Title
Implementation of web-based educational tool to promote clinical reasoning in pbl

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Publication Date
2018

Implementation of Web-Based Educational Tool to Promote Clinical Reasoning in PBL

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February 2018

ABSTRACT

Clinical reasoning is the complex cognitive analysis employed by physicians during the medical decision making process. This is first introduced in the problem-based learning (PBL) course in the preclinical medical school curriculum with the PBL facilitator playing a critical role in meeting these educational goals. However, factors, such as the instructor's clinical experience and teaching style, will have an impact the group's engagement in the clinical reasoning process. Thus, the clinical reasoning tool was developed to address this variability, with the goal of strengthening small group engagement in clinical reasoning during PBL. The clinical reasoning tool (CRT) is an online educational application, which provides a framework for the process of developing and analyzing the differential diagnosis for a clinical case. It was assigned as a self-directed learning assignment to one student per small group for selected second-year PBL cases during one academic quarter. There was a >70% CRT implementation rate across the seven selected cases with a total of 86 CRT look-ups produced. Overall, students felt the tool provided a useful framework for developing and analyzing a clinical case, however 68% were dissatisfied with the tool, citing concerns about suboptimal implementation and tool functionality, and only 18% felt it offered educational value. In contrast, 57% of faculty facilitators found the CRT to be a useful educational resource, though in need of a modified implementation approach. The CRT has the potential to serve as a valuable educational tool. However, its role within the medical school curriculum must be optimized. Consequently, there are several areas for improvement and innovation in the CRT, including tool design, curricular implementation, and educational outcomes evaluation. Overall, this project allowed educators to explore new teaching modalities at the level of undergraduate medical education.

BACKGROUND

Clinical reasoning is essential to the physician's practice of medicine. For each patient, the clinician gathers clinical clues through physical exam, labs, and imaging, develops and modifies the differential diagnosis based on supporting evidence, and identifies an appropriate diagnosis and management plan. Clinical reasoning, then, is the underlying complex cognitive process used to analyze information, evaluate its significance, and determine clinical decisions[19]. It employs two thinking strategies: analytic and non-analytic reasoning. Analytic reasoning is slow and systematic, using Bayesian analysis to modify the differential, thus providing the greatest potential for diagnostic accuracy. Non-analytic reasoning is fast and intuitive, using pattern-recognition to decrease cognitive load and emphasize efficiency[4,7]. While excess dependence on pattern-recognition can predispose to diagnostic errors[8,18], the high-volume conditions of clinical medicine do not allow for comprehensive analyses of each patient. Thus, the current consensus in the literature encourages the combined use of fast and slow thinking to best ensure clinical accuracy and to incorporate this dual cognitive approach into the education of medical trainees[7,8].

This paradigm shift gave rise to innovation in medical education allowing for the introduction of problem-based learning (PBL). PBL was created in the 1970s by McMaster University in response to student dissatisfaction with the traditional curriculum. A primary goal of PBL is the development of an integrated knowledge-base centered around a clinical scenario and built using the problem-solving processes of clinical medicine[1]. There is an extensive body of literature assessing the effectiveness of PBL, however the conclusions are mixed. Earlier studies concluded that there was minimal evidence that PBL improves clinical performance or knowledge acquisition[3]. However, it is important to note that

NBME licensure exam scores were used as the primary educational outcome in these studies. The literature has demonstrated that assessing clinical reasoning and problem-solving abilities in students is highly complex and best achieved through a multi-modal evaluation approach[6,11,17]. More recent literature using a variety of educational outcomes has found greater support for PBL[16], demonstrating improvements in comprehension and recall[5], knowledge acquisition and integration[10], and learning motivation[15].

Despite the conflicting evidence, PBL has been widely implemented at medical schools across the country, including UC San Diego. As a third-year medical student, I have had the opportunity to graduate from UCSD's PBL curriculum and reflect on its value and applicability during my clinical clerkships. While PBL allowed me to develop a knowledge-base centered around a defined clinical problem (e.g. pathophysiology, diagnosis, and management of gastric cancer), it did not fully equip me with the cognitive tools needed to approach diagnostic complexity and ambiguity, which are ubiquitous to the clinical setting. However, I felt that this skill gap had the potential to be modified with increased active participation and practice in clinical reasoning in the earlier years of medical school.

I hypothesize that the following variables could be targeted to strengthen the clinical reasoning aspect of UCSD's PBL curriculum: (1) variability in PBL tutor teaching styles and clinical experience, and (2) lack of a guiding clinical reasoning framework for preclinical students to use. The PBL tutor plays a crucial role in providing the cognitive framework within which students build their case-based knowledge[16]. However, if the tutor has difficulty meeting this need, students have the potential to complete a PBL case with suboptimal engagement in clinical reasoning. Thus, I propose the introduction of a clinical reasoning tool in PBL to support the tutor and ensure optimal teaching[14]. There has been significant innovation in PBL educational approaches, especially in technology integration[2,12]. However, there is little evidence of interventions targeted specifically at strengthening clinical reasoning. This project will thus attempt to implement a novel educational approach to bridge an identified skill gap in clinical reasoning between the preclinical and clinical years of medical school.

METHODS

Intervention

1) Clinical Reasoning Tool (CRT) Development
    a. CRT was developed in conjunction with UCSD Educational Computing Department
    b. CRT is an online educational modality accessible to UCSD faculty and medical students. Students and faculty have full access to the tool when logged into their WebPortal accounts.
    c. Access link: https://meded-portal.ucsd.edu/isp/2017/crt/index.cfm
    d. See Appendix 1 for an example student CRT look-up
2) CRT Implementation
    a. *Student population*:
        i. Second-year medical students (MS2)
        ii. MS2s have covered all first year organ-system blocks and have the basic knowledge to effectively participate in differential diagnosis development and clinical reasoning
    b. *Course*:
        i. MS2 PBL course, Fall Quarter (September – December 2017)
        ii. CRT was piloted for one quarter to determine optimal implementation approach. Fall quarter was chosen to promote student uptake early in the year.
    c. *PBL cases*:
        i. 7 of 12 PBL cases were selected for use with the CRT

ii. Inclusion criteria: MS2 PBL cases with a learning objective specifying the development of a "differential diagnosis"
iii. Eligible cases were reviewed by the organizing student and faculty to determine whether a differential diagnosis lookup using the CRT could feasibly be completed as a student assignment
iv. Selected cases:

	Block	Case	Selected?	DDX Topic
1	*Oncology*	*Lost to Follow Up*	*No*	
2	*Oncology*	*One Tough Kid*	*No*	
3	ARDD	It's Too Painful to Write	Yes	Arthralgia
4	ARDD	Ohh My Feet	Yes	Blistering skin condition
5	GI	Oh No Not Again	Yes	Upper GI bleed
6	GI	*Is There Any Hope?*	*No*	
7	ERM	Occam's Razor	Yes	Hypercalcemia
8	ERM	Menstrual Misadventures	Yes	Abnormal uterine bleeding
9	ERM	An Unexpected Diagnosis	Yes	Ovarian mass
10	*Cardiology*	*15-Love*	*No*	
11	Cardiology	Progressive Periodic Pesky Palpitations	Yes	Palpitations
12	*Cardiology*	*My Girlfriend Heard a Noise*	*No*	

1. Oncology block cases were excluded for scheduling reasons

d. *PBL Implementation*:
i. One student in each PBL small group was assigned to complete the "Differential Diagnosis" look-up using the CRT as their topic presentation in between PBL Day 1 and 2. The student was encouraged to access outside resources and utilize secondary presentation modalities as needed.
ii. The student was instructed to upload their completed "Clinical Reasoning Map" to their MyGroups page on WebPortal for faculty review prior to Day 2 presentations.
iii. The student presented their look-up directly using the CRT or any other presentation modality on Day 2.
iv. Student and faculty instructional materials were developed and uploaded to WebPortal and directly emailed to students and faculty, respectively, prior to each selected case.

Assessment & Evaluation

1) Student Assignment Review
a. Student assignments uploaded for each selected PBL case were reviewed by the organizing student (16 small groups, 8-9 students per group)
b. Each small group's assignments were reviewed to determine whether:
i. A DDX look-up was completed as requested
ii. The DDX look-up was completed using the CRT
iii. Students used an additional modality (Word doc, PPT) to supplement their CRT look-up and why (content discussion only vs. clinical reasoning demonstration)
c. Student assignments were reviewed each weekend after the completion of a case. Exemplary look-ups were identified, anonymized, and emailed to the MS2 class as examples in an effort to provide real-time feedback.
2) Faculty Facilitator Feedback
a. Anonymous, online survey was developed to acquire feedback from faculty small group facilitators
b. Survey was administered after the completion of each organ system block
3) Student Feedback

a. Anonymous, IRB-approved, online survey was developed to acquire student feedback
b. Survey was administered to all MS2s (regardless of whether they personally used the CRT) after the last selected PBL case; informed consent was obtained prior to survey

RESULTS

Student Assignment Data

	Block	Case	Selected?	DDX Topic		Group uptake and implementation			
					(-) DDX look up (-) CRT	(+) DDX look up (-) CRT	(+) DDX look up (+) CRT	CRT only	CRT w/ ppt
3	ARDD	It's Too Painful to Write	Yes	Arthralgia	0	3	12	6	6
4	ARDD	Ohh My Feet	Yes	Blistering skin condition	0	4	11	6	5
5	GI	Oh No Not Again	Yes	Upper GI bleed	0	3	13	1	12
7	ERM	Occam's Razor	Yes	Hypercalcemia	0	2	14	4	10
8	ERM	Menstrual Misadventures	Yes	Abnormal uterine bleeding	1	2	13	2	11
9	ERM	An Unexpected Diagnosis	Yes	Ovarian mass	0	5	11	2	9
11	Cardiology	Progressive Periodic Pesky Palpitations	Yes	Palpitations	0	3	12	2	10
					1	***22***	***86***	***23***	***63***

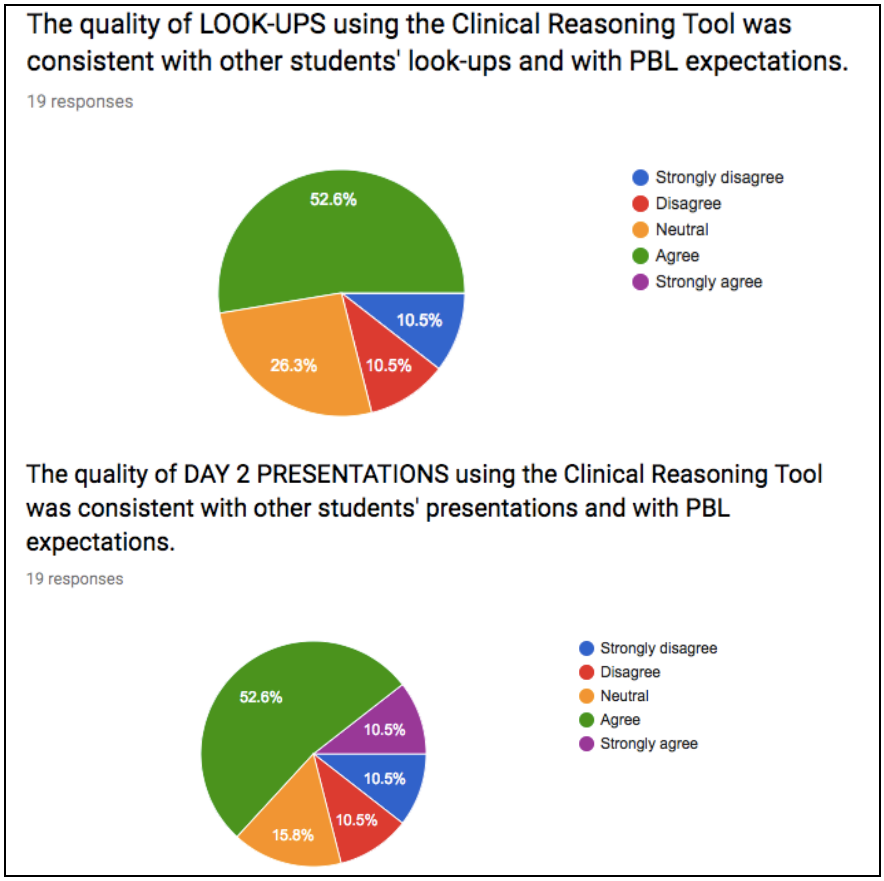
A. Implementation:
- 68-87% of small groups used the CRT for each assigned PBL case.
- There were typically 2-4 groups that completed a differential diagnosis look up, but did not use the CRT.
- Among several groups, one student completed more than one CRT differential diagnosis look up even though each student in the group had not used the tool at least once.

B. Tool Functionality:
- Overall, 73% of CRT looks up required the use of an additional modality (i.e. Word document or PowerPoint) to create a complete Day 2 presentation
    - 45/63 (71%) additional materials were dedicated to content discussion only (i.e. flowcharts, management algorithms, etiology and clinical presentation of other diagnoses in "Top 3")
    - 17/63 (27%) additional materials were dedicated to demonstration of both clinical reasoning and content discussion (i.e. slides discussing why diagnoses were ruled in/out, highlighted pertinent positives/negatives)

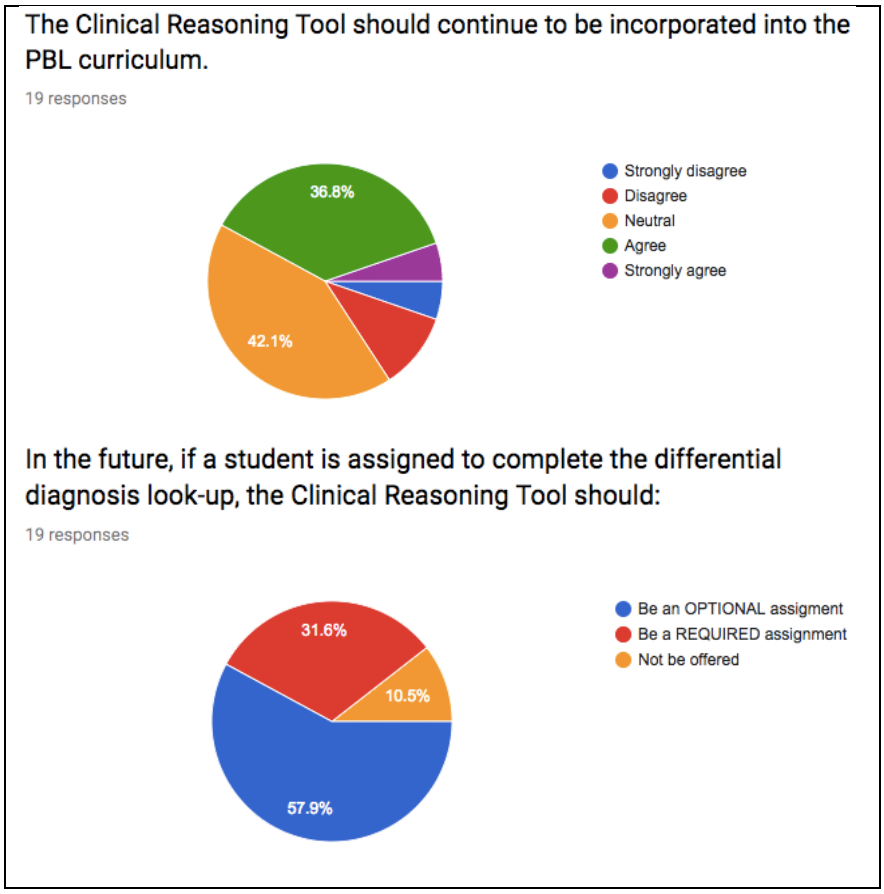
C. Look-Up Content:
- Ranking of "Top 3 Diagnoses" infrequently changed following analysis of clinical data. Frequently, the diagnosis in the #1 position was the known case diagnosis.
- "Broad Differential Diagnosis" section was typically thorough across most look-ups
- Clinical analysis section was typically the weakest in most look-ups
    - There was a tendency to include only clinical data that proved the known diagnosis
    - There was feedback that this section of the application was difficult to use
- Quality of look-ups, with regards to student's demonstration of clinical reasoning, clustered within groups. For example, if a student early in the quarter completed a thorough and thoughtful CRT look-up, most subsequent students in the small group used that example as a standard for their own look-up. Students that developed CRT look-ups that were limited in clinical reasoning set a similar standard for their group. Consequently, the degree of thoughtfulness and analysis in CRT look-ups tended to cluster within small groups where students used their peers' work as examples for their own.

Faculty Facilitator Feedback Data

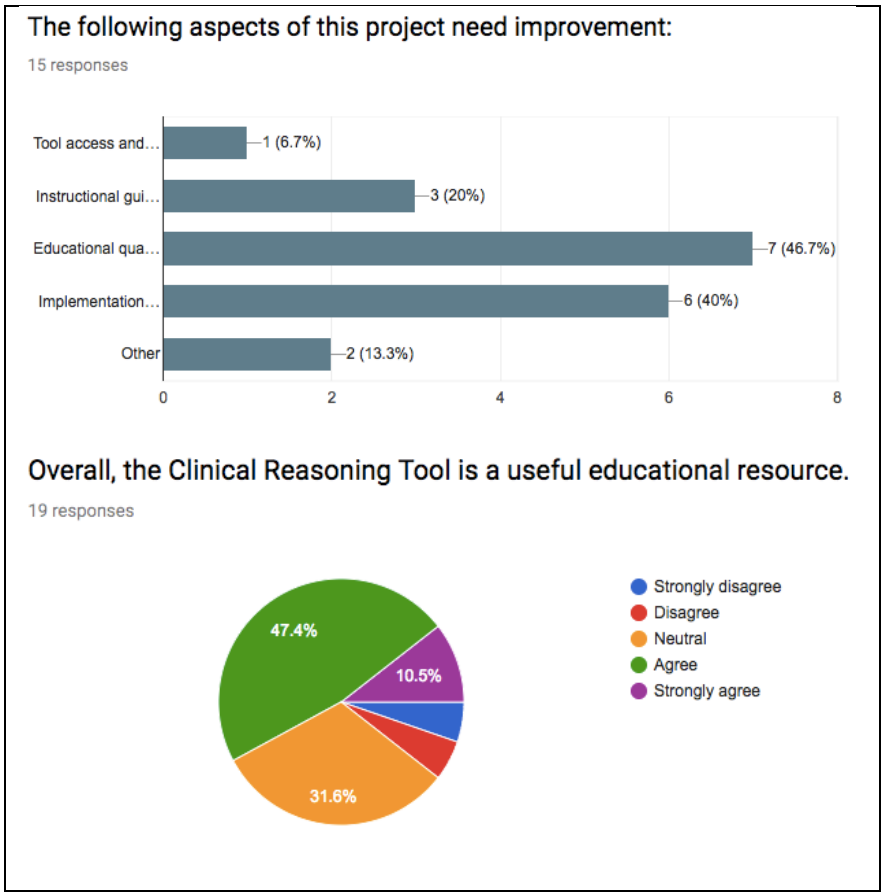
N = 19/37 (51% respondent rate)
Selected graphs are highlighted below. See Appendix 2 for all data.



More than 50% of faculty respondents agree or strongly agree that the quality of look-ups and presentations produced using the CRT is consistent with other students and with PBL expectations.



41% of faculty respondents agree or strongly agree that the CRT should continue to be incorporated into the PBL curriculum. If it is incorporated, 58% believe use of the CRT should be an optional assignment.



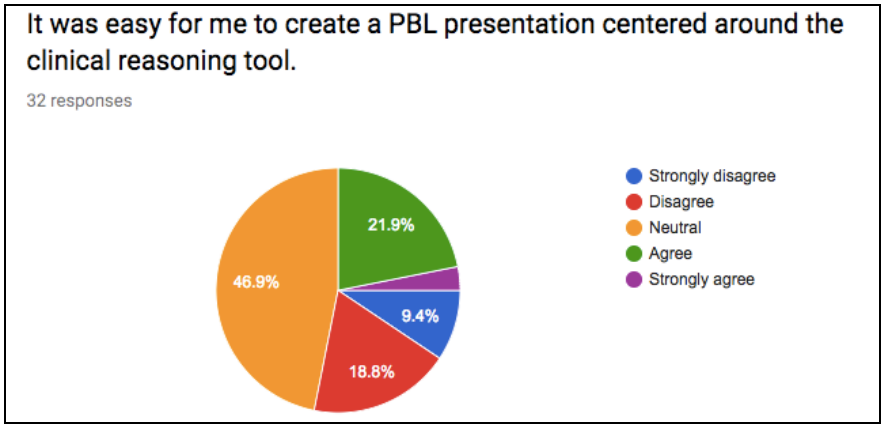
Overall, 57% of faculty respondents agree or strongly agree that the CRT is a useful educational resource. 40% and 46% recommend improvements to the tool implementation and educational quality of the tool, respectively.

Suggestions for improvement include:

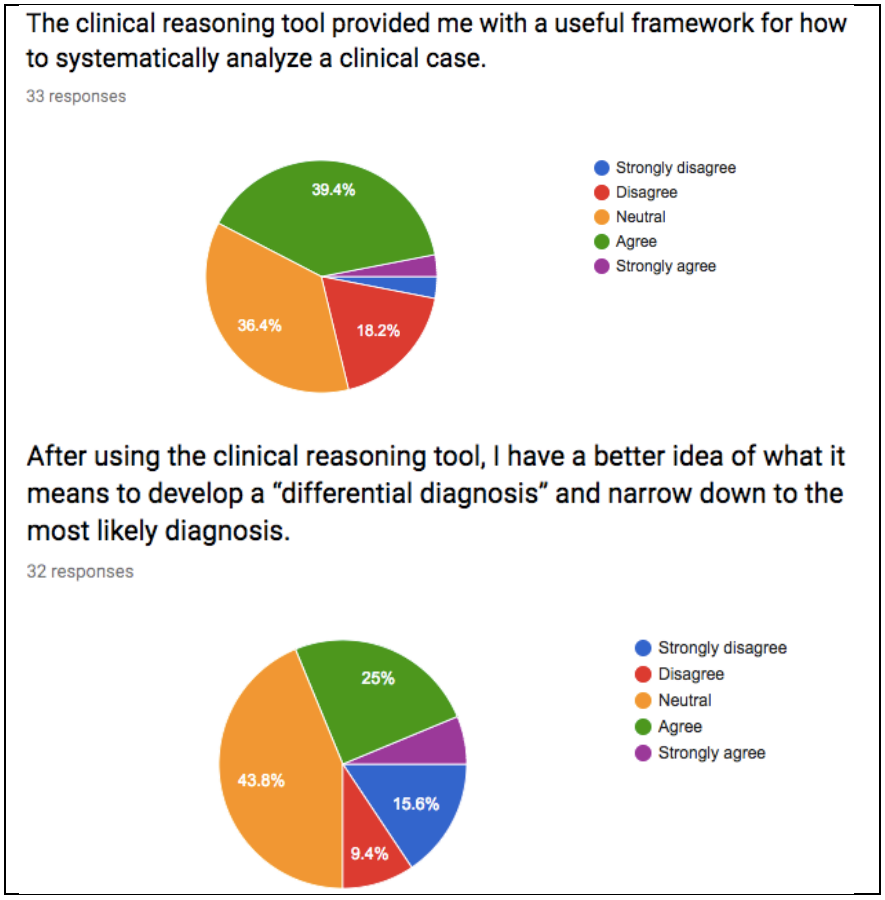
- Use tool during day 1 discussions
- Use tool in MS1 PBL
- Reserve tool for more complex cases
- Expand the "clinical reasoning" portion of tool (show how diagnoses are ruled in or out)
- Consider creating PowerPoint template if tool will not be used in the future

Student Feedback Data

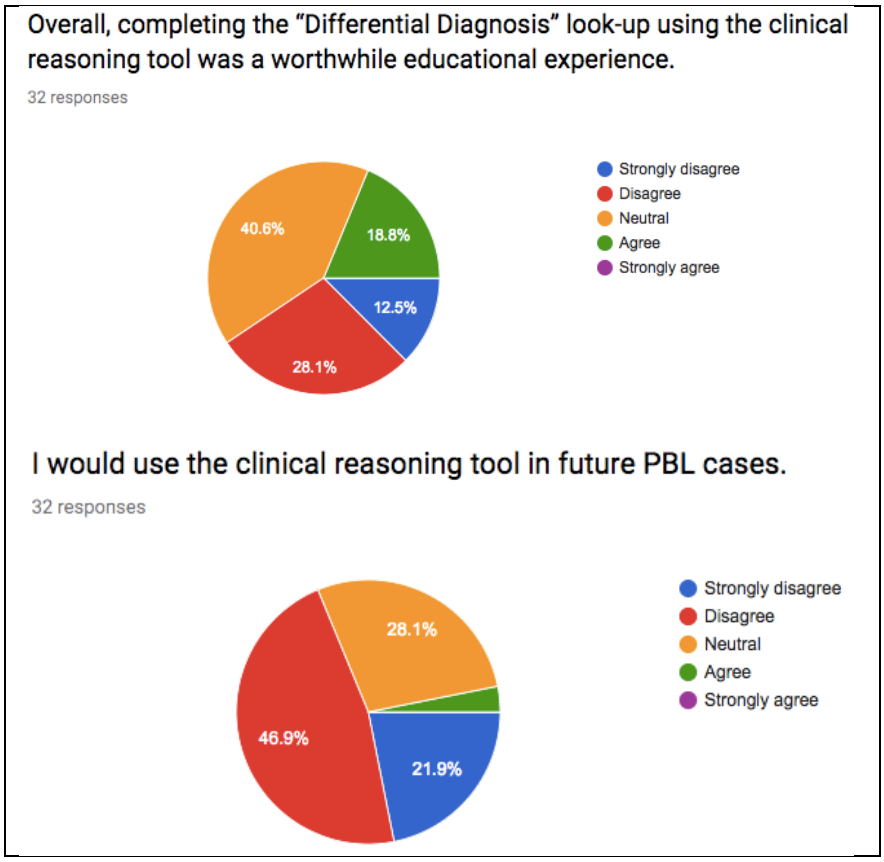
N = 33/131 (25% respondent rate)
Selected graphs are highlighted below. See Appendix 3 for all data.



25% of student respondents found it easy to create a PBL presentation centered around the CRT, while 28% did not.



42% of student respondents felt that the CRT provided them with a useful framework for systematically analyzing a clinical case. 31% of student respondents felt that the CRT improved their understanding of how to develop and narrow a differential, while 25% disagreed.



18% of student respondents found the CRT to be a useful educational experience, while 40% did not. Overall, 68% of student respondents would choose not to use the CRT in future PBL cases.

From free-text survey responses, positive and challenging aspects of the tool are summarized below.
Positive aspects of the tool include:

- Adds good organization to process of clinical case analysis
- Useful in developing and narrowing differential
- Easy to use and navigate tool
- Early exposure to clinical reasoning, unique to preclinical curriculum

Challenging aspects of the tool include:

- Look up felt redundant after having similar discussion in class during Day 1; recommend use of tool during Day 1 as a group
- Trouble with user interface (i.e. clinical information section, and had to use both CRT and PowerPoint to complete a lookup)
- Expected tool to entail smart algorithm which generated and modified differential as clinical information was input

DISCUSSION

Clinical reasoning is the complex cognitive analysis employed by physicians during the medical decision making process. These skills are developed and refined throughout one's medical training and practice, but are often first introduced in the preclinical medical education curriculum through PBL. The PBL facilitator plays a vital role in meeting this educational goal. Variability in facilitator clinical and teaching experiences will have an impact on student engagement in clinical reasoning, and serves as a potential area for intervention. Consequently, the clinical reasoning tool was developed in an effort to strengthen engagement in clinical reasoning during PBL and provides a framework for the process of developing and analyzing the differential diagnosis for a clinical case.

Overall, medical students felt that the clinical reasoning tool provided a useful framework for the process of diagnostic reasoning. However, they were much less enthusiastic about the educational experience of using the tool as an assignment between PBL Day 1 and 2. Based on feedback, they believed that the tool would have better served their educational needs if it was used in a group setting during Day 1 discussions. They perceived the individual assignment to be a redundant task, especially if they had a seasoned instructor that could guide the group through a similar clinical analysis during Day 1. Additionally, the negative impression of the CRT may not be directed at the educational value of the tool itself, but rather the tool's functional limitations (i.e. technical issues in the "Clinical Information" section and limited space for content discussion), which impacted user experience and hindered student workflow. Overall, it is important to interpret this data with caution in the setting of the low respondent rate (25%). The data may be skewed by respondent bias, in which students who felt strongly about their experience with the CRT chose to provide feedback.

Aside from the survey data, there is data from the student assignments to suggest that there was a subgroup of students who found the CRT look-up to be a useful educational exercise. There were several students in the MS2 class that volunteered to complete more than one CRT look-up despite the fact that other members in their group had not used the tool at least once. Incidentally, the quality of these look ups was above average in terms of the student's ability to demonstrate their clinical reasoning process for the PBL case. This highlighted the presence of at least a small subgroup of preclinical students that are aware of and enthusiastic about engaging in clinical analysis and developing a relevant skills set at the preclinical level.

In contrast to the student feedback, the faculty facilitators found the CRT to be a useful educational resource with a potential ongoing role in PBL. 40% of faculty felt that the CRT should continue to be incorporated into PBL, however the implementation approach should be reconsidered. Echoing the suggestions of the medical students, the faculty recommended CRT utilization during Day 1 discussions, in the MS1 curriculum, or reserved for more complex cases. It is also important to note the faculty respondent rate of 51%, which may also influence these data.

Comparing the faculty and student feedback brought to light an interesting dilemma in medical education. Preclinical medical students with minimal clinical experience perceived the clinical reasoning activity to be an extraneous academic exercise with limited utility in their current academic responsibilities. In a world of knowledge-based assessments, clinical analysis and diagnostic reasoning were seen as a low priority. However, faculty and senior medical students with clinical experience were able to appreciate the educational value of such an activity and its application in the clinical setting. A faculty member noted this discrepancy by commenting, "Students did not like [the CRT], but then did excellent work using it and presenting it." This poses an interesting challenge in medical education – how can educators encourage the development of clinically relevant skills, such as clinical reasoning, oral presentations, or note-writing, when the learner may not recognize the presence of a knowledge gap due to lack of firsthand experience? On the other hand, is there evidence to suggest that MS3 students are inadequately prepared for the clinical reasoning process they will encounter during their clinical clerkships? In a survey of third-year students and clerkship directors, O'Brien et al. found that clerkship directors felt that students had difficulty applying their knowledge to the clinical reasoning process, while students did not identify this as an area of struggle in the clerkship experience[13]. How to reconcile this discrepancy is not clear – should educators continue to find ways to bring the clinical experience to the classroom, or let the experience of MS3 year run its course among individual learners?

Moving forward, there are many avenues for improvement and innovation in this project. First, the CRT implementation approach was a central component of student and faculty critique. For small groups with

seasoned clinical facilitators, using the CRT as an independent assignment was perceived as a redundant exercise. Many faculty and students suggested use of the tool as a group activity during Day 1 discussions. We can also consider expanding the tool's use to include MS1 spring quarter PBL or the MS3 Internal Medicine clerkship, as a part of the H&P write up or a new admission presentation to their team. There may also be a role for the CRT in the preclinical ACA clerkship. These avenues should be explored as potential new use cases for the CRT.

Second, the tool itself must be optimized for the student user experience. Roughly 75% of look ups using the CRT required use of an additional modality, such as Word document or PowerPoint, to incorporate background information, flowcharts and diagrams, and even demonstration of clinical reasoning. This suggests that the current tool provides insufficient functionality as a presentation modality. Additional space for free content should be incorporated into the tool, or an entirely new platform could be considered, such as a standardized PowerPoint template. Technical challenges, such as limited functionality of the "Clinical Information" section and unpredictable data storage, must also be addressed in conjunction with the UCSD Educational Computing Department. Instructional PowerPoints, which included a screen capture video demonstrating an example CRT look up, were developed and distributed to students and faculty before each selected PBL case. Based on video viewer data, it became clear that very few students and faculty referenced these instructional materials, and as a result had difficulty when using the CRT for their assignment. As a way of addressing this issue, the PBL course directors and organizing student identified exemplary student CRT look-ups and emailed them as examples to the MS2 class before the next selected PBL case. This effort to deliver real-time feedback seemed to provide some clarity to students in how to use the CRT. In addition to sharing peer examples, we may consider introducing the CRT and its implementation during an in-class lecture or require viewing of the instructional video during PBL or facilitator prep meetings.

Third, it is crucial to assess the educational value and effectiveness of this curricular intervention. While assessment of clinical reasoning is complex with no clear consensus on the most accurate method, there is a potential role for the use of Clinical Reasoning Problems (CRPs), a clinical reasoning assessment method recently developed in Australia. CRPs were developed in order to monitor evolution of clinical reasoning in PBL in the medical school setting[9]. Educational outcomes assessment centered around CRPs or a similar concept will provide crucial insight into the educational value of the CRT.

The CRT is an innovative, easily accessible, online educational modality that can be used to promote active engagement in clinical reasoning in the medical school curriculum. While its optimal role in PBL should continue to be explored, there are several other places where the CRT might be implemented across the preclinical and clinical years of medical school. These might include using the CRT to complete a clinical case analysis during the first-year ambulatory medicine clerkship or third-year Internal Medicine clerkship, or using the CRT to assess clinical reasoning during standardized patient exams. Overall, this project allows educators to explore the use of new teaching modalities at the level of undergraduate medical education.

This project was a formative learning experience for me as an early medical educator. One of the main lessons that I have learned is that curricular change is challenging. The challenge begins in the development phase but predominates during the implementation process. Piloting new curricula requires that the educator continually evaluate the implementation process and provide feedback and necessary changes in real-time. There is also significant value to observing the curricular change firsthand to gain insight into the student user experience, which was something I was unable to incorporate into my time as a project leader. It was also humbling to receive feedback from students and faculty, and to learn how to translate criticism into project improvements moving forward. It was also valuable to learn that

different populations within an educational setting will have varying impressions of the same curricular change. For example, senior medical students and faculty were able to appreciate the role of the CRT, however the target audience (MS2 students) was not. An educator's assessment of a curricular weakness may not align with the student perspective and can thus limit students' willingness to participate in the curricular change. The clinical reasoning project provided me with not only a new practical skill set (i.e. application design, completing an IRB proposal, etc), but also with a broader appreciation of the responsibilities and challenges faced by medical educators during the process of curricular innovation.

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APPENDIX 1 – Sample CRT Look-Up

Your Clinical Reasoning Map

Below is the clinical reasoning map generated through your analysis of this week's PBL case! Please save a copy of this page, upload it to your My Groups page, and present the analytic map during your Day 2 presentations.

KEY CLINICAL FEATURES:

35 year old woman with pain in hands and feet for past 6 mos

started in hands and gradually progressed to feet

feels stiff 1 hour each morning associated with limited amount of swelling and warmth in fingers, wrists, feet

decreased range of motion of wrists due to pain and swelling

FH of sister with SLE, mother with Hashimoto's thyroiditis, grandmother who died in 50s of joint problem

PEX: fixed 1cm nodule at bilateral elbows; 1+ swelling and tenderness of MCPs, PIPs, MTPs, and PIPs of feet bilaterally; swelling and fluctuance of wrists with warmth, pain, and decreased range of motion bilaterally

Labs: ESR 45mm/hr, CRP 10mg/dL

U/S of wrist shows moderate fluid and soft tissue swelling with small erosion along right ulnar styloid

BROAD DIFFERENTIAL DIAGNOSIS:

Infectious

- viral arthritis
- Lyme arthritis
- infectious arthritis

Auto-immune & Inflammatory

- rheumatoid arthritis
- systemic lupus erythematosus
- Sjogren's syndrome
- dermatomyositis
- psoriatic arthritis

Endocrine & Metabolic

- crystalline arthritis (gout)

Malignancy

- hypertrophic osteoarthropathy secondary to lung cancer
- myelodysplasia

Trauma & MSK

- osteoarthritis

LEADING DIAGNOSIS (INITAL):

1. rheumatoid arthritis
2. osteoarthritis
3. viral arthritis

CLINICAL INFORMATION:

Type	Description	Significance
Additional history	1 hour morning stiffness	inflammatory arthritis causes AM stiffness and improves with use; OA usually gets worse with use
Additional history	FH: sister with SLE, mother with Hashimoto	significant FH of autoimmune disorders
Additional history	6 month duration of pain in hands and feet	viral arthritis tends to be shorter than this
Clinical signs (PEX, vitals)	fixed 1cm nodule at bilateral elbows	classic finding in RA
Clinical signs (PEX, vitals)	involves MCPs, PIPs, MTPs, and PIPs of feet	RA tends to affect MCPs, MTPs, PIPs; OA often involves DIPs and not as much MCPs
Labs	fluid from arthrocentesis - neg crystal analysis, neg gram stain	not gout, not infectious arthritis
Labs	ESR 45 mm/hr (elevated), CRP 10mg/dL (elevated)	nonspecific indicators of inflammation
Imaging	U/S of wrist with doppler showing increased vascularization	indicates inflammatory - could be RA or inflammatory OA
Imaging	U/S of wrist shows moderate fluid associated with soft tissue swelling	swelling in RA is usually warm, soft, tender; in OA swelling is more bony and hard
Imaging	U/S of wrist shows small erosion along right ulnar styloid	RA tends to have erosion of bone while OA tends to form osteophytes

LEADING DIAGNOSIS (REVISED):

1. rheumatoid arthritis
2. osteoarthritis

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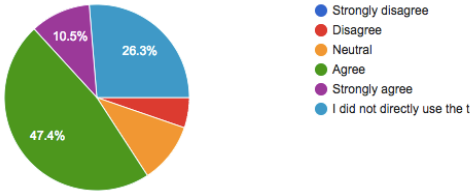
APPENDIX 2 – Faculty Facilitator Feedback Data

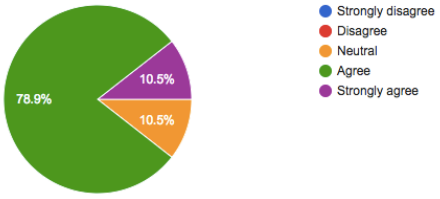
The Clinical Reasoning Tool was easy to access and navigate.

19 responses



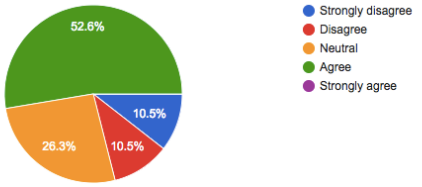
The instructional materials were useful in describing how to implement the tool in PBL.

19 responses



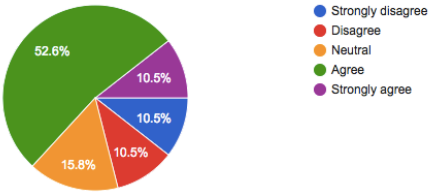
The quality of LOOK-UPS using the Clinical Reasoning Tool was consistent with other students' look-ups and with PBL expectations.

19 responses



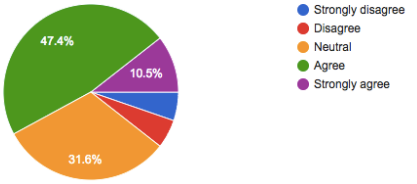
The quality of DAY 2 PRESENTATIONS using the Clinical Reasoning Tool was consistent with other students' presentations and with PBL expectations.

19 responses



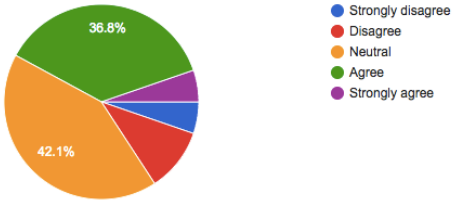
Overall, the Clinical Reasoning Tool is a useful educational resource.

19 responses



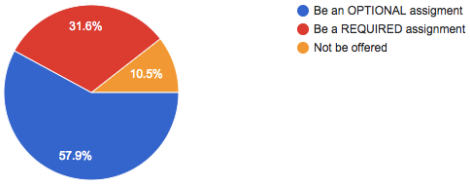
The Clinical Reasoning Tool should continue to be incorporated into the PBL curriculum.

19 responses



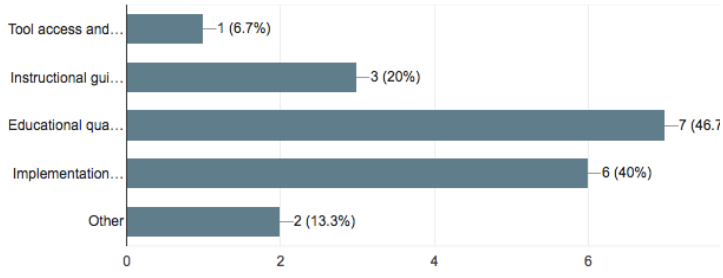
In the future, if a student is assigned to complete the differential diagnosis look-up, the Clinical Reasoning Tool should:

19 responses



The following aspects of this project need improvement:

15 responses

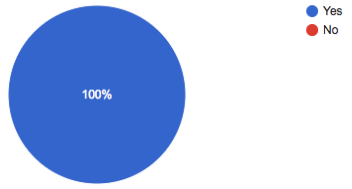


We were fine without it. My group felt it extraneous and didn't add value or create the intended framework for discussion. I agree with them.
I think the tool would be much more useful DURING the day one process because most of the time by the end of day one, students already have a pretty good idea about the diagnosis and they don't really need to go back and do it again.
Several students remarked that it would be good to use the clinical reasoning framework on day 1 when formulating a DDx in class (with the understanding that it may not be as complete as the DDx generated for a look-up. Also, it was commented that the usibility of the site could be improved including allowing people to go back and make changes to what they have already entered. Overall, I think it is a great idea to get students to broaden their differential.
- as a 'look-up', students were not sure how to use the tool, and it led to superficial low-quality presentations on Day 2, that often re-stated the discussion on Day 1 - a better use of the tool, would be in-class on Day 1 - maybe in between parts A and B, or B & C, depending on the case - to help guide the discussion, organize information, and formulate the working DDX on the board; this would then help students tailor/focus their look-ups
It seems it would work best in a more complex case (than say GI Bleed) where there is a large differential and you can compare why some processes on the differential are much more likely than others using this tool.
I like the structure this clinical reasoning tool offers. Prior to using this tool the write-ups that were focused on the differential diagnosis varied significantly. If it is decided this tool won't be used following this trial, would it be possible to use the design of this tool to create a PowerPoint formatted to "fill in the blanks"? Just a thought as I would like to see the tool remain a part of PBL in one form or another.
It seems like a good learning tool, however it seems it would be a great tool and more useful during day 1 session or during the first year. It did not seem to add significant amount of learning at this time of when it is used as part of the look-up or during second year.
Students did not like it, but then did an excellent work using it and presenting it.
Expand how tool helps show how dx's are ruled in and out.
Our MS2 students did not feel there was significant benefit using the Clinical Reasoning Tool. I (faculty member) would agree with that assessment. It may be beneficial for MS1 students though.

APPENDIX 3 – Student Feedback Data

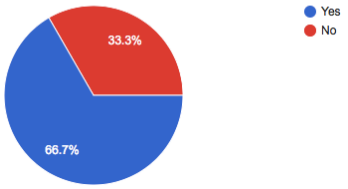
Did your PBL small group use the clinical reasoning tool for assigned PBL cases at least once during Fall Quarter?

33 responses



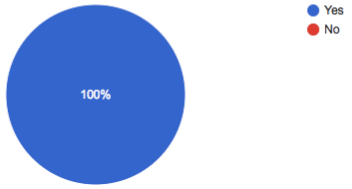
Were you assigned to complete the "Differential Diagnosis" PBL look-up using the clinical reasoning tool at least once during Fall Quarter?

33 responses



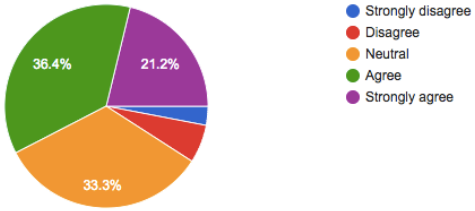
Did you observe another student present the "Differential Diagnosis" PBL look-up using the clinical reasoning tool at least once during Fall Quarter?

33 responses



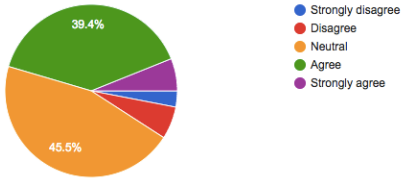
The clinical reasoning tool was easy to locate on WebPortal.

33 responses



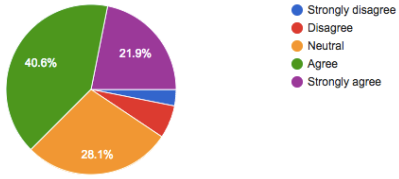
The online tutorial was useful in informing me how to use the tool for my PBL look-up.

33 responses



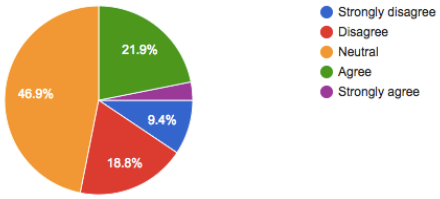
For each page of the tool, the instructions and commands were easy to understand.

32 responses



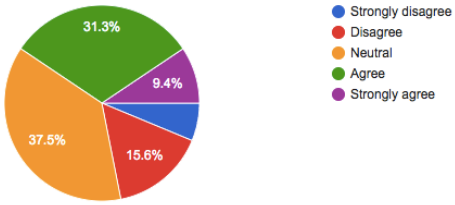
It was easy for me to create a PBL presentation centered around the clinical reasoning tool.

32 responses



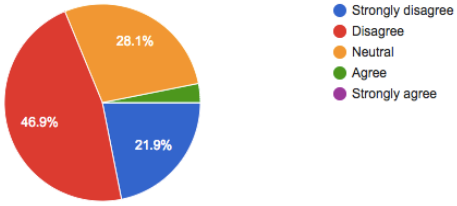
Overall, I found the clinical reasoning tool easy to use and navigate.

32 responses



I would use the clinical reasoning tool in future PBL cases.

32 responses



Please comment on any positive aspects of the clinical reasoning tool.

20 responses

Would be better if used in first year and also if used during day 1 as a group, rather than as a lookup for one person. Seemed a bit redundant after the day 1 case was complete.
would potentially be helpful during PBL
none
I thought it was a great way to organize information and was laid out really well.
Well organized and straightforward.
Easy to locate, good concept
I liked the theory behind improving our clinical reasoning. I think this tool would be well-suited as an in-class activity either on the first or second day. I think it is helpful to have it in more of a discussion format so students can share their logic and reasoning for various differentials.
I never had to use it personally.
Helpful for the generation of the DDx. Forces you to take the time to think about the pathophysiology of associated conditions and how they would present.
Easy to use
While it was somewhat useful to build a framework, it didn't add much utility. I was expecting some sort of application where as you enter in clinical findings, you get narrowed down choices of what the diagnoses could be. This ended up being a glorified worksheet
Can help organize thoughts for a broad differential
It was something that we don't get a lot in PBL and second year in general. I think it was nice to have.
Systematic DDx useful to work through
Helps break down specific data and what it means in relation to diagnoses
Never used it
I didn't use it
I thought it was good in help you narrow down your differential.
It is organized logically.
The tool helped me organize the case and the DDx

Please comment on any challenging aspects of the clinical reasoning tool.

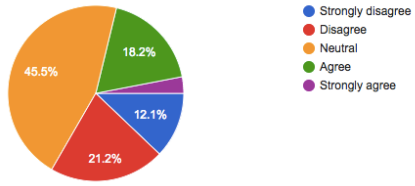
21 responses

after day 1 of PBL, there's not much use in doing it at home b/c we've already generated the info in class
GUI could be better.
It was useless to use retrospectively. Often we were assigned this tool with another lookup, then doing the tool itself seemed pointless because the class had already completed our differential for that case. If this were used in lieu of the whiteboard or the computer during class and during the case discussion on day 1, that's the only way to make this work (having someone actively fill it out with class help to assist in narrowing the differential). Doing it after day 1 just seemed like busy work.
Didn't really add any value to our PBL sessions.
Our PBL group agreed that we thought the tool would have been a lot more useful to use during day 1 of PBL. We would have been able to collaborate more as a group and share ideas of what we think the diagnosis could be. We would then be able to help each other rule things out and give ideas as to why we thought a particular diagnosis was right or wrong-- which is what I think PBL should be like in the first place. If we wait until day 2 of PBL, the students are less inclined to use the tool and it just becomes an ineffective assignment since it feels like a another lookup without actually gaining the experience of learning in a group setting.

I found the tool difficult because although it was intended to improve my clinical reasoning, it promoted the process but did not improve or enhance my knowledge of differentials. Working on it alone I found that I was just looking up a variety of differentials by myself and regurgitating them. I feel narrow minded on my own. In general, I think PBL can "jump the gun" and ask us questions about things we haven't learned yet. I think it would be more helpful to do this when we can draw from more knowledge on the second day (as a group) or if on the first day as a group so we can share our knowledge.
I never used it personally.
Hard to save work, i.e., if you accidentally go back on a web page, you lose everything that you typed.
Didn't really help to generate ddx. Was more of an organizational tool
Can be fairly tedious depending on the case
It was relatively easy to use, although it was very annoying that I couldn't go back to a previous page to edit my entries.
I think it was a bit difficult to integrate the clinical reasoning tool with the overall format of PBL as a lookup - it seemed like it would be something that would be good to go through during the actual case.
I think good PBL instructors will go through a DDX in class.
We had good facilitators who had already worked through the DDx with us during the case, so the tool felt redundant. I also never was assigned the tool so I can't speak to the ease of use, hence "neutral" answers
Takes a long time to input data. Not clear what ddx should be best. Sometimes have one ddx that is a priority, others not good but need to pick 3.
I did not feel that this added much to my learning. To me, it felt simply like a template that essentially mirrored what I do anyways for differential diagnosis look-ups, and just added another step of busy work to my look-up (i.e. having to type in the info to the tool and then create a power point/take screenshots of the tool, rather than just making a power point).
I think it would be more helpful if it provided information on the differential diagnoses instead of just acted as a framework
I didn't use it
I had expected to have different ddx options available to me as I navigated the clinical reasoning tool. It was good for organization, but I found similar ddx lists on the internet that were more useful. I think this tool may be good for PBL1 where they are learning to do a ddx more.
It was sort of an unnecessary level of organization, doesn't really give any extra help to get a differential. At this stage in our schooling I would hope anyone could look at a set of facts, see what's relevant, weigh the evidence, and predict some outcomes - all without the help of a form.
I felt that the tool simply reorganized the chart we make in PBL anyway with DDx hypothesis, To-Do's, etc. I personally did not see much of a benefit from creating the tool. It would be nice if the tool had some case specific clinical information (pertinent positives, symptoms, PEx signs)that would help guide my decision making.

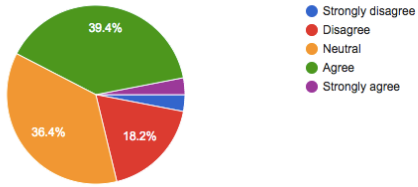
The clinical reasoning tool allowed me to think critically about the PBL case.

33 responses



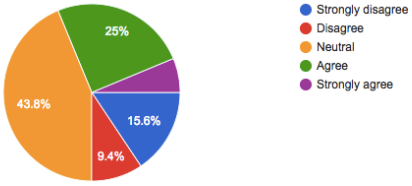
The clinical reasoning tool provided me with a useful framework for how to systematically analyze a clinical case.

33 responses



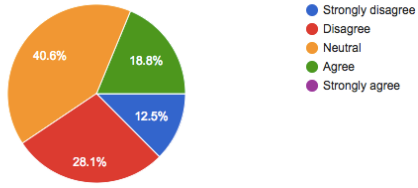
After using the clinical reasoning tool, I have a better idea of what it means to develop a "differential diagnosis" and narrow down to the most likely diagnosis.

32 responses



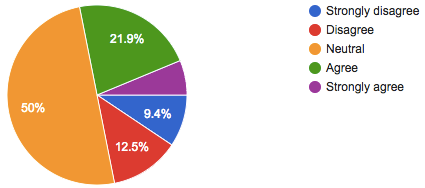
Overall, completing the "Differential Diagnosis" look-up using the clinical reasoning tool was a worthwhile educational experience.

32 responses



When listening to a classmate's "Differential Diagnosis" presentation, the clinical reasoning tool allowed the presenter to develop a logical presentation, which I could easily follow and understand.

32 responses



Overall, the clinical reasoning tool improved my PBL learning experience.

32 responses