

# Using SNAPPS to Facilitate the Expression of Clinical Reasoning and Uncertainties: A Randomized Comparison Group Trial

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## Abstract

### Purpose

When medical students present cases to preceptors, they focus mainly on factual information and reveal little about their diagnostic reasoning or uncertainties. Do third-year students using the six-step, learner-centered SNAPPS technique (**S**ummarize history and findings, **N**arrow the differential; **A**nalyze the differential; **P**robe preceptor about uncertainties; **P**lan management; **S**elect case-related issues for self-study) for case presentations to family medicine ambulatory care preceptors express clinical reasoning and learning issues more than students not trained in the technique?

### Method

The authors conducted a posttest-only, comparison groups, randomized trial in

2004–2005 with 64 students in three groups: SNAPPS training, feedback training (controlling for training time), and usual-and-customary instruction. SNAPPS training combined brief faculty development with more extensive learner development followed by practice during a four-week family medicine rotation. During the last week, students audiotaped case presentations, which the authors coded for 10 dependent variables organized into six outcome categories that measure expression of clinical diagnostic reasoning and learning issues.

### Results

The authors coded 66 SNAPPS, 67 comparison, and 82 usual-and-customary case presentations. Students in the SNAPPS group outperformed students in

comparison and usual-and-customary groups for each outcome category. SNAPPS presentations were no longer than usual presentations but were one minute longer than those of the comparison group.

### Conclusions

SNAPPS greatly facilitates and enhances expression of diagnostic reasoning and uncertainties during case presentations to ambulatory care preceptors. Students can conduct case presentations using a technique that makes each step explicit and gives learners, rather than preceptors, the responsibility for expressing their clinical reasoning and uncertainties.

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The main goals of clinical teaching include assessing students' clinical reasoning skills, facilitating and strengthening their development, and providing them with opportunities for practice and feedback.<sup>1,2</sup> These goals have important implications for learning because the quality of the clinical reasoning strategies that medical students use influences diagnostic success.<sup>3,4</sup> To facilitate the development of students' clinical reasoning skills, the preceptor first needs access to the learners' clinical thinking. Studies of traditional case

presentations to preceptors have shown that students focus mainly on factual information and seldom express their clinical reasoning or case-based uncertainties.<sup>5,6</sup> However, both students and preceptors consider the opportunity to reflect about the reasoning process as one of the most valued aspects of the educational encounter.<sup>7</sup> Thus, there is a need, recently advocated by Irby and Wilkerson,<sup>8</sup> to develop time-efficient teaching methods in the clinical setting that provide insights into the students' clinical reasoning strategies and uncertainties while also allowing the preceptor to remain fully engaged in the priorities of patient care.

During traditional case presentations, students' reasoning skills and knowledge base remain mostly unknown.<sup>9</sup> However, there are some approaches designed to elicit students' thinking; for example, the One-Minute Preceptor technique provides preceptors with five steps to probe and guide student reasoning.<sup>10</sup> The successful implementation of this technique depends on teacher training and practice as well as the teacher's skill

at integrating the five steps into already time-pressured patient encounters. Such an approach is teacher-centered. SNAPPS (**S**ummarize history and findings, **N**arrow the differential; **A**nalyze the differential; **P**robe preceptor about uncertainties; **P**lan management; **S**elect case-related issues for self-study) is a learner-centered case presentation technique that depends mostly on the student for its successful implementation.<sup>11</sup> The six-step mnemonic outlines a collaborative case presentation that the student leads and the preceptor facilitates. A concise summary of the facts is followed by five steps that facilitate the expression of diagnostic reasoning and case-related uncertainties (List 1). SNAPPS is intended to redirect, but not lengthen, the learning encounter by condensing the reporting of facts and encouraging the expression of reasoning and uncertainties. Brief faculty development coupled with more extensive learner development serve as companion pieces in the successful implementation of this learner-driven technique.<sup>11</sup> The case presentation becomes a cognitive dance

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## List 1

**SNAPPS, a Mnemonic for a Learner-Centered Technique for Case Presentations in the Outpatient Setting**

The learner will:

1. **S**UMMARIZE briefly the history and findings.
2. **N**ARROW the differential to two or three relevant possibilities.
3. **A**NALYZE the differential by comparing and contrasting the possibilities.
4. **P**ROBE the preceptor by asking questions about uncertainties, difficulties, or alternative approaches.
5. **P**LAN management for the patient's medical issues.
6. **S**ELECT a case-related issue for self study.

in which one partner leads, but both must know the steps. In the time-pressured office environment where the preceptor's priority is high-quality patient care, SNAPPS prompts the student, rather than the preceptor, to lead the educational encounter, though the preceptor may need to coach until the steps become automatic.

In the office, multiple factors (e.g., patients' clinical problems, teacher expectations, learner's developmental level) influence the teaching and learning that take place.<sup>12</sup> Teaching methods designed to facilitate the expression of clinical reasoning may not hold up under the time pressures that are now so prominent in the office environment. There is a need to develop teaching methods that facilitate the expression of clinical reasoning *in vivo*—in a real practice setting—rather than in a standardized setting. The present study of SNAPPS examines whether a structured case presentation technique, in which the student holds the major responsibility for the learning encounter, can facilitate the expression of diagnostic reasoning and uncertainties in the actual office setting.

The specific question this study addresses is: How do third-year medical students who use the SNAPPS technique for presenting cases to family medicine ambulatory care preceptors compare with students using a comparative technique and with students performing the usual-and-customary presentations in their abilities (1) to summarize the patient findings concisely and thoroughly, (2) to provide a limited differential diagnosis, (3) to justify the differential diagnosis adequately, (4) to express uncertainties to preceptors, (5) to plan the patient's management, and (6) to identify case-related issues for self study?

**Method****Design**

We used a posttest-only, comparison groups, randomized trial to study the case presentations of students trained in the SNAPPS technique as compared both with students trained in an instructional format that paralleled SNAPPS training but focused instead on techniques for eliciting feedback from preceptors (referred to henceforth as the "comparison group") and with students receiving the usual-and-customary clerkship instruction (i.e., a general orientation only). The three experimental groups represent three levels of the instructional method, the independent variable. The Case Western Reserve University (CWRU) School of Medicine (SOM) and the University of Illinois at Chicago (UIC) internal review boards (IRBs) approved this study, which partially fulfilled the requirements for a master's degree in health professions education at UIC for one of us (T.W.).

**Student participants**

We recruited third-year medical students at CWRU SOM between April 2004 and November 2005 during the orientation meetings for the compulsory, four-week family medicine clerkships. The orientations took place on the first day of each clerkship rotation. Students in all study groups attended this general clerkship orientation, which included a review of clerkship goals, schedules of activities, and performance expectations. The students did not receive any information about the study before the recruitment discussion. The weekly clerkship format consisted of one day of didactics at the medical school and four days of ambulatory patient care in the offices of family medicine physician preceptors. The medical school family

medicine clerkship office assigned all students to preceptors. One hundred sixty-two students who each worked with a consistent preceptor for at least three half-days per week were eligible for the study. After receiving informed consent, we assigned the students who chose to participate in the study into one of the three study groups based on the random assignment of their preceptors to study groups.

**Preceptors**

We asked physicians who served as family medicine clerkship preceptors for third-year medical students at CWRU SOM to participate in the study. Two preceptors who did all case presentations in the patient's presence were not eligible, and we excluded them before randomly assigning the remaining preceptors to study groups. Forty-two preceptors at 30 sites who worked with a student for at least three half-days per week consented. We assigned preceptors to the three study groups based on random assignment with replacement design. Each preceptor was unaware of the other two study techniques, and none precepted students from the other two study groups. All eligible preceptors consented to participate.

**Experimental groups**

**SNAPPS group.** Each preceptor assigned to the SNAPPS group learned the technique during a 20-minute orientation meeting with one of us (T.W.). Each meeting took place in the preceptor's office approximately two weeks before working with the first study student. The meeting included both a viewing of an 11-minute instructional DVD explaining and demonstrating the SNAPPS technique and an opportunity for the preceptor to ask questions about the technique. The physician preceptors received a three- by five-inch laminated card highlighting the six steps of the SNAPPS technique. On the day before a student's first visit to the office, the preceptor received a phone call reminding him or her that the student would be using the SNAPPS technique for case presentations.

Students in the SNAPPS group learned the technique in a 45-minute training session during a lunch meeting immediately after a recruitment discussion on the first Monday of the four-week family medicine rotation. The

training session consisted of four parts: (1) discussing how students usually do case presentations in the ambulatory setting, (2) viewing the same 11-minute SNAPPS instructional DVD used with the preceptors, (3) participating in a scripted role-play of a SNAPPS case presentation, and (4) asking questions. Each student received a laminated three-by-five-inch SNAPPS card. A 20-minute follow-up meeting took place on the next two Mondays to reinforce the use of the SNAPPS technique. Because all meetings took place during the lunch hour between required morning and afternoon didactics, students attended the sessions unless they had been excused for illness or an emergency. During these follow-up meetings, students read a write-up of a patient's history, physical examination, and lab findings. One student presented the information using the SNAPPS technique, and then the rest of the group provided feedback. Students also had the opportunity to discuss any issues they encountered using the SNAPPS technique. We informed them, as part of the consenting procedure, that there were three study groups, and we asked them not to discuss the study or the SNAPPS technique with their peers.

**Comparison group.** Each preceptor assigned to the comparison group had a phone orientation (about 10 minutes) with one of us (T.W.) approximately two weeks before the first student's visit to his or her office. This orientation included both a general discussion about the importance of providing regular feedback to third-year medical students who would be coming to the office and an opportunity to ask questions. No discussion of specific expectations for the students or preceptors occurred. On the day before a student's first visit to the office, the preceptor received a phone call reminder that the student would be looking forward to receiving feedback about his or her performance.

Students in the comparison group participated in weekly training sessions that paralleled in length, logistics, and structure those for the students in the SNAPPS group, but their sessions focused on techniques for obtaining feedback from preceptors. This training controlled for the two effects in the SNAPPS group of training time and added attention focused on student-preceptor interactions. Comparison

group students received instruction in three feedback techniques: (1) asking specific questions about progress, (2) giving preceptors time to respond, and (3) asking one-item questions such as "What's the one thing you would like me to do more of?" The comparison students received a three-by-five-inch card that listed these feedback techniques. Like the SNAPPS group, training sessions took place during the lunch hour between required morning and afternoon didactics. Students attended the sessions unless they had been excused for illness or an emergency. Students in the comparison group did not receive information about the SNAPPS technique during their orientation, and we asked them not to discuss the feedback techniques with their peers.

**Usual-and-customary group.** All preceptors assigned to the usual-and-customary group received a phone call approximately two weeks before a student's first visit to their office, informing them that a student would be coming to their office for a four-week family medicine rotation. We addressed any questions they asked. These preceptors did not receive phone call reminders before the students' first day in the office. Students assigned to this group followed the usual-and-customary clerkship routines, including attendance at the general clerkship orientation. These students immediately began their office experiences and used whatever method of case presentation they chose. There was no specific training about case presentations or about obtaining feedback. During weekly didactics, students in the usual-and-customary group had an unscheduled lunch hour, as is the typical routine.

All students in the four-week family medicine rotation participated in a common didactic curriculum every Monday. We asked students enrolled in the study not to discuss the study procedures with other students.

### Outcomes

We developed the SNAPPS technique for case presentations based on the elements that any clinical preceptor would look for in order to assess student clinical reasoning and learning issues.<sup>10</sup> We identified eight presentation elements, the dependent variables, related to clinical reasoning and case-based

uncertainties: (1) basic attributes of the chief complaint and history of present illness, (2) inclusion of both history and physical exam findings, (3) formulation of a differential diagnosis, (4) justification of the hypotheses in the differential, (5) comparing and contrasting hypotheses, (6) expression of case-based uncertainties, (7) a plan for patient management, and (8) identification of case-based learning issues for self study. We added two additional dependent variables to measure presentation time and conciseness, for a total of 10 dependent variables. Table 1 contains the rationale, operational definition, and research hypothesis for each dependent variable, organized into six outcome categories.

### Audiotaping and coding

On the last Monday of the four-week family medicine rotation, students in all three experimental groups attended a 30-minute lunch hour meeting. During this meeting, students received a tape recorder and instructions for its use. We asked them to audiotape as many case presentations as possible in the final week of their family medicine rotation but not to audiotape case presentations that occurred in the presence of a patient. To guarantee confidentiality, each student received cassette tapes labeled with a number known only by the study administrator. Departmental education monies funded the recorders and tapes. We made phone calls to preceptors in all three experimental groups, reminding them that students would be audiotaping their case presentations during the final week of the rotation.

Two of us (T.W., K.P.), each with previous training in coding presentations using the Learner Thinking-Behavior Scale,<sup>13</sup> listened to all the nontranscribed audiotapes and coded the content of the presentations according to the 10 dependent variables presented above. We were blinded to both the identity and experimental group assignment of each study participant. During the training and initial calibration phase, we listened to and coded the case presentations together. Then, we coded 10 presentations independently and calculated interrater reliability for those presentations. This process continued until the interrater reliability was greater than .80. We reached consensus on any divergent coding results.

**Table 1**  
**Outcome Categories and Dependent Variables**

Outcomes	Dependent variable	Rationale for inclusion as variable	Operational definition	Hypothesis
Summarizing patient findings	Presentation length Conciseness	Data and clinical reasoning included without lengthening presentation Allows time for expression of clinical reasoning	Start time to end time in minutes Time for summary (chief complaint [CC], history of present illness [HPI], physical exam [PE], labs, imaging) ÷ total presentation time	SNAPPS presentation lengths are no longer than other two groups' presentations SNAPPS summary conciseness—Smaller proportion of presentation than for other two groups
	Summary thoroughness: Basic attributes Summary thoroughness: Completeness	Enough key features to communicate story effectively Contains two essential elements: HPI and PE	Number of nine basic attributes that can be contained in CC and HPI Contains or does not contain both an HPI and PE	SNAPPS will have no fewer basic attributes in summary than other two groups No difference in completeness of summary among three groups
Providing a differential diagnosis (DDX)	Number of diagnoses in differential	Focused DDX with two to three relevant possibilities	Number of diagnostic possibilities expressed	SNAPPS will have a DDX two to three times more often than other two groups
Analyzing possibilities in DDX	Justification Comparing—contrasting	Each diagnosis (DX) supported by patient findings and knowledge of disease Higher-level expression of clinical diagnostic reasoning	Describes evidence from case summary, literature, or previous experience that supports why a DX is included in DDX Number of distinct comparisons made between two diseases	SNAPPS will justify more DX than other two groups SNAPPS will compare—contrast diagnostic possibilities more than other two groups
Expressing uncertainties and obtaining clarification	Student information seeking	Learning enhanced, and errors corrected when disclosure is without blame	Number of student-initiated questions about uncertainties and areas needing clarification after patient summary	SNAPPS more likely to demonstrate information seeking than other two groups
Discussing patient management	Student-initiated management discussions	Assess clinical reasoning by analyzing management plan	Number of student-initiated management discussions	SNAPPS will initiate management discussion more than other two groups
Identifying case-related topics for further study	Student-initiated reading selections	Case-related topics focused on learning needs	Number of student-initiated reading selections	SNAPPS will initiate more reading selections than other two groups

**Data analysis**

We analyzed the results for each dependent variable for between-group differences using ANOVA for all ratio-scaled variables, with post hoc comparisons for group-to-group comparisons, and chi-square tests for nominal-scaled variables. We used a .05 level of significance. We calculated effect sizes for ratio-scaled variables using the Cohen d method. On the basis of Cohen's work,<sup>14</sup> .2 is considered a small effect, .5 a medium effect, and .8 a large effect. Based on existing data about conciseness scores,<sup>6</sup> a sample size of 22 per group would have 80% power to detect differences between groups.

**Results**

Of the 162 eligible students, 108 consented to participate. Of these, 76 students audiotaped their case presentations, and 64 produced audible case presentation recordings (Table 2). All students in the three study groups successfully passed all prior courses; any further analyses of the equivalence of the participants across the three groups was not possible because CWRU SOM uses a pass–fail grading system; also, IRB approval prohibited access to personal data. On average, the participants recorded 3.31 (SD 2.10) case presentations. The number of case presentations recorded did not differ among study groups ( $P = .13$ ; see Table 2).

Case presentations served as the unit of analysis for the study. We also repeated the analyses using students as the unit of analysis (within-subject effect) and using only the first case presentation for each student (range of presentations effect) as the unit of analysis. All three analyses yielded the same results (Table 3).

**Summarizing patient findings**

**Presentation length.** There were no statistically significant differences in presentation length (time in minutes) between students in the SNAPPS group and the ones in the usual-and-customary group (5.65 minutes versus 4.85, a difference of 48 seconds) or between the students in the comparison and usual-and-customary groups (4.66 versus 4.85, a difference of 11 seconds). Students in the SNAPPS group took, on average, one minute more to present their cases than the students in the comparison group (5.65 versus 4.66,  $P = .05$ ).

Table 2

**Distribution of Participants According to Study Groups and Taped Case Presentations and Coded Case Presentations**

Measure	SNAPPS group	Comparison group	Usual-and-customary group	Total
Students who consented and were randomized into groups	39	32	37	108
Students with taped case presentations	26	28	22	76
Students with audible case presentations	21	23	20	64 NS*
Number of case presentations	66	67	82	215
Range of presentations per student	1–7	1–7	1–10	1–10
Mean (SD) number of case presentations	3.00 (1.77)	2.91 (1.95)	4.10 (2.45)	3.31 (2.10) NS*

\* NS, not significant.

**Summary conciseness.** Students using the SNAPPS technique were more concise in their summaries (proportion of total presentation time) than students in both the comparison and usual-and-customary groups (0.48 compared with 0.62 and 0.62,  $P < .000$ ). Students using the SNAPPS technique took, on average, 14% less presentation time to summarize the patient findings than the students in the other two study groups (effect size = 0.69).

**Summary thoroughness: Basic attributes.** Students in the three study groups reported an average of 4.39 (SD 1.47) out of nine possible basic attributes of the patient's chief complaint and of the history of the present illness; there were no differences among the groups ( $P = .079$ ).

**Summary thoroughness: Completeness.** The summaries of patient findings for the students in all three study groups were complete (i.e., they contained both a history of present illness and report of physical examination findings) 92.5% of the time (SD 26.30). There were no significant differences among the three study groups ( $\chi^2(2) = 5.57, P = .062$ ).

### Providing and analyzing differential diagnoses

**Number of diagnoses in the differential.** Students using the SNAPPS technique expressed more than twice as many diagnoses in their case presentations than students in the other two groups (2.08 versus 0.81 and 0.77,  $P < .000$ ; effect size = 1.07).

**Justification.** Students in the SNAPPS group justified their diagnostic

possibilities more than five times more often than the students in the other two study groups (1.26 versus 0.22 and 0.23,  $P < .000$ ; effect size = 1.08) by providing supporting evidence from the case summary, literature, or their previous experience.

**Comparing and contrasting hypotheses.** Students in the SNAPPS group compared and contrasted two diagnostic possibilities more often than the students in the other study groups (0.20 versus 0.01 and 0.00,  $P < .000$ ). Comparing and contrasting diagnostic possibilities almost never occurred during the presentations of students in the comparison and usual-and-customary groups (effect size = 0.27).

### Expressing uncertainties and obtaining clarification

Students in the SNAPPS group formulated nearly eight times more questions and uncertainties than the students in the comparison group and more than twice as many as the students in the usual-and-customary groups (84.38 versus 10.77 and 33.33,  $\chi^2(2) = 75.75, P < .000$ ).

### Discussing patient management

Students using the SNAPPS technique initiated management discussions nearly 30% more often than students in the other two study groups (84.84% versus 56.72% and 53.66%,  $\chi^2(2) = 17.84, P < .003$ ).

### Identifying case-related topics for further study

Student-initiated selection of readings occurred only among students using the SNAPPS technique. They identified case-

related readings in approximately 51.61% of their case presentations. In our analysis of the presence of either student-initiated or preceptor-initiated reading selections, we found, again, that reading selections occurred only among students using the SNAPPS technique.

## Discussion

The results from this randomized trial showed that the SNAPPS learner-centered technique for case presentations facilitated the expression of clinical diagnostic reasoning and case-based uncertainties in the busy office setting without extending the usual length of the student case presentations. Each of the six study outcomes has important implications for teaching and learning in the outpatient setting. We discuss each outcome in turn, followed by a general discussion of the implications of the results from this study.

### Summarizing patient findings

The summary of the patient findings from the students using the SNAPPS technique accounted for approximately half of the presentation time (as compared with a little less than two thirds of the presentation time for the comparison and usual-and-customary groups). Further, SNAPPS presentations contained as many basic clinical findings as the traditional case presentations. Guided by the SNAPPS technique, students summarized patient findings concisely while maintaining the same degree of thoroughness as in traditional case presentations.

SNAPPS case presentations were no longer than the usual-and-customary student presentations, but they did differ by approximately one additional minute from those given by students in the comparison group. Expressing uncertainties and obtaining clarification occurred less often in the comparison group, a finding that may have contributed to the shorter overall presentation length in that group. The length of case presentations for students in the comparison and usual-and-customary groups did not differ significantly, however. Preceptors who must combine teaching with efficient patient care should expect that SNAPPS presentations will be similar in length to typical case presentations—approximately five minutes—and generally not more than one minute longer.

**Table 3**  
**Results for Each Dependent Variable According to Six Outcome Categories**

Outcomes	Dependent variables	SNAPPS group presentations (n = 66)	Comparison group presentations (n = 67)	Usual-and-customary group presentations (n = 82)	Significance	P value	Effect size*
Summarizing patient findings	Presentation length in minutes (SD)	5.65 (2.45)	4.66 (2.52)	4.85 (2.29)	$F(2,211) = 3.16$	<.039	
	Summary conciseness as proportion of whole (SD)	0.48 (0.18)	0.62 (0.18)	0.62 (0.20)	$F(2,211) = 11.96$	<.000	0.69
	Summary thoroughness: Mean number of basic attributes (SD)	4.65 (1.47)	4.09 (1.54)	4.43 (1.38)	$F(2,212) = 2.51$	<.079	
	Summary thoroughness: Percent complete	97.0%	86.6%	93.9%	$\chi^2(2) = 5.57$	<.062	
Providing a differential diagnosis	Number of diagnoses in differential (SD)	2.08 (1.24)	0.81 (1.03)	0.77 (0.89)	$F(2,212) = 34.28$	<.000	1.07
Analyzing possibilities in differential diagnosis	Number of justifications (SD)	1.26 (1.24)	0.22 (0.55)	0.23 (0.57)	$F(2,212) = 34.98$	<.000	1.08
	Number of comparing and contrasting comments (SD)	0.20 (0.47)	0.01 (0.12)	0.00 (0.00)	$F(2,212) = 11.44$	<.000	0.27
Expressing uncertainties and obtaining clarification	Percent of presentations with students seeking information by asking questions or by acknowledging their uncertainties	84.38%	10.77%	33.33%	$\chi^2(2) = 75.75$	<.000	
Discussing patient management	Percent of presentations with students initiating management discussions to plan patient care	84.84%	56.72%	53.66%	$\chi^2(2) = 17.84$	<.003	
Identifying case-related topics for further study	Percent of presentations with students initiating reading selections to plan for patient-focused study after the session	51.61%	0	0			

\* SNAPPS versus combined comparison and usual-and-customary.

### Providing a differential diagnosis

SNAPPS presentations contained a limited differential diagnosis—on average, two hypotheses. Students in the other two study groups either did not present a diagnostic hypothesis at all or provided only a single possibility. It was not uncommon for the students in the comparison and usual-and-customary groups to introduce management suggestions immediately after their summaries of the patient findings. This reduced discourse makes providing feedback and guidance to the students about their clinical reasoning nearly impossible.<sup>15</sup> Clinical teachers cannot diagnose the learner's level of diagnostic reasoning without knowing the student's diagnostic hypotheses.

### Analyzing possibilities in the differential diagnosis

SNAPPS users reasoned out loud, justifying their diagnostic hypotheses more often than students in other groups. They compared and contrasted their diagnoses or justified each diagnostic possibility in turn based on patient findings. Students in the other study groups rarely justified their diagnoses. Non-SNAPPS users, when offering a single diagnostic possibility, may be relying exclusively on some pattern recognition strategy. Eva<sup>16</sup> suggested that novices who use nonanalytic reasoning strategies, such as pattern recognition, still need to perform an analytic confirmation to avoid premature closure and diagnostic errors.

Analytic strategies, such as comparing and contrasting diagnostic possibilities or justifying the diagnosis based on patient findings, can provide confirmatory evidence for a diagnostic possibility initially generated by the novice through pattern recognition.

### Expressing uncertainties and obtaining clarification

SNAPPS students expressed uncertainties to preceptors more often than students in the other groups, allowing for immediate feedback. Connell and colleagues<sup>13</sup> found that when preceptors sought their students' thought processes during case presentations, the learners also increased their own expression of their clinical thinking. The SNAPPS technique

provided the teachers with learner-initiated insights into the students' reasoning process and levels of understanding and uncertainty. The technique helps align teaching moments with the immediate needs of the learner, rather than providing the learner with only what the preceptor deems relevant. Experts cannot easily predict the errors that novices make.<sup>17</sup> By setting the expectation that it is acceptable, in fact essential, for students to reveal their uncertainties, preceptors can provide individualized feedback to reinforce good thinking or to correct errors. In an era of increased focus on patient safety and medical errors, students using SNAPPS can reveal their uncertainties and obtain clarification and feedback as a routine part of their case presentations without fear of blame or reprisals.

### Discussing patient management

SNAPPS students initiated patient management discussions more often than did the other two groups, providing insights for the preceptor to shape the subsequent management discussion and the assessment of the learner's level of development.

### Identifying case-related topics for further study

The identification of learning issues revealed one of the most striking results of the study. Discussions about case-related readings occurred only with SNAPPS users. Bowen<sup>1</sup> notes that preceptors should encourage useful reading habits, especially because readings related to the learners' patients foster a double cognitive and experiential encoding in their memories. This encouragement does not often happen in the busy office setting. With the SNAPPS technique, the students themselves are readily able to identify case-related readings. Preceptors can then help the students better focus the learning topics and suggest, when needed, other diagnostic hypotheses or treatment plans to explore. The preceptors can encourage the students to compare and contrast topics and provide follow-up opportunities to share what they have learned.<sup>1,18</sup>

### Implications

One of the main goals of clinical teaching is to facilitate the development of diagnostic reasoning in learners.<sup>1</sup> To do so, the preceptor first needs to access the

learner's diagnostic reasoning to guide its further development. In the fast-paced office setting, teaching methods need to be time efficient. With health system priorities focused on patient care and clinical productivity, little time remains for teaching or for extensive faculty development. Teaching methods need to foster brief, teachable moments between patient-care episodes.<sup>8</sup> The results from this study showed that enhancing the expression of clinical reasoning and uncertainties is possible, even in an office setting with multiple competing demands on physician time and thinking, through a learner-centered technique for case presentations. SNAPPS places responsibility on the learners to formulate a case presentation that gives the preceptor insights into their thinking and uncertainties. The preceptor's role remains critical to the success of the learning encounter, but it is focused not on obtaining a differential diagnosis and its justification but on guiding and advancing the learner's clinical reasoning. Bowen<sup>1</sup> notes that the clinical teacher has two simultaneous roles in the busy office setting: diagnosing the patient's disorder and gaining insight into the learner's abilities. A learner-centered case presentation technique such as SNAPPS moves the locus of responsibility for insights into the learner's abilities from the preceptor to the learner.<sup>9</sup>

There are important implications for teaching and learning suggested by the present study. First, a relatively small intervention can make a substantial difference in the expression of clinical reasoning. The SNAPPS technique for case presentations is, by design, very close in structure to the traditional presentation method medical students usually follow, with two exceptions: SNAPPS requires students to probe the preceptor with questions about uncertainties and to select case-related readings. SNAPPS does, however, make explicit the expectations for these and the other steps in the case presentation and gives the learner, rather than the preceptor, the responsibility for ensuring that each step is completed. In addition, the SNAPPS technique gives the student permission to shorten case summaries as long as the key patient findings are present, leaving the preceptor free to ask for any additional information.

Second, the methods used in this study included both faculty and learner development. Though both were essential, the faculty development was brief, whereas the learner development was more extensive. In a learner-centered case presentation such as SNAPPS, faculty need to be permissive and coach as needed. The faculty must understand the expectations of SNAPPS, but they need not drive its implementation. Rather, the student must initiate each step, and the preceptor need only respond. Students may need more directed coaching at first, but they readily become skilled at completing each step of SNAPPS. The results from this study suggest a change in the balance of training when implementing teaching strategies. Medical educators have until now focused almost entirely on faculty development to enhance education in patient-care settings, even though engaging busy clinicians in faculty development efforts is difficult. With the SNAPPS technique, student development is primary and equally as important as faculty development in the successful implementation of teaching and learning methods. "It takes two to tango!"

The present study took place in a family medicine ambulatory care setting. One cannot generalize the findings to other disciplines or settings such as the inpatient hospital service. These are areas awaiting further research into the SNAPPS technique. This study also focused on student expression of clinical diagnostic reasoning and uncertainties, not on the way the preceptors responded to them. Exploring the differences between teaching students who use the SNAPPS technique for case presentations and those who use the traditional method is another area ripe for study.

### Conclusion

The SNAPPS technique greatly facilitates and enhances the expression of clinical diagnostic reasoning during case presentations to ambulatory preceptors. Implementation combined brief faculty development with more extensive learner development. Students can conduct case presentations using a technique that makes each step explicit and gives *learners* the responsibility for expressing their clinical reasoning and uncertainties rather than *preceptors* the task of eliciting them.

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## Teaching and Learning Moments

## The Good Patient

Before medical school, I had taken it for granted that doctors treated all patients equally. My experience caring for a patient on my third-year surgical rotation taught me otherwise.

My patient was a young man, just a few years older than myself. He was a good kid—from the suburbs, a law school student, with two devoted parents. He was tall with an athletic build, dark blond hair, light brown eyes, the kind of guy nurses doted over, someone whose path I might have crossed in other circumstances.

He was otherwise healthy, but he had a problem. Some vague fatigue, a hematocrit in the low 20s, and then the CT, which revealed a massive gastric sarcoma. I was there for his “debulking” surgery; the morale in the OR was high that day. Nurses played “Guess how much the tumor weighs” as the surgeon scooped out the bowling-ball-sized cancer in record time. And what an interesting case! A brother with Wilms tumor, aunts with early-onset breast cancer—could it be Li-Fraumeni, we wondered?

And then the surgery was done, and he was my patient. I was the first one to see him each morning, to turn on the light just hours after the previous night's blood draw. From the team's perspective, he was one of our “healthiest” patients and did not require much attention.

Early on, he complained of some throat irritation and pain with swallowing, likely related to his nasogastric tube, which I faithfully reported back to the team. We spent a few minutes with him and gave him some numbing spray for his throat, but he still complained daily. The team teased, “We'll just have to make him your personal patient, now won't we?” I could take the hint—in bringing up my patient's throat, I was also wasting precious time on rounds, and so I learned to keep quiet about his complaints.

Yet, the following week, in taking signout with my intern, I found there was page after page about my patient's throat but that the nightfloat had decided not to check on him. While I knew this probably wasn't crucial and didn't want anyone to be blamed, I kept thinking—he was so young, my age. If our positions had been reversed, who would speak up for me if no one would hear me? I broke my silence and brought up my patient's throat again on rounds.

This time, the intern was chastised on the spot for not taking care of things sooner. Yet, when we got to my patient's room, the reminder of our 25-patient list soon caught up to us, and the patient was simply handed the stern “Okay, yes . . . someone will come back to see you” line. The next day, nothing had changed—neither his

discomfort nor the lack of attention to it—and yet he had no complaints and tried to crack a smile. I remember looking at him that day. He seemed dirty and disheveled; his hair was now matted and frazzled. A “good patient” today—no complaints, right on schedule. Today he had given up. Just like everyone on the team, he had learned his place, too.

My patient was discharged shortly thereafter, only to return the following weekend with an intraabdominal abscess almost as large as his original tumor. Probably, there was no way our team could have prevented this. At least his throat didn't hurt anymore.

During my clinical years, I learned more and more to think and act like a doctor. In caring for this patient, I also learned that it is important to continue to take a step back and think about what kind of doctor I want to become. Acknowledging and alleviating what seems like a minor complaint may not be as medically necessary as, say, tumor removal, but such acts recognize and dignify patients' humanity. Doctors may not always get “good patients,” but we must always be good to our patients.

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