We piloted an innovation in teaching by conducting live virtual bedside clinics and evaluated the effectiveness compared to conventional bedside clinics. The purpose is to report the methodology and survey results of this innovation in teaching. A virtual bedside clinic was set up utilizing multiple audio-visual aids at a tertiary eye care facility. The bedside clinic was conducted and streamed live to pre-registered participants across the globe using the Zoom platform. The online survey was conducted comparing its effectiveness with conventional bedside clinics. A total of five sessions were conducted. A total of 2058 participants registered (411/session), of which 938 (45.57%) attended (187/session). A total of 287 participants (30.6%) responded to the survey. The respondents included ophthalmology residents (43.4%), fellows (19%), sub-specialty ophthalmologists (15.4%), general ophthalmologists (12%), and optometrists (9%). More than 95% of the respondents felt that these clinics were equally effective/better in imparting the following: physical examination 97%, clinical knowledge 99.3%, clinical reasoning 98.3%, procedural skills 95%, and communication skills 96.5%. Respondents suggested that these clinics were better/equally effective in the following techniques: general examination (96%), ocular motility (93.3%), nystagmus examination (93.2%), and anterior (80%) and posterior segment examination (73.3%). The hybrid mode presentation (97.3%) and discussion with the panel (100%) were reported to be equally effective/much better. Live virtual bedside clinics are a novel and effective way of continuing quality teaching and impactful learning. Most of the bedside manners, procedural skills, and examination techniques can be effectively taught through this virtual platform with a scope to improve anterior and posterior segment examination skills.

**Key words:** Education, pediatric ophthalmology, strabismus, virtual teaching

Bedside clinics have always been one of the cornerstones in imparting essential skills in medicine.[1] Reportedly, bedside skills appear to be declining, and unfortunately, there is increased dependence on investigations and technology.[2] This not only adds to the cost of the workup and medical treatment but overall reduces the skills of the budding medical trainees.

Further, the severe acute respiratory distress syndrome coronavirus disease 2019 (SARS-2 COVID-19) pandemic has further hampered the bedside training with emphasis on the minimum time spent with patients, social distancing, and avoiding crowding. Thus, an even less time is spent at the patient’s bedside, and physical examinations seem markedly truncated.

The COVID-19 pandemic has caused widespread distress and disruption not only to ophthalmologists but also to all our colleagues, friends, families, and patients all over the world.[3] Training and education are silent casualties caused by COVID-19 across the country and the globe,[7] especially in the field of ophthalmology, especially with many ophthalmology conditions being non-emergency and relatively elective. In a recent survey, Mishra et al.[8] reported that the majority of ophthalmology trainees across India felt that the COVID-19 lockdown had adversely affected their learning and trainees perceived higher than usual stress levels during the lockdown. Many trainees and/or residents were involved in COVID duties, rather than seeing patients of their chosen specialty.[9] The pandemic has also created a non-uniformity of education all around the country and even across the globe,[10-12] driving us to adapt to newer ways of teaching so that learning is uninterrupted even in these tough times.[13]

In this era of physical distancing, we piloted an innovative way of teaching by conducting live virtual bedside clinics (that is, live streaming of bedside examination skills in ophthalmology) and evaluated the effectiveness in comparison to conventional
Methods

Bedside clinics were conducted at our tertiary eye care center in South India with a patient, an examiner (trainee), a moderator, and a discussant/expert (online), Fig. 1. The bedside clinic was streamed live to pre-registered participants across the globe using the Zoom platform (Zoom Video Communications, San Jose, California, United States). A survey was conducted using google forms; the collected data were converted in google sheets and analyzed. The study was exempted from review of the Institutional Ethics committee (IEC), with the nature of study being a comparison among instructional techniques, curricula, or classroom management methods. The review board certificate of exemption was issued, and the study was conducted adhering to the Declaration of Helsinki.

A) Requirements for the virtual bedside clinic setup: [Fig. 1]
1) Computer unit to run Zoom or a similar platform
2) Slit Lamp chair unit with a videography attachment
3) Multiple videography cameras (with a minimum resolution of 1080 p) to focus on the examiner and the patient during the virtual bedside clinic
4) Microphones and other audio-visual aids (collar microphones/handheld microphones, etc.)

Along with these above-mentioned requirements, a case presenter, a session moderator, and a discussant (expert panel) comprise an integral part of this platform.

B) Presentation mode and duration:

The hybrid form of presentation was chosen, which included live bedside clinical examination and discussion, streaming of pre-recorded important clinical findings, and PowerPoint presentation of the additional relevant material. Sessions were conducted for 60 to 90 minutes each. All sessions were preceded by a written consent from the patient or parents/guardians for the live bedside streaming and recording of the session.

C) Feedback questionnaire and its validation:

A feedback questionnaire [e-supplement 1] was prepared using google forms. The central idea for the questionnaire was to assess how close the virtual bedside clinics can meet the conventional bedside clinics. Further, the questionnaire attempted the scoring for each of the examination segment/technique. The detailed questionnaire is attached in e-supplement 1. In brief, this comprised consent from the respondents to participate in the survey, followed by obtaining demographic details about the participants (name, gender, email address, designation, and institute). All the collected data were kept confidential and accessible only to the investigator (DAV).

The questionnaire concentrated on five learning themes were identified as per the ideal bedside clinical scenario,[14] and respondents were asked to rate them comparing to conventional bedside clinical experience on an ordinal scale. These five themes were as follows: 1) Clinical knowledge, 2) clinical reasoning, 3) physical examination skills, 4) procedural skills, and 5) communication skills. The next set of questions
was dedicated to each examination technique and how effectively it was demonstrated compared to conventional bedside clinics. Miscellaneous and open-ended descriptive questions were included in the last segment to get suggestions for further improvement of these sessions and better future experience.

Validation of questionnaire: The initial face validity of the questionnaire was performed by a panel of experts including an ophthalmologist, a researcher, and an academician. Based on the inputs by the experts, appropriate changes were made for each module. After establishing the face validity for all the subsets of questions evaluating various learning themes and examination techniques, the final version of the questionnaire was administered to in-house residents and fellows who attended similar sessions within the institute across the network of four tertiary eye care centers. The data were obtained and spread across the clean spread sheet. The individual component analysis was performed establishing the validity of the questionnaire, which was then administered for virtual bedside clinic sessions as a part for current study.

D) Overview of preparation and execution of live virtual bedside clinics

Preliminary workup for virtual bedside clinics

a. The topic on which a case to be presented was decided a week prior.
b. The relevant case was identified in the out-patient clinic, and availability was confirmed by scheduling a visit on a scheduled virtual bedside clinic.
c. A flyer was prepared and circulated 2–3 days prior and circulated across the globe through an e-mail database of trainees and through social media for prior registration (complimentary but mandatory).
d. Registered participants received a link to join the virtual bedside clinic on their registered email address.
e. The relevant and important clinical signs were video-recorded in high definition (with prior informed written consent) to make them available to watch multiple times without subjecting the patient through repeated examinations.
f. A brief PowerPoint presentation to highlight and reiterate important learnings was prepared.

Flow during the Virtual bedside clinic

All SARS COVID-19 related precautions were followed (using social distancing, masks, gloves, and visors for the patient, attendants if any, and examiners as appropriate).

a. The moderator welcomed the participants and briefed about the chief objective (s) (one or two) of each bedside clinic. Participants were encouraged to be actively involved in the discussion.
b. A presenter elaborated the chief complaints and the history of presenting illness to the moderator, and relevant positive and negative history is discussed with the discussant in an interactive dialogue.
c. Only after the initial history was discussed, the patient was called in the examination room.
d. Before beginning the examination, informed written consent was obtained from the patient (in the case of children, consent from one of the parents was obtained) and was recorded live.
e. The bedside clinical examination is performed by a presenter and projected via streaming. The moderator and discussant add their comments and inputs as and when indicated.
f. General physical examination, local external examination, motility and strabismus examination, pupillary examination, and anterior and posterior segment examination were performed on a case-to-case basis, and each examination is live-streamed to be watched closely by each participant.
g. Following this, the patient was greeted for the patience and co-operation and allowed to leave the examination room. Further discussion of the case, various differential diagnoses, investigations, and management was carried out in an interactive format among the presenter, moderator, discussant, and participants who joined virtually.
h. Meanwhile, the pre-recorded relevant clinical signs of interest are played and discussed in detail.
i. Questions from the participants are answered during/ at the end of the session through interactive dialogues.

Collection of responses and feedbacks after the session

a. A feedback form (google form) is circulated at the end of the session through direct link in the chat box and later through e-mails.
b. A respondent signs the consent by clicking on a check box before filling the feedback and agrees to participate in the survey.
c. The feedbacks from all the respondents are converted to google sheets, and the data are analyzed using the same.

Statistical analysis

The responses received from the survey through google forms were converted to google sheets, and descriptive and comparative analysis was performed using the google sheet’s data analysis functions.

Results

A total of five sessions were planned, and data from each session were collected for analysis. A total of 2058 registered (average 411/session), out of which 938 (45.57%) attended (average: 187/session). A total of 287 participants responded for survey. Out of the total respondents, 34% were male. The distribution of respondents was as follows: residents (43.4%), fellows (19%), sub-specialty trained ophthalmologists (15.4), general ophthalmologists (12%), optometrists (9%), and others (1.4%). Maximum respondents were from the Diplomate of National Board (DNB) institute (36.7%), followed by other academic institutes (23.4%), private institutes, (17.8%) and government medical colleges (12.2%).

More than 95% of the respondents felt that these virtual bedside clinics were equally effective/much better than conventional bedside clinics in imparting various skills (physical examination skills 97%, clinical knowledge 99.3%, clinical reasoning 98.3%, procedural skills 95%, and communication skills 96.5%), Fig. 2.

Further, the respondents scored the various examination techniques, namely, general examination (96%), ocular motility assessment (93.3%), nystagmus evaluation (93.3%), anterior segment examination (80%), and posterior segment examination (73.3%) to be equally effective/better than physical
bedside clinics, Fig. 3. 97.3% of the respondents reported the hybrid presentation mode to be more effective and useful than physical bedside clinics. 100% of the attendants felt that discussion with the panel was equally effective/much better compared to conventional bedside clinics.

Among various levels of attendants, residents reported better results than the rest of the attendants for nystagmus evaluation (100% versus 93.3%) and the hybrid presentation mode (98.7% versus 97%). Around 90% of the respondents felt that the duration of the individual session was appropriate (46%)/just adequate (44.5%). 5% each reported that the duration was too long/too short. 96.2% participants expressed strong interest in attending similar upcoming editions, whereas 3.5% replied that they may join in for such future sessions.

Discussion

Sir William Osler (1849–1919), the famous Canadian physician, said two quotes: ’To study the phenomena of disease without books is to sail an uncharted sea whilst to study books without patients is not to go to sea at all’, and ‘Medicine is learned by the bedside and not in the classroom’. These quotes are much valid and relevant even today.[15]

A review article on bedside teaching in medical education states that bedside teaching is rationally necessary in learning certain clinical skills and evidence supporting the value of bedside teaching.[1] Recent literature suggests that bedside teaching is declining in the medical curriculum. Because of its value for students/residents, patients, and medical teachers, obstacles to bedside teaching should be overcome.[13] This becomes even more relevant in today’s time of the SARS COVID-19 pandemic where physical distancing is the new normal.

In a cross-sectional survey conducted by Rana et al.[17] most of the respondents had favorable perceptions of ophthalmology webinars happening during the COVID-19 pandemic. However, they reported need for improvisation in the volume of webinars, target-audience-based delivery, and participant interaction to add value to this new dimension of teaching—learning.

Dasgupta et al.[18] conducted a survey among ophthalmology residents and generated overall mixed responses in favor of webinars. They reported that webinars bear enormous potential to supplement the traditional learning tools by providing uninterrupted learning experiences. However, they suggested that various pedagogical and technical issues need to be addressed.

Therefore, considering this need of hour to continue quality learning and impactful teaching incorporating audio-visual technology/aids, we piloted live virtual bedside clinics and describe the methodology along with survey results in this paper.

Various sessions focussed on basics of strabismus evaluation, nystagmus evaluation, ocular motility disorders, and neuro-ophthalmological cases. The conversion rate of registration to attendance was more than 45%, and that of attendance to participation in the survey was more than 30%. The response rate in our study was comparable to average acceptable survey response rates for online surveys through e-mails.[19]

The virtual bedside clinic sessions were made available for participation to anyone interested in the topic for learning. Registration was complimentary but mandatory. This led to outreach of the sessions to various cadres of trainees, optometrists, and practicing ophthalmologists. The timing chosen for the sessions was in the late afternoon (15:00 hours) so that most of the trainees and practitioners could attend taking out time from their clinical/academic work.

The survey questionnaire was constructed taking into consideration the ideal bedside clinics and expected teaching/learning arms of such sessions.[1]

Our survey results were promising and showed that most respondents felt that virtual bedside clinical teaching was equally effective or better as compared to conventional bedside clinical teaching by >95% of the participants.

We utilized the opportunity of projecting and demonstrating important clinical signs with pre-recorded high-definition videos and PowerPoint presentations. This hybrid mode of presentation allowed us to demonstrate such clinical findings with greater details and without subjecting the patient to repeated testing. Additionally, it gave an opportunity to each participant to view and learn these findings while sitting at their own place and at their
own comfort, which is usually not possible in conventional bedside clinics. We hypothesize that this allowed the hybrid mode of presentation to be appreciated by the majority of the participants.

The results were promising especially for general/external examination, ocular motility, and nystagmus evaluation, which are usually difficult to understand by residents/fellows in training. Our results suggest a definite scope to improve anterior segment and posterior segment examination demonstration through this platform. Real-time display of indirect ophthalmoscopic fundus examination using video indirect ophthalmoscopy should help improve in the demonstration of posterior segment.

Our study has a few limitations. It is a pilot study with a limited number of sessions. Most of our sessions were limited to sub-specialties such as pediatric ophthalmology and neuro-ophthalmology. However, this needs to be assessed for its feasibility and effectiveness in the anterior segment, glaucoma, and retina-related cases. Further, we did not assess cost effectiveness of this innovation in education in the current study. This virtual bedside clinic platform lacks hands on training and post-session assessment, which are important components of any teaching module. There is a scope for including post-session assessment using various online tools such as google classrooms and so on.

**Conclusion**

The current study suggests that in the current scenario, live virtual bedside clinics are a novel and effective way of continuing quality teaching and impactful learning. Most of the bedside manners, procedural skills, and examination techniques can be effectively taught through this virtual platform, although there is scope for improving anterior and posterior segment examination techniques. We suggest that more studies exploring the use in other ophthalmology specialties and medicine in general will help improve the quality of hybrid virtual bedside teachings.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

**References**

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Live Virtual Bedside Clinical Learning
Feedback form

* Required

1. Email *

2. This feedback form is being developed to obtain constructive criticism for various components of the teaching highlighted in the virtual clinic. Your true feedback will enable us to value on this learning process. This may also be used to develop study observing the teaching skills imparted through a virtual bedside clinic. By clicking this box I give my voluntary and informed consent that the feedback provided by me might be used for continuous quality improvement and also study to observe the quality of teaching skills. *

Check all that apply.

☐ I agree

3. Your name *

4. Gender *

Mark only one oval.

☐ Male
☐ Female
5. **Designation * **

*Mark only one oval.*

- [ ] Ophthalmology resident
- [ ] Ophthalmology fellow (short / long term)
- [ ] Optometrist
- [ ] General Ophthalmologist
- [ ] Sub-specialty trained ophthalmologist
- [ ] Other

6. **Institute * **

*Mark only one oval.*

- [ ] Government medical college
- [ ] DNB institute
- [ ] Other academic institutes
- [ ] Private Ltd
- [ ] Individual practitioner
- [ ] Other

7. **How do you rate the "physical examination skills" learnt in this virtual bedside clinic as compared to conventional bedside clinic? * **

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equal
- [ ] Better
- [ ] Much better
8. How do you rate the "clinical knowledge" learnt in this virtual bedside clinic as compared to conventional bedside clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equal
- [ ] Better
- [ ] Much better

9. How do you rate the "clinical reasoning" learnt in this virtual bedside clinic as compared to conventional bedside clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equal
- [ ] Better
- [ ] Much better

10. How do you rate the "procedural skills" learnt in this virtual bedside clinic as compared to conventional bedside clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equal
- [ ] Better
- [ ] Much better
11. How do you rate the "communication skills" learnt in this virtual bedside clinic as compared to conventional bedside clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equal
- [ ] Better
- [ ] Much better

12. How will you rate the demonstration of "general / external examination" as compared to conventional clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equally effective
- [ ] Better
- [ ] Much better

13. How will you rate the demonstration of "ocular motility" as compared to conventional clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equally effective
- [ ] Better
- [ ] Much better
14. How will you rate the demonstration of nystagmus evaluation as compared to conventional clinic? *

*Mark only one oval.*

- Much worse
- Worse
- Equally effective
- Better
- Much better

15. How will you rate the demonstration of "anterior segment examination" as compared to conventional clinic? *

*Mark only one oval.*

- Much worse
- Worse
- Equally effective
- Better
- Much better

16. How will you rate the demonstration of "posterior segment examination" as compared to conventional clinic? *

*Mark only one oval.*

- Much worse
- Worse
- Equally effective
- Better
- Much better
17. How will you rate the demonstration of recorded findings on slides as compared to conventional clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equally effective
- [ ] Better
- [ ] Much better

18. How will you rate the discussion as compared to conventional clinic? *

*Mark only one oval.*

- [ ] Much worse
- [ ] Worse
- [ ] Equally effective
- [ ] Better
- [ ] Much better

19. Was the duration of the bedside clinic: *

*Mark only one oval.*

- [ ] Too long
- [ ] Too short
- [ ] Just adequate
- [ ] Appropriate
20. Will you attend the upcoming editions of live virtual bedside clinical training? *

*Mark only one oval.*

- [ ] Yes
- [ ] No
- [ ] Maybe

21. Please provide your inputs on how to improve these live virtual bedside clinical training sessions.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

22. Please provide suggestions on any particular topics to be covered in upcoming editions of live virtual bedside clinical training.

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