scott J, Mehr D, Popejoy L, et al. Setting thresholds for MDS quality indicators for nursing home quality improvement reports. <i>Joint Commission Journal on Quality Improvement</i> 1997;23:602-11.
	MDS OSCAR	CHSRA QIs, citations	Rantz MJ, Popejoy L, Mehr D, Zwygart-Stauffacher M, Hicks L, Grando V, et al. Verifying nursing home care quality using minimum data set quality indicators and other quality measures. <i>Journal of Nursing Care Quality</i> 1997;12:54-62.
	MDS	Assessment items of physical function, conditions	Wipke-Tevis DD, Rantz MJ, Mehr DR, Popejoy L, Petroski GF, Madsen R, et al. Prevalence, Incidence, Management, and Predictors of Venous Ulcers in the Long-Term-Care Population Using the MDS. <i>Advances in Skin &amp; Wound Care</i> 2000;13:218-24.

*Continued*

**Table 1. Continued**

Setting	Data set used	Outcomes measured	Citation
	OSCAR	Structural characteristics	Brannon D, Mor V, Zinn J, Davis J. A structural contingency theory analysis of nursing facility resident care (abstract). Abstract Book/Association for Health Services Research 1998;15:116-7.
	OSCAR Medicaid claims	50 QIs from claims of adverse outcomes, lack of therapy, inappropriate medications; citations	Flanagan SA, Monane M, Chawla AJ, Schroeder D. Use of Medicaid claims data to derive indicators of quality of care in nursing homes (abstract). Abstract Book/ Association for Health Services Research 1998;14:177-8.
	OSCAR Medicaid claims	50 QIs from claims of adverse outcomes and inappropriate treatments	Flanagan S, Rosen A, Schroeder D, Monane M. Use of Medicaid claims data to derive indicators of quality care in nursing homes (abstract). AHSR & FHSR Annual Meeting Abstract Book 1996;12:131.
	OSCAR	Staffing and citations	Harrington C, Zimmerman D, Karon SL, Robinson J, Beutel P. Nursing home staffing and its relationship to deficiencies. Journal of Gerontology: Social Sciences 2000;55B:S278-87.
	OSCAR	Staffing and citations	Harrington C, Woolhandler S, Mullan J, Carrillo H, Himmelstein DU. Does investor ownership of nursing homes compromise the quality of care? American Journal of Public Health 2001;91:1452-5.
	OSCAR	Staffing, citations, outcomes	Harrington C. A nursing home consumer information system. AHCPR RO1 1995-1998.
	OSCAR Medicare claims	Nurse and therapist staffing	Moore T, Schmitz R. Management of skilled therapy and nurse staffing under SNF prospective payment: results of a case study (abstract). Abstract Book/Association for Health Services Research 2000;16:237.
	Medicare claims	Overall cost, ER use, acute care use	Burl JB, Bonner A, Rao M, Khan AM. Geriatric nurse practitioners in long-term care: demonstration of effectiveness in managed care. Journal of the American Geriatrics Society 1998;46:506-10.
	NY Patient Review Instrument	Risk adjusted QIs of functional decline, decubiti, physical restraints	Mukamel DB, Brower CA. The influence of risk adjustment methodologies on interpretation of outcome measures of quality in nursing homes (abstract). Abstract Book/Association for Health Services Research 1998;14:189-90.
Com- munity- based care	Medicaid claims	Birth outcomes, cost	Alexander JW, Mackey MC. Cost effectiveness of a high-risk pregnancy program. Care Management Journals: Journal of Case Management, The Journal of Long Term Home Health Care 1999;1:170-4.
	Medicaid claims	Patterns of care, service use	Bronstein JM, Johnson VA, Fargason CA. Living claims data to measure quality of care for Medicaid clients (abstract). AHSR & FHSR Annual Meeting Abstract Book 1997;13:47.
	Medicaid claims	Cost and service use	Clark RE, Teague GB, Ricketts SK, Bush PW, Xie H, McGuire TG, et al. Cost-effectiveness of assertive community treatment versus standard case management for persons with co-occurring severe mental illness and substance use disorders. Health Services Research 1998;33:1285-308.
	Medicaid claims	Continuity of provider, service use, hemoglobin A1c test	Gill JM, McClellan SA. Impact of continuity of care on diabetes-related quality of care (abstract). Abstract Book/ Association for Health Services Research 1998;15:282.
	Medicaid claims	Costs, service use, hospitalization, outpatient	Guo JJ, Gibson JT, Gropper DM, Oswald SL, Barker KN. Empiric investigation on direct costs-of-illness and healthcare utilization of Medicaid patients with diabetes mellitus. American Journal of Managed Care 1998;4:1433-46.

*Continued*

**Table 1. Continued**

Setting	Data set used	Outcomes measured	Citation
	Medicaid claims	Cost and service and medication use	Hollingsworth EJ. Use of Medicaid for mental health care by clients of community support programs. <i>Community Mental Health Journal</i> 1994;30:541-9.
	Medicaid claims	Cost and service use	Schoenman JA, Evans WN, Schur CL. Primary care case management for Medicaid recipients: evaluation of the Maryland access to care program. <i>Inquiry</i> 1997;34:155-70.
	Medicaid claims	Patterns of care, service use	West JC, Spencer C, Bradford RL. USA. Assessing patterns and quality of care for children with conduct disorders in Maryland's Medicaid managed and non-managed systems of care (abstract). <i>Abstract Book/Association for Health Services Research</i> 1998;15:71.
	Medicaid claims	Cost and hospital acquired pressure ulcers	Allman RM, Damiano AM, Strauss MJ. Pressure ulcer status and post-discharge health care resource utilization among older adults with activity limitations. <i>Advances in Wound Care: the Journal for Prevention &amp; Healing</i> 1996;9:38-44.
	Medicare claims	Cost of ulcer care	Harrington C, Zagari MJ, Corea J, Klitenic J. A cost analysis of diabetic lower-extremity ulcers. <i>Diabetes Care</i> 2000;23:1333-8.
	Medicare claims	Cost and service use	Lipman M, Shaffer T, Weller W, Anderson G. USA. What can claims data tell us about quality of care: a case study of lung cancer (abstract). <i>Abstract Book/Association for Health Services Research</i> 1998;15:334-5.
	Medicare claims	ER use, hospitalizations	Shelton P, Sager MA, Schraeder C. The Community Assessment Risk Screen (CARS): identifying elderly persons at risk for hospitalization or emergency department visit. <i>American Journal of Managed Care</i> 2000;6:925-33.
Home health	OASIS	Health outcomes of HMO patients	Adams CE, Wilson M, Haney M, Short R. Using the outcome-based quality improvement model and OASIS to improve HMO patients' outcomes. <i>Home Healthcare Nurse</i> 1998;16:395-401.
	OASIS	Hospital readmission	Madigan EA, Schott D, Matthews CR. Rehospitalization among home healthcare patients: results of a prospective study. <i>Home Healthcare Nurse</i> 2001;19:298-305.
	OASIS	Risk adjusted QIs, 32 outcome models	Shaughnessy PW, Hittle DR, Powell MC, Schlenker RE, Beaudry JM, Javorek FJ. Assessing the utility of risk-adjusted outcome measures for home health care (abstract). <i>Abstract Book/Association for Health Services Research</i> . 1998;14:204-5.
	MDS-HC	Hospital use, cost	Landi F, Gambassi G, Pola R, Tabaccanti S, Cavinato T, Carbonin P, et al. Impact of integrated home care services on hospital use. <i>Journal of the American Geriatrics Society</i> 1999;47:1430-4.
	MDS-HC MDS	8 QIs	Morris J. Quality outcomes in subacute and home care programs. <i>AHCPR U18</i> 1996-1999.
	Medicare claims, Medicare cost reports	Service use, payment method, quality of care	Brown R, Phillips B, Bishop C, Thornton C, Ritter G, Klein A, et al. The effects of predetermined payment rates for Medicare home healthcare. <i>Health Services Research</i> 1997;32:397-414.

familiar with large data sets available for research that have potential for use in interpreting quality of care in nonacute care settings. The results of those interviews are compiled in Table 2 with descriptions and possible research uses of CMS data sets, description of the Online Survey Certification and Reporting System (OSCAR), Web addresses with consumer and provider

information, and several free downloadable data sets. CMS also provides a general description of data sets available for research at <http://www.cms.hhs.gov/researchers/default.asp>, which describe data sources, data request, and data use requirements.

## RESULTS

### *Examples of Research*

Across all nonacute care settings, Medicare claims and Medicaid cost report data are commonly used in research to evaluate service use, patterns of care, and cost. Table 1 displays a sample of recent publications of studies completed and recent or current federally funded research projects that use large data sets to evaluate outcomes of care quality. In Table 1, it is apparent that the use of large data sets is becoming rather commonplace, particularly in nursing homes. The Long-term Care Minimum Data Set (MDS) data is a source of assessment information about nursing home residents in nursing facilities certified to participate in the Medicare and/or Medicaid programs. Residents are assessed on admission, quarterly, annually, and at times of significant change in condition by nursing facility staff. Data are transmitted to state certification and survey agency data systems, then uploaded to a national data bank. The MDS instrument has established validity and reliability for items and subscales.<sup>3-12</sup> Methods of calculating quality indicators from MDS items are established,<sup>13-17</sup> and quality indicators are being used for research about quality of care,<sup>18-21</sup> for quality improvement activities by nursing facility staff,<sup>16,22,23</sup> and also to focus the survey process of regulators beginning in the late 1990s.

The Online Survey Certification and Reporting System (OSCAR) is the other commonly used large data set in nursing facilities. This includes the deficiencies state surveyors issue to facilities as part of the federal survey process, facility and resident characteristics, and a sample of staffing. Interpreting staffing and quality of care from survey deficiencies using OSCAR data has been the primary focus of the research of Harrington and colleagues.<sup>24-26</sup> This work and data set are the foundation for the recent report to Congress, *Appropriateness of minimum nurse staffing ratios in nursing homes*.<sup>27</sup>

In the home health arena, the Outcomes and Assessment Information System (OASIS) is used by health care agencies as a data source for interpreting quality of care and outcomes of clients they serve.<sup>28-30</sup> The research team that developed OASIS also developed methods of interpreting quality indicators from the data.<sup>31-33</sup> Another MDS-based instrument for home care (MDS-HC) has been developed and field tested as a standardized assessment instrument for use in home care and methods to measure whether quality indicators using approaches similar to the MDS for nursing facilities are feasible.<sup>34</sup> The MDS-HC has not been implemented nationally in the United States, so national data are not available. It has been used internationally to evaluate home care services and resident outcomes.<sup>35</sup>

The Centers for Medicare and Medicaid Services (CMS) has required the use of the Inpatient Rehabilitation Facility-Patient Assessment Instrument (IRF-PAI) for selected inpatient rehabilitation hospital or rehabilitation unit of a hospital since January 2002. The IRF-PAI data are being reported to CMS and should be available to researchers within the next 2 years. At this time, all rehabilitation facilities are required to submit IRF-PAI payment data electronically. Currently, submission of medical need and quality indicator data is voluntary. CMS will also be requiring swing-bed hospitals to submit assessment data electronically in the near future, and swing-bed data should be available to researchers in the next few years.

### *CMS Data Sets*

The Centers for Medicare and Medicaid Services (CMS) offers multiple nonacute data sets that can be accessed by federal Department of Health and Human Services (DHHS) agencies/contractors, non-DHHS federal agencies, state government agencies, congressional entities, academic institutions, and public sector researchers. The various data sets available and possible research uses are detailed in Table 2.

There are five categories of CMS nonacute data sets:

1. **Research Identifiable Data** contain actual beneficiary-specific and physician-specific information. Research Identifiable Files require a formal request, including a rigorous review process. CMS data release policies seek to ensure that files containing physician and/or beneficiary identifiers are used only when necessary and in accordance with disclosure provisions of the Privacy Act. Data with beneficiary or physician identifiers are subject to the Privacy Act, Freedom of Information Act, and other federal government rules and regulations. As such, the information is confidential and may be used only for reasons compatible with the purpose(s) for which the data are collected. CMS employs strict security measures to safeguard individual privacy. Researchers need to submit a written request, study plan, or protocols including the purpose, objectives, importance, research questions, evidence of funding, and Data Use Agreements (DUA) to CMS for review. CMS will then approve or reject the data file release. The study must have merit to the Medicare beneficiary population, be reviewed and approved or denied by the Centers for Medicare and Medicaid Services, and meet access and notification procedures required by the System of Records (SOR). The researcher must sign a Data Use Agreement to ensure the security and confidentiality of the data set with beneficiary or physician identifiable information. Several types of Research Identifiable Files are available to researchers:

- A. *Medicare standard analytic files (SAFs)* may be requested for nonacute settings such as skilled

**Table 2. Centers for Medicare & Medicaid Services (CMS) nonacute Medicare and Medicaid large data sets**

File group or File name	Unit of analysis	Description or sample	Years	Frequency of file creation	Selected variables	Possible research use
Section 1 Research identifiable data sets requires written request, study plan, evidence of funding and data use agreement <sup>1</sup>						
100% Standard Analytic File (SAF) <sup>2</sup> Skilled Nursing Facility (SNF)	Final action claim <sup>3</sup> ; all adjustments resolved	SNF claims for Medicare beneficiaries	1991-present	Calendar year files	All SNF claims including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc.	-Identify and study a cohort of patients -Study racial or age related group -Study cost or coding -Study specific diagnoses or procedure codes
Home Health Agency (HHA) 100% Standard Analytic File (SAF)		All HHA claims for 100% of Medicare & Medicaid beneficiaries			All HHA claims including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc.	
Hospice 100% Standard Analytic File (SAF) <u>Other Available SAFs</u> -Physician Supplier Part B -Outpatient -Durable Medical Equipment -Inpatient		All Hospice claims for 100% of Medicare beneficiaries			All Hospice claims including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc.	
Web Information: <a href="http://www.cms.hhs.gov/data/purchase/default.asp">http://www.cms.hhs.gov/data/purchase/default.asp</a>						
5% Sample Beneficiary Standard Analytic File (SAF) <sup>3</sup>	Final action claim; all adjustments resolved	All claims for 5% of Medicare beneficiaries	1991-present	Calendar year files	5% random sample of representative SNF claims for calendar year including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc.	-Same as SAF datasets
Web Information: <a href="http://www.cms.hhs.gov/data/purchase/default.asp">http://www.cms.hhs.gov/data/purchase/default.asp</a>						
Medicare Provider Provider Analysis and Review (MEDPAR) File	SNF Stay	SNF stay files roll up individual beneficiary claims for the same stay or admission. Stay files represent a sample of 100% of beneficiaries from 1991 to present.	1991-present	Calendar or fiscal year (FY) files available	20% random sample of beneficiary SNF stays base on date of SNF admission for FY or calendar year including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc. Less expensive than SAFs.	-Study a SNF episode of care for patients -Study inpatient stays based on hospital discharge date and SNF stays based on admission date. -Study cost or coding -Study specific diagnoses
Web Information: <a href="http://www.cms.hhs.gov/data/purchase/default.asp">http://www.cms.hhs.gov/data/purchase/default.asp</a>						
Medicare Provider Analysis and Review (MEDPAR) File	Beneficiary	Statistically representative sample <sup>4</sup> of Medicare beneficiaries—approximately 13,000 aged and 2,500	1991-present	Annually	Interview survey of a nationally representative sample of aged, disabled and institutionalized Medicare	-Study expenditures and sources of payment for all services used by Medicare beneficiaries -Study health status

*Continued*

**Table 2. Continued**

File group or File name	Unit of analysis	Description or sample	Years	Frequency of file creation	Selected variables	Possible research use
Web Information: <a href="http://www.cms.hhs.gov/mcbs/fileaval.asp">http://www.cms.hhs.gov/mcbs/fileaval.asp</a>		Medicare beneficiaries with disabilities. About 1,100 are long-term care facilities, which may be SNF, nursing home, assisted living, developmentally disabled, mental health, etc. facilities.			beneficiaries. Survey items cover medical care expenditures, health insurance coverage, sources of payment, health status and functioning and a variety of demographic and behavioral information.	and family supports for institutionalized long-term care population. -Study health care utilization.
State Medicaid Research Files—(SMRFs) Claim Inpatient (Claim-IP) Claim Long-term (Claim-LT) Claim Other (Claim-OT) Claim Drug (Claim-Rx) Person Summary Record File	Claim Recipient	All claims for 100% of Medicaid recipients in MSIS participating States  Summary of Medicaid eligibility and claims for MSIS participating States by calendar year. DB2 Structure will replace summary and SMRF in 1999.	1992-1995 (Data for 32 States)  1996-1998 (Only certain States are available. Contact ResDAC to identify States.)	Annually  Annually	State Medicaid Research Files (SMRFs) contain beneficiary-level enrollment, utilization, and expenditure data on a calendar year (CY) basis. The Medicaid Provider Data File contains descriptive information about Medicaid providers	-Study utilization such as drug information in particular State for the Medicaid population -Study Medicaid enrollment including special populations such as children, pregnant woman, disabled. -Study Medicaid covered preventive services. -Study a cohort of patients across inpatient, outpatient, home health, custodial care services and supports
Web Information: <a href="http://www.cms.hhs.gov/data/purchase/medicaid.pdf">http://www.cms.hhs.gov/data/purchase/medicaid.pdf</a> Technical Information: <a href="http://www.resdac.umn.edu">www.resdac.umn.edu</a>						
Long-Term Care Resident Assessment Instrument Minimum Data Set (MDS) <sup>5</sup> Web Information: <a href="http://cms.hhs.gov/data/requests/glossary.asp#LTCMDS">http://cms.hhs.gov/data/requests/glossary.asp#LTCMDS</a> Technical Information: <a href="http://www.cms.hhs.gov/medicaid/mds20/">http://www.cms.hhs.gov/medicaid/mds20/</a>	Assessment Record at Defined Intervals	All SNF and Nursing Home Residents for Medicare and Medicaid Certified Facilities	July 1998 to present	Monthly	528 assessment items including Cognition, Mood & Behavior, Physical functioning, diagnoses, health conditions, treatments & procedures, etc.	-Target age or race cohorts. -Processes of Care -Care Planning -ADL improvement -Depression -Pressure ulcer care -Special care residents
Outcome and Assessment Information Set (OASIS) <sup>2</sup> Web Information: <a href="http://cms.hhs.gov/cata/requests/glossary.asp#LTCMDS">http://cms.hhs.gov/cata/requests/glossary.asp#LTCMDS</a> Technical Information: <a href="http://www.cms.hhs.gov/oasis/">http://www.cms.hhs.gov/oasis/</a>	Assessment Record at Defined Intervals Over the Episode of Care	Home Health patients receiving Medicare and Medicaid	August 1999-present	Monthly	41 patient assessment outcome measures include functional outcomes such as ambulation, physiologic outcomes such as improvement in urinary incontinence, emotional/behavioral/cognitive outcomes such as stabilization in cognitive functioning and selected utilization outcomes such as acute care hospitalization measures.	-Target age or race cohorts. -Episode of home health care -Rehospitalization -ADL improvement -Pain Management

*Continued*

**Table 2. Continued**

File group or File name	Unit of analysis	Description or sample	Years	Frequency of file creation	Selected variables	Possible research use
Section 2 Beneficiary encrypted files (BEFs) requires abbreviated data use agreement & payment <sup>6</sup>						
Beneficiary Encrypted Files (BEFs) Standard Analytic Files <sup>3</sup> Phys/Supplier Part B (5% Sample only file available) Outpatient Inpatient Home Health Agency Hospice SNF Web Information: <a href="http://www.cms.hhs.gov/data/purchase/default.asp">http://www.cms.hhs.gov/data/purchase/default.asp</a>	Final action claim; all adjustments resolved	All claims for 5% sample of Medicare beneficiaries or 100% resident file for individual States or 100% national file. <sup>7</sup>	1991-present	Calendar year files	All claims in each provider group listed for calendar year including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc. without physician identifiers and beneficiary health insurance claim (HIC).	-Study total number of procedures or total costs of procedures. -Study changes in reimbursement rates based on legislative mandates (e.g., 1997 Balanced Budget Act)
Expanded Modified MEDPAR-Skilled Nursing Facility <sup>3</sup> Web Information: <a href="http://www.cms.hhs.gov/data/purchase/default.asp">http://www.cms.hhs.gov/data/purchase/default.asp</a>	Final action claim; all adjustments resolved	SNF claims for 100% sample of Medicare beneficiaries who use SNF services.	FY 1993-FY 2000	Fiscal year files	100% claims for a sample of beneficiaries who use SNFs based on date of SNF admission for FY or calendar year including demographic, cost, therapy, admission date, primary diagnosis, procedure codes, etc. without identifiers	-Study cost or coding -Study specific diagnoses
Section 3 Public use files for purchase directory <sup>8</sup> & CMS consumer and provider information without date use agreement						
Public Use Files SNF Minimum Data Set Web Information: <a href="http://www.cms.hhs.gov/data/purchase/directory.asp#ppsm">http://www.cms.hhs.gov/data/purchase/directory.asp#ppsm</a> Retired Files <a href="http://www.cms.hhs.gov/data/purchase/retired.asp">http://www.cms.hhs.gov/data/purchase/retired.asp</a>	PPS Minimum Date Sets (PPS9-PPS12) are updated at the close of each calendar quarter. Some files are in the retired files are also available	Medicare SNF Cost Report and the Hospital-Based SNF Cost Report	OCT. 88-89 <sup>9</sup> Oct. 89-90 Oct. 90-91 Oct. 91-92 Oct. 93-94 Oct. 94-95 Oct. 95-96 Oct. 96-97 Oct. 97-98 Oct. 98-99	Fiscal year files	Contains cost, statistical, financial and other data from the Medicare SNF Cost Report and the Hospital-Based SNF Cost Report	-Study SNF cost and statistical submitted by SNFs
Home Health Agency Practical Data Set	HHA Practical Data Set Contains retired files that were updated at the close of each calendar quarter	Medicare financial data for Medicare-certified, freestanding, hospital-based, and skilled nursing facility (SNF)-based home health agencies (HHAs).	Jan.-Oct. 94 Oct. 94-95 Oct. 95-96 Oct. 96-97 Oct. 97-98 Oct. 98-99 Oct. 99-00	Fiscal year files	Contains statistical and utilization data, total cost and Medicare cost by cost center, settlement date and financial data for Medicare-certified freestanding, hospital-based, and skilled nursing facility (SNF)-based home health agencies (HHAs).	-Study HHA cost and statistical submitted by HHAs

*Continued*

**Table 2. Continued**

File group or File name	Unit of analysis	Description or sample	Years	Frequency of file creation	Selected variables	Possible research use
Section 4 Nursing facility and survey and certification data requiring payment & without data use agreement						
Online Survey Certification and Reporting System (OSCAR) <sup>10</sup>	State Survey Agency Inspections and Certification Data	OSCAR includes basic demographic and deficiency compliance information for approximately 210,000 providers and suppliers including hospitals, skilled nursing facilities, nursing homes (Medicaid only), intermediate care facilities for mentally retarded, home health agency, hospice, laboratories, etc.	Updated continuously System retains last four inspection histories of deficiency information and resident census data	Annually	OSCAR is available through a series of standard reports including facility profiles summarizing individual provider demographic & compliance data, name and address listings, aggregate deficiency statistics and termination listings. Additionally, CMS can provide customized ad hoc reports and flat file extracts.	-Describe demographic information on nursing homes or home health agencies -Study nursing home staffing -Review nursing home deficiency information around quality of care and quality of life.
Section 5 No cost downloadable public use files & Web consumer and provider information						
Public Use Files		SNFPPS98.ZIP contains cost, statistical, and other data used in establishing the Skilled Nursing Facility (SNF), prospective payment rates, that were published in the Federal Register on May 14, 1998, for cost reporting periods beginning on or after July 1, 1998.	July 1, 1998	Federal Register Report Published May 14, 1998	The cost and statistical data were obtained from the hospital-based SNFs and Freestanding SNFs (Forms 2552, 2540, & 2540S). This file also contains the standardization factors and case-mix correction factors.	-Review statistical cost and utilization data used to calculate SNF and HHA prospective payment system -Understand how various CMS reports, cost and wage indexes and utilization data used to project prospective payment rates.
SNF Prospective Payment Rates Web Information: <a href="http://www.cms.hhs.gov/providers/pufdownload/default.asp">http://www.cms.hhs.gov/providers/pufdownload/default.asp</a>		HHAPPS00.ZIP contains home health files (HHPPS) for which the final Rule was published in the Federal Register on June 29, 2000. The audited cost report file contains audited cost reports for sample agencies with cost reporting periods ending in fiscal year 1997.	October 1, 2000	Federal Register Report Published June 29, 2000	The audited cost report file contains audited cost reports for sample agencies with cost reporting periods ending in fiscal year 1997. The provider level utilization file, derived from National Claims History (NCH) data and combined with wage index value data, contains visit totals for the 6 disciplines (skilled nursing, physical therapy, occupational therapy, speech language therapy, medical social, and home health aide) as well as the total number of episodes (for both episodes with less than or equal to 4 visits and for episodes with greater than 4 visits) aggregated to the provider level.	
Home Health Prospective Payment System Web Information: <a href="http://www.cms.hhs.gov/providers/pufdownload/default.asp">http://www.cms.hhs.gov/providers/pufdownload/default.asp</a>						

*Continued*

Table 2. Continued

File group or File name	Unit of analysis	Description or sample	Years	Frequency of file creation	Selected variables	Possible research use
www.medicare.gov/nhcompare/home.asp	Multiple OSCAR and CMS Data Sources	Provides consumer the following on every nursing home. 1. Directory of Nursing Homes (Address, Ownership & # beds) 2. Resident Characteristics by facility (pressure sore, Uti, etc.) 3. Nursing Home Survey Inspection Results 4. Nursing Home Staff levels	Current	N/A	The primary purpose of this tool is to provide detailed information about the performance of every Medicare and Medicaid certified nursing home in the country. <i>Important Information on Nursing Home Compare</i> and other resources, including the Guide to Choosing a Nursing Home, and Nursing Home Checklist are also available to help consumers with their nursing home choice.	-Offers a quick and easy way to review information and obtain address, telephone etc. on every nursing home in the country -Allows researchers to review survey inspection results and staffing information at a facility level.
www.cms.hhs.gov/Medicaid/mds20	Information from multiple sources of information	Selected information for providers or researchers: 1. Nursing Home Provide Public Use Reports 2. MDS 2.0 information 3. Manuals & Guides 4. 3 Reports to Congress on Staffing, Residents and Facility Deficiencies Staffing 5. Federal and State Surveyor Directory	Current	N/A	Designed to offer professionals, nursing homes, providers, State Survey Agencies and professional organizations with information on training, reports and available information pertaining to nursing homes and the survey process.	-Staffing Reports provide tables and reports on nursing home staffing. -Review MDS information and guidance to providers -Congressional Reports provide detailed descriptions and statistical information on nursing home questions.
www.cms.hhs.gov/quality/mds30	Information on the development of MDS 3.0 from multiple sources of information	Selected information for providers or researchers: 1. Draft MDS 3.0 2. 6/2/03 Town Hall Meeting Information 3. MDS 3.0 Validation Timeline 4. Future Validation Materials	Current	N/A	Designed to offer professionals, nursing homes, providers, State Survey Agencies and professional organizations with information on MDS 3.0 development and validation testing.	-Understand new MDS 3.0 items and validation testing. -Monitor MDS 3.0 validation testing from Aug. 2003 - Dec. 2004.
http://www.cms.hhs.gov/quality/nhqj/	Information CMS's Nursing Home Quality Initiative from multiple sources of information	Selected information for providers or researchers: 1. Revisions to Covariates on publicly reported quality measures 2. Technical info and users manual for national measures. 4. Final Report on Validation of	Current	N/A	Designed to offer professionals, nursing homes, providers, State Survey Agencies and professional organizations with information on CMS's Nursing Home Quality Initiative Implementing National Publicly Reported	-Understand CMS Nursing Home Publicly Reported Measures on Nursing Home Compare -Review validation and pilot activities leading up to national implementation of CMS Nursing Home Quality Initiative

Continued

**Table 2. Continued**

File group or File name	Unit of analysis	Description or sample	Years	Frequency of file creation	Selected variables	Possible research use
www.cms.hhs.gov/states/mdsreports/	MDS Quality Indicator and Frequency Reports	Post-Acute and Long-Term Care Quality Indicators MDS assessments are available to generate frequency reports and quality indicator information at a State and national level.	Current	N/A	National Measures in November 2002. MDS assessment data are used to generate the reports available through this website: <i>Frequency Reports</i> —which give a picture of the characteristics of the nursing home population in each state and nationally through presentation of data on frequency of responses to specific MDS items. <i>Quality Indicator Reports</i> —which present data on 24 “indicators” of quality of care (32 with subcategories). These data are also presented at a state and national level.	<ul style="list-style-type: none"> <li>-Review definition of the MDS Quality Indicator Reports.</li> <li>-Review Quality Indicator Frequency Reports at a National and State level.</li> <li>-Review Resource Utilization Group (RUGs) Frequency Reports at a National and State level.</li> </ul>

<sup>1</sup> Researchers may order data directly from CMS or use ResDAC with the exception of MDS and OASIS, which must be ordered through ResDAC. Additional information about these files can be found at <http://www.cms.hhs.gov/researchers/default.asp> or by contacting the Research Data Assistance Center (ResDAC), which is a CMS contractor that provides free assistance to researchers interested in using Medicare and/or Medicaid data. ResDAC provides expertise and skill in epidemiology, health services research, biostatistics, public health, health informatics and economics. ResDAC can be contacted at 1-888-973-7322 or by e-mail at [ResDAC@tc.umn.edu](mailto:ResDAC@tc.umn.edu).

<sup>2</sup> Not all variables collected from this instrument are found in the data set.

<sup>3</sup> At 18 months, the file is considered by CMS to be 98% complete.

<sup>4</sup> Claims are not part of the medical record so payment items are the more accurate & reliable items because CMS contractors review them.

<sup>5</sup> The limitation of this representative sample of interview is that it is self-report information from a smaller sample with less statistical power.

<sup>6</sup> CMS files containing person-specific data elements are available for purchase as BEFs. In these files all identifiers have been encrypted, ranged, or blanked to protect the privacy of our beneficiaries. The BEFs require the submission of a signed Data Use Agreement (DUA), ResDAC must be used by academic, non-profit, and governmental researchers who are interested in using Medicare and Medicaid data for their research. Please view more about ResDAC at <http://www.resdac.umn.edu/assist.htm> or phone them at 888-9ResDAC.

<sup>7</sup> 5% files include beneficiary encrypted tables while 100% files include blanked fields.

<sup>8</sup> The public use files are the primary source of data for Federal agencies outside of CMS, government contractors, academic researchers, and commercial enterprises that are not permitted access to individual identifiable information. Most of the 'PUFs are "flat files that are fixed length records (all records on each file are the same length: e.g. 211 bytes) and lend themselves to processing in a spreadsheet or database software package. PUFs purchase directory can be found at <http://www.cms.hhs.gov/data/purchase/default.asp>.

<sup>9</sup> Check the public use files at <http://www.cms.hhs.gov/data/purchase/directory.asp#ppsmmin> as CMS may add or delete time periods which may change the time periods available to researchers.

<sup>10</sup> Requests for OSCAR data can be made by calling Diane Spencer at 410-786-3112 or e-mailing her at [dspencer@cms.hhs.gov](mailto:dspencer@cms.hhs.gov).

nursing facility, home health agency, and hospice. These include claims-related data such as demographic information, cost, therapy, admission date, primary diagnosis, procedure codes, etc.

- B. *State Medicaid Research Files* (SMRFs) may be requested for long-term care settings. Claims records contain beneficiary-level enrollment, utilization, and expenditure data on a calendar year basis.
  - C. *Long-term care Minimum Data Set* (MDS), which contains person-specific identifiable data, is the core set of screening and assessment elements of the Resident Assessment Instrument (RAI). This assessment system provides a comprehensive, accurate, standardized, reproducible assessment of each long-term care facility resident's functional capabilities and helps staff to identify health problems. Every resident in a Medicare- and/or Medicaid-certified long-term care facility, including private pay, receives an MDS assessment.
  - D. *Outcome and Assessment Information Set* (OASIS), which contains person-specific identifiable data, is a group of data elements that represent core items of a comprehensive assessment for an adult home care patient. These form the basis for measuring patient outcomes for purposes of outcome-based quality improvement. This assessment is performed on every patient who receives services from home health agencies that are approved to participate in the Medicare and/or Medicaid programs. OASIS data are required only for Medicare and/or Medicaid patients. There is no information in the OASIS data regarding private pay patients.
2. **Beneficiary Encrypted Data** contain encrypted beneficiary-specific information or a combination of data elements that could lead to the deduction of a beneficiary's identity. A DUA is required for Beneficiary Encrypted Data Files. A Beneficiary Encrypted Files (BEF) Order Form and an Agreement for Release of Centers for Medicare and Medicaid Services (CMS) Beneficiary Encrypted Files and payment are required. BEFs, Standard Analytic Files for nonacute Home Health Agency, Hospice, and SNF include demographic information, cost, therapy, primary diagnosis, procedure codes, etc, with encrypted physician identifiers and beneficiary health insurance claim numbers. BEF 100% files have blanked fields when describing physician or beneficiary identifiers while 5% of files contain encrypted beneficiary-specific information. CMS must also review research/data before publication/release. Any result that may lead to identification of an individual beneficiary (eg, cell sizes with fewer than 11 cases) will be suppressed. BEFs can be found in the Files

for Purchase Directory, formerly the Public Use Files (PUFs) Catalog, at <http://cms.hhs.gov/data/purchase/default.asp>.

3. **Public Use Files** are also contained in the Purchase Directory, which provides a listing of current and historical Medicare and Medicaid beneficiary and non-beneficiary data files that are available to the public. These files contain information on Medicare enrollment, payments, utilization, providers, Medicaid eligibles, recipients, medical vendor payments, and services. The Files for Purchase Directory also contains instructions for ordering Medicare and Medicaid data files from CMS and helpful order forms designed to assist requestors. Data files are grouped under the headings of Beneficiary Encrypted Data Files (BEFs), Standard Analytic Files (SAFs), and Non-Beneficiary Files. Non-Beneficiary Files contain facility information and are within the public domain. No Data Use Agreement is required and payment must be submitted. Public use files from nonacute providers can include their cost reports, statistical data, and claims related information without identifiers.
4. **The Online Survey Certification and Reporting System** (OSCAR) includes demographic and deficiency compliance information for approximately 210,000 providers and suppliers and has no DUA requirement.
5. **The Centers for Medicare and Medicaid Services** (CMS) provides free and accessible nonacute care information on the worldwide web and through Downloadable Public Use Files. Web addresses and downloadable files are available in Table 2.

### *Requesting Data Sets*

Researchers should be aware of some important CMS requirements and limitations when requesting CMS data:

- To request research identifiable files requires a formal request, a DUA, and a rigorous review process.
- Release of Beneficiary Encrypted Files (BEFs) is also subject to a DUA even though physician and/or beneficiary identifiers are blanked out or encrypted. File information is encrypted with zip codes blank. The lowest level of cross-sectional analysis would be the county level, and the file is not cross-referenced.
- Public Use Files do not have patient- or physician-level data.
- Research Identifiable Files, BEFs, and public use files require payment; costs will vary depending on the file size and type of data requested.
- CMS does not allow commercial or for-profit entities to access CMS data or for the testing of proprietary products.
- Some databases, including many standard analytic files, are available on computer disk starting with 2001, released in August 2002. Larger data sets are

on 3480/3490 tape cartridges and must be read by a cartridge tape reader. The data are available only in an EBCDIC format to researchers.

Researchers may order data directly from CMS or use the Research Data Assistance Center (ResDAC), with the exception of MDS and OASIS, which must be ordered through the ResDAC. Additional information about these files can be found at <http://www.hcfa.gov/stats/PublicUseFiles/datarequests/data.htm> or by contacting ResDAC, which is a CMS contractor that provides free assistance to researchers in the non-profit sector, university settings, and some government sites interested in using Medicare and/or Medicaid data. CMS has contracted with ResDAC for researchers pursuing studies to provide the expertise of faculty and others who are knowledgeable and experienced in both CMS's data and program history. ResDAC provides expert advice on the appropriate use of CMS data files, and can offer guidance for acquiring data from CMS. ResDAC may be contacted by telephone (1-888-973-7322) or e-mail (ResDAC@tc.umn.edu)

### *Advantages and Disadvantages of Using Available Data Sets*

While there are obvious advantages of using existing data sets, such as avoiding the expensive, time-consuming, national-in-scope tasks of primary data collection, there are disadvantages and challenges for researchers. When using these data sets, researchers are limited to the items and intervals at which they are collected. Research questions must be carefully crafted to be measurable using the data available and limitations must be acknowledged when interpreting and explaining results.

Using data sets requires proficient computing and statistical skills combined with meticulous programming to answer the research questions. A working knowledge of the data structure and layout is required. The research can be accomplished with the assistance of an interpretive code book for each data set, time to learn the layout, and time for programming to answer questions. ResDAC offers seminars and workshops to assist research staff with understanding the data sets. Challenges include the learning time that is necessary to use the various data sets, the expense of purchasing selected data sets, the time required to complete the DUA process when necessary, and locating a skilled computing expert to assist with the data if the researcher does not have the needed computing skills.

## **DISCUSSION**

Many possibilities exist for measuring quality of nursing care received by persons in long-term care. This is evident in this review of research recently completed or currently underway, and the databases available and used in nonacute care settings. There are data at the facility or agency level and at the individual level that

can be very useful, depending on the research questions of interest. There are standardized quality of care outcome and process analytic approaches that are being used by regulators and researchers using resident/client-level assessment data,<sup>14,17,32</sup> as well as other researcher constructed interpretations of quality of care outcome measures from resident assessment data.<sup>18,19,21</sup>

One issue to consider carefully is that long-term care by its very nature is an interdisciplinary effort and not the purview of just nursing, medicine, rehabilitation therapy, social services, dietetics, or pharmacy. Long-term care settings are mosaics of care delivery. However, most of the care that individuals receive in long-term care is nursing care that is designed to manage chronic illnesses, assist with activities of daily living, and facilitate engagement in everyday life activities. Therefore, a researcher must be familiar with the delivery of care in the settings being studied so that interpretation of outcomes attributable to nursing care and other interdisciplinary efforts are accurate. Nurse researchers are ideally prepared to design and conduct long-term care research that measures resident/client outcomes attributable to nursing care.

Another key issue is related to the timeliness of data. With recent technological advances in our world it is feasible that data collected for one purpose (such as payment or description of care needs) can be used for other purposes (such as facility level quality improvement projects or information for consumers making long-term care choices). However, if facilities or consumers are to find the information useful, it must be timely. For quality indicator reports such as those available to long-term care facilities or home health agencies based on MDS or OASIS data to be helpful to facilities, they must be accurate and timely. Facility or agency staff must be able to detect changes in their quality indicators so they can take action before their clients' health and well-being are jeopardized. For quality of care information to be useful to consumers, it must reflect current conditions in the facility, not those for prior years.

The primary recommendation from this review of existing data sets and current research projects and literature using them is that timeliness of data access must be improved. If researchers are to use these data in intervention studies, they must have access to data to develop their interventions, provide timely evaluative information to facility staff, and have access to data for outcome evaluation. For intervention research using large data sets to be successful, several things must occur. State agencies must support the effort—that is, encourage facilities or agencies to participate. Data access must be readily facilitated so that it is available to be used by the researcher for the intervention. Researchers and their staff must be skilled in large data set management, manipulation, and analysis. The data must be transformed into readily understandable dis-

plays so that both professional and non-professional staff can grasp how quality of care is being measured, and how they compare to themselves and others over time. If timely data access is difficult to achieve, these large data sets can only be used for retrospective descriptive studies, and intervention studies will be rare or non-existent. If we are truly to improve quality of care, intervention studies using large data sets are essential and must become commonplace in long-term care.

At the state level, it would appear that academic-state-provider partnerships could facilitate the use of large data sets to improve quality of care. Researchers can partner with state agencies to help them interpret trends in the data that would indicate shifts (both good and poor) in quality of nursing care. With so much resident/client-level outcome and process of care data available, it seems that we are at a point to be able to predict future outcomes. This will create opportunities to target oversight of care so that facilities and agencies providing care that places clients at risk can be corrected before problems occur. Conversely, creating methods of positive reinforcement and incentives for good care practices and client outcomes is also feasible. From the clinical perspective, academic institutions with expertise in nursing care can provide the clinical guidance that many facilities need. Facility staff are often eager to learn best practice information and faculty with this expertise can be a valuable resource.

In summary, large data sets in nonacute care hold much potential for measuring quality of care in long-term care settings such as nursing facilities, ambulatory care, and home care. Public policy makers must facilitate timely data access so that research can move beyond descriptive studies to interventions that can be tested and proven to improve quality of care and outcomes of those we serve.

The authors thank the following people who helped assemble and review the information prepared for this article: Mary Pratt, CMS, Center for Beneficiary Choices; Robyn Thomas, CMS, Office of Information Systems; Susan Joslin, CMS, Centers for Medicaid and State Operations; Barb Frank, ResDAC; Mary Zwygart-Stauffacher, University of Wisconsin-Eau Claire; and Steven Miller, QIPMO Coordinator, University of Missouri-Columbia.

## REFERENCES

- Rantz MJ. Nursing quality measurement: A review of nursing studies. Washington, DC: American Nurses' Association; 1995.
- Rantz MJ, Bostick J, Riggs J. Nursing quality measurement: A review of nursing studies. Washington DC: American Nurses' Association; 2002.
- Burrows AB, Morris JN, Simon SE, et al. Development of a Minimum Data Set-based depression rating scale for use in nursing homes. *Age Aging* 2000;29:165-72.
- Hartmaier SL, Sloane PD, Guess HA, et al. The MDS Cognition Scale: A valid instrument for identifying and staging nursing home residents with dementia using the Minimum Data Set. *J Am Geriatr Soc* 1994;42:1173-79.
- Hartmaier SL, Sloane PD, Guess HA, et al. Validation of the Minimum Data Set Cognitive Performance Scale: Agreement with the Mini-Mental State Examination. *J Gerontol A Bio Sci Med Sci* 1995;50a:M128-M133.
- Hawes C, Morris JN, Phillips CD, et al. Reliability estimates for the minimum data set for nursing home assessment and care screening (MDS). *Gerontologist* 1995;35:172-78.
- Hawes C, Morris JN, Phillips CD, et al. Development of the nursing home resident assessment instrument in the USA. *Age Aging* 1997;26:19-25.
- Morris JN, Hawes C, Fries B, et al. Designing the national resident assessment instrument for nursing homes. *Gerontologist* 1990;30:293-307.
- Morris JN, Fries BE, Mehr DR, et al. MDS cognitive performance scale. *J Gerontol A Bio Sci Med Sci* 1994;49: M174-82.
- Morris JH, Nonemaker S, Murphy K, et al. A commitment to change: Revision of HCFA's RAI. *J Am Geriatr Soc* 1997;45:1011-16.
- Morris JN, Fries BE, Morris SA. Scaling ADLs within the MDS. *J Gerontol A Bio Sci Med Sci* 1999;54a:M546-53.
- Snowden M, McCormick W, Russo J, et al. Validity and responsiveness of the Minimum Data Set. *J Am Geriatr Soc* 1999;47:1000-04.
- Abt Associates, Inc. Identification and evaluation of existing quality indicators that are appropriate for use in long-term care settings. Cambridge, MA: Abt Associates; 2001.
- Arling G, Karon SL, Sainfort F, et al. Risk adjustment of nursing home quality indicators. *Gerontologist* 1997;37:757-66.
- Karon S, Sainfort F, Zimmerman DR. Stability of nursing home quality indicators over time. *Med Care* 1999;37:570-79.
- Karon SL, Zimmerman DR. Using indicators to structure quality improvement initiatives in long-term care. *Qual Manag Health Care* 1996;4:54-66.
- Zimmerman DR, Karon SL, Arling G, et al. Development and testing of nursing home quality indicators. *HCFR* 1995;16:107-27.
- Mukamel DB. Risk-adjusted outcome measures and quality of care in nursing homes. *Med Care* 1997;35:367-85.
- Mukamel DB, Spector WD. Nursing home costs and risk-adjusted outcome measures of quality. *Med Care* 2000;38: 78-89.
- Rantz MJ, Mehr D, Conn V, et al. Assessing the quality of nursing home care: The foundation for improving resident outcomes. *J Nurs Care Qual* 1996;10:1-9.
- Spector WD, Mukamel DB. Using outcomes to make inferences about nursing home quality. *Eval Health Prof* 1998; 21:291-315.
- Karon SL, Zimmerman DR. Nursing home quality indicators and quality improvement initiatives. *Top Health Inf Mgt* 1998;18:46-58.
- Rantz MJ, Popejoy L, Petroski GF, et al. Randomized clinical trial of a quality improvement intervention in nursing homes. *Gerontologist* 2001;41:525-38.
- Harrington C, Carrillo H. The regulation and enforcement of federal nursing home standards, 1991-1997. *Med Care Res Rev* 1999;56:471-94.
- Harrington C, Zimmerman D, Karon SL, et al. Nursing home staffing and its relationship to deficiencies. *J Gerontol B Psychol Sci Soc Sci* 2000;55B:S278-S287.

26. Harrington C, Woolhandler S, Mulian R, et al. Does investor ownership of nursing homes compromise the quality of care? *AJPH* 2001;91:1452-55.
27. Healthcare Financing Administration. Report to congress: Appropriateness of minimum nurse staffing ratios in nursing homes. Washington, DC: HCFA; 2000.
28. Adams CE, Wilson M, Haney M, et al. Using the outcome-based quality improvement model and OASIS to improve HMO patients' outcomes. *Home Healthc Nurse* 1998;16:395-401.
29. Madigan EA, Fortinsky RH. Additional psychometric evaluation of the outcomes and assessment information set (OASIS). *Home Health Care Serv Q* 2000;18:49-62.
30. Madigan EA, Schott D, Matthews CR. Rehospitalization among home healthcare patients: Results of a prospective study. *Home Healthc Nurse* 2001;19:298-305.
31. Richard AA, Crisler KS, Stearns PM. Using OASIS for outcome-based quality improvement. . . Outcome and assessment information set. *Home Healthc Nurse* 2000;18:232-37.
32. Shaughnessy PW, Crisler KS, Schlenker RE. Outcome-based quality improvement in home health care: The OASIS indicators. *Qual Manag Health Care* 1998;7:58-67.
33. Shaughnessy PW, Crisler KS, Bennett RE. We've collected the OASIS data, now what? Illustrative outcome and case mix reports . . . Outcome and assessment information set. *Home Healthc Nurse* 2000;18:258-66.
34. Morris JN, Fries BE, Steel K, et al. Comprehensive clinical assessment in community setting: Applicability of the MDS-HC. *J Am Geriatr Soc* 1997;45:1017-24.
35. Landi F, Gambassi G, Pola R, et al. Impact of integrated home care services on hospital use. *J Am Geriatr Soc* 1999;47:1430-34.