MANAGEMENT OF PATIENTS IN THE INTENSIVE CARE UNIT: COMPARISON VIA WORK SAMPLING ANALYSIS OF AN ACUTE CARE NURSE PRACTITIONER AND PHYSICIANS IN TRAINING

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• **BACKGROUND**  Little is known about aspects of practice that differ between acute care nurse practitioners and physicians that might affect patients’ outcomes.

• **OBJECTIVE**  To determine if time spent in work activities differs between an acute care nurse practitioner and physicians in training (pulmonary/critical care fellows) managing patients’ care in a step-down medical intensive care unit.

• **METHODS**  Work sampling techniques were used to collect data when the nurse practitioner had 6 months’ or less experience in the role (T1), after the nurse practitioner had 12 months’ experience in the role (T2), and when physicians in training provided care on a rotational schedule (nurse practitioner not present, T3). These data were used to estimate the time spent in direct management of patients, coordination of care, and nonunit activities.

• **RESULTS**  Results for T1 and T2 were similar. When T2 and T3 were compared, the nurse practitioner and the physicians in training spent approximately half their time in activities directly related to management of patients (40% vs 44%, not significantly different). The nurse practitioner spent more time in activities related to coordination of care (45% vs 18%; \( P < .001 \)) and less time in nonunit activities (15% vs 37%; \( P < .001 \)).

• **CONCLUSION**  The nurse practitioner and the physicians in training spent a similar proportion of time performing required tasks. Because of training requirements, physicians spent more time than the nurse practitioner in nonunit activities. Conversely, the nurse practitioner spent more time interacting with patients and patients’ families and collaborating with health team members. (American Journal of Critical Care. 2003;12:436-443)

Outcomes have been compared between care managed by an acute care nurse practitioner (ACNP) and care managed by a physician in only a limited number of studies.\(^1\)\(^-\)\(^10\) In most of these studies, patients’ outcomes or financial outcomes were compared, for example, morbidity, length of stay, costs, or satisfaction after introduction of one\(^1\)\(^-\)\(^2\) or more\(^3\)\(^-\)\(^5\) ACNPs or a team made up of ACNPs and physician assistants (PAs)\(^6\)\(^-\)\(^7\) to a practice setting. Most studies reported beneficial outcomes. For example, Dahle et al\(^1\) reported lower total hospital costs \( (P < .03) \) during the year a nurse practitioner participated in care delivered to patients with heart failure, with primary savings in ancillary, laboratory, respiratory therapy, and electrocardiographic costs. Spisso et al\(^3\) reported a decrease in length of stay and improved discharge documentation when nurse practitioners joined a trauma service. Russell et al\(^4\) compared outcomes for neuroscience patients managed by 2 ACNPs and a retrospective sample of patients admitted to the same unit who were managed by residents. ACNP-managed patients had a shorter stay in the ICU \( (P < .001) \), a shorter stay...
in the hospital ($P = .03$), a lower rate of urinary tract infection and skin breakdown ($P < .05$), and a shorter time to discontinuation of the Foley catheter and mobilization ($P < .05$). Rudy et al$^6$ compared the activities performed by an ACNP-P A team with activities of residents managing medical patients in an acute care setting. Compared with residents, the ACNP-P A team was more likely ($P < .05$) to discuss patients’ problems with the nursing staff and to interact with patients’ family members. Residents managed more patients, participated more actively in patient rounds, and spent more time in lectures and conferences ($P < .05$).

**Table 1** Practice responsibilities of ACNP and PITs during 3 observation intervals in the SD-MICU

<table>
<thead>
<tr>
<th>Interval</th>
<th>ACNP</th>
<th>PITs</th>
</tr>
</thead>
<tbody>
<tr>
<td>T&lt;sub&gt;1&lt;/sub&gt;</td>
<td>All SD-MICU admissions</td>
<td>None</td>
</tr>
<tr>
<td>T&lt;sub&gt;2&lt;/sub&gt;</td>
<td>All SD-MICU admissions</td>
<td>All patients in long-term acute care hospital’s ventilator unit (n = 14)</td>
</tr>
<tr>
<td>T&lt;sub&gt;3&lt;/sub&gt;</td>
<td>None (ACNP not in unit)</td>
<td>Consultations, clinic, other rotations (other ICUs), training activities</td>
</tr>
</tbody>
</table>

ACNP indicates acute care nurse practitioner; PITs, physicians in training; SD-MICU, step-down medical intensive care unit; T<sub>1</sub>, when ACNP had <6 months’ experience in the role; T<sub>2</sub>, after ACNP had 12 months’ experience in the role; T<sub>3</sub>, when ACNP was not present and PITs provided all care.

Although these studies suggest that the ACNP role is associated with good outcomes, they provide limited information about aspects of ACNP practice that might explain why patients’ outcomes differ.$^{11}$ For example, it is not clear whether these differences are due to more timely monitoring and adjustment of interventions, greater continuity of care, differences in patients’ acuity or patient caseload, or other factors.$^{10-12}$

The introduction of an ACNP into the step-down medical intensive care unit (SD-MICU) at the University of Pittsburgh Medical Center, a tertiary care center, provided the opportunity to prospectively obtain data about the time management of an ACNP and physicians in training when managing the care of patients admitted to an SD-MICU. The following research questions were addressed:

- Are there changes in the proportion of time spent in routine management of patients, coordination of care, and nonunit activities by an ACNP managing the care of patients in an SD-MICU when comparisons are made between the initial and subsequent year of employment?
- Are there differences in the proportion of time spent in these activities by an ACNP and physicians in training when managing the care of patients in an SD-MICU?

**Materials and Methods**

A causal comparative longitudinal design with 19 months of data collection (January 2000-July 2001) was used. Data were collected during 3 periods: (1) when the ACNP had 6 months’ or less experience in the role (T<sub>1</sub>), (2) after the ACNP had 12 months’ experience in the role (T<sub>2</sub>), and (3) when physicians in training (n = 6) provided care on a rotational basis (ACNP not present, T<sub>3</sub>; Table 1). The data were collected by 2 graduate nursing students and 2 members of the research team (F.J.T., C.S.) trained in work sampling procedures.$^{13-15}$

**Setting**

The setting for the study was a 6-bed SD-MICU, 1 of 10 ICUs located at the University of Pittsburgh Medical Center. Patients admitted to the SD-MICU have stable or decreasing needs for mechanical venti-
lation, have stable hemodynamic parameters, and are in the recovery phase of their critical illness.

The nurse-to-patient ratio varied from 1:2 (7 AM to 3 PM) to 1:3 (3 PM to 7 AM). A respiratory therapist was assigned to the unit on all shifts. Six attending physicians provided care on a rotating (1 month) basis. Each attending physician was responsible for medical management of patients admitted to the SD-MICU and an adjacent 14-bed high-acuity MICU. In addition, the service was responsible for management of 14 ventilator-dependent patients in a long-term acute care hospital located 3.2 km (2 miles, a 15-minute drive) from the subacute-MICU.

Sample
The sample was made up of 1 certified ACNP with a master’s degree employed by the university-affiliated practice plan of the service administratively responsible for the unit, and 6 physicians in training who rotated through the SD-MICU once (2 critical care fellows) or multiple times (4 pulmonary fellows) during their fellowship. Both providers (ACNP and physicians in training) were responsible for managing the care of all patients admitted to the unit 5 days a week (Monday-Friday) in collaboration with the attending physician. This role included assessment, diagnosis, and writing all orders for care, including orders for weaning and extubation. Both providers worked an 8- to 10-hour day during daylight hours. During the providers’ off hours, SD-MICU coverage was provided by residents, and weekend coverage was provided by an attending physician. The physicians in training were also on call 1 night per week and 1 weekend night per month in addition to being responsible for a 2-hour outpatient clinic on a weekly basis. The institutional review board granted approval for the study to be conducted without written informed consent. The ACNP and the physicians in training provided verbal consent to participate in the study.

Instrument
The Clinician Activities Tool was designed to document time spent in various activities during management of patients in a critical care setting. The tool includes 42 activities organized into 3 categories and 9 subcategories (Table 2). The first category, routine management of patients, included activities required to assess, diagnose, plan, evaluate, and document patients’ progress. The second category, coordination of care, included activities to facilitate patients’ care and interactions with patients and patients’ families. The third category, nonunit activities, included activities that did not directly relate to management of patients in the SD-MICU, for example, education, meals, and sleeping after being on call. These categories were intended to separate required work (routine management of patients) and interactions with patients and patients’ families. The third category, nonunit activities, included activities that did not directly relate to management of patients in the SD-MICU, for example, education, meals, and sleeping after being on call. These categories were intended to separate required work (routine management of patients), facilitative work (coordination of care), and nonunit activities. The 42 activities were ascertained from a study in which time and motion analysis was used to document activities of general internal medicine residents at 2 urban hospitals. The activities were reviewed by a critical care physician and 2 advanced practice nurses for content validity, sorted into categories, revised as indicated, and pilot tested. Interrater reliability was greater than 95% when the tool was used by 2 data collectors.

### Table 2 Clinician Activities Tool

<table>
<thead>
<tr>
<th>Routine management of patients</th>
<th>Coordination of care</th>
<th>Nonunit activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedures/testing</td>
<td>Consultation</td>
<td>Educational activities</td>
</tr>
<tr>
<td>Patient procedures</td>
<td>Intensive care unit’s attending physician</td>
<td>Attending conferences</td>
</tr>
<tr>
<td>Patient testing</td>
<td>Patient’s attending physician</td>
<td>Caring for patient (off unit)</td>
</tr>
<tr>
<td>Information gathering</td>
<td>Consulting physician</td>
<td>Travel to educational activity</td>
</tr>
<tr>
<td>History</td>
<td>Fellow/resident/intern</td>
<td>Reading</td>
</tr>
<tr>
<td>Physical examination</td>
<td>Nursing staff</td>
<td>Teaching</td>
</tr>
<tr>
<td>Chart review</td>
<td>Respiratory therapists</td>
<td>Administration</td>
</tr>
<tr>
<td>Phone calls/computer</td>
<td>Members of other disciplines</td>
<td>Meetings/phone calls</td>
</tr>
<tr>
<td>Searching for records</td>
<td>Sign-out rounds</td>
<td>Interaction with unit secretary</td>
</tr>
<tr>
<td>Documentation</td>
<td>Care planning meeting</td>
<td>Transit</td>
</tr>
<tr>
<td>Charting</td>
<td>Patient/family interaction</td>
<td>Transporting patients</td>
</tr>
<tr>
<td>Writing orders</td>
<td>Teaching/counseling patients</td>
<td>Travel to activities</td>
</tr>
<tr>
<td>Discharge summary</td>
<td>Teaching/counseling patients’ families</td>
<td>Personal</td>
</tr>
<tr>
<td>Dictation</td>
<td>Obtaining patients’ consent</td>
<td>Eating</td>
</tr>
<tr>
<td>Making chart notes</td>
<td>Obtaining consent of patients’ families</td>
<td>Conversation</td>
</tr>
<tr>
<td>Making personal notes</td>
<td>Conversation with patient</td>
<td>Sleep after call</td>
</tr>
<tr>
<td>Filling out forms</td>
<td>Conversation with patients’ families</td>
<td>Personal time</td>
</tr>
</tbody>
</table>

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Work Sampling Procedures

Work sampling is a measurement technique that involves gathering data about activities that individuals perform at preset intervals during a work unit, such as a shift or a week. At the preset interval, trained observers record the activity being performed or request those observed to report this information. The number of observations are summed, and the sums are used to estimate the proportion of time spent performing these activities.

Work sampling procedures for this study were as follows. Each day of the week was divided into four 2-hour time blocks or a total of 20 blocks for the 40-hour week. Work sampling observations were randomly scheduled during these 2-hour time blocks for several weeks until all blocks were completed. The maximum observation time per day was 4 hours. Using a stopwatch, the observer recorded work activities at 10-minute intervals and later at 5-minute intervals. The 10-minute interval yielded 13 data points for each 2-hour block (6 per hour + 1 additional recording at the end of the block) x 20 blocks = 260 data points. The 5-minute interval yielded 25 data points for each 2-hour block (12 per hour + 1 additional recording at the end of the block) x 20 blocks = 500 data points. The total score on the Clinicians Activities Tool was equal to the total number of times the activity was observed. Using these data, we estimated the proportion of time spent in activities involved in routine management of patients, coordination of care, and nonunit activities. Data collectors were instructed to remain at a sufficient distance to avoid interfering, but close enough to ascertain the work performed.

Statistical Analysis

Data were analyzed by using the Fisher test for differences between uncorrelated proportions, with a Bonferroni correction for multiple comparisons. Comparisons were made between activities performed by the ACNP and by physicians in training, by the ACNP during the initial and subsequent year of employment, and for the 2 (5- and 10-minute) recording intervals. Data are reported for 5-minute observations, with the exception of comparison of 5- and 10-minute recording intervals.

Results

During the data collection period, we found no significant differences in the number of patients managed per day by the ACNP (mean, 5.9; SD, 0.3) and the physicians in training (mean, 5.8; SD, 0.6) or the number of patients per day being weaned from mechanical ventilation (mean, 2.2 and SD, 1.4 for the ACNP and mean, 2.3 and SD, 1.3 for the physicians in training). The ages of patients managed by the ACNP (mean, 65 years; SD, 16 years) and by the physicians in training (mean, 62 years; SD, 17 years) did not differ significantly. The patients managed by the 2 groups did not differ in percentage of females either (46% for the ACNP and 47% for the physicians in training). Mean scores on the Acute Physiology and Chronic Health Evaluation III on the first day of admission to the SD-MICU were high for patients managed by the ACNP (mean, 51; SD, 16) and physicians in training (mean, 51; SD, 25) but were similar to scores for the first day of admission to other ICUs in this facility (mean, 49; SD, 6).

ACNP Activities According to Length of Experience

To determine the effect of increased experience in the ACNP role, we compared findings during the initial observation time (≤6 months’ experience) and subsequent year (≥12 months’ experience). We found no significant differences (Table 3).

Comparison of ACNP and Physicians in Training

According to the 5-minute data (n = 500 observations), the ACNP and the physicians in training spent approximately half their time in activities related to routine management of patients (40% vs 44%; not significant). The ACNP spent more time in activities related to coordination of care (45% vs 18%; P < .001) and less time in nonunit activities.

<table>
<thead>
<tr>
<th>Activity</th>
<th>≤ 6 months*</th>
<th>≥ 12 months†</th>
<th>z score</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine management of patients</td>
<td>109 (42)</td>
<td>104 (40)</td>
<td>0.39</td>
<td>.70</td>
</tr>
<tr>
<td>Coordination of care</td>
<td>120 (46)</td>
<td>117 (45)</td>
<td>0.23</td>
<td>.82</td>
</tr>
<tr>
<td>Nonunit activities</td>
<td>31 (12)</td>
<td>38 (15)</td>
<td>0.94</td>
<td>.35</td>
</tr>
</tbody>
</table>

*Assigned to step-down medical intensive care unit only.
†Assigned to step-down medical intensive care unit and ventilator-dependent unit in long-term acute care hospital.
The ACNP spent more time \((P < .05)\) interacting with the nursing staff, ICU attending physician, consulting physicians, and members of other disciplines (Figure 1). As anticipated, physicians spent more time off the unit in activities related to their training \((P < .05); \text{Figure 2})\).

### Recording Interval

Observations made at 10- and 5-minute intervals were compared to determine if a shorter observation interval altered study findings for either care provider. Findings were equivalent in regard to the proportion of time spent in the 3 categories of activities (Table 4).

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(15% vs 37%; \(P < .001\); Table 4). The ACNP spent more time \((P < .05)\) interacting with the nursing staff, ICU attending physician, consulting physicians, and members of other disciplines (Figure 1). As anticipated, physicians spent more time off the unit in activities related to their training \((P < .05); \text{Figure 2})\).
Discussion

Major findings of this study were (1) compared with physicians in training, the ACNP spent an equivalent proportion of time in activities related to routine patient management, more time in coordination of care, and less time in nonunit activities; and (2) the proportion of time in these activities did not change significantly with increased experience or the added responsibility of patients in the long-term acute care hospital.

In several previous studies in which work sampling was used to determine the time house staff spend in various activities, findings were similar. Guarisco et al.17 asked house staff rotating through an internal medicine service to record the activity the house staff were performing when signaled by a randomly activated beeper. In a 12-week period, 6599 recordings (3533 on-call days, 3066 off-call days) were obtained. When grouped into our broad categories (routine management of patients, coordination of care, and nonunit activity), the proportion of time spent in routine management of patients (45%), coordination of care (22%), and nonunit activities (33%) were similar to our findings for physicians in training, that is, 44%, 18%, and 37%, respectively. Finkler et al.15 calculated the percentage of time house staff spent performing various activities. When grouped into our broad categories, the findings were again similar. Internal medicine house staff and the physicians in our study allocated similar

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**Figure 2** Five-minute data for number of observations of the acute care nurse practitioner and physicians in training in nonunit activities. The total number of observations for each of the 10 activities shown ranged from 1 to 75. No reading, teaching, or travel to educational activities were observed during data collection. Significant differences are indicated after Bonferroni correction for multiple comparisons.
amounts of time to routine management of patients (43% vs 44%), coordination of care (15% vs 18%), and nonunit activity (42% vs 37%).

The results of several previous studies suggest that the acuity of ACNP-managed patients may differ from the acuity of patients managed by house staff. Howie and Erickson described activities of an ACNP team affiliated with a general medical service in a university hospital. The ACNP team admitted and managed patients who had a lower probability of acute cardiac decompensation or need for ICU admission and did not provide care for patients who required transfer to the ICU. Admissions to the ACNP team were capped at 3 to 5 patients per day compared with 10 patients per day for the medical team. Rudy et al also reported differences in acuity and workload. Compared with the ACNP-PA team, residents cared for patients who were older and sicker and cared for more patients. Conversely, in our study, 1 ACNP or 1 physician in training (pulmonary/critical care fellow) was assigned to the SD-MICU, and both managed a similar caseload with similar acuity, as indicated by scores on the Acute Physiology and Chronic Health Evaluation III on SD-MICU admission.

Both providers spent approximately half their time in activities related to routine management of patients, a finding that suggests equivalent efficiency in performing required tasks. We found no change in this time allotment when comparisons were made between initial and subsequent employment in the ACNP role, suggesting quick acclimatization. As anticipated, physicians spent more time in training-related activities. Conversely, our results indicated that the ACNP spent more time interacting with patients, patients’ families, and nursing staff. None of the observations involved personal conversation (listed separately under nonunit activities). Unlike the physicians in training, who rotated through the unit at 2- to 4-week intervals, the ACNP directed patients’ care in the unit before data collection and was the sole primary care provider for an extended period. Thus, the results indicated that the staff had a greater opportunity to develop a professional relationship with the ACNP and subsequently felt more comfortable asking the ACNP questions. On the basis of a survey of ACNPs, physicians, administrators, and staff nurses, van Soeren and Micevski identified similar success indicators. ACNPs were cited as enabling greater continuity of care, giving increased attention to issues of patients and patients’ families, and promoting a team approach. Previous research suggested that a team-oriented culture characterized by supportive nursing leadership and timely communication is associated with a shorter hospital stay, higher technical quality of care, and greater ability to meet needs of patients’ families. Further research is needed to confirm this possibility.

<table>
<thead>
<tr>
<th>Activity</th>
<th>10-Minute data</th>
<th>5-Minute data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACNP (n = 260)</td>
<td>PIT (n = 260)</td>
</tr>
<tr>
<td>Routine management of patients</td>
<td>109 (42)</td>
<td>117 (45)</td>
</tr>
<tr>
<td>Coordination of care</td>
<td>120 (46)</td>
<td>42 (16)</td>
</tr>
<tr>
<td>Nonunit activities</td>
<td>31 (12)</td>
<td>101 (39)</td>
</tr>
</tbody>
</table>

Consistent presence of an ACNP focused on coordinating care may enhance quality of care and shorten patients’ stay.

Significant differences were not seen when comparisons were made between observations during the initial (≤6 months’ experience) and subsequent year (≥12 months’ experience) of ACNP employment, despite the additional responsibility of managing patients in the long-term acute care hospital. When absolute differences were compared, 12-month data reflected a 2% reduction in the proportion of time spent in routine management of patients, a 1% reduction in time spent in coordination of care, and a 3% increase in off-unit activities. The increase in off-unit activities most likely was due to duties in the long-term acute care hospital, which occurred outside the SD-MICU, and were therefore documented as off-unit activities. The ability to manage both groups of patients without a significant change in the proportion of time spent in routine management of patients (42% vs...
40%) suggests greater efficiency in carrying out the requirements of the role. However, this potential cannot be confirmed by using work sampling data.

This study has several limitations. First, observations were made in only a single ICU, and only 1 ACNP was observed managing patients’ care. Therefore, our findings may not reflect work performed in other settings or be representative of other nurse practitioners. Second, study data were obtained by work sampling. Our methods may have resulted in overreporting or underreporting of activities. However, our findings were based on direct observation, which yields more reliable results than does recall or self-report.19,20 Further, findings were consistent when observations were made over time for the ACNP, and little change occurred when 5- and 10-minute recordings were compared. Also, our findings were similar to the results of other studies in regard to time spent in various categories of activities.15,17

Conclusion

The ACNP and the physicians in training had equivalent efficiency in performing required tasks. As anticipated, physicians in training spent more time in nonunit activities. Conversely, the ACNP spent substantially more time interacting with patients and patients’ families and collaborating with other health team members. Further study is indicated to determine if these differences affect patients’ outcomes.

ACKNOWLEDGMENTS

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REFERENCES


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