



Staff Time and Resource Intensity Verification Project

01/05/09

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Contract: Skilled Nursing Facility Time Study

Contract Number: Contract Number: 500-02-0030\0002

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1. Introduction

Overview

The Centers for Medicare and Medicaid Services (CMS) funded a national nursing home staff time measurement study to update the Resource Utilization Groups (RUG-III) case mix weights, which support the Skilled Nursing Facility Prospective Payment System (SNF PPS). This study, the Staff Time and Resource Intensity Verification, (STRIVE) collected staff resource time, resident assessment data, and resident drug data to be analyzed by the STRIVE team. These data are to be used to update the current case mix weights to better reflect current care practices and procedures.

This study consists of two logical phases: Phase 1 Data Collection and Phase 2 Data Analysis. This report is a summary of the Phase 1 Data Collection Methodologies and Results. Phase 2 Data Analysis information will be documented in a later report.

Project Team

The STRIVE Project team has extensive experience with design, training, and analysis of staff time measurement studies including SNF time studies and RUG-III development and analysis. Members of the team, lead by the Iowa Foundation for Medical Care, are identified in Table 1-1.

Table 1-1. STRIVE Project Team

Team Member	Organization	Role
Jean Eby	Iowa Foundation for Medical Care	Project Director
Dane Pelfrey	Iowa Foundation for Medical Care	Project Manager
Kathy Langenberg, R.N.	Iowa Foundation for Medical Care	Operations Manager
Brant Fries, Ph.D.	University of Michigan	Analytic Task Leader/Research Design Specialist
Robert Godbout, Ph.D.	Stepwise Systems, Inc.	Survey Design Consultant
David Maltiz, Ph.D.	Stepwise Systems, Inc.	Survey Design Consultant
David Oatway, R.N., M.P.H.	CareTrack Systems, LLC	Database Manager

STRIVE Technical Expert Panel

The STRIVE project team established a Technical Expert Panel (TEP) to review and make specific recommendations to the Centers for Medicare and Medicaid Services (CMS) and the project team regarding implementing and conducting the time study. The STRIVE project team submitted names and qualifications of proposed members to CMS. The team identified individuals who would bring different perspectives and expertise in Nursing Home care to the meetings. The individuals selected to be participants and observers of the STRIVE TEP are noted in Tables 1-2 and 1-3.

Table 1-2. STRIVE Technical Expert Panel Participants

Participant	Organization
Buchanan, Joan	Harvard University
Carter, Carol	MedPac

Participant	Organization
Ciolek, Cathy	American Physical Therapy Association (APTA) - Trialliance
Dobson, Al	Lewin Group (Dobson Davanzo)
Greene-Burger, Sarah	National Citizens' Coalition for Nursing Home Reform (NCCNHR)
Hines, Lisa	
Hirdes, John	University of Waterloo - Ontario, Canada
Hojlo, Christa	U.S. Department of Veterans Affairs
Job, Carol	Myers & Stauffer
Karuza, Jurgis	American Medical Directors Association (AMDA), University of Rochester Medical Center (URMC)
Kramer, Andy	Researcher
Lazarus, Barry	The Alliance for Quality Nursing Home Care
Manard, Barbara	American Association of Homes and Services for the Aging (AAHSA)
Moore, Terry	Abt Associates
Ousley, Mary	American Health Care Association (AHCA)
Robinson, Alverta	American Hospital Association (AHA)
Scott-Cawiezell, Jill	University of Missouri
Speil, Steve	Federation of American Hospitals (FAH)
Stein-Lloyd, Leslie	American Occupational Therapy Association (AOTA) - Trialliance

Table 1-3. STRIVE Technical Expert Panel Observers

Observer	Organization
Archuleta, Rochelle	American Hospital Association (AHA)
Carter, Diane	American Association of Nurse Assessment Coordinators (AANAC)
Cholakian, Marianne	Office of the Inspector General (OIG)
Cornelius, Betty	
Edelman, Toby	Center for Medicare Advocacy
Fitzler, Sandy	American Health Care Association (AHCA)
Gruhn, Peter	American Health Care Association (AHCA)
Maher, Carol	American Association of Nurse Assessment Coordinators (AANAC)
Munley-Gallagher, Rita	American Nurses Association (ANA)
Nashimi, Robin	National Quality Forum (NQF)
Polniaszek, Susan	Association for Standardized Patient Educators (ASPE)
Saliba, Deb	RAND Corporation
Stevens, Lynne	American Speech-Language-Hearing Association (ASHA) - Trialliance
Wade, Kathy	Myers & Stauffer
Wern, Maureen	National Association of Subacute and Post Acute Care (NASPAC)

Observer	Organization
White, Steve	American Speech-Language-Hearing Association (ASHA) – Trialliance
Woody, Iara	American Association of Homes and Services for the Aging (AAHSA)

States were diligently recruited to be involved in the STRIVE project. Fifteen states volunteered participation in the project, which provided a good geographical distribution across the country. These states are identified in Table 1-4.

Table 1-4. Participating States

District of Columbia	Nevada
Florida	New York
Illinois	Ohio
Iowa	South Dakota
Kentucky	Texas
Louisiana	Virginia
Michigan	Washington
Montana	

The STRIVE Project's time studies were conducted by volunteers. These volunteers were from national and state organizations, national and state associations, numerous nursing home chains and facilities across the nation. Our appreciation is extended to all volunteers who supported and participated in this study. These volunteers promoted STRIVE and participated in the studies enabling STRIVE to perform successful studies in every state. The state agencies and associations that were involved in the STRIVE project are listed in Table 1-5.

Table 1-5. State Organizations and Associations Providing STRIVE Study Staff

State	Organizaion/Association
Texas	Texas Quality Improvement Organization
Ohio	Ohio Dept. of Job and Family Services, Office of Ohio Health Plans, Bureau of Long Term Care Facilities
Virginia	Department of Medical Assistance Services
Louisiana	Department of Health and Human Services and Louisiana Nursing Home Association
Washington	Department of Social and Health Services, Office of Rates and Management
South Dakota	Department of Social Services, Provider Reimbursement and Audits
Montana	Senior and Long Term Care Division, Department of Public Health and Human Services

Kentucky	Department for Medicaid Services Long Term Care and Community Alternatives
Nevada	Department of Health and Human Services Division of Health Care Financing and Policy (DHCFP)
Illinois	Illinois Department of Healthcare Family Services
New York	Division of Quality and Surveillance for Nursing Homes & Intermediate Care Facilities / Mental Retardation Continuing Care Leadership Coalition
Washington, D.C.	District of Columbia Healthcare Association

2. Methodology

Sampling Methodology

The Staff Time Resource Intensity Verification (STRIVE) project's data will be used for two primary purposes: (1) to refine the current Resource Utilization Group (RUG) classification systems, and (2) to develop case mix indices (CMIs) which will form the basis for future versions of the Medicare skilled nursing facility (SNF) payment rates. The data collected are of two major types: resident assessment data and staff time data. These data were collected in a sample of 205 nursing homes.

The two major applications, RUG refinement and CMI development, have rather different data requirements. Both applications require data that can be generalized to the national population of nursing homes. For development of CMIs, it must be possible to accurately generalize the data to the nation as a whole so that the CMIs and payment rates that are computed from the data accurately reflect nursing home costs nationally. To meet this need, a fairly simple sampling design would probably suffice.

For RUG refinement, in contrast, it is not absolutely essential that the data be collected in a nationally representative sample of nursing homes. The RUG system is based upon relationships between a resident's characteristics (measured by assessment instruments) and staff costs for the resident (measured by staff time devoted to resident care). Numerous staff time studies in different settings and even different countries have demonstrated that these fundamental relationships are relatively invariant across different populations of nursing homes and residents¹²³. Thus, there is a substantial body of evidence that suggests that even if data are not strictly representative of the population as a whole, a valid RUG system can be developed.

However, there are two reasons why a fairly complex sample of nursing homes is necessary to meet the needs of RUG refinement. First, it is important in drawing a sample of nursing homes to exclude facilities that have very poor quality. Poor quality facilities are likely to have low or sub-optimal staffing levels. The relationships between resident care and staff time in such facilities may be attenuated or distorted, and there is general agreement that it is not appropriate to include such facilities in the staff time study. Second, there are a number of relatively rare, but high-cost special populations that should be over-sampled so that there are enough cases to model costs for members of these small but important groups. To meet these needs, a complex, probability-based sample design was developed that involved clustering, stratification, and sampling with probability proportional to size.

It is important to note, however, that due to practical and logistical considerations, it was not possible to adhere strictly to random sampling when selecting facilities or residents for participation in the study. Data collection in this study was dependent to a large degree upon volunteers. State agency and nursing home association staff volunteered to supervise the collection of data in participating facilities. The nursing homes themselves could not be required to participate. Although facilities were recruited from a randomly drawn sample, study staff had no control over which facilities agreed to participate. Finally, within larger participating nursing facilities, residents and staff could not be selected randomly for inclusion in the study. Logistical considerations guided the selection of the particular nursing units that were included in the study when the nursing home was too large to be included in its entirety.

¹ Ljunggren G, Fries BE, Winblad U. "International Validation and Reliability Testing of a Patient Classification System for Long-Term Care" *European J. Gerontology*, 1(6):372-383 (Jul-Aug), 1992

² Ikegami N, Morris JN, Fries BE. "Low-Care Cases in Long-Term Care Setting: Variation Among Nations" *Age and Ageing*, 26 Suppl. 2:67-73, 1997.

³ Björkgren MA, Häkkinen U, Finne-Soveri UH, Fries BE. "Validity and Reliability of Resource Utilization Groups (RUG-III) in Finnish Long-Term Care Facilities" *Scandinavian J Public Health* 27:228-234, 1999.

For all of these reasons, the STRIVE sample of nursing homes, residents, and staff was not strictly random. The sample design, however, was rigorously derived and was developed to satisfy the competing data requirements of the study, while accommodating practical limitations. Random processes were used wherever possible and, where not possible, standardized procedures were substituted to eliminate judgment-based biases from affecting the sample.

The following details the methodology that was used to draw the STRIVE sample.

Overview of Sample Design

Table 2-1 below presents an overview of the steps involved in drawing the sample. These steps are briefly described in this “Overview” section. For complete detailed documentation of each step, refer to Appendix A-1.

Table 2-1. Overview of Sampling Procedures

Step	Description	Sampling Procedure
1	Identified all certified facilities in the nation.	Definition of population
2	Identified 15 states that agreed to participate in the study.	Self-selection (not random)
3	Applied data-based exclusions using QI/QM data and survey deficiency data. Eliminated poorest quality facilities in each state (5% to 10% of all facilities). Population defined as all remaining facilities (referred to as “eligible facilities”).	Redefinition of population
4	Applied geographic restrictions in certain states.	Redefinition of population
5	Stratified eligible facilities within each state into five strata. Some strata were not represented in some states.	Stratification
6	Set targeted number of facilities for each stratum within each state. Targets were based upon number of available facilities, number of facilities data monitors were able to visit, and overall study targets.	Sample size determination (no selection involved)
7	Within each stratum within each state, selected the target number of facilities with probability proportional to size (where size was defined by the number of residents in the facility on a given day). Selected an over-sample allowing for deletions and refusals.	Sample with probability proportional to size
8	Each list of sampled facilities (for each stratum within each state) was put in random order.	Randomization
9	Sample lists within each state were reviewed by stakeholders who eliminated facilities that were closed, unable to participate, or were known to be of very poor quality.	Exclusions based on judgment (not random)
10	Remaining facilities were contacted in random order until enough facilities in each stratum agreed to participate.	Self-selection (not random)
11	Enumerated nursing units within each selected facility. If facility was sufficiently small, all nursing units were included in study. In larger facilities, units were selected using a standard protocol.	Selection by standard protocol (not random)

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- **Step 1.** The data from the Center for Medicare and Medicaid Services (CMS) national MDS repository were used to identify all facilities in the nation that had submitted at least one MDS assessment over a target six-month period. This list represented all certified facilities in the nation and was used to construct the initial sampling frame for each of the states that participated in the study.
 - **Step 2.** States were contacted to enlist support for the study. Because participation in the study required state agencies and/or state nursing home associations to provide volunteers who could travel throughout the state and serve as data monitors, not all states that wished to participate could do so, due to budgetary and other constraints. Fifteen states were able to meet the study's staffing requirements and agreed to participate (refer to Table 1-4 for a list of participating states). Note that these 15 states do not represent a random sample of states since they volunteered to participate (i.e., they were self-selected).
 - **Step 3.** Two data sets were used to eliminate poor quality facilities from the sampling frame. The first data set consisted of quality indicator and quality measure (QI/QM) data for all facilities in the nation. Based upon advice from a panel of QI/QM development experts, a set of measures were identified which were combined to produce a composite QI/QM score, with a higher score indicating poorer quality. Facilities were rank ordered by this score within each state and the top (worst) 5% within each state were eliminated from the sampling frame.

The second data set consisted of special focus facility (SFF) scores for every facility in the nation. The SFF scores are produced using an algorithm developed by CMS that considers survey and complaint deficiencies and scores them according to scope and severity. Facilities with the highest scores are those with the most serious quality-related deficiencies. These scores were rank ordered within state and the top (worst) 5% within each state were eliminated from the sampling frame.

Since 5% of the facilities in each state were eliminated on the basis of QI/QM scores and 5% were independently eliminated on the basis of SFF scores, a total of 5% to 10% were eliminated within each state. This step essentially redefined the population of facilities that comprised the sampling frame. Instead of including *all* certified facilities, the sampling frame now consisted of all certified facilities except those of the lowest quality. In the discussion below, these remaining facilities are referred to as "eligible facilities."

- **Step 4.** Due to travel and budget restrictions, four states (Florida, Illinois, Louisiana, and Texas) agreed to participate but only if the study area was restricted to certain sections of the state. Where these restrictions applied, counties were used to define the geographic areas of interest. All eligible facilities in the agreed-upon set of counties comprised the sampling frames for those states with geographic restrictions. For the remaining states, all eligible facilities in each state comprised the sampling frame.
- **Step 5.** As mentioned above, it was deemed necessary to over-sample members of certain resident special populations in order to yield a sufficient number of cases for the RUG classification analysis. A literature review as well as consultation with CMS and the project's Technical Expert Panel yielded a list of potentially important special populations. National MDS data were used to estimate the relative prevalence of each of these groups in the population and estimates were made of the number of cases in each group that would be obtained in our sample without employing a targeted sample. Several groups were identified that were sufficiently rare and important that targeting was required and that were sufficiently concentrated in facilities that targeting was likely to successfully enhance their representation in the sample. The strata that resulted were as follows:
 - Hospital-based (HB) facilities. Residents in HB facilities typically have stays that are considerably shorter than residents in non-HB facilities. Furthermore, HB facilities typically have different staffing patterns and cost structures than non-HB facilities. For this reason, HB facilities were included as a stratum.
 - Facilities with a high concentration of residents on ventilators/respirators (Hi-Vent). Residents who are on ventilators/respirators are known to be costly to care for and to require more intensive staff resources. Using MDS data, facilities were identified in which 12% or

more of their residents were on ventilators/respirators. These facilities fell into the Hi-Vent stratum.

- Facilities with a high concentration of residents with HIV (Hi-HIV). Residents with HIV are known to be costly to care for and to require more intensive staff resources. Using MDS data, facilities were identified in which 10% or more of their residents had HIV. These facilities fell into the Hi-HIV stratum.
- Facilities with a high concentration of Medicare Part A residents (Hi-PartA). The RUG refinement results and the CMI results that result from the STRIVE study are relevant to both the Medicare and Medicaid programs. However, because only a relatively small minority of residents (12.4%) nationally is served in SNFs under Medicare's Part A program, it was necessary to over-sample facilities that served such residents in order to obtain a sufficient number for analysis. Using MDS and SNF claims data, facilities were identified in which 20% or more of their residents were in stays that were paid for under Medicare Part A. These facilities fell into the Hi-PartA stratum.
- All remaining facilities ("Other"). Facilities that did not qualify for any of the four strata described above fell into the "Other" stratum.

The strata were defined hierarchically in the order listed above so that they were mutually exclusive. Thus, if an eligible facility qualified for more than one stratum, it was classified into the first one in the list that it qualified for. Using this approach, every eligible facility in each state was classified into one of the five strata listed. Note that some strata were not represented in some states.

- **Step 6.** Targets were set for each stratum within each state. These targets represented the number of facilities that were desired for inclusion in the sample. The targets were set based on a number of factors: (a) the number of facilities that each state's data monitors could visit, (b) the number of facilities that were available within each state's strata (for some of the rarer strata, the number of available facilities was sometimes quite small), and (c) the number of cases that were needed within each stratum for the sample as a whole. The sample-wide targets for each stratum were set on the basis of an extensive set of simulations and sensitivity analyses that were aimed at determining the sample sizes that were required to achieve reasonable levels of precision and statistical power. As the study progressed, state sample targets were sometimes modified because of sample shortfalls in states that had been completed earlier in the study.
- **Step 7.** The SAS SURVEYSELECT procedure was used to select facilities from each stratum within a state. Facilities were selected with probability proportional to size, where "size" was represented by the number of residents in the facility on a particular day, according to the facility's MDS data. The use of probability proportional to size sampling favored the selection of larger, higher-volume facilities, although every eligible facility (even very small facilities) had a non-zero probability of selection. This method was used for two reasons: (a) it tended to select relatively few facilities that were very small so that scarce project resources were not spent on facilities that would yield a low number of cases, and (b) sampling with probability proportional to size tends to produce better national estimates with lower margins of error when the units to be selected vary widely with regard to size (as is the case among nursing facilities). Because this sampling methodology was used and because larger facilities had a high probability of inclusion in the sample, it will be necessary to develop case weights that can be applied to make accurate national estimates from the data.

It was anticipated that some facilities on the sample lists would be eliminated by stakeholders (see Step 8, below) and that other facilities would not agree to participate in the study. Therefore, the number of facilities that were selected for the sample within each state and stratum was greater than the target number of facilities. In other words, each stratum was over-sampled with the aim of having enough facilities available on the sample lists to meet the target desired, after stakeholder exclusion and facility refusal to participate.

- **Step 8.** Each state/stratum facility sample list was put in random order in preparation for Step 10, below.

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- **Step 9.** Each of the stratum sample lists within a state was sent to stakeholders for review. These stakeholders were state Medicaid agency staff as well as regional CMS staff. Stakeholders were asked to review the lists and eliminate any facilities that (a) were closed, (b) were unable to participate in the study due to emergencies, bankruptcies, investigations, etc., or (c) were known to have very poor quality.
 - **Step 10.** All facilities on the sample lists that remained after stakeholder review were deemed eligible to be contacted for enlistment in the study. Recall that in Step 8 the lists were put in random order. Facilities that had not been eliminated by the stakeholders were contacted in the order listed until the target number of facilities agreed to participate.
 - **Step 11.** Once a facility agreed to participate in the study, it was scheduled for onsite data collection. The number of supervisory staff and the amount of equipment available allowed for a maximum of about 50 residents and associated staff to be included in the study in each facility. If a facility was sufficiently small, all nursing units, residents, and staff were included in the study. However, many facilities could not be studied in their entirety. For these facilities, nursing units were selected for inclusion in the study. Residents and staff who belonged to those nursing units were included in the data collection, while outside residents and staff were excluded.

In these larger facilities, it was not possible to randomly select nursing units for inclusion in the study. Nursing units were sometimes located on different floors of a building or, in some cases, in different buildings on a campus. In such cases, the only feasible option was to study units that were located adjacent or very near one another. It was often not logistically possible for the data monitors to supervise widely dispersed nursing units. Moreover, if the facility was in a special population stratum (Hi-Vent, Hi-HIV, or Hi-PartA), then priority was given to units with residents in the corresponding special population in order to maximize the number of residents in our sample who belonged to those special populations.

Therefore, random selection of nursing units was not performed. Instead, a standard protocol was developed for the selection of units and this protocol was followed by project staff in consultation with nursing home management. This procedure minimized the use of judgment-based selection, which might impose unknown biases. Instead, the selection procedure was uniform across nursing homes and applied by project staff who managed the study. When the volunteer data monitors arrived at the facility, the nursing units to be included in the study had already been selected by project staff – the data monitors were not involved in the selection procedures.

It can be seen that the sample design that was used for this study was a three-stage cluster sample with stratification. The three types of clusters selected at the three stages were participating states, participating facilities, and the nursing units within each participating facility. Stratification of facilities was applied within states.

Appendix A-1, provides detailed discussions of each of the sampling steps that were summarized above.

Study Coordination Methodology

The STRIVE study was conducted using an all-volunteer study staff. The study methodology used was based on recruiting volunteers from the states and facilities to conduct and participate in the studies. Recruitment of states, facilities, and volunteers was a challenging part of this study. Volunteers were obtained by diligently working with numerous organizations, associations, and healthcare entities to provide accurate information on the expectations and time commitments for volunteers. This was done by holding conference calls, distributing emails with recruiting materials, and posting information on our STRIVE website. We also worked with AANAC to issue CEUs as an incentive to clinical staff who volunteered to conduct a study. This volunteer effort was collaboration among many federal and state governments, nursing homes, consumer advocates, provider and professional associations, and academic institutions. There was also involvement from prime and subcontractors. These volunteers filled the roles needed to conduct successful studies. These roles were State STRIVE Coordinators, State STRIVE Resource Coordinators, Lead Data Monitors, and Data Monitors.

- **State STRIVE Coordinator** is the primary contact within a state for the time study. This person should be a senior State Medicaid or Survey Staff member or a selected staff member with immediate access to a senior member.

The State STRIVE Coordinator's tasks include:

- Being the agency liaison for policy issues with the STRIVE team
 - Providing general oversight
 - Coordinating staff commitments
 - Appointing a State Resource Coordinator
- **State STRIVE Resource Coordinator** is appointed by the State STRIVE Coordinator. Large states may have more than one State Resource Coordinator to allow regionalization of the facility coordination tasks.

The State Resource Coordinator's tasks include:

- Assisting with exclusion criteria for facilities within the state
 - Assisting with coordinating schedules between State Medicaid and Survey agencies
 - Scheduling Lead Data Monitors in coordination with IFMC
 - Recruiting Data Monitors
 - Collaborating with IFMC on scheduling staff, equipment, and facilities in his or her state
 - Coordinating the state training; determining location, dates, training equipment needs; inviting attendees
- **Lead Data Monitors** are appointed by the State Resource Coordinator for each facility. Lead Data Monitors are usually clinicians. Lead Data Monitors must be familiar with using computers.

The Lead Data Monitors' tasks include:

- Training Data Monitors
- Scheduling Data Monitors for facility training and data collection
- Coordinating collection of all data (time data and supplemental data)
- Performing Data Monitor tasks
- Managing and maintaining data integrity

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- Preparing equipment for next study
 - **Data Monitors** may be state personnel or volunteers from associations, nursing facilities, or other sources. Data Monitors should be familiar with using computers.

The Data Monitors' tasks include:

- Training facility staff in time data collection procedures
- Monitoring data collection during shifts
- Distributing and collecting PDAs during the study
- Uploading and reviewing data at the end of each shift
- Preparing PDAs for the next shift

IFMC used a 'Train-the-Trainer' concept for training each state's volunteer study personell. A state training was held in each state the week prior to the first study. Study processes, procedures, and equipment functionality were covered in training. Volunteers were also provided exercises and time to practice and become familiar with the equipment. Due to each state's individual circumstances, adjustments were made to training to accommodate each state's needs. IFMC STRIVE staff supervised the first study in each state to ensure all processes and procedures were understood and followed.

Study Phases

The coordination of the STRIVE time studies consisted of three phases: pre-study activities, study week activities, and post study week activities. IFMC managed all studies with multiple studies in different phases at the same time.

The pre-study activities included recruiting and preparing the facility for the study; coordinating tasks with the facility; preparing data monitors for the study; gathering information about facility residents and staff; selection of units or wings to be included in the study; preparing and shipping equipment and forms needed for the study.

Study week activities included Lead Data Monitors and Data Montiors training facility staff to participate in the time study using personal data assistants (PDAs) and/or paper forms. Once trained, the data collection took place. Besides conducting the study, Data Monitors had several tasks to complete during the study week. These included tracking admissions and discharges, collecting resident drug information, collecting business office information, and communicating with facility administration and IFMC on study status and issues.

Post-study activities included the facility therapy department finishing 7 days of data collection with paper forms and the completion of the STRIVE MDS and Addendum by the facility MDS Coordinators. Once these data were received at IFMC it was thoroughly reviewed. If there were questions about the data or an incomplete set of data, follow-up calls were made to the facility. Data entry of the paper tools were completed prior to sending the facility database to CareTrack Systems.

A more detailed list of tasks can be found in Appendix A-25.

Time Data Collection Methodology

The primary component of Nursing Home cost is the Nursing Home staff time required to provide care for or on behalf of an individual resident, as well as time spent doing other tasks necessary to the operation of the nursing home. The STRIVE study used the basic approach of collecting 48 continuous hours of nursing home staff time and 7 days of therapy time, along with collecting studied residents' characteristics through the use of assessments, their drug data, and additional business office data in each nursing home studied.

Most staff time measurement (STM) study schedules started on Monday and ran through Thursday in the facilities; however, in a few cases the schedule had to be altered to run from Tuesday through Friday to accommodate facility or data monitor needs. Typically, one Lead Data Monitor and two Data Monitors conducted the training and oversaw the study in each nursing home. The Lead Data Monitor and Data Monitors trained nursing home staff to record the time data by using PDAs, paper forms, or a combination of both. Data monitors issued PDAs to nursing home staff at the beginning of each shift and collected PDAs at the end of each shift. Data Monitors uploaded the data to the laptop and reviewed the time recorded with the staff members to ensure completed records. Once a day a CD was burned containing the data to date and labeled. When PDAs were unavailable for use, Data Monitors issued paper forms to nursing home staff at the beginning of each shift, collected paper forms at the end of each shift, and reviewed paper forms with the staff members to insure complete data. Time was collected for 48 continuous hours for nursing and ancillary staff. Therapists collected their time for 7 days with three days on the PDAs and the four remaining days on paper when the Data Monitors were not on-sight.

There were three types of staff time data collected during the study: Resident Specific Time (RST), Non-Resident Specific Time (NRST), and Non-study Time (NST). RST was the time a staff member spent with or on behalf of a resident housed on the time study unit(s). NRST was the time staff members spent supporting the delivery of care for all residents on a unit included in the time study. NRST included Non-study Tasks (NST) which were tasks not related to the study, Meals and Breaks Paid (MB), and Unpaid meal or time (UPT). NST was the time staff members spent doing tasks that supported the facility as a whole but was not related to the direct care of the residents who were included in the time study. Data Monitors collected some additional data from the nursing home. This data included the Culture Change and IT Survey from each studied facility, as well as business office information such as resident billing information and studied residents' admission and discharge dates and status. Resident medication information was also collected when possible. At the end of the study week, the Data Monitors packaged the databases and forms and sent them to IFMC.

During IFMC's data-finalization process, missing data were collected and entered into the databases. Paper form data were also entered into the database. Once this process was complete, the finalized databases were sent to CareTrack for data cleansing and analysis.

STRIVE MDS/Addendum Methodology

Using the MDS was an integral part of understanding the characteristics of each resident in the STRIVE Time Study. As part of study, facilities were asked to update an MDS 2.0, called the STRIVE MDS, for each resident included in the study. The STRIVE MDS was a full MDS (without Resident Assessment Protocols) that had approximately one-third of the items grayed out that were not needed for the study. The assessor was asked to follow the same guidelines that were used for completing the standard MDS 2.0. Refer to Appendix A-3 for the STRIVE MDS Assessment.

The STRIVE Minimum Data Set (MDS) Addendum was an additional set of questions for facilities to complete along with the STRIVE MDS on each study resident. The primary use of the data collected on the STRIVE addendum was to directly support the time study data analysis. In addition, CMS used this opportunity to collect resident level clinical data during the STRIVE study to advance several important CMS initiatives. The specific uses of the STRIVE addendum data would be for Resource Use Prediction, Quality Measure Refinements, Post Acute Care Reform, and the New Freedom Initiative. Refer to Appendix A-4 for the STRIVE Assessment Addendum.

The facility was instructed by IFMC clinical staff via telephone on the completion requirements for these assessments. The facility had one week prior and two weeks after the study to complete the STRIVE MDS and STRIVE Addendum on each study resident. The Assessment Reference Date (ARD) was Thursday of the time study week and in an effort to capture staff time accurately, the facility staff members were asked to not to complete STRIVE assessments during the week of the time study unless it was their regularly scheduled time. Once the assessments were complete, the facility sent them to IFMC. Follow up calls were made to the facilities to retrieve any missing MDS assessments from study residents.

For assessments not received or for the incomplete assessments, the Resident Profile Table (RPT) was used to get the missing assessment information for a study resident. Use of the RPT is described in the following section.

Preliminary Data Processing and Data Cleansing

Initial data cleaning and preparation was done according to the standards used in previous studies and to the data specifications agreed to among the STRIVE team at the beginning of the study. Any changes made to the data that were exceptions to the standard specifications were documented in a facility specific log.

Once the time data were entered into the database by IFMC it was sent to CareTrack for prep and cleaning. A master copy of the original database was maintained for each facility for future review and troubleshooting. Processing of the data began by importing all time data into a table where reconciliation of the data took place. The resident roster, staff roster, units, admissions, discharges, time records, gaps and training records were checked for accuracy. Issues with admission and discharges during the study; and group time records were handled by established procedures. A facility finalization form was used to communicate any special notes or issues from a facility that may have impacted the data. Any inconsistencies identified were thoroughly researched, documented, and adjusted to maintain an accurate database. Once the time data were prepared and cleansed the new database was sent back to IFMC. This file was then loaded to a database for entry of the MDS and Addendum assessment data. For more information regarding data preparation refer to Appendix A-2.

Comparison of STRIVE MDS and MDS Data Repository

The STRIVE project collected concurrent staff time and Minimum Data Set (MDS) data in over 200 nursing homes around the nation. The purpose of this effort is to update and refine the resource utilization group (RUG) systems that are currently in use. The RUG systems are designed to predict staff time using variables (such as resident conditions, functional levels, and services) that are recorded on or derived from the MDS. It is therefore essential that the time study data and the MDS data be as close in time to one another as possible.

Because the concurrency of the data is an essential element of the study, the decision was made to ask facilities to complete special MDS assessments (referred to as “STRIVE MDSs” throughout this paper) that would reflect residents’ status during the time study. Under normal MDS requirements, an MDS must be completed at least on a quarterly basis for every resident, or more frequently if there is a significant change in the resident’s condition or if the resident’s care is being paid for under the Part A skilled nursing facility prospective payment system (i.e., under SNF PPS). These regularly completed MDS assessments are submitted by facilities to their state’s data system and stored in CMS’s national repository.

When designing the study, STRIVE staff had two alternative ways of obtaining MDS data: using existing repository data or collecting special MDS assessments. The advantage of using existing MDS data was that it was readily available, but its disadvantage was that it would not be as timely as specially collected MDS data could be. Collecting STRIVE MDS assessments would solve the timeliness problem. However, because there was not enough funding available to pay for the special assessments, it would be necessary to ask facilities to perform them on a volunteer basis. This would substantially increase the amount of facility resources required to participate in the study and introduce logistical problems in coordinating the collection and data entry of the assessment forms. Moreover, there were concerns about whether facilities would have the resources to completely and accurately perform a fairly large number of assessments for its study residents in a short period of time.

After considering the various trade-offs, the decision was made to collect STRIVE MDSs. After data collection was partway complete, the decision was made to investigate the possibility of supplementing the STRIVE MDS data with repository MDS data. There were four reasons for this decision:

- Because of the configuration of the nursing units within some facilities, the project collected time study data on some residents who were not formally part of the study and who were not assessed using the STRIVE MDS. If repository data could be used for these residents, then the study’s sample size could be increased at little cost.
- Some facilities did not complete or submit STRIVE MDSs on all study residents. The project hoped that repository MDS data could be used for these residents.
- Some individual data items were missing on STRIVE MDS assessments. It was hoped that repository data could be used to fill in these missing data items.
- If the project demonstrated that repository data could be used as a reasonable substitute for specially collected MDS data, then future time studies could be significantly streamlined. Those studies could avoid the significant effort required on the part of facilities and project staff to collect special MDS assessments.

The research reported in this paper was conducted to determine whether repository MDS data matched STRIVE MDS data well enough that it could be successfully substituted for the special MDS data in this and future time studies. The methodology that was employed, the study’s results, and the conclusions that were drawn from this research are described below.

Methodology

The study's basic approach was to compare responses on individual MDS data items that came from two sources: STRIVE MDS assessments and the MDS data repository. Each of these data sets is described below.

STRIVE MDS Assessments

The starting point for the analysis was a database of residents that were included in time studies in 113 facilities. This database contained interim data for approximately 50% of the facilities that would ultimately be included in the STRIVE study. STRIVE MDS assessments were available for 4,730 of the 5,320 residents (88.9%) that were in the time study database⁴. Residents in the database who did not have STRIVE MDS assessments were either on nursing units that were not included in the time study or were on time study units but did not have STRIVE MDSs submitted on their behalf by participating facilities.

A data file (referred to below as the "finder file") was prepared that contained facility and resident identifiers for each resident in the STRIVE database. The finder file contained the following fields:

- Facility state ID.
- Facility internal ID (a code used in the MDS repository to uniquely identify each facility within a state).
- Resident last name.
- Resident first name.
- Resident gender.
- Resident birth date.
- Resident social security number.

Not all resident identifiers were available for all residents. This finder file was submitted to CMS's QIES data repository that uses a standard algorithm to match the identifiers in the finder file with identifiers in the repository. This algorithm uses various combinations of the identifiers to achieve the best match to the repository identifiers. The algorithm returns the resident internal ID for matched records. The resident internal ID uniquely identifies each resident within a state. These resident IDs were used to match the STRIVE MDS data to the repository data described below.

MDS Repository Data

Each facility's time study involved a one-week onsite visit. The first part of the week was reserved for preparation and training. The 48-hour nursing time study began Wednesday morning or afternoon and ended Friday morning or afternoon. Since the time study always included Thursday of the week, we refer below to the time study date as the Thursday of the week of the study.

Time study dates for the facilities in the database spanned the period from June 15, 2006 through February 15, 2007. All available MDS repository data for the 113 facilities were requested and obtained on May 2, 2007. Data were requested with target dates⁵ on or after January 1, 2005.

⁴ Many of the residents without STRIVE MDSs were on nursing units that were not part of the time study.

⁵ The target date for an MDS record is defined as the discharge date (for a discharge tracking form), the reentry date (for a reentry tracking record), or the assessment reference date for an assessment.

Once the repository data were obtained, the first step was to use the data to identify residents who appear to have been in the facility on the study date. These active residents were identified using a program that scanned each resident's MDS data stream in reverse chronological order starting with the study date. If the first record encountered (i.e., the latest record) was a discharge, then it was assumed that the resident was not active on the study date. However, if the first record encountered was a regular assessment or a readmission tracking record and if the target date for the record was within 100 days of the target date (the approximate maximum allowable time gap between MDS records, given MDS completion rules), then it was assumed that the resident was active. If no such record was found, then the resident was classified as "not-active"⁶.

The MDS data were processed to produce a resident profile table (RPT) record for each active resident. The idea behind the RPT file was to assemble a composite MDS record for each resident that contains values for each MDS item that are as close as possible in time to that resident's time study date. For example, one could start with the study date and work backwards in time through the resident's MDS data. The first (latest) assessment encountered would be examined and any non-missing data items would be stored in the resident's RPT record. Then the next (second latest) assessment would be examined and any non-missing data items would be stored in the resident's RPT record if the corresponding RPT value had not yet been filled in. This process would continue until all of the resident's records that preceded the study date had been processed.

Three sets of values were assembled for each item:

- **"Pre" MDS values.** Values obtained from MDS repository records which precede the STRIVE study date for the resident. For each MDS variable, the latest non-missing value was obtained from the repository data and stored in the relevant "pre" variable.
- **"Post" MDS values.** Values obtained from MDS repository records that followed the STRIVE study date for the resident. For each MDS variable, the earliest non-missing value was obtained from the repository data and stored in the relevant "post" variable.
- **"Near" MDS values.** For each MDS variable, the pre and post values were examined. The near value was obtained using the following rules:
 - If both the pre and post values were missing, the near value was set to missing.
 - If the pre value was non-missing, and the post value was missing, then the near value was set to the pre value.
 - If the pre value was missing, and the post value was non-missing, then the near value was set to the post value.
 - If the pre and post values were both non-missing, the near value was set to the value that came from the assessment that was closest in time to the STRIVE study date. If both the pre and post values were equidistant from the study date, then the near value was set to the pre value.

Along with the values themselves, information was captured for each MDS item regarding the time gap (in days) between the study date and the target date of the assessment that served as the source for the RPT value. Pre-, post- and near gap variables were created for each MDS item so that the effect of gap could be measured for each variable individually.

⁶ The actual algorithm was a bit more complicated than described because admission or 5-day assessments can occur after the study date but have an admission date that precedes the study date. The program took such situations into account in determining each resident's active status.

Measures of Correspondence

After building the RPT file, it was merged with the STRIVE MDS data file. The merged file allowed direct comparison between the RPT values and the STRIVE MDS values for each resident in the database. The degree of correspondence was assessed in two ways.

The first approach was to determine for each MDS item, whether the pre, post, and near RPT values for a resident matched or did not match the STRIVE MDS values. Match rates were then computed across residents for each MDS item. If the RPT and STRIVE MDS values had a high match rate, one could conclude that the two sources of information yield roughly the same results. If the match rate is low (poor), then it would suggest that the two data sources are not interchangeable. Match rates were analyzed by gap time to determine whether a better match resulted when the RPT data were collected within a short period of time of the STRIVE MDS data compared with RPT data that was less timely.

A second approach to comparing the suitability of using RPT data in a RUGs study was to compute RUGs for each resident using STRIVE MDS data and, separately, using RPT data. The two sets of RUGs values were compared across residents to determine the degree of correspondence (the match rate). Additionally, the two sets of RUGs values were used to predict staff time in a regression model and the r-squares resulting from each model were compared. If the two data sources account for roughly the same proportion of variance in staff time, this would suggest that the RPT data could be substituted for the STRIVE MDS data.

Results

Data Processing Results

The STRIVE MDS data file contained 5,320 records⁷. As noted above, the data were collected in 113 study facilities that had study dates ranging from June 15, 2006 through February 15, 2007. Using CMS's standard resident matching algorithm, 5,165 (97.1%) of these records were matched against the CMS national repository using the resident matching algorithm. These represented the set of STRIVE cases that could be matched with RPT records.

MDS data were pulled from the CMS's national data repository on May 2, 2007 for the 113 facilities that were represented in the STRIVE MDS data file. All assessments with target dates on or after January 1, 2005 were selected. Table 2-2 shows the distribution of target dates for the MDS records that were selected.

Table 2-2. Distribution of Target Dates in Assessment Data

Target Month	No. of Asmts	Pcnt of Asmts	Cum Pcnt of Asmnts
Jan 2005	12,189	3.7%	3.7%
Feb 2005	11,617	3.5%	7.3%
Mar 2005	13,132	4.0%	11.3%
Apr 2005	12,557	3.8%	15.1%
May 2005	12,506	3.8%	18.9%
Jun 2005	11,765	3.6%	22.5%

⁷ This number and all additional results presented in this paper exclude a pilot facility that was not included in the analyses.

Target Month	No. of Asmts	Pcnt of Asmts	Cum Pcnt of Asmnts
Jul 2005	11,838	3.6%	26.1%
Aug 2005	12,033	3.7%	29.8%
Sep 2005	11,662	3.6%	33.3%
Oct 2005	11,906	3.6%	37.0%
Nov 2005	11,655	3.6%	40.5%
Dec 2005	12,177	3.7%	44.2%
Jan 2006	12,418	3.8%	48.0%
Feb 2006	11,340	3.5%	51.5%
Mar 2006	12,800	3.9%	55.4%
Apr 2006	12,201	3.7%	59.1%
May 2006	12,315	3.8%	62.9%
Jun 2006	11,996	3.7%	66.5%
Jul 2006	12,067	3.7%	70.2%
Aug 2006	12,523	3.8%	74.0%
Sep 2006	11,665	3.6%	77.6%
Oct 2006	12,580	3.8%	81.4%
Nov 2006	11,950	3.6%	85.0%
Dec 2006	12,051	3.7%	88.7%
Jan 2007	12,804	3.9%	92.6%
Feb 2007	11,454	3.5%	96.1%
Mar 2007	11,080	3.4%	99.5%
Apr 2007	1,659	0.5%	100.0%

A total of 327,940 assessment records were selected. Target dates spanned the period from January 2005 through April 2007. The percent of cases in each target month was roughly constant (ranging between approximately 3% to 4%) except for the last month (April 2007) which had a notably small number of cases. This was expected because the data were drawn at the beginning of May before facilities had the opportunity to submit all of their April assessments. Given the timing of the data selection, the assessment data were considered complete through March 2007, only about a month after the last time study date (in mid-February 2007). This means that there is considerably less assessment data for the “post” measures than for the “pre” measures, especially for facilities that had study dates relatively late in the time period under consideration.

The MDS repository data were processed to identify residents in the 113 facilities who appeared to be active on each facility’s study date. There were 12,593 active residents identified. RPT records containing pre, post, and near variables were created for each of these active residents. The resulting RPT file was matched and merged with the STRIVE data for the 5,165 STRIVE residents who had been matched with MDS repository identifiers. 4,830 of the 5,165 STRIVE records (93.5%) matched the RPT file. Those that did not match failed because they were not identified as active residents on their facility’s study date using the MDS data stream. An examination of a subset of cases that did not match revealed that some of these cases had admissions or discharges during the study week and that some of them had missing MDS records that were never submitted by facilities.

Of the 4,830 matching records, 322 (6.7%) did not have a STRIVE MDS. Since the analyses below were aimed at comparing STRIVE MDS data values with RPT values, only cases with STRIVE MDS data were included. Thus, all analyses below were based upon the 4,508 residents who (a) matched the identifiers maintained in the national MDS repository, (b) were classified as active on their study date based upon their MDS repository data, and (c) had STRIVE MDS data.

Item Match Rates

For each MDS item, flags were created that reflected the presence or absence of a match between the STRIVE item value and the pre, post, and near values. These flags were assigned the following values:

- The match flag was assigned a missing value if either the STRIVE value or the RPT value was missing.
- The match flag was assigned a value of “1” if the two values were non-missing and they matched.
- The match flag was assigned a value of “0” if the two values were non-missing and they did not match.

For each comparison, the percentage of non-missing cases with a value of “1” (where the values matched) was computed. It was hypothesized that pre, post, or near values might have higher match rates if they were derived from assessments that were closer in time to the study date (i.e., that had smaller time gaps) than if they were more distant in time. To test this hypothesis, the match rates were classified by the absolute value of the gap using the following gap categories:

- 0-7 days
- 8-14 days
- 15-21 days
- 22-30 days
- 31-60 days
- 61-90 days
- 91 or more days

Appendix A-5 contains three tables that summarize these results:

- Match Rates Between Pre-RPT And STRIVE MDS Values
- Match Rates Between Post-RPT And STRIVE MDS Values
- Match Rates Between Near-RPT And STRIVE MDS Values

Each row in these tables presents the results for a single MDS item. The columns show the match rates for each of the gap categories.

The second to the last column (labeled “total”) presents the match rates across all of the gap categories. The last column (labeled “missing”) shows the percent of cases that were missing (i.e., where either the STRIVE MDS value or the RPT value was missing). The missing rate is higher for some MDS items because those items are not collected on all types of assessments.

An example may help the reader understand these statistics more easily. On the first page of the Match Rates Between Pre-RPT and STRIVE MDS Values table, it can be seen that item B2A (“short-term memory OK”) has a match rate of 97.5% when the gap is between 0 and 7 days. This means that the STRIVE MDS and the pre-RPT values for B2A matched one another 97.5% of the time when the two values are non-missing and when the pre-RPT value came from a

repository MDS with a target date that preceded the study date by no more than 7 days. Looking across the row for item B2A, the match rates for other gap periods can be seen (they ranged from a high of 97.5% for 0-7 days to a low of 81.5% for 91+ days). Across all gap periods, the match rate was 96.8% (the value in the “Total” column). The value was missing on either the STRIVE MDS and/or on the pre-RPT 5.0% of the time (the value in the “Missing” column).

The second to the last row in each of the three tables (labeled “Total”) shows the average match rates and the average missing percentage across all MDS items. The “Total” row of the Match Rates Between Pre-RPT and STRIVE MDS Values table indicates a Pre match rate across all MDS items of 95.2% for a 0-7 day gap. This value falls to 89.2% for a 91+ day gap. The last row (labeled “Cum Gap”) shows the average cumulative percent of cases across all MDS items at each gap point. It can be seen that on average, 17.8% of the cases had lags of 7 days or less, that 27.9% had lags of 14 days or fewer, and so on.

Table 2-3, below, summarizes the average match rates and the percent missing across all MDS items (these statistics are identical to those at the bottom of the pre, post, and near tables in Appendix A-5).

Table 2-3. Average Match Rates by Gap Days

Type of Value	Average Match Rate Across All MDS Items by Gap Days							Total	Avg Pcnt Missing
	0-7	8-14	15-21	22-30	31-60	61-90	91+		
Pre	95.2%	94.0%	94.2%	94.1%	93.9%	93.8%	89.2%	93.8%	9.6%
Post	94.3%	92.7%	91.1%	91.1%	91.5%	91.6%	87.4%	91.8%	32.5%
Near	95.1%	93.9%	93.3%	93.5%	93.2%	91.9%	94.4%	93.6%	6.5%

It can be seen from this table (and from Appendix A-5) that the match rates are generally quite high, with the match rates for most items and most gap periods exceeding 90%. From Table 2-3, it can be seen that the average effect of gap is fairly small. For gap periods of 60 days or less, the trend is nearly flat, especially for pre and near values. For each gap period, the near match rate is nearly identical to the pre match rate, while post matches are slightly lower. However, the percent of missing cases for each of the three types of values are rather different. Post values have the highest missing percentage. Near and pre values have missing percentages that are much lower than post matches, while near values have the lowest percentage of missing cases. The high missing percentage for post matches is due to the fact that for most facilities the volume of available pre MDS data was much higher than the volume of available post MDS data. Because near values are derived from pre and post values, if either or both are present, it was expected that near values would have the lowest percentage of missing cases.

From these results, it would appear that the type of value has little impact on the match rate, but that near values have the lowest percentage of missing cases. Near values would therefore provide the highest percentage of valid cases with little sacrifice in match rate. Furthermore, it appears that the effect of gap is fairly small for all types of values. For near values, the match rate is fairly constant for all gap periods except for 61-90 days which is a few percentage points lower than the other periods.

Because the results were so consistent across the three types of values and across gap periods, it appears that the results can be summarized well by simply using the near match rates and ignoring the effect of gap. The analyses below therefore concentrate on the overall near match rates.

Table 2-4 presents the distribution match rates across all 322 MDS items that were on the STRIVE MDS. The metric used for each MDS item was the overall near match rate across all gap periods.

Table 2-4. Distribution of Overall Near Match Rates Across MDS Items

Total Near Match Rate	Number of Items	Percent of Items	Cum Pcnt of Items
99%+	57	17.7%	17.7%
95% - 98%	119	37.0%	54.7%
90% - 94%	83	25.8%	80.4%
85% - 89%	36	11.2%	91.6%
80% - 84%	13	4.0%	95.7%
70% - 79%	8	2.5%	98.1%
40% - 69%	6	1.9%	100.0%
Total	322	100.0%	

It can be seen that of the 322 MDS items, 17.7% had near perfect matches (99% or greater) with the STRIVE MDS items values. 80.4% of the items had match rates that were 90% or greater (“Cum Pcnt of Items” column). Only 14 items had match rates that were below 80%. Thus, for the vast majority of the MDS items the match rates were quite high.

RUGs Match Rates

The goals of the STRIVE project are to recalibrate existing RUGs models and to develop refined models. The utility of using RPT data to supplement STRIVE MDS data therefore depends upon the ability of the RPT data to accurately represent residents’ status during the time study. The results above suggest that overall, the RPT values match the STRIVE MDS values fairly well. It is worth asking, however, how well the RPT values represent the resident’s RUGs status, at least using the current RUG-53 model.

The RUG-53 model uses 107 MDS items to produce resident classifications. It is possible that match rates on individual items could be high, but that small mismatches could be amplified when the composite RUGs measure is created using multiple items. On the other hand, the RUGs model may be somewhat “forgiving” of certain mismatches. For example, an ADL item could have a mismatch of only one point and still keep a resident in the same RUGs group. Because of uncertainties about the impact of RPT mismatches on RUG classifications, a series of analyses were conducted to quantify the effectiveness of using RPT data in the RUG-53 model.

The first step in this analysis was to look at the overall near match rate for the 107 RUG items. The match rate was 90% or greater for 88 of the 107 items (82.2%). Of the items with the lowest match rates, one (T1B – ordered therapy) is not relevant for STRIVE’s RUG calibration procedures. This item is used by the RUG model only on 5-day assessments to project the amount of therapy that will be provided near the beginning of a SNF stay. It is expected that therapy minutes and days from the time study, rather than from the MDS, will be used in the model recalibration and development process. Therefore, it is not anticipated that T1B will be used for these purposes.

Similarly, the P1B items, which report therapy minutes and days, will probably not be used either. It can be seen that these items tend to have the lowest match rates. It is likely that the low match rates for all of these therapy items is due to the volatility of the provision of therapy, because the

duration and frequency of therapy tends to fluctuate during the course of a SNF stay. Similarly, two other MDS items with low match rates (P7-physician visits, and P8-physician orders) tend to fluctuate over time.

This item level analysis shows that most, but not all, RUGs items have high match rates. To test the impact of the match rates on RUGs, we calculated RUG-53 groups for each of the 4,508 residents in our sample in two ways: based upon their STRIVE MDS data and based upon their near RPT data. We then computed the match rate between the pairs of RUGs groups across all residents to determine the level of correspondence.

When RUG-53 based on STRIVE MDS data was compared with RUG-53 based on near RPT data, the RUG groups agreed for 58.0% of the residents. As noted above, the therapy-based P1B items were among those with the lowest match rates and will probably not be used for RUG recalibration or development. We therefore re-computed the near RPT RUG group for each case using the P1B values from the resident's STRIVE MDS. This essentially holds the P1B items constant, removing the influence of the P1B items on differences between the near RPT RUG and the STRIVE MDS RUG. Using these re-computed near RPT RUG groups, the match rate between the STRIVE RUG and the near RPT RUG increased somewhat to 65.4%.

Prediction of Staff Time

The analyses described above used match rates to quantify the degree of correspondence between two different measures of resident status: one based upon the STRIVE MDS and the other based upon the RPT data. On the level of individual items, the reliability was rather high with match rates generally above 90%. However, the reliability for the RUGs composite measures was somewhat lower, with match rates between about 58% and 65%, depending upon whether the P1B therapy items were held constant.

The most important measure of the utility of the RPT values, however, is the degree to which the RPT-based RUG groups predict staff time. RUG model development seeks to maximize the predictive validity of the RUG groups (subject to additional considerations, such as the "reasonableness" of the group definitions). Thus, it makes sense as a final test of the utility of the RPT values to measure the predictive validity of the RPT-based RUG groups and to compare this with the predictive validity of the RUG groups based on the STRIVE MDS. Predictive validity is measured using the r-square that results when the RUG groups are used in a linear regression model to predict staff time.

Four sets of regression models were developed. Each set of models used various transformations (described below) of staff time minutes as the dependent variable, and used RUG groups (as a series of binary group membership vectors) as independent variables. In the first set of models, the RUG groups were created using the STRIVE MDS data. In the remaining three sets of models, the RUG groups were computed using the pre, post, and near RPT data to define the RUG groups. The RPT-based RUG groups were created in two ways: (a) using the RPT values for all RUG items, and (b) substituting STRIVE MDS values for the P1B items so that therapy time could be "held constant", as described above.

Four versions of therapy minutes were used as the dependent variable:

- Total staff time minutes.
- The log of total staff time minutes.
- Total staff cost, estimated by weighting each staff type (e.g., RN, LPN, etc.) according to the wage weights used in the 1995-1997 staff time study.
- The log of total staff cost.

In total, 28 regression models were tested. There were four models that used RUG classifications based on STRIVE MDS data: one model for each of the four dependent variables listed above.

There were and additional 24 models that were based upon RPT data. These 24 models resulted from the combination of three data sources (pre RPT, post RPT, and near RPT), four dependent variables (total staff time, log total staff time, total staff cost, and log total staff cost), and two ways of handling the P1B items to define RUG groups (using RPT P1B values vs. substituting STRIVE P1B values for the RPT P1B values).

In order to simplify the interpretation of the results, only those residents with complete data for all of 28 of the regression models were included in the analysis. There were 3,528 residents that met this qualification. For each of the 28 regression models, the r-square was calculated. Table 2-5 presents these results.

Table 2-5. R-squares from STRIVE MDS and RPT MDS Models

Dependent Variable	STRIVE MDS	RPT P1B Items Used			STRIVE P1B Items Substituted		
		Pre RPT Values	Post RPT Values	Near RPT Values	Pre RPT Values	Post RPT Values	Near RPT Values
Total staff time (minutes)	0.379	0.337	0.339	0.356	0.347	0.353	0.362
Log of total staff time	0.441	0.397	0.408	0.417	0.405	0.420	0.421
Total staff cost	0.448	0.391	0.397	0.425	0.424	0.424	0.434
Log of total staff cost	0.468	0.417	0.420	0.439	0.437	0.443	0.447

Each column in Table 2-5 presents the r-squares from the regression models described above. The column labeled STRIVE MDS shows results for models based upon STRIVE MDS data. The columns labeled RPT P1B Items Used show results for models in which the RPT values for the P1B items were used for RUG classification. The columns labeled STRIVE P1B Items Substituted show results for models in which the STRIVE MDS values for the P1B items were substituted for the RPT P1B values in performing RUG classification. The rows within each of these columns present results for the four staff time and cost measures that were used as dependent variables.

It can be seen in the STRIVE MDS column that the r-squares were higher when staff costs, rather than staff minutes, were used as the dependent variable, and that the log transformations improved the r-squares as well. The highest r-square for the STRIVE MDS was 0.468, which was obtained when the log of total staff cost was the dependent variable.

The pattern of results in each row was identical for the three types of RPT values. The lowest values were obtained using pre values, slightly higher values were obtained using post values, and the highest values were obtained using near values. However, the differences between the pre and near values were fairly small. Furthermore, substituting the STRIVE P1B values for the RPT P1B values improved prediction somewhat. As with the STRIVE MDS results, the best RPT results were obtained when the log of total staff cost was the dependent variable. In the bottom section of the table, it can be seen that the r-square for the near RPT when the P1B items were “held constant” was 0.447. This was only 0.021 lower than for the corresponding STRIVE r-square. Thus, using the near RPT instead of the STRIVE MDS to classify residents into RUG groups resulted in a loss of about 2.1% of the variance in log staff cost that is accounted for by RUGs.

Discussion

The results presented in this paper suggest that it is reasonable to use MDS repository data to supplement the STRIVE MDS data that were collected. It has been shown that for the vast majority

of MDS items, the RPT values achieve a 90% or better match with STRIVE MDS values. However, high match rates alone are not sufficient evidence that the RPT data should be used for RUG model refinement. It is conceivable that some important RUG items could have enough mismatches to substantially lower the predictive efficiency of the RUG model. Moreover, even though the match rates were generally quite high for individual MDS items (averaging 93.6%), the RUG group match rates were substantially lower (no higher than 65.4%).

The most important test of the reasonableness of using RPT data was the regression analysis presented above. This analysis showed that the RPT-based classifications had r-squares that were only a few percentage points lower than those obtained using STRIVE MDS data. This clearly demonstrated that RPT data could be used with very little loss in the efficiency of the RUG-53 model.

Based upon these results, we conclude that:

- The near RPT values appear to have slightly higher match rates and predictive validity than the pre or post RPT values. Additionally, there is less missing data when near RPT values are used. Therefore we will use near RPT values to supplement the STRIVE MDS.
- Near RPT values should be used to “plug” missing values in the STRIVE MDS. In other words, if a resident has a STRIVE MDS that has a missing value on a particular MDS item, a corresponding near RPT value should be substituted for the missing value.
- If a STRIVE MDS is missing entirely for a resident, either because it was not received from a study facility or because the resident was in a nursing unit that was not a study unit, near RPT values should be used to construct a STRIVE MDS for that resident.
- STRIVE MDSs that have “plugged” values or that were entirely missing and were constructed from RPT data should be flagged appropriately. Key data analyses should be performed with and without these cases to evaluate their impact on the study’s results.

The results presented in this report should be useful to those who are planning future time studies. Based upon our experience conducting the STRIVE project, we noted some issues that are associated with collecting special MDS assessments:

- Performing a large number of assessments in a short period of time requires a significant amount of time on the part of facility staff. Project staff who were involved in facility recruitment for STRIVE report that a substantial number of facilities refused to participate in the study because of this requirement.
- Staff were asked to complete supplemental assessment items so that new MDS variables could be pilot tested and so that their utility in a classification system could be evaluated. It is likely that these supplemental items would have been completed with more diligence without the additional assessment requirement associated with the STRIVE MDS.

It should be noted that the STRIVE MDSs were completed on a volunteer basis. Our results suggest that in a volunteer study repository MDS data could be used with very little loss of predictive validity.

RPT Overlay Methodology

Introduction

An analysis of the quality of the STRIVE MDS indicated that about 5% of STRIVE MDSs were missing at least five items (excluding checklist items, and not accounting for skip patterns). As well, in several facilities, staff were able to complete the Staff Time Measurement but not the MDS. Thus, using information from the MDS Archives could be used to overlay these missing items (including completely missing MDSs) and possibly improve the analysis.

The first step was to determine how to assemble the appropriate assessment from the MDS Archives. The Resident Profile Table (RPT) is an algorithm developed by Stepwise Systems to develop a complete assessment for a given reference date by searching backwards in time to earlier assessments until all MDS items are complete. Thus, for example, if the most recent assessment prior to a target date is a quarterly assessment, then for MDS items not contained in the quarterly, RPT algorithm will look back to earlier assessments until it find a full assessment (admission, significant change, annual) with these items.

For this project, Stepwise Systems conducted an analysis of the match among known STRIVE MDSs and three ways to assemble an RPT assessment: using only at MDS assessment prior to the date of the STRIVE MDS, using assessments only following that date, or using the assessment(s) closest to that date.

For a majority of the items, the overall match rate between the known STRIVE MDS and each of the three RPT MDS assessment was high (93.8% match for the “pre”, 91.8% for the “post, and 93.6% for the “nearest”). It was decided that if RPT values were to be used as an overlay, the values from the nearest RPT would have the fewest missing values, one of the higher two match rates, and make the most theoretical sense.

Determining Overlay Logic

The lack of a match between any item on the STRIVE MDS value and the RPT value can be due to several reasons, including:

- Intrinsic inter-observer reliability of the item
- An acute phase for the resident, where his/her status is rapidly changing
- Longer-term changes since an earlier assessment

These issues have ramifications for determining the overlay logic, e.g. whether to overlay items and/or an entire MDS. Little can be done about the (un)reliability intrinsic in any assessment items. However, it was important to see if RPT data derived from an assessment quite distant in time from the STRIVE MDS were less representative or if a resident in an acute phase could be identified from their characteristics. In both cases, these might be reasons to avoid using the RPT data for this resident.

The first analysis attempted to find a measure that would indicate a resident was in an acute phase, with conditions fluctuating. Specific MDS-based scales and items had potential to affect the stability of the MDS. To determine if there was any effect of these items/scales, a logistic regression was carried out. The number of matches was modeled as the number of events (match between nearest RPT value and STRIVE) out of n trials (MDS items).

The analysis used the following to predict change in STRIVE MDS items (n=322), and RUG items (n=104; excluding only the items about planned therapies – T1 – and reason for assessment – AA8b).

The following items were used (STRIVE variable name is given in parentheses):

Scales

- RUG-53 category (strive_srughier53)
- Changes in Health, End-stage disease and Symptoms and Signs/ CHES (strive_ches_nh2): due to small numbers, scores of 3 and greater were collapsed into a single group
- Activities of Daily Living/ ADL (strive_adlhier)
- Cognitive Performance Scale/ CPS (cps2)
- Depression Rating Scale/ DRS (strive_drs_nh2)
- Pain (strive_pain)
- Patient Severity Index/ PSI (strive_psi): due to small numbers, scores of 9 and greater were collapsed into a single group
- Resident Assessment Protocol triggers:
 - Delirium (strive_delrap)
 - Cognitive loss and dementia (strive_cograp)
 - Visual function (strive_visrap)
 - Communication (strive_comrap)
 - ADL (strive_adlrap)
 - Urinary incontinence (strive_contrap)
 - Psychosocial well-being (strive_psychrap)
 - Mood state (strive_moodrap)
 - Behavioral symptoms (strive_behrap)
 - Activities (strive_actrap)
 - Falls (strive_fallrap)
 - Nutritional (strive_nutrap)
 - Feeding tubes (strive_feedrap)
 - Dehydration and fluid maintenance (strive_dehydrap)
 - Dental care (strive_dentrap)
 - Pressure ulcer (strive_pressrap)
 - Hypotension/ gait (strive_hypo)
 - Cognitive/behavioral (strive_impair)
 - Discomfort (strive_discomf)
 - Overall psychotropic trigger (strive_drugrap))
 - Sum of RAPs (strive_sumrap)

MDS items

- change in behav symptoms (E5)
- change in ADL function (G9)
- weight change of 3+ pounds in 7 days (j1a)
- fever (j1g)

-
- internal bleeding (j1j)
 - unsteady gait (j1n)
 - vomiting (j1o)
 - fell in past 30 days (j4a)
 - fell in past 31-180 days (j4b)
 - hip fracture (j4c)
 - other fracture (j4d)
 - conditions made pattern unstable (j5a)
 - episodic flare up (j5b)
 - end-stage disease (j5c)
 - weight loss (k3a)
 - new medications (o2)
 - hospital stays (p5)
 - emergency room visits (p6)
 - overall change in care needs (q2)

A “change” score was developed using the items that were significantly associated with change, and using Automatic Interactions Detection. However, the change score explained less than 1% of the variance in the match rates. Overall most MDS items had very high match rates, and thus using resident characteristics to determine overlay logic was not helpful and could introduce bias by developing an overlay logic on resident characteristics.

Similarly, the time between the RPT and the STRIVE MDS assessment neither made a consistent nor substantially difference in the match rates.

Based on these results, it was decided to use all RPT data to fill in (i.e., overlay) missing MDS items.

Overlaying STRIVE MDS items

Two cases were considered. First, for STRIVE MDSs where there was greater than 80 items missing (excluding checklists and items part of skip patterns) – including residents for whom there is no STRIVE MDS – the entire MDS was overlaid using the RPT. Approximately 55 (0.6%) of the STRIVE MDSs required a complete overlay.

Second, if the STRIVE MDS did not require a complete overlay, STRIVE MDS items were overlaid using the following logic:

- Items that are not part of a skip pattern or checklist, overlay if it is missing on STRIVE MDS
- Items that are not part of a skip pattern but are part of a checklist, overlay if the entire checklist is zero (including “None of the Above”). This means that checklists where we have omitted “None of the Above,” there is no possibility of overlay. This is because the checklists are zero-filled by the MDS data-entry program used by IFMC, and we cannot determine whether the STRIVE MDS was skipped or was truly zero.
- Items that are part of a skip pattern and not on checklist, overlay only if it is missing and it is either unclear whether the item should have been skipped, or when the items should have been non-missing.

-
- Items that are part of a skip pattern and on checklist, overlay only if it is either unclear whether the item should have been skipped, or when the items should have been non-missing; and when the entire checklist is 0 (including None of the Above).

Exceptions are:

- ICD-9 Codes (I3A thru I3E): these items were only overlaid for those who had no STRIVE MDS or a poorly filled out STRIVE MDS.
- Extensive Services: k5a- Parenteral IV; p1ac- IV Med; p1ai- Suctioning; p1aj- Tracheostomy; p1al- Ventilator/Respirator

These variables were overlaid when the RPT indicated that the service occurred and the STRIVE MDS did not. This was performed when classifying STRIVE MDSs.

Overall, 58% of the STRIVE MDS were not missing items and thus did not need an overlay at all; an additional 26% needed five or fewer items overlaid. Restricting attention to the 104 RUG-III items about 84% of the STRIVE MDS did not need an overlay for the items needed for RUG classification.

Nursing Home Medications

The STRIVE project wanted to analyze the medications received by facility residents. The STRIVE team researched several alternatives for obtaining resident medication data. One alternative was to have the facilities fill out the MDS Medication Supplement (Section U) when they completed the STRIVE MDS for Part A residents. This alternative was rejected due to the additional assessment burden on the facility. The requirement that the facility complete the STRIVE MDS and the STRIVE addendum for each resident already was causing facilities to decline participation in the STRIVE study. A second alternative was to obtain data from the CMS's Chronic Condition Warehouse (CCW). Research of the CCW found that the medication data were only for Part D covered medications and that these data were not yet being collected in the CCW. The third alternative that was diligently pursued was having the facility's pharmacy chain's billing department supply the medication data for residents in a facility during the time study. This alternative appeared to be an efficient way to obtain accurate information; however due to privacy and legal concerns as well as cost considerations, this alternative did not turn out to be feasible. The last alternative considered, which was adopted, was to obtain Medical Administration Records (MAR) or physician order records or other resident medication information for STRIVE study residents. As this request was not part of the conditions to participate in the STRIVE study, facilities were asked to volunteer to send this information to the STRIVE team. At first facilities were requested to send the drug information on all residents in the STRIVE time study. To reduce facility burden, the request was changed to send the information only on Part A residents. All 205 facilities were requested to volunteer this information and 107 facilities did provide the information.

Most medication records provided by the facilities were received in hardcopy. A few facilities did provide records on CD. STRIVE staff documented receptions from facilities in a tracking database prior to forwarding the medication records onto CMS and the University of Michigan. University of Michigan College of Pharmacy staff then entered the medication records into a drug database. Variables in the drug database are identified in tables 2-6, 2-7 and 2-8.

Table 2-6. Resident Variables

Facility ID
Resident ID
Status
Type of Documentation
STM start date
STM end date
STM within MAR provided

Table 2-7. Drug Variables

NDC
Drug as entered on MAR
Drug strength or volume
Strength or volume units
Quantity
Frequency
Route
PRN

Table 2-8. Other Variables

Duration in days

Drug start date
Drug discontinuation date
Medication NOT administered during STM
STM Day1-7 AS ORDERED
STM Day1
STM Day2
STM Day3
STM Day4
STM Day5
STM Day6
STM Day7

For additional information, refer to Appendix A-7.

There were many challenges with handling the medication record hard copies including illegible handwriting or handwriting that did not copy resulting in missing/partial readable entries; copies of the medication records that were poor quality and, at times, difficult to read; and inconsistent ways of recording medications given.

Once all drug data is entered into the database, analysis will begin in Phase II of this project. These data will be used to study the impact of medications on resource utilization. That information will be presented in the Phase II report.

Information Technology Survey

CMS is interested in the impact of clinical information systems on resident care. To gauge the use of the various types of information technology (IT) employed in facilities, the homes were asked to fill out an Information Technology Assessment. The survey asked questions about the use of technology for electronic assessments, billing, treatment plans, physician orders, etc. This assessment was provided to facility administration during the STRIVE Time Study week, collected by the STRIVE Study Lead Data Monitor, and sent to IFMC. Once surveys were received by IFMC, they were sent to CMS. IFMC received 182 surveys from facilities participating in the time study. A copy of this survey can be found in Appendix A-8.

Culture Change

Facilities can be in various stages of culture change and offer different amenities. Some may have pets on the premises and/or offer meals or snacks on demand, while others may have homey decors and layouts. Additional facilities might have groups of residents who share a semi-private dining room and/or give their residents more control of their schedules.

Each facility in the STRIVE Time Study was asked to complete an Artifacts of Culture Change survey to help determine their stage of culture change. During the time study week the STRIVE Study Lead Data Monitor asked the facility administration to fill out the survey. Once completed, the survey was sent back to IFMC and sent in a batch to CMS. IFMC received 186 surveys from facilities participating in the time study. A copy of this survey can be found in Appendix A-9.

3. Results

Sampling Results

This section of the report presents information about the sample that was obtained by the study, as previously described in the Methodology section. The following topics are covered:

- Development of sample weights.
- Effect of sample weights.
- Comparison of facilities that participated in the study with those that were excluded or refused to participate.
- Comparison of facility and resident characteristics in the sample with the population.
- Preliminary estimates of the precision of the sample.
- Counts of the number of residents obtained from various special populations.

Development of Sample Weights

As described in the sampling methodology section of this report, the sample design that was used for the STRIVE study was a three-stage cluster sample with stratification. The three types of clusters selected at the three stages were participating states, participating facilities, and the nursing units within each participating facility. Stratification of facilities was applied within states. Certain strata were deliberately over-sampled. In addition, the proportion of available facilities that were selected for the study varied greatly from state to state, again by design. As a result, not all of the facilities and residents in the sample had an equal probability of selection. Because of this, sampling weights had to be developed to allow the calculation of unbiased population estimates from the sample data.

The sample weight for each resident in the sample was equal to the inverse of that resident's probability of selection for inclusion in the sample. The steps involved in calculating the weights were as follows:

1. Determine each resident's probability of selection. This probability was the joint probability of three events and was determined by computing the product of three component probabilities:
 - a. The probability that the resident's facility was included on an initial sampling list. The SAS SURVEYSELECT procedure was used to randomly select facilities, with probability proportional to size (assessment volume) from each facility within each of a state's strata. SAS reports the probability of selection for each selected facility, and these probabilities were used as the first of the three components⁸.
 - b. The probability that the resident's facility was selected from the initial sampling list for inclusion in the study. The initial sampling lists were an over-sample. In other words, more facilities were selected than were needed within each state's strata. Some facilities on the list were eliminated by state and regional office staff who reviewed the lists for facilities that were unable to participate in the study or that were known to have very poor quality. Furthermore, because participation in the study was voluntary, only some of the facilities that were invited to participate in the study

⁸ In some special cases, calculated probabilities were substituted for the SAS probabilities (e.g., when all facilities in a stratum were selected or where a supplemental sample was required).

actually joined it. For both of these reasons, only a subset of the facilities that were on the initial sampling list actually participated in the study. The probability of inclusion was computed by dividing the number of facilities that participated by the number of facilities that were on the initial list. Thus, if 60% of the facilities on the list participated in the study, then the probability of participation was considered to be 0.60.

It was known that the participating facilities were not actually a random sample of those that were on the initial list and that the method of computing this probability was therefore not entirely accurate from a statistical perspective. However, practical considerations made it impossible to enforce random selection in this phase of the sampling process. We therefore assumed that the process approximated random selection and later tested this assumption by comparing sample characteristics with population characteristics, as will be explained below.

- c. The probability that an individual resident was included in his or her facility's data collection. Once a facility was selected and agreed to participate, nursing units within the facility were selected for inclusion in the data collection process. In smaller facilities, all residents in the facility were included in the study. However, because of equipment and training considerations, we were not able to include all nursing units in the study in larger facilities. When only a subset of nursing units could be included, a standardized protocol was applied to select the units. While this process was standardized, it was not random. Like the previous step, however, we were unable to use random selection in this step. We therefore assumed that the process approximated random selection, even though this was not accurate from a statistical point of view. Using this approach, the probability of resident selection within a facility was equal to the proportion of facility residents that were included in the study. For example, if 75% of a facility's residents were located on study units and were included in the data collection, then the probability of selection for each of those residents was equal to 0.75. Again, analysis comparing sample characteristics with the population were performed to test this assumption and are presented below.

2. The joint probability of selection was simply the product of the three components described above. If these three probabilities are designated a, b, and c, then the joint probability (j) is equal to:

$$j = a * b * c$$

3. The raw sampling weight, r, is equal to the inverse of the joint probability:

$$r = 1 / j$$

4. The sum of the raw sampling weights will be equal to the number of residents in the population (the total number of residents in the 15 states that participated in the study). For most purposes, it is desirable for the weighted totals to equal the number of residents in the sample, rather than the population. To achieve this, the raw sample weights were multiplied by an appropriate scaling factor so that they would sum to the appropriate sample count. This scaling factor, s, is equal to the total number of residents in the sample (n) divided by the total number of residents in the population (N):

$$s = n / N$$

5. Thus, the final sampling weight for each case in the sample, w, is equal to:

$$w = s * r$$

Effect of Sample Weights

Table 3-1 shows the number of facilities and residents in the study sample in each of the 15 participating states. There were a total of 205 facilities and 10,136 residents in the sample.

Table 3-1. Number of Sample Facilities and Residents by State

State	Facilities	Residents
Dist of Columbia	9	395
Florida	4	206
Iowa	21	1194
Illinois	15	929
Kentucky	12	627
Louisiana	10	583
Michigan	5	282
Montana	9	395
Nevada	15	607
New York	21	1063
Ohio	20	860
South Dakota	18	715
Texas	14	744
Virginia	17	918
Washington	15	618
All States	205	10,136

Every facility in the population and in the sample was assigned to one of the following five strata:

- Hospital-based (HB) facilities. Residents in HB facilities typically have stays that are considerably shorter than residents in non-HB facilities. Furthermore, HB facilities typically have different staffing patterns and cost structures than non-HB facilities. For this reason, HB facilities were included as a stratum.
- Facilities with a high concentration of residents on ventilators/respirators (Hi-Vent). Residents who are on ventilators/respirators are known to be costly to care for and to require more intensive staff resources. Using MDS data, facilities were identified in which 12% or more of their residents were on ventilators/respirators. These facilities fell into the Hi-Vent stratum.
- Facilities with a high concentration of residents with HIV (Hi-HIV). Residents with HIV are known to be costly to care for and to require more intensive staff resources. Using MDS data, facilities were identified in which 10% or more of their residents had HIV. These facilities fell into the Hi-HIV stratum.
- Facilities with a high concentration of Medicare Part A residents (Hi-PartA). The RUG refinement results and the CMI's that result from the STRIVE study are relevant to both the Medicare and Medicaid programs. However, because only a relatively small minority of residents (12.4%) nationally is served in SNFs under Medicare's Part A program, it was necessary to over-sample facilities that served such residents in order to obtain a sufficient number for analysis. Using MDS and SNF claims data, facilities were identified in which 20% or more of their residents were in stays that were paid for under Medicare Part A. These facilities fell into the Hi-PartA stratum.
- All remaining facilities ("Other"). Facilities that did not qualify for any of the four strata described above fell into the "Other" stratum.

The strata were defined hierarchically in the order listed above so that they were mutually exclusive. Thus, if an eligible facility qualified for more than one stratum, it was classified into the first one in the list that it qualified for. Using this approach, every eligible facility in each state was classified into one of the five strata listed. Note that some strata were not represented in some states.

Table 3-2 shows the number of residents in the sample and in the population by stratum. The first pair of data columns in Table 3-2 show unweighted resident counts and percentages for the sample.

The next pair of columns show the sample counts after the case weights described above were applied. The remaining columns show the number and percent of residents that fell into each stratum for the 15 STRIVE states and for the entire nation. These counts are based upon all residents who were active (in a facility) on a given date (March 1, 2006).

Table 3-2. Number of Residents in the Sample and Population by Stratum

Stratum	Unweighted Sample		Weighted Sample		STRIVE States		National	
	Residents	Percent	Residents	Percent	Residents	Percent	Residents	Percent
Hosp-based	863	8.5%	418	4.1%	25,120	4.1%	66,639	4.7%
Hi-Vent	440	4.3%	205	2.0%	13,159	2.1%	19,785	1.4%
Hi-HIV	411	4.1%	39	0.4%	4,439	0.7%	6,010	0.4%
Hi-Part A	4,298	42.4%	1,648	16.3%	111,540	18.1%	233,875	16.4%
Other	4,124	40.7%	7,825	77.2%	460,900	74.9%	1,098,077	77.1%
Total	10,136	100.0%	10,136	100.0%	615,158	100.0%	1,424,386	100.0%

It can be seen that the sample weights dramatically affected the distribution of cases by stratum. For example, in the unweighted sample, 42.4% of the residents fell into the Hi-PartA stratum. However, after applying the sample weights, only 16.3% of the cases fell into this stratum. This shift in the distribution reflects that fact that some of the strata were heavily oversampled. When compared with the two population distributions, it can be seen that the sample weights were successful in producing a weighted distribution that resembled the population.

Comparison of Participating with Non-Participating Facilities

As noted above, several of the steps involved in the sampling process were not random processes. Due to practical constraints, we were forced to treat them from a sampling perspective as if they were random, even though they were not. In order to determine whether this approach was reasonable and whether biases may have been introduced by the non-random selection procedures, two sets of analyses were performed. The first analysis, which is described later in this report, compared facilities that participated in the study with those that refused to participate or were eliminated from the sample by state and regional office staff. The second set of analyses, which is also reported later in this report, compared sample characteristics with population characteristics on selected variables that were deemed to be of importance to the measurement of case mix.

State agencies perform surveys of every certified nursing facility in the nation about once per year. In the course of the survey, data are collected regarding the staffing levels of the nursing home. These data are stored in CMS's OSCAR database. CMS has developed procedures to identify and adjust outliers in the staffing data in order to improve its accuracy. The adjusted data are reported on a quarterly basis on CMS's Nursing Home Compare web site. Staffing levels are, of course, highly relevant to the STRIVE which is aimed at measuring and predicting the use of staff resources. Since the OSCAR staffing data are available for every certified nursing home in the nation, these data provided an opportunity to determine whether the sampling procedures that were used by STRIVE introduced any biases with regard to staffing levels.

OSCAR staffing data were downloaded from the Nursing Home Compare web site on 12/11/2007. This data set contains staffing data collected on the last available regular survey for every certified facility nationally. Since surveys are performed every 9-18 months, the staffing data roughly coincide with the time period during which STRIVE field work was being performed.

Table 3-3 presents mean minutes per resident day for the following categories of facilities:

- Eliminated: facilities that were on the initial STRIVE sampling lists but were eliminated by state and regional office staff because they were unable to participate (due to facility emergencies, bankruptcies, investigations, etc.) or known to have very poor quality.
- Declined: sampled facilities that were invited, but declined, to participate in the study.
- STRIVE sample: facilities that participated in the STRIVE study.
- STRIVE states: all certified facilities in the 15 states that participated in the STRIVE study.
- National: all certified facilities nationally.

Mean minutes per resident day are presented for three categories of staff: RNs, LVNs, and aides. Note that due to the unavailability of staffing data for some facilities, the facility counts in Table 3-3 are slightly lower than those reported elsewhere in this report.

Table 3-3. Mean Minutes Per Resident Day

Facility Category	Number of Facilities	Mean Minutes per Resident Day		
		RN	LVN	Aide
Eliminated	90	36.6	49.6	138.1
Declined	288	37.6	47.5	133.8*
STRIVE sample	200	38.9	43.7	139.3
STRIVE states	6,054	36.8	48.2	139.2
National	14,886	38.5	48.0	141.1

*Significantly different from STRIVE states mean ($p < 0.05$)

95% confidence intervals were computed for the group means in the first three rows of the table (eliminated, declined, and STRIVE sample facilities). If the confidence interval did not include the population value for the STRIVE states, the group mean was considered to be significantly different ($p < 0.05$) from the population value.

Only one of the nine means that were tested was found to be significantly different: the aide mean for facilities that declined to participate (133.8 minutes per day) was significantly lower than the mean for the STRIVE states (139.2 minutes per day). While statistically significant, this difference is relatively small (5.4 minutes per day, or 4.0% lower) in absolute terms. The other eight means were not significantly different from the population means.

Overall, these results suggest that two of the non-random processes that were used during sample selection, elimination of sampled facilities and refusal to participate, did not introduce any substantial bias in the sample with regard to staffing levels as measured by OSCAR data.

Comparison of Sample and Population Statistics

Another set of analyses was performed to check for possible biases in the STRIVE sample. These analyses involved using MDS data to compare the sample with population values on variables that are related in important ways to the measurement of case mix. These results are presented in Tables 3-4, 3-5, and 3-6, below.

Table 3-4 shows the percent distribution for resident gender and for selected activity of daily living (ADL) variables for the sample and for the population. The sample statistics are based upon 10,136 cases and were weighted using the sample weights described above. The sample distributions in the first data column ("STRIVE sample") are based upon items on the special STRIVE MDS that was administered by facilities for study residents. Resident profile table (RPT) data were used to fill in

missing data for individual residents. RPT data were drawn from the national MDS Data Repository and represented the values of data items that were closest in time to the STRIVE study dates for each facility.

The population statistics are based entirely upon RPT data. For the second data column in the table ("STRIVE States"), RPT data were used for all 615,156 residents in the 15 study states who were active (in a facility) on March 1, 2006. For the final data column in the table ("National") the statistics are based upon RPT data for all 1,424,379 residents in the nation who were active on March 1, 2006.

Tables 3-5 and 3-6 present statistics for the sample, for the STRIVE states, and for the nation using the same data sources described above. Table 3-5 shows the percent of residents who had each of the conditions or received each of the treatments listed. Table 3-6 shows the mean age, RUGs ADL, and RUGs cognitive performance scale (CPS) scores for the three groups of residents.

Table 3-4. Comparison of Sample with Population on Gender and Selected ADLs

Variable	Value	STRIVE Sample	STRIVE States	National
AA2 (gender)	1. Male	27.7%	30.9%	30.1%
	2. Female	72.3%	69.1%	69.9%
	Total	100.0%	100.0%	100.0%
G1AA (bed mobility self-perf)	0. Independent	27.7%	29.6%	28.4%
	1. Supervision	6.3%	7.3%	6.3%
	2. Limited assist	16.7%	18.0%	17.4%
	3. Extens assist	29.4%	29.8%	31.7%
	4. Total depend	19.9%	15.3%	16.2%
	5. Did not occur	0.0%	0.1%	0.0%
Total	100.0%	100.0%	100.0%	
G1BA (transferring self-perf)	0. Independent	16.1%	20.1%	19.6%
	1. Supervision	6.2%	7.9%	7.0%
	2. Limited assist	19.7%	19.0%	18.6%
	3. Extens assist	32.1%	30.0%	31.2%
	4. Total depend	24.9%	22.1%	22.7%
	5. Did not occur	1.0%	0.9%	0.9%
Total	100.0%	100.0%	100.0%	
G1HA (eating self-perf)	0. Independent	36.7%	42.7%	43.2%
	1. Supervision	24.9%	25.3%	23.6%
	2. Limited assist	10.5%	9.1%	9.3%
	3. Extens assist	10.4%	8.2%	8.9%
	4. Total depend	17.4%	14.7%	14.9%
	5. Did not occur	0.0%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	
G1IA (toileting self-perf)	0. Independent	10.6%	15.5%	14.9%
	1. Supervision	4.5%	6.3%	5.7%
	2. Limited assist	15.8%	16.0%	15.6%
	3. Extens assist	34.3%	31.6%	32.6%
	4. Total depend	32.8%	30.3%	30.9%
	5. Did not occur	2.0%	0.3%	0.3%
Total	100.0%	100.0%	100.0%	

Table 3-5. Comparison of Sample with Population on Selected Conditions and Services

Variable	STRIVE Sample	STRIVE States	National
Verbal/physical abuse	0.7%	0.8%	0.8%
K5A (perenteral/IV)	1.9%	1.6%	1.7%
K5B (feeding tube)	7.0%	6.6%	6.3%
P1AC (IV medication)	7.1%	7.9%	8.3%
P1AG (oxygen therapy)	11.2%	11.9%	12.4%
P1AI (suctioning)	2.1%	1.1%	1.0%
P1AJ (tracheostomy care)	2.0%	1.0%	1.0%
I1A (diabetes mellitus)	28.9%	29.4%	29.0%
I1V (hemiplegia/hemiparesis)	9.3%	10.5%	10.0%
I1Z (quadriplegia)	0.8%	0.7%	0.8%

Table 3-6. Comparison of Sample with Population on Mean Age and ADL Scale Scores

Variable	STRIVE Sample	STRIVE States	National
Age	79.5	79.7	80.0
RUGs ADL scale score	11.9	10.8	10.9
RUGS CPS scale score	2.9	2.6	2.6

Most of the variables that were chosen for analysis in these tables were selected because of their known importance in resource use classification. The results presented in all three tables show that the sample statistics match quite closely the statistics for all residents in the population in the 15 study states. This suggests that despite the limitations in the sampling methodology, the sample results are capable of producing unbiased estimates of population results on important resident-level variables that are related to resource use.

Strictly speaking, while the sample statistics should provide unbiased estimates of population values for the 15 study states, the sample design does not insure that they can be generalized to the nation as a whole. This is due to the fact that the 15 study states were not drawn randomly but participated on a volunteer basis. Nevertheless, it can be seen that the sample results match the national population statistics to about the same degree as they match the statistics for the 15-state population.

It is always possible that the sample statistics deviate to a large degree on other variables that were not analyzed. However, the variables that were selected represent a fairly broad collection of the types of variables that are known to be important in measuring resource utilization. Thus, it seems reasonable to expect that the results that are obtained from the STRIVE sample represent an unbiased estimate of population values for the 15 states and for the nation as a whole.

Precision of the Sample

As previously discussed in the sampling methodology section, the STRIVE sample design had two goals: (a) to obtain a sample that could be generalized to the national population without bias and with sufficient precision, and (b) to obtain enough cases from certain important special populations of residents to yield sufficient statistical power to support case mix analyses. The current section of the report presents estimates of the precision of the sample, which is relevant to the first goal. The

following section of the report presents data regarding special populations, which is relevant to the second goal.

In the planning phase of the study, estimates were made of the statistical precision that was expected under various sampling scenarios. This analysis used data from the 1995/1997 time study to estimate parameters that were needed to make projections. The results presented below are based upon this methodology and are preliminary estimates of the STRIVE sample's precision. Final estimates will be made later based entirely upon the STRIVE data. These results will be reported during the analytic phase of the study.

The preliminary projections were made using the following methodology.

- Data from the 1995/1997 time study were used to estimate the variance of the individual group means for each RUG group under two sampling scenarios: simple random sampling and cluster sampling (the actual design used was cluster sampling, where facilities served as clusters).
- For each RUG group, the ratio of the variance under cluster sampling was divided by the variance under simple random sampling to yield the design effect for each RUG group.
- Projected variances under simple random sampling were computed for each RUG group under various sample size scenarios.
- For each RUG group within a given sample size scenario, a projected variance was computed by multiplying the anticipated variance under simple random sampling by the design effect for the RUG group.
- A composite variance, across all RUG groups, was computed. This value was computed by multiplying each group's variance by the squared proportion of cases that were expected within each group and summing these crossproducts across groups. This value was used to compute the composite standard error and margin of error. This composite standard error represents that expected standard error of mean staff time for the sample after removing the effect of case mix (RUG groups) from the variance.

Table 3-7, below, presents the projected margins of error for the STRIVE study using the study's actual sample size, as well as the margin of error for the 1995/1997 time study, for comparison.

Table 3-7. Projected Margin of Error for Mean Staff Time

Subgroup	STRIVE Sample	1995/1997 Time Study	Percent Improvement
Medicare Residents			
Nursing time	±3.1%	±4.5%	31%
Therapy time	±2.2%	±3.1%	29%
Non-Medicare Residents			
Nursing time	±1.3%	±2.1%	38%
Therapy time	±7.8%	±12.5%	38%

Table 3-7 presents projected margins of error for the mean nursing time and mean therapy time statistics for two groups of residents: Medicare residents and non-Medicare residents. It can be seen that based upon the actual STRIVE sample size (10,136), the margins of error for Medicare residents is expected to be approximately ±3.1% for nursing time and ±2.2% for therapy time. For non-Medicare residents, the values are ±1.3% for nursing time and ±7.8% for therapy time. Note that the margin of error for therapy time for non-Medicare residents is relatively large because therapy is rare in this subpopulation and the means will be based on a relatively small sample size.

It can be seen from Table 3-7 that each of these values is lower than the respective values for the 1995/1997 time study. The final column of Table 3-7 shows the percent improvement that is expected for the current study when compared with the old time study. The percent improvement is expected to range from 29% to 38%.

Special Populations

As described above, the sampling plan was designed to target certain special populations that were deemed important for case mix analysis but are relatively rare in the population. Based upon a review of the literature and discussions with CMS and with the project's technical expert panel, a list of important special populations was compiled. MDS and other data were then analyzed to determine which of these groups could be successfully targeted. Our goal was to obtain at least 50-100 residents in each of these groups in order to support planned case mix analyses. Table 3-8 presents counts of the number of residents in each of the groups that were obtained.

Table 3-8. Number of Sample Residents in Special Populations

Special Population	Residents	Special Population	Residents
Ventilators	254	Respiratory therapy	329
HIV	253	Suctioning	362
Alzheimers	1,313	Physical/verbal abuse	59
SMI-All	3,003	Burns	30
SMI-Schizophrenia	679	Chemotherapy	49
SMI-Bipolar	279	Traumatic brain injury	112
SMI-Other	2,045	Surgical wound care	653
Deaf/blind	169	Dialysis	176
Deaf	935	Hospice	282
Blind	870	RUG44: BA/BB group	73
Under age 18 years	5	Bariatric (weight>=300 lbs)	72
19-40 years old	133	Paliative care	370
41-64 years old	1,324	Pain	3,805

It can be seen that only three groups fell below the goal of having 50-100 residents. There were only five residents under 18 years of age. This is not surprising because pediatric facilities were specifically excluded from the STRIVE sample and no attempt was made to sample enough pediatric residents for special analysis. There were only 30 residents with burns. Preliminary analysis indicated that these residents are exceedingly rare and that, because they do not tend to cluster in particular facilities, they are not amenable to targeted sampling. The chemotherapy group fell just below the goal with 49 residents. Again, they are very rare in the population and tend not to be concentrated in specialty facilities. Based upon these results, we concluded that we met the special population goals that we had set for all groups where this was feasible.

Special Populations II

It has been of concern that the RUG-III system does not explain the resource use of nursing facility residents with specific kinds of characteristics and/or needs. In addition, there are resident populations in which there is analytic/research interest. Therefore, one explicit goal of STRIVE is to examine and potentially improve how the RUG system provides a valid case-mix measurement for these populations.

Method

A focused list of special populations was first compiled by the subcontractor team, based on the literature and knowledge of issues relating to these populations. Additional groups were identified by CMS and by the STRIVE project's Technical Expert Panel. The final list is provided in Appendix A-12.

The identified populations fell into three groups. First, several of these "special populations" were quite prevalent, and no specific sample targeting was needed (e.g., Alzheimers disease, severe mental illness) – there would be sufficient numbers in any sample drawn. Second, other populations were rare, but it was not possible to target them in a sample as their prevalence in a facility varied greatly. Thus, for example, a facility that had a high number of residents with burns when the sample was determined could not be expected a few months later (during data collection) to have a similarly high prevalence of burn residents. For these populations, analysis would have to be done on whatever numbers were included in the sample. Finally, however, it was possible in the sampling to target a few special populations – residents with AIDS, on ventilators/respirators, funded by Medicare (Part A), and in hospital-based facilities. For further detail on the targeted sampling procedures, please refer to the Sampling Methodology section of this report.

Results

The prevalence of these special populations in the STRIVE sample is provided. For most of these populations, a sample size for analysis of at least 50 was obtained. The special populations where the sample sizes were below 50 were:

- Age ≤18years
- Burns
- Chemotherapy
- RUG groups BB1 or BB2

Care will need to be taken in analysis of these populations, given this low sample size.

Identification of Part A Residents

Table 3-9.

Step	Description	Count	Pcnt
1	Claims recs for STRIVE facs: thru_dt 1/05 - 9/07	225,454	
	Create Stay Records		
2	Stays created from claims recs	123,601	
3	Stays removed for pmt=0 or covered los=0	2,488	2.0%
4	Valid stays	121,113	98.0%
	Match Stays to ECR		
5	Stays that were active on facility study date	3,445	
6	Did not match ECR	238	6.9%
7	Matched ECR	3,206	93.1%
	Match RPT to STRIVE		
8	RPT records for STRIVE facilities	24,595	
9	Finder file match	9,701	96.8%
10	UM manual match	324	3.2%
11	Total RPT records matched to STRIVE residents	10,025	100.0%
	Match STRIVE RPT Recs to Stays		
12	RPT records matched to stay via ECR/finder	1,883	18.8%

13	RPT records matched to stay (#6) via HIC+DOB	115	1.1%
14	Total RPT recs matched to stays (#12 + #14)	1,998	19.9%

Wage Rate Determination and Weighting

A primary objective of the STRIVE study is to use resident characteristics to explain the per diem cost of care. A large part of the cost is composed of nursing facility staff time. In order to accurately calculate costs of staff time, appropriate wage weights are needed.

The following describes the process, criteria and data sources used to arrive at the wage weights used in the cost. It is intended to be read in conjunction with Appendix A-14.

Method

Identification of wage weight sources

A variety of sources were considered by CMS and subcontractors. Their disadvantages and advantages are documented in Appendix A-13 (authored by CMS). Two candidate sources were identified:

1. The Bureau of Labor Statistics/ Occupation and Employment Survey (May 2005 estimates, where industry is "nursing care facilities")
reference: http://www.bls.gov/oes/oes_2005_m.htm
 - diversity of job titles specific nursing home industry
 - nationally representative
 - documentation/data are publicly available
2. 2006-2007 American Association of Homes and Services for the Aging (AAHSA) Nursing Home Salary and Benefits Report
reference: <http://hhcsinc.com/surveys.php>
 - potential wage information for more job titles

STRIVE job titles

The STRIVE job titles were determined by the subcontractor team and meant to encompass the range of possible job roles. Nursing Facilities were allowed to add job roles if the roles that were provided were not sufficient.

Comparison with earlier 95/97 study

Wage data used in the 95/97 study were also provided. These were used in order to provide a basis of comparison with the wage rates obtained from the BLS/OES and AAHSA.

Estimation of per diem costs by job title using BLS/OES and AAHSA

Per diem costs of each job title were calculated using the resident-specific (RST) time collected in the first 10% of the STRIVE data (n=1169 residents). Time per resident by job title was provided by Caretrack Systems. The mean time was calculated in addition to the mean of the non-zero time.

The wages from the earlier 95/97 study, the BLS/OES and AAHSA were not comparable because they were from different years and the effect of inflation was not reflected in the wages. The BLS/OES wages were inflation-adjusted (approximate) to 2006 dollars using the consumer price index from the BLS website (adjustment factor=1.03).

For the 95/97 study, the wages were inflation adjusted to 2006 dollars by comparing the RN wages from the 95/97 study to the RN wages reported in AAHSA. This results in inflation adjustment factors of 1.53 and 1.51 for the 1993 and 1996 wages, respectively.

AAHSA wages were already in 2006 dollars so no adjustment was done. Note that this method assumes that the inflation was constant across all job titles. This is not correct because it is known that CNA wages have increased slightly faster than other job titles.

Evaluation criteria

We compared the wage sources with regard to the following:

Job title match with STRIVE job titles

Comparison of the mean and median wages

Relative wage weights

Difference in the overall average per diem cost for job title

Difference in the average per diem cost (using non-zero time). This was examined in order to estimate the cost of rare staff types.

Results

Of all the resident-specific time that was collected, the STRIVE job title of “CNA/RCT/GNA” comprised about 48.5% of the time, LPN/LVN comprised 14.7%, and RN comprised 12.1% of the time. Altogether, these staff types accounted for about 78.2% of all resident-specific staff time.

We identified 5 main issues for discussion among the subcontractors:

1. STM Job titles that don't match to any source
2. Close match to >1 source, within 5%
3. Close match to >1 source, NOT within 5%
4. Multiple job titles matched to 1 STM job title
5. Job titles that matched to only 1 source

When compared to the earlier time study, the wages are also similar, with the exception of CNAs. As previously mentioned, the CNA wages have increased much faster than other nursing-type job titles. This most likely explains the lower wages from the 95/97 study compared to the more recent BLS/OES and AAHSA data.

Evaluation

Please refer to Appendix A-14.

Job Title Match

In general, both BLS/OES and AAHSA data matched many of the main STM job titles (e.g., CNA, RN). Since AAHSA had more specific job titles than BLS/OES, more than 1 AAHSA job title could be matched to a STM job title (e.g. RN). Additionally, AAHSA had job titles that matched some very specific job titles, which BLS/OES could not (e.g. Activity Aide).

A majority of the differences between the sources were within 10%. One of the AAHSA job titles that matched with LPN/LVN was slightly greater than 10% of the wage for LPN/LVN according to BLS/OES. The largest difference was nearly 20%, which was observed for occupational therapy

aides. However, occupational therapy aides only accounted for 0.31% of the total RST. Table 3-10 identifies these differences.

Table 3-10. Job titles and differences between BLS/OES (2006) and AAHSA

STM Job title	% range difference
CNA GNA RCT	1.0-1.5%
LPN/ LVN	1.0-6.3%
RN	1.0-10%
Respiratory therapist	2.0-2.5%
SW	3.0-3.5%
PT	3.0-4.6%
PT assistant	7.5-8.0%
OT	1.0%
COTA	3.3-4.6%
Dietician	5.2-5.7%
SLP	5.8-6.5%
OT aide	19-20%
Thpy transport	1.0-3.7%

*job titles that are not listed do not have both AAHSA and BLS/OES wages

Comparison of median and mean wages.

When available, the median and mean wages do not appear to differ considerably. The major exception is occupational therapy aides, which had an 8-11% difference between median and means

Relative wage weights

When the mean wage weights were indexed to the CNA wages, the relative wage weights for LPN/LVN and RNs varied modestly between the 2 data sources. According to BLS/OES, LPN/LVNs make 1.75 times the CNA wage and RNs make 2.40 times the CNA wage. When the AAHSA wages are used, LPN/LVNs make 1.89 times the CNA wage, while RN's make 2.33 times the CNA wage.

Difference in the overall mean cost.

Difference in the average per diem cost (using non-zero time). This was examined in order to estimate the cost of rare staff types.

Both cost measures did not appear to differ considerably by sources (within 1-2% difference). Thus, it appears that even the relatively large difference in wages for occupational therapy aides did not have a large impact on the overall per diem cost. Also using median wages instead of mean wages also resulted in less than 1% difference in overall per diem costs (based on 10% sample).

Decision

For all job titles, the BLS/OES hourly wage data should be used. This is due to the well-documented methods and publicly available data. Note at the time only 2006 BLS/OES wages were available, the final wage weights used in the STRIVE are 2007 BLS/OES data. Refer to the following sections of Appendix A-14: "compare mean-median" and "compare mean-median (nonzero)"

Further decisions were made regarding which job roles were to be considered as RN, LPN or Aide costs. These were confirmed by CMS and displayed in the Job Categories section of Appendix A-14.

Therapy Adjustments

As part of the Staff Time Measurement, STRIVE collected the time therapy staff spent caring for residents in the sample. Actual STRIVE-collected therapy time will be used within STRIVE for two purposes. First, it is used to classify residents into Resource Utilization Groups. Second, when costed out (using wage weights), it is part of the dependent variable representing the daily cost of care for each resident in the sample.

Initial evaluation of the therapy times reported in the CareTrack System and from paper forms filled out by facility staff contained less therapy time than expected. The project used the adjusted data to provide more representative measures of the therapy actually given.

The primary measure used to verify the accuracy of therapy times collected as part of the STRIVE STM was the match between the STRIVE RUG III- 53 group distribution among the rehabilitation groups (using these times) and the national distribution from the MDS Repository. Relative to the nation, it appeared that the STRIVE sample had a much greater proportion of Rehab-Medium groups and a smaller proportion of Rehab-Ultra groups. Refer to Appendix A-15, "RUG-53, Part A (chart, final)" and "RUG-53, All (chart, final)".

The following potential reasons for this difference in RUG III-53 group distribution were examined:

- Differences by facility and state
- Differences due to data collection methods (Supervised versus Unsupervised)

The differences in RUG III-53 group distribution could not be explained by differential collection among facilities or states.

When the total therapy time distribution was examined for residents by study schedule, it appeared that the distribution of therapy time was even across the days where collection was supervised. However for the non-supervised days there was considerably less time, as well as fewer residents receiving therapy; (Refer to the Therapy Distribution section of Appendix A-15).

This seemed to be due to the data collection method, since in facilities where there was unsupervised data collection on Tuesday (schedule C) there was much less therapy time compared to nursing facilities where there was supervised data collection on Tuesday (schedules A and B).

As a result, the therapy times were adjusted for this difference in data collection through inflating the STM days and minutes and comparing them with the time reported on the STRIVE MDS (p1baa for days of speech therapy, p1bab for days of occupational therapy, and p1bcb for days of occupational therapy. Note adjustments are performed on therapy time received by residents ("resident" time), by therapy discipline: physical therapy (PT), occupational therapy (OT), and speech language pathologist (SLP).

Adjustment for classification

Days adjustment

- During the supervised data collection (weekdays only):
 - If there are 3 days of 15+ minutes of therapy, then assume that therapy occurred for all 5 weekdays
 - If there are 2 days of 15+ minutes of therapy, then assume that therapy occurred for 3 out of the 5 weekdays
 - If there is 1 day of 15+ minutes of therapy, then assume that therapy occurred for 1 out of the 5 weekdays

- For non-supervised weekday collection
 - Use this data only when there are no days of 15+ minutes during supervised data collection
 - No inflation of days of therapy during non-supervised weekday data collection
- For weekend therapy
- Count weekend days where there was 15+ minutes of therapy
- Compare the sum of the inflated days of supervised data collection and weekend days, or the sum of the non-supervised data collection and weekend days (when applicable) with what is reported on the MDS and use whichever is greater

Minutes adjustment

- Using data from the supervised data collection, determine the average therapy session by summing minutes across days where there was 15+ minutes of therapy
- If the average therapy session cannot be calculated using the supervised data (i.e. did not receive therapy for 15+ min during supervised data collection), use the non-supervised data.
- The total weekly minutes is then the average therapy session multiplied by the days of therapy (obtained from the days adjustment above).

The result of these adjustments was a much closer fit to the national distribution; this match was augmented with the changes in Extensive Services.

Adjustment for dependent variable

In order to adjust for the therapy time for use as a dependent variable, for each resident the ratio of the unadjusted weekly resident time to the adjusted weekly resident time was used to inflate the weekly therapy staff time, from which a per diem time was obtained.

Table 3-11. Example

	Tu	We	Th	Fr	Sa	Su	Mo	Total Time	Avg Therapy session	Days 15+ min
Observed	45	40	40	0	0	0	0	125	42	3
Assumed	✓	✓	✓	✓	0	0	✓	210	42	5

ESTIMATED DAYS of THERAPY* = 5

ADJUSTED WEEKLY MINUTES = 5 x 42 = 210 min

INFLATION FACTOR = 210 min / 125 min = 1.68

If Per Diem Staff Time is 20 minutes, then:

ADJUSTED PER DIEM STAFF TIME = 1.68 * 20 min = 33.6 min

The SAS code to accomplish these adjustments is provided in Appendix A-16.

Extensive Services Adjustment

After adjusting the therapy time for collection differences, it was also realized that the number of groups with extensive services was also low in the STRIVE sample, compared to the National Sample and to Medicare funded residents (defined as having a Part A claim during study period). As

a result, for extensive services (k5a- Parenteral IV; p1ac- IV Med; p1ai- Suctioning; p1aj- Tracheostomy; p1al- Ventilator/Respirator), we assumed that the resident was receiving these services if it was indicated on either their STRIVE MDS or the nearest RPT value.

Comparison of STRIVE RUG III-53 Group Distribution after Adjustments, to Nation and Part A Residents

After adjusting for the extensive services and for therapy collection, the RUG-III 53 group distribution was much closer to the National Distribution, using the entire sample and for just residents who had Part A claims. Refer to the RUG-53, Part A (data) and RUG-53, All (data) sections of Appendix A-15.

Data Preparation and Construction of the Data Set

This section describes the construction and cleaning of the STRIVE 100% Sample SAS Analytical data set. The data set is composed of several elements, derived from a variety of sources. These include:

- STRIVE MDS and STRIVE Addendum data describing resident characteristics
- Staff Time Measurement data from CareTrack.
- RPT data to fill in missing values on the STRIVE MDS (or missing assessments), from Stepwise Systems using data from the national MDS repository
- Wage weights, developed by UM from Bureau of Labor Statistics
- Sample weights, developed by Stepwise Systems
- Facility-level information (e.g., ownership), developed by Stepwise Systems, using OSCAR data
- Eventually, it will also include Drug data on a sub-sample of residents.
- Additional variables are created from merging and analyses of these data, as described below.

The database was assembled using the SAS Statistical Language, Version 9.1.

Steps in Constructing and Cleaning the STRIVE SAS Analytical Data Set:

The following data management steps outline the process of cleaning, merging, calculating, and organizing the various data types listed above into the final analytical data set. There were three major phases in this effort:

- Phase 1: Data Cleaning and Merging
- Phase 2: Additional Variable Calculations
- Phase 3: Create Validation Sample, Create Auxiliary Data Set, and Order Variables.

The steps to accomplish these phases are listed below.

Phase 1: Data Cleaning and Merging:

STEP 1: Check that resident MDS and STM data are correctly matched to each resident. Develop the MDS flag variable to determine residents who do not have an MDS. Use flag to check if data from IFMC were correctly downloaded.

STEP 2: Delete records not in study. These are dummy R0 records assigned by CareTrack for recording non-study resident time.

STEP 3: Delete records without resident identifiers. These are records identified by CareTrack with dummy resident names of the form "ZZZNew." These records may have STM time but MDS data cannot be linked without resident identifiers such as name, date of birth, and gender. As these records are artifacts of data collection, they are deleted from the study data.

STEP 4: Extract date portion of date variables and assign output format (SAS format: date9). Only the date portion of these variables is needed because the time-of-day portion was always missing. STRIVE data collection protocol did not include collecting time-of-day.

STEP 5: Use STRIVE Version Crosswalk to create MDS and Addendum Variable Labels. There were 3 STRIVE MDS versions and 6 STRIVE Addendum versions. Thus, when items changed

between versions, they are given different variable names. See Appendix A-17 – STRIVE Addendum Crosswalk.xls for decisions when slightly different versions of items are cross-walked.

STEP 6: Merge STM data with MDS data. STM data provided by CareTrack cover the STM Nursing Resident-Specific Time (RST), Therapy RST, Non-Resident Specific Time (NRST), and Meals and Breaks, respectively. The data detail the care times for each resident, by each staff role. Times are accumulated across major categories of staff roles (see Appendix A-18 – STRIVE Staff Roles.xls for categories of staff roles). Also see Appendix A-19 – STRIVE STM Variables.xls and Appendix A-20 – STRIVE STM Resolutions.xls gives details about the decisions made in designing the original STM files provided by CareTrack.

STEP 7: Link Facility Unit (facility-level) identifiers to resident-level MDS and STM data. These identifiers will be used to determine how NRST time is allocated, to identify special care units (e.g., high HIV) and STRIVE Supplemental Units (units where STM time but no MDSs were collected). The Study Unit identifiers are based on facility survey data and STM collection notes. For Supplemental Units, use research results that identify which had incomplete RST data to delete resident records.

STEP 8: Determine STRIVE usable observations. Delete records that have zero nursing RST time, not on STRIVE study units, or in supplemental units where all nursing RST time was not collected. Develop data flag for records where the resident was admitted or discharged within the 48-hour STM. The final “100%” data set has 10,486 study residents with valid STM time (nonzero Nursing RST). See Appendix A-21 – STRIVE N of Cases – 100% Data.xls for a diagram of steps to determine the final study residents.

STEP 9: Merge Facility Variables to Resident-level STM and MDS variables. This added external information about facilities, including ownership, chain membership, etc. This step involved checking facility variables for accuracy.

STEP 10: Create a variable representing the resident’s age (in years). Review RPT to determine missing dates of birth. Final variable creation done *after* RPT overlay of MDS missing items in STEPs 15 and 21 below.

STEP 11: Create a “resolved” Medicare Part A Payer Source for each resident, using data set provided by Stepwise systems, developed from CMS Medicare billing data. The logic to resolve differences between these data and the data provided by each facility’s business office is described elsewhere. Final variable creation done *after* RPT overlay in STEPs 15 and 21 below. Create Urban/Rural County variable by facility and merge with resident-level data.

STEP 12: Clean and convert character ICD-9 codes for MDS Section I3 into numeric codes. Separate analysis of the frequency of different ICD-9 in the STRIVE 50% sample were used to group ICD-9 codes into major diagnostic categories. These diagnostics also were contrasted with diagnoses in the MDS “pick lists” (MDS sections I1, I2 and J1), and diagnosis variables added to the database. See Appendix A-22 – STRIVE ICD9 Code Labels.xls and Appendix A-23 – STRIVE ICD9 Variable Names.xls for detail on new diagnoses and checklist resolutions.

STEP 13: Merge Sample Weight variables provided by Stepwise Systems into resident-level data. The development of these resident weights is provided elsewhere. Reorder ID, Facility, MDS, Addendum, and STM variables.

STEP 14: Merge with RPT file from Stepwise Systems. The RPT data provides historic MDS information on STRIVE sample residents. The merge is done using STRIVE identifiers, provided to Stepwise Systems. Detailed information on the logic of developing the RPT file is provided elsewhere.

STEP 15: Use RPT data to overlay missing STRIVE MDS items: overlay all MDS items when STRIVE MDS was not collected, or overlay if STRIVE MDS had greater than 80 percent missing items.

Phase II: Additional Variable Calculations:

STEP 16: Create Scale variables representing major MDS scales, such as the Cognitive Performance Scale, the RAP triggers, etc.

STEP 17: Classify sample residents using the several RUG-III systems (34-group, 44-group, 53-group; hierarchal and CMI-maximizing) using only MDS items (i.e., with therapy times derived from the MDS Section P).

STEP 18: Determine Special Populations. The coding for identifying these populations based on MDS items is provided in Appendix A-12 – Special Population Table and SAS code (UM).xls. As well create variables that identify the relationship between unit identification and MDS identification (e.g., HIV based on diagnoses in the MDS and placement on a “high-HIV” unit).

STEP 19: Calculate STM and Wage variables. Use staff wage data (see Appendix A-14 – Wage Weighting Decisions 12-Mar-08.xls to calculate “relative staff cost” variables for by individual staff roles and major staff categories.

STEP 20: Adjust STM Therapy variables for RUG classification. Issues identified with Therapy times were resolved using day-specific therapies that were presented in the Therapy Adjustments section of this report. The adjusted therapy times are computed to replace the raw therapy variables. Adjustments to STM Therapy as a dependent variable are found in STEP 25 below (e.g. cost).

STEP 21: Creating Medicare Part A and Age variables (after RPT overlay).

STEP 22: Calculate NRST Variables (facility-level totals). Non-resident-specific time is allocated to all residents on a unit, either equally across all residents or proportionately to their staff time (for this staff role). The results of both calculations are retained as separate variables in the database.

STEP 23: Calculate NRST plus Meals and Breaks Allocation variables; equal and proportional NRST.

STEP 24: Create Total Cost Variables. These include accumulations of NRST with direct RST time and wage-weighted RST

STEP 25: Adjusting therapy time as a dependent variable.

1. Dependent variable (therapy)- by discipline:
 - ratio of weekly resident PDA time and adjusted weekly resident time=inflation factor (X)
 - (weekly staff PDA time *X)/7= per diem role staff time

Add NRST to truncated time

Create summary minute and cost variables

Create logs of summary minute and cost variables

Phase 3: Create Validation Sample, Create Auxiliary Data Set, and Order Variables:

STEP 26: Select Validation Sample. One third (N=3,379) of the final analytic sample is identified by random, and reserved for “validation.”

STEP 27: Final Dataset Adjustments. Several minor changes were made to complete the final analytic file.

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1. Reorder variables to keep similar variables together.
 2. Reduce length of SAS variables to reduce storage size of database
 3. Drop 350 residents that do not have an MDS (STRIVE or RPT) and retain in an auxiliary data set.
 4. Drop variables unlikely to be needed (e.g., care times by individual staff roles). All dropped variables are retained in auxiliary data set that can be easily remerged with the primary analytical dataset
 5. Attach SAS value formats to category variables
 6. Sort the data set by Resident ID variable (RESID)

The final SAS analytic dataset is STVRPT_032808.sas7bdat (N = 10,136). The auxiliary dataset is AUXIL_031908.sas7dat. See Appendix A-24 for variable order.

SAS Analytical Data Set Overview:

Final 100% Data Analytical File: *stvrpt_032808.sas7bdat*

This file is resident-level data and sorted on the resident ID variable (RESID, a concatenation of state and STRIVE facility identifier with the STRIVE resident identifier (a sequential number: R1, R2, etc.). The final number of study residents is 10,136; this is the STRIVE study sample and sample weighting (CASE_WEIGHT and STRATUM) is available to produce a nationally representative sample. These residents have an MDS (STRIVE or RPT) and non-zero Nursing RST times.

Missing STRIVE MDS items were over laid with RPT MDS items. RPT is extracted from the national repository of MDS mandated for nursing home facilities. 873 study residents have a complete MDS overlay because no STRIVE MDS was collected. RPT data are also used in the STM Adjustment RUG coding.

This data set includes also includes flags to identify the validation sample, residents admitted/discharged during STM, etc. (see below).

Auxiliary Data:

During the process of data management, several resident records (350 without an MDS) and variables not included in the main analytical data set were put into auxiliary data sets. The main auxiliary set is ***auxil_031908.sas7bdat***. These records/variables can be accessed if needed; as they are also sorted by RESID, they can easily be remerged with the primary analytic dataset).

Analytical Data Set Flags:

Selecting for subsets of residents using the final analytical data set:

1. To select for residents with full Nursing RST time (48 hours) plus MDS (STRIVE or RPT), use the MDS_STM flag. Residents with code 1 (N = 9,721) have an MDS plus STM. Residents with code 0 (N = 415) have an MDS plus less than 48 hours Nursing RST.
2. To select for residents included in the 1/3 validation sample, use the VAL flag. Residents with code 1 (N = 3,379) are in the validation sample. Residents with code 0 (N = 6757) are not in the validation sample.

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3. To select for residents with a STRIVE MDS, use the MDS flag. Residents with code 1 (N = 9,263) have a STRIVE MDS. Residents with code 0 (N = 873) do not have a STRIVE MDS; these residents have a RPT and missing STRIVE MDS items were over laid.
 4. To select for residents with a RPT MDS, use the RPT flag. Residents with code 1 (N=9,824) have a RPT. Residents with code 0 (N = 312) do not have a RPT; these residents have a STRIVE MDS but missing MDS items could not be over laid. (See data cleaning STEP 15 below for detail on RPT overlay.)

Final Analytical Data Set Variable Groups:

See **Appendix A-24** – Proc Contents STRIVE Analytical Data Base 03-28-08.xls for a listing of the variables in each of the following variable groups. Also listed are the SAS variable value formats.

- ID and Weighting Variables
- Flag Variables
- Facility Variables
- MDS Variables (over laid with RPT MDS)
- Addendum Variables
- ICD9 Variables
- New ICD9 Dx Variables
- ICD9 Resolution Variables
- RPT Variables
- Scale Variables
- Special Population Variables
- Unit Combination Variables
- RUG-III MDS Variables
- RUG STM Adjustment Variables
- N_Variables RUG STM Adjustment
- STM Summary Variables