# Prioritizing Quality over Quantity: Defining Optimal Pharmacist-to-Patient Ratios to Ensure Comprehensive Direct Patient Care in a Medical or Surgical Unit

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**To cite:** Damji S, Legal M, Dahri K, Partovi N, Shalansky S. Prioritizing quality over quantity: defining optimal pharmacist-to-patient ratios to ensure comprehensive direct patient care in a medical or surgical unit. *Can J Hosp Pharm.* Forthcoming 2024. doi: 10.4212/cjhp.3437

## ABSTRACT

**Background:** The expanding scope of practice of hospital pharmacists has contributed to improvements in patient care; however, workload remains a barrier to the provision of optimal pharmaceutical care. Established ratios to guide clinical pharmacy staffing on medical and surgical units are lacking in Canada.

**Objectives:** To determine the pharmacist-to-patient ratio that allows for provision of comprehensive pharmaceutical care to each patient on a medical or surgical unit and to determine which comprehensive care tasks can be delivered in settings where staffing is limited.

**Methods:** A multiphase study was conducted in 6 hospitals. First, a modified Delphi study was conducted to define and prioritize the elements of comprehensive pharmaceutical care. Next, a work sampling study was conducted to establish the frequency of each task and the time required for completion. Finally, a workforce calculator was used to determine pharmacy staffing ratios.

**Results:** Ten pharmacists participated in the modified Delphi study, and 31 participated in the work sampling study. A total of 15 comprehensive care tasks were identified, 7 of which were categorized as tasks to prioritize in settings where staffing is limited. The optimal staffing ratios were 1 pharmacist to 13 patients in internal medicine teaching units, 1 pharmacist to 26 patients in hospitalist or internal medicine nonteaching units, and 1 pharmacist to 14 patients in surgical units.

**Conclusions:** The optimal staffing ratios determined in this study should enable pharmacists to provide comprehensive care to each patient. Implementing these staffing ratios could increase the consistency of clinical pharmacy services, improve patient outcomes, and improve pharmacists' work satisfaction. Further research is required to validate these ratios in a variety of settings.

**Keywords:** clinical pharmacy, key performance indicators, work sampling, pharmacy staffing, patient ratio, workload

## RÉSUMÉ

**Contexte :** L'élargissement du champ d'exercice des pharmaciens d'hôpitaux a contribué à l'amélioration des soins aux patients; cependant, la charge de travail reste un obstacle à la prestation de soins pharmaceutiques optimaux. Il n'existe pas de ratios établis pour guider la dotation en pharmacie clinique dans les unités médicales et chirurgicales au Canada.

**Objectifs :** Déterminer le ratio pharmacien-patient permettant de fournir des soins pharmaceutiques complets à chaque patient dans une unité médicale ou chirurgicale donnée et déterminer quelles tâches de soins complets peuvent être dispensées dans des contextes où le personnel est limité.

**Méthodes :** Une étude multiphase a été menée dans 6 hôpitaux. Tout d'abord, une étude Delphi modifiée a été menée pour définir et hiérarchiser les éléments d'une prise en charge pharmaceutique générale. Ensuite, une étude par échantillonnage de travaux a été menée afin d'établir la fréquence de chaque tâche et le temps nécessaire pour l'accomplir. Enfin, un calculateur d'effectifs a été utilisé pour déterminer les ratios de dotation en pharmacie.

**Résultats :** Dix pharmaciens ont participé à l'étude Delphi modifiée et 31 ont participé à l'étude par échantillonnage de travail. Au total, 15 tâches de soins complets ont été identifiées, dont 7 ont été classées comme des tâches à prioriser dans des contextes où le personnel est limité. Les ratios d'effectifs optimaux étaient de 1 pharmacien pour 13 patients dans les unités d'enseignement de médecine interne, de 1 pharmacien pour 26 patients dans les unités non pédagogiques hospitalières ou de médecine interne et de 1 pharmacien pour 14 patients dans les unités chirurgicales.

**Conclusions :** Les ratios d'effectifs optimaux déterminés dans cette étude devraient permettre aux pharmaciens de prodiguer des soins complets à chaque patient. Les mettre en œuvre pourrait accroître la cohérence des services de pharmacie clinique, améliorer les résultats pour les patients ainsi que la satisfaction au travail des pharmaciens. Des recherches supplémentaires sont nécessaires pour valider ces ratios dans divers contextes.

**Mots-clés :** pharmacie clinique, indicateurs de performance clés, échantillonnage du travail, dotation en pharmacie, ratio de patients, charge de travail

## INTRODUCTION

Provision of hospital pharmacy services has evolved from reactive consult-based care to proactive care involving a thorough patient and medication assessment.[1,2] This shift led Hepler and Strand to coin the term "pharmaceutical care", which is defined as the responsible provision of drug therapy to achieve defined outcomes that improve a patient's quality of life.[3] Currently, evidence-based standards, including the Canadian Society of Hospital Pharmacy (CSHP) key performance indicators (KPIs),[4] published in 2015, and the standards of the American College of Clinical Pharmacy (ACCP),[5,6] published in 2017, help in directing how pharmacists provide pharmaceutical care. As the role and scope of hospital pharmacists expand, it is important for the profession to re-evaluate how care is provided, both to meet increasing demands for comprehensive pharmaceutical care and to optimize patient outcomes.

Physicians, nurses, and allied health professionals have established recommended staffing ratios for their respective professions.[7-13] However, defined ratios for Canadian pharmacists who provide clinical services are lacking. Pharmacists have consistently identified high workloads as a barrier to providing optimal pharmaceutical care,[14-16] yet comprehensive pharmacy services have been associated with reductions in mortality, adverse drug reactions (ADRs), and health care costs.[17-22] Given the imbalance between high workloads and the desire to increase hospital pharmacy services, establishing optimal staffing ratios is critical.

Pharmacists globally have faced a similar dilemma, which has led pharmacists in Australia and the United Kingdom to determine optimal pharmacy staffing ratios.[23-25] These ratios have limited application to practice in Canada because of differences in scopes of practice and workflow. Establishing staffing ratios reflective of current practice in British Columbia will allow the profession to articulate the staffing required to optimize patient outcomes.

The primary objective of this study was to determine the pharmacist-to-patient ratio that would enable hospital pharmacists to provide comprehensive pharmaceutical care to each patient admitted to a medical or surgical unit.

The secondary objective was to describe which elements of comprehensive pharmaceutical care are recommended and deliverable in settings where resources and staffing are limited.

## METHODS

This study consisted of 3 phases. First, a modified Delphi study was conducted to define and prioritize the tasks associated with comprehensive pharmaceutical care. Second, a work sampling study was conducted, during which real-world data were gathered to determine the time required to complete each task and the average frequency of each task per admission. Third, a validated workforce calculator was used to determine staffing ratios based on the results of phases 1 and 2.[25,26]

Pharmacist participants were recruited from 6 medium and large hospitals in British Columbia. The hospitals were purposefully chosen by the study investigators to ensure a regional balance in the study population, as well as a mix of hospitals of different sizes and types (e.g., teaching and community hospitals). Small hospitals and pediatric hospitals were excluded, to avoid introducing heterogeneity and because of uncertainty regarding the consistency of pharmacy staffing at these sites.

Ethics approval was obtained from the University of British Columbia (UBC) Behavioural Research Ethics Board, and institutional approval was obtained from each of the health care organizations involved in the study. All participants provided informed consent upon recruitment.

### Phase 1: Delphi Study

#### *Participant Recruitment*

A panel consisting of hospital pharmacy leaders and staff pharmacists was assembled using purposive and snowball sampling. Eligible pharmacy leaders had to have at least 5 years of work experience, with at least 1 year in their current role. Hospital pharmacists had to have at least 3 years of work experience. Prospective participants identified through the authors' professional networks were contacted through their work email addresses. The intent was to recruit 10 to 15 participants with expertise in pharmacy staffing and/or pharmacy practice in medicine and surgery representative of each included hospital.

#### *Design*

The study team developed a list of 16 candidate tasks based on 2 recognized pharmacy practice documents: the CSHP KPIs and the ACCP guidelines for clinical pharmacist competencies.[4-6]

A modified Delphi study was conducted, which consisted of 3 rounds of online surveys and a virtual discussion at the beginning of the second round.[4,27,28] Each participant received a link to each online survey by email; the surveys were hosted on the UBC survey platform.[29] In each round, participants were first asked to indicate whether each task should be included as part of comprehensive care, assuming an ideal setting without resource limitations, and were then asked to prioritize each task for an environment with limited staffing and resources, according to the following categories: highest-priority tasks, tasks to prioritize if time permits, and tasks that are not a priority. A threshold of at least 70% was used to define consensus in each round. During round 1 of the survey, panelists could contribute additional tasks to the list.

After each round of the survey closed, a data summary showing each participant's response alongside the Delphi panel's response to each question was sent by email to each participant. Only tasks that did not reach consensus were included in the subsequent survey round(s). All survey responses were anonymous, and participants had the option to mask their identity during the virtual panel discussion.

### *Data Analysis*

All survey responses were analyzed using descriptive statistics within the UBC survey platform, and survey responses and statistics were accessible to only one of the study investigators (S.D.).[29]

## Phase 2: Work Sampling

### *Participant Recruitment*

Clinical pharmacists and clinical pharmacy specialists who spent at least 25% of their time covering a medical or surgical unit were eligible to participate in the second phase. The medical units consisted of internal medicine units (teaching and nonteaching units) and hospitalist units. The surgical units consisted of units for general, vascular, gastrointestinal, hepatobiliary, and orthopedic surgery, as well as surgical oncology. Additional definitions are outlined in the Supplement (available from https://www.cjhp-online.ca/index.php/cjhp/article/view/3437/). Participants must have been scheduled to work in one of these units for at least 1 week in May or June 2022. To prevent bias, the identities of participants were blinded from all study investigators except S.D. Prospective participants were recruited through work email and professional interactions during day-to-day work, and pharmacists who expressed interest were invited to complete an electronic screening survey to confirm eligibility before their enrolment in the work sampling study. The target convenience sample size was 10 pharmacists from medical units and 10 from surgical units.

### *Design*

A self-reported work sampling study was conducted, in which each participating pharmacist collected data during a 5-day work week on their medical or surgical unit.[30-32] The final list of comprehensive care tasks established during phase 1 of the study guided data collection. Before collecting data, each participant completed an online survey hosted on the UBC survey platform[29] (link distributed by email) to gather baseline characteristics regarding their work experience and workload satisfaction. One investigator (S.D.) provided a virtual training session to each participant, during which the definition of each comprehensive care task and instructions for data collection were reviewed. In addition, each participant received a reference guide summarizing key procedures. The same investigator was available to answer questions throughout the data collection period.

Participants completed 3 data collection forms: Time, Frequency and Overview. The "Time" form captured the amount of time spent performing each comprehensive care task. Participants were instructed to record 3 to 5 instances of each task being performed thoroughly. The tasks could be performed for any patients on any days during the data collection period. Participants could use a timing device of their choice and were asked to round their times to the nearest half-minute. Participants reported which tasks they conducted concurrently and which were conducted during interdisciplinary rounds.

The "Frequency" form captured how often participants conducted each comprehensive care task. Participants were instructed to select 5 patients that they were actively following and to count how frequently they conducted each task for each patient over the sampling week. Participants reported which patients had not been discharged by the end of their data collection period, and these patients were excluded from calculation of the frequency of discharge-related tasks.

The "Overview" form was intended to capture the typical daily workflow of a hospital pharmacist. On a single designated day during their data collection period, participants were asked to document the time spent on all activities performed throughout their shift, including not only clinical tasks but also nonclinical tasks, such as breaks and transit time to the units. Participants were provided with examples of these nonclinical tasks for reference purposes.

To minimize bias and to validate the pharmacists' self-reported data collection, a random selection of participants were each shadowed by 1 of 2 independent observers for a single shift. Both observers were UBC pharmacy students. They used the "Multi-Stopwatch" (version 3.3.0) application available on Apple iOS devices and recorded times to the nearest second. The observers recorded the time spent performing comprehensive care tasks and nonclinical tasks. Thirteen examples of nonclinical tasks were provided to each observer; any additional task observed was recorded separately and further categorized during the data analysis. Each observer received 2 days of on-site training and performed one 8-hour trial run of data collection to ensure appropriate collection. To ensure participant confidentiality, only the observer and 1 study investigator (S.D.) knew the identities of the pharmacists being shadowed. To maintain patient confidentiality, observers were not permitted to review patient charts, attend interdisciplinary rounds, or enter patient rooms. To collect data accurately for activities performed within patients' rooms, the observer waited outside the room and recorded how long the pharmacist spent inside, after which they asked the pharmacist which task or tasks had been performed during that time. Both observers followed institution-specific COVID-19 regulations and did not collect data on units with active outbreaks of infectious disease.

### *Data Analysis*

All recorded data were transferred to a digital spreadsheet (Microsoft Excel, version 15.27), which was accessible to a single study investigator (S.D.). Descriptive statistics were used to determine the median time spent performing each task and the median frequency per admission. Agreement between the pharmacist's and the independent observer's data was assessed by comparing the overlap between the observer's data point and the pharmacist's reported times, plus or minus the standard deviation or interquartile range as appropriate.

### Phase 3: Calculation of Ratios

#### *Design*

The times and frequencies of tasks captured in phase 2, obtained as pharmacists' self-reported data, were input into the Clinical Pharmacy Workforce Calculator (see Supplement, Table S1, available from https://www.cjhp-online.ca/index.php/cjhp/article/view/3437/) to calculate staffing ratios. This calculator is based on the World Health Organization's Workload Indicators of Staffing Need (WISN) equation[26] and has been used previously to explore pharmacist-to-patient ratios.[25,33-36]

The WISN equation has the following components: the "activity standard", which was established by phase 1 of this study; "pharmacist time", which represents the available time that a pharmacist has to provide comprehensive patient care; and the "time per patient", which represents the total amount of time spent providing comprehensive care to a patient throughout their hospital stay, based on the results of phase 2.[26] Pharmacist-to-patient ratios were calculated on the basis of average length of stay of patients admitted to internal medicine, hospitalist, and surgical units. These data were obtained from the Decision Support office at one of the included hospitals. It was assumed that each pharmacist worked an 8-hour shift each day, did not work on weekends or statutory holidays, and took a 60-minute break daily.

#### *Data Analysis*

The primary analysis involved calculating the staffing ratios required to provide comprehensive pharmaceutical care to all patients on medical and surgical units. Secondary analyses involved estimating ratios for 4 scenarios in which various combinations of high-priority and lower-priority tasks were completed. In addition, 2 subgroup analyses were conducted, one comparing ratios at sites using electronic medical records (EMRs) and sites using paper charts, and the other comparing ratios for pharmacists working with and without a pharmacy learner.

## RESULTS

### Phase 1: Delphi Study

Ten individuals participated in the modified Delphi study: 5 pharmacy leaders, 2 clinical pharmacy specialists, and 3 clinical pharmacists. At least 1 participant was recruited from each participating hospital. Ten participants completed the online survey during rounds 1 and 2 of the Delphi study, and 9 participants completed round 3.

When asked which tasks would constitute comprehensive care in a setting with unlimited resources, participants reached consensus during round 1 of the Delphi survey. One additional task was suggested by a participant: discharge planning and liaising with the community pharmacy. Consensus was reached to include this task during round 2. When asked how these tasks should be prioritized in resource-limited settings, consensus was reached after 3 rounds of online surveys and the virtual discussion during round 2. The final list of tasks contained 15 items (see Table 1).

### Phase 2: Work Sampling

Thirty-one pharmacists participated in the work sampling study (Table 2). Twenty-four of these pharmacists worked on a medical unit: 11 on internal medicine teaching units, 2 on internal medicine nonteaching units, and 11 on hospitalist units. Seven participants worked on a surgical unit. Data were collected over a total of 153 shifts, representing 1224 hours. At baseline, the most commonly reported subgroups for patient workload were 21–25 patients and more than 30 patients.

The tasks reported to take the most time were completing the initial care plan and performing discharge planning (Table 3). The tasks reported to occur most frequently were resolving drug therapy problems and monitoring patients for ADRs or interactions. Medical rounds occur on internal medicine teaching wards only, and all pharmacists working on such wards reported providing elements of comprehensive care during these rounds. Pharmacists working on internal medicine teaching wards spent a median 40 minutes on nonclinical activities per day, those working on hospitalist or internal medicine nonteaching wards spent 50 minutes, and those working on surgical wards spent 36 minutes; these totals do not include any time spent teaching a pharmacy learner or performing distribution-related activities.

Twelve pharmacists were shadowed by an independent student observer for 1 shift each, reflecting a total of 96 observed hours. Nine of these pharmacists worked on medical wards and 3 worked on surgical wards. The student observers recorded a total of 402 comprehensive care tasks, with 82% agreement between students' observations and pharmacists' reported data. The 18% of observations that were not in alignment with data reported by the pharmacist being shadowed still fell within the time range reported by pharmacists overall.

### Phase 3: Calculation of Ratios

The calculated staffing ratios required to provide comprehensive pharmaceutical care are reported in Table 4.

Pharmacists with preceptor responsibilities for learners spent an additional 110 minutes daily, on average, on teaching activities; this altered the ratios to 1 pharmacist for every 9, 22, or 10 patients for internal medicine teaching, hospitalist or nonteaching, and surgical units, respectively. The optimal staffing ratio for internal medicine teaching units at sites using EMRs, without a pharmacy learner, was 1 pharmacist to 12 patients, compared with 1 pharmacist to 14 patients for sites using paper charts. This ratio could be calculated only for internal medicine teaching units, because only 1 of the 6 included study sites was using EMRs at the time of our study, and the majority of participants at that site were working in internal medicine teaching units. Extrapolating these data to hospitalist or surgical wards would not be appropriate.

## DISCUSSION

Hospital pharmacists aspire to provide comprehensive pharmaceutical care to all patients, but current workloads prevent them from achieving this aspiration, as demonstrated by pharmacists' activities documented in this study (Table 2 and Supplement, Table S2, available from https://www.cjhp-online.ca/index.php/cjhp/article/view/3437/). Existing workloads are the product of historical efforts by hospital pharmacy departments to provide some service to as many patients as possible within limited staffing budgets. In this context, and with increasing demand for hospital pharmacy services, it is important to reassess the approach to pharmacy staffing. In this study, we attempted to determine staffing ratios that would allow pharmacists to provide comprehensive pharmaceutical care to all patients on general medical and surgical units. We determined that ratios of 13, 26, and 14 patients per pharmacist, for internal medicine teaching, hospitalist nonteaching, and surgical units, respectively, would be required to achieve this goal.

The time-and-motion data gathered in this study align with the results of a previous project that described the workflow of hospital pharmacists.[37] Additionally, the

**TABLE 1. Results of Phase 1: Modified Delphi Study**

| Candidate Task | Component of Comprehensive Care (Yes or No) | Level of Priority[a] |
|---|---|---|
| Conducts patient interviews to obtain relevant subjective information and history of medication use | Yes: Conducts patient interviews to gather BPMH<br>Yes: Conducts patient interviews to gather relevant subjective history and more detailed medical history | 2<br>2 |
| Documents complete list of medications, allergies, discrepancies | Yes | 1 |
| Completes an initial pharmaceutical care plan | Yes | 1 |
| Resolves DTPs identified by others or by targeted drug reports or worklists | Yes | 1 |
| Resolves DTPs identified proactively and independently | Yes | 1 |
| Establishes and documents patient-specific and measurable outcomes | Yes: Establishes patient-specific and measurable outcomes<br>Yes: Documents patient-specific and measurable outcomes | 1<br>2 |
| Performs TDM | Yes | 1 |
| Monitors patients for ADRs and interactions | Yes | 2 |
| Advocates for cost-effective use of tests | Yes | 2 |
| Makes cost-effective drug-related decisions | Yes | 2 |
| Participates in interprofessional patient care rounds | Yes: Participates in medical or bedside rounds<br>Yes: Participates in interdisciplinary disposition planning rounds | 1<br>2 |
| Performs basic life support and participates in drug management during medical emergencies | No | 3 |
| Assists with drug distribution | No | 3 |
| Advocates for patient access to medications | Yes | 2 |
| Provides disease and medication education to patients | Yes | 2 |
| Performs discharge medication reconciliation | Yes | 2 |
| Performs discharge planning, liaises with the community pharmacist | Suggested by participant during Delphi process | 2 |

ADR = adverse drug reaction, BPMH = best possible medication history, DTP = drug therapy problem, TDM = therapeutic drug monitoring.
[a]Levels of priority: 1 = highest priority, 2 = prioritize if time permits, 3 = not a priority.

**TABLE 2 (Part 1 of 2). Baseline Characteristics in Phase 2**

| Characteristic | Data |
|---|---|
| **Pharmacists** | **No. (%) of Participants (*n* = 31)** |
| Current role | |
| Clinical pharmacist | 25 (81) |
| Clinical pharmacy specialist | 6 (19) |
| Experience as a pharmacist (years) | |
| ≤ 2 | 10 (32) |
| 3–5 | 13 (42) |
| 6–10 | 4 (13) |
| > 10 | 4 (13) |
| Experience at current hospital | |
| ≤ 6 months | 2 (6) |
| 7–12 months | 8 (26) |
| 1–2 years | 11 (35) |
| ≥ 3 years | 10 (32) |
| Charting system | |
| EMR | 7 (23) |
| Paper | 24 (77) |
| Hospital | |
| Burnaby Hospital | 3 (10) |
| Richmond Hospital | 2 (6) |
| Royal Columbian Hospital | 5 (16) |
| St Paul's Hospital | 7 (23) |
| Surrey Memorial Hospital | 3 (10) |
| Vancouver General Hospital | 11 (35) |
| The pharmacist feels they are able to provide comprehensive care to each patient under their care with their current workload | |
| Strongly agree | 0 |
| Agree | 11 (35) |
| Neutral | 5 (16) |
| Disagree | 11 (35) |
| Strongly disagree | 4 (13) |
| The pharmacist feels they are able to provide effective pharmaceutical care | |
| Strongly agree | 0 |
| Agree | 12 (39) |
| Neutral | 13 (42) |
| Disagree | 5 (16) |
| Strongly disagree | 1 (3) |
| The pharmacist feels they are able to provide safe comprehensive care | |
| Strongly agree | 0 |
| Agree | 20 (65) |
| Neutral | 7 (23) |
| Disagree | 3 (10) |
| Strongly disagree | 1 (3) |
| The pharmacist feels satisfied by the level of care they are able to provide | |
| Strongly agree | 0 |
| Agree | 9 (29) |
| Neutral | 10 (32) |
| Disagree | 11 (35) |
| Strongly disagree | 1 (3) |

**TABLE 2 (Part 2 of 2). Baseline Characteristics in Phase 2**

| Characteristic | Data |
|---|---|
| **Pharmacists** | **No. (%) of Participants (*n* = 31)** |
| Patient workload | |
| 1–15 patients | 0 |
| 16–20 patients | 5 (16) |
| 21–25 patients | 10 (32) |
| 26–30 patients | 5 (16) |
| > 30 patients | 11 (35) |
| **Participants' Care Units** | **Median Value** |
| No. of admissions/day | |
| Internal medicine teaching | 4 |
| Hospitalist (nonteaching) | 3 |
| Surgery | 6 |
| No. of discharges/day | |
| Internal medicine teaching | 4 |
| Hospitalist (nonteaching) | 4 |
| Surgery | 3 |
| No. of ALC patients/day | |
| Internal medicine teaching | 1 |
| Hospitalist (nonteaching) | 5 |
| Surgery | 0 |
| Charlson comorbidity index | |
| Internal medicine teaching | 6 |
| Hospitalist (nonteaching) | 6 |
| Surgery | 4 |
| No. of home medications per patient | |
| Internal medicine teaching | 7 |
| Hospitalist (nonteaching) | 7 |
| Surgery | 6 |
| No. of medications in hospital per patient | |
| Internal medicine teaching | 8 |
| Hospitalist (nonteaching) | 8 |
| Surgery | 7 |

ALC = alternate level of care (patients who are medically stable, yet remain in hospital because of rehabilitation or disposition-related issues), EMR = electronic medical record.

high level of agreement between pharmacist-reported data and student observations in this study further validates the use of pharmacist-reported data in the calculation of staffing ratios. The list of comprehensive care tasks in the current study is more thorough than those in 2 previous studies exploring pharmacist ratios,[24,25] leading to a more comprehensive activity standard. Although the times spent resolving drug therapy problems, conducting patient interviews, monitoring for ADRs, and providing patient education were similar to those presented in the Australian literature,[23,24] the times required for therapeutic drug monitoring (TDM) and completing a pharmacy care plan differed, likely because of differences in workflow. Our ratios of 1:13 for internal medicine teaching units and 1:26 for hospitalist or nonteaching units differ from the ratio of

1:19 established for medicine pharmacists in Australia.[24] Although the pooled ratio for all medicine units in our study was similar to 1:19, we chose to separate teaching from nonteaching units because of differences between these unit types in terms of pharmacist workflow. Our ratio of 1:14 for surgical units differs from the ratio of 1:23 established in Australia,[24] possibly because of differences in patient complexity or length of stay or differences in the tasks included in our analyses.

The ratios established in this study could help to guide hospital pharmacy staffing when new medical or surgical units are opened, and they offer a perspective on the level of care that is achievable with existing ratios. These results can also provide guidance on how clinical pharmacy tasks are

**TABLE 3. Median Times and Frequencies**

| | Internal Medicine (Teaching) (*n* = 11) | | Hospitalist or Nonteaching (*n* = 13) | | Surgery (*n* = 7) | |
|---|---|---|---|---|---|---|
| Comprehensive Care Task | Median (IQR) Time per Task[a] (min) | Median Frequency per Admission[b] | Median (IQR) Time per Task[a] (min) | Median Frequency per Admission[b] | Median (IQR) Time per Task[a] (min) | Median Frequency per Admission[b] |
| Conducts patient interviews to gather BPMH | 10 (7–15) | 1 | 9 (5–15) | 1 | 10 (5–10) | 1 |
| Conducts patient interviews to gather relevant subjective history and more detailed medical history | 10 (8–15) | 1 | 7 (5–12) | 1 | 8 (5–10) | 1 |
| Documents complete list of medications, allergies, discrepancies | 10 (5–15) | 1 | 6 (3–10) | 1 | 10 (5–14) | 1 |
| Completes an initial pharmaceutical care plan | 20 (15–26) | 1 | 20 (13–25) | 1 | 15 (15–21) | 1 |
| Resolves DTPs | 6 (5–15) | 5 | 4 (2–10) | 4 | 5 (2–10) | 2 |
| Establishes and documents patient-specific and measurable outcomes | 5.5 (5–15) | 1 | 5 (5–9) | 1 | 10 (6–12) | 1 |
| Performs TDM | 10 (8–15) | 0.75 | 4.5 (3–8) | 0.5 | 9 (5–15) | 0.25 |
| Monitors patients for ADRs and interactions | 5 (5–10) | 2 | 3 (2–6) | 4 | 5 (3–10) | 1 |
| Advocates for cost-effective use of tests | 1 (1–4) | 0.5 | 2 (1–3) | 0.5 | 5 (2–5) | 0.25 |
| Makes cost-effective drug-related decisions | 7 (3–10) | 0.5 | 5 (3–10) | 1 | 8 (3–17) | 0.5 |
| Advocates for patient access to medications | 5 (3–10) | 1 | 5 (3–6) | 0.5 | 4.5 (2–5) | 0.5 |
| Provides disease and medication education to patients | 10 (7–15) | 1 | 7 (5–15) | 1 | 8 (5–14) | 1 |
| Performs discharge medication reconciliation | 10 (6–15) | 1 | 7 (5–15) | 1 | 10 (5–12) | 1 |
| Performs discharge planning, liaises with the community pharmacist | 15 (8–20) | 1 | 7 (5–15) | 1 | 10 (5–13) | 1 |
| Participates in medical or bedside rounds | 45 (30–74) | 1 | NA | | NA | |
| Participates in disposition planning rounds | 30 (30–34) | 1 | 60 (47–60) | 1 | 35 (30–45) | 1 |

ADR = adverse drug reaction, BPMH = best possible medication history, DTP = drug therapy problem, IQR = interquartile range, NA = not applicable, TDM = therapeutic drug monitoring.
[a]The time per task is the amount of time it takes a clinical pharmacist to perform 1 instance of the particular comprehensive care task.
[b]The frequency per admission is how often a clinical pharmacist performs a particular comprehensive care task per patient throughout the patient's hospital stay (for example, 0.5 = task performed once per admission for 1 of 2 patients).

**TABLE 4. Pharmacist-to-Patient Ratios for Inpatient Medicine and Surgery Units: Primary and Secondary Analyses**

| Scenario | Internal Medicine (Teaching) Unit[a] | Hospitalist or Nonteaching Unit[b] | Surgical Unit[c] |
|---|---|---|---|
| I[d] | 13 patients per RPh | 26 patients per RPh | 14 patients per RPh |
| Secondary scenarios | | | |
| II[e] | 21 patients per RPh | 44 patients per RPh | 24 patients per RPh |
| III[f] | 29 patients per RPh | 59 patients per RPh | 32 patients per RPh |
| IV[g] | 42 patients per RPh | 82 patients per RPh | 54 patients per RPh |
| V[h] | Primary ward: 11 patients per RPh<br>Secondary ward: 7 patients per RPh | Primary ward: 21 patients per RPh<br>Secondary ward 8 patients per RPh | Primary ward: 11 patients per RPh<br>Secondary ward: 8 patients per RPh |

DTP = drug therapy problem, RPh = clinical pharmacist, TDM = therapeutic drug monitoring.
[a]Average length of stay 8 days.
[b]Average length of stay 13 days.
[c]Average length of stay 6 days.
[d] Scenario I: The pharmacist completes 100% of all tasks involved in providing comprehensive care for all patients and attends medical and disposition rounds daily.
[e]Scenario II: The pharmacist completes 100% of all high-priority tasks for all patients, but completes tasks categorized as "prioritize if time permits" for only 25% of patients categorized as high risk. The pharmacist attends medical rounds daily and disposition rounds 3 times per week.
[f] Scenario III: The pharmacist completes an initial care plan for 80% of patients, reactively resolves DTPs and performs TDM for all patients, and performs other tasks for 20% of patients. The pharmacist attends medical rounds twice per week and disposition rounds once per week.
[g]Scenario IV: The pharmacist completes a care plan for 25% of patients, resolves DTPs reactively, and performs TDM for all patients. The pharmacist attends medical rounds once per week and does not attend disposition planning rounds.
[h]Scenario V: The pharmacist provides comprehensive care (scenario I) for patients on their primary ward and spends 2 hours per day providing reactive care (scenario IV) on a secondary medicine ward.

prioritized when ratios are suboptimal. Barriers to improving pharmacist staffing ratios include systemic resource limitations, staffing shortages, and an incomplete understanding among decision-makers regarding the value of a pharmacist. Inconsistent pharmacist staffing ratios and pharmacy services likely contribute to this uncertainty. Pharmacy leaders can advocate for improved staffing ratios by proactively articulating these optimal ratios for medical and surgical units. Although increasing hospital pharmacy staffing will be associated with increased up-front costs, it could yield improved patient outcomes and reduce overall health care costs.[17-22]

This study had several limitations. First, pharmacists working in hospitalist or nonteaching units typically have more assigned patients than those working in internal medicine teaching units and may be accustomed to conducting some clinical tasks less thoroughly. For example, the time spent performing TDM within internal medicine teaching units was 10 minutes, but in nonteaching units it was 4.5 minutes. This difference in real-world data collection could have resulted in less "time per patient" and higher calculated ratios for nonteaching units. Second, most of the pharmacists in our study had 5 years or less of work experience and might be less efficient than their more experienced colleagues. However, we feel that the study sample accurately reflects the complement of pharmacists who typically work on general medicine and surgery units in our health care system. Third, some of the included hospitals will be transitioning to EMR systems, which may significantly alter pharmacists' workflow in the future. This limitation was mitigated by conducting a subgroup comparison of pharmacist-to-patient ratios at sites using EMR and paper charts. Lastly, these ratios are not applicable to pharmacists who are performing both clinical and distribution activities within a single shift, and it is unclear how well these ratios apply to subspecialty medical and surgical units and to other hospitals across the country.

Further research is needed to explore the applicability of these ratios within subspecialty medicine and surgical units, the potential role of pharmacy technicians for providing comprehensive pharmaceutical care, and the consequent benefit to patient outcomes and pharmacist job satisfaction.

## CONCLUSION

This study defined and prioritized clinical tasks involved in providing comprehensive pharmaceutical care to medical and surgical patients and subsequently determined the optimal pharmacist-to-patient ratios in these areas. Staffing ratios of 1:13 for internal medicine teaching units, 1:26 for hospitalist or nonteaching units, and 1:14 for surgical units may allow pharmacists to provide comprehensive care to each patient admitted under their care.

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**Competing interests:** None declared.

**Disclaimer:** Stephen Shalansky is the Editor of the *Canadian Journal of Hospital Pharmacy*. He did not participate in the editorial decision-making for this article.



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**Funding:** None received.

**Submitted:** January 13, 2023
**Accepted:** May 25, 2023
**Published:** November 8, 2023