

## FINAL PROGRESS REPORT

**Project Title:** *Preventing/Managing C. Diff for Nursing Home Residents, Admissions, and Discharges*

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## Structured Abstract

**Purpose:** Investigate the care of individuals with *C. difficile* in long-term care

**Scope:** Aim 1 tested the reliability of a scale to evaluate whether staff members follow best practices when using personal protective equipment (PPE). Aim 2 tested a special transfer form to be used by nursing homes and hospitals to identify individuals with infectious conditions. Aim 3 focused on the cost of proper treatment for nursing home residents with *C. difficile*. Aim 4 involved the use of secondary data from nursing homes (NHs) and hospitals to investigate hospital discharges for individuals with *C. difficile* as well as nursing home data related to individuals with drug-resistant infections.

**Methods:** For Aim 1, video-recorded clinical simulations were used in NHs to determine the reliability of the PPE scale for nursing aides. In Aim 2, qualitative methods were used to investigate the difficulties in properly implementing a transfer form in NHs. In Aim 3, statistical simulations estimated cost parameters for good PPE use. In Aim 4, various multivariate statistical methods were used.

**Results:** Aim 1: The PPE scale showed adequate reliability. Aim 2: Failure in implementation of the transfer form largely resulted from lack of history on recordkeeping concerning transfers. Aim 3: Labor costs were the major cost factor in caring for those with *C. difficile*. Aim 4: Analyses of hospital discharge data indicated that individual patient characteristics were the main driver of *C. difficile* in the hospital. Analyses of MDS data showed considerable usefulness in gaining information on drug-resistant infections in NHs.

**Key Words:** *C. difficile*, clinical simulation, nursing homes, PPE, MSRA

## **Preventing/Managing C. Diff for Nursing Home Residents, Admissions, and Discharges**

The original project design involved the development and testing of best practices for preventing and managing *C. difficile* among those who receive care in nursing homes. Initial discussions with stakeholders resulted in a major change in that goal. The stakeholders indicated that best practices were well established. They indicated that investigations addressing other issues would be of more assistance to providers. We responded to their concerns. The final report provides information separately on each of our four revised specific aims. Each section of the report will include five subsections: Purpose, Scope, Methods, Results, and Products.

## **AIM 1: TESTING THE RELIABILITY OF A SCALE DESIGNED TO MEASURE ADHERENCE TO BEST PRACTICES RELATED TO THE USE OF PERSONAL PROTECTIVE EQUIPMENT**

### **PURPOSE** (objectives of the study):

Healthcare-associated infections, such as *Clostridium difficile* infection (CDI), pose a significant threat to the morbidity and mortality of Texas nursing home residents. Competent performance of personal protective equipment (PPE) skills will decrease the risk of spreading CDI to other residents. Investigation of this aim demonstrates the use of clinical simulation scenarios and a PPE skill rating tool to measure certified nursing assistant (CNA) PPE skill competency in selected Texas nursing homes. The clinical simulation scenarios and the PPE rating tool provided information that permitted the study to quantify the CNAs' PPE skills competencies and compare them across three dimensions of PPE utilization between nursing homes. The PPE rating tool demonstrated moderate to strong inter-rater agreement. The clinical simulation scenarios demonstrated that registered nurse (RN) researchers can successfully implement simulation technology in Texas nursing homes. This study confirms that measurement of PPE skills competency can be accomplished utilizing clinical simulation scenarios and a PPE rating tool in situ in Texas nursing homes.

### **SCOPE** (Background, Context, Settings, Participants, Incidence, Prevalence):

Personal Protective Equipment Rating Tool (PPERT): The study utilized the PPERT, developed by a researcher in Toronto, Canada. The study team contacted the developer and obtained written permission to use the PPERT. The PPERT provides a measurement of PPE skills competency while observing health professionals demonstrating PPE skills. The developer found the PPERT to be reliable and valid as a measure of health professionals' PPE skills competency levels when performing PPE skills during a serious game computer program in an acute care setting. This study investigated utilization of the PPERT to measure CNA PPE skills competency when performing PPE skills during a clinical simulation scenario in a long-term care

setting. The objective of the PPERT is to provide a measurement of health professional competency in avoiding potential cross-contamination of infectious organisms. The PPERT utilizes a five-category scale to rate six dimensions of PPE skills competency while performing contact precautions. The rater assigns one of five category ratings, ranging from 1 to 5, to each of six dimensions.

**Data Collection in Nursing Homes:** The PPERT was used to judge the skills of nursing home aides when facing a resident with an infectious disease.

**METHODS** (Study Design, Data Sources/Collection, Interventions, Measures, Limitations):

**PPERTE:** The study collected data from seven RN raters recruited and trained for inter-rater reliability testing of the PPERT. The seven RN raters completed one PPERT form for each of the eight videos, providing rater identification, video identification, and a category rating score for each of the six dimensions of the PPERT. The seven RN raters each returned eight completed PPERT forms for analysis, resulting in 56 PPERT forms. The study recorded the category rating scores on a spreadsheet for access and analysis. The study also scanned the PPERT forms and retained the hard copies for archiving purposes.

**Data Collection in Nursing Homes:** After completion of the laboratory-conducted PPERT inter-rater reliability testing, the study recruited three RNs experienced in performing, teaching, and evaluating PPE skills in the nursing home setting. The study trained these RNs to conduct clinical simulation scenarios and capture the data from the CNA performances on video-recording equipment. These three RN researchers also participated in the inter-rater reliability testing of the PPERT discussed in the previous section.

The study involved a clinical simulation scenario that required the CNA to provide personal care to a nursing home resident on contact precautions for CDI in a simulated

clinical environment. The script included a bed-bound nursing home resident in need of personal care for soiled briefs. The RN researcher briefed the CNAs on the clinical simulation scenario script prior to the start of each clinical simulation scenario. The script detailed that PPE be available to the CNA outside the resident's room. The CNA starts the clinical simulation scenario by selecting and donning PPE, then enters the room to provide personal care to the resident by changing the soiled briefs, and completes the scenario by doffing the PPE.

Three RN researchers enlisted the cooperation of a total of eight nursing homes to participate in the clinical simulation scenario portion of the study. Each of the three RN researchers recruited 40 CNAs to participate in the clinical simulation scenario study from their participating nursing homes. In total, 120 CNAs participated in the clinical simulation scenario study. Each video was rated using the PPERT by the two nurses who did not do the initial videotaping.

**RESULTS** (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications):

**PPERTE:** An analysis of the PPERT data to obtain the inter-rater agreement coefficient between total video scores in Table 1 shows that the mean kappa was 0.66 (range, 0.42 to 0.89), with a mean observed agreement of 93.48% (range, 88.75% to 97.45%). A kappa of 0.66 is strong inter-rater agreement.

Inter-rater Agreement Between Total Video Scores  
for Laboratory Testing of PPERT  
Obs = Observed    Exp = Expected    Agrm = Agreement  
Avg = Average

<b>Raters</b>	<b>Obs Agrm %</b>	<b>Exp Agrm %</b>	<b>Kappa</b>
Rater 1 vs Rater 2	97.45%	77.81%	0.8851
Rater 1 vs Rater 3	94.91%	79.63%	0.7500
Rater 1 vs Rater 4	90.90%	82.95%	0.4661
Rater 1 vs Rater 5	93.75%	83.01%	0.6322
Rater 1 vs Rater 6	94.53%	81.45%	0.7053
Rater 2 vs Rater 3	95.99%	77.97%	0.8179
Rater 2 vs Rater 4	94.00%	80.62%	0.6903
Rater 2 vs Rater 5	93.13%	77.69%	0.6919
Rater 2 vs Rater 6	88.75%	78.50%	0.4767
Rater 3 vs Rater 4	93.88%	83.19%	0.6357
Rater 3 vs Rater 5	94.25%	81.75%	0.6849
Rater 3 vs Rater 6	94.83%	78.72%	0.7573
Rater 4 vs Rater 5	95.25%	84.00%	0.7031
Rater 4 vs Rater 6	89.76%	82.31%	0.4209
Rater 5 vs Rater 6	90.75%	80.41%	0.5279
	<b>Avg 93.48%</b>	<b>Avg 80.67%</b>	<b>Avg 0.6564</b>

Nursing Home Study: An analysis of the PPERT data from the nursing homes to obtain the inter-rater agreement coefficient for total video scores showed a mean kappa of 0.58, with a mean observed agreement of 94.13%.

Inter-rater Agreement Between Total Video Scores for  
Nursing Aides

Obs = Observed    Exp = Expected    Agrm = Agreement    Avg = Average

<b>Rater</b>	<b>Obs Agrm %</b>	<b>Exp Agrm %</b>	<b>Kappa</b>
Rater A vs Rater B	93.18%	85.94%	0.5150
Rater A vs Rater C	94.24%	83.78%	0.6447
Rater B vs Rater C	94.96%	88.05%	0.5784
	<b>Avg 94.13%</b>	<b>Avg 85.92%</b>	<b>Avg 0.5794</b>

**LIST OF PUBLICATIONS AND PRODUCTS** (Bibliography of Outputs from the Study):

Planned products include a journal article detailing the laboratory testing of the PPERT and a journal article detailing the results of the simulations with nursing aides.



## **AIM 2: TESTING A TRANSFER INFORMATION FORM TO BE USED BY NURSING HOMES**

### **PURPOSE** (objectives of the study):

The purpose of this study was to examine nursing home staffs' perceived challenges when implementing a transfer form to promote cross-site communication between nursing home staff and ED/hospital staff when transferring nursing home residents with suspected *Clostridium difficile* infection (CDI) from the nursing home to the ED/hospital.

### **SCOPE** (Background, Context, Settings, Participants, Incidence, Prevalence):

As part of a larger study on healthcare-acquired infections in long-term care, three participating nursing homes, all located in central Texas, were asked to fill out the transfer form on all residents transferring from the nursing home to the ED/hospital.

### **METHODS** (Study Design, Data Sources/Collection, Interventions, Measures, Limitations):

The research team subsequently engaged 10 key nursing home staff members, representing unit charge nurses, directors of nursing (DON), and assisted directors of nursing (ADON), in individual interviews. The interviews focused on each staff member's experience implementing the transfer form. The resulting interview records from the individual interviews were summarized using thematic content analysis.

### **RESULTS** (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications):

Key challenges of implementing a transfer form for nursing home residents with suspected CDI emerged from the analysis of the individual interviews. These challenges were the following: having no dedicated individual for keeping an updated list of resident transfers, where the residents was transferred, and a copy of the transfer form; lack of uniform training across nursing leadership on the use of the transfer form; and lack of easily retrievable electronic resident health information.

Due to constrained resources and a lack of incentives, nursing home staff did not effectively implement the transfer form for residents with suspected CDI. Future attempts at facilitating cross-organization communication should focus on resource development (including inclusion of residents and family members as resources) or the creation of alternatives that are not resource intensive. Creating incentives for tracking and reporting cases of CDI, using the 'present-on-admission' hospital reimbursement policies as an example, should also be considered.

**LIST OF PUBLICATIONS AND PRODUCTS** (Bibliography of Outputs from the Study):

A paper for submission to a professional journal is being prepared.

### **AIM 3: ESTIMATING THE COST OF USING PERSONAL PROTECTIVE EQUIPMENT WHEN CARING FOR NURSING HOME RESIDENTS**

#### **PURPOSE** (objectives of the study):

Infections such as *Clostridium difficile* (*C. diff*) are an increasing problem in healthcare settings. Although reducing infections through better antibiotic stewardship may be possible, contact precautions along with patient isolation are currently the main avenues used to reduce transmission once a case is suspected or diagnosed. Work on this project aim examined metrics needed to make the business case for proper care and contagious infection prevention in nursing homes.

#### **SCOPE** (Background, Context, Settings, Participants, Incidence, Prevalence):

Nursing homes in Texas

#### **METHODS** (Study Design, Data Sources/Collection, Interventions, Measures, Limitations):

Guidelines and related resources for contact precautions and patient isolation in nursing homes were identified. Nursing homes were surveyed to measure time and resource costs. Four general processes were captured: 1) case identification, 2) preparation of the isolation room, 3) treatment of the resident, and 4) transfer to an acute care facility. Simulation with bootstrap estimation was used to identify personnel labor time and direct labor costs and consequences associated with the level of procedural compliance.

#### **RESULTS** (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications):

Proper *C. diff* care costs vary considerably and are highly dependent upon the amount of time devoted to daily care activities and the length of time the patient requires isolation and contact precautions. Assuming perfect compliance, additional labor costs range from less than \$20 to almost \$200 per resident day.

Infections such as *C. diff* pose a health threat to nursing homes residents and staff and require special care processes for a week or longer. The results of this study suggest that the additional costs of proper *C. diff* care could easily exceed the daily Medicaid or other fixed-payment rate provided for typical long-term nursing home residents, which may discourage nursing homes from using proper infection prevention.

**LIST OF PUBLICATIONS AND PRODUCTS** (Bibliography of Outputs from the Study):

A paper is being prepared for submission to a professional journal.

#### **AIM 4: INVESTIGATING THE USEFULNESS OF SECONDARY DATA FROM HOSPITALS AND NURSING HOMES IN UNDERSTANDING *C. DIFF* AND HEALTHCARE-ASSOCIATED INFECTIONS**

Two databases were used to address this aim. Each will be discussed separately.

##### **TEXAS DISCHARGE DATA STUDY**

**PURPOSE** (objectives of the study):

*Clostridium difficile* infection (CDI) is a dangerous and potentially life-threatening antibiotic-associated healthcare-acquired infection. The incidence of CDI in US acute care hospitals has increased in recent years, with newer cases trending toward increased severity and treatment resistance. The purpose of this study was to compare facility and individual characteristics between those patients identified as having developed CDI in the hospital and those identified as having developed CDI in the community.

**SCOPE** (Background, Context, Settings, Participants, Incidence, Prevalence):

Data for this study were obtained from the 2011 Texas hospital inpatient discharge public use data file, maintained by the Texas Health Care Information Council (THCIC). We present descriptive individual and facility characteristics of inpatient discharges with hospital-acquired CDI and community-acquired CDI (i.e., 'present on admission'). The likelihood that CDI was hospital acquired was modeled using logistic regression.

**METHODS** (Study Design, Data Sources/Collection, Interventions, Measures, Limitations):

The data files from 2011 were downloaded, and 19,489 hospitals were analyzed in this study. Some facilities were excluded from reporting to the Center for Health Statistics, whereas other facilities preferred to pay a fine rather than report to DSHS. In this study, 1,169 hospital observations were excluded due to missing values for the response or explanatory variables. Of all the observations, 2,708 discharges were HAI (hospital acquired) CDIFF cases, and 16,781 discharges were POA (community acquired, or present on admission) CDIFF cases.

**RESULTS** (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications):

Of all discharges indicating CDI acquired in the hospital, 69% were for patients over 65 years, and less than 2% were in patients between ages 0 and 17 years. Fifty-five percent of these discharges were for female patients, and the majority of the discharges were for White patients (68%). Multivariate analysis revealed that individual patient characteristics were more predictive of hospital-acquired CDI than facility identity was.

These results show that the driving factors of hospital-acquired CDI in Texas in 2011 were individual characteristics rather than hospital characteristics. This finding is of interest, as CMS has introduced a series of performance-based payment changes that includes nonpayment for hospital-acquired infections. These results may speak to the impact of the Acute Inpatient Prospective Payment System (IPPS) on hospital and patient outcomes, specifically on patient safety. The use of pay-for-performance measures, such as present-on-admission (POA) reporting, may improve hospital performance and patient outcomes.

**LIST OF PUBLICATIONS AND PRODUCTS** (Bibliography of Outputs from the Study):

A paper is being prepared to submit to a professional journal.

## THE MDS MDRO STUDY

### **PURPOSE** (objectives of the study):

With the revision of the MDS, data are now available on multidrug-resistant organisms (MDROs) in the nursing home population. This new information allows for better prevalence measures in nursing homes and a better understanding of the movement of persons with an MDRO between the hospital and long-term care settings.

### **SCOPE** (Background, Context, Settings, Participants, Incidence, Prevalence):

Data were collected for the census of nursing home residents in Medicare- or Medicaid-certified nursing homes across the entire United States. These Minimum Data Set (MDS) assessments occurred between October 1, 2010, and December 31, 2011.

### **METHODS** (Study Design, Data Sources/Collection, Interventions, Measures, Limitations):

We used a resident-level “active MDRO” infection indicator, measured at admission and periodically thereafter (at least quarterly), and detailed tracking records that captured details about every admission into and discharge from nursing homes, and we collected demographic data, including location. Information from just over 4,000,000 residents was assessed during this period.

### **RESULTS** (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications):

We found a very high volume of bidirectional patient flow between NHs and acute care hospitals (ACHs), indicating the need to study MDRO infections in NHs as well as in hospitals. We calculated that 4.24% of nursing home residents had an active

MRDO diagnosis on at least one assessment during the study period. This rate varied significantly by gender, age, urban/rural status, and NH state. Our analysis of MDS data revealed that 2% of NH discharges to ACHs involved a resident with an active MDRO diagnosis. Conversely, 1.8% of NH admissions from an ACH involved a patient with an active MDRO diagnosis. These numbers indicate almost identical MDRO prevalence for both directions during care transition. Among the 176,806 residents with an active MDRO infection on at least one assessment, we detected a change in nursing home MDRO status from “no infection” (0) to “infection” (1) for 104,988 residents (59%). Of those 104,988 residents who had a change in infection status from 0 to 1, we found that 51% had the change occur in the NH, and 49% had the change occur in the ACH. This finding provides some evidence that the “source” of the MDRO infection for NH residents can be either the NH or the hospital, with roughly equal probability.

**LIST OF PUBLICATIONS AND PRODUCTS** (Bibliography of Outputs from the Study):

The MDS paper has been accepted for inclusion in an AHRQ-sponsored issue of a professional journal that focuses on infectious disease.