

Development and Evaluation of a Teleconsultation Training Module for Indian Medical Undergraduates: A Pilot Mixed-methods Study

SH LAVANYA¹, DONNA T WEISS², L KALPANA³, MEDHA A JOSHI⁴, SEEMA DEEPAK⁵

ABSTRACT

Introduction: Online video teleconsultation requires skills that are currently not included in the Indian Undergraduate (UG) medical curriculum. Medical students lack competence related to teleconsultation. Despite proposed national telemedicine guidelines and an increasing use of teleconsultations, there is a paucity of literature related to the training of UG medical students.

Aim: To develop, implement, and evaluate a structured teleconsultation training module for UG medical students.

Materials and Methods: An exploratory sequential mixed-method pilot study with a pre-post design was conducted in the Department of Pharmacology, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka, India from July 2023 to March 2024 among 30 second-year medical students. A total of 34 students were enrolled and 30 completed the study. The study developed and implemented a teleconsultation module consisting of synchronous and asynchronous teaching sessions. The curriculum focused on technical proficiency and ethical aspects, including communication, informed consent, and

e-prescription. Active learning techniques, such as role-plays and interactive lectures, were utilised. With informed consent, student competence was evaluated through pre-validated Multiple Choice Questions (MCQs) knowledge questionnaires and checklist-based simulated-patient encounters.

Results: The study achieved its defined threshold for educational impact, which required at least 80% of students to demonstrate a >50% increase in post-intervention scores. Following training, 93% of students showed significant improvement in the knowledge questionnaire, and 96.7% demonstrated enhanced proficiency in simulated-patient encounters. Furthermore, all students and faculty reported improved confidence in “web-side” etiquette and proficiency in module delivery, respectively. Significant improvements were observed in knowledge and skills ($p < 0.05$).

Conclusion: With the changing healthcare landscape, it is imperative to integrate structured teleconsultation training into the Indian UG curriculum. Equipping students with formal virtual care skills is essential for meeting modern healthcare demands and ensuring adherence to national guidelines.

Keywords: Medical students, Structured, Undergraduate curriculum, Virtual-care

INTRODUCTION

Teleconsultations in the Post-Coronavirus Disease 2019 (COVID-19) era have significantly expanded the global Telemedicine (TM) market, which is expected to reach United States Dollar (USD) 364-709 billion by 2031-2034 Compound Annual Growth Rate (CAGR) 11-18% [1]. The adoption and utilisation of telemedicine for healthcare delivery in India necessitated the formulation of the Telemedicine Practice Guidelines (TPG) of 2020 and 2022 by regulatory authorities, which specify the requirements for Registered Medical Practitioners to conduct online consultations [2,3]. Although the Telemedicine Practice Guidelines mandate that all Registered Medical Practitioners must undergo mandatory online certification to provide teleconsultations, reports suggest that only about 230,000 healthcare professionals in India are currently certified [4]. The challenge of maintaining a trained workforce is further intensified by the annual graduation of approximately 100,000 Bachelor of Medicine and Bachelor of Surgery (MBBS) students who have not received formal telemedicine training.

Formal telemedicine training for UG medical students is a relatively new concept in India. Except for a few centres that offer training for residents and postgraduates, Indian medical schools do not offer any structured program in their UG curriculum. Conducting a successful online video consultation requires additional knowledge and skills related to telemedicine terminologies, applications, technical set-up for teleconsultation, patient selection, ethical concerns, and

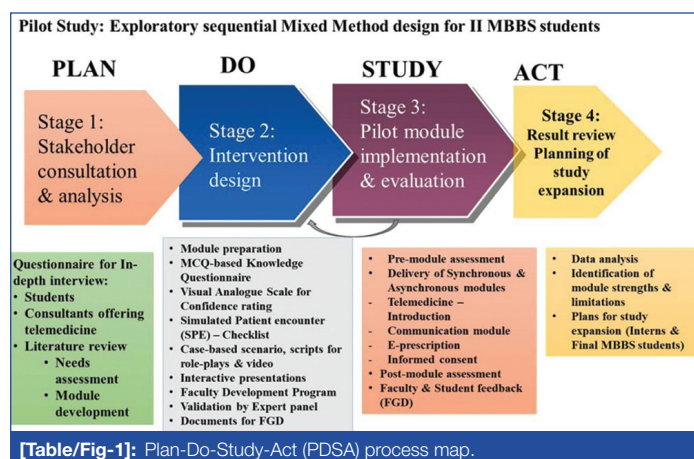
communication skills. Medical students lack such skills due to the absence of a formal training program, as reported by recent studies [5,6]. Indian research on telemedicine has primarily highlighted faculty and students' preparedness and perceptions; however, there is a paucity of literature on the development of training modules and implementation, despite a strong felt-need by stakeholders [7,8]. Training UG medical students with additional ‘web-side’ skills may result in improved virtual patient care, effective and timely healthcare delivery; thereby reducing travelling costs, waiting time for consultations and emotional burden on patient and families.

To address this important gap in training and align student learning with national guidelines, this pilot project aimed to develop a basic telemedicine module for UG medical students based on needs assessment, train faculty facilitators for module implementation and also to implement and evaluate the module.

MATERIALS AND METHODS

An exploratory sequential mixed-methods design was planned to develop, implement and evaluate an online video consultation training module. The pilot study was planned and executed in an Indian tertiary teaching hospital, in the Department of Pharmacology, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka, India, from July 2023 to March 2024, to assess the feasibility of telemedicine module implementation in academic settings. As per the published literature, the study was prearranged to involve a

minimum of 30 students from a batch of 150 students from 2nd year MBBS [9,10]. Following approval from Institutional Ethics Committee, a 'Plan-Do-Study-Act' methodology with a pre-post study design was employed to develop and introduce the module in a structured way [Table/Fig-1]. Invitations were sent out to students through the Institute's student WhatsApp group and interested students were informed to contact the principal investigator directly for further details on participation. Those students who volunteered, were included on a first come-first serve basis and their details were maintained under absolute confidentiality. The students were also assured that their participation or non participation did not affect their routine academic outcomes and were free to withdraw at any point of the study. A total of 34 students who were enrolled signed an informed consent document. Ethical approval was obtained from the Institutional Ethics Committee (BGSIGMS/IEC/App/Jul2023/002); letter dated 25th July 2023. Written informed consent was obtained from all study participants.



Stage-1 Plan-phase: The first part of the study involved qualitative needs assessment. Following problem identification, a targeted needs assessment was conducted through expert consultations and in-depth interviews with medical students. These interviews were conducted face-to-face or via telephonic consultation by researcher 1 with six consultants from clinical specialties (dermatology, general medicine, psychiatry and endocrinology) and twelve Phase-II MBBS students (as data saturation was attained) who were enrolled for the study and volunteered for the interview. The interview questions were self-prepared by researchers and validated by a 5-member expert committee. The qualitative analysis of the responses, along with a robust literature review guided the researchers on topics for module development [Table/Fig-2] [5-8].

Stage-2 Do-phase: Module development and faculty training. This phase included preparation of teaching-learning and assessment tools by the module-development team that comprised the researchers. Based on the felt-needs expressed by interviewees, the modules were planned and designed using the constructivist learning theory as a conceptual framework to introduce learners to the basics of telemedicine in India, essential skills to set-up a teleconsultation area, basic communication skills to initiate a virtual encounter, including obtaining an informed consent, e-prescribing and counseling techniques in a simulated environment. Interactive sessions for introducing the concepts of telemedicine, online video communication encounters and a hands-on workshop to accommodate skills-building opportunities formed the crux of teaching-learning sessions to foster active engagement.

- Module development:** The module development team met weekly for 1 hour virtually to develop teaching-learning modules [Table/Fig-3]. The TPG 2020 and 2022 guidelines were used as the reference documents [2,3]. The hands-on workshop with faculty facilitators featured as virtual sessions, focused on initiating a telemedicine encounter (preparing workstation,

Themes and subthemes	Summary (n=12)	Illustrative quotations
Theme 1: Need for offering Tele consultation services	- TM is the future for providing healthcare services in India for better patient care (100% students) - COVID-19 pandemic-driven practice - 83% consultants	"TM is the future. As doctors, we need to evolve and cater to the patient needs, especially after the pandemic" - S3 - Necessity is the mother of all inventions. During COVID times, it was through TM that we connected with our patients" - C6
Theme 2: Felt need for formal inclusion in UG medical curriculum	TM should be taught to medical students to help in their future practice - 100% students and consultants	"Yes, it must be included. We are taught many things in bedside- clinics, but what I understand is when we talk to the patient who is remotely sitting, we need to make extra efforts to make him feel at ease and elicit information. This is not taught - S10" "We have received no formal academic training as students. During pandemic, there was so much of confusion and it was totally new to us. It's the right time to introduce in curriculum you don't have to wait for another pandemic to teach you!" - C1
Theme 3: TM Modules/ Skills to be taught for MBBS students	- Communication skills - History taking and clinical examination - e-prescription - Tele-triaging, Time management - Data documentation - Hands-on training for online-consultation	"Talking to a patient when he is not in front of you is a challenging task. I want to learn that" - S3 "There are time constraints – we need to minimise screen time, improve listening skills without losing concentration" - C4

[Table/Fig-2]: Summary of themes and illustrative quotations of in-depth interview with medical students and teleconsultants.

Teaching-Learning Modules

Synchronous Sessions (60 min each)	Introduction to Telemedicine Introduction to 'Web-side' skills (Lights-Camera-Action)
Asynchronous Sessions (90 min each)	Informed consent E-prescribing

Note: The duration for asynchronous sessions was inclusive of time for pre-reading, video watching and end-of-session formative assessment (case-scenario-based)

[Table/Fig-3]: Telemedicine teaching-learning modules.

simulating eye contact, overcoming technological barriers, obtaining informed consent, history taking and e-prescribing). The session also included an exemplar video on the conduct of a successful virtual patient encounter.

- Tools/instruments:** The T-L tools developed included interactive PowerPoint presentations, videos, case-based scenarios, student and facilitator guides and Simulated Patient (SP) encounter checklists. The assessment tools included e-questionnaires on knowledge, confidence rating and perceptions on telemedicine. The pre-module survey was designed to align with the learning objectives that included measures of telemedicine knowledge (MCQ-based-10 items-Single best response type) and students' confidence rating that employed the visual analogue scale-VAS (Range:1-Not-at-all confident to 5-Extremely confident).

To assess students' online consultation proficiency, a 45-item SP encounter checklist was developed, incorporating standards defined by the TPG-2020 and TPG-2022 for Registered Medical Practitioners. The checklist allocated 25 points to general communication aspects, focusing on appropriate verbal and non verbal skills. A further 15 points targeted video-specific competencies-such as workstation preparation, eye-contact simulation, managing technical lapses, and

obtaining informed consent (over all SP scores: 40 points); while five points were dedicated to the e-prescription transmission task. The checklist items were adapted from frameworks by Cornes S et al., Afonso N et al., and the Cleveland Clinic communication sheet and were modified to align with the module's specific case requirements [11-13]. Google forms for assessing pre-module students' awareness regarding telemedicine, perceptions and attitudes (10-items) using a 5-point Likert scale, (1=strongly disagree, 5=strongly agree) was developed.

Post-module assessment regarding improvements in telemedicine knowledge, confidence and teleconsultation skills (if any) was planned using MCQ-based tool, VAS and SP encounter checklist respectively, same as the pre-module assessment. Students' rating of modules and satisfaction (on a 5-point scale; 1=poor, 5=outstanding) were included in the post-module survey forms. The survey forms also included open-ended questions on reasons for perceived improvement in confidence levels, strengths of the module and suggestions for improvement. Faculty feedback forms to elicit any improvements in their proficiency levels in module conduction, satisfaction and module rating with areas for improvement were prepared. The modules, in-depth interview questionnaire, e-questionnaires, MCQs, SP encounter checklist, feedback forms were all validated by the 5-member expert committee that included medical education experts from both within and outside the Institution. The various tools/instruments were subjected to content and face validity. As proposed by a previous study, Lawshe's method combined with expert committee members' input was used to assess content validity [14]. Face validity was assessed to check for the clarity, relevance and appropriateness of the tools using inputs from both expert committee and nine medical students (not enrolled in the study). The tools were revised so as to obtain a content-validity-index (0.9) and satisfactory face-validity-index (0.8).

- **Faculty training:** Five faculty facilitators from the Department of Pharmacology, excluding the researchers, underwent an extensive Faculty Development Program (FDP) of four hours duration to improve their proficiency in module delivery and conduct of SP encounters. The faculty was trained on marking the SPE checklist, to assure observer uniformity during encounters. The faculty received pre-session reading materials and multimedia resources relevant to telemedicine. Two weeks prior to the session implementation, students were given the student guide that included the session overview, TPG guidelines 2022 and optional reference materials.

Stage-3 and 4: Module implementation and evaluation: Students were organised in small groups of 5-6, each assigned a faculty facilitator who guided small-group learning experiences and also conducted pre- and post-module assessment. For accessing the online sessions and modules, students and faculty required access to laptops, Zoom, Google Drives and Institutional LMS - Learning Management System. Additionally, a dedicated WhatsApp group was created to facilitate real-time coordination between students and facilitators. This longitudinal program spanned 10 hours and was delivered in two-hour weekly sessions outside of standard college hours. The pre-module and post-module knowledge assessment was completed by students directly before the introductory session and concluding session respectively in the facilitators' presence. The post-module survey and skill assessment was completed within five days of module completion. Data was compiled from performance records, checklists, and electronic forms. The program's success was measured against achieving a >50% improvement in knowledge, skills, and confidence for at least 80% of students, alongside a >50% improvement in faculty proficiency. Faculty proficiency self-assessment and feedback on the program was elicited through feedback forms.

STATISTICAL ANALYSIS

The data were entered into Microsoft Excel sheet. The continuous data (scores) were expressed in median and range. The qualitative or categorical type of data was expressed in percentages. Qualitative data obtained by in-depth interviews, focus-group discussions and open-ended questions in surveys were analysed by using the principles of thematic analysis as suggested by researchers [15]. The difference between pre- and post-intervention scores were analysed using the Wilcoxon signed-rank test. The percentage improvement in the different components of knowledge and skills was calculated by the formula $(X2-X1)/(X1) * 100$ where X1 are the scores of respective components at the baseline before intervention and X2 are the scores of respective components after intervention. The Likert scores were simplified as students who agreed/strongly agreed were categorised as agree, and disagreed/strongly disagreed as disagree, and those who opted as neutral, were considered as neutral for the purpose of analysis. Analysis was conducted using Microsoft Excel 2021 and Statistical Package for Social Sciences version 20.0 (IBM SPSS Statistics for Windows, version 20.0. Armonk, NY: IBM Corp). A p-value of <0.05 was considered statistically significant.

RESULTS

The qualitative analysis from consultants and students revealed three major themes: 1) perceived future relevance of telemedicine; 2) need for formal curricular integration; and 3) essential skill domains required for training.

Participant characteristics: Among 34, 30 (88%) 2nd MBBS students with mean age 19.5 years completed all the tasks and were included in data analysis. Of these, 16 (53.3%) were females and 14 (46.7%) males and only one student had a formal training in telemedicine. Four students opted out of the study citing other academic commitments.

Knowledge, confidence and teleconsultation-skills assessment scores: Statistically significant improvements in the post intervention scores were noticed in the median scores of study parameters. Post-training, 93% of students had improved MCQ-based knowledge scores. 100% students perceived enhanced overall confidence in their online video consultation skills that included improved skills in preparing workstation, obtaining e-consent, initiating and conducting a teleconsultation with appropriate usage of verbal and non verbal communication skills. The median scores of teleconsultation-specific SPE and overall SPE scores significantly improved from baseline scores in 96.7% and 93% students respectively as per faculty observations and assessments. Though e-prescription scores were better at the baseline itself among all participants, the post intervention showed statistically significant difference (pre vs post: 4.0 vs 5.0 Z: -5.48; p<0.001) [Table/Fig-4].

Variables	Pre-test Median (Range)	Post-test Median (Range)	Z-value (p-value)
Knowledge scores	4.5 (1.0-8.0)	10.0 (7.0-10.0)	-4.84 (<0.001)*
Simulated Patient (SP) encounter scores	16.0 (16.0-30.0)	34.0 (29.0-40.0)	-4.79 (<0.001)*
Specific Simulated Patient (SP) encounter scores	5.0 (4.0-8.0)	13.0 (11.0-14.0)	-4.84 (<0.001)*
Overall confidence rating	2.0 (1.0-4.0)	4.0 (2.0-5.0)	-4.90 (<0.001)*
e-Prescription scores	4.0 (4.0-4.0)	5.0 (5.0-5.0)	-5.48 (<0.001)*

[Table/Fig-4]: Comparison of median scores of different variables before (pre) and after (post) intervention.

*Indicates statistical significance at p<0.05

Student perceptions and attitudes: Awareness and receptivity towards telemedicine was relatively high in the study group with over 93% willing to use teleconsultation in their future practice and agreeing for its inclusion in UG medical curriculum [Table/Fig-5]. The

program was well-received by all participants with exemplar video, communication module and hands-on workshop being the most appreciated [Table/Fig-6]. Majority of the students (>96%) were willing to recommend the module to their peers, due to relevance, clarity and simplified presentation of content. All students agreed that the competence acquired during training sessions would benefit them in future.

Parameters	Agree (n) %	Disagree (n) %	Neutral (n) %
Telemedicine awareness			
Telemedicine and telehealth are synonymous terms	16.7 (5)	5 (16.7)	20 (66.6)
Telemedicine provides health care services where distance is a problem	29 (96.7)	0	1 (3.3)
Telemedicine communication skills are different from the communication skills needed for in-person care	24 (80)	0	6 (20)
In India, the Board of Governors and National Medical Commission issue guidelines for practicing telemedicine	20 (66.6)	0	10 (33.3)
Teleconsultation can be of various types; involving doctors/patients/healthcare professionals	28 (93.3)	0	2 (6.7)
Telemedicine: Perceptions and attitudes			
Telemedicine can be an effective way of treating patients	28 (93.3)	0	2 (6.7)
I see the need for Telemedicine services in India	24 (80)	0	6 (20)
Telemedicine will be a part of my future practice	28 (93.3)	0	2 (6.7)
Teleconsultations in India are pandemic-driven; may lose significance in future	2 (6.7)	20 (66.6)	8 (26.7)
Telemedicine concepts should be taught in UG medical curriculum	28 (93.3)	0	2 (6.7)
[Table/Fig-5]: Students' awareness, perceptions and attitudes towards telemedicine (n=30).			

Sessions	Good (n) %	Excellent (n) %	Outstanding (n) %
Introduction to telemedicine	03 (10)	10 (33.3)	17 (56.7)
SP encounter (Hands-on workshop)	01 (3.3)	05 (16.7)	24 (80.0)
Informed consent	06 (20.0)	07 (23.3)	17 (56.7)
E-prescription	02 (6.7)	05 (16.7)	23 (76.7)
Basics of communication	01 (3.3)	04 (13.4)	25 (83.3)
Exemplar video	0	02 (6.7)	28 (93.3)
Overall module satisfaction	01 (3.3)	09 (30)	20 (66.6)
[Table/Fig-6]: Module rating and overall satisfaction by students (1=poor, 5=Outstanding).			

Faculty feedback: All faculty (100%) reported improvement in module delivery and assessment skills on post-training feedback. The faculty rated all modules as excellent. Suggestions to extend the module to virtual physical examination and complex communication skills were given by 4 (80%) faculty and 8 (26.6%) students. All faculty opined on including facilitators from clinical disciplines. Ten (33.3%) students suggested that the entire module be made asynchronous to allow flexibility of learning at their own pace. Among them 5 (16.6%) students recommended practice with more exemplars with standardised patients.

DISCUSSION

Telemedicine training as a mode of patient care is currently not a part of the Indian UG medical curriculum. With the COVID-19 pandemic posing serious challenges to public healthcare systems across the world, India embraced the change by rolling out telemedicine services through online eSanjeevani portal [4,16]. The World Health Organisation (WHO) and the Accreditation Council for Graduate

Medical Education (ACGME) have recommended integration of digital health tools to support digitally skilled workforce and the need for continual assessment and feedback for telehealth competencies, respectively. This emphasises the need to set standards of practice for getting Indian medical graduates future-ready [17,18].

Development and implementation of a training module require systematic and meticulous preparation and co-operation from various stakeholders. Researchers have stressed the need to form a task force for telemedicine that comprises a wide range of diverse stakeholders who can play a vital role in successful implementation [19-21]. The modules were carefully designed based on the qualitative analysis of stakeholders' suggestions and published reports. The core domains that emerged included the learning objectives for attaining the desired professional competencies, instructional strategies focusing on blended, case-based, interactive learning and ethical frameworks during teleconsultations. These findings were in consensus with published literature [22]. The telemedicine modules are an ideal format for training as they are workflow-specific, and rely on digital tools and virtual etiquette that mirrors the distant and virtual nature of healthcare it offers.

The pilot module was the first-step in initiating a task force at our academic Institute, by having proficient facilitators, trained students who will be the telemedicine champions and expert committee to guide curricular innovations. Teleconsultation requires a diverse set of technical and communication skills. Since the UG medical students are not exposed to any of these skills in their regular curriculum, the modules were designed to prime them with basics of teleconsultation, with scope for further expansion in future modules.

A pilot study is aimed at assessing feasibility of a future main study, plan time, resources and data management [23]. Faculty from Department of Pharmacology was chosen due to the ease of training and their voluntariness to be a part of the project. The training module was piloted on Phase-II medical students as they are introduced to bedside clinics as a part of their regular curriculum; where they are taught history taking, obtaining informed consent and clinical examination skills. As a part of the AETCOM (Attitude, Ethics and Communication) module, the students are taught the basics of ethics and communication skills [24]. The pharmacology curriculum includes prescription writing and counseling sessions. However, these skills are taught in face-to-face settings. Offering medical care in a virtual environment requires a unique set of skills like on-camera etiquette, e-prescribing, verbal and non verbal communication skills that are addenda to bedside skills. Studies by Jonas CE et al., [25], Gunner CK et al., [6] and Costich M et al., [26] have demonstrated successful incorporation into medical curriculum using third-year, fourth-year UGs and residents respectively [6,25,26]. Yet another study by Liu C et al., implemented telemedicine training in second-year medical students in an Australian University [27]. Thirty-four students were inducted into the study taking into consideration possible attrition.

The duration of the longitudinal program was two hours/week, which was in line with the literature available, where duration of the sessions ranged between one hour to 13 weeks [21]. Based on the published literature, lectures and video-based communication were the widely employed techniques in telemedicine training, with lesser usage of simulation-based education, workshops, and reflective practices [21]. The pilot-module offered a wide-range of teaching-learning strategies to help students achieve the required competencies. In addition, various assessment tools and pre-post module surveys were employed to evaluate students' competence, both objectively and subjectively unlike studies by Gunner CK et al., and Mulcare M et al., where the outcomes assessment was purely subjective [6,28].

As per the operational definitions which were decided upon by thorough deliberation with experts and statistician; the study would

be considered to have an educational impact, if and only if at least 80% of students demonstrated >50% increase in their post-intervention scores. The significant improvements in knowledge scores, SP encounter scores and confidence rating highlighted the effectiveness of the study and also reiterated the need for such formal trainings in UG medical curricula. The improved scores may be attributed to the improvement in telehealth literacy (TPG 2020 and 2022 guidelines) and hands-on-training in virtual communication skills through blended learning that offered the benefits of both flexibility and enhanced engagement. The overall improvement of confidence scores in 100% of students was attributed to their strengthened technical-knowledge, hands-on-training and immediate, structured feedback offered by facilitators. The baseline high scores in e-prescribing may be attributed to the prescription writing and counseling skills that are already taught as a part of Pharmacology curriculum. E-transmission of prescriptions was seamlessly done by students as these are millennials who have grown up using digital technology; and are cognisant about integrating technological skills into medical care delivery. Despite majority of students not having any prior telemedicine training, they appreciated the need for learning new skills that would aid their future practice. Post-module survey highlighted the satisfaction with modules, especially exemplar videos and hands-on workshop. These findings were similar to studies conducted by several researchers [6,11,25].

Strengths: The current dearth of published Indian studies on telemedicine training for UG medical students was addressed by this project. Content of the modules was planned and developed after thorough research and analysis. Despite being a pilot study, the outcome assessment was based on objective measures of knowledge and skills in simulated settings.

Limitation(s)

The study could have been further strengthened by adding a few more clinical scenarios, with objective measurements in real clinical environments. Improvements in faculty proficiency post-training could be assessed through direct observation and rating by experts. Students who volunteered for the training program were highly interested in Telemedicine, so, there might be a scope for response bias. This may partially explain the high baseline scores with reference to attitude, perceptions and module satisfaction. A large-scale study, involving the entire student population, may shed more light on this matter. The entire program was rolled out longitudinally, beyond college hours, which required immense dedication and commitment from collaborators. Challenges like attrition of trained faculty and unexpected delays in validation process were timely tackled by additional faculty training and focused discussions, respectively. Consistent communications with stakeholders on shared goals were crucial for the project's success.

Expansion phase involving final Phase MBBS students and residents is currently underway to measure the impact of training on real patient-centered outcomes. Training of faculty from other specialties for precepting telemedicine encounters will further add to the telemedicine task force of the Institution.

CONCLUSION(S)

In light of an evolving healthcare arena, it is imperative for medical students to master “web-side” etiquette and virtual patient-care skills alongside traditional bedside clinical training. Formal and structured training is essential to ensure the delivery of high-quality teleconsultation that aligns with the regulatory requirements. Beyond optimising patient care, trained medical students may contribute to the growing telehealth workforce and serve as change-agents by educating others in society. Furthermore, these competencies are particularly vital given the National Medical Commission's mandatory

family adoption program in India, as teleconsultation skills enable students to effectively monitor remote families and cater to their diverse healthcare needs.

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PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Pharmacology, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka, India.
2. Professor Emeritus, Department of Health and Rehabilitation Sciences, College of Public Health, Temple University, Philadelphia, Pennsylvania, USA.
3. Professor and Head, Department of Pharmacology, BGS Global Institute of Medical Sciences, Bengaluru, Karnataka, India.
4. Former Head, Department of DME, International Medical School, MSU, Bengaluru, Karnataka, India.
5. Professor, Department of Anatomy, Mysore Medical College and Research Institute (MMCRI), Mysuru, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. SH Lavanya,
11th Cross, 5th Main, NGEF Layout, Nagarabhavi 170,
Bengaluru-560072, Karnataka, India.
E-mail: lavanyasumanthraj@gmail.com

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