

Objective Structured Practical Examination (OSPE) as a Formative Assessment Tool in Microbiology

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Abstract:

Background: Assessment is a key element of medical education, influencing both learning and competency evaluation. Traditional practical examinations often suffer from subjectivity and limited standardization, restricting their ability to assess diverse skills. The Objective Structured Practical Examination (OSPE) offers a more structured and objective alternative, particularly suited for competency-based and formative assessment in microbiology.

Aim and Objectives: This study aimed to evaluate the effectiveness of OSPE in assessing hospital infection control practices among undergraduate medical students. It also explored student perceptions and identified the strengths and limitations of OSPE.

Materials and Methods: This prospective study was conducted over six months in the Department of Microbiology at a tertiary care teaching institute. A total of 94 Phase II MBBS students participated. OSPE was implemented through multiple timed stations assessing infection control practices, including hand hygiene, personal protective equipment use, biomedical waste management, and post-exposure prophylaxis. Performance was evaluated using validated checklists, and student feedback was collected through a structured questionnaire.

Results: A majority of students reported positive perceptions, with 88% finding the questions relevant and 89% satisfied with the time provided. Ninety percent agreed that procedure stations effectively assessed infection control skills, and 87% felt the examination covered a wide knowledge area. While some students preferred traditional methods, 91% recommended OSPE for microbiology practicals. Additionally, 92% reported improved skills and greater satisfaction with OSPE. Logistical challenges, including limited faculty and time requirements, were noted.

Conclusion: OSPE is an effective and acceptable formative assessment tool that enhances skill development and student satisfaction. A combined approach with traditional methods may ensure comprehensive evaluation while addressing practical constraints.

Keywords: Objective Structured Practical Examination (OSPE); Formative assessment; Microbiology education; Infection control skills; Competency-based medical education.

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Introduction

Assessment is a fundamental component of medical education, as it not only evaluates students' knowledge and skills but also directs their learning process and professional development. In competency-based medical education, there is an increasing emphasis on formative assessment methods that provide continuous feedback and promote skill acquisition rather than merely certifying competence at the end of training. Traditional practical examinations (TPE), commonly used in undergraduate medical curricula, are often criticized for their subjectivity,

lack of standardization, and limited ability to comprehensively assess psychomotor and cognitive domains [1,2]. To address these limitations, the Objective Structured Practical Examination (OSPE) has emerged as a structured and objective method for assessing practical competencies. OSPE consists of a series of timed stations where students perform specific tasks or answer questions based on practical scenarios, ensuring uniformity in assessment and minimizing examiner bias. This method aligns assessment with predefined learning objectives and allows evaluation of a wide range of

skills, including observation, interpretation, procedural skills, and problem-solving abilities [1,3]. Recent studies have demonstrated that OSPE enhances reliability, validity, and acceptability compared to conventional assessment methods. It provides a standardized framework that ensures equal difficulty levels for all students and facilitates objective scoring using checklists or structured marking schemes.

Additionally, OSPE has been shown to improve student performance, engagement, and satisfaction by encouraging active learning and focused preparation [1,4]. Importantly, its role as a formative assessment tool enables timely feedback, helping students identify their strengths and weaknesses and guiding targeted learning interventions [2,5]. In the context of microbiology, where practical skills such as microscopy, culture techniques, identification of organisms, and interpretation of laboratory results are crucial, the need for an objective and comprehensive assessment method is particularly significant. Conventional practical examinations may fail to adequately assess these competencies due to variability in examiner judgment and limited sampling of skills. OSPE, with its structured station-based approach, offers a more holistic evaluation of microbiological competencies and aligns well with the goals of competency-based curricula [5]. Therefore, incorporating OSPE as a formative assessment tool in microbiology has the potential to improve the quality of assessment, enhance student learning outcomes, and ensure the development of essential laboratory skills. Hospital infection control practices are one of the certifiable exercises in Microbiology. Hospital infection control practices are important and every Indian medical graduate (IMG) must be able to practice them. COVID-19 pandemic has highlighted the importance of these infection control practices in prevention of the pandemic. This study aims to evaluate the effectiveness of OSPE model of Hospital infection control practices as a formative assessment tool in undergraduate microbiology education.

Aim and Objectives

The aim of the study is to evaluate the effectiveness of the Objective Structured Practical Examination (OSPE) model of Hospital infection control practices as a formative assessment tool in microbiology among undergraduate medical students.

The objectives of the study are as follows –

1. To assess the effectiveness of OSPE in evaluating cognitive, psychomotor, and interpretative skills of students.

2. To determine the student's perception regarding OSPE model of Hospital infection control practices.
3. To identify the strengths and limitations of OSPE as a formative assessment tool in microbiology.

Material and Methods

This prospective study was conducted at the Department of Microbiology, CIMS, and Chhindwara over a period of 6 months. Phase II MBBS students who gave consent to participate in this study were included in this study and all the students who remained absent on the day of intervention and those students who do not give consent for participation were excluded from this study. In our study, out of 100 students, 94 students were included in the study and 06 students were absent on the day of intervention and were excluded from the study. After obtaining the institutional ethical committee approval (No. CIMS/Ethics Committee/2024/8519 dated 01/08/2024) this study was conducted in the months of January to June 2025. The practical skills of undergraduate medical students were evaluated during their performing of hospital infection control practices. Complete instructions were given to students in this regard to the example of assessment and the course to be secured. The practical demonstration of the infection control topics and prevention topics/categories included in the study were – (1) Hand hygiene (2) Donning of personal protective equipment (PPE) kit (3) Doffing of PPE kit (4) Donning of gloves (5) Doffing of gloves (6) Biomedical waste discard bags and use (7) Biomedical waste discard techniques (8) Blood spill management (9) Needle stick injury (10) Post exposure prophylaxis. These topics were already covered in theory lectures for the second MBBS students. Checklist on these topics were prepared. These checklists were used for evaluating the students. These checklists were validated by the three external subject experts. Multiple skill and response stations were arranged (Table 1). Feedback form were collected and perception regarding OSPE by students were assessed in the form of a pre-validated questionnaire (Table 2).

The answer key for the 10 questions was given to the evaluators and they valued accordingly. A total of 94 students participated in this study. At the beginning of the examination, the attendance and signature of all the students and examiners were taken. The required instruments and materials were provided at the respective stations. Each station was allotted 3 min to answer, and 30 sec were given in-between stations. The evaluation was done for 4 days, 24 students each day for 3 days and 22 students on the last day. There were two evaluators and OSPE was evaluated by them in rotation.

OSPE detected both knowledge and skills and thus the competency of the student.

Table 1: OSPE stations

Sr. No.	Station	Maximum marks
1	Perform hand hygiene	3
2	Perform donning of PPE	3
3	Sequential steps for blood spill management	2
4	Perform doffing of PPE	3
5	A. Mention the infectious agents transmitted through needle stick injury B. Which infectious specimens can be collected for needle stick injury C. Mention the precautions to be taken for prevention of needle stick injury	3
6	Perform donning of gloves	2.5
7	A. Mention the colour coded biomedical waste bags B. Mention the type of waste discarded in these colour coded bags	2
8	Perform doffing of gloves	2.5
9	A. Enumerate the steps of post-exposure management B. Mention when the first dose of PEP will start for HIV	2
10	A. Enumerate the treatment/ disposal method for biomedical waste B. Mention the method of disposal of cytotoxic drug waste	2
	Total Marks	25

Results

Eighty eight percent students felt that questions in OSPE were relevant to their knowledge, 89% were of the view that sufficient time was given to each station in OSPE, ninety percent students were of the opinion the procedure stations were relevant to demonstrate the infection control skills in OSPE, 87% felt that it covered a vast range of knowledge about infection control skills. Though 56% students felt there was no difference in practical skill examination by OPSE and traditional practical examination and 58% felt that practical skills were better tested by traditional examination. Many students (91%) were of the opinion that OSPE

should be followed as method of assessment in Microbiology Practical, 92% felt that it resulted in improving my infection control skills in Microbiology and 92% felt more satisfied with my assessment with OSPE as compared to traditional practical method (Table 2).

Feedback given by students was useful and motivated in implementing OSPE in routine exams. Due to limited number of faculties, preparation of OSPE stations, checklists is a tedious process and implementation is time consuming process. Due to these reasons, OSPE is used for formative assessment in the department and OSPE question bank formation is in process in the department.

Table 2: Student's Perception Questionnaires regarding OSPE on Infection control skills (n=94)
1 =Strongly Disagree 2 =Disagree 3 = Neutral 4 =Agree 5 =Strongly Agree

Sr. No.	Questions	5 (%)	4 (%)	3 (%)	2 (%)	1 (%)
1	Questions asked in OSPE were relevant to assess my knowledge	88	6	3	2	1
2	Sufficient time was given to each station in OSPE	89	8	2	1	0
3	The procedure stations used in OSPE were relevant to demonstrate the infection control skills	90	7	1	0	2
4	OSPE covered wider range of knowledge about infection control skills	87	10	1	2	0
5	There is no difference in the examination of the practical skill by OSPE & traditional practical examination	56	8	0	34	2
6	Practical skills are better tested in the examination by traditional practical	58	8	0	34	0
7	OSPE is more objective way of assessment as compared to traditional practical method	81	15	1	0	2
8	OSPE is easier to pass as compared to traditional practical method	86	12	0	2	0
9	More score can be done in OSPE than in traditional practical method	85	13	1	1	0
10	OSPE is more stressful as compared to traditional practical method	56	6	0	36	2

11	OSPE should be followed as method of assessment in Microbiology Practical	91	6	0	3	0
12	OSPE has resulted in improving my infection control skills in Microbiology	92	4	2	2	0
13	I feel more confident in performing infection control skills after OSPE	87	9	2	1	1
14	I feel more satisfied with my assessment with OSPE as compared to traditional practical method.	92	2	2	2	2

Discussion

The results of the present study indicate that students largely favor the Objective Structured Practical Examination (OSPE) as an assessment method in microbiology, especially for evaluating infection control competencies. Most participants considered the OSPE stations to be relevant to their learning (88%) and felt that the time allocated per station was sufficient (89%). These findings are in agreement with earlier research that emphasizes the structured and standardized format of OSPE, which helps minimize subjectivity and enhances fairness in evaluation (6, 7). Additionally, a substantial proportion of students acknowledged that procedure-based stations were effective in demonstrating infection control practices (90%) and that OSPE encompassed a wide range of relevant knowledge areas (87%). This supports the role of OSPE in assessing not only theoretical understanding but also practical and procedural skills, as noted in prior studies in medical education (8, 9).

However, not all responses were uniformly in favor of OSPE. Over half of the students (56%) perceived no clear distinction between OSPE and conventional practical examinations, and 58% felt that traditional methods were more effective for assessing hands-on skills. This indicates that, despite its advantages, OSPE may not fully replace traditional approaches in the perception of some learners. Familiarity with conventional examinations and the opportunity for direct interaction with examiners may influence these preferences. Similar mixed responses have been documented in previous studies, suggesting that both methods have their own strengths and could be used complementarily (10, 11).

A significant majority of students endorsed the continued implementation of OSPE, with 91% recommending its inclusion in microbiology practical assessments. Moreover, 92% reported that OSPE contributed to improving their infection control skills and expressed higher satisfaction compared to traditional examination formats. These observations are consistent with contemporary literature, which highlights that OSPE promotes active participation, facilitates structured feedback, and strengthens clinical competence and learner confidence (12, 13).

Student feedback also played an important role in encouraging faculty to adopt OSPE in routine practice. Nevertheless, several operational challenges were identified, such as inadequate faculty numbers, the considerable time required to design stations, and the effort involved in preparing detailed evaluation checklists. These issues have been similarly reported in other educational settings, where resource and logistical constraints hinder large-scale implementation of OSPE (14, 15). As a result, in the current context, OSPE is primarily being applied for formative assessment, while efforts are ongoing to develop a structured question bank to support its future use in summative evaluations.

This study has certain limitations. The sample size was limited to a single batch of students from one institution, which may restrict the generalizability of the results to other settings. The study primarily relied on student perceptions and self-reported feedback, which may be influenced by subjective bias and may not fully reflect actual improvement in practical competencies. In addition, the implementation of OSPE was constrained by limited faculty availability and the time required for designing stations and checklists. The study also did not include a detailed comparison of student performance outcomes between OSPE and traditional practical examinations, which could have provided stronger evidence of its effectiveness. Furthermore, as OSPE was used mainly for formative purposes, its impact on summative assessment and long-term retention of skills was not evaluated.

Conclusion

In summary, OSPE emerges as an effective and widely accepted tool for assessing microbiology practical skills, particularly in infection control. However, combining OSPE with traditional practical examinations may offer a more balanced and feasible assessment strategy, addressing both learner preferences and institutional limitations while ensuring a comprehensive evaluation of competencies.

The Objective Structured Practical Examination (OSPE) is a reliable and learner-centered method for formative assessment in microbiology. It enables systematic evaluation of both theoretical understanding and practical competencies,

particularly in essential areas like infection control. Students generally perceive OSPE as a fair, relevant, and useful approach that supports skill development and enhances their overall learning experience. By encouraging active participation and allowing structured feedback, OSPE contributes to continuous improvement in student performance. Nevertheless, its implementation requires careful planning, adequate staffing, and time for the preparation of stations and assessment criteria.

Incorporating OSPE into routine teaching can strengthen competency-based education in microbiology. Using it alongside traditional practical examinations may provide a more comprehensive and feasible assessment framework, balancing educational benefits with available resources.

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Abbreviations

- TPE - Traditional practical examinations
- OSPE - Objective Structured Practical Examination
- IMG – Indian Medical Graduate
- PPE - Personal protective equipment

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