

## On the advantages and disadvantages of virtual continuing medical education: a scoping review

### Avantages et inconvénients de la formation médicale continue virtuelle : une étude de la portée

Courtney Cheng,<sup>1</sup> Janet Papadakos,<sup>2,3,4</sup> Ben Umakanthan,<sup>2</sup> Rouhi Fazelzad,<sup>5</sup> Maria Athina (Tina) Martimianakis,<sup>6,9</sup> Mohamed Ugas,<sup>2</sup> Meredith Elana Giuliani<sup>2,3,7,8,9</sup>

<sup>1</sup>Royal College of Surgeons in Ireland, Dublin, Ireland; <sup>2</sup>Cancer Education Program, Princess Margaret Cancer Centre, Ontario, Canada; <sup>3</sup>The Institute for Education Research, University Health Network, Ontario, Canada; <sup>4</sup>Institute of Health Policy, Management & Evaluation, University of Toronto, Ontario, Canada; <sup>5</sup>Library and Information Sciences, Princess Margaret Cancer Centre, Ontario, Canada; <sup>6</sup>Department of Paediatrics, University of Toronto, Ontario, Canada; <sup>7</sup>Radiation Medicine Program, Princess Margaret Cancer Centre, Ontario, Canada; <sup>8</sup>Department of Radiation Oncology, University of Toronto, Ontario, Canada; <sup>9</sup>The Wilson Centre, University Health Network, Ontario, Canada.

Correspondence to: Meredith Giuliani; email: meredith.giuliani@rmp.uhn.ca

Published ahead of issue: Jan 10, 2023. CMEJ 2023 Available at <https://doi.org/10.36834/cmej.75681>

© 2023 Cheng, Papadakos, Umakanthan, Fazelzad, Martimianakis, Ugas, Giuliani; licensee Synergies Partners. This is an Open Journal Systems article distributed under the terms of the Creative Commons Attribution License. (<https://creativecommons.org/licenses/by-nc-nd/4.0>) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is cited.

### Abstract

**Introduction:** With the COVID-19 pandemic, most continuing medical education activities became virtual (VCME). The authors conducted a scoping review to synthesize the advantages and disadvantages of VCME to establish the impact of this approach on inequities that physicians face along the intersections of gender, race, and location of practice.

**Methods:** Guided by the methodological framework of Arksey and O'Malley, the search included six databases and was limited to studies published between January 1991 to April 2021. Eligible studies included those related to accredited/non-accredited post-certification medical education, conferences, or meetings in a virtual setting focused on physicians. Numeric and inductive thematic analyses were performed.

**Results:** 282 studies were included in the review. Salient advantages identified were convenience, favourable learning formats, collaboration opportunities, effectiveness at improving knowledge and clinical practices, and cost-effectiveness. Prominent disadvantages included technological barriers, poor design, cost, lack of sufficient technological skill, and time. Analysis of the studies showed that VCME was most common in the general/family practice specialty, in suburban settings, and held by countries in the Global North. A minority of studies reported on gender (35%) and race (4%).

**Discussion:** Most studies report advantages of VCME, but disadvantages and barriers exist that are contextual to the location of practice and medical subspecialty. VCME events are largely organized by Global North countries with suboptimized accessibility for Global South attendees. A lack of reported data on gender and race reveals a limited understanding of how VCME affects vulnerable populations, prompting potential future considerations as it evolves.

### Résumé

**Introduction :** Par suite de la pandémie de la COVID-19, la plupart des activités de formation médicale continue ont été offertes en ligne. Les auteurs ont effectué une revue de la portée visant à synthétiser les avantages et les inconvénients de la formation médicale continue en mode virtuel (FMCV) et à examiner les effets de cette approche sur les inégalités qui affectent les médecins en fonction du sexe, de la race et du lieu d'exercice.

**Méthodes :** Suivant le cadre méthodologique d'Arksey et O'Malley, nous avons effectué une recherche dans six banques de données, que nous avons limitée aux études publiées entre janvier 1991 et avril 2021. Les études incluses étaient celles relatives à la formation médicale post-certification, accréditée ou non, aux conférences et aux réunions destinées aux médecins qui se sont déroulées dans un cadre virtuel. Une analyse numérique et une analyse thématique inductive ont été réalisées.

**Résultats :** Au total, 282 articles ont été inclus dans l'étude. Les principaux avantages identifiés sont la commodité, les formats favorables à l'apprentissage, les possibilités de collaboration, l'efficacité pour l'amélioration des connaissances et des pratiques cliniques et le rapport coût-efficacité. Les principaux inconvénients sont les obstacles technologiques, les défauts de conception, le coût, les compétences technologiques insuffisantes et le manque de temps. L'analyse des études a montré que la FMCV était la plus courante dans la spécialité de la médecine générale/familiale, dans les banlieues et dans les pays du Nord. Quelques études considèrent les facteurs sexe (35 %) et race (4 %).

**Discussion :** La plupart des études évoquent les avantages de la FMCV, mais il existe des inconvénients et des obstacles liés au lieu d'exercice et à la sous-spécialité médicale. La plupart des activités de FMCV sont organisées dans les pays du Nord et leur accessibilité n'est pas optimale pour les participants provenant des pays du Sud. Le manque de données sur le sexe et la race pose une limite à notre compréhension de la façon dont la FMCV affecte les populations vulnérables. Ces facteurs seraient à prendre en considération dans les recherches futures sur le sujet et au fur et à mesure que la FMCV évolue.

## Introduction

Continuing medical education (CME) is defined as “educational activities which serve to maintain, develop, or increase the knowledge, skills, and professional performance and relationships that a physician uses to provide services to patients, the public, or the profession.”<sup>1,2</sup> Traditional CME activities include in-person lectures and conferences that may require travel to attend.<sup>3</sup> With technological advances, there has been increased opportunity to deliver CME using virtual modalities that eliminate the need for travel and offer greater flexibility to participants.<sup>3</sup> Since 2005, virtual CME (VCME) with Internet enduring materials (online activities that do not have a designated time or location for participation), has seen the greatest growth in participant engagement and accounted for 43% of all physician CME learning in 2017.<sup>4</sup> In 2019, providers accredited in the Accreditation Council for Continuing Medical Education (ACCME) system offered 49,431 Internet enduring materials, for which there were over 5.6 million physician participants.<sup>5</sup> Moreover, compared to other CME activity types, Internet-based offerings, such as Internet (live) and Internet enduring materials, constituted more than 45% of total physician engagement in 2019.<sup>5</sup> The interactive nature and multimedia capabilities of the Web offers opportunities for practical problem-solving, performing tasks in authentic clinical learning settings, and participating in social dialogue. The literature also suggests online CME activities have the potential to improve physician knowledge,<sup>6,7</sup> clinical care,<sup>8,9</sup> and patient health outcomes,<sup>10</sup> with larger effects for online forms compared to traditional activities.<sup>11-13</sup>

Physicians face various barriers to obtaining CME, depending on personal factors as well as practice-specific contexts. With time and cost reported as the most significant barriers to physician participation in traditional in-person didactic formats,<sup>14,15</sup> VCME is a promising approach as it can offer greater scheduling flexibility, reduce travel time, and expenses.<sup>16</sup> However, equity data on the rise of VCME is limited and, at times, conflicting. In the context of VCME, equity entails ensuring fairness in opportunity by removing barriers to participation.<sup>17</sup> Research indicates that physicians prefer CME delivered in the format of in-person lectures compared to other modalities including Web-based training.<sup>18</sup> This finding is consistent across gender, location, race, and physician specialty.<sup>18</sup> More recent findings however, show that rural physicians prefer videoconferencing as the mode of

delivery of CME compared to urban physicians,<sup>19</sup> and physicians in rural practice locations are more likely to enrol in Web-delivered CME compared to those practicing in urban areas.<sup>20</sup> This data suggests that VCME may be more accessible to geographically dispersed health professionals in comparison to in-person delivery. However, the latter study only sampled a small number of rural physicians, which limits generalizability, and greater program interest may not reflect participation. Regarding gender, one study found that male physicians were more likely to use the Internet for CME compared to female physicians<sup>21</sup> but another study found that female physicians were more likely to use online CME programs than male counterparts, and that these physicians were also younger.<sup>22</sup> VCME may provide greater accessibility for health professionals with young families to overcome barriers associated with travel and childcare expenses. A better understanding of how virtual delivery impacts access to CME is crucial for informing those who develop and implement online CME programs to meet the needs of all learners.

Given the recent COVID-19 pandemic, a greater reliance on virtual methods has resulted in a massive upheaval in CME. Various CME events, including in-person lecture series and large meetings, converted to online teaching and e-conferences, which explored different approaches for delivery of material and audience engagement. Organizers looking to make decisions about which of these innovative virtual methods should be retained post-pandemic,<sup>23,24</sup> presenting an ideal opportunity to re-evaluate CME standards and explore the possibilities of the future state of VCME. Additionally, it is important to understand whether VCME contributes positively or negatively to learning disparities, such that future restructuring avoids reproducing or exacerbating existing inequities. Therefore, the aims of this review is to first synthesize the advantages and disadvantages of VCME and then establish the impact of this approach on inequities that physicians face along the intersections of gender, race, location of practice, and medical sub-specialty.

## Methods

A scoping review<sup>25</sup> methodology was selected as the focus of this work has not been thoroughly investigated in the literature to date. We sought to identify knowledge gaps and to scope the body of literature. Our approach was guided by the methodological framework articulated by Arksey and O'Malley.<sup>25</sup>

### Data sources and article identification

A comprehensive literature search was performed on VCME in the following databases: Medline ALL, Cochrane Central Register of Controlled Trial, Cochrane Database of Systematic Reviews, and Embase, all from the OvidSP platform; ERIC from EBSCOhost, and Global Index Medicus (AIM, LILACS, IMEMR, IMSEAR, WRRIM) from the World Health Organization. There were no language restrictions. The search was limited to studies published between January 1991 to April 2021, as 1991 marks the advent of commercial Internet exchange and is not so long ago that the technology discussed in these articles is no longer relevant.<sup>26</sup> Where provided, both controlled vocabulary terms and text words were used in the subject component blocks. There were three subject blocks in the search strategies. The first subject block contained medical/surgical professionals and educators, such as physicians, surgeons, and faculty. The second subject block included continuing medical education, such as education, medical education, in-service-training, professional development, and clinical competency. The third subject block contained virtual learning, such as distance education, educational technology, virtual reality, online learning, and e-learning (see Appendix A).

### Article selection and eligibility

Included publications were restricted to those focused on physicians and related to accredited/non-accredited post-certification medical education (e.g., continuing education, faculty development, maintenance of certification and/or professional development). Publications were focused on virtual education (e.g., e-learning, virtual space with avatars, video-based, app-based, SMS based) related to conferences and/or annual meetings in any virtual format. Study populations that encompass physicians with other health care professionals were included. Publications were excluded if they were intended solely for non-health professions, non-clinical health professionals, non-medical health professionals, focused on undergraduate learning or post-graduate training, focused on patient or caregiver education, involved clinical telemedicine or were conference proceedings, dissertations, or news articles.

### Data abstraction

Citations for screening were managed and stored in Endnote, a citation management software, and Covidence,<sup>27</sup> an online systematic review manager and screening tool. Procedures applicable to scoping reviews for study appraisal, as outlined in the Joanna Briggs

Institute methods,<sup>28</sup> were followed. Three reviewers (CC, MG, BU) performed data abstraction and appraisal independently with an a priori study protocol as a guide. Title and abstract screens were conducted, and the full text of all articles that met inclusion criteria were reviewed. Discrepancies between reviewers were resolved by a fourth reviewer (JP). The data abstraction form was pilot tested on a random sample of four articles by CC and BU before data were extracted from the remaining articles and charted.

### Data analysis

Numeric analysis was used to summarize the characteristics of included studies. Inductive thematic analysis was conducted to categorize findings.

## Results

The literature search yielded 38,465 studies, of which 12,324 duplicates were removed. The remaining 26,141 articles underwent title and abstract screening and 25,477 were excluded. Six-hundred and sixty-four articles remained for full-text review. Following full text review, 282 articles met eligibility criteria and are summarized in this review (see Figure 1 for PRISMA flow chart and Appendix B for a list of included articles).

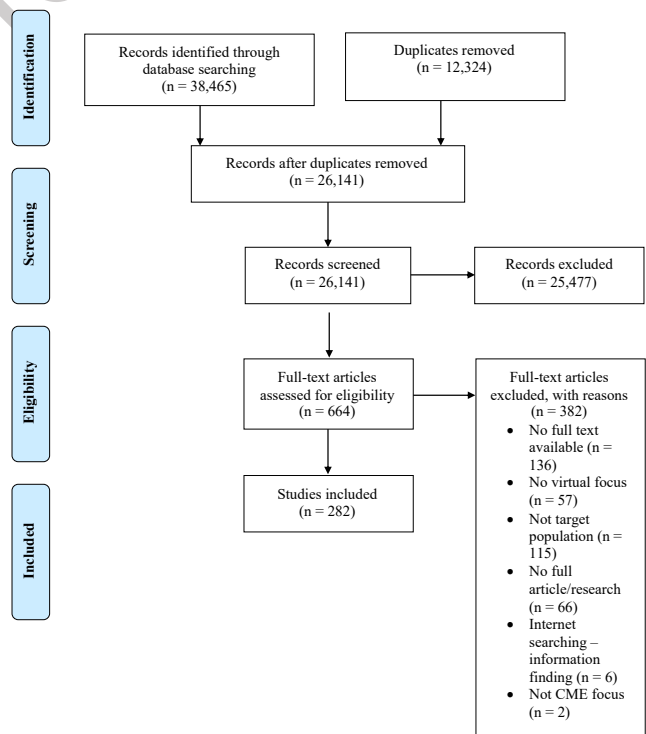


Figure 1. PRISMA flow diagram

### Numeric analysis

Of articles that reported the country of origin, the predominant country was the United States (29%,  $n = 83$ ), followed by Canada (11%,  $n = 30$ ), Australia (6%,  $n = 16$ ), the United Kingdom (3%,  $n = 9$ ), and France (2%,  $n = 6$ ). By continent, most VCME programs originated from North America (41%,  $n = 115$ ), followed by Europe (17%,  $n = 47$ ), Asia (8%,  $n = 24$ ), Australia/Oceania (7%,  $n = 19$ ), South America (4%,  $n = 12$ ), and Africa (1%,  $n = 3$ ), respectively. For the remaining VCME programs, the continent of origin was not applicable (10%,  $n = 29$ ), not reported (9%,  $n = 25$ ) or had a multi-continental origin (3%,  $n = 8$ ). Among the 282 included articles, 155 (55%) were empirical studies, 43 (15%) were editorials/commentaries, and 30 (11%) were case studies. Of the empirical studies, 79 (51%) were pre-post studies, 38 (25%) were cross sectional surveys, 31 (20%) were randomized controlled trials, and 5 (3%) were prospective cohort studies. Among the included studies, 122 (43%) were published between 2010 to 2019, 99 (35%) were published between 2000 to 2009, 42 (15%) were published from 2020 to the present year, and 19 (7%) were published between 1991 to 1999. Nearly all included studies were published in English (93%,  $n = 265$ ), followed by German (2%,  $n = 6$ ), French (1%,  $n = 3$ ), Portuguese (1%,  $n = 3$ ), and Spanish (1%,  $n = 3$ ). Less than 1% ( $n = 1$ ) of articles were published in the following languages: Danish, Korean, Norwegian, Polish, and English and French.

VCME launch year was defined as the year in which the VCME activity was made available to participants. Among the included studies, 11 (4%) had VCME launch years between 1991 to 1999, 53 (19%) had VCME launch years between 2000 to 2009, 53 (19%) had VCME launch years between 2010 to 2019, and 12 (4%) had VCME launch years from 2020 to the present year.

The modality of VCME used in the included studies was mostly websites and/or discussion boards (27%,  $n = 77$ ), followed by e-learning modules (20%,  $n = 57$ ), videoconferences (18%,  $n = 50$ ), webinars (3%,  $n = 7$ ), simulations (2%,  $n = 6$ ), CD-ROM (1%,  $n = 4$ ), social media (1%,  $n = 4$ ), SMS text messaging (1%,  $n = 3$ ), applications (1%,  $n = 4$ ), video games (<1%,  $n = 1$ ), and podcasts (<1%,  $n = 1$ ). The remaining studies use multiple modalities (16%,  $n = 44$ ), did not report the modality of VCME (6%,  $n = 16$ ), or the modality of VCME was not applicable (e.g., letter to the editor broadly describing the need for virtual learning) (3%,  $n = 7$ ). Refer to Appendix A for a detailed breakdown.

The majority of articles did not report the age, race, nationality nor ethnicity of participants. Of the articles that

reported age (28%,  $n = 79$ ), most participants were between the ages of 41 and 50 years old. In articles that specified the race of participants (4%,  $n = 11$ ), White Hispanic and/or other non-White racial groups (e.g., Black, Asian/Pacific Islander, Latino) were included. Of the included articles, seven (3%) mentioned the nationality of participants consisting of Chinese and Japanese, Dutch, Vietnamese, predominantly Italian, predominantly Chilean, predominantly non-Saudi Arabian, and multi-national. In terms of the language of VCME, the majority (39%,  $n = 109$ ) of VCME programs were in English (see Table 1).

Table 1. Article characteristics

Variables	N (%)
<b>Language of VCME</b>	
English	109 (39)
French	7 (3)
Spanish	7 (3)
Italian	4 (1)
Portuguese	4 (1)
German	3 (1)
Vietnamese	3 (1)
Dutch	2 (<1)
Japanese	1 (<1)
Norwegian	1 (<1)
Polish	1 (<1)
Persian	1 (<1)
Turkish	1 (<1)
Multiple	15 (5)
<b>Medical Speciality</b>	
General/Family Practice	70 (25)
Multiple Specialities	56 (20)
General Surgery	14 (5)
Paediatrics	9 (3)
Radiology	9 (3)
Emergency Medicine	7 (2)
Ophthalmology	7 (2)
Obstetrics and Gynaecology	4 (1)
Anesthesiology	4 (1)
Dermatology	4 (1)
Psychiatry	4 (1)
Urology	3 (1)
Internal Medicine	2 (<1)
Neurosurgery	2 (<1)
Oncology	2 (<1)
Orthopaedics	2 (<1)
Pathology	2 (<1)
Plastic Surgery	2 (<1)
Sports Medicine	1 (<1)

Among the included articles, 100 (35%) included discernible information regarding the gender of participants. Among these, 57 had more male than female participants, 40 had more female than male participants, and three had an equal proportion of male and female participants. No other gender identities were reported. In articles that specified the location of participants, the



majority of articles included participants from semi-rural/suburban (8%,  $n = 23$ ) regions followed by rural (5%,  $n = 15$ ) and urban (7%,  $n = 19$ ) regions. Refer to Appendix A for further details on study characteristics.

### Thematic analysis

The advantages and disadvantages were analyzed thematically using an inductive approach. Five main categories of advantages were identified: convenience ( $n = 107$ ); favourable learning formats ( $n = 92$ ); opportunities for collaboration ( $n = 79$ ); effectiveness at improving (short-term) knowledge and clinical practices of participants ( $n = 70$ ); and cost-effectiveness ( $n = 59$ ). Five main categories of disadvantages were also identified: technological barriers ( $n = 73$ ); poor design ( $n = 53$ ); cost ( $n = 20$ ); lack of sufficient technological skill ( $n = 18$ ); and lack of time ( $n = 16$ ). Other disadvantages included privacy concerns ( $n = 8$ ); lack of familiarity with VCME ( $n = 7$ ); difficulty with evaluation ( $n = 5$ ); country-specific differences ( $n = 5$ ); learner isolation ( $n = 4$ ); and the need for in-person training ( $n = 4$ ).

### Advantages

A majority of articles reported an advantage of VCME being convenience<sup>29-31</sup> (38%,  $n = 107$ ), including ease of access (e.g., ability to access the program anywhere with an enabled device, regardless of geographic location),<sup>10,15,23,32-93</sup> reduced travel (time, distance),<sup>10,15,33,34,39,53,54,58,70,82,91,94-113</sup> and scheduling flexibility.<sup>32-34,39,40,44-46,49,51,52,61,63,64,69,75,81,83,88,92,94,97,98,106,113-132</sup> This data was gathered through surveys (e.g., questionnaires, evaluation forms) ( $n = 57$ ); focus groups ( $n = 1$ ); interviews ( $n = 5$ ); a combination of surveys, focus groups and/or interviews, ( $n = 6$ ); general feedback (e.g., comments from participants) ( $n = 3$ ); data analysis (e.g., using analytics to measure participation and engagement) ( $n = 1$ ); or feedback from VCME organizers ( $n = 5$ ).

Of the 107 studies that reported convenience as an advantage of VCME, 17 had more male than female participants, 11 had more female than male participants, and one had an equal proportion of male and female participants. The remaining 78 studies did not report the gender of participants. Of those studies that had a greater proportion of female participants ( $n = 11$ ),<sup>31,44,49,75,79,80,93,98,115,126,133</sup> three had female participants less than 40 years of age<sup>31,49,79</sup>; five had female participants between the ages of 41 and 55,<sup>75,80,115,126,133</sup> and two included participants over 30 years.<sup>44,98</sup> Archibald et al. did not report participant age.<sup>93</sup>

The second most reported advantage was favourable learning formats<sup>94</sup> (33%,  $n = 92$ ), including the qualities of being self-directed/self-paced;<sup>33,34,48,59,61,64,72,73,85,92,97,113,115,125,130,134-142,120,122,123,143,144</sup> interactive;<sup>6,10,29,32,39,41,43-45,57,69,72,88,94,97,99,101,102,105,106,115,118,130,136,142,145-152</sup> engaging;<sup>10,32,93,102,143,153</sup> user-friendly;<sup>44,59-61,95,99,114,115,137,139,149,151,154-169</sup> easy to follow/understand (e.g. rehearsed, refined presentation),<sup>59,60,114,137,170</sup> well-designed;<sup>33,40,41,43,54,59-61,88,93,135,167,171,172</sup> providing immediate feedback;<sup>76,93,147,173-175</sup> and enabling active participation.<sup>56,130,174,176-180</sup>

The next most cited advantage was opportunities for collaboration<sup>180</sup> (28%,  $n = 79$ ), including greater communication and interaction with doctors from different geographic locations (e.g., international experts),<sup>39-41,43,47-49,55,56,58,63,65,66,69,71,75,82,85,92,96,99-101,103,105-107,109,110,112,113,118,125,128,130,131,136,140,146,149,151,159,161,165,167,176-179,181-196</sup> allowing for greater diversity of learners and disciplines;<sup>8,41,43,63,65,76,84,90,95,103,105,119,123,124,144,145,159,161,165,171,176,195,197</sup> reduced feelings of professional isolation,<sup>55,85,101,113,146,151,193,198</sup> and possible benefits for physician recruitment and retention in remote areas.<sup>55,146</sup>

Subsequent advantages were effectiveness at improving the (short-term) knowledge and clinical practices of participants<sup>6-8,32-34,42-44,49,61,66,68,69,76,85,88,93,95,107,115,117,128,131,133,134,137,139,142-144,147,150,153,155,158,159,169,181,186,197,199-227</sup> (25%,  $n = 70$ ); and cost-effectiveness<sup>107,112,130,144,188,192,219,225</sup> (21%,  $n = 59$ ), such as low costs to implement the program,<sup>29,39,45,56,90,98,104,106,113,119,120,128,129,151,156,159,163,173,174,195,202,228-230</sup> as well as reduced costs to attend with respect to travel<sup>10,15,29,33-35,39,44,49,50,52,53,58,70,82,83,85,100,102,103,107-109,114,116,120,122,150,162,163,195,210,231</sup> and accommodation expenses.<sup>29,34,44,52,82,83,85,150,163,195</sup>

### Disadvantages

Most articles reported that a disadvantage was related to technological barriers (26%,  $n = 73$ ), including structural barriers (e.g., limited bandwidth, poor audio quality);<sup>29,31,36,44-46,50,56,58-60,62,69,70,76,82-86,88,91,95,100,108,112,115,118,126,130,143,147,150,153,155,157,161,174,178,180,181,185,187,193,195,208,224,228,230-247</sup> lack of functioning and availability of equipment (e.g., computer, device);<sup>45,70,72,115,123,174,233,237</sup> software problems (e.g., system crashes);<sup>75,117,197,248</sup> and lack of access (e.g., no Twitter<sup>249</sup>). Of these articles, seven had participants from low-income countries;<sup>44,56,82,118,178,245,247</sup> 10 studies had participants from lower-middle income

countries;<sup>31,44,82,85,115,118,143,155,239,242</sup> six studies had participants from upper-middle income countries;<sup>31,44,112,117,118,243</sup> and 22 studies had participants from high-income countries, of which nine had participants from rural areas of high-income countries.<sup>36,58,70,126,193,228,244,246,250</sup> Of the remaining articles, two mentioned participants from over 50 different countries and 32 did not report the location of participants. Overall, the majority of those who reported technological barriers were located in Global South countries.

The second most reported disadvantage was poor design (19%,  $n = 53$ ), including lack of interaction (between learner and facilitator or between learners);<sup>34,51,59,67,70,77,79,84,88,90,104,112,123,135,142,168,208,216,224,239,243,251-256</sup> lack of active participation;<sup>33,125,159,232,237,257,258</sup> logistical issues (e.g., microphone and camera placement, unmuted microphones)<sup>36,58,59,110,174,232,236,259</sup> and technology-related logistical issues (e.g., site blocked by institution);<sup>31,33,59,60,108,117,149,177,187,202,228,259</sup> not user-friendly;<sup>34,59,66,149,208,248,251</sup> poor delivery format;<sup>193,216,260</sup> and lack of coordination (e.g., with audio visual department).<sup>232</sup>

The next most reported disadvantage was related to cost<sup>40,46,70,97,105,112,116,118,130,146,155,178,180,183,184,194,198,228,231,240,261</sup> (7%,  $n = 21$ ), of which  $n = 12$  articles mentioned high costs to develop, implement, and/or sustain the VCME program,<sup>40,70,97,105,112,130,178,180,184,194,198,228</sup> with participants located in rural areas of high-income countries,<sup>40,70,184,198,228</sup> low-income countries,<sup>178,194</sup> and less developed areas of upper-middle-income countries.<sup>112</sup> The other nine articles mentioned high costs to participate (e.g., monthly subscription cost),<sup>46,116,118,146,155,183,231,240,261</sup> with participants mostly located in lower-middle income countries.<sup>118,146,155,231,261</sup> Lack of funding and support was reported by participants located in rural U.S.,<sup>184</sup> less developed provinces in China,<sup>112</sup> and developing countries.<sup>194</sup> An article by Geissbuhler et al. mentioned a lack of international support for reducing costs associated with satellite connectivity in Mali.<sup>146</sup>

Other reported disadvantages were lack of sufficient technological (e.g., computer, Internet) skill<sup>34,45,51,59,60,70,72,73,106,125,148,150,155,178,208,243,261,262</sup> (6%,  $n = 18$ ) and lack of time<sup>59,60,70,72,75,118,125,150,155,161,193,208,224,240,257,261,263</sup> (6%,  $n = 16$ ). In one of these studies in which there were more female than male general practitioners, many participants reported being able to access VCME from home but finding it difficult to find time while balancing family

responsibilities.<sup>75</sup> Moreover, in the study by Curran et al.,<sup>59</sup> the majority of those who did not use the web-based aspect were mostly female and reported that personal commitments were a time-limiting factor that made accessing the web-based VCME challenging. Similar findings were reported by and Curran et al.<sup>60</sup> where personal activities left little time to participate in VCME. The remaining studies did not provide discernible information regarding the gender of participants or further details regarding physicians' reasons for reporting lack of time as a barrier.

Several articles also mentioned disadvantages associated with privacy concerns (e.g., online payment, Internet security)<sup>34,48,72,105,114,149,190,249</sup> (3%,  $n = 8$ ); lack of familiarity with VCME (e.g., more experience and success with traditional CME)<sup>36,57,106,135,264</sup> (2%,  $n = 7$ ), including educators' lack of familiarity;<sup>123,244</sup> difficulty with participant evaluation (e.g., lack of integrity in completing VCME)<sup>44,74,114,159,248</sup> (2%,  $n = 5$ ); country-specific differences (2%,  $n = 5$ ) (e.g., misunderstanding of lab results, differences in treatment, language barriers)<sup>43,69,154,237,241,</sup> learner isolation ( $n = 4$ , 1%) (e.g., impersonal interactions);<sup>130,132,195,253</sup> and the need for in-person training.<sup>45,51,98,265</sup>

## Discussion

### Structural barriers

This scoping review has highlighted the importance of VCME as a tool. However, the widespread delivery is still restricted by structural barriers, including limited bandwidth and slow Internet connectivity. A large proportion of participants who reported these barriers were located in low and lower-middle income countries, which may be associated with a lack of funding, and unaffordable, often higher costs of Internet connectivity, compared to high income countries.<sup>146,231,233</sup> Likewise, a significant proportion of participants located in high-income countries, notably those in rural areas, face similar technological difficulties.<sup>231</sup> The limited provision of reliable high-speed Internet in high-income countries may also be attributed to some degree to a lack of financial support. For example, although Canada is considered a high-income country, with \$6 billion in funding in 2019 to provide Canadians with reliable high-speed Internet,<sup>266</sup> there are still areas that are satellite dependent, communities without fibre transport technologies, and areas where less than one quarter of households have access to broadband services of 50 Mbps download and 10

Mbps upload speeds or greater.<sup>267</sup> Furthermore, although 87.4% of households in Canada have access to broadband speeds of at least 50/10 Mbps, only 45.6% of households in rural communities have access to these services.<sup>267</sup> These statistics indicate that physicians located in rural areas may have different technology requirements compared to their urban counterparts. Thus, without an emphasis on the need for funding to support VCME projects in low/lower-middle income countries and rural regions of high-income countries, physicians in these areas may be left behind while the field of VCME advances, therefore further widening the technological and social gap that exists between and within countries.

## Country of origin of VCME

Another important aspect to consider is the temporality of VCME, as live sessions are usually held at more suitable times for physicians living in the host country of the VCME event. This synchronous nature of VCME may limit attendance and participation for those living in other countries due to differences in time zones.<sup>171,249</sup> To provide a more supportive environment for all learners, live sessions could be recorded and viewed by participants at a more convenient time.<sup>268</sup> Presenters in different time zones could be invited to pre-record their presentations, which may have the additional benefit of avoiding technical or Internet connectivity issues at the scheduled time of the VCME event.<sup>82</sup> Online discussion forums for learners to leave questions for presenters to answer on their own time could also be included.<sup>123</sup> This solution may not provide the same sense of interaction associated with live or in-person CME discussion forums, but it is a useful initial consideration to keep in mind as the use of VCME continues to expand.

The country of origin of VCME is also important when considering cross-country cultural differences that may exist between the VCME host and its recipients, such as differences in communication style, disease management, and healthcare systems.<sup>154</sup> Several ways in which VCME programs can provide information that better reflects the local context include incorporating local information and treatment guidelines,<sup>154</sup> using locally-based case presentations,<sup>56</sup> and including local experts as co-organizers.<sup>82</sup> In one study, a VCME program originating in Canada that was adapted to a Uruguayan context specifically had translations performed by Uruguayan experts in order to encapsulate disease management practices that aligned with Uruguayan culture.<sup>241</sup> This

example highlights the need for culturally appropriate translations rather than simply obtaining literal translations from English,<sup>269</sup> which is often the VCME source language. Moreover, it demonstrates the importance of addressing the needs of participants from Global South countries, particularly in the context of VCME in which a majority of interventions, as shown in our analyses, are created by Global North countries. Therefore, as VCME seeks to open opportunities for collaboration by eliminating temporal and geographical constraints, VCME organizers must consider language and cultural differences to increase VCME access and use, reduce misinterpretation, and enhance the effectiveness of VCME in improving physicians' knowledge.

## Duality of VCME

VCME is perceived to save time, minimize costs, and eliminate travel, therefore increasing the accessibility of CME to marginalized groups, including women and physicians with young children.<sup>102,126,240,270</sup> However, travelling away from home to attend in-person conferences and CME programs may have been an opportunity for physicians to take protected time off from domestic responsibilities.<sup>59,60,75,271</sup> Prior to the pandemic, female physicians were already devoting more hours to household and child-care duties than their male counterparts.<sup>272,273</sup> Along with the pandemic and consequent increase in VCME that can be accessed from home, this disparity has likely intensified, negatively impacting the ability of female physicians to balance their work and personal lives. There is also a common assumption that female physicians will make sacrifices in their professional lives to accommodate their home and family care responsibilities.<sup>271</sup> With CME programs being delivered virtually and allowing physicians to access them from home, the expectation for female physicians to make time for domestic responsibilities amidst their work life may be further exacerbated. As a result, VCME may be reinforcing gender stereotypes and undermining the career development of female physicians in the process of attempting to address a need. This unintended consequence is a crucial aspect of VCME that CME providers must take into account.

## Cost of VCME

A prominent advantage of VCME is its cost-effective nature due to the elimination of travel<sup>116</sup> and accommodation expenses, therefore improving the accessibility of CME to a wider physician audience.<sup>64,82,274</sup> It has also shown to be cost-effective when built upon existing platforms and

resources<sup>120,228</sup> and may even offset the initial costs of investment over time as these virtual modalities are used more frequently. However, a reduction in the cost of participation may have important implications, such as a greater reliance on commercial sponsors, a decrease in the perceived value and worth of presenters' expertise, and a reduction in participants' commitment to the VCME program. Since registration fees are often needed to support the host platform and provide remuneration to speakers, providing CME courses free-of-charge may require greater financial support from commercial organizations, which can lead to biased practice-transforming information and techniques,<sup>275</sup> as well as greater scepticism among participants regarding the credibility of the information provided virtually.<sup>227,257</sup> Additionally, with VCME being perceived as less financially demanding, organizers may decide to divert funds away from VCME and re-allocate it towards other educational activities.<sup>82</sup> Consequently, there may be a reduction in the quantity of presenters that can be invited to speak at VCME events, as well as a decrease in the perceived value and worth of presenters' expertise,<sup>256</sup> which can further decrease participants' motivation to participate and complete the CME course.<sup>166</sup>

### Future of VCME

Since the beginning of the COVID-19 pandemic, there has been a significant increase in the number and frequency of VCME activities.<sup>276</sup> Not only has VCME allowed specialty medical training to endure during the pandemic, but it has also served as a means of communicating up-to-date information on COVID-19, as well as providing peer support and reducing feelings of isolation among medical professionals.<sup>277</sup> It has also led to record attendance numbers in participants and experts that were not previously possible with in-person conferences.<sup>179</sup> Although most VCME activities were focused on general/family practitioners, VCME focused on specialties such as oncology, sports medicine, and plastic surgery have also been positively received,<sup>77,174,236</sup> suggesting that the benefits of VCME may not be limited by medical specialty. Although we did not detect meaningful differences in gender regarding the convenience of VCME, it should be noted that only fewer than one-third of articles that mentioned convenience as an advantage of CME reported on participants' gender. Thus, more data is needed in order to determine whether there are differences in VCME access based on participant gender.

In the post-pandemic phase, VCME may continue to be a highly demanded modality for CME delivery, particularly in Global South countries, with a recent online survey showing that physicians located in sub-Saharan Africa were more receptive to the transition to VCME compared to those from North America.<sup>231</sup> VCME may reduce cost and travel distance for physicians located in these regions, the latter of which is particularly pronounced in low-income countries as most CME events tend to occur in North America. This finding may provide another reason to retain VCME in the post-pandemic era, especially for those located in low-income countries. However, as most VCME interventions are created by Global North countries, an emphasis must be placed on addressing the specific needs of those located in the Global South to ensure equitable access among all participants.

### Study limitations

Our scoping review has several limitations. First, our searches were limited to physicians, as the inclusion of all health professionals generated an unfeasible number of records. Second, we excluded conference proceedings, dissertations, and news articles, given their less detailed and low information yield. As breadth of evidence is the focus of this scoping review, methodological quality and critical appraisal of the included studies was not assessed.

## Conclusion

To our knowledge, this is the first literature review that attempts to synthesize the advantages and disadvantages of VCME with an equity lens. While most studies reported advantages of VCME, disadvantages and barriers to VCME were also mentioned. However, few articles reported the age, race, nationality, and ethnicity of participants, and only a minority of articles reported the gender of participants. Thus, our analysis on the implications of VCME on vulnerable populations is limited. Additionally, as VCME events are largely organized by North American and European countries, a lack of attention towards factors such as distance, time zone, and Internet accessibility means that VCME events will not be optimized for all attendees. The increase in published data on the topic of VCME in the last decade is a trend which will likely continue into the post-pandemic phase. We therefore hope that our review will prompt further research in this area with particular attention to age, race, nationality, ethnicity, and gender of participants, as VCME continues to be increasingly used to update physicians' knowledge and optimize delivery of care.



See Appendix B for list of all articles included in the review with asterisks to denote those that were not directly referenced in the manuscript.

**Conflicts of Interest:** The authors report no conflicts of interest.

**Funding:** Princess Margaret Cancer Foundation.

## References

- Accreditation Council for Continuing Medical Education. *CME content: definition and examples*. [Internet]. 2019. Available from: <https://www.accme.org/accreditation-rules/policies/cme-content-definition-and-examples>. [Accessed Aug 17, 2020].
- American Medical Association. *The AMA physician's recognition award and credit system*. [Internet]. 2017. Available from: <https://www.ama-assn.org/media/7831/download>. [Accessed Aug 17, 2020].
- Praharaj SK, Ameen S. The relevance of continuing medical education. *Indian J Psychol Med*. 2020;42(5 Suppl):97S-102S. <https://doi.org/10.1177/0253717620957524>
- Accreditation Council for Continuing Medical Education. *ACCME 2017 data report addendum PDF*. [Internet]. 2019. Available from: <https://www.accme.org/publications/accme-2017-data-report-addendum-pdf>. [Accessed Aug 17, 2020].
- Accreditation Council for Continuing Medical Education. *ACCME data report steady growth in Accredited Continuing Medical Education – 2019*. [Internet]. 2019. Available from: [https://www.accme.org/sites/default/files/2020-07/872\\_2020%2007%2028\\_2019\\_Data\\_Report.pdf](https://www.accme.org/sites/default/files/2020-07/872_2020%2007%2028_2019_Data_Report.pdf). [Accessed Aug 17, 2020].
- Canchihuaman FA, Garcia PJ, Gloyd SS, Holmes KK. An interactive internet-based continuing education course on sexually transmitted diseases for physicians and midwives in Peru. *PLoS One*. 2011;6(5):e19318. <https://doi.org/10.1371/journal.pone.0019318>
- Bonawitz R, Bird L, Le NB, et al. Implementing the mobile continuing medical education (mCME) project in Vietnam: making it work and sharing lessons learned. *Mhealth*. 2019;5:7. <https://doi.org/10.21037/mhealth.2019.02.01>
- Casebeer L, Engler S, Bennett N, et al. A controlled trial of the effectiveness of internet continuing medical education. *BMC Med*. 2008;6:37. <https://doi.org/10.1186/1741-7015-6-37>
- Allison JJ, Kiefe CI, Wall T, et al. Multicomponent Internet continuing medical education to promote chlamydia screening. *Am J Prev Med*. 2005;28(3):285-90. <https://doi.org/10.1016/j.amepre.2004.12.013>
- Harris SB, Leiter LA, Webster-Bogaert S, Van DM, O'Neill C. Teleconferenced educational detailing: Diabetes education for primary care physicians. *J Contin Educ Health Prof*. 2005 Spring;25(2):87-97. <https://doi.org/10.1002/chp.13>
- Salinas GD. CME effectiveness: utilizing outcomes assessments of 600+ CME programs to evaluate the association between format and effectiveness. *J Contin Educ Health Prof*. Spring 2015;35 Suppl 1:S38-9. <https://doi.org/10.1002/chp.21279>
- Fordis M, King JE, Ballantyne CM, et al. Comparison of the instructional efficacy of Internet-based CME with live interactive CME workshops: a randomized controlled trial. *JAMA*. 2005;294(9):1043-1051. <https://doi.org/10.1001/jama.294.9.1043>
- Pelayo M, Cebrián D, Areosa A, Agra Y, Izquierdo JV, Buendía F. Effects of online palliative care training on knowledge, attitude and satisfaction of primary care physicians. *BMC Fam Pract*. 2011;12(1):37. <https://doi.org/10.1186/1471-2296-12-37>
- Cook DA, Price DW, Wittich CM, West CP, Blachman MJ. Factors influencing physicians' selection of continuous professional development activities: a cross-specialty national survey. *J Contin Educ Health Prof*. 2017 Summer;37(3):154-160. <https://doi.org/10.1097/ceh.000000000000163>
- O'Brien Pott M, Blanshan AS, Huneke KM, Baasch Thomas BL, Cook DA. Barriers to identifying and obtaining CME: a national survey of physicians, nurse practitioners and physician assistants. *BMC Med Educ*. 2021;21(1):168. <https://doi.org/10.1186/s12909-021-02595-x>
- Jeong D, Presseau J, ElChamaa R, et al. Barriers and facilitators to self-directed learning in continuing professional development for physicians in Canada: a scoping review. *Acad Med*. 2018;93(8):1245-1254. <https://doi.org/10.1097/acm.0000000000002237>
- Concordia University Irvine. *How to balance equity, equality, and fairness*. [Internet] 2019. Available from: <https://www.cui.edu/academicprograms/education/servant-leadership-institute/perfecting-the-practice/blog/post/how-to-balance-equity-equality-and-fairness>. [Accessed Aug 17, 2020].
- Stancic N, Mullen PD, Prokhorov AV, Frankowski RF, McAlister AL. Continuing medical education: what delivery format do physicians prefer? *J Contin Educ Health Prof*. 2003 Summer ;23(3):162-7. <https://doi.org/10.1002/chp.1340230307>
- Curran VR, Keegan D, Parsons W, et al. A comparative analysis of the perceived continuing medical education needs of a cohort of rural and urban Canadian family physicians. *Can J Rural Med*. 2007 Summer;12(3):161-6.
- Schoen MJ, Tipton EF, Houston TK, et al. Characteristics that predict physician participation in a Web-based CME activity: the MI-Plus study. *J Contin Educ Health Prof*. 2009 Fall;29(4):246-53. <https://doi.org/10.1002/chp.20043>
- Casebeer L, Bennett N, Kristofco R, Carillo A, Centor R. Physician Internet medical information seeking and on-line continuing education use patterns. *J Contin Educ Health Prof*. Winter 2002;22(1):33-42. <https://doi.org/10.1002/chp.1340220105>
- Harris Jr JM, Novalis-Marine C, Harris RB. Women physicians are early adopters of on-line continuing medical education. *J Contin Educ Health Prof*. 2003;23(4):221-228. <https://doi.org/10.1002/chp.1340230505>
- Tretter JT, Windram J, Faulkner T, et al. Heart University: a new online educational forum in paediatric and adult congenital cardiac care. The future of virtual learning in a post-pandemic world? *Cardiol Young*. 2020;30(4):560-567. <https://doi.org/10.1017/S1047951120000852>
- Bhargava S, Farabi B, Rathod D, Singh AK. The fate of major dermatology conferences and meetings of 2020: are e-conferences and digital learning the future? *Clin Exp Dermatol*. 2020;45(6):759-761. <https://doi.org/10.1111/ced.14272>
- Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*.

- 2005;8(1):19-32.  
<https://doi.org/10.1080/1364557032000119616>
26. National Science Foundation Office of Inspector General. OIG Review of NFSNET. Report. 1993:35.
  27. Veritas Health Innovation. Covidence systematic review software [Internet] 2014. Available from <https://www.covidence.org> [Accessed Jun 24, 2020].
  28. Moola S, Munn Z, Sears K, et al. Conducting systematic reviews of association (etiology): The Joanna Briggs Institute's approach. *Int J Evid Based Healthc*. 2015 Sep;13(3):163-9. <https://doi.org/10.1097/xeb.0000000000000064>
  29. Richardson ML, Norris TE. On-line delivery of continuing medical education over the World-Wide Web: an on-line needs assessment. *AJR Am J Roentgenol*. 1997;168(5):1161-4. <https://doi.org/10.1016/j.ijmedinf.2005.09.004>
  30. Sly JL, Lombardi E, Kusel M, Sly PD. Piloting a web-based continuing professional development program for asthma education. *Int J Med Inform*. 2006;75(10-11):708-13. <https://doi.org/10.1016/j.ijmedinf.2005.09.004>
  31. Vides-Porras A, Cáceres P, Company A, et al. Gaining insight into the implementation of an e-learning smoking cessation course in Latin American countries. *Health Promot Int*. 2021;36(2):349-362. <https://doi.org/10.1093/heapro/daaa054>
  32. Farokhi MR, Zarifsanaiyeh N, Haghighi F, Mehrabi M. E-learning or in-person approaches in continuous medical education: A comparative study. *IIOAB J*. 2016;7(2):472-476.
  33. Curran VR, Hoekman T, Gulliver W, Landells I, Hatcher L. Web-based continuing medical education. (II): Evaluation study of computer-mediated continuing medical education. *J Contin Educ Health Prof*. 2000;20(2):106-19. <https://doi.org/10.1002/chp.1340200207>
  34. Gandsas A, McIntire K. Minimally Invasive Therapy and Allied Technologies: new solutions to old problems. *Minim Invasive Ther Allied Technol*. 2002;11(2):35-6. <https://doi.org/10.1080/136457002753632420>
  35. Greenberg JA, Schwarz E, Paige J, Dort J, Bachman S. At-home hands-on surgical training during COVID19: proof of concept using a virtual telementoring platform. *Surg Endosc*. 2021;35(5):1963-1969. <https://doi.org/10.1007/s00464-021-08470-6>
  36. Klein D, Davis P, Hickey L. Videoconferences for rural physicians' continuing health education. *J Telemed Telecare*. 2005;11 Suppl 1:97-9. <https://doi.org/10.1258/1357633054461822>
  37. Krupinski EA, Lopez AM, Lyman T, Barker G, Weinstein RS. Continuing education via telemedicine: analysis of reasons for attending or not attending. *Telemed J E Health*. 2004;10(3):403-9. <https://doi.org/10.1089/tmj.2004.10.403>
  38. Kulatunga GGAK, Marasinghe RB, Karunathilake IM, Dissanayake VHW. Development and implementation of a web-based continuing professional development (CPD) programme on medical genetics. *J Telemed Telecare*. 2013;19(7):388-92. <https://doi.org/10.1177/1357633X13506525>
  39. Lamba P. Teleconferencing in medical education: a useful tool. *Australas Med J*. 2011;4(8):442-7. <https://doi.org/10.4066/AMJ.2011.823>
  40. Liaw S-T, Pearce C, Keppell M. Developing a web-based learning network for continuing medical education. *J Workplace Learn*. 2002;14(3):98-108. <https://doi.org/10.1108/13665620210421911>
  41. Malassagne B, Mutter D, Leroy J, Smith M, Soler L, Marescaux J. Teleeducation in surgery: European Institute for Telesurgery experience. *World J Surg*. 2001;25(11):1490-4. <https://doi.org/10.1007/s00268-001-0135-z>
  42. McEnery KW, Roth SM, Walkup RV. Radiology CME on the Web using secure document transfer and internationally distributed image servers. *Proc AMIA Annu Fall Symp*. 1996:37-40.
  43. Medina-Presentado JC, Margolis A, Teixeira L, et al. Online continuing interprofessional education on hospital-acquired infections for Latin America. *Braz J Infect Dis*. 2017;21(2):140-147. <https://dx.doi.org/10.1016/j.bjid.2016.11.003>
  44. Abawi K, Gertiser L, Idris R, et al. A large-scale Internet/computer-based, training module: dissemination of evidence-based management of postpartum hemorrhage to front-line health care workers. *IJEL*. 2017;16(4):317-328.
  45. Bollinger RC, McKenzie-White J, Gupta A. Building a global health education network for clinical care and research. The benefits and challenges of distance learning tools. Lessons learned from the Hopkins Center for Clinical Global Health Education. *Infect Dis Clin North Am*. 2011;25(2):385-98. <https://doi.org/10.1016/j.idc.2011.02.006>
  46. Murphy K, Munk PL. Continuing medical education: MOOCs (Massive Open Online Courses) and their implications for radiology learning. *Can Assoc Radiol J*. 2013;64(3):165. <https://doi.org/10.1016/j.carj.2013.06.001>
  47. Norman JN, Alsajir MB. Tele-education - Postgraduate education. *Med Principles Pract*. 2001;10(3):115-122. <https://doi.org/10.1159/000050354>
  48. Peterson MW, Galvin JR, Dayton C, D'Alessandro MP. Realizing the promise: delivering pulmonary continuing medical education over the Internet. *Chest*. 1999;115(5):1429-36. <https://doi.org/10.1378/chest.115.5.1429>
  49. Rana R, Kumawat D, Sahay P, et al. Perception among ophthalmologists about webinars as a method of continued medical education during COVID-19 pandemic. *Indian J Ophthalmol*. 2021;69(4). [https://doi.org/10.4103/ijo.IJO\\_3136\\_20](https://doi.org/10.4103/ijo.IJO_3136_20)
  50. Regueiro MD, Greer JB, Binion DG, et al. The inflammatory bowel disease live interinstitutional and interdisciplinary videoconference education (IBD LIVE) series. *Inflamm Bowel Dis*. 2014;20(10):1687-1695. <https://doi.org/10.1097/MIB.0000000000000187>
  51. Ruf D, Kriston L, Berner M, Harter M. General practitioners and online continuing medical education - which factors influence its use? *Ger Med Sci*. 2009;7:Doc08. <https://doi.org/10.3205/000067>
  52. Taekman JM, Kingsley CP, Shelley KH. Medical education over the Internet. *Acad Med*. 1996;71(5):525.
  53. Tello R, Davison BD, Blickman JG. The virtual course: delivery of live and recorded continuing medical education material over the Internet. *AJR Am J Roentgenol*. 2000;174(6):1519-21. <https://doi.org/10.2214/ajr.174.6.1741519>
  54. Whitten P, Ford DJ, Davis N, Speicher R, Collins B. Comparison of face-to-face versus interactive video continuing medical education delivery modalities. *J Contin Ed Health Prof*. 1998;18(2):93-99. <https://doi.org/10.1002/chp.1340180205>

55. Bagayoko CO, Perrin C, Gagnon M-P, Geissbuhler A. Continuing distance education: a capacity-building tool for the de-isolation of care professionals and researchers. *J Gen Intern Med*. 2013;28 Suppl 3:S666-70. <https://doi.org/10.1007/s11606-013-2522-1>
56. Boatin A, Ngonzi J, Bradford L, Wylie B, Goodman A. Teaching by teleconference: a model for distance medical education across two continents. *Open J Obstet Gynecol*. 2015;5(13):754-761. <https://doi.org/10.4236/ojog.2015.513106>
57. Butterworth K, Hayes B, Zimmerman M, Knoble S. Needs assessment for continuing medical education in Nepal. *Med Teach*. 2009;31(5):463. <http://doi.org/10.1080/01421590903051315>
58. Callas PW, Ricci MA, Caputo MP. Improved rural provider access to continuing medical education through interactive videoconferencing. *Telemed J E Health*. 2000;6(4):393-9. <https://doi.org/10.1089/15305620050503861>
59. Curran V, Kirby F, Allen M, Sargeant J. A mixed learning technology approach for continuing medical education. *Med Educ Online*. 2003;8(1):434-1. <https://doi.org/10.3402/meo.v8i.4341>
60. Curran V, Kirby F, Allen M, Sargeant J. A mixed learning technology strategy for providing continuing medical education to rural physicians. *J Telemed Telecare*. 2003;9(5):305-7. <https://doi.org/10.1258/135763303769211364>
61. Curran V, Lockyer J, Sargeant J, Fleet L. Evaluation of learning outcomes in Web-based continuing medical education. *Acad Med*. 2006;81(10 Suppl):S30-4. <https://doi.org/10.1097/01.ACM.0000236509.32699.f5>
62. Curran VR, Fleet L, Kirby F. Factors influencing rural health care professionals' access to continuing professional education. *Aust J Rural*. 2006;14(2):51-5. <https://doi.org/10.1111/j.1440-1584.2006.00763.x>
63. Datta C. The rise of e-learning and opportunities for Indian family physicians. *J Family Med Prim Care*. 2012;1(1):7-9. <https://doi.org/10.4103/2249-4863.94441>
64. de Carvalho Mesquita K, da Silva JA, Igreja ACdSM. Aplicabilidade da educação a distância na educação médica continuada. *Brasília Med*. 2012;49(2):111-117.
65. DeLacy FB, Nehme J, Lacy AM, Chand M. Educational technology: revolutionizing surgical education. *Br J Hosp Med (Lond)*. 2017;78(8):426-427. <https://doi.org/10.12968/hmed.2017.78.8.426>
66. Dinh M, Tan T, Bein K, Hayman J, Wong YK, Dinh D. Emergency department knowledge management in the age of Web 2.0: evaluation of a new concept. *Emerg Med Australas*. 2011;23(1):46-53. <https://doi.org/10.1111/j.1742-6723.2010.01373.x>
67. Dufour JC, Cuggia M, Soula G, Spector M, Kohler F. An integrated approach to distance learning with digital video in the French-speaking Virtual Medical University. *Int J Med Inform*. 2007;76(5-6):369-376. <http://doi.org/10.1016/j.ijmedinf.2007.01.011>
68. Fordis M, King JE, Ballantyne CM, et al. Comparison of the instructional efficacy of Internet-based CME with live interactive CME workshops: a randomized controlled trial. *JAMA*. 2005;294(9):1043-51. <https://doi.org/10.1001/jama.294.9.1043>
69. Hoedebecke K, Mahmoud M, Yakubu K, et al. Collaborative global health e-learning: a massive open online course experience of young family doctors. *J Family Med Prim Care*. 2018;7(5):884-887. [https://doi.org/10.4103/jfmpc.jfmpc\\_186\\_18](https://doi.org/10.4103/jfmpc.jfmpc_186_18)
70. Janes R, Arroll B, Buetow S, Coster G, McCormick R, Hague I. Rural New Zealand health professionals' perceived barriers to greater use of the internet for learning. *Rural Remote Health*. 2005;5(4):436.
71. Kanneganti A, Lim KMX, Chan GMF, et al. Pedagogy in a pandemic - COVID-19 and virtual continuing medical education (vCME) in obstetrics and gynecology. *Acta Obstet Gynecol Scand*. 2020;99(6):692-695. <https://doi.org/10.1111/aogs.13885>
72. Lupiáñez-Villanueva F, Mayer MA, Torrent J. Opportunities and challenges of Web 2.0 within the health care systems: an empirical exploration. *Inform Health Soc Care*. Sep 2009;34(3):117-26. <https://doi.org/10.1080/17538150903102265>
73. Mamary E, Charles P. Promoting self-directed learning for continuing medical education. *Medical Teach*. 2003;25(2):188-90. <https://doi.org/10.1080/0142159031000092607>
74. Masud S, Ayub A, Mahboob U. Use of massive online open courses as a potential resource to provide continuing medical education in Pakistan. *J Coll Physicians Surg Pak*. 2016;26(2):160-1. <https://doi.org/10.2016/JCPSP.160161>
75. Bermejo-Caja CJ, Koatz D, Orrego C, et al. Acceptability and feasibility of a virtual community of practice to primary care professionals regarding patient empowerment: a qualitative pilot study. *BMC Health Serv Res*. 2019;19(1):403. <https://doi.org/10.1186/s12913-019-4185-z>
76. Mohan D, Fischhoff B, Angus DC, et al. Serious games may improve physician heuristics in trauma triage. *Proc Natl Acad Sci U S A*. 2018;115(37):9204-9209. <https://doi.org/10.1073/pnas.1805450115>
77. Nahai F. Distance learning in plastic surgery: are live meetings destined for the scrapheap? *Aesthet Surg J*. 2012;32(5):659-60. <https://doi.org/10.1177/1090820X12448817>
78. Neto RM. Distance education in medical ultrasound in Brazil. *Obstet Gynecol*. 2015;9(2):197-202. <http://doi.org/10.5005/jp-journals-10009-1406>
79. Newman TH, Robb H, Michaels J, et al. The end of conferences as we know them? Trainee perspectives from the Virtual ACCESS Conference 2020. *BJU Int*. 2021;127(2):263-265. <https://doi.org/10.1111/bju.15330>
80. Nofal MR, Halim N, Le BN, et al. Unpacking the "Black Box": How an SMS-Based Continuing Medical Education Intervention Improved Medical Knowledge Among HIV Clinicians in Vietnam. *Glob Health Sci Pract*. 2018;6(4):668-679. <https://doi.org/10.9745/GHSP-D-18-00298>
81. O'Brien Pott M, Blanshan AS, Huneke KM, Baasch Thomas BL, Cook DA. What influences choice of continuing medical education modalities and providers? A National Survey of US physicians, nurse practitioners, and physician assistants. *Acad Med*. 2020;96(1):93-100. <https://doi.org/10.1097/ACM.00000000000003758>
82. Ottesen TD, Montoya RL, Ogunleye TD, et al. Implementation and impact evaluation of a virtual orthopaedic continuing

- medical education conference in a low-resource country. *J Surg Educ.* 2021; 78(5):1629-1636. <https://doi.org/10.1016/j.jsurg.2021.01.002>
83. Penna GCe, Mendes HG, Dias MAdS, et al. Avaliação do emprego de videoconferências para a capacitação à distância dos médicos das equipes de saúde da família dentro do projeto nacional telessaúde. Evaluation of the use of videoconferencing for distance training of doctors in the family health teams within the national telehealth project. *Rev Med Minas Gerais.* 2015;25(1):108-14
  84. Prinz JC, Hartmann D, Wolff H, et al. Dermatology continuing medical education during Corona times and beyond: Experience from the 2020 digital advanced training week for practical dermatology and venerology and lessons for future concepts. *Hautarzt.* 2021;72(4):362-366. <https://doi.org/10.1007/s00105-020-04755-4>
  85. Ramanathan R, Aldis R, Gupta S, Desai M, Bollinger Jr RC, Reed VA. Mixed methods evaluation of an international internet-based continuing medical education course for pediatric HIV providers in Pune, India. *Educ Health (Abingdon).* 2011;24(1):540.
  86. Ramsay R, Nashat NH, Thuraisingham C, et al. Reimagining medical education for primary care in the time of COVID-19: a world view. *Educ Prim Care.* 2021;32(1):2-5. <https://doi.org/10.1080/14739879.2020.1851147>
  87. Rebbeck T, Macedo L, Paul P, Trevena L, Cameron ID. General practitioners' knowledge of whiplash guidelines improved with online education. *Aust Health Rev.* 2013;37(5):688-94. <https://doi.org/10.1071/AH13057>
  88. Ruiz-Barrera MA, Agudelo-Arrieta M, Aponte-Caballero R, et al. Developing a Web-Based Congress: The 2020 International Web-Based Neurosurgery Congress Method. *World Neurosurg.* 2021;148:e415-e424. <https://doi.org/10.1016/j.wneu.2020.12.174>
  89. Abboudi H, Khan MS, Aboumarzouk O, et al. Current status of validation for robotic surgery simulators a systematic review. *BJU International.* 2013;111(2):194-205. <http://doi.org/10.1111/j.1464-410X.2012.11270.x>
  90. Tarchichi TR, Szymusiak J. Continuing medical education in the time of social distancing: the case for expanding podcast usage for continuing education. *J Contin Educ Health Prof.* 2021;41(1):70-74. <https://doi.org/10.1097/ceh.0000000000000324>
  91. Willman AS. Use of Web 2.0 tools and social media for continuous professional development among primary healthcare practitioners within the Defence Primary Healthcare: a qualitative review. *BMJ Mil Health.* 2020;166(4):232-235. <https://doi.org/10.1136/jramc-2018-001098>
  92. Zereshkian A, Wong R, Leifer R, et al. Continuing professional development needs amongst University of Toronto's Department of Radiation Oncology Faculty. *J Cancer Educ.* 2021;36(1):118-125. <https://doi.org/10.1007/s13187-019-01607-1>
  93. Archibald D, Burns JK, Fitzgerald M, Merkley VF. Aligning practice data and institution-specific CPD: medical quality management as the driver for an eLearning development process. *J Eur CME.* 2020;9(1):1754120. <https://doi.org/10.1080/21614083.2020.1754120>
  94. Vollmar HC, Schurer-Maly CC, Lelgemann M, Konecny N, Koch M, Butzlaff M. Online continuing medical education based on national disease management guidelines. The e-learning platform leitnien-wissen.de. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz.* 2006;49(5):412-417. <https://doi.org/10.1007/s00103-006-1251-6>
  95. Adler G, Pritchett LR, Kauth MR. Meeting the continuing education needs of rural mental health providers. *Telemed J E Health.* 2013;19(11):852-6. <https://doi.org/10.1089/tmj.2013.0010>
  96. Allen M, Sargeant J, MacDougall E, Proctor-Simms M. Videoconferencing for continuing medical education: from pilot project to sustained programme. *J Telemed Telecare.* 2002;8(3):131-7. <https://doi.org/10.1177/1357633X0200800302>
  97. Chao J. Continuing medical education software: a comparative review. *J Fam Pract.* 1992;34(5):598-604.
  98. Chatziralli I, Ventura CV, Touhami S, et al. Transforming ophthalmic education into virtual learning during COVID-19 pandemic: a global perspective. *Eye (Lon).* 2021;35(5):1459-1466. <https://doi.org/10.1038/s41433-020-1080-0>
  99. Cho MJ, Hong JP. The emergence of virtual education during the COVID-19 pandemic: The past, present, and future of the plastic surgery education. *J Plast Reconstr Aesthet Surg.* 2021;74(6):1413-1421. <https://doi.org/10.1016/j.jbps.2020.12.099>
  100. Ghanem O, Logghe HJ, Tran BV, Huynh D, Jacob B. Closed Facebook TM groups and CME credit: a new format for continuing medical education. *Surg Endosc.* 2019;33(2):587-591. <https://doi.org/10.1007/s00464-018-6376-9>
  101. Greenwood J, Williams R. Continuing professional development for Australian rural psychiatrists by videoconference. *Australas Psychiatry.* 2008;16(4):273-6. <https://doi.org/10.1080/10398560801982994>
  102. Kisilevsky E, Margolin E, Kohly RP. Access, an unintended consequence of virtual continuing medical education during COVID-19: a department's experience at the University of Toronto. *Can J Ophthalmol.* 2021;56(1):e18-e19. <https://doi.org/10.1016/j.ijco.2020.10.002>
  103. Knipfer C, Wagner F, Knipfer K, et al. Learners' acceptance of a webinar for continuing medical education. *Int J Oral Maxillofac Surg.* 2019;48(6):841-846. <https://dx.doi.org/10.1016/j.ijom.2018.11.010>
  104. Levy BT, Albrecht L, Gjerde CL. Using videoconferencing to train community family medicine preceptors. *Acad Med.* 1998;73(5):616-7. <https://doi.org/10.1097/00001888-199805000-00094>
  105. Lewis CE, Relan A, Hines OJ, Tillou A, Hiatt JR. Morbidity and mortality as a televideoconference: A randomized prospective evaluation of learning and perceptions. *J Am Coll Surg.* 2011;212(3):400-405. <http://doi.org/10.1016/j.jamcollsurg.2010.12.002>
  106. Lott DR. Can Distance Education Solve Rural Physicians' Professional Isolation Problems? *J Contin High Educ.* 1996; 44(3):25-28. <https://doi.org/10.1080/07377366.1996.10400300>



107. Lynch J, Weaver L, Hall P, et al. Using telehealth technology to support CME in end-of-life care for community physicians in Ontario. *Telemed J E Health*. 2004;10(1):103-7. <https://doi.org/10.1089/153056204773644643>
108. Michelson G, Scibor M, Keppler K, Dick B, Kuchenbecker J. Online medical education in ophthalmology. *Ophthalmology*. 2000;97(4):290-294. <https://doi.org/10.1007/s003470050530>
109. Omil-Lima D, Fernstrum A, Gupta K, et al. Urologic education in the era of COVID-19: results from a webinar-based reconstructive urology lecture series. *Urology*. 2021;152:2-8. <https://doi.org/10.1016/j.urology.2021.03.004>
110. Sen Gupta TK, Wallace DA, Clark SL, Bannan G. Videoconferencing: practical advice on implementation. *Aus J Rural Health*. 1998;6(1):2-4. <https://doi.org/10.1111/j.1440-1584.1998.tb00273.x>
111. Walsh K. E-learning in medical education: the potential environmental impact. *Educ Prim Care*. 2018;29(2):104-106. <https://doi.org/10.1080/14739879.2017.1389619>
112. Wang Z-Y, Zhang L-J, Liu Y-H, Jiang W-X, Tang S-L, Liu X-Y. Process evaluation of E-learning in continuing medical education: evidence from the China-Gates Foundation Tuberculosis Control Program. *Infectious Dis Poverty*. 2021;10(1):23. <https://doi.org/10.1186/s40249-021-00810-x>
113. White LE, Krousel-Wood MA, Mather F. Technology meets healthcare: Distance learning and telehealth. *Ochsner J*. 2001;3(1):22-29.
114. Allen JW. Surgical Internet at a glance: continuing medical education. *Am J Surg*. 2001;181(2):89-90. [https://doi.org/10.1016/s0002-9610\(00\)00570-5](https://doi.org/10.1016/s0002-9610(00)00570-5)
115. Chen T-H, Buenconsejo-Lum LE, Braun KL, Higa C, Maskarinec GG. A pilot evaluation of distance education modalities for health workers in the U.S.-Affiliated Pacific Islands. *Pac Health Dialog*. 2007;14(1):22-30.
116. Davis P, McCracken P. Restructuring rural continuing medical education through videoconferencing. *J Telemed Telecare*. 2002;8 Suppl 2:108-9. <https://doi.org/10.1177/1357633X020080S249>
117. Diehl LA, Souza RM, Gordan PA, Esteves RZ, Coelho IC. InsuOnline, an electronic game for medical education on insulin therapy: a randomized controlled trial with primary care physicians. *J Med Internet Res*. 2017;19(3):e72. <https://doi.org/10.2196/jmir.6944>
118. Feldacker C, Jacob S, Chung MH, Nartker A, Kim HN. Experiences and perceptions of online continuing professional development among clinicians in sub-Saharan Africa. *Hum Resour Health*. 2017;15(1):89. <https://doi.org/10.1186/s12960-017-0266-4>
119. Gupta MP, Sridhar J, Wykoff CC, Yonekawa Y. Ophthalmology conferences in the coronavirus disease 2019 era. *Curr Opin Ophthalmol*. 2020;31(5):396-402. <https://doi.org/10.1097/ICU.0000000000000688>
120. Hemmati N, Omrani S, Hemmati N. A comparison of Internet-based learning and traditional classroom lecture to learn CPR for continuing medical education. *Turk Online J Dist Educ*. 2013;14(1):256-265.
121. Jarvis-Selinger S, Gullion J, Lauscher HN, Ho K. Integrating continuing professional development and graduate curriculum in a case-based interprofessional online course: telemedicine in action. *J Contin Educ Health Prof*. 2007;27(4):253-4. <https://doi.org/10.1002/chp.145>
122. Krebs TL, Berg WA, Roys SR, Ratakonda S, Pomerantz SM, Siegel EL. MammoWeb continuing medical education (CME): a web-based breast imaging CME program. *J Digit Imaging*. 1999;12(2 Suppl 1):124-6. <https://doi.org/10.1007/BF03168777>
123. Kresevic D, Burant C, Denton J, Heath B, Kyriotakis G. The use of multimodal strategies for distance education in the GRECCs. *Gerontol Geriatr Educ*. 2011;32(1):54-79. <https://doi.org/10.1080/02701960.2011.550216>
124. Leite MTM, Carlini AL, Ramos MP, Sigulem D. Educação médica continuada online: potencial e desafios no cenário brasileiro. Online continuing medical education: potential and challenges in the Brazilian context. *Rev Bras Educ Méd*. 2010;03 2010;34(1):141-149. <https://doi.org/10.1590/S0100-55022010000100017>
125. Lockyer J, Sargeant J, Curran V, Fleet L. The transition from face-to-face to online CME facilitation. *Med Teach*. 2006;28(7):625-30. <https://doi.org/10.1080/01421590600922909>
126. MacWalter G, McKay J, Bowie P. Utilisation of internet resources for continuing professional development: a cross-sectional survey of general practitioners in Scotland. *BMC Med Educ*. 2016;16:24. <https://doi.org/10.1186/s12909-016-0540-5>
127. Mazzoleni MC, Maugeri C, Rognoni C, Cantoni A, Imbriani M. Is it worth investing in online continuous education for healthcare staff? *Stud Health Technol Inform*. 2012;180:939-43.
128. Nelsen BR, Chen YK, Lasic M, Bader AM, Arriaga AF. Advances in anesthesia education: increasing access and collaboration in medical education, from E-learning to telesimulation. *Curr Opin Anaesthesiol*. 2020;33(6):800-807. <https://doi.org/10.1097/aco.0000000000000931>
129. Tucker AP, Miller A, Sweeney D, Jones RW. Continuing medical education: A needs analysis of anaesthetists. *Anaesth Intensive Care*. 2006;34(6):765-769. <https://doi.org/10.1177/0310057X0603400604>
130. Tullo E, Newton J, Clapp A. What can e-learning offer geriatric medicine in the UK? *Rev Clin Gerontol*. 2012;22(3):235-242. <http://doi.org/10.1017/S0959259812000081>
131. Wiecha J, Barrie N. Collaborative online learning: a new approach to distance CME. *Acad Med*. 2002;77(9):928-9.
132. Yee M, Simpson-Young V, Paton R, Zuo Y. How do GPs want to learn in the digital era? *Aust Fam Physician*. 2014;43(6):399-402.
133. Mazzoleni MC, Rognoni C, Finozzi E, et al. Usage and effectiveness of e-learning courses for continuous medical education. *Stud Health Technol Inform*. 2009;150:921-5.
134. Comer A, Harris AD, Shardell M, et al. Attaining safety for patients through interdisciplinary risk reduction efforts (ASPIRRE) subgroup. Web-based training improves knowledge about central line bloodstream infections. *Infect Control Hosp Epidemiol*. 2011;32(12):1219-22. <https://doi.org/10.1086/662585>
135. Humphreys H, McHugh S, Dimitrov BD, Cowman S, Tierney S, Hill AD. Web-based training to improve knowledge and change practice in preventing healthcare infection. *Infect Control Hosp Epidemiol*. 2012;33(6):644-5. <https://doi.org/10.1086/665717>

136. Curran V, Kirby F, Parsons E, Lockyer J. Short report: satisfaction with on-line CME. Evaluation of the ruralMDcme website. *Can Fam Physician*. 2004;50:271-4.
137. Della Corte F, La Mura F, Petrino R. E-learning as educational tool in emergency and disaster medicine teaching. *Minerva Anesthesiol*. 2005;71(5):181-95.
138. Le TT, Rait MA, Jarlsberg LG, Eid NS, Cabana MD. A randomized controlled trial to evaluate the effectiveness of a distance asthma learning program for pediatricians. *J Asthma*. 2010;47(3):245-50. <https://doi.org/10.3109/02770900903560209>
139. Mehta N, Geissel K, Rhodes E, Salinas G. Comparative effectiveness in CME: evaluation of personalized and self-directed learning models. *J Contin Educ Health Prof*. 2015;35 Suppl 1:S24-6. <https://doi.org/10.1002/chp.21284>
140. Oliveira AC, Mattos S, Coimbra M. Development and assessment of an e-learning course on pediatric cardiology basics. *JMIR Med Educ*. 2017;3(1):e10. <https://doi.org/10.2196/mededu.5434>
141. Raggio V, Roche L, Esperón P, Stoll M. Curso on-line: Introducción a la medicina genómica. On-line Course: Introduction to genomic medicine. *Rev Méd Urug*. 2007;23(2):116-121.
142. Sargeant J, Curran V, Jarvis-Selinger S, et al. Interactive on-line continuing medical education: physicians' perceptions and experiences. *J Contin Educ Health Prof*. 2004;24(4):227-36. <https://doi.org/10.1002/chp.1340240406>.
143. Stancic N, Mullen PD, Prokhorov AV, Frankowski RF, McAlister AL. Continuing medical education: what delivery format do physicians prefer? *J Contin Educ Health Prof*. 2003;23(3):162-7. <https://doi.org/10.1002/chp.1340230307>
144. Gill CJ, Le NB, Halim N, et al. mCME project V.2.0: randomised controlled trial of a revised SMS-based continuing medical education intervention among HIV clinicians in Vietnam. *BMJ Glob Health*. 2018;3(1):e000632. <https://doi.org/10.1136/bmjgh-2017-000632>
145. Krishnamachari B, Rehman M, Cohn JE, et al. Video education on hereditary breast and ovarian cancer (HBOC) for physicians: an interventional Study. *J Cancer Educ*. 2018;33(6):1213-1221. <https://doi.org/10.1007/s13187-017-1233-4>
146. Chen HS, Guo FR, Chen CY, Chen JH, Kuo TS. Review of telemedicine projects in Taiwan. *Int J Med Inform*. 2001;61(2-3):117-29. [https://doi.org/10.1016/s1386-5056\(01\)00134-4](https://doi.org/10.1016/s1386-5056(01)00134-4)
147. Geissbuhler A, Bagayoko CO, Ly O. The RAFT network: 5 years of distance continuing medical education and tele-consultations over the Internet in French-speaking Africa. *Int J Med Inform*. 2007;76(5-6):351-6. <https://doi.org/10.1016/j.ijmedinf.2007.01.012>
148. Gerbert B, Bronstone A, Maurer T, Berger T, McPhee SJ, Caspers N. The effectiveness of an Internet-based tutorial in improving primary care physicians' skin cancer triage skills. *J Cancer Educ*. 2002;17(1):7. <https://doi.org/10.1080/08858190209528784>
149. Goodyear-Smith F, Whitehorn M, McCormick R. Experiences and preferences of general practitioners regarding continuing medical education: a qualitative study. *N Z Med J*. 2003;116(1172):U399.
150. Klein M, Niebuhr V, D'Alessandro D. Innovative online faculty development utilizing the power of social media. *Acad Pediatr*. 2013;13(6):564-9. <https://doi.org/10.1016/j.acap.2013.07.005>
151. Margolis A, Gonzalez-Martinez F, Noboa O, et al. Online continuing medical education for the Latin American nephrology community. *Stud Health Technol Inform*. 2015;216:372-5.
152. Murphy-Southwick C, McBride M. Geriatric education across 94 million acres: adapting conference programming in a rural state. *Gerontol Geriatr Educ*. 2006;26(4):25-36.
153. Sherman A. Continuing medical education methodology: current trends and applications in wound care. *J Diabetes Sci Technol*. 2010;4(4):853-6. <https://doi.org/10.1177/193229681000400413>
154. Bond SE, Crowther SP, Adhikari S, et al. Design and implementation of a novel web-based e-learning tool for education of health professionals on the antibiotic Vancomycin. *J Med Internet Res*. 2017;19(3):e93. <https://doi.org/10.2196/jmir.6971>
155. Anthierens S, Tonkin-Crine S, Douglas E, et al. General practitioners' views on the acceptability and applicability of a web-based intervention to reduce antibiotic prescribing for acute cough in multiple European countries: a qualitative study prior to a randomised trial. *BMC Fam Pract*. 2012;13:101. <https://doi.org/10.1186/1471-2296-13-101>
156. Bassey IE, Ekanem IA, Olasode BJ, Jombo GTA. Web-based learning as an important bridge in information divide in contemporary practice of pathology in the developing world: findings from Nigeria. *Internet J Third World Med*. 2010;8(2)
157. Bellande BJ. The future of CME. *South Med J*. 1991;84(8):1007-11. <https://doi.org/10.1097/00007611-199108000-00014>
158. Nafrawi AG. The future of CME. *South Med J*. 1992;85(2):221. <https://doi.org/10.1097/00007611-199202000-00032>
159. Bonevski B, Magin P, Horton G, Bryant J, Randell M, Kimlin MG. An internet based approach to improve general practitioners' knowledge and practices: the development and pilot testing of the "ABC's of vitamin D" program. *Int J Med Inform*. 2015;84(6):413-22. <https://doi.org/10.1016/j.ijmedinf.2015.01.006>
160. Burgos F, Disdier C, De Santamaria EL, et al. Telemedicine enhances quality of forced spirometry in primary care. *Eur Respir J*. 2012;39(6):1313-1318. <http://doi.org/10.1183/09031936.00168010>
161. Carrizosa J, Braga P, Albuquerque M, et al. Epilepsy for primary health care: a cost-effective Latin American E-learning initiative. *Epileptic Disord*. 2018;20(5):386-395. <https://doi.org/10.1684/epd.2018.0997>
162. Cates JR, Diehl SJ, Fuemmeler BF, et al. Toward optimal communication about HPV vaccination for preteens and their parents: evaluation of an online training for pediatric and family medicine health care providers. *J Public Health Manag Pract*. 2020;26(2):159-167. <https://doi.org/10.1097/phh.0000000000001022>
163. Chandrasekaran A, Thukral A, Deorari AK. E-learning in newborn health - a paradigm shift for continuing professional development for doctors and nurses. *Indian J Pediatr*. 2014;81(12):1376-80. <https://doi.org/10.1007/s12098-014-1362-2>

164. Chio KS. Effective Practices in Providing Online, In-Service Training to Health Professionals in Low-Resource Settings. *Inter J Train Dev*. 2012;16(3):228-234.
165. Hogg W. The computer, CME and the family physician. *CMAJ*. 1991;144(3):346-351.
166. Jennings AA, Boyle S, Foley T. The development and evaluation of an online dementia resource for primary care based health professionals. *Internet Interv*. 2018;11:47-52. <http://doi.org/10.1016/j.invent.2018.01.004>
167. Kauffman L, Weisberg EM, Zember WF, Fishman EK. # RadEd: How and why to use Twitter for online radiology education. *Curr Probl Diag Radiol*. 2021;50(3):369-373. <https://doi.org/10.1067/j.cpradiol.2021.02.002>
168. Kemper KJ, Gardiner P, Gobble J, Mitra A, Woods C. Randomized controlled trial comparing four strategies for delivering e-curriculum to health care professionals [ISRCTN88148532]. *BMC Med Educ*. 2006;6:2. <https://doi.org/10.1186/1472-6920-6-2>
169. Lund A, Lam K, Parks P. Disaster Medicine Online: evaluation of an online, modular, interactive, asynchronous curriculum. *CJEM*. 2002;4(6):408-13. <https://doi.org/10.1017/s1481803500007910>
170. Marcinkiewicz A, Cybart A, Chrominska-Szosland D, Nosko J. Nowe formy kształcenia w medycynie pracy. [New forms of training in occupational medicine]. *Med Pr*. 2003;54(6):573-578.
171. Melo MD, Silva NL, Liu PM, et al. E-Learning and Simulation on a pré-hospital emergency course: a participant's perspective. Curso de emergência utilizando E-learning e simulação: visão do participante. *Rev Bras Educ Méd*. 2016;40(4):713-719. <https://doi.org/10.1590/1981-52712015v40n4e02482014>
172. Stoner SA, Mikko AT, Carpenter KM. Web-based training for primary care providers on screening, brief intervention, and referral to treatment (SBIRT) for alcohol, tobacco, and other drugs. *J Subst Abuse Treat*. 2014;47(5):362-70. <https://doi.org/10.1016/j.jsat.2014.06.009>
173. Huang K-J, Cen G, Qiu Z-J, Jiang T, Cao J, Fu C-Y. Application of international videoconferences for continuing medical education programs related to laparoscopic surgery. *Telemed J E Health*. 2014;20(2):157-60. <https://doi.org/10.1089/tmi.2013.0070>
174. Isbej L, Uribe J, Carrasco O, et al. Experiencia de educacion continua en linea en gastroenterologia para medicos no especialistas. [Experience of continuing online education in gastroenterology for non specialist medical doctors]. *Rev Med Chil*. 2019;147(8):1059-1066. <https://doi.org/10.4067/S0034-98872019000801059>
175. Casebeer L, Allison J, Spettell CM. Designing tailored Web-based instruction to improve practicing physicians' chlamydia screening rates. *Acad Med*. 2002;77(9):929. <https://doi.org/10.1097/00001888-200209000-00032>
176. Schroeder AN, Hall MM, Kruse RC. Sports ultrasound training during a pandemic: developing a "Hands-on" skill through distance learning. *Am J Phys Med Rehabil*. 2020;99(9):860-862. <https://doi.org/10.1097/phm.0000000000001515>
177. Larson Williams A, Hawkins A, Sabin L, et al. Motivating HIV providers in Vietnam to learn: a mixed-methods analysis of a mobile health continuing medical education intervention. *JMIR Med Educ*. 2019;5(1):e12058. <https://doi.org/10.2196/12058>
178. Kimura S, Onishi H, Kawamata M. Characteristics and perceptions of twice-weekly webinars for primary care physicians in Japan: a qualitative study. *Int J Med Educ*. 2018;9:229-238. <https://doi.org/10.5116/ijme.5b6b.21e1>
179. Melus-Palazon E, Bartolome-Moreno C, Palacin-Arbues JC, et al. Experience with using second life for medical education in a family and community medicine education unit. *BMC Med Educ*. 2012;12:30. <https://doi.org/10.1186/1472-6920-12-30>
180. Nchise A, Boateng R, Mbarika V, Saiba E, Johnson O. The challenge of taking baby steps-Preliminary insights into telemedicine adoption in Rwanda. *Health Pol Technol*. 2012;1(4):207-213. <http://doi.org/10.1016/j.hlpt.2012.10.004>
181. Vervoort D, Ma X, Bookholane H, Nguyen TC. Conference cancelled: The equitable flip side of the academic surgery coin. *Am J Surg*. 2020;220(6):1539-1540. <https://doi.org/10.1016/j.amjsurg.2020.07.008>
182. Wallis JW, Parker JA. Use of the Internet for teaching in nuclear medicine. *Semin Nucl Med*. 1998;28(2):165-76. [https://doi.org/10.1016/s0001-2998\(98\)80006-8](https://doi.org/10.1016/s0001-2998(98)80006-8)
183. Allen M, Sargeant J, Mann K, Fleming M, Premi J. Videoconferencing for practice-based small-group continuing medical education: feasibility, acceptability, effectiveness, and cost. *J Contin Educ Health Prof*. 2003;23(1):38-47. <https://doi.org/10.1002/chp.1340230107>
184. Butzlaff M, Telzerow A, Lange S, Kruger N. Arzte, internet und neues wissen nutzung und effizienz von neuen weiterbildungsmedien im krankenhaus. [Physicians, internet and new knowledge. Utilization and efficiency of new continuing education media in the hospital]. *Med Klin (Munich)*. 2001;96(6):309-20. <https://doi.org/10.1007/pl00002211>
185. Casanova Dias M, Giacco D, Hanon C. Early career psychiatrists' preferences on e-learning: Viewpoint from the EPA committee on education. *Eur Psychiatry*. 2017;42:86-88. <http://doi.org/10.1016/j.eurpsy.2016.12.003>
186. Crandall LA, Coggan JM. Impact of new information technologies on training and continuing education for rural health professionals. *J Rural Health*. 1994;10(3):208-15. <https://doi.org/10.1111/j.1748-0361.1994.tb00231.x>
187. Gjersvik PJ, Nylenna M, Aasland OG. Hvordan holder norske hudleger seg faglig oppdatert? [How do Norwegian dermatologists keep themselves professionally updated?]. *Tidsskr Nor Laegeforen*. 2001;121(30):3515-8.
188. Jafari P, Kostas T, Levine S, et al. ECHO-Chicago Geriatrics: using telementoring to "geriatricize" the primary care workforce. *Gerontol Geriatr Educ*. 2019;1-9. <http://doi.org/10.1080/02701960.2019.1572005>
189. Kristensen I, Lindh J, Nilsson P, et al. Telemedicine as a tool for sharing competence in paediatric radiotherapy: implementation and initial experiences from a Swedish project. *Acta Oncol*. 2009;48(1):146-52. <https://doi.org/10.1080/02841860802409520>
190. Landman A, Yagi Y, Gilbertson J, Dawson R, Marchevsky A, Becich MJ. Prototype Web-based continuing medical education using FlashPix images. *Proc AMIA Symp*. 2000:462-6.

191. Lim CCT, Yang GL. Electronic teaching files and continuing professional development in radiology. *Biomed Imaging Interv J*. 2006;2(2):e5. <http://doi.org/10.2349/bij.2.2.e5>
192. Murad A, Lederman R, Bosua R, Chang S, Wark JD. Enhancing general practitioners participation in a virtual community of practice for continuing medical education: an exploratory study. *Stud Health Technol Inform*. 2017;239:97-103.
193. Sethi SK, Singla S. Virtual pediatric renal grand rounds: An innovative e-learning. *Pediatr Nephrol*. 2011;26(1):159-160. <http://doi.org/10.1007/s00467-010-1613-z>
194. Sethi SK, Desai TP, Jhaveri KD. Online blogging during conferences: An innovative way of e-learning. *Kidney Int*. 2010;78(12):1199-1201. <http://doi.org/10.1038/ki.2010.395>
195. Sweetman G, Brazil V. Education links between the Australian rural and tertiary emergency departments: Videoconference can support a virtual learning community. *Emerg Med Australas*. 2007;19(2):176-177. <http://doi.org/10.1111/j.1742-6723.2007.00951.x>
196. Ure B, Zoeller C, Lacher M. The role of new information technology meeting the global need and gap of education in pediatric surgery. *Semin Pediatr Surg*. 2015;24(3):134-7. <https://doi.org/10.1053/j.sempedsurg.2015.02.012>
197. Vervoort D, Dearani JA, Starnes VA, Thourani VH, Nguyen TC. Brave New World: Virtual conferencing and surgical education in the Coronavirus Disease 2019 era. *J Thorac Cardiovasc Surg*. 2021;161(3):748-752. <https://doi.org/10.1016/j.jtcvs.2020.07.094>
198. Yadav H, Lin WY. Teleprimary care in Malaysia: a tool for teleconsultation and distance learning in health care. *Asia Pac J Public Health*. 2001;13 Suppl:S58-61.
199. Kerfoot BP, Baker H. An online spaced-education game for global continuing medical education: a randomized trial. *Ann Surgery*. 2012;256(1):33-8. <https://doi.org/10.1097/SLA.0b013e31825b3912>
200. Wang F. Valuation of online continuing medical education and telemedicine in Taiwan. *J Educ Technol Society*. 2008;11(4):190-198.
201. Allison JJ, Kiefe CI, Wall T, et al. Multicomponent Internet continuing medical education to promote chlamydia screening. *Am J Prev Med*. 2005;28(3):285-90. <https://doi.org/10.1016/j.amepre.2004.12.013>
202. Bos-Bonnie LHA, van Bergen JEAM, Te Pas E, Kijser MA, van Dijk N. Effectiveness of an individual, online e-learning program about sexually transmitted infections: a prospective cohort study. *BMC Fam Pract*. 2017;18(1):57. <https://doi.org/10.1186/s12875-017-0625-1>
203. Calabro GE, Tognetto A, Mazzaccara A, et al. Scienze omiche e capacity building dei professionisti sanitari: corso di formazione a distanza per i medici italiani [Omic sciences and capacity building of health professionals: a distance learning training course for Italian physicians, 2017-2018]. *Ig Sanita Pubbl*. 2019;75(2):105-124.
204. Carroll JC, Grad R, Allanson JE, et al. The gene messenger impact project: an innovative genetics continuing education strategy for primary care providers. *J Contin Educ Health Prof*. 2016;36(3):178-85. <https://doi.org/10.1097/CEH.000000000000079>
205. Casebeer L, Andolsek K, Abdolrasulnia M, et al. Evaluation of an online bioterrorism continuing medical education course. *J Contin Educ Health Prof*. 2006;26(2):137-44. <https://doi.org/10.1002/chp.62>
206. Casebeer L, Brown J, Roepke N, et al. Evidence-based choices of physicians: a comparative analysis of physicians participating in Internet CME and non-participants. *BMC Med Educ*. 2010;10:42. <https://doi.org/10.1186/1472-6920-10-42>
207. Casebeer LL, Strasser SM, Spettell CM, et al. Designing tailored Web-based instruction to improve practicing physicians' preventive practices. *J Med Internet Res*. 2003;5(3):e20. <https://doi.org/10.2196/jmir.5.3.e20>
208. Choi Y, Peairs KS, Sateia HF, Riddell R, Zhang C, McGuire MJ. High value care in cancer surveillance and screening: evaluating an e-curriculum for primary care providers. *J Cancer Educ*. 2021. <https://doi.org/10.1007/s13187-021-01986-4>
209. Curran VR, Fleet LJ, Kirby F. A comparative evaluation of the effect of Internet-based CME delivery format on satisfaction, knowledge and confidence. *BMC Med Educ*. 2010;10:10. <https://doi.org/10.1186/1472-6920-10-10>
210. Gagnon M-P, Legare F, Labrecque M, Fremont P, Cauchon M, Desmarts M. Perceived barriers to completing an e-learning program on evidence-based medicine. *Inform Prim Care*. 2007;15(2):83-91. <https://doi.org/10.14236/jhi.v15i2.646>
211. Gallardo-Rincon H, Saucedo-Martinez R, Mujica-Rosales R, et al. Online continuing medical education as a key link for successful noncommunicable disease self-management: the CASALUD TM Model. *Diabetes Metab Syndr Obes*. 2017;10:443-455. <https://doi.org/10.2147/DMSO.S137891>
212. Hampton CL, et al. The interactive videoconference: an effective CME delivery system. *J Contin Educ Health Prof*. 1994;14(2):83-89. <https://doi.org/10.1002/chp.4750140204>
213. Harris JM, Salasche SJ, Harris RB. Can Internet-based continuing medical education improve physicians' skin cancer knowledge and skills? *J Gen Intern Med*. 2001;16(1):50-6. <https://doi.org/10.1111/j.1525-1497.2001.00615.x>
214. Henny KD, Duke CC, Sutton MY. Uptake of online HIV-related continuing medical education training among primary care providers in Southeast United States, 2017-2018. *AIDS Care*. 2021;33(12):1515-1524. <https://doi.org/10.1080/09540121.2020.1822986>
215. Hicks KK, Murano PS. Online nutrition and T2DM continuing medical education course launched on state-level medical association. *Adv Med Educ Pract*. 2017;8:413-418. <https://doi.org/10.2147/AMEP.S138278>
216. Kerfoot BP, Turchin A, Breydo E, Gagnon D, Conlin PR. An online spaced-education game among clinicians improves their patients' time to blood pressure control: a randomized controlled trial. *Circ Cardiovasc Qual Outcomes*. 2014;7(3):468-74. <https://doi.org/10.1161/circoutcomes.113.000814>
217. Lineker SC, Fleet LJ, Bell MJ, et al. Getting a grip on Arthritis online: responses of rural/remote primary care providers to a web-based continuing medical education programme. *Can J Rural Med*. 2019;24(2):52-60. [https://doi.org/10.4103/CJRM.CJRM\\_10\\_18](https://doi.org/10.4103/CJRM.CJRM_10_18)
218. Markova A, Weinstock MA, Risica P, et al. Effect of a web-based curriculum on primary care practice: basic skin cancer triage trial. *Fam Med*. 2013;45(8):558-68.



219. Mazzuocolo LD, Marciano S, Echeverria CM. Implementacion de una modalidad de educacion medica a distancia en psoriasis. [Implementation of a telementoring model of medical education in psoriasis]. *Medicina (B Aires)*. 2016;76(6):359-361.
220. McFadden P, Crim A. Comparison of the effectiveness of interactive didactic lecture versus online simulation-based CME programs directed at improving the diagnostic capabilities of primary care practitioners. *J Contin Educ Health Prof*. 2016;36(1):32-7. <https://doi.org/10.1097/CEH.0000000000000061>
221. Mistraletti G, Umbrello M, Anania S, et al. Neurological assessment with validated tools in general ICU: multicenter, randomized, before and after, pragmatic study to evaluate the effectiveness of an e-learning platform for continuous medical education. *Minerva Anestesiol*. 2017;83(2):145-154. <https://doi.org/10.23736/S0375-9393.16.11103-4>
222. Ng EWM, Le Marne F, Sinclair KG, et al. Evaluation of an educational video providing key messages for doctors to counsel families following a first afebrile seizure. *J Paediatr Child Health*. Feb 2021;57(2):198-203. <https://doi.org/10.1111/jpc.15171>
223. Nicastro E, Lo Vecchio A, Liguoro I, et al. The impact of e-learning on adherence to guidelines for acute gastroenteritis: a single-arm intervention study. *PLoS One*. 2015;10(7):e0132213. <https://doi.org/10.1371/journal.pone.0132213>
224. Ozturk E, van Iersel M, van Loon K, et al. Interactive online learning on perioperative management of elderly patients. *Am J Surg*. 2018;216(3):624-629. <https://doi.org/10.1016/j.amisurg.2018.01.071>
225. Pelayo M, Cebrian D, Areosa A, Agra Y, Izquierdo JV, Buendia F. Effects of online palliative care training on knowledge, attitude and satisfaction of primary care physicians. *BMC Fam Pract*. 2011;12:37. <https://doi.org/10.1186/1471-2296-12-37>
226. Samuelson KW, Koenig CJ, McCamish N, et al. Web-based PTSD training for primary care providers: a pilot study. *Psychol Serv*. 2014;11(2):153-61. <https://doi.org/10.1037/a0034855>
227. Thielmann A, Puth M-T, Weltermann B. Improving knowledge on vaccine storage management in general practices: Learning effectiveness of an online-based program. *Vaccine*. 2020;38(47):7551-7557. <https://doi.org/10.1016/j.vaccine.2020.09.049>
228. Woods JM, Scott HF, Mullan PC, et al. Using an eLearning module to facilitate sepsis knowledge acquisition across multiple institutions and learner disciplines. *Pediatr Emerg Care*. 2021;37(12):31070-e1074. <http://dx.doi.org/10.1097/PEC.0000000000001902>
229. Young KJ, Kim JJ, Yeung G, Sit C, Tobe SW. Physician preferences for accredited online continuing medical education. *J Contin Educ Health Prof*. 2011;31(4):241-6. <https://doi.org/10.1002/chp.20136>
230. Curran VR, Hoekman T, Gulliver W, Landells I, Hatcher L. Web-based continuing medical education (I): field test of a hybrid computer-mediated instructional delivery system. *J Contin Educ Health Prof*. 2000;20(2):97-105. <https://doi.org/10.1002/chp.1340200206>
231. Dubner SJ, Moss AJ, Schapachnik ES, et al. Web-based virtual cardiac symposia: A new approach for worldwide professional medical education. *Ann Noninvasive Electrocardiol*. 2007;12(2):165-170. <http://doi.org/10.1111/j.1542-474X.2007.00156.x>
232. Haller U, Gabathuler H. Telemedical training at the Department of Gynaecology, University Hospital Zurich. *Curr Probl Dermatol*. 2003;32:39-42. <https://doi.org/10.1159/000067376>
233. El-Ghandour NMF, Ezzat AAM, Zaazoue MA, Gonzalez-Lopez P, Jhawar BS, Soliman MAR. Virtual learning during the COVID-19 pandemic: a turning point in neurosurgical education. *Neurosurg Focus*. 2020;49(6):E18. <https://doi.org/10.3171/2020.9.Focus20634>
234. Bitterman JE, Schappert J, Schaefer J. Overcoming remoteness in CME videoteleconferencing: "I want my MD TV.". *J Contin Educ Health Prof*. 2000;20(1):7-12. <https://doi.org/10.1002/chp.1340200103>
235. Burkholder TW, Bellows JW, King RA. Free open access medical education (FOAM) in emergency medicine: the global distribution of users in 2016. *West J Emerg Med*. 2018;19(3):600-605. <https://doi.org/10.5811/westjem.2018.3.36825>
236. Curran V, Fleet L, Simmons K, Ravalia M, Snow P. Exploratory study of rural physicians' self-directed learning experiences in a digital age. *J Contin Educ Health Prof*. 2016;36(4):284-289. <https://doi.org/10.1097/CEH.0000000000000111>
237. de'Angelis N, Gavriilidis P, Martinez-Perez A, et al. Educational value of surgical videos on YouTube: quality assessment of laparoscopic appendectomy videos by senior surgeons vs. novice trainees. *World J Emerg Surg*. 2019;14:22. <https://doi.org/10.1186/s13017-019-0241-6>
238. Della Mea V, Carbone A, Greatti E, Beltrami CA. Introducing videoconferencing into educational oncopathology seminars: technical aspects, user satisfaction and open issues. *J Telemed Telecare*. 2003;9(2):95-8. <https://doi.org/10.1258/135763303321327957>
239. Dhanasekaran K, Babu R, Kumar V, Singh S, Hariprasad R. Factors influencing the retention of participants in online cancer screening training programs in India. *BMC Med Educ*. 2020;20(1):220. <https://doi.org/10.1186/s12909-020-02144-y>
240. Gall JA. Continuing education in forensic medicine: An exercise in distance learning. *J Clin Forensic Med*. 1997;4(3):117-120. [https://doi.org/10.1016/s1353-1131\(97\)90090-0](https://doi.org/10.1016/s1353-1131(97)90090-0)
241. Hadadgar A, Changiz T, Dehghani Z, et al. A theory-based study of factors explaining general practitioners' intention to use and participation in electronic continuing medical education. *J Contin Educ Health Prof*. 2016;36(4):290-294. <https://doi.org/10.1097/CEH.0000000000000123>
242. Kua V, Belii A, Pontone S, Beydon L. Enquête nationale sur la formation médicale continue des anesthésistes-réanimateurs [National survey in France about continuing medical education among anaesthesiologists]. *Ann Fr Anesth Reanim*. 2006;25(2):144-151. <http://doi.org/10.1016/j.annfar.2005.08.024>
243. Llambi L, Margolis A, Toews J, et al. Distance education for physicians: adaptation of a Canadian experience to Uruguay. *J Contin Educ Health Prof*. 2008;28(2):79-85. <https://doi.org/10.1002/chp.161>
244. Misra UK, Kalita J, Mishra SK, Yadav RK. Telemedicine for distance education in neurology: preliminary experience in

- India. *J Telemed Telecare*. 2004;10(6):363-5.  
<https://doi.org/10.1258/1357633042602044>
245. Nasir A, Khader A, Nasir L, Abuzayed I, Seita A. Paediatric continuing medical education needs and preferences of UNRWA physicians in Jordan. *East Mediterr Health J*. 2016;22(1):47-51.
246. Ricci MA, Caputo MP, Callas PW, Gagne M. The use of telemedicine for delivering continuing medical education in rural communities. *Telemed J E Health*. 2005;11(2):124-9.  
<https://doi.org/10.1089/tmj.2005.11.124>
247. Rusatira JC, Tomaszewski B, Dusabejumbo V, et al. Enabling access to medical and health education in Rwanda using mobile technology: needs assessment for the development of mobile medical educator apps. *JMIR Med Educ*. 2016;2(1):e7.  
<https://doi.org/10.2196/mededu.5336>
248. Schoen MJ, Tipton EF, Houston TK, et al. Characteristics that predict physician participation in a Web-based CME activity: the MI-Plus study. *J Contin Educ Health Prof*. 2009;29(4):246-53.  
<https://doi.org/10.1002/chp.20043>
249. Scott KW, Dushime T, Rusanganwa V, Woskie L, Attebery C, Binagwaho A. Leveraging massive open online courses to expand quality of healthcare education to health practitioners in Rwanda. *BMJ Open Qual*. 2019;8(4):e000532.  
<https://doi.org/10.1136/bmj-oq-2018-000532>
250. Gavrin JR. Internet resources for professional continuing education credits in pain and palliative care. *J Pain Palliat Care Pharmacother*. 2006;20(1):37-42.  
[https://doi.org/10.1300/J354v20n01\\_09](https://doi.org/10.1300/J354v20n01_09)
251. Bolderston A, Watson J, Woznitza N, et al. Twitter journal clubs and continuing professional development: an analysis of a #MedRadJClub tweet chat. *Radiography (Lond)*. 2018;24(1):3-8.  
<http://doi.org/10.1016/j.radi.2017.09.005>
252. Curran JA, Murphy AL, Sinclair D, McGrath P. Factors influencing rural and urban emergency clinicians' participation in an online knowledge exchange intervention. *Rural Remote Health*. 2013;13(1):2175.
253. Curran V, Kirby F, Parsons E, Lockyer J. Discourse analysis of computer-mediated conferencing in World Wide Web-based continuing medical education. *J Contin Educ Health Prof*. 2003;23(4):229-38.  
<https://doi.org/10.1002/chp.1340230506>
254. Guan J, Tregonning S, Keenan L. Social interaction and participation: formative evaluation of online CME modules. *J Contin Educ Health Prof*. 2008;28(3):172-9.  
<https://doi.org/10.1002/chp.174>
255. Patelis N, Matheiken SJ, Beard JD. The challenges of developing distance learning for surgeons. *European journal of vascular and endovascular*. 2015;49(3):237-8.  
<https://doi.org/10.1016/j.ejvs.2014.09.001>
256. Pavese P, Coulouma M, Sellier E, Stahl JP, Wintenberger C, Francois P. CD-ROM continuous medical education model for the management of urinary tract infections in family practice. *Med Mal Infect*. 2012;42(7):321-6.  
<https://doi.org/10.1016/j.medmal.2012.05.010>
257. Sandars J, Langlois M. Online learning networks for general practitioners: Evaluation of a pilot project. *Educ Primary Care*. 2005;16(6):688-696.
258. Curran VR, Lockyer J, Kirby F, Sargeant J, Fleet L, Wright D. The nature of the interaction between participants and facilitators in online asynchronous continuing medical education learning environments. *Teach Learn Med*. 2005;17(3):240-5.  
[https://doi.org/10.1207/s15328015tlm1703\\_7](https://doi.org/10.1207/s15328015tlm1703_7)
259. Brace-Govan J, Gabbott M. General practitioners and online continuing professional education: projected understandings. *J Educat Technol Society*. 2004;7(1):51-62.
260. Ogrinc G, Splaine ME, Foster T, Regan-Smith M, Batalden P. Exploring and embracing complexity in a distance-learning curriculum for physicians. *Acad Med*. 2003;78(3):280-5.  
<https://doi.org/10.1097/00001888-200303000-00010>
261. Williams P, Gunter B, Nicholas D. Health education online: issues arising from the development and roll-out of a pilot distance education programme for NHS staff. *Health Educ*. 2006;106(3):210-226.  
<https://doi.org/10.1108/09654280610658550>
262. Pullen D. Doctors online: learning using an Internet based content management system. *Int J Educ Dev Info Comm Technol*. 2013;9(1):50-63.
263. Shah N, Ashraf H, Anwar F, Khan A, Akhtar H, Abro MA. Status of postgraduate training and continuing medical education of family physicians in Pakistan. *Pak J Med Sci*. 2012;28(1):4-8.
264. Al-Sughayr A, Al-Abdulwahhab B, Al-Yemeni M. Primary health care physicians' knowledge, use, and attitude towards online continuous medical education in Saudi Arabia. *Saudi Med J*. 2010;31:1049-53.
265. Sandars J, Walsh K, Homer M. High users of online continuing medical education: a questionnaire survey of choice and approach to learning. *Med Teach*. 2010;32(1):83-5.  
<https://doi.org/10.3109/01421590903199171>
266. Bower EA, Girard DE, Wessel K, Becker TM, Choi D. Barriers to innovation in continuing medical education. *J Contin Educ Health Prof*. 2008;28(3):148-156.  
<https://doi.org/10.1002/chp.176>
267. Naldi L, Manfrini R, Martin L, Deligant C, Dri P. Feasibility of a web-based continuing medical education program in dermatology: the DermoFAD experience in Italy. *Dermatology*. 2006;213(1):6-11.  
<https://doi.org/10.1159/000092830>
268. Innovation, Science, and Economic Development Canada. High-speed access for all: Canada's connectivity strategy (2019).
269. Government of Canada. *National broadband internet service availability map*. Government of Canada. [Internet]. 2021. Available from:  
<https://www.ic.gc.ca/app/sitt/bbmap/hm.html?lang=eng>. [Accessed on March 25, 2021]
270. Pickering JD, Henningsohn L, DeRuiter MC, de Jong PGM, Reinders MEJ. Twelve tips for developing and delivering a massive open online course in medical education. *Med Teach*. 2017;39(7):691-696.  
<https://doi.org/10.1080/0142159X.2017.1322189>
271. Caffarella RS. Viewing cultural barriers as opportunities to enhance learning: an international perspective. *Adult Educ Res Conference*. 2010. Available from:  
<https://newprairiepress.org/aerc/2010/papers/10>. [Accessed Mar 25, 2021].
272. Harris JM, Jr., Novalis-Marine C, Harris RB. Women physicians are early adopters of on-line continuing medical education. *J Contin Educ Health Prof*. 2003;23(4):221-8.  
<https://doi.org/10.1002/chp.1340230505>

273. Brubaker L. Women physicians and the COVID-19 Pandemic. *JAMA*. 2020;324(9):835-836. <https://doi.org/10.1001/jama.2020.14797>
274. Jolly S, Griffith KA, DeCastro R, Stewart A, Ubel P, Jagsi R. Gender differences in time spent on parenting and domestic responsibilities by high-achieving young physician-researchers. *Ann Intern Med*. 2014;160(5):344-353. <https://doi.org/10.7326/M13-0974>
275. Ly DP, Jena AB. Sex differences in time spent on household activities and care of children among US physicians, 2003-2016. *Mayo Clin Proc*. 2018;93(10):1484-1487. <https://doi.org/10.1016/j.mayocp.2018.02.018>
276. Shah S, Diwan S, Kohan L, et al. The technological impact of COVID-19 on the future of education and health care delivery. *Pain Physician*. 2020; 23(4S):S367-S380.
277. Setia S, Tay JC, Chia YC, Subramaniam K. Massive open online courses (MOOCs) for continuing medical education - why and how? *Adv Med Educ Pract*. 2019;10:805-812. <https://doi.org/10.2147/amep.S219104>
278. Ismail II, Abdelkarim A, Al-Hashel JY. Physicians' attitude towards webinars and online education amid COVID-19 pandemic: When less is more. *PLoS One*. 2021;16(4):e0250241. <https://doi.org/10.1371/journal.pone.0250241>
279. Kanneganti A, Sia C-H, Ashokka B, Ooi SBS. Continuing medical education during a pandemic: an academic institution's experience. *Postgrad Med J*. 2020;96(1137):384. <https://doi.org/10.1136/postgradmedj-2020-137840>
280. Duma N, Durani U, Woods CB, et al. Evaluating unconscious bias: Speaker introductions at an international oncology conference. *J Clin Oncol*. 2019;37(15\_suppl):10503-10503. [https://doi.org/10.1200/JCO.2019.37.15\\_suppl.10503](https://doi.org/10.1200/JCO.2019.37.15_suppl.10503)

Published ahead of issue

## Appendix A. Ovid MEDLINE(R) ALL 1991 to April 15, 2021

#	Searches	Results	Type
1	exp Medicine/	115540	Advanced
2	exp Physicians/	148772	Advanced
3	Faculty/	10128	Advanced
4	Faculty, Medical/	13707	Advanced
5	physician?.tw,kf.	410178	Advanced
6	doctor?.tw,kf.	128332	Advanced
7	surgeon?.tw,kf.	214553	Advanced
8	(medical adj2 staff?).tw,kf.	14698	Advanced
9	(medical adj2 personnel?).tw,kf.	7321	Advanced
10	(medical adj2 profession?).tw,kf.	7726	Advanced
11	(medical adj2 facult*).tw,kf.	4886	Advanced
12	(medical adj2 educator?).tw,kf.	2523	Advanced
13	(medical adj2 trainee*).tw,kf.	1538	Advanced
14	(medical adj2 instructor*).tw,kf.	83	Advanced
15	(surgical adj2 staff?).tw,kf.	767	Advanced
16	(surgical adj2 personnel?).tw,kf.	282	Advanced
17	(surgical adj2 profession?).tw,kf.	126	Advanced
18	(surgical adj2 facult*).tw,kf.	320	Advanced
19	(surgical adj2 educator?).tw,kf.	235	Advanced
20	(surgical adj2 trainee?).tw,kf.	1897	Advanced
21	(surgical adj2 instructor*).tw,kf.	17	Advanced
22	(clinical adj2 train*).tw,kf.	8882	Advanced
23	specialist?.tw,kf.	103641	Advanced
24	specialti*.tw,kf.	21519	Advanced
25	or/1-24	1916488	Advanced
26	Education/	21201	Advanced
27	Education, Medical/	57966	Advanced
28	Education, Medical, Continuing/	25093	Advanced
29	Education, Professional, Retraining/	1246	Advanced
30	exp Inservice Training/	29490	Advanced
31	Models, Educational/	10308	Advanced
32	exp Professional Competence/	120048	Advanced
33	Clinical Competence/	96230	Advanced
34	Schools, Medical/	26078	Advanced
35	exp Hospitals, Teaching/	52582	Advanced
36	Hospital Medicine/	226	Advanced
37	exp Teaching/	87776	Advanced
38	Learning/	68021	Advanced
39	(continu* adj5 educat*).tw,kf.	28449	Advanced
40	(medical adj5 educat*).tw,kf.	69502	Advanced
41	(surgical adj5 educat*).tw,kf.	5038	Advanced
42	(model? adj2 educat*).tw,kf.	3279	Advanced
43	(module? adj2 educat*).tw,kf.	1145	Advanced
44	(medical adj2 (retrain* or re-train*)).tw,kf.	16	Advanced
45	(surgical adj2 (retrain* or re-train*)).tw,kf.	6	Advanced
46	(specialist? adj2 (retrain* or re-train*)).tw,kf.	13	Advanced
47	(medical adj2 (recertificat* or re-certificat*)).mp,kw.	16	Advanced
48	(surgical adj2 (recertificat* or re-certificat*)).mp,kw.	3	Advanced
49	(specialist? adj2 (recertificat* or re-certificat*)).mp,kw.	16	Advanced
50	((inservice? or in-service?) adj2 train*).tw,kf.	1846	Advanced
51	(staff? adj2 development?).tw,kf.	2099	Advanced
52	(profession* adj2 development?).tw,kf.	12030	Advanced
53	(profession* adj2 competen*).tw,kf.	3150	Advanced
54	(clinical* adj2 competen*).tw,kf.	4635	Advanced
55	((medical or medicine) adj2 (school? or universit* or institut* or college?)).tw,kf.	117949	Advanced
56	((surgical or surgery) adj2 (school? or universit* or institut* or college?)).tw,kf.	5217	Advanced
57	(hospital? adj2 teaching*).tw,kf.	49098	Advanced



58	(hospital? adj2 (medical or medicine)).tw,kf.	22830	Advanced
59	(continu* adj5 teaching*).tw,kf.	773	Advanced
60	(medical adj5 teaching*).tw,kf.	10793	Advanced
61	(surgical adj5 teaching*).tw,kf.	1977	Advanced
62	(model? adj2 teaching*).tw,kf.	1578	Advanced
63	(module? adj2 teaching*).tw,kf.	555	Advanced
64	(continu* adj5 learning*).tw,kf.	3097	Advanced
65	(medical adj5 learning*).tw,kf.	6428	Advanced
66	(surgical adj5 learning*).tw,kf.	1675	Advanced
67	(model? adj2 learning*).tw,kf.	12055	Advanced
68	(module? adj2 learning*).tw,kf.	1547	Advanced
69	or/26-68	627399	Advanced
70	Education, Distance/	4813	Advanced
71	Educational Technology/	1557	Advanced
72	Virtual Reality/	2666	Advanced
73	Computer-Assisted Instruction/	12077	Advanced
74	Computer User Training/	2034	Advanced
75	Computer Communication Networks/	13655	Advanced
76	Online Systems/	8430	Advanced
77	Internet/	75355	Advanced
78	exp Self-Directed Learning as Topic/	14555	Advanced
79	(educat* adj2 technolog*).tw,kf.	2213	Advanced
80	(distance adj2 educat*).tw,kf.	1198	Advanced
81	(distance adj2 learn*).tw,kf.	1776	Advanced
82	(distance adj2 teach*).tw,kf.	91	Advanced
83	(distance adj2 course?).tw,kf.	261	Advanced
84	(distance adj2 lectur*).tw,kf.	2	Advanced
85	(distance adj2 session?).tw,kf.	51	Advanced
86	(distance adj2 seminar?).tw,kf.	3	Advanced
87	(distance adj2 class*).tw,kf.	600	Advanced
88	(distance adj2 (workshop? or work-shop?)).tw,kf.	9	Advanced
89	(distance adj2 curricul*).tw,kf.	18	Advanced
90	(distance adj2 train*).tw,kf.	612	Advanced
91	((online or on-line) adj2 educat*).tw,kf.	2162	Advanced
92	((online or on-line) adj2 learn*).tw,kf.	2834	Advanced
93	((online or on-line) adj2 teach*).tw,kf.	655	Advanced
94	((online or on-line) adj2 course?).tw,kf.	1564	Advanced
95	((online or on-line) adj2 lectur*).tw,kf.	238	Advanced
96	((online or on-line) adj2 session?).tw,kf.	441	Advanced
97	((online or on-line) adj2 seminar?).tw,kf.	46	Advanced
98	((online or on-line) adj2 class*).tw,kf.	615	Advanced
99	((online or on-line) adj2 (workshop? or work-shop?)).tw,kf.	107	Advanced
100	((online or on-line) adj2 curricul*).tw,kf.	311	Advanced
101	((online or on-line) adj2 train*).tw,kf.	1354	Advanced
102	(computer? adj2 educat*).tw,kf.	622	Advanced
103	(computer? adj2 learn*).tw,kf.	1296	Advanced
104	(computer? adj2 teach*).tw,kf.	311	Advanced
105	(computer? adj2 course?).tw,kf.	169	Advanced
106	(computer? adj2 lectur*).tw,kf.	46	Advanced
107	(computer? adj2 session?).tw,kf.	155	Advanced
108	(computer? adj2 seminar?).tw,kf.	8	Advanced
109	(computer? adj2 class*).tw,kf.	825	Advanced
110	(computer? adj2 (workshop? or work-shop?)).tw,kf.	38	Advanced
111	(computer? adj2 curricul*).tw,kf.	49	Advanced
112	(computer? adj2 train*).tw,kf.	1141	Advanced
113	(digital adj2 educat*).tw,kf.	285	Advanced
114	(digital adj2 learn*).tw,kf.	345	Advanced
115	(digital adj2 teach*).tw,kf.	174	Advanced
116	(digital adj2 course?).tw,kf.	44	Advanced
117	(digital adj2 lectur*).tw,kf.	23	Advanced

118	(digital adj2 session?).tw,kf.	34	Advanced
119	(digital adj2 seminar?).tw,kf.	7	Advanced
120	(digital adj2 class*).tw,kf.	215	Advanced
121	(digital adj2 (workshop? or work-shop?)).tw,kf.	23	Advanced
122	(digital adj2 curricul*).tw,kf.	21	Advanced
123	(digital adj2 train*).tw,kf.	191	Advanced
124	(internet? adj2 educat*).tw,kf.	410	Advanced
125	(internet? adj2 teach*).tw,kf.	78	Advanced
126	(internet? adj2 learn*).tw,kf.	177	Advanced
127	(internet? adj2 course?).tw,kf.	102	Advanced
128	(internet? adj2 lectur*).tw,kf.	24	Advanced
129	(internet? adj2 session?).tw,kf.	52	Advanced
130	(internet? adj2 seminar?).tw,kf.	3	Advanced
131	(internet? adj2 class*).tw,kf.	84	Advanced
132	(internet? adj2 (workshop? or work-shop?)).tw,kf.	20	Advanced
133	(internet? adj2 curricul*).tw,kf.	16	Advanced
134	(internet? adj2 train*).tw,kf.	196	Advanced
135	(web adj2 educat*).tw,kf.	691	Advanced
136	(web adj2 teach*).tw,kf.	191	Advanced
137	(web adj2 learn*).tw,kf.	584	Advanced
138	(web adj2 course?).tw,kf.	250	Advanced
139	(web adj2 lectur*).tw,kf.	41	Advanced
140	(web adj2 session?).tw,kf.	92	Advanced
141	(web adj2 seminar?).tw,kf.	20	Advanced
142	(web adj2 class*).tw,kf.	130	Advanced
143	(web adj2 (workshop? or work-shop?)).tw,kf.	29	Advanced
144	(web adj2 curricul*).tw,kf.	132	Advanced
145	(web adj2 train*).tw,kf.	402	Advanced
146	(video* adj2 educat*).tw,kf.	1781	Advanced
147	(video* adj2 teach*).tw,kf.	708	Advanced
148	(video* adj2 learn*).tw,kf.	420	Advanced
149	(video* adj2 course?).tw,kf.	118	Advanced
150	(video* adj2 lectur*).tw,kf.	404	Advanced
151	(video* adj2 session?).tw,kf.	967	Advanced
152	(video* adj2 seminar?).tw,kf.	24	Advanced
153	(video* adj2 class*).tw,kf.	416	Advanced
154	(video* adj2 (workshop? or work-shop?)).tw,kf.	57	Advanced
155	(video* adj2 curricul*).tw,kf.	56	Advanced
156	(video* adj2 train*).tw,kf.	1217	Advanced
157	(recorded adj2 course?).tw,kf.	325	Advanced
158	(recorded adj2 lectur*).tw,kf.	118	Advanced
159	(recorded adj2 session?).tw,kf.	764	Advanced
160	(recorded adj2 seminar?).tw,kf.	14	Advanced
161	(recorded adj2 class*).tw,kf.	687	Advanced
162	(recorded adj2 (workshop? or work-shop?)).tw,kf.	15	Advanced
163	(recorded adj2 curricul*).tw,kf.	4	Advanced
164	(electronic adj2 educat*).tw,kf.	261	Advanced
165	e-educat*.tw,kf.	52	Advanced
166	(electronic adj2 teach*).tw,kf.	90	Advanced
167	(eteach* or e-teach*).tw,kf.	33	Advanced
168	(electronic adj2 learn*).tw,kf.	340	Advanced
169	(elearn* or e-learn*).tw,kf.	3386	Advanced
170	(electronic adj2 course?).tw,kf.	50	Advanced
171	(ecourse? or e-course?).tw,kf.	47	Advanced
172	(electronic adj2 lectur*).tw,kf.	13	Advanced
173	(electur* or e-lectur*).tw,kf.	15	Advanced
174	(electronic adj2 session?).tw,kf.	34	Advanced
175	(ession? or e-session?).tw,kf.	8	Advanced
176	(electronic adj2 seminar?).tw,kf.	6	Advanced
177	(eseminar? or e-seminar?).tw,kf.	1	Advanced

178	(electronic adj2 class*).tw,kf.	192	Advanced
179	(eclass* or e-class*).tw,kf.	313	Advanced
180	(electronic adj2 (workshop? or work-shop?)).tw,kf.	29	Advanced
181	(eworkshop? or e-workshop?).tw,kf.	5	Advanced
182	(ework-shop? or e-work-shop?).tw,kf.	0	Advanced
183	(electronic adj2 curricul*).tw,kf.	36	Advanced
184	(ecurricul* or e-curricul*).tw,kf.	16	Advanced
185	(electronic adj2 train*).tw,kf.	153	Advanced
186	(etrain* or e-train*).tw,kf.	99	Advanced
187	mobile educat*.tw,kf.	40	Advanced
188	(meducat* or m-educat*).tw,kf.	46	Advanced
189	mobile teach*.tw,kf.	7	Advanced
190	(mteach* or m-teach*).tw,kf.	5	Advanced
191	mobile learn*.tw,kf.	214	Advanced
192	(mlearn* or m-learn*).tw,kf.	82	Advanced
193	mobile course?.tw,kf.	1	Advanced
194	(mcourse? or m-course?).tw,kf.	78	Advanced
195	mobile lectur*.tw,kf.	0	Advanced
196	(mlectur* or m-lectur*).tw,kf.	0	Advanced
197	mobile session?.tw,kf.	9	Advanced
198	(msession? or m-session?).tw,kf.	10	Advanced
199	mobile seminar?.tw,kf.	2	Advanced
200	(mseminar? or m-seminar?).tw,kf.	1	Advanced
201	mobile class*.tw,kf.	18	Advanced
202	(mcalss* or m-class*).tw,kf.	466	Advanced
203	(mobile adj2 (workshop? or work-shop?)).tw,kf.	11	Advanced
204	(mworkshop? or m-workshop?).tw,kf.	0	Advanced
205	(mwork-shop? or m-work-shop?).tw,kf.	0	Advanced
206	mobile curricul*.tw,kf.	1	Advanced
207	(mcurricul* or m-curricul*).tw,kf.	0	Advanced
208	mobile train*.tw,kf.	31	Advanced
209	(mtrain* or m-train*).tw,kf.	55	Advanced
210	(teleeducat* or tele-educat*).tw,kf.	197	Advanced
211	(teleteach* or tele-teach*).tw,kf.	47	Advanced
212	(telelearn* or tele-learn*).tw,kf.	19	Advanced
213	(telecourse? or tele-course?).tw,kf.	8	Advanced
214	(telelectur* or tele-lectur*).tw,kf.	18	Advanced
215	(telesession? or tele-session?).tw,kf.	8	Advanced
216	(teleseminar? or tele-seminar?).tw,kf.	0	Advanced
217	(teleclass* or tele-class*).tw,kf.	3	Advanced
218	(teleworkshop? or tele-workshop?).tw,kf.	0	Advanced
219	(telework-shop? or tele-work-shop?).tw,kf.	0	Advanced
220	(telecurricul* or tele-curricul*).tw,kf.	0	Advanced
221	(teletrain* or tele-train*).tw,kf.	21	Advanced
222	(self-directed adj2 educat*).tw,kf.	203	Advanced
223	(self-directed adj2 teach*).tw,kf.	47	Advanced
224	(self-directed adj2 learn*).tw,kf.	1853	Advanced
225	(self-directed adj2 course?).tw,kf.	28	Advanced
226	(self-directed adj2 lectur*).tw,kf.	12	Advanced
227	(self-directed adj2 session?).tw,kf.	42	Advanced
228	(self-directed adj2 seminar?).tw,kf.	3	Advanced
229	(self-directed adj2 class*).tw,kf.	10	Advanced
230	(self-directed adj2 (workshop? or work-shop?)).tw,kf.	6	Advanced
231	(self-directed adj2 curricul*).tw,kf.	43	Advanced
232	(self-directed adj2 train*).tw,kf.	112	Advanced
233	(non-classroom? or non-classroom?).tw,kf.	14	Advanced
234	webinar?.tw,kf.	872	Advanced
235	virtual*.tw,kf.	138414	Advanced
236	(VR adj2 simulation?).tw,kf.	357	Advanced
237	(technolog* adj2 simulation?).tw,kf.	741	Advanced

238	avatar*.tw,kf.	1437	Advanced
239	second-life?.tw,kf.	279	Advanced
240	or/70-239	270982	Advanced
241	25 and 69 and 240	14257	Advanced
242	(physician? adj3 profession* develop*).tw,kf.	120	Advanced
243	(surgeon? adj3 profession* develop*).tw,kf.	31	Advanced
244	PCPD.tw,kf.	43	Advanced
245	CME-CPD.tw,kf.	48	Advanced
246	(CME adj10 certificat*).tw,kf.	71	Advanced
247	(CME adj10 simulation?).tw,kf.	41	Advanced
248	((online or on-line) adj2 CME).tw,kf.	125	Advanced
249	(computer? adj2 CME).tw,kf.	11	Advanced
250	(digital adj2 CME).tw,kf.	1	Advanced
251	(internet? adj2 CME).tw,kf.	22	Advanced
252	(web adj2 CME).tw,kf.	18	Advanced
253	(teleCME or tele-CME).tw,kf.	0	Advanced
254	(mCME or m-CME).tw,kf.	30	Advanced
255	(eCME or e-CME).tw,kf.	45	Advanced
256	or/241-255	14718	Advanced
257	exp animals/ not (exp animals/ and exp humans/)	4813301	Advanced
258	256 not 257	14677	Advanced
259	limit 258 to (clinical conference or consensus development conference or consensus development conference, nih or news or newspaper article or patient education handout or personal narrative)	81	Advanced
260	258 not 259	14596	Advanced
261	limit 260 to yr="1991 -Current"	13771	Advanced

Published ahead



## Appendix B. Alphabetical list of included articles

*Indicates articles not referenced in the body of the manuscript	
Citation	Publication year
<sup>44</sup> Abawi K, Gertiser L, Idris R, et al. A large-scale Internet/computer-based, training module: dissemination of evidence-based management of postpartum hemorrhage to front-line health care workers. <i>IJEL</i> . 2017;16(4):317-328.	2017
<sup>95</sup> Adler G, Pritchett LR, Kauth MR. Meeting the continuing education needs of rural mental health providers. <i>Telemed J E Health</i> . 2013;19(11):852-6. <a href="https://doi.org/10.1089/tmj.2013.0010">https://doi.org/10.1089/tmj.2013.0010</a>	2013
<sup>114</sup> Allen JW. Surgical Internet at a glance: continuing medical education. <i>Am J Surg</i> . 2001;181(2):89-90. <a href="https://doi.org/10.1016/s0002-9610(00)00570-5">https://doi.org/10.1016/s0002-9610(00)00570-5</a>	2001
<sup>96</sup> Allen M, Sargeant J, MacDougall E, Proctor-Simms M. Videoconferencing for continuing medical education: from pilot project to sustained programme. <i>J Telemed Telecare</i> . 2002;8(3):131-7. <a href="https://doi.org/10.1177/1357633X0200800302">https://doi.org/10.1177/1357633X0200800302</a>	2002
<sup>183</sup> Allen M, Sargeant J, Mann K, Fleming M, Premi J. Videoconferencing for practice-based small-group continuing medical education: feasibility, acceptability, effectiveness, and cost. <i>J Contin Educ Health Prof</i> . 2003;23(1):38-47. <a href="https://doi.org/10.1002/chp.1340230107">https://doi.org/10.1002/chp.1340230107</a>	2003
<sup>201</sup> Allison JJ, Kiefe CI, Wall T, et al. Multicomponent Internet continuing medical education to promote chlamydia screening. <i>Am J Prev Med</i> . 2005;28(3):285-90. <a href="https://doi.org/10.1016/j.amepre.2004.12.013">https://doi.org/10.1016/j.amepre.2004.12.013</a>	2005
<sup>26</sup> Al-Sughayr A, Al-Abdulwahhab B, Al-Yemeni M. Primary health care physicians' knowledge, use, and attitude towards online continuous medical education in Saudi Arabia. <i>Saudi Med J</i> . 2010;31:1049-53.	2010
*Anthes DL, Berry RE, Lanning A. Internet resources for family physicians. <i>Can Fam Physician</i> . 1997;43:1104-1113.	1997
<sup>155</sup> Anthierens S, Tonkin-Crine S, Douglas E, et al. General practitioners' views on the acceptability and applicability of a web-based intervention to reduce antibiotic prescribing for acute cough in multiple European countries: a qualitative study prior to a randomised trial. <i>BMC Fam Pract</i> . 2012;13:101. <a href="https://doi.org/10.1186/1471-2296-13-101">https://doi.org/10.1186/1471-2296-13-101</a>	2012
<sup>93</sup> Archibald D, Burns JK, Fitzgerald M, Merkley VF. Aligning practice data and institution-specific CPD: medical quality management as the driver for an elearning development process. <i>J Eur CME</i> . 2020;9(1):1754120. <a href="https://doi.org/10.1080/21614083.2020.1754120">https://doi.org/10.1080/21614083.2020.1754120</a>	2020
*Asfar T, Lee DJ, Lam BL, et al. Evaluation of a Web-Based Training in Smoking Cessation Counseling Targeting U.S. Eye-Care Professionals. <i>Health Educ Behav</i> . 2018;45(2):181-9.	2018
<sup>55</sup> Bagayoko CO, Perrin C, Gagnon M-P, Geissbuhler A. Continuing distance education: a capacity-building tool for the de-isolation of care professionals and researchers. <i>J Gen Intern Med</i> . 2013;28Suppl 3:S666-70. <a href="https://doi.org/10.1007/s11606-013-2522-1">https://doi.org/10.1007/s11606-013-2522-1</a>	2013
*Barteit S, Jahn A, Banda SS, et al. E-Learning for Medical Education in Sub-Saharan Africa and Low-Resource Settings: Viewpoint. <i>J Med Internet Res</i> . 2019;21(1):e12449.	2019
Bashook PG, Parboosingh J. Recertification and the maintenance of competence. <i>BMJ</i> . 1998;316(7130):545-8.	1998
<sup>156</sup> Bassey IE, Ekanem IA, Olasode BJ, Jombo GTA. Web-based learning as an important bridge in information divide in contemporary practice of pathology in the developing world: findings from Nigeria. <i>Internet J Third World Med</i> . 2010;8(2)	2010
<sup>157</sup> Bellande BJ. The future of CME. <i>South Med J</i> . 1991;84(8):1007-11. <a href="https://doi.org/10.1097/00007611-199108000-00014">https://doi.org/10.1097/00007611-199108000-00014</a>	1991
<sup>75</sup> Bermejo-Caja CJ, Koatz D, Orrego C, et al. Acceptability and feasibility of a virtual community of practice to primary care professionals regarding patient empowerment: a qualitative pilot study. <i>BMC Health Serv Res</i> . 2019;19(1):403.	2019
<sup>24</sup> Bhargava S, Farabi B, Rathod D, Singh AK. The fate of major dermatology conferences and meetings of 2020: are e-conferences and digital learning the future? <i>Clin Exp Dermatol</i> . 2020;45(6):759-761. <a href="https://doi.org/10.1111/ced.14272">https://doi.org/10.1111/ced.14272</a>	2020
<sup>234</sup> Bitterman JE, Schappert J, Schaefer J. Overcoming remoteness in CME videoteleconferencing: "I want my MD TV." <i>J Contin Educ Health Prof</i> . 2000;20(1):7-12. <a href="https://doi.org/10.1002/chp.1340200103">https://doi.org/10.1002/chp.1340200103</a>	2000
<sup>56</sup> Boatin A, Ngonzi J, Bradford L, Wylie B, Goodman A. Teaching by teleconference: a model for distance medical education across two continents. <i>Open J Obstet Gynecol</i> . 2015;5(13):754-761. <a href="https://doi.org/10.4236/ojog.2015.513106">https://doi.org/10.4236/ojog.2015.513106</a>	2015
<sup>253</sup> Bolderston A, Watson J, Woznitza N, et al. Twitter journal clubs and continuing professional development: an analysis of a #MedRadJClub tweet chat. <i>Radiography</i> . 2018;24(1):3-8. <a href="http://doi.org/10.1016/j.radi.2017.09.005">http://doi.org/10.1016/j.radi.2017.09.005</a>	2018
<sup>45</sup> Bollinger RC, McKenzie-White J, Gupta A. Building a global health education network for clinical care and research. The benefits and challenges of distance learning tools. Lessons learned from the Hopkins Center for Clinical Global Health Education. <i>Infect Dis Clin North Am</i> . 2011;25(2):385-98. <a href="https://doi.org/10.1016/j.idc.2011.02.006">https://doi.org/10.1016/j.idc.2011.02.006</a>	2011
<sup>7</sup> Bonawitz R, Bird L, Le NB, et al. Implementing the mobile continuing medical education (mCME) project in Vietnam: making it work and sharing lessons learned. <i>Mhealth</i> . 2019;5:7. <a href="https://doi.org/10.21037/mhealth.2019.02.01">https://doi.org/10.21037/mhealth.2019.02.01</a>	2019
<sup>154</sup> Bond SE, Crowther SP, Adhikari S, et al. Design and implementation of a novel web-based e-learning tool for education of health professionals on the antibiotic Vancomycin. <i>J Med Internet Res</i> . 2017;19(3):e93. <a href="https://doi.org/10.2196/jmir.6971">https://doi.org/10.2196/jmir.6971</a>	2017
<sup>159</sup> Bonevski B, Magin P, Horton G, Bryant J, Randell M, Kimlin MG. An internet based approach to improve general practitioners' knowledge and practices: the development and pilot testing of the "ABC's of vitamin D" program. <i>Int J Med Inform</i> . 2015;84(6):413-22. <a href="https://doi.org/10.1016/j.ijmedinf.2015.01.006">https://doi.org/10.1016/j.ijmedinf.2015.01.006</a>	2015
<sup>202</sup> Bos-Bonnie LHA, van Bergen JEAM, Te Pas E, Kijser MA, van Dijk N. Effectiveness of an individual, online e-learning program about sexually transmitted infections: a prospective cohort study. <i>BMC Fam Pract</i> . 2017;18(1):57. <a href="https://doi.org/10.1186/s12875-017-0625-1">https://doi.org/10.1186/s12875-017-0625-1</a>	2017
<sup>266</sup> Bower EA, Girard DE, Wessel K, Becker TM, Choi D. Barriers to innovation in continuing medical education. <i>J Contin Educ Health Prof</i> . 2008;28(3):148-156. <a href="https://doi.org/10.1002/chp.176">https://doi.org/10.1002/chp.176</a>	2008
<sup>259</sup> Brace-Govan J, Gabbott M. General practitioners and online continuing professional education: projected understandings. <i>J Educt Technol Society</i> . 2004;7(1):51-62.	2004
*Brands B, Chomtho S, Suthutvoravut U, et al. Early Nutrition eAcademy Southeast asia e-Learning for enhancing knowledge on nutrition during the first 1000days of life. <i>Nutrients</i> . 2020;12(6):1817.	2020
*Bundy DG, Morawski LF, Lazoric S, Bradbury S, Kamachi K, Suresh GK. Education in quality improvement for pediatric practice: an online program to teach clinicians QI. <i>Acad Pediatr</i> . 2014;14(5):517-525.	2014

<sup>160</sup> Burgos F, Disdier C, De Santamaria EL, et al. Telemedicine enhances quality of forced spirometry in primary care. <i>Eur Respir J</i> . 2012;39(6):1313-1318. <a href="http://doi.org/10.1183/09031936.00168010">http://doi.org/10.1183/09031936.00168010</a>	2012
<sup>235</sup> Burkholder TW, Bellows JW, King RA. Free open access medical education (FOAM) in emergency medicine: the global distribution of users in 2016. <i>West J Emerg Med</i> . 2018;19(3):600-605. <a href="https://doi.org/10.5811/westjem.2018.3.36825">https://doi.org/10.5811/westjem.2018.3.36825</a>	2018
<sup>57</sup> Butterworth K, Hayes B, Zimmerman M, Knoble S. Needs assessment for continuing medical education in Nepal. <i>Med Teach</i> . 2009;31(5):463. <a href="http://doi.org/10.1080/01421590903051315">http://doi.org/10.1080/01421590903051315</a>	2009
*Butzlaff M, Koneczny N, Floer B, et al. Primary care physicians, internet and new knowledge. Utilization and efficiency of new educational media. <i>Medizinische Klinik</i> . 2002;97(7):383-8.	2002
<sup>184</sup> Butzlaff M, Telzerow A, Lange S, Krüger N. Ärzte, Internet und neues Wissen. Nutzung und Effizienz von neuen Weiterbildungsmedien im Krankenhaus [Physicians, internet and new knowledge. Utilization and efficiency of new continuing education media in the hospital]. <i>Med Klin (Munich)</i> . 2001;96(6):309-320. <a href="https://doi.org/10.1007/pl00002211">https://doi.org/10.1007/pl00002211</a>	2001
<sup>203</sup> Calabro GE, Tognetto A, Mazzaccara A, et al. Scienze omiche e capacity building dei professionisti sanitari: corso di formazione a distanza per i medici italiani [Omic sciences and capacity building of health professionals: a distance learning training course for Italian physicians, 2017-2018]. <i>Ig Sanita Pubbl</i> . 2019;75(2):105-124.	2021
<sup>58</sup> Callas PW, Ricci MA, Caputo MP. Improved rural provider access to continuing medical education through interactive videoconferencing. <i>Telemed J E Health</i> . 2000;6(4):393-9. <a href="https://doi.org/10.1089/15305620050503861">https://doi.org/10.1089/15305620050503861</a>	2000
<sup>6</sup> Canchihuaman FA, Garcia PJ, Gloyd SS, Holmes KK. An interactive internet-based continuing education course on sexually transmitted diseases for physicians and midwives in Peru. <i>PLoS One</i> . 2011;6(5):e19318. <a href="https://doi.org/10.1371/journal.pone.0019318">https://doi.org/10.1371/journal.pone.0019318</a>	2011
<sup>161</sup> Carrizosa J, Braga P, Albuquerque M, et al. Epilepsy for primary health care: a cost-effective Latin American E-learning initiative. <i>Epileptic Disord</i> . 2018;20(5):386-395. <a href="https://doi.org/10.1684/epd.2018.0997">https://doi.org/10.1684/epd.2018.0997</a>	2018
<sup>204</sup> Carroll JC, Grad R, Allanson JE, et al. The Gene Messenger Impact Project: an Innovative Genetics Continuing Education Strategy for Primary Care Providers. <i>J Contin Educ Health Prof</i> . 2016;36(3):178-85. <a href="https://doi.org/10.1097/CEH.0000000000000079">https://doi.org/10.1097/CEH.0000000000000079</a>	2016
<sup>185</sup> Casanova Dias M, Giacco D, Hanon C. Early career psychiatrists' preferences on e-learning: Viewpoint from the EPA Committee on Education. <i>Eur Psychiatry</i> . 2017;42:86-88. <a href="http://doi.org/10.1016/j.eurpsy.2016.12.003">http://doi.org/10.1016/j.eurpsy.2016.12.003</a>	2017
<sup>175</sup> Casebeer L, Allison J, Spettell CM. Designing tailored Web-based instruction to improve practicing physicians' chlamydia screening rates. <i>Acad Med</i> . 2002;77(9):929. <a href="https://doi.org/10.1097/00001888-200209000-00032">https://doi.org/10.1097/00001888-200209000-00032</a>	2002
<sup>205</sup> Casebeer L, Andolsek K, Abdolrasulnia M, et al. Evaluation of an online bioterrorism continuing medical education course. <i>J Contin Educ Health Prof</i> . 2006;26(2):137-44. <a href="https://doi.org/10.1002/chp.62">https://doi.org/10.1002/chp.62</a>	2006
<sup>206</sup> Casebeer L, Brown J, Roepke N, et al. Evidence-based choices of physicians: a comparative analysis of physicians participating in Internet CME and non-participants. <i>BMC Med Educ</i> . 2010;10:42. <a href="https://doi.org/10.1186/1472-6920-10-42">https://doi.org/10.1186/1472-6920-10-42</a>	2010
<sup>8</sup> Casebeer L, Engler S, Bennett N, et al. A controlled trial of the effectiveness of internet continuing medical education. <i>BMC Med</i> . 2008;6:37. <a href="https://doi.org/10.1186/1741-7015-6-37">https://doi.org/10.1186/1741-7015-6-37</a>	2008
<sup>207</sup> Casebeer LL, Strasser SM, Spettell CM, et al. Designing tailored Web-based instruction to improve practicing physicians' preventive practices. <i>J Med Internet Res</i> . 2003;5(3):e20. <a href="https://doi.org/10.2196/jmir.5.3.e20">https://doi.org/10.2196/jmir.5.3.e20</a>	2003
<sup>162</sup> Cates JR, Diehl SJ, Fuehmeler BF, et al. Toward Optimal Communication About HPV Vaccination for Preteens and Their Parents: Evaluation of an Online Training for Pediatric and Family Medicine Health Care Providers. <i>J Public Health Manag Pract</i> . 2020;26(2):159-167. <a href="https://doi.org/10.1097/phh.0000000000001022">https://doi.org/10.1097/phh.0000000000001022</a>	2020
*Chan TM, Thoma B, Lin M. Creating, curating, and sharing online faculty development resources: the medical education in cases series experience. <i>Academic Med</i> . 2015;90(6):785-9.	2015
<sup>163</sup> Chandrasekaran A, Thukral A, Deorari AK. E-learning in newborn health - a paradigm shift for continuing professional development for doctors and nurses. <i>Indian J Pediatr</i> . 2014;81(12):1376-1380. <a href="https://doi.org/10.1007/s12098-014-1362-2">https://doi.org/10.1007/s12098-014-1362-2</a>	2014
<sup>97</sup> Chao J. Continuing medical education software: a comparative review. <i>J Fam Pract</i> . 1992;34(5):598-604.	1992
<sup>98</sup> Chatziralli I, Ventura CV, Touhami S, et al. Transforming ophthalmic education into virtual learning during COVID-19pandemic: a global perspective. <i>Eye (Lon)</i> . 2021;35(5):1459-1466. <a href="https://doi.org/10.1038/s41433-020-1080-0">https://doi.org/10.1038/s41433-020-1080-0</a>	2020
<sup>146</sup> Chen HS, Guo FR, Chen CY, Chen JH, Kuo TS. Review of telemedicine projects in Taiwan. <i>Int J Med Inform</i> . 2001;61(2-3):117-29. <a href="https://doi.org/10.1016/s1386-5056(01)00134-4">https://doi.org/10.1016/s1386-5056(01)00134-4</a>	2001
<sup>115</sup> Chen T-H, Buenconsejo-Lum LE, Braun KL, Higa C, Maskarinec GG. A pilot evaluation of distance education modalities for health workers in the U.S.-Affiliated Pacific Islands. <i>Pac Health Dialog</i> . 2007;14(1):22-30.	2007
<sup>164</sup> Chio KS. Effective Practices in Providing Online, In-Service Training to Health Professionals in Low-Resource Settings. <i>Inter J Train Dev</i> . 2012;16(3):228-234.	2012
<sup>99</sup> Cho MJ, Hong JP. The emergence of virtual education during the COVID-19pandemic: the past, present, and future of the plastic surgery education. <i>J Plast Reconstr Aesthet Surg</i> . 2021;74(6):1413-1421. <a href="https://doi.org/10.1016/j.bjps.2020.12.099">https://doi.org/10.1016/j.bjps.2020.12.099</a>	2021
<sup>208</sup> Choi Y, Peairs KS, Sateja HF, Riddell R, Zhang C, McGuire MJ. High value care in cancer surveillance and screening: evaluating an e-curriculum for primary care providers. <i>J Cancer Educ</i> . 2021. <a href="https://doi.org/10.1007/s13187-021-01986-4">https://doi.org/10.1007/s13187-021-01986-4</a>	2021
*Chung S, Mandl KD, Shannon M, Fleisher GR. Efficacy of an educational Web site for educating physicians about bioterrorism. <i>Acad Emerg Med</i> . 2004;11(2):143-8.	2004
<sup>134</sup> Comer A, Harris AD, Shardell M, et al. Web-based training improves knowledge about central line bloodstream infections. <i>Infect Control Hosp Epidemiol</i> . 2011;32(12):1219-1222. <a href="https://doi.org/10.1086/662585">https://doi.org/10.1086/662585</a>	2011
*Cook DA, Blachman MJ, Price DW, et al. Educational technologies for physician continuous professional development: a national survey. <i>Acad Med</i> . 2018;93(1):104-112.	2018
<sup>186</sup> Crandall LA, Coggan JM. Impact of new information technologies on training and continuing education for rural health professionals. <i>J Rural Health</i> . 1994;10(3):208-15. <a href="https://doi.org/10.1111/j.1748-0361.1994.tb00231.x">https://doi.org/10.1111/j.1748-0361.1994.tb00231.x</a>	1994
*Crenshaw K, Curry W, Salanitro AH, et al. Is physician engagement with Web-based CME associated with patients' baseline hemoglobin A1c levels? The rural diabetes online care study. <i>Acad Med</i> . 2010;85(9):1511-1517.	2010

- <sup>236</sup>Curran V, Fleet L, Simmons K, Ravalía M, Snow P. Exploratory study of rural physicians' self-directed learning experiences in a digital age. *J Contin Educ Health Prof.* 2016;36(4):284-289. <https://doi.org/10.1097/CEH.0000000000000111> 2016
- <sup>59</sup>Curran V, Kirby F, Allen M, Sargeant J. A mixed learning technology approach for continuing medical education. *Med Educ Online.* 2003;8(1):4341. <https://doi.org/10.3402/meo.v8i.4341> 2003
- <sup>60</sup>Curran V, Kirby F, Allen M, Sargeant J. A mixed learning technology strategy for providing continuing medical education to rural physicians. *J Telemed Telecare.* 2003;9(5):305-7. <https://doi.org/10.1258/135763303769211364> 2003
- <sup>253</sup>Curran V, Kirby F, Parsons E, Lockyer J. Discourse analysis of computer-mediated conferencing in World Wide Web-based continuing medical education. *J Contin Educ Health Prof.* 2003;23(4):229-38. <https://doi.org/10.1002/chp.1340230506> 2003
- <sup>136</sup>Curran V, Kirby F, Parsons E, Lockyer J. Short report: satisfaction with on-line CME. Evaluation of the ruralMDcme website. *Can Fam Physician.* 2004;50:271-4. 2004
- <sup>61</sup>Curran V, Lockyer J, Sargeant J, Fleet L. Evaluation of learning outcomes in Web-based continuing medical education. *Acad Med.* 2006;81(10Suppl):S30-S34. <https://doi.org/10.1097/01.ACM.0000236509.32699.f5> 2006
- <sup>62</sup>Curran VR, Fleet L, Kirby F. Factors influencing rural health care professionals' access to continuing professional education. *Aust J Rural.* 2006;14(2):51-5. <https://doi.org/10.1111/j.1440-1584.2006.00763.x> 2006
- <sup>209</sup>Curran VR, Fleet L, Kirby F. A comparative evaluation of the effect of Internet-based CME delivery format on satisfaction, knowledge and confidence. *BMC Med Educ.* 2010;10:10. <https://doi.org/10.1186/1472-6920-10-10> 2010
- <sup>230</sup>Curran VR, Hoekman T, Gulliver W, Landells I, Hatcher L. Web-based continuing medical education (I): field test of a hybrid computer-mediated instructional delivery system. *J Contin Educ Health Prof.* 2000;20(2):97-105. <https://doi.org/10.1002/chp.1340200206> 2000
- <sup>33</sup>Curran VR, Hoekman T, Gulliver W, Landells I, Hatcher L. Web-based continuing medical education. (II): Evaluation study of computer-mediated continuing medical education. *J Contin Educ Health Prof.* 2000;20(2):106-19. <https://doi.org/10.1002/chp.1340200207> 2000
- <sup>258</sup>Curran VR, Lockyer J, Kirby F, Sargeant J, Fleet L, Wright D. The nature of the interaction between participants and facilitators in online asynchronous continuing medical education learning environments. *Teach Learn Med.* 2005;17(3):240-5. [https://doi.org/10.1207/s15328015tlm1703\\_7](https://doi.org/10.1207/s15328015tlm1703_7) 2005
- \*Dae-Jung C, Young-Sung LEE, Eung-Do KIM, Dong-Ki AHN, Byung-Joon S. Awareness Assessment on Continuing Medical Education in Korean Orthopaedic Society. *J Kor Orthoped Assoc.* 2014;49:214-22. 2014
- <sup>63</sup>Datta C. The rise of e-learning and opportunities for Indian family physicians. *J Family Med Prim Care.* 2012;1(1):7-9. <https://doi.org/10.4103/2249-4863.94441> 2012
- <sup>116</sup>Davis P, McCracken P. Restructuring rural continuing medical education through videoconferencing. *J Telemed Telecare.* 2002;8Suppl 2:108-9. <https://doi.org/10.1177/1357633X020080S249> 2002
- <sup>64</sup>de Carvalho Mesquita K, da Silva JA, Igreja ACdSM. Aplicabilidade da educação a distância na educação médica continuada. *Brasília Med.* 2012;49(2):111-117 2012
- <sup>237</sup>de'Angelis N, Gavriilidis P, Martinez-Perez A, et al. Educational value of surgical videos on YouTube: quality assessment of laparoscopic appendectomy videos by senior surgeons vs. novice trainees. *World J Emerg Surg.* 2019;14:22. <https://doi.org/10.1186/s13017-019-0241-6> 2019
- <sup>65</sup>DeLacy FB, Nehme J, Lacy AM, Chand M. Educational technology: revolutionizing surgical education. *Br J Hosp Med (Lond).* 2017;78(8):426-427. <https://doi.org/10.12968/hmed.2017.78.8.426> 2017
- <sup>137</sup>Della Corte F, La Mura F, Petrino R. E-learning as educational tool in emergency and disaster medicine teaching. *Minerva Anestesiol.* 2005;71(5):181-95. 2005
- <sup>238</sup>Della Mea V, Carbone A, Greatti E, Beltrami CA. Introducing videoconferencing into educational oncopathology seminars: technical aspects, user satisfaction and open issues. *J Telemed Telecare.* 2003;9(2):95-8. <https://doi.org/10.1258/135763303321327957> 2003
- <sup>239</sup>Dhanasekaran K, Babu R, Kumar V, Singh S, Hariprasad R. Factors influencing the retention of participants in online cancer screening training programs in India. *BMC Med Educ.* 2020;20(1):220. <https://doi.org/10.1186/s12909-020-02144-y> 2020
- <sup>117</sup>Diehl LA, Souza RM, Gordan PA, Esteves RZ, Coelho IC. InsuOnline, an Electronic Game for Medical Education on Insulin Therapy: a Randomized Controlled Trial With Primary Care Physicians. *J Med Internet Res.* 2017;19(3):e72. <https://doi.org/10.2196/jmir.6944> 2017
- <sup>66</sup>Dinh M, Tan T, Bein K, Hayman J, Wong YK, Dinh D. Emergency department knowledge management in the age of Web 2.0: Evaluation of a new concept. *Emerg Med Australas.* 2011;23(1):46-53. <https://doi.org/10.1111/j.1742-6723.2010.01373.x> 2011
- <sup>229</sup>Dubner SJ, Moss AJ, Schapachnik ES, et al. Web-based virtual cardiac symposia: a new approach for worldwide professional medical education. *Ann Noninvasive Electrocardiol.* 2007;12(2):165-170. <http://doi.org/10.1111/j.1542-474X.2007.00156.x> 2007
- <sup>67</sup>Dufour JC, Cuggia M, Soula G, Spector M, Kohler F. An integrated approach to distance learning with digital video in the French-speaking Virtual Medical University. *Int J Med Inform.* 2007;76(5-6):369-376. <http://doi.org/10.1016/j.ijmedinf.2007.01.011> 2007
- \*Edwards RA, Colchamiro R, Tolan E, et al. Online continuing education for expanding clinicians' roles in breastfeeding support. *J Hum Lact.* 2015;31(4):582-586. 2015
- <sup>233</sup>El-Ghandour NMF, Ezzat AAM, Zaazoue MA, Gonzalez-Lopez P, Jhawar BS, Soliman MAR. Virtual learning during the COVID-19 pandemic: a turning point in neurosurgical education. *Neurosurg Focus.* Dec 2020;49(6):E18. <https://doi.org/10.3171/2020.9.Focus20634> 2020
- <sup>32</sup>Farokhi MR, Zarifanaiey N, Haghighi F, Mehrabi M. E-learning or in-person approaches in continuous medical education: a comparative study. *IIOAB J.* 2016;7(Supplement2):472-6. 2016
- \*Farooq S. Continuing professional development for psychiatrists in developing countries. *Advances in Psychiatric Treatment.* 2003;9(3):161-3. 2003
- <sup>118</sup>Feldacker C, Jacob S, Chung MH, Nartker A, Kim HN. Experiences and perceptions of online continuing professional development among clinicians in sub-Saharan Africa. *Hum Resour Health.* 2017;15(1):89. <https://doi.org/10.1186/s12960-017-0266-4> 2017

*Folkl A, Chan T, Blau E. Use of free, open access medical education and perceived emergency medicine educational needs among rural physicians in Southwestern Ontario. <i>Cureus</i> . 2016;8(9):e796.	2016
*Ford CR, Sawyer P, Brown CJ. Utilizing geriatrics-focused web-based continuing education to reach practitioners in rural practice. <i>TechTrends: Linking Research and Practice to Improve Learning</i> . 2018;62(3):286-95.	2018
<sup>12</sup> Fordis M, King JE, Ballantyne CM, et al. Comparison of the Instructional Efficacy of Internet-Based CME With Live Interactive CME Workshops: A Randomized Controlled Trial. <i>JAMA</i> . 2005;294(9):1043-1051. <a href="https://doi.org/10.1001/jama.294.9.1043">https://doi.org/10.1001/jama.294.9.1043</a>	2005
*Frush K, Hohenhaus S, Luo X, Gerardi M, Wiebe RA. Evaluation of a Web-based education program on reducing medication dosing error: a multicenter, randomized controlled trial. <i>Pediatr Emerg Care</i> . 2006;22(1):62-70.	2006
<sup>210</sup> Gagnon M-P, Legare F, Labrecque M, Fremont P, Cauchon M, Desmartis M. Perceived barriers to completing an e-learning program on evidence-based medicine. <i>Inform Prim Care</i> . 2007;15(2):83-91. <a href="https://doi.org/10.14236/jhi.v15i2.646">https://doi.org/10.14236/jhi.v15i2.646</a>	2007
<sup>240</sup> Gall JA. Continuing education in forensic medicine: an exercise in distance learning. <i>J Clin Forensic Med</i> . 1997;4(3):117-120. <a href="https://doi.org/10.1016/s1353-1131(97)90090-0">https://doi.org/10.1016/s1353-1131(97)90090-0</a>	1997
<sup>211</sup> Gallardo-Rincon H, Saucedo-Martinez R, Mujica-Rosales R, et al. Online continuing medical education as a key link for successful noncommunicable disease self-management: the CASALUD TM Model. <i>Diabetes Metab Syndr Obes</i> . 2017;10:443-455. <a href="https://doi.org/10.2147/DMSO.S137891">https://doi.org/10.2147/DMSO.S137891</a>	2017
<sup>34</sup> Gandsas A, McIntire K. Internet and continuing medical education. <i>Minim Invasive Ther Allied Technol</i> . 2002;11(2):35-6. <a href="https://doi.org/10.1080/136457002753632420">https://doi.org/10.1080/136457002753632420</a>	2002
<sup>250</sup> Gavrin JR. Internet resources for professional continuing education credits in pain and palliative care. <i>J Pain Palliat Care Pharmacother</i> . 2006;20(1):37-42. <a href="https://doi.org/10.1300/J354v20n01_09">https://doi.org/10.1300/J354v20n01_09</a>	2006
<sup>147</sup> Geissbuhler A, Bagayoko CO, Ly O. The RAFT network: 5years of distance continuing medical education and tele-consultations over the Internet in French-speaking Africa. <i>Inte J Med Inform</i> . 2007;76(5-6):351-6. <a href="https://doi.org/10.1016/j.ijmedinf.2007.01.012">https://doi.org/10.1016/j.ijmedinf.2007.01.012</a>	2007
*Geraghty JG, Young HL. Continuing medical education by satellite: implications for oncology education. <i>Eur J Cancer Care (Engl)</i> . 1999;8(1):48-50.	1999
<sup>148</sup> Gerbert B, Bronstone A, Maurer T, Berger T, McPhee SJ, Caspers N. The effectiveness of an Internet-based tutorial in improving primary care physicians' skin cancer triage skills. <i>J Cancer Educ</i> . 2002;17(1):7-11. <a href="https://doi.org/10.1080/08858190209528784">https://doi.org/10.1080/08858190209528784</a>	2002
<sup>100</sup> Ghanem O, Logghe HJ, Tran BV, Huynh D, Jacob B. Closed Facebook™ groups and CME credit: a new format for continuing medical education. <i>Surg Endosc</i> . 2019;33(2):587-591. <a href="https://doi.org/10.1007/s00464-018-6376-9">https://doi.org/10.1007/s00464-018-6376-9</a>	2019
<sup>143</sup> Gill CJ, Le NB, Halim N, et al. mCME project V.2.0: randomised controlled trial of a revised SMS-based continuing medical education intervention among HIV clinicians in Vietnam. <i>BMJ Glob Health</i> . 2018;3(1):e000632. <a href="https://doi.org/10.1136/bmjgh-2017-000632">https://doi.org/10.1136/bmjgh-2017-000632</a>	2018
<sup>185</sup> Gjersvik PJ, Nylenna M, Aasland OG. [How do Norwegian dermatologists keep themselves professionally updated?]. <i>Hvordan holder norske hudleger seg faglig oppdatert? Tidsskr Nor Laegeforen</i> . 2001;121(30):3515-8.	2001
<sup>149</sup> Goodyear-Smith F, Whitehorn M, McCormick R. Experiences and preferences of general practitioners regarding continuing medical education: a qualitative study. <i>N Z Med J</i> . 2003;116(1172):U399.	2003
*Gorrindo T, Goldfarb E, Birnbaum RJ, et al. Simulation-based ongoing professional practice evaluation in psychiatry: a novel tool for performance assessment. <i>Jt Comm J Qual Patient Saf</i> . 2013;39(7):319-323.	2013
*Gravas S, Ahmad M, Hernández-Porras A, et al. Impact of COVID-19 on medical education: introducing homo digitalis. <i>World J Urol</i> . 2021;39(6):1997-2003.	2020
<sup>35</sup> Greenberg JA, Schwarz E, Paige J, Dort J, Bachman S. At-home hands-on surgical training during COVID19: proof of concept using a virtual telementoring platform. <i>Surg Endosc</i> . 2021;35(5):1963-1969. <a href="https://doi.org/10.1007/s00464-021-08470-6">https://doi.org/10.1007/s00464-021-08470-6</a>	2021
<sup>102</sup> Greenwood J, Williams R. Continuing professional development for Australian rural psychiatrists by videoconference. <i>Australas Psychiatry</i> . 2008;16(4):273-6. <a href="https://doi.org/10.1080/10398560801982994">https://doi.org/10.1080/10398560801982994</a>	2008
<sup>254</sup> Guan J, Tregonning S, Keenan L. Social interaction and participation: formative evaluation of online CME modules. <i>J Contin Educ Health Prof</i> . 2008;28(3):172-9. <a href="https://doi.org/10.1002/chp.174">https://doi.org/10.1002/chp.174</a>	2008
<sup>119</sup> Gupta MP, Sridhar J, Wykoff CC, Yonekawa Y. Ophthalmology conferences in the coronavirus disease 2019 era. <i>Current opinion in ophthalmology</i> . 2020;31(5):396-402. <a href="https://doi.org/10.1097/ICU.0000000000000688">https://doi.org/10.1097/ICU.0000000000000688</a>	2020
<sup>241</sup> Hadadgar A, Changiz T, Dehghani Z, et al. A Theory-Based Study of Factors Explaining General Practitioners' Intention to Use and Participation in Electronic Continuing Medical Education. <i>J Contin Educ Health Prof</i> . 2016;36(4):290-294. <a href="https://doi.org/10.1097/CEH.0000000000000123">https://doi.org/10.1097/CEH.0000000000000123</a>	2016
*Hadadgar A, Changiz T, Kononowicz AA, et al. Creating and validating e-cases as educational tools in general practitioners' continuing medical education context. <i>Bio-Algorithms and Med-Systems</i> . 2018;14(1):20170027.	2018
*Hajjar IM, Ruiz JG, Teasdale TA, Mintzer MJ. The use of the internet in geriatrics education: results of a national survey of medical geriatrics academic programs. <i>Gerontol Geriatr Educ</i> . 2007;27(4):85-95.	2007
<sup>232</sup> Haller U, Gabathuler H. Telemedical training at the Department of Gynaecology, University Hospital Zurich. <i>Curr Probl Dermatol</i> . 2003;32:39-42. <a href="https://doi.org/10.1159/000067376">https://doi.org/10.1159/000067376</a>	2003
<sup>212</sup> Hampton CL, Mazmanian PE, Smith TJ. The interactive videoconference: an effective CME delivery system. <i>J Contin Educ Health Prof</i> . 1994;14(2):83-89. <a href="https://doi.org/10.1002/chp.4750140204">https://doi.org/10.1002/chp.4750140204</a>	1994
*Harris JM Jr, Novalis-Marine C, Amend RW, Surprenant ZJ. Promoting free online CME for intimate partner violence: what works at what cost?. <i>J Contin Educ Health Prof</i> . 2009;29(3):135-141.	2009
<sup>213</sup> Harris JM, Salasche SJ, Harris RB. Can Internet-based continuing medical education improve physicians' skin cancer knowledge and skills? <i>J Gen Intern Med</i> . 2001;16(1):50-6. <a href="https://doi.org/10.1111/j.1525-1497.2001.00615.x">https://doi.org/10.1111/j.1525-1497.2001.00615.x</a>	2001
<sup>10</sup> Harris SB, Leiter LA, Webster-Bogaert S, Van DM, O'Neill C. Teleconferenced educational detailing: Diabetes education for primary care physicians. <i>J Contin Educ Health Prof</i> . 2005Spring;25(2):87-97. <a href="https://doi.org/10.1002/chp.13">https://doi.org/10.1002/chp.13</a>	2005
<sup>120</sup> Hemmati N, Omrani S, Hemmati N. A Comparison of Internet-Based Learning and Traditional Classroom Lecture to Learn CPR for Continuing Medical Education. <i>Turk Online J Dist Educ</i> . 2013;14(1):256-265.	2013



<sup>214</sup> Henny KD, Duke CC, Sutton MY. Uptake of online HIV-related continuing medical education training among primary care providers in Southeast United States, 2017-2018. <i>AIDS Care</i> . Sep 27 2020;1-10. <a href="https://doi.org/10.1080/09540121.2020.1822986">https://doi.org/10.1080/09540121.2020.1822986</a>	2020
<sup>215</sup> Hicks KK, Murano PS. Online nutrition and T2DM continuing medical education course launched on state-level medical association. <i>Adv Med Educ Pract</i> . 2017;8:413-418. <a href="https://doi.org/10.2147/AMEP.S138278">https://doi.org/10.2147/AMEP.S138278</a>	2017
<sup>69</sup> Hoedebecke K, Mahmoud M, Yakubu K, et al. Collaborative global health E-learning: a Massive Open Online Course experience of young family doctors. <i>J Family Med Prim Care</i> . 2018;7(5):884-887. <a href="https://doi.org/10.4103/jfmpc.jfmpc_186_18">https://doi.org/10.4103/jfmpc.jfmpc_186_18</a>	2018
<sup>165</sup> Hogg W. The computer, CME and the family physician. <i>CMAJ</i> . 1991;144(3):346-351.	1991
<sup>173</sup> Huang K-J, Cen G, Qiu Z-J, Jiang T, Cao J, Fu C-Y. Application of international videoconferences for continuing medical education programs related to laparoscopic surgery. <i>Telemed J E Health</i> . 2014;20(2):157-60. <a href="https://doi.org/10.1089/tmj.2013.0070">https://doi.org/10.1089/tmj.2013.0070</a>	2014
*Hylton DA, Shargall Y, Finley C, Agzarian J, Fahim C, Hanna WC. A novel online education module to teach clinicians how to correctly identify ultrasonographic features of mediastinal lymph nodes during endobronchial ultrasound. <i>Can J Surg</i> . 2020;63(1):E62-E68.	2020
<sup>174</sup> Isbej L, Uribe J, Carrasco O, et al. [Experience of continuing online education in gastroenterology for non specialist medical doctors]. <i>Experiencia de educacion continua en linea en gastroenterologia para medicos no especialistas</i> . <i>Rev Med Chil</i> . 2019;147(8):1059-1066. <a href="https://doi.org/10.4067/S0034-98872019000801059">https://doi.org/10.4067/S0034-98872019000801059</a>	2019
<sup>188</sup> Jafari P, Kostas T, Levine S, et al. ECHO-Chicago Geriatrics: using telementoring to "geriatricize" the primary care workforce. <i>Gerontol Geriatr Educ</i> . 2019;1-9. <a href="http://doi.org/10.1080/02701960.2019.1572005">http://doi.org/10.1080/02701960.2019.1572005</a>	2020
<sup>70</sup> Janes R, Arroll B, Buetow S, Coster G, McCormick R, Hague I. Rural New Zealand health professionals' perceived barriers to greater use of the internet for learning. <i>Rural Remote Health</i> . 2005;5(4):436.	2005
<sup>123</sup> Jarvis-Selinger S, Gullion J, Lauscher HN, Ho K. Integrating continuing professional development and graduate curriculum in a case-based interprofessional online course: telemedicine in action. <i>J Contin Educ Health Prof</i> . 2007;27(4):253-4. <a href="https://doi.org/10.1002/chp.145">https://doi.org/10.1002/chp.145</a>	2007
*Javaudin F, Montassier E, Goffinet N, Quilliot F, Potel G, Batard E. Interactive E-learning in the Emergency Department: Participation in an Antibiotic stewardship Program. <i>Ann Fr Med d'Urgence</i> . 2014;4(3):167-172	2014
<sup>164</sup> Jennings AA, Boyle S, Foley T. The development and evaluation of an online dementia resource for primary care based health professionals. <i>Internet Interv</i> . 2018;11:47-52. <a href="http://doi.org/10.1016/j.invent.2018.01.004">http://doi.org/10.1016/j.invent.2018.01.004</a>	2018
*Kanneganti A, Lim KMX, Chan GMF, et al. Pedagogy in a pandemic - COVID-19 and virtual continuing medical education (vCME) in obstetrics and gynecology. <i>Acta Obstet Gynecol Scand</i> . 2020;99(6):692-695.	2020
<sup>167</sup> Kauffman L, Weisberg EM, Zember WF, Fishman EK. #RadEd: How and Why to Use Twitter for Online Radiology Education. <i>Curr Probl Diag Radiol</i> . 2021;50(3):369-373. <a href="https://doi.org/10.1067/j.cpradiol.2021.02.002">https://doi.org/10.1067/j.cpradiol.2021.02.002</a>	2021
<sup>168</sup> Kemper KJ, Gardiner P, Gobble J, Mitra A, Woods C. Randomized controlled trial comparing four strategies for delivering e-curriculum to health care professionals [ISRCTN88148532]. <i>BMC Med Educ</i> . 2006;6:2. <a href="https://doi.org/10.1186/1472-6920-6-2">https://doi.org/10.1186/1472-6920-6-2</a>	2006
<sup>199</sup> Kerfoot BP, Baker H. An online spaced-education game for global continuing medical education: a randomized trial. <i>Ann Surgery</i> . 2012;256(1):33-8. <a href="https://doi.org/10.1097/SLA.0b013e31825b3912">https://doi.org/10.1097/SLA.0b013e31825b3912</a>	2012
<sup>216</sup> Kerfoot BP, Turchin A, Breydo E, Gagnon D, Conlin PR. An online spaced-education game among clinicians improves their patients' time to blood pressure control: a randomized controlled trial. <i>Circ Cardiovasc Qual Outcomes</i> . 2014;7(3):468-74. <a href="https://doi.org/10.1161/circoutcomes.113.000814">https://doi.org/10.1161/circoutcomes.113.000814</a>	2014
<sup>178</sup> Kimura S, Onishi H, Kawamata M. Characteristics and perceptions of twice-weekly webinars for primary care physicians in Japan: a qualitative study. <i>Int J Med Educ</i> . 2018;9:229-238. <a href="https://doi.org/10.5116/ijme.5b6b.21e1">https://doi.org/10.5116/ijme.5b6b.21e1</a>	2018
<sup>102</sup> Kisilevsky E, Margolin E, Kohly RP. Access, an unintended consequence of virtual continuing medical education during COVID-19: a department's experience at the University of Toronto. <i>Can J Ophthalmol</i> . 2021;56(1):e18-e19. <a href="https://doi.org/10.1016/j.cjco.2020.10.002">https://doi.org/10.1016/j.cjco.2020.10.002</a>	2021
*Kizakevich PN, Culwell A, Furberg R, et al. Virtual simulation-enhanced triage training for Iraqi medical personnel. <i>Stud Health Technol Inform</i> . 2007;125:223-228.	2007
*Klein D, Davis P, Hickey L. Videoconferences for rural physicians' continuing health education. <i>J Telemed Telecare</i> . 2005;11Suppl 1:97-99.	2005
<sup>150</sup> Klein M, Niebuhr V, D'Alessandro D. Innovative online faculty development utilizing the power of social media. <i>Acad Pediatr</i> . 2013;13(6):564-9. <a href="https://doi.org/10.1016/j.acap.2013.07.005">https://doi.org/10.1016/j.acap.2013.07.005</a>	2013
*Knipfer C, Wagner F, Knipfer K, et al. Learners' acceptance of a webinar for continuing medical education. <i>Int J Oral Maxillofac Surg</i> . 2019;48(6):841-846.	2019
*Krebs TL, Berg WA, Roys SR, Ratakonda S, Pomerantz SM, Siegel EL. MammoWeb continuing medical education (CME): a web-based breast imaging CME program. <i>J Digit Imaging</i> . 1999;12(2Suppl 1):124-126.	1999
<sup>123</sup> Krešević D, Burant C, Denton J, Heath B, Kypriotakis G. The use of multimodal strategies for distance education in the GRECCs. <i>Gerontol Geriatr Educ</i> . 2011;32(1):54-79. <a href="https://doi.org/10.1080/02701960.2011.550216">https://doi.org/10.1080/02701960.2011.550216</a>	2011
<sup>145</sup> Krishnamachari B, Rehman M, Cohn JE, et al. Video Education on Hereditary Breast and Ovarian Cancer (HBOC) for Physicians: an Interventional Study. <i>J Cancer Educ</i> . 2018;33(6):1213-1221. <a href="https://doi.org/10.1007/s13187-017-1233-4">https://doi.org/10.1007/s13187-017-1233-4</a>	2018
<sup>189</sup> Kristensen I, Lindh J, Nilsson P, et al. Telemedicine as a tool for sharing competence in paediatric radiotherapy: implementation and initial experiences from a Swedish project. <i>Acta Oncol</i> . 2009;48(1):146-52. <a href="https://doi.org/10.1080/02841860802409520">https://doi.org/10.1080/02841860802409520</a>	2009
<sup>37</sup> Krupinski EA, Lopez AM, Lyman T, Barker G, Weinstein RS. Continuing education via telemedicine: analysis of reasons for attending or not attending. <i>Telemed J E Health</i> . 2004;10(3):403-9. <a href="https://doi.org/10.1089/tmj.2004.10.403">https://doi.org/10.1089/tmj.2004.10.403</a>	2004
<sup>242</sup> Kua V, Belii A, Pontone S, Beydon L. National survey in France about continuing medical education among anaesthesiologist. [Enquête nationale sur la formation médicale continue des anesthésistes-réanimateurs]. <i>Ann Fr Anesth Reanim</i> . 2006;25(2):144-151. <a href="http://doi.org/10.1016/j.annfar.2005.08.024">http://doi.org/10.1016/j.annfar.2005.08.024</a>	2005
<sup>38</sup> Kulatunga GGAK, Marasinghe RB, Karunathilake IM, Dissanayake VHW. Development and implementation of a web-based continuing professional development (CPD) programme on medical genetics. <i>J Telemed Telecare</i> . 2013;19(7):388-92. <a href="https://doi.org/10.1177/1357633X13506525">https://doi.org/10.1177/1357633X13506525</a>	2013

<sup>39</sup> Lamba P. Teleconferencing in medical education: a useful tool. <i>Australas Med J</i> . 2011;4(8):442-7. <a href="https://doi.org/10.4066/AMJ.2011.823">https://doi.org/10.4066/AMJ.2011.823</a>	2011
<sup>188</sup> Landman A, Yagi Y, Gilbertson J, Dawson R, Marchevsky A, Becich MJ. Prototype Web-based continuing medical education using FlashPix images. <i>Proc AMIA Symp</i> . 2000:462-6.	2000
<sup>138</sup> Le TT, Rait MA, Jarlsberg LG, Eid NS, Cabana MD. A randomized controlled trial to evaluate the effectiveness of a distance asthma learning program for pediatricians. <i>J Asthma</i> . 2010;47(3):245-50. <a href="https://doi.org/10.3109/02770900903560209">https://doi.org/10.3109/02770900903560209</a>	2010
<sup>124</sup> Leite MTM, Carlini AL, Ramos MP, Sigulem D. Educação médica continuada online: potencial e desafios no cenário brasileiro. Online continuing medical education: potential and challenges in the Brazilian context. <i>Rev Bras Educ Méd</i> . 2010;032010;34(1):141-149. <a href="https://doi.org/10.1590/S0100-55022010000100017">https://doi.org/10.1590/S0100-55022010000100017</a>	2010
<sup>104</sup> Levy BT, Albrecht L, Gjerde CL. Using videoconferencing to train community family medicine preceptors. <i>Acad Med</i> . 1998;73(5):616-7. <a href="https://doi.org/10.1097/00001888-199805000-00094">https://doi.org/10.1097/00001888-199805000-00094</a>	1998
<sup>105</sup> Lewis CE, Relan A, Hines OJ, Tillou A, Hiatt JR. Morbidity and mortality as a televideoconference: a randomized prospective evaluation of learning and perceptions. <i>J Am Coll Surg</i> . 2011;212(3):400-405. <a href="http://doi.org/10.1016/j.jamcollsurg.2010.12.002">http://doi.org/10.1016/j.jamcollsurg.2010.12.002</a>	2011
<sup>40</sup> Liaw S-T, Pearce C, Keppell M. Developing a Web-based Learning Network for Continuing Medical Education. <i>J Workplace Learn</i> . 2002;14(3):98-108. <a href="https://doi.org/10.1108/13665620210421911">https://doi.org/10.1108/13665620210421911</a>	2002
<sup>191</sup> Lim CCT, Yang GL. Electronic teaching files and continuing professional development in radiology. <i>Biomed Imaging Interv J</i> . 2006;2(2):e5. <a href="http://doi.org/10.2349/bijii.2.2.e5">http://doi.org/10.2349/bijii.2.2.e5</a>	2006
<sup>217</sup> Lineker SC, Fleet LJ, Bell MJ, et al. Getting a Grip on Arthritis Online: Responses of rural/remote primary care providers to a web-based continuing medical education programme. <i>Can J Rural Med</i> . 2019;24(2):52-60. <a href="https://doi.org/10.4103/CJRM.CJRM_10_18">https://doi.org/10.4103/CJRM.CJRM_10_18</a>	2019
<sup>243</sup> Llambi L, Margolis A, Toews J, et al. Distance education for physicians: adaptation of a Canadian experience to Uruguay. <i>J Contin Educ Health Prof</i> . 2008;28(2):79-85. <a href="https://doi.org/10.1002/chp.161">https://doi.org/10.1002/chp.161</a>	2008
<sup>125</sup> Lockyer J, Sargeant J, Curran V, Fleet L. The transition from face-to-face to online CME facilitation. <i>Med Teach</i> . 2006;28(7):625-30. <a href="https://doi.org/10.1080/01421590600922909">https://doi.org/10.1080/01421590600922909</a>	2006
<sup>106</sup> Lott DR. Can Distance Education Solve Rural Physicians' Professional Isolation Problems? <i>J Contin High Educ</i> . 1996; 44(3)25-28. <a href="https://doi.org/10.1080/07377366.1996.10400300">https://doi.org/10.1080/07377366.1996.10400300</a>	1996
<sup>169</sup> Lund A, Lam K, Parks P. Disaster Medicine Online: evaluation of an online, modular, interactive, asynchronous curriculum. <i>CJEM</i> . 2002;4(6):408-13. <a href="https://doi.org/10.1017/s1481803500007910">https://doi.org/10.1017/s1481803500007910</a>	2002
<sup>72</sup> Lupiañez-Villanueva F, Mayer MA, Torrent J. Opportunities and challenges of Web 2.0 within the health care systems: an empirical exploration. <i>Inform Health Soc Care</i> . Sep 2009;34(3):117-26. <a href="https://doi.org/10.1080/17538150903102265">https://doi.org/10.1080/17538150903102265</a>	2009
<sup>107</sup> Lynch J, Weaver L, Hall P, et al. Using telehealth technology to support CME in end-of-life care for community physicians in Ontario. <i>Telemed J E Health</i> . 2004;10(1):103-7. <a href="https://doi.org/10.1089/153056204773644643">https://doi.org/10.1089/153056204773644643</a>	2004
<sup>126</sup> MacWalter G, McKay J, Bowie P. Utilisation of internet resources for continuing professional development: a cross-sectional survey of general practitioners in Scotland. <i>BMC Med Educ</i> . 2016;16:24. <a href="https://doi.org/10.1186/s12909-016-0540-5">https://doi.org/10.1186/s12909-016-0540-5</a>	2016
<sup>41</sup> Malassagne B, Mutter D, Leroy J, Smith M, Soler L, Marescaux J. Teleeducation in surgery: European Institute for Telesurgery experience. <i>World J Surg</i> . 2001;25(11):1490-4. <a href="https://doi.org/10.1007/s00268-001-0135-z">https://doi.org/10.1007/s00268-001-0135-z</a>	2001
<sup>73</sup> Mamary E, Charles P. Promoting self-directed learning for continuing medical education. <i>Medical Teach</i> . 2003;25(2):188-90. <a href="https://doi.org/10.1080/0142159031000092607">https://doi.org/10.1080/0142159031000092607</a>	2003
<sup>170</sup> Marcinkiewicz A, Cybart A, Chrominska-Szosland D, Nosko J. New forms of training in occupational medicine. <i>Med Pr</i> . 2003;54(6):573-578.	2003
<sup>151</sup> Margolis A, Gonzalez-Martinez F, Noboa O, et al. Online Continuing Medical Education for the Latin American Nephrology Community. <i>Stud Health Technol Inform</i> . 2015;216:372-5.	2015
<sup>218</sup> Markova A, Weinstock MA, Risica P, et al. Effect of a web-based curriculum on primary care practice: basic skin cancer triage trial. <i>Fam Med</i> . 2013;45(8):558-68.	2013
<sup>74</sup> Masud S, Ayub A, Mahboob U. Use of massive online open courses as a potential resource to provide continuing medical education in Pakistan. <i>J Coll Physicians Surg Pak</i> . 2016;26(2):160-1. <a href="https://doi.org/10.2016/JCPSP.160161">https://doi.org/10.2016/JCPSP.160161</a>	2016
<sup>127</sup> Mazzoleni MC, Maugeri C, Rognoni C, Cantoni A, Imbriani M. Is it worth investing in online continuous education for healthcare staff? <i>Stud Health Technol Inform</i> . 2012;180:939-43.	2012
<sup>133</sup> Mazzoleni MC, Rognoni C, Finozzi E, et al. Usage and effectiveness of e-learning courses for continuous medical education. <i>Stud Health Technol Inform</i> . 2009;150:921-5.	2009
<sup>219</sup> Mazzuocolo LD, Marciano S, Echeverria CM. [Implementation of a telementoring model of medical education in psoriasis]. <i>Implementacion de una modalidad de educacion medica a distancia en psoriasis. Medicina (B Aires)</i> . 2016;76(6):359-361..	2016
<sup>42</sup> McEnery KW, Roth SM, Walkup RV. Radiology CME on the Web using secure document transfer and internationally distributed image servers. <i>Proc AMIA Annu Fall Symp</i> . 1996:37-40.	1996
<sup>220</sup> McFadden P, Crim A. Comparison of the Effectiveness of Interactive Didactic Lecture Versus Online Simulation-Based CME Programs Directed at Improving the Diagnostic Capabilities of Primary Care Practitioners. <i>J Contin Educ Health Prof</i> . 2016;36(1):32-7. <a href="https://doi.org/10.1097/CEH.0000000000000061">https://doi.org/10.1097/CEH.0000000000000061</a>	2016
<sup>43</sup> Medina-Presentado JC, Margolis A, Teixeira L, et al. Online continuing interprofessional education on hospital-acquired infections for Latin America. <i>Braz J Infect Dis</i> . 2017;21(2):140-147. <a href="https://dx.doi.org/10.1016/j.bjid.2016.11.003">https://dx.doi.org/10.1016/j.bjid.2016.11.003</a>	2017
<sup>139</sup> Mehta N, Geissel K, Rhodes E, Salinas G. Comparative effectiveness in CME: evaluation of personalized and self-directed learning models. <i>J Contin Educ Health Prof</i> . 2015;35Suppl 1:S24-6. <a href="https://doi.org/10.1002/chp.21284">https://doi.org/10.1002/chp.21284</a>	2015
<sup>171</sup> Melo MdCbd, Silva NLdc, Liu PMF, et al. E-Learning and Simulation on a pré-hospital emergency course: a participant's perspective. Curso de emergência utilizando E-learning e simulação: visão do participante. <i>Rev Bras Educ Méd</i> . 2016;40(4):713-719. <a href="https://doi.org/10.1590/1981-52712015v40n4e02482014">https://doi.org/10.1590/1981-52712015v40n4e02482014</a>	2016
<sup>179</sup> Melus-Palazon E, Bartolome-Moreno C, Palacin-Arbues JC, et al. Experience with using second life for medical education in a family and community medicine education unit. <i>BMC Med Educ</i> . 2012;12:30. <a href="https://doi.org/10.1186/1472-6920-12-30">https://doi.org/10.1186/1472-6920-12-30</a>	2012

<sup>108</sup> Michelson G, Scibor M, Keppler K, Dick B, Kuchenbecker J. Online medical education in ophthalmology. <i>Ophthalmologie</i> . 2000;97(4):290-294. <a href="https://doi.org/10.1007/s003470050530">https://doi.org/10.1007/s003470050530</a>	2000
<sup>244</sup> Misra UK, Kalita J, Mishra SK, Yadav RK. Telemedicine for distance education in neurology: preliminary experience in India. <i>J Telemed Telecare</i> . 2004;10(6):363-5. <a href="https://doi.org/10.1258/1357633042602044">https://doi.org/10.1258/1357633042602044</a>	2004
<sup>221</sup> Mistraletti G, Umbrello M, Anania S, et al. Neurological assessment with validated tools in general ICU: multicenter, randomized, before and after, pragmatic study to evaluate the effectiveness of an e-learning platform for continuous medical education. <i>Minerva Anestesiol</i> . 2017;83(2):145-154. <a href="https://doi.org/10.23736/S0375-9393.16.11103-4">https://doi.org/10.23736/S0375-9393.16.11103-4</a>	2017
<sup>76</sup> Mohan D, Fischhoff B, Angus DC, et al. Serious games may improve physician heuristics in trauma triage. <i>Proc Natl Acad Sci U S A</i> . 2018;115(37):9204-9209. <a href="https://doi.org/10.1073/pnas.1805450115">https://doi.org/10.1073/pnas.1805450115</a>	2018
*Moreno-Sanz C, Seoane-González JB. Experience with a Spanish-language laparoscopy website. <i>J Laparoendosc Adv Surg Tech A</i> . 2006;16(1):33-36.	2006
<sup>192</sup> Murad A, Lederman R, Bosua R, Chang S, Wark JD. Enhancing General Practitioners Participation in a Virtual Community of Practice for Continuing Medical Education: an Exploratory Study. <i>Stud Health Technol Inform</i> . 2017;239:97-103.	2017
<sup>46</sup> Murphy K, Munk PL. Continuing medical education: MOOCs (Massive Open Online Courses) and their implications for radiology learning. <i>Can Assoc Radiol J</i> . 2013;64(3):165. <a href="https://doi.org/10.1016/j.carj.2013.06.001">https://doi.org/10.1016/j.carj.2013.06.001</a>	2013
<sup>152</sup> Murphy-Southwick C, McBride M. Geriatric education across 94million acres: adapting conference programming in a rural state. <i>Gerontol Geriatr Educ</i> . 2006;26(4):25-36.	2006
<sup>77</sup> Nahai F. Distance learning in plastic surgery: are live meetings destined for the scrapheap? <i>Aesthet Surg J</i> . 2012;32(5):659-60. <a href="https://doi.org/10.1177/1090820X12448817">https://doi.org/10.1177/1090820X12448817</a>	2012
<sup>245</sup> Nasir A, Khader A, Nasir L, Abuzayed I, Seita A. Paediatric continuing medical education needs and preferences of UNRWA physicians in Jordan. <i>East Mediterr Health J</i> . 2016;22(1):47-51.	2016
<sup>267</sup> Naldi L, Manfrini R, Martin L, Deligant C, Dri P. Feasibility of a web-based continuing medical education program in dermatology: the DermoFAD experience in Italy. <i>Dermatology</i> . 2006;213(1):6-11. <a href="https://doi.org/10.1159/000092830">https://doi.org/10.1159/000092830</a>	2006
<sup>180</sup> Nchise A, Boateng R, Mbarika V, Saiba E, Johnson O. The challenge of taking baby steps-Preliminary insights into telemedicine adoption in Rwanda. <i>Health Pol Technol</i> . 2012;1(4):207-213. <a href="http://doi.org/10.1016/j.hlpt.2012.10.004">http://doi.org/10.1016/j.hlpt.2012.10.004</a>	2012
<sup>128</sup> Nelsen BR, Chen YK, Lasic M, Bader AM, Arriaga AF. Advances in anesthesia education: increasing access and collaboration in medical education, from E-learning to telesimulation. <i>Curr Opin Anaesthesiol</i> . 2020;33(6):800-807. <a href="https://doi.org/10.1097/aco.0000000000000931">https://doi.org/10.1097/aco.0000000000000931</a>	2020
<sup>78</sup> Neto RM. Distance education in medical ultrasound in Brazil. <i>Obstet Gynecol</i> . 2015;9(2):197-202. <a href="http://doi.org/10.5005/jp-journals-10009-1406">http://doi.org/10.5005/jp-journals-10009-1406</a>	2015
<sup>79</sup> Newman TH, Robb H, Michaels J, et al. The end of conferences as we know them? Trainee perspectives from the Virtual ACCESS Conference 2020. <i>BJU Int</i> . 2021;127(2):263-265. <a href="https://doi.org/10.1111/bju.15330">https://doi.org/10.1111/bju.15330</a>	2021
<sup>222</sup> Ng EWM, Le Marne F, Sinclair KG, et al. Evaluation of an educational video providing key messages for doctors to counsel families following a first afebrile seizure. <i>J Paediatr Child Health</i> . Feb 2021;57(2):198-203. <a href="https://doi.org/10.1111/jpc.15171">https://doi.org/10.1111/jpc.15171</a>	2021
<sup>223</sup> Nicastro E, Lo Vecchio A, Liguoro I, et al. The Impact of E-Learning on Adherence to Guidelines for Acute Gastroenteritis: a Single-Arm Intervention Study. <i>PLoS One</i> . 2015;10(7):e0132213. <a href="https://doi.org/10.1371/journal.pone.0132213">https://doi.org/10.1371/journal.pone.0132213</a>	2015
<sup>80</sup> Nofal MR, Halim N, Le BN, et al. Unpacking the "Black Box": How an SMS-Based Continuing Medical Education Intervention Improved Medical Knowledge Among HIV Clinicians in Vietnam. <i>Glob Health Sci Pract</i> . 2018;6(4):668-679. <a href="https://doi.org/10.9745/GHSP-D-18-00298">https://doi.org/10.9745/GHSP-D-18-00298</a>	2018
<sup>47</sup> Norman JN, Alsajir MB. Tele-education - postgraduate education. <i>Med Principles Pract</i> . 2001;10(3):115-122. <a href="https://doi.org/10.1159/000050354">https://doi.org/10.1159/000050354</a>	2001
<sup>81</sup> O'Brien Pott M, Blanshan AS, Huneke KM, Baasch Thomas BL, Cook DA. What influences choice of continuing medical education modalities and providers? A National Survey of US physicians, nurse practitioners, and physician assistants. <i>Acad Med</i> . 2020;96(1):93-100. <a href="https://doi.org/10.1097/ACM.00000000000003758">https://doi.org/10.1097/ACM.00000000000003758</a>	2021
<sup>260</sup> Ogrinc G, Splaine ME, Foster T, Regan-Smith M, Batalden P. Exploring and embracing complexity in a distance-learning curriculum for physicians. <i>Acad Med</i> . 2003;78(3):280-5. <a href="https://doi.org/10.1097/00001888-200303000-00010">https://doi.org/10.1097/00001888-200303000-00010</a>	2003
<sup>140</sup> Oliveira AC, Mattos S, Coimbra M. Development and assessment of an e-learning course on pediatric cardiology basics. <i>JMIR Med Educ</i> . 2017;3(1):e10. <a href="https://doi.org/10.2196/mededu.5434">https://doi.org/10.2196/mededu.5434</a>	2017
*Olivieri JJ, Downes MC. Outcomes in CME/CPD - special collection: effect size benchmarking for internet-based enduring CME Activities. <i>J Eur CME</i> . 2020;9(1):1832796.	2020
<sup>110</sup> Omil-Lima D, Fernstrum A, Gupta K, et al. Urologic education in the era of COVID-19: results from a webinar-based reconstructive urology lecture series. <i>Urology</i> . 2021;152:2-8. <a href="https://doi.org/10.1016/j.urology.2021.03.004">https://doi.org/10.1016/j.urology.2021.03.004</a>	2021
<sup>82</sup> Ottesen TD, Montoya RL, Ogunleye TD, et al. Implementation and impact evaluation of a virtual orthopaedic continuing medical education conference in a low-resource country. <i>J Surg Educ</i> . 2021; 78(5):1629-1636. <a href="https://doi.org/10.1016/j.jsurg.2021.01.002">https://doi.org/10.1016/j.jsurg.2021.01.002</a>	2021
<sup>224</sup> Ozturk E, van Iersel M, van Loon K, et al. Interactive online learning on perioperative management of elderly patients. <i>Am J Surg</i> . 2018;216(3):624-629. <a href="https://doi.org/10.1016/j.amjsurg.2018.01.071">https://doi.org/10.1016/j.amjsurg.2018.01.071</a>	2018
<sup>255</sup> Patelis N, Matheiken SJ, Beard JD. The challenges of developing distance learning for surgeons. <i>Eur J Vasc Endovasc Surg</i> . 2015;49(3):237-8. <a href="https://doi.org/10.1016/j.eivs.2014.09.001">https://doi.org/10.1016/j.eivs.2014.09.001</a>	2015
<sup>254</sup> Pavese P, Coulouma M, Sellier E, Stahl JP, Wintenberger C, Francois P. CD-ROM continuous medical education model for the management of urinary tract infections in family practice. <i>Med Mal Infect</i> . 2012;42(7):321-6. <a href="https://doi.org/10.1016/j.medmal.2012.05.010">https://doi.org/10.1016/j.medmal.2012.05.010</a>	2012
<sup>13</sup> Pelayo M, Cebrián D, Areosa A, Agra Y, Izquierdo JV, Buendía F. Effects of online palliative care training on knowledge, attitude and satisfaction of primary care physicians. <i>BMC Fam Pract</i> . 2011;12(1):37. <a href="https://doi.org/10.1186/1471-2296-12-37">https://doi.org/10.1186/1471-2296-12-37</a>	2011
<sup>83</sup> Penna GCE, Mendes HG, Dias MAdS, et al. Avaliação do emprego de videoconferências para a capacitação à distância dos médicos das equipes de saúde da família dentro do projeto nacional telessaúde. Evaluation of the use of videoconferencing for distance training of doctors in the family health teams within the national telehealth project. <i>Rev Med Minas Gerais</i> . 2015;25(1):108-14	2015

<sup>48</sup> Peterson MW, Galvin JR, Dayton C, D'Alessandro MP. Realizing the promise: delivering pulmonary continuing medical education over the Internet. <i>Chest</i> . 1999;115(5):1429-36. <a href="https://doi.org/10.1378/chest.115.5.1429">https://doi.org/10.1378/chest.115.5.1429</a>	1999
<sup>15</sup> O'Brien Pott M, Blanshan AS, Huneke KM, Baasch Thomas BL, Cook DA. Barriers to identifying and obtaining CME: a national survey of physicians, nurse practitioners and physician assistants. <i>BMC Med Educ</i> . 2021;21(1):168. <a href="https://doi.org/10.1186/s12909-021-02595-x">https://doi.org/10.1186/s12909-021-02595-x</a>	2021
<sup>84</sup> Prinz JC, Hartmann D, Wolff H, et al. [Dermatology continuing medical education during Corona times and beyond : experience from the 2020digital advanced training week for practical dermatology and venerology and lessons for future concepts]. <i>Hautarzt</i> . 2021;72(4):362-366. <a href="https://doi.org/10.1007/s00105-020-04755-4">https://doi.org/10.1007/s00105-020-04755-4</a>	2021
<sup>262</sup> Pullen D. Doctors online: learning using an internet based content management system. <i>Int J Educ Dev Info Comm Technol</i> . 2013;9(1):50-63.	2013
<sup>143</sup> Raggio V, Roche L, Esperón P, Stoll M. Curso on-line: Introducción a la medicina genómica. Primera experiencia. On-line Course: Introduction to genomic medicine. <i>Rev Méd Urug</i> . 2007;23(2):116-121.	2007
<sup>85</sup> Ramanathan R, Aldis R, Gupta S, Desai M, Bollinger Jr RC, Reed VA. Mixed methods evaluation of an international internet-based continuing medical education course for pediatric HIV providers in Pune, India. <i>Educ Health (Abingdon)</i> . 2011;24(1):540.	2011
*Ramsauer B, Groning T. Online further training from GynToGo to UniversityToGo. <i>Gynakologe</i> . 2018;51(6):467-471	2018
<sup>86</sup> Ramsay R, Nashat NH, Thuraisingham C, et al. Reimagining medical education for primary care in the time of COVID-19: a world view. <i>Educ Prim Care</i> . 2021;32(1):2-5. <a href="https://doi.org/10.1080/14739879.2020.1851147">https://doi.org/10.1080/14739879.2020.1851147</a>	2021
<sup>49</sup> Rana R, Kumawat D, Sahay P, et al. Perception among ophthalmologists about webinars as a method of continued medical education during COVID-19pandemic. <i>Indian J Ophthalmol</i> . 2021;69(4). <a href="https://doi.org/10.4103/ijo.IJO_3136_20">https://doi.org/10.4103/ijo.IJO_3136_20</a>	2021
<sup>87</sup> Rebbeck T, Macedo L, Paul P, Trevena L, Cameron ID. General practitioners' knowledge of whiplash guidelines improved with online education. <i>Aust Health Rev</i> . 2013;37(5):688-94. <a href="https://doi.org/10.1071/AH13057">https://doi.org/10.1071/AH13057</a>	2013
<sup>50</sup> Regueiro MD, Greer JB, Binion DG, et al. The inflammatory bowel disease Live Interinstitutional and Interdisciplinary Videoconference Education (IBD LIVE) series. <i>Inflamm Bowel Dis</i> . 2014;20(10):1687-1695. <a href="https://doi.org/10.1097/MIB.0000000000000187">https://doi.org/10.1097/MIB.0000000000000187</a>	2014
<sup>246</sup> Ricci MA, Caputo MP, Callas PW, Gagne M. The use of telemedicine for delivering continuing medical education in rural communities. <i>Telemed J E Health</i> . 2005;11(2):124-9. <a href="https://doi.org/10.1089/tmj.2005.11.124">https://doi.org/10.1089/tmj.2005.11.124</a>	2005
*Ryan P, Richards JC, McCabe MP, et al. Australian GPs' preferences for education about depression and related disorders. <i>Aust Fam Physician</i> . 2004;33(5):381-384.	2004
<sup>29</sup> Richardson ML, Norris TE. On-line delivery of continuing medical education over the World-Wide Web: an on-line needs assessment. <i>AJR Am J Roentgenol</i> . 1997;168(5):1161-4.	1997
<sup>51</sup> Ruf D, Kriston L, Berner M, Härter M. General practitioners and online continuing medical education - which factors influence its use?. <i>Ger Med Sci</i> . 2009;7:Doc08. <a href="https://doi.org/10.3205/000067">https://doi.org/10.3205/000067</a>	2009
<sup>88</sup> Ruiz-Barrera MA, Agudelo-Arrieta M, Aponte-Caballero R, et al. Developing a Web-Based Congress: the 2020International Web-Based Neurosurgery Congress Method. <i>World Neurosurg</i> . 2021;148:e415-e424. <a href="https://doi.org/10.1016/j.wneu.2020.12.174">https://doi.org/10.1016/j.wneu.2020.12.174</a>	2021
<sup>247</sup> Rusatira JC, Tomaszewski B, Dusabembo V, et al. Enabling access to medical and health education in Rwanda using mobile technology: needs assessment for the development of mobile medical educator apps. <i>JMIR Med Educ</i> . 2016;2(1):e7. <a href="https://doi.org/10.2196/mededu.5336">https://doi.org/10.2196/mededu.5336</a>	2016
*Ryan G, Lyon P, Kumar K, Bell J, Barnet S, Shaw T. Online CME: an effective alternative to face-to-face delivery. <i>Med Teach</i> . 2007;29(8):e251-e257.	2007
<sup>228</sup> Samuelson KW, Koenig CJ, McCamish N, et al. Web-based PTSD training for primary care providers: a pilot study. <i>Psychol Serv</i> . 2014;11(2):153-61. <a href="https://doi.org/10.1037/a0034855">https://doi.org/10.1037/a0034855</a>	2014
<sup>257</sup> Sandars J, Langlois M. Online learning networks for general practitioners: Evaluation of a pilot project. <i>Educ Primary Care</i> . 2005;16(6):688-696.	2005
<sup>265</sup> Sandars J, Walsh K, Homer M. High users of online continuing medical education: a questionnaire survey of choice and approach to learning. <i>Med Teach</i> . 2010;32(1):83-5. <a href="https://doi.org/10.3109/01421590903199171">https://doi.org/10.3109/01421590903199171</a>	2010
<sup>142</sup> Sargeant J, Curran V, Jarvis-Selinger S, et al. Interactive on-line continuing medical education: physicians' perceptions and experiences. <i>J Contin Educ Health Prof</i> . 2004;24(4):227-36. <a href="https://doi.org/10.1002/chp.1340240406">https://doi.org/10.1002/chp.1340240406</a> .	2004
<sup>248</sup> Schoen MJ, Tipton EF, Houston TK, et al. Characteristics that predict physician participation in a web-based CME activity: the MI-Plus study. <i>J Contin Educ Health Prof</i> . 2009;29(4):246-53. <a href="https://doi.org/10.1002/chp.20043">https://doi.org/10.1002/chp.20043</a>	2009
*Schopf T, Flytkjaer V. Impact of interactive web-based education with mobile and email-based support of general practitioners on treatment and referral patterns of patients with atopic dermatitis: randomized controlled trial. <i>J Med Internet Res</i> . 2012;14(6):e171.	2012
<sup>176</sup> Schroeder AN, Hall MM, Kruse RC. Sports Ultrasound Training During a Pandemic: Developing a "Hands-on" Skill Through Distance Learning. <i>Am J Phys Med Rehabil</i> . 2020;99(9):860-862. <a href="https://doi.org/10.1097/phm.0000000000001515">https://doi.org/10.1097/phm.0000000000001515</a>	2020
<sup>249</sup> Scott KW, Dushime T, Rusanganwa V, Woskie L, Attebery C, Binagwaho A. Leveraging massive open online courses to expand quality of healthcare education to health practitioners in Rwanda. <i>BMJ Open Qual</i> . 2019;8(4):e000532. <a href="https://doi.org/10.1136/bmjoc-2018-000532">https://doi.org/10.1136/bmjoc-2018-000532</a>	2019
<sup>110</sup> Sen Gupta TK, Wallace DA, Clark SL, Bannan G. Videoconferencing: practical advice on implementation. <i>Aus J Rural Health</i> . 1998;6(1):2-4. <a href="https://doi.org/10.1111/j.1440-1584.1998.tb00273.x">https://doi.org/10.1111/j.1440-1584.1998.tb00273.x</a>	1998
*Serrand M, Lefèbvre A, Desplanches T, Yacoub A, Semama D, Sagot P. DPC RMM : évaluation d'un outil de développement professionnel continue par e-learning à partir des revues de morbi-mortalité de Bourgogne [CME MMC: Evaluation of a continuous medical education tool by e-learning from the morbi-mortality conferences of the Burgundy]. <i>J Gynecol Obstet Biol Reprod (Paris)</i> . 2016;45(8):890-899.	2016
<sup>193</sup> Sethi SK, Singla S. Virtual pediatric renal grand rounds: an innovative e-learning. <i>Pediatr Nephrol</i> . 2011;26(1):159-160. <a href="http://doi.org/10.1007/s00467-010-1613-z">http://doi.org/10.1007/s00467-010-1613-z</a>	2010
<sup>194</sup> Sethi SK, Desai TP, Jhaveri KD. Online blogging during conferences: an innovative way of e-learning. <i>Kidney Int</i> . 2010;78(12):1199-1201. <a href="http://doi.org/10.1038/ki.2010.395">http://doi.org/10.1038/ki.2010.395</a>	2010



<sup>263</sup> Shah N, Ashraf H, Anwar F, Khan A, Akhtar H, Abro MA. Status of postgraduate training and continuing medical education of family physicians in Pakistan. <i>Pak J Med Sci</i> . 2012;28(1):4-8.	2012
*Shaw T, Long A, Chopra S, Kerfoot BP. Impact on clinical behavior of face-to-face continuing medical education blended with online spaced education: a randomized controlled trial. <i>J Contin Educ Health Prof</i> . 2011;31(2):103-108.	2011
<sup>153</sup> Sherman A. Continuing medical education methodology: current trends and applications in wound care. <i>J Diabetes Sci Technol</i> . 2010;4(4):853-6. <a href="https://doi.org/10.1177/193229681000400413">https://doi.org/10.1177/193229681000400413</a>	2010
<sup>30</sup> Sly JL, Lombardi E, Kusel M, Sly PD. Piloting a web-based continuing professional development program for asthma education. <i>Int J Med Inform</i> . 2006;75(10-11):708-13. <a href="https://doi.org/10.1016/j.ijmedinf.2005.09.004">https://doi.org/10.1016/j.ijmedinf.2005.09.004</a>	2006
<sup>143</sup> Stancic N, Mullen PD, Prokhorov AV, Frankowski RF, McAlister AL. Continuing medical education: what delivery format do physicians prefer? <i>J Contin Educ Health Prof</i> . 2003;23(3):162-7. <a href="https://doi.org/10.1002/chp.1340230307">https://doi.org/10.1002/chp.1340230307</a>	2003
<sup>172</sup> Stoner SA, Mikko AT, Carpenter KM. Web-based training for primary care providers on screening, brief intervention, and referral to treatment (SBIRT) for alcohol, tobacco, and other drugs. <i>J Subst Abuse Treat</i> . 2014;47(5):362-70. <a href="https://doi.org/10.1016/j.jsat.2014.06.009">https://doi.org/10.1016/j.jsat.2014.06.009</a>	2014
<sup>195</sup> Sweetman G, Brazil V. Education links between the Australian rural and tertiary emergency departments: videoconference can support a virtual learning community [1]. <i>Emerg Med Australas</i> . 2007;19(2):176-177. <a href="http://doi.org/10.1111/j.1742-6723.2007.00951.x">http://doi.org/10.1111/j.1742-6723.2007.00951.x</a>	2007
<sup>52</sup> Taekman JM, Kingsley CP, Shelley KH. Medical education over the Internet. <i>Acad Med</i> . 1996;71(5):525.	1996
<sup>90</sup> Tarchichi TR, Szymusiak J. Continuing Medical Education in the Time of Social Distancing: the Case for Expanding Podcast Usage for Continuing Education. <i>J Contin Educ Health Prof</i> . 2021;41(1):70-74. <a href="https://doi.org/10.1097/ceh.0000000000000324">https://doi.org/10.1097/ceh.0000000000000324</a>	2021
<sup>53</sup> Tello R, Davison BD, Blickman JG. The virtual course: delivery of live and recorded continuing medical education material over the Internet. <i>AJR Am J Roentgenol</i> . 2000;174(6):1519-21. <a href="https://doi.org/10.2214/ajr.174.6.1741519">https://doi.org/10.2214/ajr.174.6.1741519</a>	2000
<sup>227</sup> Thielmann A, Puth M-T, Weltermann B. Improving knowledge on vaccine storage management in general practices: learning effectiveness of an online-based program. <i>Vaccine</i> . 2020;38(47):7551-7557. <a href="https://doi.org/10.1016/j.vaccine.2020.09.049">https://doi.org/10.1016/j.vaccine.2020.09.049</a>	2020
<sup>23</sup> Tretter JT, Windram J, Faulkner T, et al. Heart University: a new online educational forum in paediatric and adult congenital cardiac care. The future of virtual learning in a post-pandemic world? <i>Cardiol Young</i> . 2020;30(4):560-567. <a href="https://doi.org/10.1017/S1047951120000852">https://doi.org/10.1017/S1047951120000852</a>	2020
<sup>129</sup> Tucker AP, Miller A, Sweeney D, Jones RW. Continuing medical education: a needs analysis of anaesthetists. <i>Anaesth Intensive Care</i> . 2006;34(6):765-769. <a href="https://doi.org/10.1177/0310057X0603400604">https://doi.org/10.1177/0310057X0603400604</a>	2006
<sup>130</sup> Tullo E, Newton J, Clapp A. What can e-learning offer geriatric medicine in the UK? <i>Rev Clin Gerontol</i> . 2012;22(3):235-242. <a href="http://doi.org/10.1017/S0959259812000081">http://doi.org/10.1017/S0959259812000081</a> .	2012
<sup>196</sup> Ure B, Zoeller C, Lacher M. The role of new information technology meeting the global need and gap of education in pediatric surgery. <i>Semin Pediatr Surg</i> . 2015;24(3):134-7. <a href="https://doi.org/10.1053/j.sempedsurg.2015.02.012">https://doi.org/10.1053/j.sempedsurg.2015.02.012</a>	2015
<sup>197</sup> Vervoort D, Dearani JA, Starnes VA, Thourani VH, Nguyen TC. Brave New World: Virtual conferencing and surgical education in the Coronavirus Disease 2019 era. <i>J Thorac Cardiovasc Surg</i> . 2021;161(3):748-752. <a href="https://doi.org/10.1016/j.jtcvs.2020.07.094">https://doi.org/10.1016/j.jtcvs.2020.07.094</a>	2021
<sup>181</sup> Vervoort D, Ma X, Bookholane H, Nguyen TC. Conference cancelled: the equitable flip side of the academic surgery coin. <i>Am J Surg</i> . 2020;220(6):1539-1540. <a href="https://doi.org/10.1016/j.amisurg.2020.07.008">https://doi.org/10.1016/j.amisurg.2020.07.008</a>	2020
<sup>31</sup> Vides-Porras A, Cáceres P, Company A, et al. Gaining insight into the implementation of an e-learning smoking cessation course in Latin American countries. <i>Health Promot Int</i> . 2021;36(2):349-362. <a href="https://doi.org/10.1093/heapro/daaa054">https://doi.org/10.1093/heapro/daaa054</a>	2020
<sup>94</sup> Vollmar HC, Schurer-Maly CC, Lelgemann M, Koneczny N, Koch M, Butzlaff M. Online continuing medical education based on national disease management guidelines. The e-learning platform leitnien-wissen.de. <i>Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz</i> . 2006;49(5):412-417. <a href="https://doi.org/10.1007/s00103-006-1251-6">https://doi.org/10.1007/s00103-006-1251-6</a>	2006
<sup>182</sup> Wallis JW, Parker JA. Use of the Internet for teaching in nuclear medicine. <i>Semin Nucl Med</i> . 1998;28(2):165-76. <a href="https://doi.org/10.1016/s0001-2998(98)80006-8">https://doi.org/10.1016/s0001-2998(98)80006-8</a>	1998
<sup>111</sup> Walsh K. E-learning in medical education: the potential environmental impact. <i>Educ Prim Care</i> . 2018;29(2):104-106. <a href="https://doi.org/10.1080/14739879.2017.1389619">https://doi.org/10.1080/14739879.2017.1389619</a>	2018
<sup>198</sup> Wang F. Valuation of Online Continuing Medical Education and Telemedicine in Taiwan. <i>J Educ Technol Society</i> . 2008;11(4):190-198.	2008
*Wang F. Continuing Medical Education via Telemedicine and Sustainable Improvements to Health. <i>Int J Telemed Appl</i> . 2016;2016:2424709.	2016
<sup>112</sup> Wang Z-Y, Zhang L-J, Liu Y-H, Jiang W-X, Tang S-L, Liu X-Y. Process evaluation of E-learning in continuing medical education: evidence from the China-Gates Foundation Tuberculosis Control Program. <i>Infectious Dis Poverty</i> . 2021;10(1):23. <a href="https://doi.org/10.1186/s40249-021-00810-x">https://doi.org/10.1186/s40249-021-00810-x</a>	2021
*Ward KM, Taubman DS, Pasternak, AL, et al. Teaching psychiatric pharmacogenomics effectively: Evaluation of a novel interprofessional online course. <i>J Am College Clin Pharm</i> . 2021;4(2):176-183.	2021
*Weston CM, Sciamanna CN, Nash DB. Evaluating online continuing medical education seminars: evidence for improving clinical practices. <i>Am J Med Qual</i> . 2008;23(6):475-483.	2008
<sup>113</sup> White LE, Krousel-Wood MA, Mather F. Technology meets healthcare: Distance learning and telehealth. <i>Ochsner J</i> . 2001;3(1):22-29.	2001
<sup>54</sup> Whitten P, Ford DJ, Davis N, Speicher R, Collins B. Comparison of Face-to-Face versus Interactive Video Continuing Medical Education Delivery Modalities. <i>J Contin Ed Health Prof</i> . 1998;18(2):93-99. <a href="https://doi.org/10.1002/chp.1340180205">https://doi.org/10.1002/chp.1340180205</a>	1998
<sup>133</sup> Wiecha J, Barrie N. Collaborative online learning: a new approach to distance CME. <i>Acad Med</i> . 2002;77(9):928-9.	2002
*Larson Williams A, Hawkins A, Sabin L, et al. Motivating HIV Providers in Vietnam to learn: a mixed-methods analysis of a mobile health continuing medical education intervention. <i>JMIR Med Educ</i> . 2019;5(1):e12058.	2019
<sup>261</sup> Williams P, Gunter B, Nicholas D. Health Education Online: Issues Arising from the Development and Roll-Out of a Pilot Distance Education Programme for NHS Staff. <i>Health Educ</i> . 2006;106(3):210-226. <a href="https://doi.org/10.1108/09654280610658550">https://doi.org/10.1108/09654280610658550</a>	2006

<sup>91</sup> Willman AS. Use of Web 2.0tools and social media for continuous professional development among primary healthcare practitioners within the Defence Primary Healthcare: a qualitative review. <i>BMJ Mil Health</i> . 2020;166(4):232-235. <a href="https://doi.org/10.1136/iracm-2018-001098">https://doi.org/10.1136/iracm-2018-001098</a>	2020
<sup>228</sup> Woods JM, Scott HF, Mullan PC, et al. Using an eLearning Module to Facilitate Sepsis Knowledge Acquisition Across Multiple Institutions and Learner Disciplines [published online ahead of print, 2019Aug 23]. <i>Pediatr Emerg Care</i> . 2021;37(12)31070-e1074. <a href="http://dx.doi.org/10.1097/PEC.0000000000001902">http://dx.doi.org/10.1097/PEC.0000000000001902</a>	2020
*Wyller TB. Internett og fjernundervisning som hjelpemiddel i videreutdanningen [Using the internet in continuous medical education]. <i>Tidsskr Nor Laegeforen</i> . 2003;123(16):2274-2276.	2003
<sup>198</sup> Yadav H, Lin WY. Teleprimary care in Malaysia: a tool for teleconsultation and distance learning in health care. <i>Asia Pac J Public Health</i> . 2001;13Suppl:S58-61	2001
<sup>132</sup> Yee M, Simpson-Young V, Paton R, Zuo Y. How do GPs want to learn in the digital era? <i>Aust Fam Physician</i> . 2014;43(6):399-402.	2013
<sup>229</sup> Young KJ, Kim JJ, Yeung G, Sit C, Tobe SW. Physician preferences for accredited online continuing medical education. <i>J Contin Educ Health Prof</i> . 2011;31(4):241-6. <a href="https://doi.org/10.1002/chp.20136">https://doi.org/10.1002/chp.20136</a>	2011
*Zeiger RF. Toward continuous medical education. <i>J Gen Intern Med</i> . 2005;20(1):91-94.	2005
<sup>92</sup> Zereshkian A, Wong R, Leifer R, et al. Continuing Professional Development Needs Amongst University of Toronto's Department of Radiation Oncology Faculty. <i>J Cancer Educ</i> . 2021;36(1):118-125. <a href="https://doi.org/10.1007/s13187-019-01607-1">https://doi.org/10.1007/s13187-019-01607-1</a>	2019
*Zimitat C. Designing effective on-line continuing medical education. <i>Med Teach</i> . 2001;23(2):117-122.	2001

Published ahead of issue