

## SNAPPS AS A METHOD OF CASE PRESENTATION FOR INPATIENT SETTING: A RANDOMIZED CONTROLLED TRIAL

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### ABSTRACT

**Background:** Case presentation is a time-honored tradition in clinical medicine. During conventional case presentations, students' reasoning skills remain mostly unknown. This study focuses on the feasibility of SNAPPS, to facilitate clinical reasoning skills in post- graduate students of surgery. **Materials and Methods:** In this randomized controlled trial, postgraduates were divided in two groups, SNAPPS (n=12) and control (n=12). They presented total 60 cases (30 each) in both the groups. The presentations were observed for Presentation time, Clinical reasoning, Expressed uncertainties and clarifications, Patient management plan and Identification of case related topics and resources. **Results:** The three variables showed statistically significant difference between two groups in Number of basic clinical attributes covered, Number of diagnoses kept in differential diagnosis and Number of justified diagnosis kept in the differential diagnosis (p value 0.0001).The four responses namely, Concisely history taking, Performing all steps of general examination, Relevant Systemic examination findings and in accordance with history and identification of sufficient case based learning issues for self study, showed significant difference between the two groups. As per tutors feedback, 25 (83.33%) in cases and 10(33.33%) in control group concisely covered all aspects of history taking. **Conclusion:** SNAPPS can be used effectively as a method of case presentation for postgraduate students in indoor settings. It is effective to facilitate the expression of clinical reasoning and diagnostic thinking as it involves case analysis and identification of practice points during case presentation. It also enables to dedicate uniform and more time for case discussion which gives it an advantage over conventional method where the time dedicated is less and varied.

**Keywords:** SNAPPS, Inpatient, Case presentation, Teaching and learning

### **INTRODUCTION:**

Teaching in the clinical environment is defined as teaching and learning focused on, and directly involving patients and their problems (Spencer J 2003). Case presentation is an important skill in medical education to assess clinical competence and other parameters. The essential elements of clinical competence include collection of patient data by an effective history taking and physical examination,

identification of the patient's problem, formulation of differential diagnoses, planning of investigations, management and demonstration of adequate communication skills while performing all of these.

In the conventional way; the case is presented by learner in a standardized format. The preceptor then asks several directed questions to clarify the history

and physical examination findings better, in order to establish a differential diagnosis and a treatment plan. This process may take place during or after the presentation and is sometimes followed by a brief mini-lecture, which rarely contains feedback. During such case presentations, students' reasoning skills and knowledge base remain mostly unknown.

A technique which is learner-centered model for case presentations to the preceptor follows a mnemonic called SNAPPS. This model was developed by Wolpaw Terry (2003), based on the work of Bordage in cognitive learning, and that of Osterman and Kottkamp on reflective practice for educators. He developed a collaborative model for case presentations in the outpatient setting that links learner initiation and preceptor facilitation in an active learning conversation. SNAPPS was then established as a method of case presentation in outdoor setting. The utility of this method is not yet tested in indoor settings which can be very well utilized for learning as clinician spends most of his time there. Hence, this study is an attempt to explore the utility and feasibility of this learner - centered model in inpatient settings and efficacy to facilitate the expression of Clinical Reasoning in the Postgraduate students.

### **Material and Methods:**

It was randomized controlled trial, carried out at Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences (Deemed University), Sawangi (Meghe), Wardha. Institutional Ethical committee clearance was obtained (DMIMS(DU)/IEC/2014-15/967 dated 15/12/2014) and written consent was obtained from participants before enrollment in the study. The study was conducted from January 2015 - January 2016.

Of the 24 postgraduate students of General Surgery, 12 were second year and 12 third year residents. They were divided into Group A SNAPPS Group (Cases n=12) for 30 presentations and Group B (Control n=12) for 30 presentations using random allocation sequence generated by 'Random allocation software version 2.0'.

### **Study Design:**

Cases were sensitized about case presentation by SNAPPS technique. A standard protocol of SNAPPS was detailed postgraduates for presentations. The cases were provided with the printed pocket cards mentioning the steps of SNAPPS.

The Preceptors (total = 8) for this study were Assistant Professors from the Department of General Surgery who were sensitized for SNAPPS technique and the various parameters to be observed during presentations. For presentations, in both groups, the choice of tutors was left to students. Cases for presentations were either from gastrointestinal or genitourinary tract.

The tutors were instructed to observe case presentations, provide feedback in a structured format and rate the case presentation on a scale of 1 to 10. Feedback of tutors was taken incorporating following parameters;

1. Conciseness of history taking
2. Performance of all the steps of general examination
3. Relevant Systemic examination in accordance with history
4. Organized sequencing and formulation of differential diagnosis
5. Hypothesis of differential diagnosis matching with history and examination
6. Ability to speak out all the difficulties faced while case discussion
7. Narration of patient management plan – realistic and appropriate to differential diagnosis
8. Identified sufficient case based learning issues for self-study
9. Time management during case presentations
10. Uniformity and skills of presentation

The other parameters of SNAPPS were observed by the students who were not the part of the study. They were asked to just observe and record the findings of presentations without interfering and interpreting the findings. They were absolutely inert, unbiased data recorders at the time of case presentations for both the groups. The parameters recorded by them were;

1. **Presentation time (in minutes):**
  - a. Total time – Time from start to finish

- b. Time for summary – Time for history and physical findings.
- c. Time for discussion -Time from start of discussion on differential diagnosis to end.

**2. Clinical reasoning:**

- A. Number of basic clinical attributes (fig. 1) covered out of nine
- B. Number of diagnoses kept in differential diagnosis
- C. Number of basic attributes in support of diagnosis in the differential diagnosis
- D. Number of justified diagnosis in the differential diagnosis
- E. Number of distinct comparisons made between two diseases

**3. Expressing uncertainties-** Number of uncertainties expressed and obtained clarifications

**4. Discussion on patient management plan**

**5. Discussion on case related topics and resources**

Data recording sheet were provided to record data. To record time, they were provided with stop watches.

**Fig 1: Basic clinical attributes**

<b>Basic Clinical Attributes</b>
1. Demographic profile
2. Chief complaints – chronology and sequence
3. Relevant sequencing of complaints in history
4. Correlation of complaints with duration
5. Additional relevant positive history
6. Correlation of complaints with each other
7. Relevant and significant negative history
8. Matching conclusions on history
9. Other significant past, personal or family histories

After case presentations, the students presenting the case were asked to fill the feedback forms and rate their case presentation on a scale of 1 to 10.

**Data Analysis:**

The data of both the groups were analyzed for each dependable variable and between group differences using percentage, mean, standard deviation, standard error and t-value. The statistical significance between the groups was calculated using student’s test and calculating p value. P<0.05 was considered as

statistically significant. Chi square test was used for nominal scaled variables.

**Observation and Results**

The second year residents (n=12) in both the groups had two case presentations each, hence 24 presentations were performed by them. Similarly, third year residents (n =12) presented three cases each in both the groups, hence 34 cases were presented by them. Total 60 presentations were done, 24 by second year residents and 36 by third year residents.

**Table 1: Variables of Case presentations**

The mean presentation time in SNAPPS group for Summary and Discussion was  $3.83 \pm 0.37$ ,  $3.73 \pm 0.58$  minutes respectively and total time was  $7.56 \pm 0.50$  minutes. The mean presentation time in control group for Summary and Discussion was  $2.90 \pm 0.30$ ,  $2.50 \pm 0.50$  minutes respectively and total time was  $5.36 \pm 0.82$  minutes. The time of presentation for Summary, Discussion and total time was statistically significant in both the groups. The control group took 32.06% less time to present Summary, 49.20% less for discussion and control group took 41.04% less time for total presentation than cases. Table 1 also depicts the mean Number of diagnoses kept as differential diagnosis, mean number of basic attributes in support of diagnosis kept as the differential diagnosis and mean number of distinct comparisons made between two diseases in cases and controls.

Number of basic clinical attributes covered, diagnoses kept in differential diagnosis and justified diagnosis kept in the differential diagnosis, showed statistically significant difference between two groups (p value 0.0001). The remaining two variables, Number of basic attributes in support of diagnosis kept in the differential diagnosis and distinct comparisons made between two diseases, were not statistically significant (p value 0.28 and 0.12 respectively).

The mean Number of uncertainties expressed and clarifications obtained by the students in cases were  $4.70 \pm 0.46$  with mean standard error 0.08. The patient management plan was discussed by all students in both the groups however, case related topics and resources were discussed by cases only.

After case presentations, feedback was taken for that particular case. The feedback was compared for both

the groups with respective responses. Significant difference was found for identification of sufficient case based learning issues for self-study  $p = 0.0001$  and for hypothesis of differential diagnosis matching with history and examination ( $p = 0.022$ ).

### **Table 2: Analysis of Student's Feedback**

All aspects of history taking were concisely covered by 23(76.67%) cases and 17(56.67%) controls. All the steps of general examination were performed by 24(80%) students in cases and 19(63.33%) in controls. 19(63.33%) students in SNAPPS group and 21(70%) in control group thought that Systemic examination findings were relevant and in accordance with history. 15(50%) students in SNAPPS group and 14(46.67%) in control group affirmed that Sequencing and formulation of differential diagnosis were well organized.

24(80%) students in SNAPPS group and 14(46.67%) in control group thought that Hypothesis of differential diagnosis was matching with history and examination. 23(76.67%) cases and 16 (53.33%) controls were able to speak out all the difficulties faced while case discussion. Narration of patient management plan was realistic and appropriate to differential diagnosis was felt by 22 (73.33%) cases and 16 (53.34%) controls.

Nearly 100% cases identified sufficient case based learning issues for self-study in contrast to controls. 21(70%) cases felt that there was uniformity in case presentation and skills of presentation were adequate as compared to 60% of controls. 100% cases agreed to strongly agreed on identifying sufficient case based learning issues for self-study whereas 100% students in control group disagreed on this.(table 2)

### **Table 3: Analysis of Tutor's Feedback**

After each presentation, the feedback was taken from the tutors on the same parameters as that of students. The four responses namely; 1.Concisely covered all aspects of history taking, 2. Performed all the steps of general examination, 3. Systemic examination findings were relevant and in accordance with history and 4. Identified sufficient case based learning issues for self study showed significant difference between comparing groups ( $p=0.001$ ,  $p=0.0001$ , 0.034, and

$p=0.0001$  respectively), whereas rest all responses were not significant.

Sequencing and formulation of differential diagnosis were well organized in 17(56.67%) in SNAPPS group and 14(46.67%) in control group. Hypothesis of differential diagnosis was matching with history and examination for 22(73.33%) presentations in cases and 18(60%) presentations in controls. During 19(63.34%) presentations in SNAPPS group and 14(46.67%) in control group, students were able to speak out all the difficulties faced while case discussion. Narration of patient management plan which was realistic and appropriate to differential diagnosis was done by all cases whereas 1(3.33%) presentation in control group was devoid of it. 100 % cases identified sufficient case based learning issues for self-study.

20(66.67%) cases and 19(63.33%) in controls followed the instructions of time management during case presentations. 23(76.66%) students in SNAPPS group and 23(76.67%) in control group uniformly presented the cases and the skill of presentation was adequate. (table 3)

### **Table 4: Rating for case presentations**

The mean rating by students for cases was  $7.53 \pm 0.97$  and for controls was  $6.46 \pm 0.93$  which was statistically significant ( $p=0.0001$ ).By tutors the mean rating for cases and controls were  $7.56 \pm 0.81$  and  $6.33 \pm 0.54$  respectively which was statistically significant ( $p = 0.0001$ ).(table 4)

### **Table 5: Correlation of overall rating on students and tutors' feedback**

The overall rating of case presentation calculated on students' feedback and tutors' feedback when correlated with each other showed non-significant but positive correlation with  $r$  value 0.06 and  $p$ -value 0.61.(table 5)

## **DISCUSSION**

The model of case presentation known by its mnemonic as SNAPPS was developed by Wolpaw Terry (2003). This work was based on the work of Bordage in cognitive learning, and that of Osterman and Kottkamp on reflective practice for educators. SNAPPS was developed as a collaborative model for

case presentations in the outpatient setting that links learner initiation and preceptor facilitation in an active learning conversation. This learner-centered case presentation technique depends mostly on student for its successful implementation. 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.

This model was designed for outdoor or office setting case presentations, because the teaching– learning moments are brief but multiple and engages the learner directly to identify learning needs in the context of the patient being seen. It offers the prerequisite skills for maintaining professional competence in the workplace by shaping ongoing practice-based and self-directed learning skills. The basic needs for such model in outdoor setting were multiple teaching learning moments, identify learning needs of the learners, to develop professional competence and to augment self-directed learning. If these are the basic fundamental needs of the learners in any domain and at any level of competence, then it can be adopted at any setting.

With these same fundamental aspects in mind, we tried to study this model at postgraduate level and at an entirely different setting of indoor. The workload for the postgraduates in indoor setting is quiet high; hence, their learning needs may sometimes be underestimated at the cost of effective patient management. The time factor of students, teachers or consultants which can be utilized for teaching and learning is always prioritized for patient management and resolving patient related matters. SNAPPS is a well established method of case presentation in outpatient settings where clinicians find it difficult to spare time for teaching. Hence this method was tested for case presentation in in-patient settings where the environment is quiet same in terms of clinical workload, teaching schedules and the number of students.

Studies of traditional case presentations have shown that students focus mainly on factual information and rarely express their clinical reasoning or case-based uncertainties (William E Cayley 2011). The conventional case presentation has many limitations

including its high subjectivity. The identification of case related issues and learning needs becomes difficult and hence self-directed learning to enhance professional competence is not possible. Evidences claim that students focus mainly on factual information and seldom express their clinical reasoning or case-based uncertainties (Wolpaw Terry 2009). 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. Thus, there is a need, 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 (Irby DM 2008).

#### **Presentation time:**

The mean presentation time for Summary and Discussion in cases was  $3.83 \pm 0.37$ , and  $3.73 \pm 0.58$  minutes respectively and total time was  $7.56 \pm 0.50$  minutes. The mean presentation time in controls for Summary and Discussion was  $2.90 \pm 0.30$ ,  $2.50 \pm 0.50$  minutes respectively and total time was  $5.36 \pm 0.82$  minutes. The time of presentation for Summary, Discussion and total time was statistically significant in both the groups ( $p = 0.0001$ ). The students in SNAPPS group took on average, two minutes more to present their cases than the students in the control group because of its structured nature of presentation and more number of basic clinical attributes. The summary of the patient findings through SNAPPS technique accounted for approximately half of the presentation time. Further, SNAPPS presentations contained more number of basic clinical findings than the traditional case presentations. In SNAPPS technique, students summarized patient findings concisely while maintaining the same degree of thoroughness as in conventional case presentations.

The total time of presentation was statistically significant ( $p=0.0001$ ), more in SNAPPS, which suggests the well-structured format and detailed coverage of case contents. Students using the SNAPPS technique were more concise in their summaries i.e. Time for summary /total presentation time than students in control group (0.50 compared with 0.55). Wolpaw Terry (2009) published first data on SNAPPS technique and related statistical analysis

for outdoor presentations. Total presentation time in their study was 5.65 minutes versus 4.66 minutes in control group, with a difference of 48 seconds. There were no statistically significant differences in presentation length (time in minutes) between students in cases and control group. Students in the SNAPPS group took, on average, one minute more to present their cases than the students in the control group (5.65 versus 4.66, with p value 0 .05). Though the length may vary, depending on the complexity of the case, the summary should not occupy more than 50% of the learning encounter and, generally, should be no longer than three minutes (Wolpaw Terry 2003).

Summary time, in present study, was short as compared to control group and was more concise to condense relevant information only. The advantages of condensed summary are that the preceptor can readily elicit further details from the learner. In this step, the learner should be encouraged to present the case at a higher level of abstraction.

#### **Summary thoroughness: Basic attributes in summary**

During presentations, the number of basic attributes in summary were observed and recorded on the forms. Out of the total 9 basic attributes in summary, they identified the numbers covered by the students. These nine basic attributes in summary were –Demographic profile, Chief complaints – chronology and sequence, Relevant sequencing of complaints in history, Correlation of complaints with duration, Additional relevant positive history, Correlation of complaints with each other, Relevant and significant negative history, Matching conclusions on history, Other significant past, personal or family histories.

The mean Number of basic clinical attributes covered out of these nine by the students was  $7.83 \pm 0.37$  in SNAPPS and  $4.56 \pm 0.50$  in control group. The difference in two groups was statistically significant with  $p < 0.0001$ . In a study by Wolpaw Terry (2009), Students in the three study groups reported an average of  $4.39 \pm 1.47$  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 ( $p$  value 0.079). The more number of basic

attributes in our study may correspond to the higher cognition of postgraduate studies.

#### **Providing and analyzing differential diagnoses:**

This step in the model is not to make exhaustive differentials or to make the differentials which are unlikely or rare. The purpose is to present two or three reasonable diagnostic possibilities that fit for history and clinical examination. For follow-up patients, the differential may focus on why the patient's disease is active or it is the recurrence of the primary disease or the complication of the primary treatment. As per original description of SNAPPS model (4) it was for whether the disease is active, what therapeutic interventions might be considered, or relevant preventive health strategies. This step requires a commitment on the part of the learner; similar to the microskills model of clinical teaching and initially represent early steps in the problem-solving process such as a hunch or best guess. In the SNAPPS method, the learner must present an initial differential to the preceptor before engaging the preceptor to expand or revise the differential (Wolpaw Terry 2009).

The mean Number of diagnoses kept in differential diagnosis was  $2.93 \pm 0.25$  in SNAPPS and  $1.76 \pm 0.43$  in control group. The difference in two groups was statistically significant with  $p < 0.0001$ . SNAPPS presentation contained on an average 3 differential diagnosis as compared to 2 differential diagnosis in control group. Control group started discussing patient management plan after enumerating the differential diagnosis. They did not analyze the differential diagnosis by appropriate reasoning. This misses the opportunity of giving feedback and guiding the students by the tutors. These findings are similar to the previous studies on SNAPPS (Wolpaw Terry 2009). Students using the SNAPPS technique expressed more than twice as many diagnoses in their case presentations than students in the other two groups ( $2.08 \pm 1.24$  versus  $0.81 \pm 1.03$  and  $0.77 \pm 0.89$ ,  $P < .000$ ; effect size 1.07). The differential diagnosis is made by both the analytical and nonanalytical skills, integrating each other and this develops with experience. Clinicians often unconsciously use multiple, combined strategies to solve clinical problems, suggesting a high degree of mental

flexibility and adaptability in clinical reasoning. If the learner is not able to describe the differential diagnosis, then by prompting the learner to reason aloud or eliciting the learner's uncertainties, the clinical teacher can uncover the reasoning process used by the learner (Bowen JL 2006)

### **Basic attributes in support of diagnosis in the differential diagnosis**

The mean Number of basic attributes in support of diagnosis kept in the differential diagnosis was  $2.60 \pm 0.49$  and  $2.73 \pm 0.44$  in SNAPPS and control group respectively. The difference in two groups was statistically not significant with  $p = 0.28$ . Both the groups used almost same number of basic attributes in support of their differential diagnosis.

More the number of basic attributes used by the students, more is the level of knowledge or cognition. When the groups are matching in terms of level of knowledge, the number of basic attributes in support of diagnosis kept in the differential diagnosis favors the process and techniques of presentation. This discussion allows the learner to verbalize his or her thinking process and can stimulate an interactive discussion with the preceptor. Learners will vary in their fund of knowledge and level of diagnostic sophistication, but all are expected to utilize the strategy of comparing and contrasting to discuss the differential (Wolpaw Terry 2003).

In the teaching environment, several learners with different levels of expertise may be involved in the same case, and eliciting the learners' various justifications of basic attributes in support of diagnosis in the differential diagnosis will help the teacher to understand their different perspectives about the case and their cognitive needs and their own perceptions about the case and hence the learning needs. In complex, ill-defined clinical cases, as in indoor settings and for postgraduate levels more than one problem representation may need to be considered. The discussion of the different justifications will help novice learners to appreciate the complexity of the case as well as their limited understanding (Bowen JL 2006).

### **Justifications of diagnosis kept in the differential diagnosis**

The mean Number of justified of diagnosis kept in the differential diagnosis was  $2.60 \pm 0.49$  and  $1.60 \pm 0.56$  in SNAPPS and control group respectively. The difference in two groups was statistically significant with  $p = 0.0001$ . The students in the SNAPPS group justified various diagnostic possibilities by providing supporting evidence in case summary and discussion on patient management plan. They justified the diagnosis based on patient's findings more elaborative than the control group. This is the analytical skill and is essential for effective diagnosing capability.

In a study by Wolpaw Terry (2009), students in the SNAPPS group justified their diagnostic possibilities more than five times more often than the students in the other two study groups ( $1.26 \pm 1.24$  versus  $0.22 \pm 0.55$  and  $0.23 \pm 0.57$ ,  $P < .000$ ; effect size 1.08) by providing supporting evidence from the case summary, literature, or their previous experience.

The steps in diagnostic reasoning are based on knowledge, experience and data acquisition. Data acquisition, depending on the setting, may include elements of the history, the findings on physical examination, and the results of laboratory testing and imaging studies. Another step is the creation of the mental abstraction, usually as a one-sentence summary defining the specific case in abstract terms. The justifications of diagnosis unless elicited in the teaching setting are rarely articulated. Rather, the teacher has to ask the justifications. The justifications of diagnosis represent the illustration of transformation of patient-specific details into abstract terms. In this transformation, the characterization of the patient's problem facilitates the retrieval of pertinent information from memory. The novice resident may be less able than the expert resident to develop accurate justifications of diagnosis. For this, the resident must have clinical experience with similar patients and must be able to recognize the information that establishes the particular diagnosis while ruling out other possibilities. The way the clinical experience is stored in memory either facilitates or hinders the ability to formulate various justifications. With repeated practice and by similar case scenarios, the students memorize the symptomatology or the justifications required to augment or to rule out a certain condition or disease (Bowen JL 2006).

Eva K W (2004) 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.

### **Comparing and contrasting between two diseases**

The mean Number of distinct comparisons made between two diseases was  $4.63 \pm 0.49$  in SNAPPS group and  $4.43 \pm 0.50$  in control group. The difference in two groups was statistically not significant with  $p 0.12$ . Both the groups were similar in comparing and contrasting the differentials.

Students in the SNAPPS group compared and contrasted two diagnostic possibilities more often than the students in the other study groups ( $0.20 \pm 0.47$  versus  $0.01 \pm 0.12$  and  $0.00 \pm 0.00$ ,  $P < .000$ ). 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) (Wolpaw Terry 2009).

In this step, the learner initiates a case-focused discussion of the differential by comparing and contrasting the relevant diagnostic possibilities and discriminating findings. Often the learner may combine this step with the previous step of identifying the diagnostic possibilities, comparing and contrasting each in turn. This discussion allows the learner to verbalize his or her thinking process and can stimulate an interactive discussion with the preceptor. Learners will vary in their level of knowledge and level of diagnostic sophistication, but all are expected to utilize the strategy of comparing and contrasting to discuss the differential.

Learners with strong diagnostic reasoning skills often use multiple abstract qualifiers to discuss the discriminating features of a clinical case, comparing and contrasting appropriate diagnostic hypotheses and linking each hypothesis to the findings in the case. The discussion between such a learner and the clinical teacher is often quite concise and may be so

abbreviated that its result, the diagnosis, appears to be a lucky guess.

Novice learners often generate numerous possible diagnoses for any given case. To prioritize such a lengthy list, they should be encouraged to compare and contrast possible diagnoses on the basis of the relationship among the actual clinical data on the case, typical presentations for each diagnostic possibility, and the relative probabilities of different diagnoses. Forcing learners to prioritize the list of diagnostic possibilities and explain their justifications helps them to create linkages between the clinical findings in the case and relevant diagnoses, bolstering their ability to develop pertinent illness scripts.

The development of elaborate illness scripts and pattern recognition involves knowledge of the typical presentation of a disease as well as the many atypical presentations or variations on the typical one. It is important for novice learners to begin by creating in memory an anchor prototype of the typical presentation, rather than giving equal consideration to a number of undifferentiated possibilities. Early in their training, medical students should be assigned to evaluate patients with common problems ideally, problems for which there are prototypical presentations. After the features of the prototype have been solidified in memory, additional clinical exposure to similar problems can offer a basis for comparison with the prototypical case, providing learners with an appreciation of atypical or subtle findings (Bowen JL 2006)

### **Expressing uncertainties and obtaining clarifications**

Almost 100 % students in the SNAPPS group expressed uncertainties and obtained clarifications regarding difficulties faced during examining the patients, diagnosis related issues, contrasting physical signs and the students mainly discussed on the further questions that can be asked for such diagnosis or cases.

The mean number of uncertainties expressed and obtained clarifications was  $4.70 \pm 0.46$  in SNAPPS group and none in control group has expressed uncertainties and obtained clarifications.

In a study by Wolpaw Terry (2009) 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% ,  $P < .000$ ).

During this step, the learner is expected to reveal areas of confusion and knowledge deficits and is rewarded for doing so. This step is the most unique aspect of the learner-driven model because the learner initiates an educational discussion by probing the preceptor with questions rather than waiting for the preceptor to initiate the probing of the learner. The learner is taught to utilize the preceptor as a knowledge resource that can readily be accessed.

The preceptors should provide the learner with specific clarifications on their uncertainties. The preceptor should point out case related issues the students experienced, relevant to patient's findings and diagnosis. The issues regarding the differentials and their justifications if not discussed by the students should be addressed by the preceptor. The other issues can be related to clinical examination skills, physical findings, sequencing the differentials and patient management.

It was 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. The students' needs are fulfilled and the difficulties they are facing are solved by the teachers (Connell KJ 1999).

Experts cannot easily predict the errors that novices make (Norman GR 1989). 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.

The feedback provided by the teachers on the errors of the students, are never forgotten and it makes them remembered forever.

A clinical teacher should provide the learner with specific cognitive feedback with diagnostically meaningful information about the case, identify redundant or irrelevant findings, and highlight the discriminating features, including their relative importance for drawing conclusions. When a learner suggests a possible but not plausible diagnostic consideration, the teacher can ask the learner to describe the key features of a prototypical case and then to compare the prototype with the findings in the case at hand (Eva KW 2004).

### **Discussing patient management**

The patient management plan was discussed by all the students in both the groups.  $\chi^2$ -value 16.52 and  $p < 0.001$ . In control group also, the students discussed patient management plans. Both the groups discussed the relevant investigations to be done and the treatment plans for that diagnosis. In a study by Wolpaw Terry (2009) 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%,  $P < .000$ ,  $\chi^2 = 48.71$ ).

The learner initiates a discussion of patient management with the preceptor and must attempt either a brief management plan or suggest specific interventions. This step asks for a commitment from the learner, but encourages him or her to access the preceptor readily as a rich resource of knowledge and experience. The discussion on patient management plans gives them a sense of application of cognitive knowledge to solve patient's problem or disease condition. The names of the investigations are not sufficient at this level but the rationale behind it, principles of that investigating modality and probable finding for that patient is expected from the student. The role of investigations and its correlation with the differential diagnosis should be emphasized more than just enumerating the investigation list as it happens at the undergraduate level. It should be followed by discussion on targeted patient treatment and not as a holistic approach for that disease. The treatment options available, feasible and their utility for the patient should be discussed. Discussion should

include the medical and surgical aspects of the treatment as well as the treatment of the complications of the primary sequel.

### **Identifying case-related topics for further study**

The case related topics and resources were discussed by all the students in SNAPPS group, whereas students in control group did not discuss the case related topics and resources  $\chi^2$ -value 60.00;  $p = 0.0001$ . The students in SNAPPS group, discussed the case related materials, study resources and also discussed the materials for further studies and advances of that disease.

In a study by Wolpaw Terry (2009), students - 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. This final step encourages the learner to read about focused, patient-based questions. The learner may identify a learning issue at the end of the patient presentation or after seeing the patient with the preceptor. The learner should check with the preceptor to focus the reading and frame relevant questions. The learner should devote time to reading immediately after the case presentation but practical possibility of this at residents' level is doubtful. It is encouraged to read in a regular, disciplined, and patient-based manner rather than in long, unfocused bursts.

Discussions about case related readings occurred only with SNAPPS users because the conventional case presentation does not allow the learners to discuss these issues after each encounter. Ideally, discussing case-related topics for further study after every case is important because every patient is different in disease presentation and progression, so each time issues would be different for the same learner. The issues of novice may be different from those of expert and that's why the resources will differ from case to case and learner to learner.

It was noted 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 (Bowen JL 2006). 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 (Bordage G 1990)

In a study by Apturkar DK (2014), assessed the clinical reasoning skills of surgery residents in outpatient setting using SNAPPS observed that nearly all residents agreed that they face difficulty while presenting a case in crowded OPD. The number of student who agrees and strongly agrees was about 80-90 % on the fact that they wanted to ask more questions, they were in hurry and found it difficult. They also agreed that, usually case was taken over by faculty providing readymade diagnosis to residents. They could not understand the logic behind the diagnosis though they wanted to express it in a better way. All faculties agreed that residents face difficulty in OPD due to workload and find it difficult to ask more questions due to busy schedule. Hence, the faculty handed over the diagnosis to residents to save the time. All faculties liked to be questioned by residents and guided them in case of difficulties.

The overall ratings given by the students themselves and the tutors are comparable for both the groups. It is obvious from the ratings that the students as well as tutors think that the SNAPPS is a better model of case presentation than the conventional one. There is a positive but non significant correlation  $r$  value 0.06 and  $p$ -value 0.61 between overall ratings in students and tutors' feedback.

### **CONCLUSION**

It is concluded from this randomized controlled study that, SNAPPS can be used effectively as a method of case presentation for postgraduate students in indoor settings or in patient settings. It is effective to facilitate the expression of clinical reasoning and diagnostic thinking in the Postgraduate students as it involves case analysis and identification of practice points during case presentation. It also emphasizes the

inculcation of nine basic clinical attributes like demographic profile, chief complaints, relevant sequencing of complaints in history, correlation of complaints with duration, additional relevant positive history, correlation of complaints with each other, relevant and significant negative history, matching conclusions on history, other significant past, personal or family histories, which are essential components of any case presentation. SNAPPS enables to dedicate uniform and more time for case discussion which gives it an advantage over conventional method where the time dedicated is less and varied. SNAPPS is effective in identifying case related issues for self study in postgraduate students.

### Recommendations

This method can be used for case presentations in indoor or inpatient settings. Further studies are required before its implementation for postgraduate students using larger sample size, and using different tools of assessments for testing diagnostic thinking and clinical reasoning. More randomized trials are essential to standardize time of summary presentation and the total time duration for postgraduates.

### Practice Points

- SNAPPS is more structured and concise model for case presentations in inpatient setting for postgraduates
- It helps to identify study resource materials
- It facilitates discussion over case related uncertainties and helps to find a solution to overcome these difficulties
- Time management is quite effective during case presentations.
- It emphasizes on positive findings of patient and focuses on relevant knowledge of students.

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**Table1: Variables of Case presentations.**

<b>SNAPPS Variable</b>	<b>SNAPPS</b>	<b>Control</b>	<b>t value</b>	<b>p value</b>
Presentation time: Summary	3.83 ± 0.37	2.90± 0.3	10.50	0.0001,S
Presentation time: Discussion	3.73 ± 0.58	2.50 ± 0.50	8.72	0.0001,S
Presentation time: Total	7.56± 0.50	5.36± 0.82	13.73	0.0001,S
Mean Number of basic clinical attributes covered	7.83 ± 0.37	4.56 ± 0.50	28.37	0.0001,S
Mean Number of diagnoses kept in differential diagnosis	2.93 ± 0.25	1.76 ± 0.43	12.79	0.0001,S
Mean Number of basic attributes in support of diagnosis in the differential diagnosis	2.60± 0.49	2.73± 0.44	1.08	0.28, NS
Mean Number of justified diagnosis in the differential diagnosis	2.60 ± 0.49	1.60 ± 0.56	7.28	0.0001,S
Mean Number of distinct comparisons made between two diseases	4.63 ± 0.49	4.43 ± 0.50	1.55	0.12, NS
Mean Number of uncertainties expressed and obtained clarifications	4.70 ± 0.46	00		
Discussed patient management plan	100 %	100 %		0.001, S
Discussed case related topics and resources	100 %	00		0.0001, S

**Table 2: Analysis of Student's Feedback**

Question	Group		Total	χ <sup>2</sup> -value
	SNAPPS	Control		
<b>Q1. Concisely covered all aspects of history taking</b>				
Disagree	2(6.67%)	2(6.67%)	4	3.15 p=0.20,NS
Neutral	5(16.67%)	11(36.67%)	16	
Agree	23(76.67%)	17(56.67%)	40	
<b>Q2. Performed all the steps of general examination</b>				
Neutral	6(20%)	11(36.67%)	17	2.05 p=0.12,NS
Agree	24(80%)	19(63.33%)	43	
<b>Q3. Systemic examination findings were relevant and in accordance with history</b>				
Disagree	0(0%)	1(3.33%)	1	2.70 p=0.43,NS
Neutral	11(36.67%)	8(26.67%)	19	
Agree	18(60%)	21(70%)	39	
Strongly Agree	1(3.33%)	0(0%)	1	
<b>Q4. Sequencing and formulation of differential diagnosis were well organized</b>				
Disagree	0(0%)	2(6.67%)	2	4.36 p=0.22,NS
Neutral	15(50%)	14(46.67%)	29	
Agree	15(50%)	12(40%)	27	
Strongly Agree	0(0%)	2(6.67%)	2	
<b>Q5. Hypothesis of differential diagnosis matching with history and examination</b>				
Disagree	0(0%)	2(6.67%)	2	9.60 p=0.022,S
Neutral	6(20%)	14(46.67%)	20	
Agree	21(70%)	14(46.67%)	35	
Strongly Agree	3(10%)	0(0%)	3	
<b>Q6. Able to speak out all the difficulties faced while case discussion</b>				
Disagree	0(0%)	2(6.67%)	2	5.03 p=0.17,NS
Neutral	7(23.33%)	12(40%)	19	
Agree	20(66.67%)	15(50%)	35	
Strongly Agree	3(10%)	1(3.33%)	4	

Question	Group		Total	χ <sup>2</sup> -value
	SNAPPS	Control		
<b>Q7. Narration of patient management plan – realistic and appropriate to differential diagnosis</b>				
Disagree	1(3.33%)	1(3.33%)	2	2.75 p=0.43,NS
Neutral	7(23.33%)	13(43.33%)	20	
Agree	19(63.33%)	14(46.67%)	33	
Strongly Agree	3(10%)	2(6.67%)	5	
<b>Q8. Identified sufficient case based learning issues for self study</b>				
Disagree	0(0%)	30(100%)	30	60.00 p=0.0001S
Neutral	0(0%)	0(0%)	00	
Agree	18(60%)	0(0%)	18	
Strongly Agree	12(40%)	0(0%)	12	
<b>Q9. Time management during case presentations</b>				
Disagree	0(0%)	1(3.33%)	1	4.05 p=0.27,NS
Neutral	10(33.33%)	11(36.67%)	21	
Agree	17(56.67%)	18(60%)	35	
Strongly Agree	3(10%)	0(0%)	3	
<b>Q10. Uniformity and skills of presentation</b>				
Neutral	9(30%)	12(40%)	21	0.68 p=0.71,NS
Agree	19(63.33%)	16(53.33%)	35	
Strongly Agree	2(6.67%)	2(6.67%)	4	

**Table 3: Analysis of Tutor's Feedback**

Question	Group		Total	χ <sup>2</sup> -value
	SNAPPS	Control		
<b>Q1. Concisely covered all aspects of history taking</b>				
Disagree	0(0%)	4(13.33%)	4	16.52 p=0.001,S
Neutral	5(16.67%)	16(53.33%)	21	
Agree	24(80%)	10(33.33%)	34	
Strongly Agree	1(3.33%)	0(0%)	1	
<b>Q2. Performed all the steps of general examination</b>				
Disagree	0(0%)	4(13.33%)	4	16.12 p=0.0001,S
Neutral	5(16.67%)	15(50%)	20	
Agree	21(70%)	11(36.67%)	32	
Strongly Agree	4(13.33%)	0(0%)	4	
<b>Q3. Systemic examination findings were relevant and in accordance with history</b>				
Disagree	0(0%)	3(10%)	3	8.67 p=0.034,S
Neutral	11(36.67%)	17(56.67%)	28	
Agree	16(53.33%)	10(33.33%)	26	
Strongly Agree	3(10%)	0(0%)	3	
<b>Q4. Sequencing and formulation of differential diagnosis were well organized</b>				
Neutral	13(43.33%)	16(53.33%)	29	2.34 p=0.31,NS
Agree	15(50%)	14(46.67%)	29	
Strongly Agree	2(6.67%)	0(0%)	2	
<b>Q5. Hypothesis of differential diagnosis matching with history and examination</b>				
Disagree	0(0%)	1(3.33%)	1	1.87 p=0.39,NS
Neutral	8(26.67%)	11(36.67%)	19	
Agree	22(73.33%)	18(60%)	40	
<b>Q6. Able to speak out all the difficulties faced while case discussion</b>				
Disagree	1(3.33%)	1(3.33%)	2	3.29 p=0.34,NS
Neutral	10(33.33%)	15(50%)	25	
Agree	17(56.67%)	14(46.67%)	31	
Strongly Agree	2(6.67%)	0(0%)	2	

Question	Group		Total	χ <sup>2</sup> -value
	SNAPPS	Control		
<b>Q7. Narration of patient management plan – realistic and appropriate to differential diagnosis</b>				
Disagree	0(0%)	1(3.33%)	1	4.34 p=0.22,NS
Neutral	14(46.67%)	13(43.33%)	27	
Agree	13(43.33%)	16(53.33%)	29	
Strongly Agree	3(10%)	0(0%)	3	
<b>Q8. Identified sufficient case based learning issues for self study</b>				
Disagree	0(0%)	28 (93.33%)	28	60.00 p=0.0001,S
Neutral	0(0%)	2(6.66%)	2	
Agree	25(83.33%)	0(0%)	25	
Strongly Agree	5(16.66%)	0(0%)	5	
<b>Q9. Time management during case presentations</b>				
Neutral	10(33.33%)	11(36.67%)	21	2.07 p=0.35,NS
Agree	18(60%)	19(63.33%)	37	
Strongly Agree	2(6.67%)	0(0%)	2	
<b>Q10. Uniformity and skills of presentation</b>				
Neutral	7(23.33%)	7(23.33%)	14	4.38 p=0.11,NS
Agree	19(63.33%)	23(76.67%)	42	
Strongly Agree	4(13.33%)	0(0%)	4	

**Table 4: Rating for case presentations**

SNAPPS Variable	SNAPPS	Control	t value	p value
Students Rating	7.53 ± 0.97	6.46 ± 0.93	4.32	0.0001,S
Tutors' Rating	7.56 ± 0.81	6.33 ± 0.54	6.87	0.0001,S

**Table 5: Correlation of overall rating on students and tutors' feedback**

	Mean	Std. Deviation	N	Correlation 'r'	p-value
Students Rating	7.00	1.08	60	0.06	0.61
Tutors' Rating	6.95	0.92	60		NS

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