

Morning Report Goes Virtual: Learner Experiences in a Virtual, Case-Based Diagnostic Reasoning Conference

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Research article

Keywords: Diagnostic reasoning, morning report, clinical teaching, case conferences

Posted Date: May 20th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-535863/v1>

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Version of Record: A version of this preprint was published at Diagnosis on August 4th, 2021. See the published version at <https://doi.org/10.1515/dx-2021-0073>.

Abstract

Background: Participation in case-based diagnostic reasoning (DR) conferences has previously been limited to those who can attend in-person. Technological advances have enabled these conferences to migrate to virtual platforms, creating an opportunity to improve access and learner participation. We describe the design and evaluation of virtual morning report (VMR), a novel case-based DR conference.

Methods: VMR took place on a videoconferencing platform. Participants included health professions students, post-graduate trainees, and practitioners. In designing VMR, we adapted concepts from experience-based learning theory to design opportunities for learner participation. Teaching strategies were informed by information-processing and situativity theories. We evaluated learner experiences in VMR using a survey with open and closed-ended questions. Survey items focused on accessing case-based teaching conferences outside of VMR, participant perceptions of the educational value of VMR, and VMR's impact on participants' confidence in performing DR. We used qualitative content analysis to manually code open-ended responses and identify themes.

Results: 203 participants (30.2%) completed the survey. 141 respondents (69.5%) did not otherwise have access to a DR conference. The majority of participants reported increased confidence performing DR. Respondents highlighted that VMR supplemented their education, created a supportive learning environment, and offered a sense of community.

Conclusions: VMR can expand access to DR education, create new opportunities for learner participation, and improve learner confidence in performing DR.

Introduction

Case-based teaching conferences are consistently the highest rated curricular element of graduate medical training in internal medicine and are an important vehicle for teaching diagnostic reasoning (DR) to trainees. (1–3) However, there is limited evidence on the optimal design of and teaching strategies in these conferences, and participation has been limited to only those who can attend in-person. (1–3) Physical constraints to attendance are relevant because access to effective DR education continues to be a barrier to teaching this important clinical skill. (3) Recent studies of resident experiences in face-to-face morning reports highlighted impediments to learner attendance and participation, including the location of morning report, discomfort with contributing to case discussions by talking aloud, and not feeling knowledgeable enough to participate. (2)

Technological advances have enabled medical education to transition from physical to online spaces, (4, 5) and case-based conferences have migrated to virtual platforms. (6–9) This has created an opportunity to redesign and expand participation with the hope of improving DR education. In March 2020, *The Clinical Problem Solvers* (CPSolvers), a multimedia organization focused on teaching and learning DR, designed the first multi-institutional, virtual, case-based DR conference, known as virtual morning report (VMR). With virtual learning platforms playing an increasing role in medical education, educators need an

understanding of how the design of and teaching during these conferences impacts learners. In this research report, we describe the design, implementation, and evaluation of VMR.

Methods

Aims

The aims of VMR were to expand access to case-based DR conferences, leverage a virtual platform to create new opportunities for learner participation, and improve learner confidence in performing DR.

Setting & Participants

VMR took place on a videoconferencing platform (Zoom Video Communications Inc., San Jose, CA, USA) and was hosted by CPSolvers. Participants included health professions students, post graduate trainees, and practitioners who asked to attend VMR.

Program Design

In developing VMR, we focused on three distinct elements of its design: conference structure, opportunities for learner participation, and facilitator teaching strategies. These three elements were the most likely to support the achievement of our aims.

Conference Structure

The structure of VMR (Fig. 1) is similar to morning reports in United States-based internal medicine residency programs (1, 2, 10–13) and draws on evidence supporting the benefits of peer-assisted learning while also ensuring the involvement of experts in DR teaching. (14–16)

In VMR, a participant volunteers to present a patient case and two health professions students or post-graduate trainees volunteer to discuss the case alongside two clinician-educators, who serve as facilitators. At the start of VMR, discussants and case presenters introduce themselves, their training level, and their location. Case presentations include sequential aliquots of clinical information followed by the final diagnosis. Discussant-facilitator pairs alternate sharing their DR aloud after each aliquot. In addition, an unlimited number of participants discuss the case using the video conferencing platform's chat function. In real time, two CPSolvers team members transcribe case details and teaching points on a virtual whiteboard. (17) VMRs are recorded and posted online for asynchronous viewing. To prioritize explicit teaching of DR, VMR is an unscripted case conference. (12) Facilitators, discussants, and participants are unaware of the case details, including the final diagnosis. We, as others have previously written, believe this structure offers the best opportunity to explicitly teach DR by allowing all participants to think through the case in real-time, similar to how DR occurs in a clinical environment. (12)

Opportunities for Learner Participation

We designed opportunities for learner participation in VMR by adapting concepts from experience-based learning theory, which views supported participation as fundamental to learning. (18) Applying these concepts to DR education in case-based teaching conferences, learning DR does not come from a facilitator reciting information to a learner. Rather, it happens when learners engage in the practice of

performing DR through varied levels of participation that range from observation to direct contribution.

(18) Specific opportunities for learner participation in VMR include

- Passive participation: watching VMR without contributing to the discussion
- Chat-based participation: watching VMR and actively contributing to the discussion via the videoconferencing platform's chat function
- Presentation-based participation: preparing and presenting a case
- Active participation: sharing one's thinking aloud by discussing alongside a facilitator

These opportunities for supported participation create varied levels of engagement that accommodate a variety of learners who may have varied DR skills, educational priorities, and comfort with the traditional form of participation that involves being called-on by facilitators. (2)

Teaching Strategies: We used teaching strategies informed by two theoretical frameworks that play an important role in teaching and learning DR: information-processing theories and situativity theories. (19–22) The former emphasize the importance of knowledge organization, while the latter highlight the role of contextual factors in learning and practicing DR. (19–22)

Specific teaching strategies comprised previously described tactics, including connecting case discussions back to core tenets of DR, such as diagnostic schemas, illness scripts, and Bayesian reasoning, and giving feedback to trainee discussants that expands and refines their knowledge structures and decision making. (20–25) For example, in articulating their reasoning aloud, facilitators often explicitly discussed a diagnostic schema, highlighted illness scripts of diagnoses under consideration, and integrated probabilistic reasoning into their teaching. Additionally, to help decrease the cognitive load for learners, facilitators asked learners to focus on one specific piece of data that they perceived to carry important diagnostic information. (26) Facilitators also incorporated teaching related to the role of contextual factors in DR. This included asking learners to consider how their thought processes might differ if certain contextual details of the case changed (e.g., if patient communication was limited because of acute encephalopathy or if the patient presented to clinic rather than the hospital). (19–22) Finally, at the end of a case, trainee discussants had the opportunity to reflect aloud on their reasoning under the guidance of facilitators. (27, 28)

Program Evaluation

We evaluated our program using a survey that included both open and closed-ended questions. (29) We followed guidelines for survey development to address content and construct validity. (30) We created and administered the survey using Qualtrics. We also collected data from VMR sessions, including total attendees and the number of chat-based participants. Descriptive statistics were performed (mean, standard deviations) using Microsoft Excel.

Individuals who attended VMR were eligible to take the survey. Participants received a link to the survey via email. Data collection occurred between June 9th, 2020 and July 29th, 2020. To maximize the response rate, we sent weekly reminders to the email list for three weeks. No financial incentives were

offered. Participants responded anonymously. The Institutional Review Board at the University of California, San Francisco reviewed the study and deemed it exempt.

Survey items (Additional File 1) focused on accessing case-based teaching conferences outside of VMR, participant perceptions of the educational value of VMR, and VMR's impact on participants' confidence in performing DR. Survey items related to the construct of DR were informed by information processing theories, such as cognitive load and script theory, and situativity theories, such as situated cognition. We piloted survey items with eight CPSolvers team members. One team member trained in cognitive interviewing (S.L.) used previously published guidelines to perform one-on-one cognitive interviews with five VMR participants who provided verbal feedback. (30) Pilots and cognitive interviews led to changes in item wording and removal of two questions that confused participants.

Two coders (J.C.P & L.C.S.) used qualitative content analysis to manually code data and identify themes. (31) Coders actively generated themes by categorizing codes. The two coders coded transcripts line-by-line using a constant comparative process to organize responses into codes and themes. They discussed and resolved conflicts of codes and themes with a third person (S.N.).

Results

The mean average attendance at VMR was 80.7 participants (SD: 22.5), with a mean of 44.5% (SD: 11.0%) of participants contributing to the platform's chat function each session. Two-hundred-three participants (30.2%; 203/672) completed the survey. Demographic information of survey participants is included in Table 1. Active participants and case presenters joined VMR from 24 countries (Table 1). One-hundred forty-one (69.5%) respondents did not have access to another case-based DR teaching conference beyond VMR. One-hundred ninety-two (94.5%) respondents described VMR as very educational or educational. The majority of participants reported increased confidence with elements of DR, such as creating a problem representation (72.4%), developing and using a diagnostic schema (71.9% and 74.9%, respectively), developing and using an illness script (61.6% and 61.6%, respectively), and articulating DR aloud (63.1%) (Table 1).

Table 1
Participant demographics and quantitative data on learner experiences in VMR.

Participant Training Level (n = 203)		Countries Represented (n = 24)		
<ul style="list-style-type: none"> • Medical Student: 106 (53.4%) • Resident: 54 (27.4%) • Attending Physician: 23 (11.7%) • Clinical Fellow: 6 (3.0%) • Allied Health Professions Student: 6 (3.0%) • Allied Health Professional: 2 (1.0%) • Declined to answer: 6 (3.0%) 		<ul style="list-style-type: none"> • USA • Guatemala • Peru • India • Brazil • Iran • Pakistan • Kenya • Vietnam • Saudi Arabia • Ireland • Bangladesh 		
Access to Another Case-Based DR Conference (n = 203)		Educational Value of VMR (n = 203)		
<ul style="list-style-type: none"> • Yes: 59 (29.1%) • No: 141 (69.5%) • Declined to Answer: 3 (1.5%) 		<ul style="list-style-type: none"> • Very educational: 171 (84.2%) • Educational: 21 (10.3%) • Neutral: 3 (1.5%) • Noneducational: 0 (0.0%) • Very noneducational: 4 (1.7%) • Declined to Answer: 4 (1.7%) 		
Impact of VMR on Participant Confidence in Elements of DR (n = 203)				
DR Element	Decline to answer	I am less confident	My confidence is the same	I am more confident
Creating a problem representation	6 (3.0%)	2 (1.0%)	48 (23.6%)	147 (72.4%)
Developing a diagnostic schema	8 (3.9%)	3 (1.5%)	46 (22.7%)	146 (71.2%)
Using a diagnostic schema	8 (3.9%)	1 (0.5%)	42 (20.7%)	152 (74.9%)
Abbreviations: VMR- virtual morning report; DR- diagnostic reasoning				

Participant Training Level (n = 203)		Countries Represented (n = 24)		
Developing an illness script	7 (3.4%)	5 (2.5%)	66 (32.5%)	125 (61.6%)
Using an illness script	8 (3.9%)	3 (1.5%)	67 (33.0%)	125 (61.6%)
Identifying a pivot point in a case	8 (3.9%)	5 (2.5%)	50 (24.6%)	140 (69.0%)
Prioritizing a differential diagnosis	8 (3.9%)	1 (0.5%)	41 (20.1%)	153 (75.4%)
Verbalizing DR aloud	9 (4.4%)	5 (2.5%)	61 (30.0%)	128 (63.1%)
Abbreviations: VMR- virtual morning report; DR- diagnostic reasoning				

Strengths of VMR included that it supplemented their education, was an engaging and supportive learning environment, and offered a sense of community (Table 2). Potential improvements to VMR included developing ways to include multimedia pieces of clinical data (e.g., radiology images).

Table 2. Findings from qualitative analysis of open-ended responses pertaining to why participants attended VMR

<u>Why participants choose to join VMR</u>		
Themes	Codes	Representative Quotes
VMR supplements their education	Access to experts in DR	<i>"There was nothing like this available to me from my school (Canadian medical student)[...] It is so incredible to have access to some of the best clinical educators in the world!"</i>
	Expand knowledge	<i>"The teaching points are phenomenal. I'm worried about starting intern year - it's a great way to get additional exposure to material."</i> <i>"As an early fourth year medical student [...] I join VMR for a variety of reasons: to get more exposure to cases [...] deeper into resident level knowledge, [...] and to learn new clinical pearls."</i>
	Improve DR skills	<i>"I'm an [international student] now starting intern year in the US. The structure of MedEd is very different oversea[...]. I had limited exposure to cases and needed to improve my clinical reasoning and increase my confidence [...] I am so glad I did because it has reignited my drive to learn better and smarter."</i>
	Improve English language skills	<i>"I'm a 5th year med student from Brazil. I want to do my IM residency in the USA so the VMR is a big opportunity for me to learn medicine in English, not only to expand my English medical vocabulary but also to rationalize and reach a diagnosis for the sake of my future patients."</i>
	Learn from role models	<i>"VMR provides strong role models for patient care and masterful clinical educators who I hope to emulate in my career."</i>
VMR is an engaging and supportive learning environment	Safe and supportive learning environment	<i>"I appreciate how the facilitators make the environment extremely comfortable for the discussants and presenters."</i> <i>"[I join VMR] to practice my clinical reasoning in a safe environment."</i>
	Fun and engaging place to learn	<i>"It's always fun, engaging, challenging, educational, and encouraging. I feel like I have grown so much in my own diagnostic reasoning just from attending."</i>
	Inclusive learning environment	<i>"[I join VMR] for the [...] culture of inclusion and promoting safe learning spaces for all levels of learners."</i>
VMR offers a sense of community	Global learning community	<i>"The community is unlike anything I have ever seen in medicine [...] it is global and quite diverse."</i> <i>"Coming together with motivated educators and trainees from around the world has been inspiring and has fueled my love for clinical reasoning and medicine overall."</i>
	Learn with others	<i>"I join VMR because I personally learn best through interaction and/or seeing others interact, especially if they are more experienced than I"</i>

Abbreviations: VMR- virtual morning report; DR- diagnostic reasoning

Discussion

Moving case-based conferences to virtual platforms can help expand access to DR education, engage learners in varying levels of participation, and offer opportunities to pilot new DR teaching strategies. To our knowledge, this is the first study to describe the implementation, evaluation, and global reach of a virtual, case-based DR conference.

While case-based teaching conferences play a central role in teaching DR to learners, we found that the majority of participants lacked access to these learning opportunities outside of VMR. This aligns with prior studies on DR teaching and highlights how education-focused organizations can help improve access to DR instruction by creating opportunities for virtual participation. (3) Furthermore, not all learners are comfortable with the traditional format in which facilitators call on participants to share their thinking aloud. (2) A small number of VMR participants contributed verbally in each session, yet nearly half engaged via chat-based participation and found VMR educational. The options to observe the case-conference or participate through chat-based communication offer alternative methods of engagement that may increase learner comfort, promote psychological safety, and enhance learning for participants. (18) Educators who host case-based teaching conferences may consider exploring how they can use videoconferencing software to not only expand access to off-site participants, including those outside their institution, but also support varied methods of participation that accommodate a variety of learner preferences and styles.

Specific facilitator teaching strategies informed by theoretical frameworks related to DR supported improved learner confidence with core DR concepts. Cognitive approaches to DR posit that one can improve their reasoning by synthesizing information into organized knowledge structures for storage in long-term memory. (22, 32, 33) Theoretical frameworks that move beyond the cognitive approaches and focus on the influence of contextual factors, such as situated cognition, emphasize the importance of integrating or reflecting on the complex interactions that occur between clinicians, patients, and the physical environment. (19–21) By explicitly discussing diagnostic schemas and illness scripts and connecting these knowledge structures to real-life clinical scenarios, facilitators may support learners’ increased confidence in organizing and applying knowledge. Furthermore, the use of reasoning terms—“schema,” “illness script,” “pretest probability,” etc.—can equip learners with a vocabulary that serves as a linguistic scaffolding upon which they can incorporate new knowledge and direct future learning. (25) We encourage facilitators to employ these strategies as a means of explicitly promoting DR education during case conferences.

Limitations to this study include a low response rate, which may have been driven in part by distribution of the survey on an email list that included individuals who had expressed interest in VMR but never

participated. The subjective responses also limit our ability to objectively assess DR skill development. Areas for further research include examining whether virtual DR case conferences can improve the performance of DR using pre- and post-assessments and further exploring strategies for case-based DR teaching.

Conclusions

VMR is a viable model that can expand access to DR education, create new opportunities for learner participation in case-based conferences, and improve learner confidence in performing DR. While VMR focuses primarily on internal medicine cases, this model is easily transferable to other clinical specialties.

Declarations

Ethics approval and consent to participate

The Institutional Review Board at the University of California, San Francisco reviewed the study and deemed it exempt.

Consent for publication

Not applicable

Competing interests

All authors are volunteer members of the Clinical Problem Solvers Team. They receive no financial benefits from this organization.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Funding

None

Authors' contributions

JCP was the lead investigator and participated in the study design, data analysis, manuscript drafting, and manuscript revisions. SL participated in the study design, data analysis, and manuscript revisions. LCS participated in the study design, data analysis, and manuscript revisions. HMM participated in the study design, data analysis, and manuscript revisions. DJM participated in the study design, data analysis, and manuscript revisions. SN was the senior investigator and participated in the study design, data analysis, manuscript drafting, and manuscript revisions.

Acknowledgements

None

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Figures

VMR Conference Structure



Role	Description
Case Presenter	A participant who volunteers to present a clinical case in serial aliquots.
Whiteboard Scribe	A participant who transcribes case details and teaching points in real time on a blank template
Facilitator	A pre-selected clinician-educator who is blind to the case and discusses their diagnostic reasoning aloud after each aliquot. They also facilitate diagnostic reasoning education by contextualizing, prompting discussion and teaching points, and providing feedback.
Volunteer Discussant	A volunteer participant (trainee or student) who is blind to the case and discusses their diagnostic reasoning aloud after each aliquot.
Chat-based & Passive Participants	An unlimited number of participants who passively view the conference and/or discuss the case using the video conferencing platform's chat function.

Figure 1

Penneretal.morning report goes virtual

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