

AHRQ GRANT FINAL PROGRESS REPORT TEMPLATE

Title Page

Title of Project: Rapid Understanding of Best Practices in Rural Intensive Care (RUBRIC)

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Structured Abstract

Purpose: Our overall objective was to develop a toolkit of strategies used by high-performing rural ICUs and to disseminate this toolkit to improve ICU care for rural communities.

Scope: Rural ICUs can save the lives of the critically ill, but even at the best of times they are challenged to ensure access and quality to their patients. Therefore, maximizing rural ICU care is beneficial to rural communities, rural hospitals, and the larger healthcare system.

Methods: In Aim 1, we conducted a national survey of rural ICUs to understand how they adapted during the COVID-19 pandemic. In Aim 2, we conducted retrospective cohort studies of patients admitted to rural ICUs using data from Medicare to examine outcomes for rural ICU care. In Aim 3, we conducted qualitative interviews and focused ethnography at one rural hospital in Michigan to characterize rural ICU care quality.

Results: For Aim 1, we found that all rural ICUs had cared for at least one COVID patient, and nearly 80% of rural ICUs felt that their resources were strained and that their hospital was overwhelmed during the pandemic. For Aim 2, we found that nearly one in 10 critically ill patients receive care in rural ICUs. Patients admitted to rural hospitals tended to be older, female, and from areas of greater socioeconomic disadvantage. The use of intermediate care within rural ICUs has nearly doubled over 10 years. Although ICU mortality was similar between rural and urban ICUs, mortality for patients in rural intermediate care was significantly higher than for patients in urban intermediate care. For Aim 3, we found that transfers out of the hospital for critically ill patients are common and are based primarily on relationships with outside hospital physicians that tends to ease the process of transfer.

Key Words: intensive care unit, ICU, critical care, rural, intermediate care

Purpose (Objectives of Study):

Our overall objective was to develop a toolkit of strategies used by high-performing rural ICUs and to disseminate this toolkit to improve ICU care for rural communities. We integrated nationwide surveys to characterize rural ICU adaptations in response to COVID-19, national claims data to compare the effectiveness of rural ICU care, and detailed hospital assessments to define strategies used by high-performing rural ICUs. To do so, we proposed three Aims: Aim 1: To characterize adaptations made by rural ICUs in response to COVID-19. Aim 2: To estimate the effect of increased healthcare demand due to COVID-19 on survival for acute respiratory failure among rural ICU patients. Aim 3: To define best practices of rural ICUs through detailed hospital assessments.

Scope (Background, Context, Settings, Participants, Incidence, Prevalence):

Individuals in rural communities experience greater healthcare disparities compared with non-rural individuals. These communities have higher levels of poverty and rates of uninsurance than non-rural populations. In part due to these socioeconomic challenges, rural communities experience healthcare disparities at baseline. Rural individuals are more likely to have heart disease, chronic obstructive pulmonary disease, cancer, stroke, and obesity.

Rural ICUs can save the lives of the critically ill, but even at the best of times they are challenged to ensure access and quality to their patients. Rural ICUs are bastions of life support for critically ill patients who might otherwise die without it. Rural ICUs are less likely to be staffed by ICU-trained physicians or nurses and are often subject to intermittent shortages in staff. Rural ICUs have fewer ICU beds—1% of ICU beds in the U.S. are in rural hospitals. Rural hospitals, with tighter margins, are unable to stockpile ventilators in anticipation of increased demand. Rural hospitals are also less likely to receive emergency or volunteer support in staffing or resources during crises than their non-rural counterparts. Therefore, maximizing rural ICU care is beneficial to rural communities, rural hospitals, and the larger healthcare system.

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

Aim 1: We conducted a national survey of rural ICUs. We contacted ICU directors or nurse managers from a 50% random sample of ICUs nationally using the 2019 American Hospital Association Annual Survey to identify rural hospitals with ICUs. Overall, we contacted 318 ICUs nationally and were able to fully complete surveys for 138 ICUs, achieving a response rate of 43.4%. One limitation to our study was its response rate. We found that there was a tremendous amount of turnover among ICU nurse managers during the time period when we were completing our survey, which made it difficult to establish rapport, make connections, and receive completed surveys. At the same time, we would like to acknowledge that a survey response rate of 43% for this type of national study is quite good, based on prior examples from the literature.

Aim 2: We conducted retrospective cohort studies of patients admitted to rural ICUs using data from Medicare. In three separate studies, we examined outcomes for these patients. In the first, we sought to examine relationships between rurality, intermediate care, and mortality for mechanically ventilated patients. Intermediate care is a type of ICU care that has increased in incidence since 2010. Little is known about the types of patients who receive intermediate care, their outcomes, or why they receive intermediate care as opposed to general or traditional ICU care. We studied Medicare beneficiaries aged 65 and over who received invasive mechanical ventilation between 2010 to 2019. Multivariable logistic regression was used to estimate the association between admission to rural or urban hospital and 30-day mortality with separate analyses for patients in intermediate and intensive care. Models were adjusted for age, sex, area deprivation index, primary diagnosis, severity of illness, comorbidities, and hospital volume.

In the second study, we examined changes in patient characteristics, hospital characteristics, and 30-day mortality among critically ill patients in the U.S. cared for in rural and urban ICUs between 2010 and 2019. We studied critically ill Medicare beneficiaries aged 65 and over hospitalized who were hospitalized between 2010 to 2019 in rural and urban intensive care units. Multivariable logistic regression was used to estimate the association between year of admission and mortality by admission to rural and or urban hospitals. The model was adjusted for patient age, sex, area deprivation index, primary diagnosis category, severity of illness, and comorbidities.

Finally, we sought to evaluate changes in end-of-life treatment intensity between urban and rural patients in the U.S. between 2010 and 2019. We performed a retrospective cohort study of all fee-for-service Medicare beneficiaries aged 65 and older hospitalized from 2010 to 2019 to identify differences changes in end-of-life treatment intensity between urban and rural hospitals over time. Rural and urban hospitals were identified by linking Medicare claims to the American Hospital Association Annual Survey and using the National Center for Health Statistics Urban-Rural Classification scheme. We included all patients who died in each year of analysis and identified factors related to treatment intensity at the end of life, including intensive care unit (ICU) utilization and procedures during terminal hospitalizations. Procedures were identified using ICD-9-CM and ICD-10-CM codes. Multivariable logistic regression accounted for age and clustered patients at the hospital level.

Aim 3: We conducted qualitative interviews and focused ethnography at one rural hospital in Michigan. Overall, we conducted seven interviews with physicians, nurses, and other key informants. We spent 2 days at the hospital observing routine ICU care. We then used interpretative description to analyze qualitative data.

Results (Principal Findings, Outcomes, Discussion, Conclusions, Significance, Implications):

Aim 1: Our principal findings were that 1) all rural ICUs had cared for at least one COVID patient; 2) nearly 80% of rural ICUs felt that their resources were strained and their hospital was overwhelmed during the pandemic; 3) most rural ICUs had an average of seven ICU beds but only four ICU nurses and two ICU physicians per 24 hours; and 4) most rural ICUs did not use telecritical care services. Other important findings were that 1) 94% of respondents were nurses; 2) most rural ICUs were mixed medical-surgical ICUs; 3) nearly all rural ICUs provided vasopressors and mechanical ventilation to patients, but fewer provided intermittent (36%) or continuous (12%) hemodialysis; and 4) only one rural ICU provided ECMO (0.7%). These findings suggest that rural ICUs recognized the challenges that they faced during COVID-19, placing rural ICU patients at risk of harm during the pandemic. Although most work has focused on the lack of ICU beds within rural communities, an equally important stressor is the lack of ICU-trained nurses and physicians in these communities. Because ICU care is mandated to provide 1:1 or 1:2 nurse:patient ratios in the U.S., many rural ICUs may be understaffed to provide high-quality care to their critically ill patients. This work was presented at the 2023 American Thoracic Society International Conference, and we are currently preparing a manuscript for submission.

Aim 2: Our principal findings were that 1) nearly one in 10 critically ill patients receive care in rural ICUs; 2) patients admitted to rural hospitals tended to be older, female, and from areas of greater socioeconomic disadvantage; 3) patients admitted to urban ICUs were more likely to receive mechanical ventilation or renal replacement therapy; 4) rural ICU patients were more likely to be transferred to other acute care hospitals compared with urban ICU patients; 5) rural patients were less likely to be discharged to hospice than urban patients (24.9% vs 30.6%, respectively); 6) the use of intermediate care within rural ICUs has nearly doubled over 10 years; 7) ICU mortality was similar between rural and urban ICUs (47.0% and 47.2%, respectively); and 8) adjusted 30-day mortality for patients in rural intermediate care was significantly higher (35.8%) than for patients in urban intermediate care (30.1%).

These findings suggest that ICU care quality may be similar between rural and urban ICUs; however, there may be important differences in care between rural and urban intermediate ICU care. There is great opportunity to evaluate the types of patients receiving intermediate care and to improve care within these units. Furthermore, hospitalized rural patients at the end of life may be less likely to receive hospice care, perhaps due to availability of hospice resources in rural communities. These three studies were presented at the 2023 ATS International Conference. The first study has been submitted for publication and is currently under review. Studies 2 and 3 are being prepared for submission.

Aim 3: Our principal findings were that 1) the smaller ICU team led to more uniform goals with significant investment in patient care; 2) ICU teams seemed to have familiarity with patients from the community; and 3) transfers out of the hospital for critically ill patients are common and based primarily on relationships with outside hospital physicians that tends to ease the process of transfer.

List of Publications and Products (Bibliography of Published Works and Electronic Resources from Study):

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