

# Medical education in post-pandemic times: Online or offline mode of learning?

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## ABSTRACT

**Background and Objective:** With the advent of the COVID-19 pandemic, face-to-face training was suspended considering social-distancing norms. The training needs of the healthcare workers (HCWs) were being met by the online mode. Initially, the use of the online mode was limited but was eventually popularized with increased use. This would have led to a change in the perception toward the online mode. However, the use of online learning has financial and temporal obstacles. With this objective, a study was conducted among the HCWs to assess the perception, satisfaction, and preference associated with the modes of learning. **Methods:** A cross-sectional study was conducted from February to April 2021 among the HCWs. An online link to the survey was circulated among the HCWs who attended online or/and offline training. The questionnaire had 38 questions assessing the sociodemographic details, perception, satisfaction level, and preferences of the participants. Univariable and multivariate logistic regression were performed using SPSS v-22. **Results:** A total of 1,113 responses were received with the mean age of  $33.17 \pm 8.13$  years and approximately 63% of the participants were females. Approximately 54% perceived the online mode of learning as a better mode of learning. Also, 67% preferred and 80.5% recommended the online mode whereas mean satisfaction was found to be more for the offline mode as compared to the online mode. **Interpretation and Conclusions:** The study concludes that the online mode of learning is the most preferred and recommended mode among the HCWs, whereas there is more dissatisfaction with respect to the offline mode. The study also emphasizes that the instructors need to improve the practical knowledge of the learners by integrating technical modalities.

**Keywords:** Distance, education, health personnel, learning, medical, perception, personal satisfaction

## Introduction

A shortage of 7.2 million healthcare workers (HCWs) was estimated worldwide in 2013, and it is expected to escalate to 12.9 million by 2035.<sup>[1]</sup> Further, limited faculty and institutional resources contribute to the suboptimal quality of the available health services in developing countries.<sup>[2]</sup> Moreover, deficient knowledge and skills of medical staff are further worsened by

the widening gap between advances and innovations in the field and its dissemination to medical professionals such as physicians at the primary health center.<sup>[3]</sup> To overcome this knowledge and skill breach, training programs in the form of continuing professional development and continuing medical education are being organized by different healthcare fraternities.<sup>[4]</sup>

Evidence suggests that training programmes are effective in improving the knowledge, skills, and practices of the healthcare professionals as well as patient-related outcomes.<sup>[5-8]</sup> With the advent of the COVID-19 pandemic, physical trainings were suspended. At the same time, there was a strong apprehension to prepare the HCWs about COVID-19 to continue their services in

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Received: 25-11-2021

Revised: 15-02-2022

Accepted: 26-03-2022

Published: 14-10-2022

### Access this article online

#### Quick Response Code:



Website:  
www.jfmpc.com

DOI:  
10.4103/jfmpc.jfmpc\_2305\_21

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**How to cite this article:** Rastogi A, Bansal A, Keshan P, Jindal A, Prakash A, Kumar V. Medical education in post-pandemic times: Online or offline mode of learning? J Family Med Prim Care 2022;11:5375-86.

healthcare setting. These trainings were conducted through online mode. Eventually, with the increasing use of online platforms, online mode was popularised among the HCWs.<sup>[9]</sup> Learners consider it as the only plausible mode for their continued learning with flexibility of time, pace, and place whereas trainers consider it as a low-cost medium which can train the masses in one go.<sup>[10,11]</sup> Thus, this could have led to a change in the perception and acceptance toward e-learning during the COVID-19 pandemic. Despite an increasing demand of e-learning, the use of e-learning remains restricted in the areas with limited Internet connectivity as two-thirds of the population of developing countries have reported to be offline.<sup>[12]</sup> Therefore, in such circumstances, offline learning approach seems to be the plausible solution to overcome the geographical, financial, and temporal obstacles faced by learners.<sup>[11]</sup>

Therefore, the perceptions, satisfaction, and preferences of HCWs related to the modes of learning are important to plan the necessary trainings accordingly. However, at present, there is inconclusive evidence about the current perception and satisfaction associated with the available modes. Thus, the present study aims at assessing the perception, satisfaction, and preference of the HCWs toward the modes of learning. The study is also documenting the future use of e-learning in the post-pandemic times.

## Methodology

### Study design

A cross-sectional study was conducted from February to April 2021 among the HCWs working in healthcare facilities across India.

### Study population

The Institute of Liver and Biliary Sciences (ILBS) has a database of approximately 6,000 HCWs across the country as it has been involved in various offline and online capacity building activities of the HCWs. Any HCW who has attended any training was eligible to participate in the study.

### Sample size and sampling strategy

The sample size was calculated using Open Epi.<sup>[13]</sup> At the time of the conceptualisation of the study, there was limited evidence that has studied the preference for the modes of learning, thus, the proportion of online and offline learning was considered to be 50% as it yielded the most conservative sample size. Considering the proportion to be 50% with alpha 5% and absolute precision as 5%, the sample size calculated was 384. Considering the 20% loss of data due to non-response or incomplete data, the total sample size required was 461. Since, the questionnaire was collected through an online platform, it was assumed that only HCWs who were having good digital literacy would attempt an online survey. To overcome this selection bias, 20% of the data was collected through the offline mode. Considering this, 461 online responses and 92 offline responses were required in the

present study. A response rate of 10% was expected, and hence, the survey link was shared with 6,000 HCWs.

### Study tool

The questionnaire was content validated by experts at the institute. Following which face validity was performed among 40 HCWs of the institute. The suggestions and feedback from the face and content validity were incorporated in the final questionnaire.

The final questionnaire consisted of 38 questions across four sections. The four sections were (i) sociodemographic details, (ii) perception, (iii) satisfaction level, and (iv) preferences related to modes of learning. The sociodemographic profile of the participants included questions such as age, gender, education, occupation, and experience. The perception and satisfaction section consisted of 10 questions each. A Likert scale of one to five was used to assess satisfaction for both modes of training.

### Study procedures

Data collection was carried out primarily through the online mode with a small proportion (20%) collected through the offline mode. An online link to the questionnaire was circulated with the HCWs. To maintain representativeness of the data collected through the survey, link to online questionnaire was shared thrice with the participants.

For offline mode of data collection, a list of multi- and super-specialty healthcare facilities from where more than 50 participants had attended the training in the past years was extracted. From the list, five institutions were randomly selected using the lottery method. Printed questionnaires were sent to randomly selected multi- and super-specialty hospitals of Delhi to collect responses from the HCWs who had attended the training organized by ILBS. It was ensured that the participants who were participating through the offline mode had not filled the questionnaire in the online mode.

### Data management and statistical analysis

Data were extracted in MS-Excel from SurveyMonkey. For the analysis purpose, age was divided into two groups: (i) <30 years and (ii) ≥30 years.<sup>[14]</sup> The years of experience was divided as (i) less than 5 years and (ii) 5 years and more.<sup>[15]</sup> Satisfaction was considered if the score was ≥35 considering the satisfaction to a mode of learning to be 67% in the previous study.<sup>[16]</sup> The training attended was recoded as yes if the participants has attended the training within 6 months to 2 years whereas it was recoded as no if the participants had never attended such a course. This was done for both the offline and online modes of training.

Data were analyzed using Statistical Package for the Social Sciences (SPSS Statistics for Windows, Version 22 Armonk, Chicago, IL: IBM Corp). Continuous data were presented as mean and standard deviation (SD) or median with inter-quartile range (IQR) as applicable. Categorical variables were presented as

frequency with their percentages. The Chi-square and univariable logistic regression were performed to assess the association of the sociodemographic characteristics with perception, satisfaction, and preferences of the learner and the degree of association was presented as the odds ratio with their 95% confidence interval (CI) and *P* value. All the variables that were significant in the univariable analysis ( $<0.10$ ) were included in multivariable analysis. Statistical significance was considered as *P* value  $<0.05$ .

**Ethical Consideration:** The ethical approval was sought from the Institutional Ethics Committee of ILBS, Delhi, with number IEC/2021/85/NA05. The first page of the questionnaire consisted of consent form which clearly stated that they were free to withdraw at any time, without giving a reason, and all information provided by them would be kept anonymous and confidential.

## Results

### Baseline characteristics

A total of 1,113 HCWs voluntarily participated in the present study. The mean age of the participants was  $33.17 \pm 8.13$  years and approximately 63% were females. Approximately 40.3% were graduates followed by 33.9% being diploma holders with 8.0 (IQR: 3.0–13.0) years as the median years of experience [Table 1].

Approximately 46% of the participants did not attend any online training ever and only 13.7% attended online training once in a year, before the pandemic. However, during the COVID-19 period, 18.2% attended one online training per month and around 20% attended two online training sessions in a month. Mobile phone was the most common device used by the participants for attending online training sessions [Table 1].

### Perception of the participants

Approximately 54% of the participants perceived online mode as a better mode of learning in the post-pandemic scenario. Around 62% of the participants considered online mode better in terms of learning theoretical concepts whereas 73% considered offline mode better to learn practical and clinical concepts. The participants found the offline mode to offer more personalized attention (60.7%) than the online mode whereas the participants considered the online mode better when it came to convenience and flexibility of the timings (85.3%) [Table 2].

The adjusted analysis of perception with the demographic characteristics stated type of HCWs, experience, training attended online and preferences toward the mode of training were found to be independently associated with the perception of the participants [Supplementary Table 1].

### Satisfaction of the participants

The mean score of satisfaction was found to be  $37.91 \pm 9.93$  for online and  $40.06 \pm 9.67$  offline [Table 3]. A total of 70.2%

**Table 1: Sociodemographic characteristics (n=1113)**

Sociodemographic characteristics	n (%)
Age in years	
Mean $\pm$ SD	33.17 $\pm$ 8.13
<30 years	413 (37.1)
$\geq$ 30 years	700 (62.9)
Gender	
Male	410 (36.8)
Female	703 (63.2)
Qualification	
Diploma holders	377 (33.9)
Graduates	449 (40.3)
Post-graduates and above	287 (25.8)
Type of healthcare worker	
Student	96 (8.7)
Nursing staff	699 (62.8)
Physician	218 (19.6)
Faculty	100 (8.9)
Marital Status	
Unmarried	367 (33.0)
Married	746 (67.0)
Type of health facility	
Government	787 (70.7)
Private	326 (29.3)
Experience	
Median Years (IQR)	8.0 (3.0-13.0)
<5 years	375 (33.7)
$\geq$ 5 years	738 (66.3)
Monthly Household Income in Indian National Rupees (n=1064)	
<25000	118 (11.1)
Between 25000 to 50000	132 (12.4)
Between 50000 to 100000	400 (37.6)
$\geq$ 100000	414 (38.9)
Have you ever attended any certificate course/training program/continued medical educations sessions in offline mode?	
Yes, within 6 months	167 (15.0)
Yes, between 6 months to 1 year	130 (11.7)
Yes, between 1 year to 2 years	506 (45.4)
No, never attended such courses	310 (27.9)
Have you ever attended any certificate course/training programme/continued medical educations sessions in online mode?	
Yes, within 6 months	581 (52.2)
Yes, between 6 months to 1 year	180 (16.1)
Yes, between 1 year to 2 years	84 (7.6)
No, never attended such courses	268 (24.1)
Frequency of attending trainings online before pandemic	
Twice a month	106 (9.5)
Once a month	110 (10.0)
Once in quarter	85 (7.6)
Once in 6 months	145 (13.0)
Once in a year	152 (13.6)
Not attended any	515 (46.3)
Frequency of attending trainings online during pandemic	
Twice a month	220 (19.8)
Once a month	203 (18.2)
Once in quarter	119 (10.7)
Once in 6 months	169 (15.2)
Once in a year	118 (10.6)
Not attended any	284 (25.5)

*Contd...*

**Table 1: Contd...**

Sociodemographic characteristics	n (%)
Most common device/medium used for attending online trainings	
Mobile	947 (85.1)
Tablet	38 (3.4)
Desktop	14 (1.3)
Laptop	114 (10.2)
Mode recommended to friend and colleagues	
Online	896 (80.5)
Offline	217 (19.5)

SD: Standard Deviation, IQR: Inter-quartile Range

**Table 2: Perception of the participants toward different modes of learning**

S. No.	Perception of the participants	Online n (%)	Offline n (%)
P. 1	Understanding of theoretical concepts	695 (62.4)	418 (37.6)
P. 2	Understanding of practical or clinical concepts	305 (27.4)	808 (72.6)
P. 3	Interaction between teacher/instructor and the learners	416 (37.4)	697 (62.6)
P. 4	Retention on knowledge and skills gained	504 (45.3)	609 (54.7)
P. 5	Flexibility of time and convenience	950 (85.3)	163 (14.7)
P. 6	Assignments and class activities	568 (51.0)	545 (49.0)
P. 7	More personalised attention from the teacher/instructor	437 (39.3)	675 (60.7)
P. 8	Social interaction and communication with co-learners	470 (42.2)	643 (57.8)
P. 9	Feedback and motivation for improvement	672 (60.4)	441 (39.6)
P. 10	Overall, which mode you perceive as better with respect to learning in normal scenario?	599 (53.8)	514 (46.2)

of the participants were satisfied with the online mode whereas 79.6% were satisfied with the offline mode of learning.

Approximately, 45% of the participants were fully satisfied with the quantity and quality of the explanation provided in the offline mode whereas approximately 34% were fully satisfied with the quantity and quality of the explanation provided in the online mode. With respect to fulfillment of learning needs, 48.5% were fully satisfied with the offline mode and 37% with the online mode. Similarly, more participants were satisfied with the offline mode of learning in terms of personalized attention from the instructor (online: 25% vs. offline: 48.6%) and quality of interaction from the instructor (online: 28.9% vs. offline: 50.8%) as compared to the online mode. In context of timing and convenience, 58.6% were fully satisfied with the online mode and 24.2% were fully satisfied with the offline mode of training [Supplementary Table 2].

On multivariate analysis, satisfaction with the online mode was independently associated with age ( $P < 0.001$ ), gender ( $<0.005$ ), sector of health facility ( $P = 0.048$ ), level of experience ( $P = 0.028$ ), income category ( $P < 0.05$ ), and training attended online ( $P = 0.007$ ), whereas satisfaction with offline mode of training was found to be significantly associated with qualification of the participants ( $P < 0.001$ ), income

levels ( $P < 0.001$ ), and experience of training attended in the offline mode ( $P = 0.006$ ) [Supplementary Table 3].

### Preference of the participants

Approximately 67% of the participants preferred the online mode as a better mode of learning in the post-pandemic scenario as compared to the offline mode. The most common reasons enlisted were access to needed information (73.8%), saves travel time (68.9%), and learning at own pace (50.3%). The most common reasons for preferring offline mode were availability of interactive simulations, discussion with other students (46.9%), adequate communication with the instructor and resolution of queries (42.4%), and classical written material and writing down of lecture notes (41.3%) [Table 4].

The odds of preferring online training among the participants who perceived online as a better mode of training were 9.63 (6.99–13.29,  $P < 0.001$ ) times higher the odds of perceiving offline mode of training to be better [Supplementary Table 4].

### Recommendation by the participants

Around 80.5% of the participants ( $n = 896$ ) recommended online mode to their friends and colleagues. The odds of recommending the online mode were more among older participants (OR: 1.52; 95%CI: 1.12-2.05;  $P = 0.006$ ) as compared to the younger participants in a univariable analysis. The other factors which were found to be significant in the univariable analysis were education qualification ( $P < 0.001$ ), type of HCWs ( $P = 0.027$ ), marital status of HCWs ( $P = 0.005$ ), experience ( $P = 0.04$ ), income levels ( $P = 0.076$ ), perception of the HCWs toward modes of learning ( $<0.001$ ), satisfaction with online ( $P < 0.001$ ) and offline mode ( $P = 0.022$ ) of learning and preference of different modes ( $P < 0.001$ ).

On adjusted analysis, only education qualification, perception, and preference toward modes of learning were found to be independently associated. Adjusted analysis suggested odds of recommending online mode of learning among the group who perceived online is better was 5.01 (95%CI: 3.15-7.98;  $P < 0.001$ ) times higher in the group who perceived offline mode of learning to be better. Similarly, odds of recommending online mode of learning among participants who preferred online mode was 3.86 (2.63-5.68;  $P < 0.001$ ) times higher than the participants who preferred offline mode of learning after adjusting for other variables [Table 5].

### Discussion

The present study found that approximately 54% of the HCWs perceived the online mode as a better mode of learning. The findings of the study are contradicting a few studies conducted within the few months of the commencement of COVID-19.<sup>[17,18]</sup> This could be explained as there was a sudden switch to online mode to continue the medical education while maintaining social distancing. Initially, the online training was being conducted with



**Table 3: Satisfaction toward online and offline mode of learning (n=1113)**

Satisfaction	Online score (Mean±SD)	Offline score (Mean±SD)	t	P
Quantity and quality of explanation of the topic	3.84±1.14	4.03±1.56	5.01	<0.001
Content of the training	3.96±1.17	4.01±1.14	1.38	0.165
Demonstration of topic by the trainer	3.76±1.18	4.08±1.17	8.03	<0.001
Fulfilment of learning needs	3.89±1.16	4.11±1.14	5.75	<0.001
Personalised attention by the teacher/instructor	3.49±1.23	4.10±1.14	14.17	<0.001
Resolution of queries and doubts	3.73±1.22	4.10±1.16	9.22	<0.001
Quality of interaction with the teacher/instructor	3.62±1.24	4.14±1.14	12.30	<0.001
Quantity of interaction with the teacher/instructor	3.65±1.23	4.05±1.16	9.88	<0.001
Evaluation patterns and assignment activities	3.77±1.20	4.00±1.17	6.06	<0.001
Timing and Convenience	4.21±1.18	3.43±1.24	-16.82	<0.001
Overall Satisfaction	37.91±9.93	40.06±9.66	7.39	<0.001

SD: Standard deviation

**Table 4: Preferences and challenges toward mode of learning**

S. No.	Preferences of the participants	n (%)
Pr. 1	Preferred mode of learning	
	Offline	366 (32.9)
	Online	747 (67.1)
Pr. 2	Reasons for preferring online mode	
	Access needed information, at any time or/and at any place.	821 (73.8)
	Learning without much travel, thus saves travel time.	767 (68.9)
	Improvement in general digital literacy.	434 (39.0)
	Access to upgraded and up-to-date educational content.	532 (47.8)
	Learning the subject at my own pace and speed.	560 (50.3)
	Learning how to work independently.	368 (33.1)
	Easier methods of evaluation of the learners and learners don't have to wait longer for their results.	503 (45.2)
Pr. 3	Reasons for preferring offline mode	
	"Classical" written material and writing down of own lecture notes.	460 (41.3)
	Interactive simulations, discussion with other students.	522 (46.9)
	Communication with the instructor and resolve the queries	472 (42.4)
	Sufficient time to resolve my queries.	397 (35.7)
	Limited requirements.	242 (21.7)
	Retain knowledge and skills gained through online teaching.	320 (28.7)
	Quality of knowledge being disseminated to be good and at student paced, rather than instructor-paced.	372 (33.4)
Pr. 4	Challenges of online mode of learning	
	No provision to "Classical" written material and writing of down own lecture notes.	426 (38.3)
	No provision to interactive simulations, discussion with other students.	421 (37.8)
	Difficult to communicate with the instructor and hence queries remain unresolved.	318 (28.6)
	Difficult to resolve queries because of limited time available during online sessions.	365 (32.8)
	Difficult to connect to online platforms, because of absence of necessary infrastructure and resources to attend such classes.	235 (21.1)
	Difficult to connect to online platforms because of stable internet connection.	251 (22.6)
	Privacy issues related to online platforms.	161 (14.5)
	Difficult to retain knowledge and skills gained through online teaching.	172 (15.4)
	Quality of knowledge being disseminated to be poor and at instructor-paced, rather than student paced.	170 (15.3)
Pr. 5	Challenges of offline mode of learning	
	Trainings to be attended at designated time and place.	620 (55.7)
	Travel to concerned place to attend such trainings, thus lot of time goes in traveling.	687 (61.7)
	The educational content is old and not upgraded.	203 (18.2)
	Offline training to be boring and monotonous.	224 (20.1)
	Difficult to retain knowledge and skills gained through offline teaching.	152 (13.7)
	Method of evaluation is complicated and I have to wait long for the results.	262 (23.5)

limited resources and less acquaintances with new modes of training among both the trainer as well as the trainee. However, with increasing need, the learners became accustomed with the online mode, and hence, were preferring the online mode of learning as observed in the present study. Similar findings were re-emphasized by a recent study among the medical undergraduate students.<sup>[19]</sup>

In the present study, with respect to perception, online mode is considered as an excellent mode for learning theoretical concepts (62.4%), however, the new mode has not replaced the offline mode in terms of practical or clinical experiences (27.4%), which are extremely important for the medical practices. The finding of the study is supported by a qualitative study assessing the preference of modes of learning in medical education.<sup>[20]</sup>

**Table 5: Association of demographic characteristics with recommendation of the participants (n=1113)**

Demographic characteristics	Online n=896 n (%)	Offline n=217 n (%)	OR (95% CI)	P	aOR (95% CI)	P*
Age category						
<30 years	315 (76.3)	98 (23.7)	Ref	0.006	Ref	0.393
≥30 years	581 (83.0)	119 (17.0)	1.52 (1.12-2.05)		1.29 (0.72-2.34)	
Gender						
Male	326 (79.5)	84 (20.5)	Ref	0.524		
Female	570 (81.1)	133 (18.9)	1.10 (0.81-1.50)			
Qualification						
Diploma holders	325 (86.2)	52 (13.8)	Ref	<0.001	Ref	0.088
Graduates	353 (78.6)	96 (21.4)	0.59 (0.41-0.85)		0.66 (0.41-1.06)	0.181
Post-graduates and above	218 (76.0)	69 (24.0)	0.42 (0.30-0.58)		0.67 (0.37-1.20)	
Type of healthcare worker						
Student	66 (68.8)	30 (30.2)	Ref	0.027	Ref	0.753
Nursing staff	573 (82.0)	126 (18.0)	2.06 (1.29-3.32)		0.89 (0.45-1.78)	0.271
Physician	179 (82.1)	33 (17.9)	2.09 (1.20-3.63)		1.50 (0.73-3.08)	0.531
Faculty	78 (78.0)	22 (22.0)	1.61 (0.85-3.06)		1.31 (0.56-3.09)	
Marital Status						
Unmarried	278 (75.7)	89 (24.3)	Ref	0.005	Ref	0.302
Married	618 (82.8)	128 (17.2)	1.55 (1.14-2.10)		1.28 (0.80-2.06)	
Type of health facility						
Government	632 (80.3)	155 (19.7)	Ref	0.795		
Private	264 (81.0)	62 (19.0)	1.04 (0.75-1.45)			
Experience						
<5 years	289 (77.0)	86 (23.0)	Ref	0.040	Ref	0.735
≥5 years	607 (82.2)	131 (17.8)	1.38 (1.01-1.87)		0.91 (0.51-1.60)	
Income category in Indian National Rupees						
<25000	103 (87.3)	15 (12.7)	Ref	0.076	Ref	0.229
25000 to 50000	106 (80.3)	26 (19.7)	0.59 (0.30-1.18)		0.62 (0.28-1.35)	0.809
50000 to 100000	335 (83.7)	65 (16.3)	0.75 (0.41-1.37)		0.92 (0.46-1.83)	0.101
≥100000	323 (78.0)	91 (22.0)	0.52 (0.29-0.93)		0.57 (0.29-1.12)	
Perception						
Offline	331 (64.4)	183 (35.6)	Ref	<0.001	Ref	<0.001
Online	565 (94.3)	34 (5.7)	9.19 (6.22-13.57)		5.01 (3.15-7.98)	
Satisfaction with Online mode of learning						
No	230 (69.3)	102 (30.7)	Ref	<0.001	Ref	0.074
Yes	666 (85.3)	115 (14.7)	2.57 (1.89-3.49)		1.43 (0.96-2.11)	
Satisfaction with Offline mode of learning						
No	195 (85.9)	32 (14.1)	Ref	0.022	Ref	0.690
Yes	701 (79.1)	185 (20.9)	0.62 (0.41-0.93)		1.11 (0.65-1.90)	
Preference						
Offline	213 (58.2)	153 (41.8)	Ref	<0.001	Ref	<0.001
Online	683 (91.4)	64 (8.6)	7.66 (5.51-10.66)		3.86 (2.63-5.68)	

\*P-Value of model: <0.001; R<sup>2</sup>: 0.23. OR: Odds ratio, aOR: Adjusted odds ratio, CI: confidence intervals, Ref: Reference

Flexibility of time and convenience associated (85.3%) are one of the most important reasons for perceiving online mode over traditional mode of learning where a learner spends long hours in traveling to reach the designated venue of training (55.7%).

Across the world, students' perspectives and preferences on the modes of learning have been disparate between pros and cons affiliated to the country. The positive perspective is promoted by previous e-learning experiences. Medical students in Nepal did not find online classes as effective as the traditional classes, and hence, approximately 78% preferred traditional teaching.<sup>[21]</sup> Similar complements for the conventional face-to-face mode of learning were provided by a study on medical and dental students of Jordan.<sup>[22]</sup> Correspondingly, classroom learning was preferred because it facilitates better teacher–student interactions, stimulates understanding, encourages interactivity

and independence from technology as discussed by an Indian study.<sup>[23]</sup>

However, unlike these studies, the present study had a preference (67.1%) and recommendation (80.5%) for the online mode of learning in post-pandemic times, which was also supported by an Israelian study.<sup>[24]</sup> These disparities in the views across the world can be explained by the quality of content, quality and quantity of interaction, digital literacy of the trainer and trainee as well as Internet connectivity. In our study, the ease to access the upgraded content at their convenience, reduction in travel time, learning the subject at own pace, and easier methods of evaluation were the main reasons for preference of online mode of learning.

Despite medical graduates having their preferences and perceptions for online mode of training, they seemed to be less

satisfied with the online mode ( $37.91 \pm 9.93$ ) when compared to the offline mode of training ( $40.06 \pm 9.67$ ). Similar results were observed from a study undertaken in Jordan.<sup>[25]</sup> Though most of the participants were satisfied with online (70.2%) as well as offline mode (79.6%), there was inclined satisfaction toward the offline mode of learning. This is similar to what was reported by a previous study conducted on medical students in Seoul.<sup>[26]</sup> The present study reveals that satisfaction was more for offline mode over online mode mainly attributable to the quantity and quality of the explanation provided, demonstration of a topic, personalized attention provided by the instructor, fulfillment of learning needs, quality and quantity of interaction with the instructor as well as ease of evaluation patterns and assignment activities. Previous studies have also shown that the quality of explanation provided and fulfillment on the learning needs have an impact on student's learning, eventually resulting in a positive impact on the satisfaction of mode of learning.<sup>[27,28]</sup> According to a study from India, interaction and focus of the instructor as well as practical learning were the major reasons for dissatisfaction with the online mode of learning as compared to other face-to-face modes of learning in medical education.<sup>[29]</sup>

The COVID-19 pandemic has changed the dimensions and style of living lives. The online mode has become the primary means of acquiring updates and continuing medical education while maintaining social distancing. However, these benefits may not be generalizable to all forms of online teaching such as recorded lectures.<sup>[30]</sup> Provision to classical written material or taking notes, limited interaction, and discussion with other students are important challenges of online learning. Also, learners find it difficult to communicate with the instructor for query resolution. They also feel that the time for discussion and query resolution is limited in the online mode of learning. A few studies have confirmed the findings that social presence and social interaction toward e-learning are important aspects of learning which are difficult to achieve in the online mode of learning.<sup>[18,20,31]</sup> A few participants have highlighted privacy issues related to online platforms, also reported by previous studies.<sup>[17,32]</sup> Difficulty in connecting to online platforms because of unstable Internet connections and infrastructure requirements have been one of technical challenges associated with the online mode, which has been reported by Indian studies and also reconfirmed by the present study.<sup>[17,33,34]</sup>

Like other online surveys, the present study too has the inherent drawback of self-reported surveys. The inherent design of the study like sampling technique could have resulted in selection bias as the study is only restricted to people with Internet access and understanding of English language. However, an attempt was made to collect 20% of the data in offline mode to minimize the selection bias.

To the best of our knowledge, the present study is one of the pioneer studies exploring the perceptions, preferences, satisfaction, and recommendations for both modes of learning among healthcare workers in post-pandemic times. The study highlights the online mode of learning as the most preferred and

recommended mode among HCWs. Utilizing the online mode of learning in hub and spoke knowledge sharing model, with experts at the hub and primary care physicians as the spokes, new and permanent capacities at remote locations can be created.<sup>[35]</sup> Thus, online mode can also be used to build capacities and improve skills by developing specialist expertise among primary healthcare physicians, eventually resulting in improved access to specialty care in remote locations.<sup>[15]</sup> Thus, for online mode to be successful, instructors and organizers need to improve the practical knowledge of the learners by the integration of technical modalities such as virtual simulation technologies and computer-based models of real-life processes to increase the satisfaction of the learner.

## Conclusion

The online mode of learning has become the new normal. It is important that the medical institution should consider the perception and preferences of their learners toward different modes and should comprehensively work toward improving the satisfaction of their learners toward online mode. The online mode needs to be upgraded through the integration of technical modalities to enrich the learners with practical and clinical knowledge. Overcoming such challenges, online learning can serve as a cost-effective mode for disseminating information among medical students, primary care physicians, and HCWs.

## Acknowledgments

The authors sincerely acknowledge Gilead, for their financial grant provided to Project ECHO, However, there is no conflict of interest or financial ties to disclose. Authors also express their gratitude to Dr. S.K. Sarin, Director Institute of Liver and Biliary Sciences for providing his mentorship. Authors would also like to extend their thanks to all the faculties for their continuous support to the Project ECHO.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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## Supplementary

For assessing the association between perception, satisfaction and preference of the learner with demographic factors, all demographic factors were included in multivariable analysis, considering that all the variables were important and may have an influence on perception, satisfaction and preference of the learner.

### Perception

Association of demographic characteristics with perception of the participants: Association of perception with demographic characteristics demonstrated education qualification ( $p<0.001$ ), type of (Healthcare workers) HCWs ( $p<0.001$ ), marital status ( $p=0.035$ ), income category ( $p=0.01$ ), preference ( $p<0.001$ ), experience of training attended in online mode ( $p=0.004$ ) were found to be associated with perception in univariable analysis. However, after adjusting for other variables type of HCWs, experience, training attended online and preferences towards mode of training were found to be independently associated with perception of the participants (Supplementary Table 1).

**Table 1: Association of demographic characteristics with perception of the participants (n=1113)**

Demographic characteristics	Online n=599 n (%)	Offline n=514 n (%)	OR (95% CI)	P	aOR (95% CI)	P*
Age category						
<30 years	208 (50.4)	205 (49.6)	Ref	0.076	Ref	0.449
≥30 years	391 (55.9)	309 (44.1)	1.25 (0.98–1.59)		1.18 (0.77-1.82)	
Gender						
Male	216 (52.7)	194 (47.3)	Ref	0.562	Ref	0.428
Female	383 (54.5)	320 (45.5)	1.07 (0.84-1.37)		0.88 (0.63-1.22)	
Qualification						
Diploma holders	230 (61.0)	147 (39.0)	Ref	0.034	Ref	0.148
Graduates	241 (53.7)	208 (46.3)	0.74 (0.56-0.97)	<0.001	0.76 (0.53-1.10)	0.174
Post-graduates and above	128 (44.6)	159 (55.4)	0.51 (0.38-0.70)		0.72 (0.45-1.16)	
Type of Healthcare workers						
Student	34 (35.4)	62 (64.6)	Ref	<0.001	Ref	0.085
Nursing staff	403 (57.6)	296 (42.4)	2.48 (1.59-3.87)	0.004	1.75 (0.93-3.29)	0.023
Physician	116 (53.2)	103 (46.8)	2.07 (1.26-3.40)	0.133	2.15 (1.11-4.15)	0.600
Faculty	46 (46.0)	54 (54.0)	1.55 (0.87-2.76)		1.22 (0.58-2.57)	
Marital Status						
Unmarried	181 (49.3)	186 (50.7)	Ref	0.035	Ref	0.564
Married	418 (56.0)	328 (44.0)	1.31 (1.02-1.68)		1.12 (0.76-1.66)	
Type of health facility						
Government	411 (52.2)	376 (47.8)	Ref	0.097	Ref	0.172
Private	188 (57.7)	138 (42.3)	1.25 (0.96-1.62)		1.28 (0.90-1.83)	
Experience						
<5 years	191 (50.9)	184 (49.1)	Ref	0.169	Ref	0.026
≥5 years	408 (55.3)	330 (44.7)	1.19 (0.93-1.53)		0.97 (0.95-1.00)	
Income category in Indian National Rupees						
<25000	77 (65.2)	41 (34.8)	Ref	0.448	Ref	0.505
25000 to 50000	80 (60.6)	52 (39.4)	0.82 (0.49-1.37)	0.035	0.82 (0.45-1.49)	0.101
50000 to 100000	217 (54.2)	183 (45.8)	0.63 (0.41-0.97)	0.006	0.65 (0.39-1.09)	0.039
≥100000	210 (50.7)	204 (49.3)	0.55 (0.36-0.84)		0.59 (0.35-0.97)	
Experience of attending online training						
No	124 (46.3)	144 (53.7)	Ref	0.004	Ref	0.013
Yes	475 (56.2)	370 (43.8)	1.49 (1.13-1.96)		1.54 (1.10-2.19)	
Experience of attending offline training						
No	170 (54.8)	140 (45.2)	Ref	0.671	Ref	0.881
Yes	429 (53.4)	374 (46.6)	0.94 (0.73-1.23)		1.03 (0.74-1.43)	
Preference of mode of learning						
Offline	527 (70.5)	220 (29.5)	Ref	<0.001	Ref	<0.001
Online	72 (19.7)	294 (80.3)	9.78 (7.23-3.22)		9.66 (7.00-3.31)	

\*P-Value of model: <0.001; R<sup>2</sup>: 0.19. OR: Odds ratio, aOR: Adjusted odds ratio, CI: confidence intervals, Ref: Reference

## Satisfaction

Association of demographic characteristics with satisfaction level of the participants (n=1113) : The odds of being satisfied with online mode of learning among older participants ( $\geq 30$  years) was 1.59 (1.23-2.07;  $p < 0.001$ ) times higher the odds of being satisfied with online mode of learning among younger participants ( $< 30$  years). Similarly, in univariable analysis, odds of being satisfied with online mode of learning varied across different types of HCW ( $p = 0.03$ ), level of experience ( $p = 0.005$ ), training attended online ( $p = 0.02$ ). On multivariate analysis, satisfaction with online mode of learning was independently associated with age ( $p < 0.001$ ), gender ( $< 0.005$ ), sector of health facility ( $p = 0.048$ ), level of experience ( $p = 0.028$ ), income category ( $p < 0.05$ ), training attended online ( $p = 0.007$ ) (Supplementary Table 3).

**Table 2: Satisfaction of the participants towards modes of learning**

S.No	Satisfaction of the participants	Fully satisfied	Somewhat satisfied	Neither satisfied nor dissatisfied	Somewhat dissatisfied	Fully dissatisfied
S.1	Quantity and quality of explanation of the topic					
	Online	377 (33.9)	380 (34.1)	228 (20.5)	56 (5.0)	72 (6.5)
	Offline	498 (44.8)	345 (31.0)	144 (12.9)	58 (5.2)	68 (6.1)
S.2	Content of the training					
	Online	463 (41.6)	345 (31.0)	176 (15.8)	55 (4.9)	74 (6.7)
	Offline	480 (43.1)	357 (32.1)	148 (13.3)	65 (5.8)	63 (5.7)
S.3	Demonstration of topic by the trainer					
	Online	359 (32.2)	366 (32.9)	231 (20.8)	77 (6.9)	80 (7.2)
	Offline	541 (48.6)	318 (28.6)	126 (11.3)	59 (5.3)	69 (6.2)
S.4	Fulfilment of learning needs					
	Online	412 (37.0)	377 (33.9)	186 (16.7)	65 (5.8)	73 (6.6)
	Offline	540 (48.5)	327 (29.4)	133 (12.0)	49 (4.4)	64 (5.7)
S.5	Personalized attention by the teacher/instructor					
	Online	278 (25.0)	316 (28.4)	292 (26.2)	126 (11.3)	101 (9.1)
	Offline	541 (48.6)	324 (29.1)	136 (12.2)	45 (4.1)	67 (6.0)
S.6	Resolution of queries and doubts					
	Online	369 (33.1)	336 (30.2)	232 (20.9)	88 (7.9)	88 (7.9)
	Offline	556 (49.9)	307 (27.6)	129 (11.6)	52 (4.7)	69 (6.2)
S.7	Quality of interaction with the teacher/instructor					
	Online	322 (28.9)	344 (30.9)	239 (21.5)	113 (10.2)	95 (8.5)
	Offline	565 (50.8)	313 (28.1)	122 (11.0)	47 (4.2)	66 (6.0)
S.8	Quantity of interaction with the teacher/instructor					
	Online	326 (29.3)	358 (32.2)	236 (21.2)	98 (8.8)	95 (8.5)
	Offline	517 (46.5)	334 (30.0)	138 (12.4)	54 (4.8)	70 (6.3)
S.9	Evaluation patterns and assignment activities					
	Online	372 (33.4)	359 (32.3)	218 (19.6)	80 (7.2)	84 (7.5)
	Offline	490 (44.0)	335 (30.1)	167 (15.0)	45 (4.0)	76 (6.9)
S.10	Timing and Convenience					
	Online	652 (58.6)	231 (20.8)	112 (10.0)	47 (4.2)	71 (6.4)
	Offline	269 (24.2)	291 (26.1)	310 (27.9)	139 (12.5)	104 (9.3)

Similarly, odds of being satisfied with offline mode of training was found to be varying across education qualification ( $p < 0.001$ ), income levels ( $p < 0.001$ ), experience of training attended in online mode ( $p = 0.008$ ) and experience of training attended in offline mode ( $p < 0.001$ ). After adjusting for other demographic variables, satisfaction with offline mode of training was found to be significantly associated with qualification of the participants ( $p < 0.001$ ), income levels ( $p < 0.001$ ) and experience of training attended in offline mode ( $p = 0.006$ ) (Supplementary Table 3).

**Table 3: Association of demographic characteristics with satisfaction level of the participants (n=1113)**

Demographic characteristic	Online				Offline			
	OR Online (95% CI)	P	aOR Online (95% CI)*	P*	OR Offline (95% CI)	P	aOR Offline (95% CI)#	P#
Age category								
<30 years	Ref	<0.001	Ref	<0.001	Ref	0.906	Ref	0.808
≥30 years	1.59 (1.23–2.07)		2.36 (1.56-3.56)		1.02 (0.75-1.38)		1.05 (0.67-1.67)	
Gender								
Male	Ref	0.615	Ref	0.005	Ref	0.832	Ref	0.071
Female	1.07 (0.82-1.39)		1.56 (1.14-2.13)		1.03 (0.76-1.40)		1.39 (0.97-1.98)	
Qualification								
Diploma holders	Ref	0.669	Ref	0.850	Ref	0.001	Ref	0.001
Graduates	1.07 (0.79-1.44)	0.676	1.03 (0.73-1.47)	0.488	1.78 (1.28-2.47)	<0.001	1.96 (1.32-2.91)	<0.001
Post-graduates and above	1.07 (0.77-1.50)		0.85 (0.55-1.33)		2.41 (1.61-3.61)		2.75 (1.61-4.70)	
Type of Healthcare workers								
Student	Ref	0.133	Ref	0.840	Ref	0.335	Ref	0.486
Nursing staff	1.40 (0.90-2.18)	0.006	1.06 (0.60-1.88)	0.028	0.76 (0.44-1.32)	0.969	1.28 (0.64-2.55)	0.659
Physician	2.05 (1.22-3.44)	0.118	1.98 (1.08-3.64)	0.435	0.99 (0.53-1.85)	0.896	1.18 (0.57-2.43)	0.998
Faculty	1.61 (0.89-2.94)		1.32 (0.66-2.62)		1.05 (0.50-2.20)		1.00 (0.44-2.29)	
Marital Status								
Unmarried	Ref	0.185	Ref	0.798	Ref	0.215	Ref	0.122
Married	1.20 (0.92-1.57)		0.95 (0.66-1.38)		0.82 (0.59-1.12)		0.71 (0.46-1.09)	
Type of health facility								
Government	Ref	0.236	Ref	0.048	Ref	0.461	Ref	0.758
Private	1.19 (0.89-1.58)		1.42 (1.00-2.00)		0.89 (0.65-1.22)		0.94 (0.64-1.38)	
Experience								
<5 years	Ref	0.005	Ref	0.028	Ref	0.305	Ref	0.623
≥5 years	1.46 (1.12-1.91)		0.97 (0.95-1.00)		1.17 (0.86-1.59)		1.01 (0.98-1.03)	
Income category in Indian National Rupees								
<25000	Ref	0.049	Ref	0.027	Ref	0.036	Ref	0.068
25000 to 50000	1.70 (1.00-2.88)	0.031	1.85 (1.07-3.21)	0.012	1.81 (1.03-3.16)	0.004	1.71 (0.96-3.05)	0.018
50000 to 100000	1.60 (1.04-2.45)	0.008	1.79 (1.13-2.82)	0.010	1.94 (1.24-3.04)	<0.001	1.79 (1.10-2.89)	<0.001
≥100000	1.78 (1.16-2.74)		1.83 (1.16-2.89)		2.91 (1.83-4.63)		2.59 (1.57-4.27)	
Experience of attending online training								
No	Ref	0.021	Ref	0.007	Ref	0.008	Ref	0.130
Yes	1.41 (1.05-1.89)		1.57 (1.13-2.17)		1.55 (1.12-2.14)		1.32 (0.92-1.89)	
Experience of attending offline training								
No	Ref	0.419	Ref	0.938	Ref	<0.001	Ref	0.006
Yes	1.12 (0.85-1.49)		1.01 (0.74-1.39)		1.85 (1.36-2.51)		1.61 (1.14-2.27)	

\*P-Value of online model: <0.001 #P-Value of offline model: <0.001; R<sup>2</sup> online mode: 0.04; R<sup>2</sup> offline mode: 0.06. OR: Odds ratio, aOR: Adjusted odds ratio, CI: confidence intervals, Ref: Reference

## Preference

Association of demographic characteristics with preference of the participants: The univariable analysis suggested age, gender, education qualification, type of HCWs, marital status, level of experience and perception were associated with preference of mode of learning. However, in adjusted analysis only perception was found to be independently associated with mode of learning. The odds of preferring online training among participants who perceived online as better mode of training was 9.63 (6.99-13.29,  $p < 0.001$ ) times higher the odds of perceiving offline mode of training to be better (Supplementary Table 4).

**Table 4: Association of demographic characteristics with preference of the participants (n=1113)**

Demographic characteristics	Online n=747 n (%)	Offline n=366 n (%)	OR (95% CI)	P	aOR (95% CI)	P*
Age category						
<30 years	256 (62.0)	157 (38.0)	Ref	0.005	Ref	0.226
≥30 years	491 (70.1)	209 (29.9)	1.44 (1.11-1.86)		1.32 (0.84-2.06)	
Gender						
Male	260 (63.4)	150 (36.6)	Ref	0.045	Ref	0.431
Female	487 (69.3)	216 (30.7)	1.30 (1.00-1.68)		1.15 (0.81-1.62)	
Qualification						
Diploma holders	282 (74.8)	95 (25.2)	Ref	0.036	Ref	0.626
Graduates	306 (68.2)	143 (31.8)	0.72 (0.53-0.98)	<0.001	0.90 (0.60-1.35)	0.008
Post-graduates and above	159 (55.4)	128 (44.6)	0.42 (0.30-0.58)		0.51 (0.31-0.84)	
Type of Healthcare workers						
Student	50 (52.0)	46 (48.0)	Ref	<0.001	Ref	0.795
Nursing staff	501 (71.7)	198 (28.3)	2.33 (1.51-3.59)	0.140	1.09 (0.58-2.04)	0.619
Physician	133 (61.0)	85 (39.0)	1.44 (0.89-2.34)	0.123	0.85 (0.44-1.63)	0.412
Faculty	63 (63.0)	37 (37.0)	1.57 (0.88-2.78)		1.37 (0.65-2.90)	
Marital Status						
Unmarried	222 (60.5)	145 (39.5)	Ref	0.001	Ref	0.164
Married	525 (70.4)	221 (29.6)	1.55 (1.19-2.01)		1.34 (0.89-2.01)	
Type of health facility						
Government	528 (67.1)	259 (32.9)	Ref	0.977	Ref	0.579
Private	219 (67.2)	107 (32.8)	1.00 (0.76-1.32)		1.11 (0.76-1.62)	
Experience						
<5 years	232 (61.9)	143 (38.1)	Ref	0.008	Ref	0.939
≥5 years	515 (69.8)	223 (30.2)	1.42 (1.10-1.85)		1.00 (0.98-1.03)	
Income category in Indian National Rupees						
<25000	85 (72.0)	33 (28.0)	Ref	0.685	Ref	0.796
25000 to 50000	92 (69.7)	40 (30.3)	0.89 (0.52-1.54)	0.597	1.09 (0.57-2.07)	0.481
50000 to 100000	278 (69.5)	122 (30.5)	0.88 (0.56-1.39)	0.167	1.22 (0.71-2.10)	0.766
≥100000	270 (65.2)	144 (34.8)	0.73 (0.46-1.14)		1.08 (0.63-1.86)	
Experience of attending online training						
No	172 (64.2)	96 (35.8)	Ref	0.240	Ref	0.337
Yes	575 (68.0)	270 (32.0)	1.19 (0.89-1.59)		1.20 (0.83-1.73)	
Experience of attending offline training						
No	219 (70.6)	91 (29.4)	Ref	0.120	Ref	0.076
Yes	528 (65.7)	275 (34.3)	0.79 (0.60-1.06)		0.72 (0.50-1.03)	
Perception						
Offline	527 (88.0)	72 (12.0)	Ref	<0.001	Ref	<0.001
Online	220 (42.8)	294 (57.2)	9.78 (7.23-13.22)		9.63 (6.99-13.29)	

\*P-Value of model: <0.001 ; R<sup>2</sup>: 0.22. OR: Odds ratio, aOR: Adjusted odds ratio, CI: confidence intervals, Ref: Reference