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 multivariable logistic regression were performed using SPSS v-22.

Results: A total of 1,113 responses were received with the mean age of 33.17 ± 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 online 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 2035.¹ Further, limited faculty and institutional resources contribute to the suboptimal quality of the available health services in developing countries.² 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.³ 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.⁴

Evidence suggests that training programmes are effective in improving the knowledge, skills, and practices of the healthcare professionals as well as patient-related outcomes.⁵ 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

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.

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healthcare setting. These trainings were conducted through online mode. Eventually, with the increasing use of online platforms, online mode was popularised among the HCWs.[9] 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.[10,11] 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.[12] Therefore, in such circumstances, offline learning approach seems to be the plausible solution to overcome the geographical, financial, and temporal obstacles faced by learners.[13]

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.[14] 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.[15] The years of experience was divided as (i) less than 5 years and (ii) 5 years and more.[16] Satisfaction was considered if the score was ≥35 considering the satisfaction to a mode of learning to be 67% in the previous study.[17] The training attended was recoded as yes if the participants had 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 ± 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 ± 9.93 for online and 40.06 ± 9.67 offline [Table 3]. A total of 70.2%...
Table 1: Contd...

| Sociodemographic characteristics | n (%) |
|----------------------------------|-------|
| 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 personalized 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) |

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 than the participants who preferred offline mode of training to be better. Similarly, odds of recommending online mode of learning among the group who perceived offline mode of training were 6.93 (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 (<0.001), type of HCWs (P = 0.027), marital status of HCWs (P = 0.005), income levels (P = 0.076), perception of the HCWs towards 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.[17,18] 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
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.\(^{19}\)

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.\(^{20}\)
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 0.888 |
| 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)           | 151 (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                                      | 325 (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 <0.001 |
| 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; 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. Similar complements for the conventional face-to-face mode of learning were provided by a study on medical and dental students of Jordan. 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.

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 Israeli study. 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 at their 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 ± 9.93) when compared to the offline mode of training (40.06 ± 9.67). Similar results were observed from a study undertaken in Jordan.[30] 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.[31]

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.[32,33] 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.[34]

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.[35] 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.[18,20,31] A few participants have highlighted privacy issues related to online platforms, also reported by previous studies.[17,32] 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.[17,33,34]

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.[19] 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.[15] 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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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).

| 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 (55.0)         | 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; R²: 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 (≥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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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) |
|      | Offine: 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 | 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)    | 0.001 | 2.36 (1.56–3.56)   | 0.001 | 1.02 (0.75–1.38)    | 1.05 | 0.67–1.67          | 1.67 |
| Gender                     |                    |    |                     |    |                     |    |                      |    |
| Male                       | Ref                | 0.615 | Ref               | 0.005 | Ref                | 0.832 | Ref                | 0.071 |
| Female                     | 1.07 (0.82–1.39)    | 0.185 | 1.56 (1.14–2.13)   | 0.185 | 1.03 (0.76–1.40)    | 1.39 | 0.97–1.98          | 1.98 |
| Qualification              |                    |    |                     |    |                     |    |                      |    |
| Diploma holders            | Ref                | 0.669 | Ref               | 0.850 | Ref                | 0.001 | Ref                | 0.001 |
| Graduates                  | 1.07 (0.79–1.44)    | 0.006 | 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)    | 0.053 | 0.85 (0.55–1.33)   | 0.241 | 1.61 (1.36–2.61)    | 2.75 | 1.61–4.70          | 1.00 |
| 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)    | 0.326 | 1.32 (0.66–2.62)   | 0.048 | 0.89 (0.65–1.22)    | 0.94 | 0.64–1.38          | 0.758 |
| Marital Status             |                    |    |                     |    |                     |    |                      |    |
| Unmarried                  | Ref                | 0.185 | Ref               | 0.798 | Ref                | 0.215 | Ref                | 0.122 |
| Married                    | 1.20 (0.92–1.57)    | 0.95 | 0.95 (0.66–1.38)   | 0.82 | 0.59 (1.12)         | 0.71 | 0.46–1.09          | 0.109 |
| Type of health facility    |                    |    |                     |    |                     |    |                      |    |
| Government                 | Ref                | 0.236 | Ref               | 0.048 | Ref                | 0.461 | Ref                | 0.758 |
| Private                    | 1.19 (0.89–1.58)    | 0.42 | 1.42 (1.00–2.00)   | 0.89 | 0.65 (1.22)         | 0.94 | 0.64–1.38          | 0.758 |
| 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 | 0.97 (0.95–1.00)   | 1.17 | 0.86–1.59          | 1.01 | 0.98–1.03          | 0.623 |
| 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)    | 0.028 | 1.83 (1.16–2.89)   | 2.91 | 1.83 (4.63)         | 2.59 | 1.57–4.27          | 1.57 |
| 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)    | 0.57 | 1.57 (1.13–2.17)   | 1.55 | 1.12–2.14          | 1.32 | 0.92–1.89          | 0.92 |
| 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 | 1.01 (0.74–1.39)   | 1.85 | 1.36–2.51          | 1.61 | 1.14–2.27          | 1.14 |

*P-value of online model: <0.001, #P-value of offline model: <0.001, OR: Odds ratio, aOR: Adjusted odds ratio, CI: confidence intervals, Ref: Reference
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) | 1.40 (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                           | 85 (72.0)          | 33 (28.0)           | Ref         | 0.685 | Ref          | 0.796 |
| <25000                           | 92 (69.7)          | 40 (30.3)           | 0.89 (0.52-1.54) | 0.597 | 1.09 (0.57-2.07) | 0.481 |
| 25000 to 50000                   | 278 (69.5)         | 122 (30.5)          | 0.88 (0.56-1.39) | 0.167 | 1.22 (0.71-2.10) | 0.766 |
| 50000 to 100000                  | 270 (65.2)         | 144 (34.8)          | 0.73 (0.46-1.14) | 1.08 (0.63-1.86) |    |
| ≥100000                          |                    |                     |             |       |              |       |
| 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 ; R²=0.22; OR: Odds ratio; aOR: Adjusted odds ratio; CI: confidence intervals; Ref: Reference