Nursing Takes Time: Workload Associated With Administering Cancer Protocols

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New medicines and therapeutic combinations are tested and marketed every year. Healthcare decision makers have to make explicit choices about adopting new treatments and deal with the resource consequences of their choices. The aim of this article is to examine the nursing workload of administering alternative chemotherapy protocols as a driver of costs. Data collection (focus groups with chemotherapy nurses and a survey of nurse unit managers) was conducted to ascertain the time required to undertake chemotherapy-related tasks and the sources of variability in six chemotherapy centers in New South Wales, Australia. Four task types (patient education, patient assessment, administration, and patient communication) were identified as being associated with administering chemotherapy. On average, patient education required 48 minutes during the first visit and 18.5 minutes thereafter, patient assessment took 20.3 minutes, administration averaged 23 minutes, and patient communication required 24.2 minutes. Each center treated an average of 14 patients per day. Each patient received 3.3 hours of staff time (1.7 hours of direct contact time and 1.6 hours of noncontact time). The result of this research will allow healthcare decision makers and evaluators to predict the amount of nursing time required to administer chemotherapy based on the characteristics of a wide range of chemotherapy protocols.
are estimated. The most common method described in the literature involves retrospective data collection, where costs are estimated on the basis of resource use data collected from clinical trials and then multiplied by unit price data identified using reimbursement databases. In essence, this means that variation in resource use between protocols can only be detected if differences exist in the number of visits required to complete a protocol. This approach cannot, for example, detect potential differences in the type, number, or complexity of tasks per visit.

Other studies have examined the costs of administering chemotherapy in more detail. Schiller et al. (2004) estimated administration costs by multiplying the expected number of total doses by the unit cost per drug administration. The costs of inpatient and outpatient administration were compared across France, Germany, Italy, Spain, and the United Kingdom using unit cost data derived from diagnostic-related group data when available (France and Italy) and county-specific data of tariffs (United Kingdom, Germany, and Spain).

Rose and Lappas (2000) obtained costs for laboratory tests, physician visits, and outpatient chemotherapy from the American Medical Association’s Resource-Based Relative Value Scale: Physician’s Guide. The overall costs for the resources consumed during chemotherapy were calculated by summing the costs per cycle of therapy and multiplying by the number of cycles of therapy administered.

An important Australian study by Delaney, Jalaludin, Moylan, and Barton (2002) found median treatment duration was 90 minutes and the chemotherapy regimen, type of infusion, and patient age were significant factors in estimating duration time. Although this study was aimed at understanding differences in treatment duration, it did not examine the variation in terms of type of tasks and intensity (i.e., number of different tasks) associated with alternative chemotherapy protocols and was based on data collected in one chemotherapy center. No studies apparently exist that systematically examine the drivers of the costs of administering alternative chemotherapy protocols. This article aims to fill the gap by reporting the results of a primary data collection, which ascertained information from nursing staff about the time required to perform chemotherapy-related tasks. The results will allow healthcare decision makers and evaluators to predict the amount of nursing time required to administer chemotherapy based on the characteristics of a wide range of chemotherapy protocols.

Methods

Task Identification

An Australian system, eviQ® Cancer Treatments Online (www.eviq.org.au), was used as the basis of this study. EvIQ provides clinicians and patients with Web-based access to recommendations regarding standardized and comprehensive oncology treatment (i.e., protocols) and procedure-specific patient information. Therefore, the chemotherapy protocols available via eviQ represent current best practice in terms of relative effectiveness (established using evidence from published peer-reviewed literature). EvIQ includes information about the costs of the drugs used in the protocols, but no information about the costs of administering the drugs or the costs associated with preventing and/or managing side effects or adverse events.

A review was conducted of more than 200 chemotherapy protocols listed on the eviQ Web site in 2008 to identify the tasks involved in administering chemotherapy, to classify common tasks, and to identify tasks specific to individual protocols. For the purposes of this study, a chemotherapy protocol is defined as the total treatment a patient will receive as part of the administration of chemotherapy agents. This treatment includes specific nursing activities associated with the administration of each protocol listed, such as patient education, patient assessment, administering (the agents), and patient communication. Within each of these activities, a set of tasks was identified to capture many nursing activities associated with administering alternative protocols.

Focus groups and a survey were used to assess the extent to which the schema accurately captured chemotherapy administration tasks and to determine the nursing resources required to complete the identified tasks.

Ethics

This study is part of a larger study that received ethics approval from the St. Vincent’s Hospital Human Research Ethics Committee. In addition, governance approval was sought at each hospital site and written informed consent was obtained from all project participants.

Nurse Focus Groups

Consensus developed during group discussion of oncology nurses was used to estimate the length of time taken for tasks and activities. One group discussion was conducted with oncology nurses in six chemotherapy centers located in metropolitan treatment centers in Australia. The method for seeking responses was based on a modified Delphi approach (Flower, Lewith, & Little, 2007; Kobayashi et al., 2007). To ensure a consistent approach for all discussions, a check sheet was developed containing information about the study and the approach being used, as well as prompts to guide the discussion. The same person facilitated each discussion group. Sessions were digitally recorded and at least one additional observer attended each group to take minutes. At the start of each discussion, participants were informed that they should base their answers on the minimum and maximum time it would take a nurse with an average amount of experience and skill to complete the task at hand. They were then asked to discuss whether the time taken was dependent on the type of protocol or the patient. Finally, if the group agreed that the time taken to complete a task depended on the protocol, participants were asked to estimate an average time for different types of protocols. Workload estimates for each task were based on the consensus answers of each group. The resource use associated with individual protocols was estimated by summing the estimated time for the specific combination of tasks for that protocol.

Nurse Unit Manager Survey

The nurse unit managers (NUMs) of each of the oncology centers completed a survey to identify the total number of staff
members and hours, the number of patients seen per day, the capacity of the center, and the total amount of time allocated to nonpatient duties for each of the center’s staff. Information was not collected regarding the time of medical oncologists and non-clinical staff, such as reception staff and cleaners. This survey was completed each day by the NUMs over a five consecutive weekday period. Prior to the survey period, the NUMs were visited by a member of the research team and the purpose and method of the questionnaire were explained and any questions about the survey were answered.

Figure 1. Schema of Activities and Tasks for Delivery of a Chemotherapy Protocol

PICC—peripherally inserted central catheter

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Analysis

Data from nurse focus groups and NUM questionnaires were entered into Microsoft® Excel®, and the mean and standard deviation of times taken to administer protocols and for individual administration tasks were calculated across the six centers. The minimum and maximum estimates provided were used in a sensitivity analysis. The taped discussion groups were transcribed; this information was used to describe the tasks involved in administering chemotherapy and to understand the reasons for variations in administration time.

Results

Task Identification

Figure 1 illustrates the typical path for a patient undergoing chemotherapy. The starting point for this generic protocol is the decision to commence chemotherapy (i.e., either following initial diagnosis, following initial surgical treatment, or as an adjuvant treatment). Four main task types were identified as capturing most nursing activities associated with administering chemotherapy (see Figure 2).

Differences may arise in the resources used between protocol cycles. For example, during the first visit, patients will receive more information and education about their treatment than in subsequent cycles. In addition to the drivers of administration costs (such as achieving access, administering premedication, and preparing chemotherapy drugs), some within-protocol drivers of resource use exist. The total number of cycles and the number of visits per cycle will vary depending on the protocol. The total number of visits (total number of cycles multiplied by the number of visits within a cycle) reflects this parameter.

Patient Education
Inform patients about the characteristics of their chemotherapy protocol, including possible adverse effects and risks and the impact they can have on quality of life. This takes place at the start of the visit to the hospital.

Patient Assessment
Determines whether the patient is fit enough to proceed with the protocol administration. For the second and subsequent visits, the nurse also assesses adverse effects of the chemotherapy protocol on the patient. This involves baseline patient observation and includes activities such as measuring temperature, pulse, and blood pressure.

Administration
Involves activities such as achieving access, administering premedication, and preparing chemotherapy drugs. This step takes place after the assessment of the patient and differs by protocol and mode of administration.

Patient Communication
Takes place simultaneously with assessment and administration, but the majority of communication will probably take place after chemotherapy administration. Communication involves scheduling appointments for subsequent visits, scheduling appointments with the oncologist and dietitian, arranging blood tests or prescriptions, and arranging transportation or services such as meal delivery.

Finally, another important parameter is the time required for each individual visit. More time per visit may necessitate more nurse and chair time. This may cause the administration of chemotherapy to be more expensive.

Nurse Focus Groups

In total, 36 nurses participated in six discussion group sessions. The estimated mean time and range of the different nursing activities are reported in Table 1.

Patient Education

Most nurses agreed that the time taken for patient education decreases after the first visit. Patients often retain information provided during the first visit, reducing the time required for education during subsequent visits. On average, patient education takes 48 minutes for the first visit, reducing to 18.5 minutes for subsequent visits. Sources of variation in the time required for this task include a patient’s ability to speak and understand English and how the individual centers organized such activities. For example, one center offered group patient education sessions on a specified day of the week rather than individual one-on-one sessions at the first visit.

Patient Assessment

Patient assessment takes, on average, just over 20 minutes per visit. Sources of variation in the time associated with this task were caused by clinical practice, patient characteristics, and protocol attributes. An example of variation from differences in clinical practice was that one hospital employed a clinical coordinator whose responsibilities included assistance with patient assessment (i.e., checking medical notes and results of blood tests) prior to the arrival of the patient. Patient characteristics, which the nurses considered to be important contributors to differences in workload, included an individual’s ability to follow instructions (e.g., directions about medication to be taken at home prior to attending the oncology clinic) and overall health status. Nurses considered the protocol-driven variations to be less important; in their opinion, additional time was only likely to be required for highly specialized protocols (e.g., trastuzumab), which may require closer monitoring of various side effects such as flushing, nausea, and shortness of breath.

Administration

The length of time required for administering chemotherapy is dependent on patient characteristics and protocol type. Total administration time takes, on average, 23 minutes (SD = 7) for a single chemotherapy drug protocol with a single premedication. Estimates of the time taken to complete individual tasks within the administration of a protocol are listed in Table 2.

In the opinion of the nurse participants, the protocol is the most important driver of variation in administration, although patient characteristics also play a role. For example, in the case of IV cannulation, some patients’ veins may be harder to find than others with a resulting variation in the time needed for this activity. Nurses’ responses also revealed that clinical practice variations contribute to differences in administration time. For example, in one oncology center, the setup of all necessary
administration equipment for all protocols during that day is done by the nurses in the morning prior to patient arrival.

Communication

Patient communication takes, on average, 24.2 minutes (SD = 11). According to the nurse participants, the time needed for patient communication was the most difficult aspect of administration time to estimate because it frequently occurred simultaneously with other tasks. That is, some aspects of communication occurred during the administration of the chemotherapy, whereas other aspects occurred as a separate task (e.g., making appointments for subsequent visits and with other healthcare professionals).

Variations in communication can be influenced by patient characteristics (i.e., the ability of the patient to speak English). But variations also can be driven by differences in clinical practice. Some hospitals employed a clinical coordinator whose responsibilities included answering calls from patients regarding appointments and handling other issues, such as adverse events. No significant protocol-driven differences were identified during the discussion groups.

Patient Monitoring

Discussion group participants were unable to identify an average monitoring time, except when the protocol included a push dose or vesicant (as this was administered with constant monitoring) or when the protocol included a specified monitoring protocol. Monitoring protocols exist only for highly specialized chemotherapy drugs (i.e., monoclonal antibodies such as rituximab, alemtuzumab, and bevacizumab). In all other situations, nurses indicated that, although they were aware of the need for constant monitoring of patients, this task took place while they were doing other activities.

Immediate Side Effects

The authors anticipated that those protocols with a higher incidence of side effects would have an impact on nurses’ workload at the time of the chemotherapy administration. In this context, side effects are defined as an adverse event (or events) occurring immediately or soon after chemotherapy has commenced and requiring treatment in the chemotherapy center. Examples of immediate side effects include extravasation, hypersensitivity, and nausea. Responses from nurses suggested that the incidence of immediate side effects is extremely rare, in most instances occurring only once or twice a year per chemotherapy center. Therefore, because the expected workload and resource use associated with the treatment of such instant side effects is extremely low, it has not been included in these results.

Costs

The final two columns in Table 2 shows the conversion of nursing time into monetary values. These costs were calculated using New South Wales Health Department wage rates (New South Wales Health Department, 2008) and were then adjusted using information from the Organisation for Economic Co-Operation and Development on purchasing price parity for 2009 data and converted to U.S. dollars. The information presented shows that the most costly activities are achieving access using a Port-a-Cath® (Smiths Medical), a peripherally inserted central catheter, or IV methods; all other activities cost between $1–$2.24.

Survey of Nurse Managers

Information from 29 of a possible 30 days (six NUMs were requested to report for five days each—one day was a nonclinical day at one of the institutions) was captured by the NUM survey, covering a total of 1,293 hours and 420 patients receiving chemotherapy protocols.

On average, each center treated 14 patients per day and each patient received about 3.5 hours of staff time, which included 1.7 hours of direct contact time and 1.6 hours of noncontact time. However, considerable variation existed across centers reflecting, in part, the size of the center as well as some variation in clinical practice. Table 3 shows the number of patients treated, staff time, and the type of staff employed at each of the six centers.

Table 1. Time Needed for Activities Related to the Administration of Chemotherapy Protocols

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>TIME (MINUTES)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>SD</td>
<td>RANGE</td>
<td></td>
</tr>
<tr>
<td>Patient education</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>First visit</td>
<td>48</td>
<td>12.5</td>
<td>30–60</td>
<td></td>
</tr>
<tr>
<td>Subsequent visit</td>
<td>18.5</td>
<td>2.2</td>
<td>15–20</td>
<td></td>
</tr>
<tr>
<td>Patient assessment</td>
<td>20.3</td>
<td>6.5</td>
<td>10–30</td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td>23</td>
<td>7</td>
<td>21–54</td>
<td></td>
</tr>
<tr>
<td>Patient communication</td>
<td>24.2</td>
<td>11</td>
<td>10–35</td>
<td></td>
</tr>
</tbody>
</table>

N = 36

Table 2. Time Taken to Complete Individual Administration Tasks and the Cost Per Task

<table>
<thead>
<tr>
<th>TASK</th>
<th>TIME (MINUTES)</th>
<th>COST (U.S.$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>SD</td>
</tr>
<tr>
<td>Achieving access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port-a-Cath®</td>
<td>12</td>
<td>2.1</td>
</tr>
<tr>
<td>PICC</td>
<td>13.2</td>
<td>1.8</td>
</tr>
<tr>
<td>IV</td>
<td>15.6</td>
<td>4.9</td>
</tr>
<tr>
<td>Prehydration</td>
<td>2.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Premedication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push</td>
<td>4.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Bag</td>
<td>4.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Oral</td>
<td>2.3</td>
<td>2</td>
</tr>
<tr>
<td>Chemotherapy drug preparation</td>
<td>3.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Change bags</td>
<td>1.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Terminate access</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port-a-Cath®</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td>PICC</td>
<td>3.8</td>
<td>1.8</td>
</tr>
<tr>
<td>IV</td>
<td>3.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Discarding</td>
<td>2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Note. Based on information from New South Wales Health Department, 2008; Organisation for Economic Co-Operation and Development, 2010.
Discussion

This study has demonstrated the possibility of estimating the nursing workload associated with the administration of chemotherapy. Given that only six focus groups were included, work still is needed to test the validity and robustness of the results, particularly outside the Australian metropolitan healthcare setting.

The results from the nurse discussion groups produced a range of nursing time estimates for specific activities within the administration of specific chemotherapy protocols. Importantly, nurses also identified three factors affecting nursing time and, therefore, nursing workload: variations in clinical practice, patient characteristics, and protocols (e.g., the number of cycles and the number of visits per cycle). Variations in clinical practice can, to some extent, be controlled by nursing staff; however, patient characteristics and the choice of treatment for patients are not readily influenced by nurses or nursing practice.

Responses from participants in the nurse discussion group indicated that clinical practice affects nursing workload across four tasks involved in the administration of a chemotherapy protocol; patient education, patient assessment, administration, and patient communication. The results from the survey of NUMs also suggest that variation in clinical practice should be taken into account in workload assessment. One limitation of the study was that the NUM survey did not include information about patient classification (i.e., type and stage of cancer); therefore, these results should be interpreted with caution. Future studies should consider the use of a method of visit classification. In addition, the NUM questionnaire did not allow the inclusion of information about unscheduled visits by patients for services, such as blood tests or assistance for patients experiencing adverse events. Future studies should consider capturing information about unexpected occasions of service.

Another limitation of the study was the use of self-report to estimate nursing workload and administration time. The literature regarding the development of tools designed to measure nursing workload in the ambulatory setting remains sparse, particularly for oncology, although the development of valid and reliable tools has been accomplished in other specialty areas, such as emergency services and homecare. However, no gold standard exists for workload measurement. The methods available, including time and motion studies and subjective evaluation (including self-reporting), are all potentially affected by bias. For example, an observer carrying out a time and motion study may affect how the work is carried out (the Hawthorne effect). In addition, time and motion analysis is very costly, time consuming, and, in the context of health care, including the administration of chemotherapy, may disrupt the privacy of nurses and patients. A small number of time and motion studies have been undertaken in the oncology setting.

Blay, Cairns, Chisholm, and O’Baugh (2002) undertook a time, motion, and work sampling study over a three-month period to assess nursing workload in an Australian metropolitan day care unit. In the study, 24 direct and 26 indirect care tasks were identified, which were then timed with direct measurement while the frequency of these tasks was obtained by the self-report of nurses over a two-week period. The time spent educating patients ranged from 1–27 minutes (13 minutes were spent on patient counseling). Although not all of the task definitions used by Blay et al. (2002) match those in the current study, those that are comparable are within 1 SD of the average. However, caution must be exercised in comparing results as Blay et al. (2002) carried out their study in only one center and the focus was on hematology, not on medical oncology, as is the case with the current study.

Colombo, Solberg, Vanderhoeft, Ramsay, and Schouten (2005) conducted a time and motion study to directly assess 10 selected nursing activities that represent the main part (60%) of nursing workload. Three of the activities measured that can be compared with the current study (preparation, change dressing, and body check) show similar results (i.e., within 1 SD of the current study’s result). Overall, the average total nursing time for chemotherapy in the current study is below that reported by Colombo et al. (2005), not surprising because that study focused on inpatients who are likely to require more nursing time.

The strengths and limitations of self-evaluation as a means of workload estimation are not well understood. Some research indicates that this method tends to underestimate the number of activities carried out by respondents and, therefore, is prone to overestimate the time taken for a specific activity. Self-reporting can be verified through actual observational studies or work sampling (Blay et al., 2002; Colombo et al., 2005; Moore & Hastings, 2006). One study, which compared the time and motion method with self-reporting for nursing tasks (Burke et al., 2000), found that self-reporting provides a reliable estimate of the allocation of nursing time among defined activity categories. The authors of the current study chose the discussion group method for pragmatic reasons and because it offered the best opportunity to obtain estimates from nurses based on protocol variation.

As far as the authors are aware, this is the first study to systematically examine the important cost drivers of the administration of chemotherapy

Table 3. Results From the Nurse Manager Survey for Individual Oncology Centers

<table>
<thead>
<tr>
<th>ONCOLOGY CENTER</th>
<th>PATIENTS TREATED (PER DAY)</th>
<th>STAFF TIME (HOURS PER DAY)</th>
<th>NUMBER OF STAFF (PER DAY)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X RANGE</td>
<td>X RANGE</td>
<td>X RANGE</td>
</tr>
<tr>
<td>1</td>
<td>8 6–12</td>
<td>44 39.5–48</td>
<td>5.5 NUM, CNS, RN</td>
</tr>
<tr>
<td>2</td>
<td>19 15–22</td>
<td>53 42–65</td>
<td>2.8 NUM, CC, CNS, RN</td>
</tr>
<tr>
<td>3</td>
<td>14 13–16</td>
<td>36 32–40</td>
<td>2.6 NUM, CNS, RN, EN</td>
</tr>
<tr>
<td>4</td>
<td>13 11–16</td>
<td>38 28–48</td>
<td>2.9 NUM, CNS, RN, CNC</td>
</tr>
<tr>
<td>5</td>
<td>14 7–19</td>
<td>22 19.5–24</td>
<td>1.6 NUM, RN</td>
</tr>
<tr>
<td>6</td>
<td>17 13–26</td>
<td>75 64–80</td>
<td>4.4 NUM, CC, CNS, RN</td>
</tr>
</tbody>
</table>

CC—clinical coordinator; CNC—clinical nurse consultant; CNS—clinical nurse specialist; EN—enrolled nurse; NUM—nurse unit manager
protocols. Therefore, for the first time and from a nursing perspective, information is available about how nursing time is spent in delivering chemotherapy and the associated costs. This information can be used by NUMs to examine the practice in their own centers or units, allocate staff to particular tasks, and advocate for appropriate staffing to cover these important activities.

Accurate estimation of the costs of protocols provides one means of differentiating between clinically equivalent protocols. However, accurate costs also are vital inputs to economic evaluation. The results of such cost-effectiveness analyses inform decisions about the relative value for money provided by alternative protocols, as well as the impact their adoption is likely to have on the overall budget of a center or institution.

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References


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