Information needs and information seeking in primary care: a study of nurse practitioners

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Objective: The objective was to understand the information-related behavior of nurse practitioners (NPs), a population of clinicians responsible for an increasing proportion of primary care.

Methods: Two phases of data collection addressed seven research questions. The initial phase of data collection was a questionnaire sent to 300 NPs, who were asked to report their experiences of needing information as a result of patient encounters as well as their experiences of seeking information. The second phase of data collection entailed a series of interviews with twenty NPs following their encounters with patients to collect data on instances of information needs and information seeking.

Results: NPs most frequently needed information related to drug therapy and diagnosis. NPs with a master's degree were found to perceive information needs more frequently than their colleagues who had not received a master's degree. The information resources NPs used most frequently were consultations with colleagues, drug reference manuals, and textbooks and protocol manuals. NPs were more likely to pursue needs related to drug therapy with a print resource and needs related to diagnosis with a colleague. The generalizability of a need emerged as a negative predictor of information seeking.

Conclusions: This study has addressed a number of questions about the information-related behavior of NPs in primary care practices and led to the development of a temporal model of information seeking in these settings. Results of this research underscore the importance of access to information resources in primary care practices. This study's findings also support the development of educational and outreach programs to promote evidence-based decision making among primary care clinicians.

INTRODUCTION

Within library and information science research is a substantial body of work addressing information-related behavior, including information needs, information seeking, and use of information resources [1, 2]. This research has been motivated primarily by the desire to develop information resources, collections, and services useful for members of specific populations. Among studies of health professionals, physicians represent the majority of populations studied [3–21]. This article reports findings from the first study of nurse practitioners (NPs), a population of clinicians responsible for a growing proportion of primary care.

Previous studies of physicians have considered the types of information needs they experience as a result of patient encounters, the proportion of needs they pursue, and the resources they use to resolve information needs. Given the similarities in the responsibilities of NPs and physicians in primary care practices, it may be assumed that their information needs and information seeking are comparable. On the other hand, differences in their education and training may be cited as reasons to anticipate variance.

Most classifications of physicians' information needs

reported in previous studies are reflections of the tasks associated with clinical care. For example diagnosis, treatment, and drug therapy are commonly identified as categories of information needs. This association of information needs with tasks is consistent with findings from research in information science. Recent studies have focused on understanding the relationship between task characteristics and information seeking [22].

Five studies of the information-related behavior of primary care physicians have been conducted by Dee and Blazek [23]; Timpka and Arborelius [24]; Covell, Uman, and Manning [25]; Gorman and Helfand [26]; and Cogdill, Friedman, Jenkins, Mays, and Sharp [27]. All five studies examined primary care physicians' information-related behavior as a consequence of encounters with patients. Interviews involving stimulated recall were conducted by Dee and Blazek as well as by Timpka and Arborelius. Interviews with primary care physicians immediately following patient encounters for a half-day period were conducted in the studies of Covell, Uman, and Manning; Gorman and Helfand; and Cogdill, Friedman, Jenkins, Mays, and Sharp.

Interviewing twelve rural primary care physicians, Dee and Blazek relied on patient records to stimulate participants' recollection of information needs [28]. They found that participants reported forty-eight information needs based on a review of 144 patient charts, an average of 0.33 needs per patient. The most frequent needs were related to treatment and diagnosis. The information resources reported as being used most frequently were colleagues, medical meetings, journals, books, and libraries.

Timpka and Arborelius also interviewed twelve physicians practicing in primary care settings but relied on video recordings of forty-six patient encounters to stimulate participants' recollection of ''dilemmas'' [29]. Participants in this study identified eighty-five information needs, an average of close to two per patient, much higher than that found in Dee and Blazek's study based on reviews of patient charts. The most common types of needs reported by physicians in Timpka and Arborelius's study were related to diagnosis and treatment.

Covell and his colleagues interviewed forty-seven physicians after each patient encounter for half a day. They found that participants were able to articulate a total of 269 information needs based on encounters with 409 patients, an average of two information needs for every three patients seen (0.66 needs per patient) [30]. The most frequent categories of information needs were related to the treatment of specific conditions and diagnoses. Thirty percent of the information needs were pursued in the half-day in which interviews were conducted in the practices. A consultation with a colleague was the category of information resource used most frequently to resolve information needs. This result contrasted with findings from a questionnaire administered prior to the interviews, in which participants indicated that print resources were used more frequently than consultations with colleagues.

Following the approach of Covell, Uman, and Manning, Gorman and Helfand interviewed forty-nine primary care physicians after their patient encounters [31]. The physicians reported a total of 295 information needs based on encounters with 514 patients, an average frequency of 0.57 needs per patient. Fourteen percent of the information needs were pursued while the patient was in the practice, and 30% were pursued within the week following the interviews. The information resources reported as being used most frequently were textbooks and manuals, followed by consultations with colleagues. Factors that emerged as significant predictors of information seeking were the physician's perceptions about the urgency of the need and his or her belief that a definitive answer could be found. Remarkably, the generalizability of a need, or the extent to which it could be applied to the care of other patients, emerged as a negative predictor of information seeking.

Cogdill and his colleagues interviewed fifteen primary care physicians serving as preceptors for medical students [32]. Each physician was interviewed for half a day after each patient encounter on two occasions: once when a medical student was present in the practice and once when a student was not in the practice. In the absence of a student, the physicians encountered a total of 148 patients and articulated sixty-two information needs (0.42 needs per patient). When a student was present in the practice, the preceptors had encounters with 154 patients and articulated forty-five information needs (0.29 needs per patient). In both the presence and absence of students, the most common information needs reported by physicians were related to diagnosis and drug therapy. Thirty-two percent of physicians' information needs reported in the absence of a student were pursued within the week following the patient encounter. In contrast, only 16% of the needs reported in the presence of a student were pursued within the week following the patient encounter. The information resources reported as being used most frequently were print resources and consultations with colleagues.

THE NURSE PRACTITIONER

NPs are nurses who have received advanced training and are authorized to provide a level of care once thought to be the exclusive responsibility of physicians. NPs currently practice in all states and many Canadian provinces. In twenty-two states, NPs are authorized to practice without physician supervision. Among the states requiring physician supervision, only one requires that the physician be present in the practice during the provision of care [33]. The majority of NPs practice in primary care settings, and, in all states, they now have some level of authority to prescribe drugs [34]. Medicare reimbursement was expanded to NPs with the Balanced Budget Act of 1997, which also removed the federal requirement of phy-

sician supervision [35]. The number of NPs is expected to increase from 55,000 in 1995 to 106,500 in 2005, while the number of primary care physicians is expected to increase by only 10% in this time period [36]. Since the profession's inception in the mid-1960s, the quality of care provided by NPs has been an enduring question. Results of a recent randomized clinical trial offer evidence that the care they provide is equal in terms of health outcomes to that provided by primary care physicians [37].

RESEARCH QUESTIONS

Promoting evidence-based decision making in primary care requires an understanding of the information needs, information seeking, and use of information resources among primary care clinicians, including NPs. To achieve this understanding, the present study focuses on seven research questions.

Information needs

1. How frequently do NPs experience information needs as a result of patient encounters?
2. How frequently do NPs experience specific types of information needs?

Information seeking

3. For what proportion of their information needs do NPs seek information?
4. Which factors are significant predictors of information seeking?

Resource use

5. How frequently do NPs use different types of information resources to resolve their information needs?
6. Are there differences in the content of NPs' consultations with a primary supervising physician, other physicians, and other NPs?
7. Are there differences in the types of resources NPs use to resolve different types of needs?

In both the questionnaire and interviews, an information need was defined as any question related to general knowledge or reference information such as information about drug dosing. This approach excluded needs for information that might typically be found in a patient's chart, from the patient's history, or through a physical examination. Information seeking was defined as any attempt to resolve an information need.

METHODS

This study's methodological approach featured triangulation in its use of two methods of data collection, a questionnaire and interviews. A preliminary analysis of the questionnaire data has been presented previously [38]. The separate methods of data collection provided insights into both NPs' beliefs about their information needs and seeking and their actual information-related behavior in response to patient encounters. The use of these two methods also paralleled the approach taken in the study of physicians conducted by Covell, Uman, and Manning [39] as well as the study conducted by Gorman and Helfand [40]. The use of a questionnaire contributed strength to the study in its breadth of scope across a large sample of NPs. Treating the NP as the unit of analysis, the questionnaire enabled the analysis of attributes of the individual that can be hypothesized as relevant to information needs and seeking. Interviews complemented the use of the questionnaire, providing the opportunity to collect more complete data on NPs' experiences of needing and seeking information.

This study investigated the information needs and information seeking of NPs in North Carolina, a state in which they are authorized to provide care under the supervision of a physician, although the supervising physician is not required to be in the practice at the time the NP sees patients. A pilot version of the questionnaire was sent to twenty-five NPs randomly selected from the list of NPs maintained by the North Carolina State Board of Nursing. The final version of the questionnaire (Appendix A) was mailed in the spring of 1998 to 300 NPs randomly selected from this list. The twenty-five pilot study participants were excluded from selection. The sample size of 300 was selected on the basis of a power analysis to ensure statistical significance in the analysis of the questionnaire data and to obtain a pool of at least twenty NPs volunteering to be interviewed. The second phase of the study entailed a series of interviews with twenty NPs recruited through the questionnaire. The sample size of twenty interview participants was based on the significance of findings from earlier research with a comparable sample size [41]. NPs for the interview phase of the data collection were recruited on the basis of their response to the final questionnaire item, which described the interviews and asked respondents to indicate their willingness to volunteer. Volunteers were contacted and recruited in random order until twenty were scheduled.

During the interviews held immediately following patient encounters, data were collected about both the information needs that arose and were resolved while the patient was in the practice as well as information needs that remained unresolved after the patient left the practice (Appendix B). At the close of the half-day of interviews in each primary care practice, participants were interviewed again to determine whether and how each information need had been pursued in the time since the patient's departure. During the interviews conducted at the end of the half-day data collection visit, participants were also asked to characterize each information need according to five factors believed to be predictive of information seeking, based on findings from the study conducted by Gorman and Helfand [42]. Participants indicated their perception of the significance of each factor for every information

need they experienced with a vertical line drawn through a visual analog scale.

Analysis of questionnaire data was conducted with the SAS statistical software application. The analysis of the interview data relied on the SUDAAN statistical software application. The categories of information needs appearing in the questionnaire were based on categories appearing in reports of previous physician studies. The categories of needs participants identified in the interviews, however, were derived inductively from an analysis of the collected data. Although not a research question for this study, a goal of the analysis of the interview data was the development of a temporal model of information seeking among primary care clinicians.

RESULTS

Questionnaire results

The overall response rate for the questionnaire was 44.6%. Of the 300 questionnaires sent out, 134 were returned. One hundred twenty-five respondents (93%) were women. Three respondents (2%) were men. Six respondents did not specify their gender. The average age of respondents was forty-five (SD = 8, *Mdn* = 43) years, and the average years of experience as an NP was ten (SD = 8, *Mdn* = 8). Three respondents did not provide information about their age, and three did not provide information about their years of experience as an NP. Fifty-three respondents (40%) indicated that they had been prepared for practice as an NP through a master's program. Seventeen (13%) indicated that they had been prepared through a post-master's certificate program. Sixty-one (46%) were prepared through a non-degree program. Three respondents chose not to specify their professional preparation.

Frequency of information needs. The questionnaire asked respondents to indicate the weekly frequency of their information needs. Respondents were presented with an array of information need categories and asked to estimate the weekly frequency of each. The average total of these needs was 33.3 per week (SD = 28.0, *Mdn* = 22). Table 1 presents the reported weekly frequency of each need category, including a normalization by the reported number of patients seen per week. The average total weekly frequency of needs normalized by the number of patients seen per week was 0.86 needs per patient (SD = 1.10, *Mdn* = 0.47). The needs reported as most frequent were related to drug therapy (*M* = 8.6, SD = 8.4, *Mdn* = 5). Diagnosis (*M* = 5.8, SD = 5.8, *Mdn* = 3.75) and therapy other than drug therapy (*M* = 5.4, SD = 5.4, *Mdn* = 3) were also ranked as frequent categories.

The average frequency of information needs among NPs prepared with a master's program or a post-master's certificate (*M* = 1.1 needs per patient, SD = 1.3, *Mdn* = 0.5) was significantly higher than the average for NPs prepared with a non-degree program (*M* = 0.6 needs per patient, SD = 0.6, *Mdn* = 0.4), $t(96.5) = 2.7$, $P = 0.01$). The frequencies of information needs were not found to be significantly different across primary care specialties.

Table 1
Frequency of information needs reported in questionnaire

Need	Weekly frequency	Standard deviation	Minimum	Maximum	Frequency per patient
Drug therapy	8.6	8.4	0	50	0.21
Diagnosis	5.8	5.8	0	30	0.15
Other therapy	5.4	5.4	0	30	0.13
Referral	3.1	3.9	0	20	0.08
Etiology	3.0	3.9	0	20	0.08
Psychosocial	2.6	3.4	0	20	0.09
Disposition	2.4	2.7	0	10	0.06
Epidemiology	2.1	3.2	0	20	0.05

Note: Frequency per patient was obtained by dividing weekly frequency by the reported number of patients per week. The category of disposition refers to information needs about where to send a patient, other than referral to a provider.

Proportion of needs pursued. Two items in the questionnaire collected data on respondents' frequency of information seeking. One question asked respondents to estimate the proportion of information needs for which they sought information (*M* = 55.0%, SD = 32.8, *Mdn* = 55%). A separate question asked respondents to estimate the weekly frequency of their information seeking (*M* = 9.9 times per week, SD = 12.7, *Mdn* = 5). This weekly frequency of information seeking was divided by the total weekly frequency of information needs to obtain a second estimate of the proportion of information needs pursued (*M* = 32.9%, SD = 38.9, *Mdn* = 19.2%). These two estimates of the proportion of needs pursued were found to be significantly different ($t(127) = 19.0$, $P = 0.0001$).

No significant differences occurred in either estimate of percentage of information needs pursued between respondents prepared with a master's degree or post-master's certificate and those prepared with a non-degree program. Likewise, no significant differences existed in the proportion of information needs pursued across respondents grouped by primary care specialty. Respondents' years of experience was found not to be significantly correlated with total frequency of needs or the proportion of needs pursued. The frequency of information seeking was, however, found to be significantly correlated with the total frequency of information needs ($r = 0.57$, $P = 0.0001$).

Use of information resources. Participants were presented with an array of information resources and asked to indicate the relative frequency of their use of each. Results are shown in Table 2. The NPs' supervising physicians and drug reference manuals were used ''a few times a week or more'' by 63% and 61% of respondents, respectively. Fifty-one percent of respondents indicated that they use textbooks ''a few times a week or more.''

Consultations with colleagues. Respondents were asked to indicate the proportion of their consultations

Table 2
Frequency of information resource use reported in questionnaire

Resource	Frequency of use					Not reported
	A few times a week or more	At least once a month	Once every few months	About once a year	Never	
Primary supervising physician	84 (63%)	33 (25%)	12 (9%)	0 (—)	1 (1%)	4 (3%)
Drug reference manual	82 (61%)	37 (28%)	11 (8%)	0 (—)	0 (—)	4 (3%)
Textbook	68 (51%)	50 (37%)	11 (8%)	1 (1%)	0 (—)	4 (3%)
Journal article	40 (30%)	62 (46%)	24 (18%)	4 (3%)	0 (—)	4 (3%)
Other nurse practitioner (NP)	35 (26%)	24 (18%)	37 (28%)	26 (19%)	8 (6%)	4 (3%)
Other physician	33 (25%)	45 (34%)	37 (28%)	12 (9%)	3 (2%)	4 (3%)
Pharmacist	19 (14%)	55 (41%)	39 (29%)	15 (11%)	0 (—)	6 (5%)

with colleagues that concerned an array of information needs. Respondents were asked about their consultations with their primary supervising physicians, other physicians, and other NPs. Diagnosis-related issues, drug therapy, and other therapies were the categories that accounted for the largest proportion of respondents' consultations with both their primary supervising physicians and other physicians. Respondents indicated that they were significantly more likely to address diagnosis-related issues in consultations with physicians than they were in consultations with other NPs (for primary supervising physicians versus other NPs $t(110) = 2.62$, $P = 0.01$; for other physicians versus other NPs $t(105) = 3.30$, $P = 0.001$). However, psychosocial issues emerging from patient care were significantly more likely to be a topic of consultations with other NPs than with physicians (for primary supervising physicians versus other NPs $t(110) = -3.26$, $P = 0.002$; for other physicians versus other NPs $t(105) = -4.53$, $P = 0.0001$).

Interview results

Demographic characteristics of interview participants were found to be consistent with those of the questionnaire respondents as well as the population of NPs in North Carolina. All interview participants were women, consistent with the high proportion of women among questionnaire respondents (98%) and the population of NPs in the state (95.4%). The average age of interview participants was forty-six (SD = 10). A relatively high proportion of interview participants (75%) had master's degrees. This proportion was lower among questionnaire respondents (53%) and the population of NPs in North Carolina (62.5%). Half of the interview participants provided care in family practice or pediatric settings. The remainder practiced in occupational, geriatric, women's health, college health, and general internal medicine settings. Across all interviews, the twenty NPs had encounters with 153 patients. The minimum number of patients seen during the half-day data collection visits was three, and the maximum was eighteen. The average number of patients seen was eight (SD = 4.1, *Mdn* = 6).

Table 3
Frequency of information needs reported in interviews

Need	Frequency	% of needs	Number of participants reporting need	% of participants
Drug therapy	32	43%	14	70%
Diagnosis	31	41%	16	80%
General management	4	5%	3	15%
Other therapy	2	3%	2	10%
Referral	2	3%	2	10%
Psychosocial	2	3%	2	10%
Prognosis	2	3%	2	10%
Total	75	101%		

Note: The total of 101% for percentages of needs is the result of rounding error.

Frequency of information needs. The total number of needs reported in the interviews was seventy-five, averaging 0.57 needs per patient (SD = 0.39, *Mdn* = 0.42). The frequency of each category of information need across the twenty half-day data collection visits is shown in Table 3.

Proportion of needs pursued. A high rate of information seeking was observed among interview participants. Sixty-four of the seventy-five information needs (85%) were pursued on at least one occasion from the time the NP encountered the patient until one week following the encounter. Six needs were pursued on two occasions. The majority of information seeking (72% of instances) occurred while the patient was in the practice. Twenty-one information needs were not pursued during the patient encounter. Of these, ten (48%) were pursued later in the half-day following the encounter or during the week following the encounter. Normalized by the number of patients seen, the frequency of lingering needs was 0.14 needs per patient. The greatest proportion (thirteen) of these twenty-one lingering needs pertained to diagnosis. Five were related to drug therapy.

Factors predictive of information seeking. Based on findings from Gorman and Helfand's study of primary care physicians [43], five factors believed to be predictive of information seeking were included in this investigation. Logistic regression analyses were performed in SUDAAN to determine the significance of each factor for information seeking, with results shown in Table 4.

Table 4
Logistic regression predicting information seeking (n = 75)

Factor	B	SE B	Saiterthwaite adjusted chi-square
Pursued at all			
Edification	0.00	0.02	0.01
Existence of an answer	0.02	0.02	1.07
Generalizability	−0.05	0.02	7.36*
Patient expectation	−0.01	0.01	0.12
Urgency	0.03	0.02	3.76
Pursued during patient encounter			
Edification	−0.02	0.02	1.43
Existence of an answer	−0.01	0.01	0.21
Generalizability	−0.05	0.02	4.62*
Patient expectation	−0.01	0.01	0.38
Urgency	0.06	0.02	13.13*
Pursued during half-day following patient encounter			
Edification	−0.02	0.01	2.48
Existence of an answer	0.01	0.02	0.15
Generalizability	0.05	0.04	1.43
Patient expectation	0.03	0.01	6.88*
Urgency	−0.01	0.02	0.22
Pursued during week following patient encounter			
Edification	0.01	0.01	0.56
Existence of an answer	0.03	0.02	4.41*
Generalizability	0.02	0.02	0.74
Patient expectation	−0.02	0.01	5.15*
Urgency	−0.03	0.01	4.53*

* *P* less than or equal to 0.03.

One factor was found to be significantly predictive of whether an information need was pursued on any occasion. This was the NP's perception about the generalizability of the need, or the extent to which the information could be applied to the care of other patients. Interestingly, generalizability was found to be a significantly negative predictor of information seeking. When information seeking during the patient encounter was examined, urgency as well as generalizability were significantly positive and negative predictors, respectively. During the half-day following the patient encounter, the NP's perception of the patient's expectation that the NP knew the information was found to be a significantly positive predictor of information seeking. Finally, during the week following the patient encounter three factors were found to be significantly predictive of information seeking: the NP's perceptions about the existence of an answer, the NP's perceptions about the patients' expectations that the NP knew the answer, and the urgency of the patient's case. Both patient expectation and urgency were found to be negative predictors of information seeking during the week following the patient encounter. This mirrored their positive significance during the encounter with the patient and the half-day following the encounter.

Use of information resources. Table 5 shows the frequency of information resource use across time, including (1) while the NP was working with the patient in the practice, (2) later in half-day following the patient encounter, and (3) during the week following the patient encounter. Although there were seventy-five occurrences of information needs, there were a total of seventy-seven occurrences of information resource use. This difference is the result of eleven needs not being pursued at all, ten needs being pursued with two different resources, and one need being pursued with four different resources. There were no instances in which a computer-based information resource was used.

Table 5
Types of resources used across time

Resource	Timing of resource use: Patient encounter	Half-day following patient encounter	Week following patient encounter	Total use
Physician	22	0	6	28 (36%)
Drug reference manual	15	0	1	16 (21%)
Colleague other than physician	9	3	2	14 (18%)
Textbook or protocol manual	8	0	4	12 (16%)
Journal article	1	1	0	2 (3%)
Laboratory manual	2	0	0	2 (3%)
Package insert	2	0	0	2 (3%)
Personal notes	1	0	0	1 (3%)
Total	60	4	13	77

A chi-square analysis of type of need pursued by type of resource used was conducted, with categories of need and resources combined to avoid occurrences of cells with expected counts of less than five. Types of need were combined into three levels: drug therapy, diagnosis, and other. This combination was made on the basis of the relatively frequent occurrence of needs related to drug therapy and diagnosis. Types of resources were combined into two levels: print and colleagues. Results of this analysis suggested that a print resource was more likely to be consulted for information needs pertaining to drug therapy and that a colleague was more likely to be consulted for information needs pertaining to diagnosis χ^2 (2, $N = 77$) = 6.91, $P < 0.05$).

DISCUSSION

This study's findings can be considered with three themes: information needs, information seeking, and use of information resources. In the theme of information seeking, the findings support the development of a temporal model of information seeking in the context of primary care.

Information needs

NPs who responded to the questionnaire in this study reported an average of 0.86 needs per patient. The frequency of needs among NPs prepared in a master's program or post-master's certificate program was significantly higher than the frequency of needs among NPs who were prepared in a non-degree program. This suggests that NPs with more education perceived information needs more frequently.

During the interviews, participants reported an average of 0.57 needs per patient. This frequency was less than the overall frequency from the questionnaire (0.86 per patient). The frequency of needs reported in the questionnaire by the twenty NPs who were later interviewed, however, was 0.50. Thus, while the frequency of needs found during the interviews was less than the overall average reported by all NPs responding to the questionnaire, the frequency of needs found among the interview participants more closely approximates their own estimates from the questionnaire.

The frequency of 0.86 needs per patient among NPs responding to the questionnaire in the present study was substantially more frequent than the frequency reported by the physicians who responded to the questionnaire administered by Covell, Uman, and Manning [44]. The primary care physicians in that study estimated that they experienced one information need per week. The frequency reported by NPs in the present study more closely approximated the frequency Covell and his colleagues observed during post-patient interviews (0.67 needs per patient). Closely paralleling the results of the interviews in this study of NPs, Gorman and Helfand reported a frequency of 0.57 needs per patient among primary care physicians [45].

It is important to note, however, that both the Covell, Uman, and Manning study and the Gorman and Helfand study only collected data on information needs that were left unresolved at the time of the patient encounter [46, 47]. The prompts used in the present study asked NPs to report both the needs that arose and were resolved during the encounter with each patient as well as needs that arose and remained unresolved at the close of the encounter. Among the seventy-five needs reported by NPs in the interview phase of the present study, twenty-one were unresolved at the close of the patient encounter. When normalized by the number of patients seen, this frequency was 0.14 needs per patient, substantially less than the frequency of needs that were unresolved at the close of physicians' encounters with patients in both the Covell, Uman, and Manning study and the Gorman and Helfand study. This difference offered further evidence that level of education and frequency of perceived needs might be positively correlated.

The results of this study's investigation into the relative frequency of types of needs among NPs were consistent with previous studies of physicians. Drug therapy and diagnosis were among the most frequent categories of information needs reported by NPs in this study and by physicians in previous research.

Information seeking

The NPs responding to the questionnaire in the present investigation reported that they pursued more than half of their information needs. When asked about their frequency of information seeking, however, the respondents reported a frequency equivalent to one-third of these needs being pursued. When interviewed, it was found that the NPs pursued a significantly greater proportion of their information needs than had been reported in the questionnaire, suggesting that NPs might not be aware of the extent to which they seek information. Among the seventy-five needs reported during the interviews, sixty-four (85%) were pursued during the patient encounter, later in the half-day following the encounter, or during the week following the encounter. The majority of information seeking occurred during the encounter with the patient. Fifty-four (72%) of the needs were pursued while the patient was in the practice. Forty-eight percent of needs that were unresolved at the end of the patient encounter were pursued within one week. This frequency was substantially higher than the 30% of needs that were found to be pursued both in the study conducted by Covell, Uman, and Manning and in the study conducted by Gorman and Helfand [48, 49]. Thus, while NPs reported a lower frequency of information needs than physicians, they pursued a higher proportion of their needs.

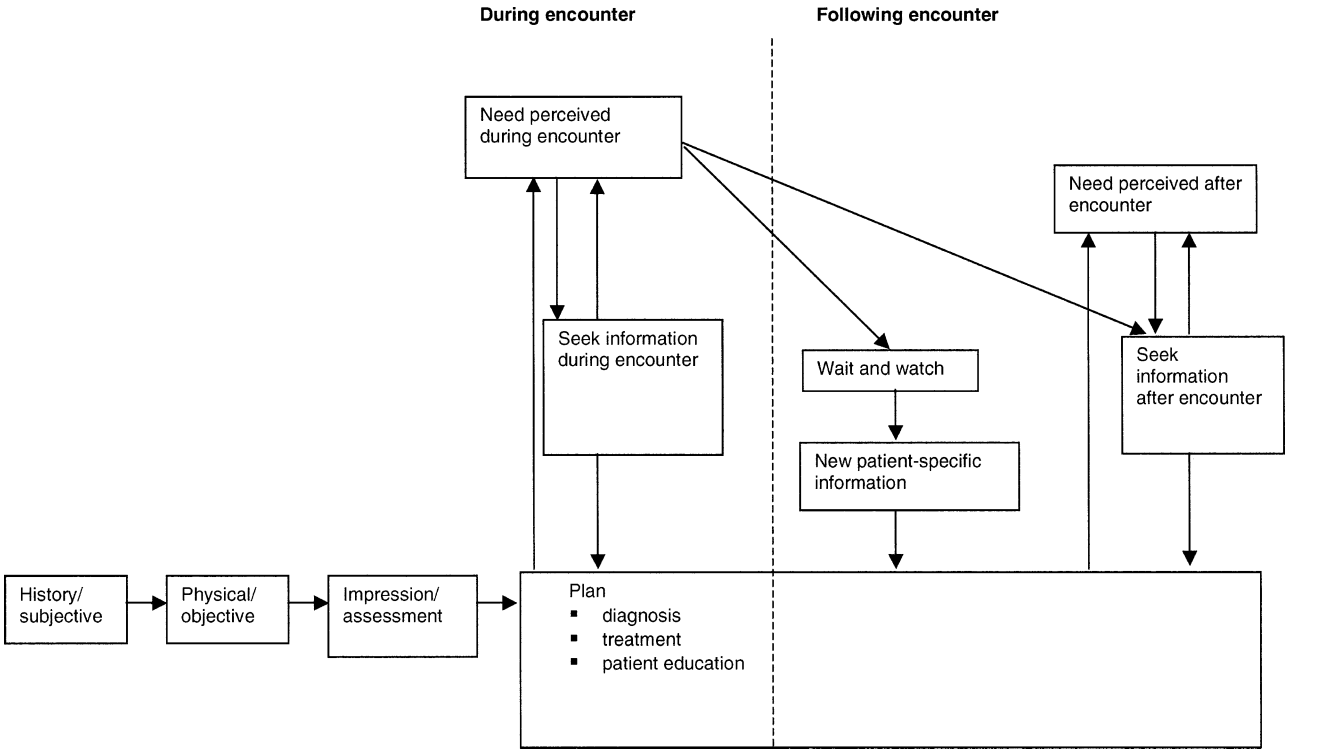
The interviews conducted in this study included the collection of data on participants' perceptions of their needs in terms of factors believed to be predictive of information seeking. This study extended Gorman and Helfand's analysis to include the significance of the factors as predictors of information seeking on three separate occasions [50]. Paralleling the results of Gorman and Helfand, each need's generalizability beyond the care of a single patient emerged as a significant negative predictor of information seeking across all occasions.

It is noteworthy that the factors of urgency and patient expectation emerged as negative predictors of information seeking during the week following the patient encounter. The information seeking that occurs during the week following the patient encounter is therefore more likely to be related to needs that are perceived as less urgent. Similarly, a patient's expectation that the NP have the information is inversely related to the likelihood that the need will be pursued during the week following the encounter. These results suggest that the needs that are associated with deferred information seeking are those that are less urgent. Those needs for which the patient expects the NP to have information are more likely to be pursued later in the same day as the patient encounter but are less likely to be pursued in the week following the encounter.

Temporal model of information seeking

Results of this study, particularly those from the interview phase of the data collection, support the construction of a temporal model of information seeking in the context of primary care, shown in Figure 1. During their encounters with patients, NPs in the present study can be characterized as conducting a history and physical to reach an impression or assessment that supports the development of a plan for the care of the patient. This component of the temporal model is analogous to Weed's subjective, objective, assessment, plan

Figure 1
Temporal model of information seeking in primary care



(SOAP) model [51]. A clinician's progress in a patient encounter may not follow this path in discrete steps. A physical examination of a patient may, for example, be guided by history-taking conducted as the physical examination progresses. Generally, however, the clinician may be characterized as seeking patient-specific information that will support the formulation of a plan for the patient's care. This plan addresses issues related to diagnosis, treatment, and patient education.

As a primary care clinician formulates the plan for a patient's care, information needs that are not entirely patient-specific may arise. After perceiving such a generalizable information need, a primary care clinician may follow four courses of action. The clinician may decide that information seeking is not indicated, leaving the need unresolved. Alternatively, the clinician may decide that ''watchful waiting'' may result in additional patient-specific information that will influence the plan at a later time and eliminate the original need for generalizable information. This is often a strategy for needs related to diagnosis.

An example of watchful waiting was when an NP reported an information need following an encounter with a patient whose chief complaint was back pain. This need (''Does he have a disk injury?'') was classified as pertaining to diagnosis. The NP chose not to seek information about diagnosing disk injuries during the patient encounter, citing the following reason: ''I gave him some medication, and if it's not better in a week he'll come back. We'll give it some time.'' In this example, the NP chose a course of waiting for additional patient-specific information: whether the pain persists beyond a week.

A third option for the clinician experiencing an information need is to seek information before concluding the encounter with the patient. Finally, the clinician may choose to pursue the need at a time following the close of the encounter. When a primary care clinician chooses to seek information—whether during or after the encounter—a variety of outcomes are possible. Optimally, the search process results in information that may be applied to the clinician's plan for the patient. However, the clinician may fail to retrieve information relevant to the information need. Independently of whether a search process results in information relevant to the plan, the search may also lead the clinician to perceive a new information need. A search process may, for example, result in relevant information that informs the plan but also spawns a new information need. Although this is possible, there were no instances of information seeking that led to new information needs in the interviews conducted in the present study.

Use of information resources

Results from the questionnaire phase of the present investigation suggested that NPs most frequently used consultations with their primary supervising physicians, drug reference manuals, and textbooks to an-

swer information needs that arose as a result of patient encounters. More than half of questionnaire respondents indicated that they use these resources ''a few times a week or more.'' Findings from the questionnaire phase of this study constituted one of the first investigations of the content of communication among different health professionals. Significant differences were found in the content of NPs' communications with physician colleagues and other NPs. Issues related to diagnosis were found to be more frequently addressed in consultations with physicians than in consultations with other NPs. Psychosocial issues were generally an infrequent topic of consultations among NPs but were found to be more frequently addressed in consultations with other NPs than in consultations with physicians.

During the interview phase of the present investigation, the participants were asked to report their use of information resources to resolve the information needs that had been reported after each patient encounter. Physician colleagues were the most frequently used information resource, followed by drug reference manuals, colleagues other than a physician, and textbooks or protocol manuals. The finding that physician colleagues and drug reference manuals were the two most frequently used resources was consistent with findings from the questionnaire.

As in the present study of NPs, Covell, Uman, and Manning found that, when interviewed after patient encounters, primary care physicians reported colleagues followed by drug reference manuals as the information resources used most frequently [52]. In contrast, Gorman and Helfand found that primary care physicians consulted colleagues less frequently than medical textbooks, practice manuals, and drug reference manuals [53].

Significant findings emerged in the analysis of the types of resources used to resolve different types of needs. Levels of resources were combined into ''print'' and ''human'' for purposes of the chi-square analysis used to address this question. Levels of needs were also combined into ''drug therapy,'' ''diagnosis,'' and ''other'' to avoid a high incidence of cells with expected counts of less than five in the chi-square analysis. Results of the analysis indicated that NPs were more likely to consult colleagues for needs related to diagnosis and print materials for needs related to drug therapy. Previous studies of physicians have not considered the types of information resources used to resolve categories of information needs.

CONCLUSIONS

Through a triangulated study of NPs, this research has addressed a number of questions related to information needs and information seeking in primary care. Results of this research underscore the importance of access to information resources in primary care settings. As in previous studies of physicians, NPs in the current study regularly experience information needs as a result of encounters with patients. Compared to primary care physicians studied in previous research, NPs perceive fewer information needs but pursue a greater proportion of their needs. Additional evidence of a possible positive correlation between level of education and the frequency of information needs emerges in this study's finding that master's-prepared NPs perceived information needs more frequently than their colleagues who had not been prepared in master's programs.

Evidence-based decisions require access to information resources as well as an understanding of how to use them effectively. Results of this study point to the importance of NPs' access to resources that can resolve information needs related to prescribing drug therapy and formulating diagnoses. Educational or outreach programs aiming to promote the use of information resources among primary care clinicians must build on an understanding of their needs and the way they are resolved. Consistent with previous studies of physicians, consultations with colleagues have been found in this study of NPs to be among the most frequently used sources of information, particularly for issues related to diagnosis. To supplement the use of consultations, education or outreach programs may highlight the use of information resources to retrieve evidence from clinical research to support diagnostic decisions.

REFERENCES

1. Dervin B, Nilan M. Information needs and uses. Annu Rev Inform Sci 1986;21:3–33.
2. Hewins ET. Information need and use studies. Annu Rev Inform Sci 1990;25:145–72.
3. Cogdill KW, Friedman CP, Jenkins CG, Mays BE, Sharp MC. Information needs and information seeking in community medical education. Acad Med 2000 May;75(5):484–6.
4. Covell DG, Uman GC, Manning PR. Information needs in office practice: are they being met? Ann Intern Med 1985 Oct;103(4):596–9.
5. Connelly DP, Rich EC, Curley SP, Kelly JT. Knowledge resource preferences of family physicians. J Family Pract 1990 Mar;30(3):353–9.
6. DaRosa DA, Mast TA, Dawson-Saunders B, Mazur J, Ramsey DE, Folse JR. A study of the information-seeking skills of medical students and physician faculty. J Med Educ 1983 Jan;58(1):45–50.
7. Dee C, Blazek R. Information needs of the rural physician: a descriptive study. Bull Med Libr Assoc 1993 Jul;81(3):259–64.
8. Ely JW, Burch RJ, Vinson DC. The information needs of family physicians: case-specific clinical questions. J Fam Pract 1992 Sep;35(3):265–9.
9. Fineberg HV, Gabel RA, Sosman MB. Acquisition and application of new medical knowledge by anesthesiologists: three recent examples. Anesthesiology 1978 Jun;48(6):430–6.
10. Gorman PN, Helfand M. Information seeking in primary care: how physicians choose which clinical questions to pursue and which to leave unanswered. Med Decis Making 1995 Apr–Jun;15(2):113–9.

11. HAUG JD. Physicians' preferences for information sources: a meta-analytic study. Bull Med Libr Assoc 1997 Jul;85(3): 223–32.
12. MANNING PR, DENSON TA. How internists learned about cimetidine. Ann Intern Med 1980 May;92(5):690–2.
13. MURRAY-LYON N. Communication in medicine: a study of how family doctors obtain information on recent advances in the treatment of rheumatic diseases. Med Educ 1977 Mar; 11(2):92–102.
14. NEUFELD VR, WOODSWORTH A. A survey of physician self-education patterns in Toronto, part II: use of journals and personal filing systems. Can Libr J 1972 Mar;29(2):104–9.
15. OSHEROFF JA, FORSYTHE DE, BUCHANAN BG, BANKOWITZ RA, BLUMENFELD BH, MILLER RA. Physicians' information needs: analysis of questions posed during clinical teaching. Ann Intern Med 1991 Apr 1;114(7):576–81.
16. STAVRI PZ. Medical problem attributes and information-seeking questions. Bull Med Libr Assoc 1996 Jul;84(3):367–74.
17. STINSON ER, MUELLER DA. Survey of health professionals' information habits and needs: conducted through personal interviews. JAMA 1980 Jan 11;243(2):140–3.
18. STRASSER TC. The information needs of practicing physicians in northeastern New York State. Bull Med Libr Assoc 1978 Apr;66(2):200–9.
19. STROSS JK, HARLAN WR. The dissemination of new medical information. JAMA 1979 Jun 15;241(24):2622–4.
20. TIMPKA T, ARBORELIUS E. The GP's dilemmas: a study of knowledge need and use during health care consultations. Methods Inf Med 1990 Jan;29(1):23–9.
21. WOOLF SH, BENSON DA. The medical information needs of internists and pediatricians at an academic medical center. Bull Med Libr Assoc 1989 Oct;77(4):372–80.
22. VAKKARI P. Task complexity, information types, search strategies and relevance: integrating studies on information seeking and retrieval. In: Wilson TD, Allen DK, eds. Exploring the contexts of information behaviour: proceedings of the Second International Conference on Research in Information Needs, Seeking and Use in Different Contexts. London, U.K. Taylor Graham, 1999:35–54.
23. DEE, op. cit.
24. TIMPKA, op. cit.
25. COVELL, op. cit.
26. GORMAN, op. cit.
27. COGDILL, op. cit.
28. DEE, op. cit.
29. TIMPKA, op. cit.
30. COVELL, op. cit.
31. GORMAN, op. cit.
32. COGDILL, op. cit.
33. COOPER RA, HENDERSON T, DIETRICH CL. Roles of nonphysician clinicians as autonomous providers of patient care. JAMA 1998 Sep 2;280(9):795–802.
34. PEARSON LJ. Annual update of how each state stands on legislative issues affecting advanced nursing practice. Nurs Pract 1999 Jan;24(1):16–9,23–4,27–30.
35. The Balanced Budget Act of 1997, Pub L No. 105–33. 105th Congress, 1st session. 5 Aug 1997.
36. COOPER RA, LAUD P, DIETRICH CL. Current and projected workforce of nonphysician clinicians. JAMA 1998 Sep 2; 280(9):788–94.
37. MUNDINGER MO, KANE RL, LENZ ER, TOTTEN AM, TSAI WY, CLEARY PD, FRIEDEWALD WT, SIU AL, SHELANSKI ML. Primary care outcomes in patients treated by nurse practitioners or physicians: a randomized trial. JAMA 2000 Jan 5; 283(1):59–68.
38. RASCH RF, COGDILL KW. Nurse practitioners' information needs and information seeking: implications for practice and education. Holist Nurs Pract 1999 Jul;13(4):90–7.
39. COVELL, op. cit.
40. GORMAN, op. cit.
41. COGDILL, op. cit.
42. GORMAN, op. cit.
43. IBID.
44. COVELL, op. cit.
45. GORMAN, op. cit.
46. COVELL, op. cit.
47. GORMAN, op. cit.
48. COVELL, op. cit.
49. GORMAN, op. cit.
50. IBID.
51. WEED LL. Medical records that guide and teach. New Engl J Med 1968 Mar 14;278(11):593–600.
52. COVELL, op. cit.
53. GORMAN, op. cit.

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APPENDIX

Questionnaire

1. How often do you consult each of the following sources of information for the purpose of resolving information needs that are related to specific patient problems?

Often *means* at least a few times a week
Regularly *means* at least once a month
Occasionally *means* once every few months
Rarely *means* about once a year

	Frequency of your consultation (circle your answer)				
Primary supervising physician	Often	Regularly	Occasionally	Rarely	Never
Other physicians	Often	Regularly	Occasionally	Rarely	Never
Other nurse practitioners	Often	Regularly	Occasionally	Rarely	Never
Pharmacists	Often	Regularly	Occasionally	Rarely	Never
Textbooks	Often	Regularly	Occasionally	Rarely	Never
Medical journal articles	Often	Regularly	Occasionally	Rarely	Never
Drug reference material, such as the *PDR*	Often	Regularly	Occasionally	Rarely	Never
Other (*please specify*):	Often	Regularly	Occasionally	Rarely	Never

2. How often do you receive information about *recent advances in drug therapy* from each of the following sources?
Frequently *means* at least once a month
Periodically *means* once every few months
Seldom *means* about once a year

	Frequency of receiving advances in drug therapy (circle your answer)			
Primary supervising physician	Frequently	Periodically	Seldom	Never
Other physicians	Frequently	Periodically	Seldom	Never
Other nurse practitioners	Frequently	Periodically	Seldom	Never
Pharmacists	Frequently	Periodically	Seldom	Never
Pharmaceutical representatives	Frequently	Periodically	Seldom	Never
Textbooks	Frequently	Periodically	Seldom	Never
Medical journal articles	Frequently	Periodically	Seldom	Never
Continuing education courses	Frequently	Periodically	Seldom	Never
Informal symposia (e.g., lunch or evening meetings)	Frequently	Periodically	Seldom	Never
Radio, television, or nonmedical periodicals	Frequently	Periodically	Seldom	Never
Patients	Frequently	Periodically	Seldom	Never
Material from the pharmaceutical industry:				
a) Advertisements	Frequently	Periodically	Seldom	Never
b) Data sheets	Frequently	Periodically	Seldom	Never
c) Books on drugs (e.g., the *PDR*)	Frequently	Periodically	Seldom	Never
d) Video or tape materials	Frequently	Periodically	Seldom	Never

3. Consider your consultations with your *primary supervising physician* that are about specific patient problems. What proportion of these are about:

	Percent of communication
Drug treatment information	___%
Other treatment information (besides drug treatment)	___%
More knowledge about possible diagnoses	___%
Epidemiological information	___%
Etiological information	
Information related to referral of a patient	___%
Information related to disposition (other than referral)	___%
of a patient	___%
Psychosocial information about a patient	___%
Other (*please specify*):	___%
Total	**100%**

4. Consider your consultations with *other* physicians about specific patient problems. What proportion of these are about:

	Percent of communication
Drug treatment information	
Other treatment information (besides drug treatment)	___%
More knowledge about possible diagnoses	___%
Epidemiological information	___%
Etiological information	___%
Information related to referral of a patient	___%
Information related to disposition (other than referral)	___%
of a patient	___%
Psychosocial information about a patient	___%
Other (*Please specify*):	___%
Total	**100%**

5. Consider your consultations with *other nurse practitioners* about specific patient problems. What proportion of these are about:

	Percent of communication
Drug treatment information	___%
Other treatment information (besides drug treatment)	___%
More knowledge about possible diagnoses	___%
Epidemiological information	
Etiological information	___%
Information related to referral of a patient	___%
Information related to disposition (other than referral)	___%
of a patient	___%
Psychosocial information about a patient	___%
Other (*please specify*):	___%
Total	**100%**

6. Your encounters with patients may raise questions in your mind that pertain to *general medical knowledge or reference information*. These are questions that could potentially be resolved by consulting an information resource external to your interaction with a patient, such as a colleague, journal article, textbook, or reference manual. Please estimate how often you experience a need for each type of information during a typical week of seeing patients.

	Frequency of your need for information in a typical week of seeing patients
Drug treatment information	_____ times per week
Other treatment information (besides drug treatment)	_____ times per week
More knowledge about possible diagnoses	_____ times per week
Epidemiological information	_____ times per week
Etiological information	_____ times per week
Information related to referral of a patient	_____ times per week
Information related to patient disposition (other than referral)	_____ times per week
Psychosocial information	_____ times per week
Other (*please specify*):	_____ times per week

7. What percentage of the information needs that are about general knowledge or reference information (i.e., not information that might be found in a patient's chart) do you actually pursue? That is, for what percentage of your information needs do you actually consult someone or look in the literature? _____%

8. And how often do you seek information as a result of a patient encounter that is about general knowledge or reference information (not information that might be in the patient's chart)? _____ times per week

Please read the following description of a recent advance in HIV-1 antibody screening.

A human immunodeficiency virus type 1 (HIV-1) antibody testing system has been developed that collects and stabilizes oral mucosal transudate (OMT) for the purpose of screening for HIV-1 antibody. In a study reported in the *Journal of the American Medical Association* (Gallo et al., 1997), OMT specimens were tested using enzyme immunoassay (EIA) screening test optimized for OMT and a Western blot confirmatory test designed for use with OMT. The results from the OMT were compared with true HIV status as determined by serum testing and/or clinical diagnosis. The investigators in this study found that the OMT is a highly accurate alternative to serum testing for HIV-1 antibody.

Understanding that not everyone will be familiar with this issue, please respond to the following questions.

9. Were you previously aware of this advance?
☐ Yes
☐ No (skip to *question 11*)

10. If *yes*, how did you learn of this advance? Select your *one, first* source of information on this topic.
☐ Primary supervising physician
☐ Consultation with physician other than primary supervising physician
☐ Consultation with other nurse practitioner
☐ Journal article
☐ Textbook
☐ Continuing education program
☐ Radio, television, or nonmedical periodicals
☐ Other (*please specify*): _____

11. Do you have a computer:
☐ At work.
☐ At home.

12. At *work*, can you access:
☐ Email
☐ The Web (e.g., Netscape)

13. At *home*, can you access:
☐ Email
☐ The Web (e.g., Netscape)

14. Are you working as a nurse practitioner:
☐ Full time
☐ Part time

15. Select all types of practice settings in which you see patients.

Town and county of practice:

☐ Hospital in-patient unit: _____
☐ Hospital out-patient unit: _____
☐ Other hospital settings: _____
☐ Community or ambulatory clinic: _____
☐ Other (*please specify*): _____

16. Select *one* of the following to characterize your *primary* practice:
☐ Family medicine
☐ Pediatrics
☐ OB/GYN
☐ General internal medicine
☐ Independent nursing practice
☐ Other (*please specify*): _____

17. How many hours per week do you see patients (as an NP)? _____ hours per week

18. Please give a single number that approximates the average number of patients you see (as an NP) in a typical week: ____ patients per week

19. To what extent does a physician see the same patients you have as an NP? *Check one box*.
☐ Physician sees all my patients on each visit.
☐ Physician sees my patients regularly but not on each visit.
☐ Physician sees my patients occasionally.
☐ Physician sees my patients only when I refer for additional services.

20. What is the year of your birth? 19_____

21. How many years of experience *as a nurse practitioner* do you have? _____

22. What is your gender?
☐ Female
☐ Male

23. What is your highest earned educational degree? _____

24. Which of the following best describes your preparation as a nurse practitioner?
☐ Post-master's certificate
☐ Master's degree program
☐ Non-degree certificate program
☐ Other (*please specify*): _____

25. Would you be willing to be interviewed at your practice? The purpose of the interview is to determine the information needs you experience after patient encounters. The interview is designed to have a minimal impact on your patient flow.
☐ Yes, I can be reached by telephone at _____ to schedule an interview.
☐ No, I prefer not to be interviewed.

APPENDIX B

Interview schedules

Post-patient interviews. The following prompts were used for each post-patient interview throughout each half-day data collection visit:

- What lingering questions occur to you as a result of this patient encounter?
- While the patient was here in the practice, did you need to consult a colleague, reference manual, or other general information resource?
- If yes, what was the question?

Interviews conducted at close of site visit. An additional interview was conducted with each participant at the end of the half-day practice visit to determine whether and how the NP attempted to resolve each information need in the time since the patient's departure from the practice. During the interview at the end of the half-day, the NP also rated each need according to five factors that might motivate information seeking. The participants indicated their perception of each factor by marking a visual analog scale. The five factors presented to participants were those that emerged as significantly associated with information seeking in the study conducted by Gorman and Helfand:

- Existence of an answer: ''Do you think a definitive answer exists (that authorities would agree on)?''
- Urgency: ''How soon must you have an answer?''
- Edification: ''Would the answer benefit your general medical knowledge? (Would you look it up for your own edification?)''
- Generalizability: ''Would the answer help you manage other patients?''
- Patient expectation: ''Does this patient expect you to know the answer?''

Interview conducted after one week.

- Have you pursued information to resolve this question?
- If yes, what resources did you use?
- If no, why not?