

Research Article

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Facilitators, barriers, and impact of e-learning on healthcare professionals in primary healthcare settings: An integrative review of literature

Hana Al-Yazidi¹, Ameneh Toosi^{2,*}, Daniel Forgrave³

¹Primary Health Care Corporation, Doha, Qatar. Email: hsaleh@phcc.gov.qa

²College of Nursing, Qatar University, Doha, Qatar.

³University of Calgary in Qatar, Doha, Qatar. Email: Daniel.forgrave@ucalgary.edu.qa

*Email: atoosi@qu.edu.qa

ABSTRACT

Background: The Primary Health Care Corporation in Qatar uses continuing professional development (CPD) to improve the knowledge and practices of healthcare professionals (HCPs). Due to COVID-19, CPD delivery has shifted from in-person to e-learning. While the need to provide CPD is evident, there is a lack of understanding of how HCPs access and use e-learning and how this learning influences the organizational outcomes in primary care settings.

Aim: The aim of this review was to explore (a) the facilitators and barriers to accessing and using e-learning and (b) the impact of e-learning on HCPs' learning, their practices, and organizational outcomes.

Methodology: Primary research publications between 2013 and 2022 were obtained from the CINAHL, MEDLINE OVID, and EBSCO databases. A total of 39 articles were included in this integrative review, which was guided by Whittemore and Knaf's framework. The MMAT was used to assess the quality of the included studies. Kirkpatrick's model guided data analysis.

Findings: The reaction level is influenced by the characteristics of e-learning content and delivery as well as the motivation of individuals. The learning level is influenced by the level of awareness, knowledge, skills, confidence, attitudes, and beliefs of HCPs. The behavior level is associated with intentions to change or apply in practice as well as implications for practice. The organizational impact is characterized by the quality of patient care.

Conclusion: Understanding the potential facilitators and barriers to accessing and using e-learning is crucial when designing and implementing CPD to improve the quality of e-learning and therefore the quality of patient care.

Keywords: E-learning, Kirkpatrick's model, integrative review, primary care, State of Qatar

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1. INTRODUCTION

Healthcare professionals' (HCPs) learning and development is a lifelong and ongoing journey of inquiry due to the progressive and rapid development of healthcare systems. Nurses need to continue their professional development to update and upgrade their knowledge and skills to keep pace with changes in healthcare and keep their professional licenses [1]. In several countries, HCPs such as physicians, midwives, and nurses are using e-learning to gain continuing professional development (CPD) points, which are mandatory requirements for maintaining their license to practice safely, maintain quality of care, and improve patients' health outcomes [2–4]. The Qatar Council for Healthcare Practitioners (QCHP) stated that all HCPs who work in Qatar are required to participate in CPD programs to maintain their registration and license [5]. QCHP has designed a CPD framework that includes in-person and online learning and development methods [5]. By following this framework, the Primary Health Care Corporation (PHCC) offers several methods for asynchronous e-learning, such as self-learning modules and an e-library with free access to journals, such as UpToDate, British Medical Journal, and Lippincott Procedures.

E-learning has been defined differently in the literature and has several synonyms and interchangeable terms, such as online learning, web-based learning, or computer-assisted learning [6]. E-learning is defined by the Oxford Learner's Dictionaries as a learning system that takes place using the internet and electronic media [7]. Moreover, e-learning is defined by Wlodarczyk et al. [8] as an asynchronous educational interaction that is delivered by the internet and defined by Lukaschek et al. [9] as an instruction that is delivered using a digital device.

1.1. E-learning approaches

E-learning can be provided through different methods, such as live webinars, training courses administered via a learning management system, and instructor-led training. These methods can be divided into two overarching categories: synchronous and asynchronous e-learning. Synchronous e-learning is an instructor-facilitated learning environment [10] that consists of two components: interactions and time [11]. Synchronous learning is real-time communication between learners and instructors via the web [11–13]. Synchronous learning can be offered in different forms, such as audio or video conferences, websites, or live broadcasts [12]. The most common form of communication in synchronous learning is online text chat [13]. Synchronous learning has several benefits and challenges. The benefits of synchronous learning include participants having the intention to stay on task, feeling a sense of participation, and achieving high course completion rates [14]. Moreover, synchronous learning facilitates direct communication between instructors and participants at a specific time [12]. However, synchronous learning can be challenging as participants may not have enough time to engage in a deep and enriching exchange of ideas [13].

Asynchronous learning is self-directed and self-paced [10]. It is defined as an interactive self-study that allows users to share information at any time without being in the same location [11]. Asynchronous learning is also defined as delayed interaction between instructors and learners [10]. Several tools and applications can be used to enhance this interaction. Asynchronous tools and applications include emails, CD-ROM, discussion

boards, wikis, social networks, blogs, group work, and podcasts [10]. These tools and applications can be used for reflections, questions, discussions, and sharing ideas and experiences [10]. Asynchronous learning has several benefits. Access is autonomous, and participants can spend more time on tasks if needed [13]. In addition, more time can be spent on information processing and reflection [10,13]. This flexibility in time allows users to understand questions before providing an answer [10]. Moreover, the asynchronous approach can increase peer interaction and reduce undesirable classroom behavior [13]. However, asynchronous learning has some challenges. Learners' workload increases due to the amount of time and effort they spend reading and writing answers [10]. Moreover, learners may have poor commitment because they tend to copy others' ideas instead of giving their opinions [10]. In addition, instructor involvement and guidelines may not be adequate to perform effective online activities; for example, immediate responses from instructors may be lacking [10].

1.2. Purpose and significance

PHCC uses e-learning for CPD to improve the knowledge, skills, behaviors, and practices of its HCPs. However, no study has been conducted by PHCC on the facilitators, barriers, and impacts of e-learning on HCPs in primary care settings in the Middle East. Even though access to CPD is important for all HCPs across the healthcare system, in this integrative review we solely focus on HCPs who work at the PHCC. The reason for this selection was that the available resources, needs, and types of CPD required vary between PHCC, secondary, and tertiary care settings. For example, HCPs who work at PHCC most often work in clinics, schools, or homes, which may not have the same resources compared to hospitals.

Therefore, this integrative review is conducted to explore the facilitators and barriers to accessing and using e-learning as well as the impact of e-learning on HCPs' learning, their practices, and organizational outcomes in primary care settings.

2. METHODOLOGY

An integrative review was conducted using the framework of Whittemore and Knafl. This framework includes five stages: problem identification, literature search, data evaluation, data analysis, and presentation [15].

2.1. Problem identification

PHCC has exclusively used e-learning to provide CPD to its HCPs during the COVID-19 pandemic. However, there is no clear understanding of the factors that influence HCPs' e-learning or the impact of e-learning on HCPs in primary healthcare settings in Qatar as no studies have been conducted to learn the facilitators, barriers, and impacts of e-learning on HCPs in this context.

2.2. Literature search

A literature search was conducted in the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the Medical Literature Analysis and Retrieval System (MEDLINE OVID), and the Academic Search Complete (EBSCO). The keywords used in the search were as follows: *healthcare provider**, *healthcare professional**, *clinical practitioners*, *physician**, *doctor**, *nurs**, *pharmacist**, *laboratory specialist**, *dietitian**, *nurse educator**, *e-learning*, *webinar*, *electronic learning*, *web-based learning*,

online learning, primary health care, primary health, public healthcare, public health care, community health, home health, school health, and family practice. The search was limited to peer-reviewed primary research articles published in English between 2013 and 2022. This search resulted in 647 possible articles for inclusion in this integrative review.

All of the 647 articles were uploaded to a web-based software platform called Covidence to be screened and assessed by the primary and secondary authors. After removing duplicates, the titles and abstracts of 456 articles were screened using inclusion and exclusion criteria that were defined by these two authors before the screening process (Table 1). After screening the titles and abstracts, 95 full-text articles were assessed for eligibility according to the inclusion and exclusion criteria. At the end of each step in the screening process, the primary and secondary authors met to resolve any conflicts related to the inclusion or exclusion of articles. As a result, 37 relevant articles were found in the literature search. The reference lists of these articles were scanned for further relevant studies. Two additional studies met the criteria, which resulted in 39 articles being included in this integrative review (Figure 1).

2.3. Data evaluation

The methodological quality of the studies was assessed using the Mixed Methods Appraisal Tool (MMAT) version 2018. The primary and secondary authors critically appraised the 39 articles in this review independently and resolved any discrepancies in the quality of studies through discussion. The qualitative and mixed methods studies were evaluated as having high methodological quality, while the quantitative studies were evaluated as having high to low methodological quality. The article with low methodological quality did not provide justification for randomization, compare the groups at the baseline, or provide a reason for the high dropout rate.

2.4. Data analysis

The data analysis of the 39 articles was based on Whittemore and Knafll's [15] four phases of data analysis: data reduction, data display, data comparison, and conclusion drawing and verification. Whittemore and Knafll [15] stated that using a philosophical or theoretical perspective in data analysis helps to focus on the purpose of an integrative review. In this integrative review, Kirkpatrick's model was used as a framework to extract, analyze, and present the data. This model is one of the best models for evaluating the effectiveness of training programs as it simplifies the complex process of evaluation by providing a structure that

can be used to establish and evaluate training programs [16]. This model consists of four levels: reaction, learning, behavior, and results [16]. For this integrative review, data were organized, summarized, and coded into an extraction table based on e-learning approaches and the levels of Kirkpatrick's model (Appendix B). Data were presented using network forms and divided according to the objectives of this integrative review (Figures 2 and 3). Codes from the extraction table were analyzed for their similarities and differences. Codes related to similar topics were categorized into themes (Figure 4).

3. RESULTS

The findings of the 39 articles were categorized into the four levels of Kirkpatrick's model: reaction, learning, behavior, and results.

3.1. Level 1: reaction

This level includes facilitators and barriers to accessing and using e-learning courses that were identified from participants' perspectives and experiences.

Characteristics of e-learning content

The quality of e-learning content could have a positive impact on its access and use. This quality was associated with being concise, clear, easy to understand [17–21], reliable, current [22], credible, unbiased [23], adequate, instructive, informative, vigorous, and rich with understandable language [1] as well as having appropriate details [18]. The content could impact HCPs' satisfaction with and the usefulness of e-learning.

Satisfaction. The participants in seven of the included studies were satisfied with the e-learning content [17,24–29]. The e-learning content was satisfactory because of the information that was covered in the course [25], the combination of local and national topics [27], and the availability of local resources [28]. Moreover, participants in several studies were satisfied with the length of e-learning courses [17,20,26,30]. Participants in the study by Lim et al. [20] were satisfied because the e-learning course was short and could be completed at work, while participants in the study by Houwink et al. [26] were satisfied because the time spent on the e-learning course was close to the recommended time to complete the course. Participants in the study by Usher et al. [30] were satisfied with the length of synchronous e-learning courses that lasted for several months, as opposed to intensive courses that presented all the information in one or two days.

However, participants in seven studies were not satisfied with e-learning content for different reasons [1,20,31–35]. Participants

Table 1. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
E-learning (synchronous or asynchronous)	In-person learning
Healthcare professionals	Non-clinical professionals, such as clerks
Primary care settings	Secondary or tertiary care settings
Primary research	Secondary research or review
Focus on using e-learning for CPD or improving knowledge, skills, attitudes, confidences, and practices	Focus on using face-to-face learning for CPD or improving knowledge, skills, attitudes, confidences, and practices
Peer-reviewed articles published in English between 2013 and 2022	Non-peer-reviewed articles, published in any language other than English, and published before 2013 and after 2022

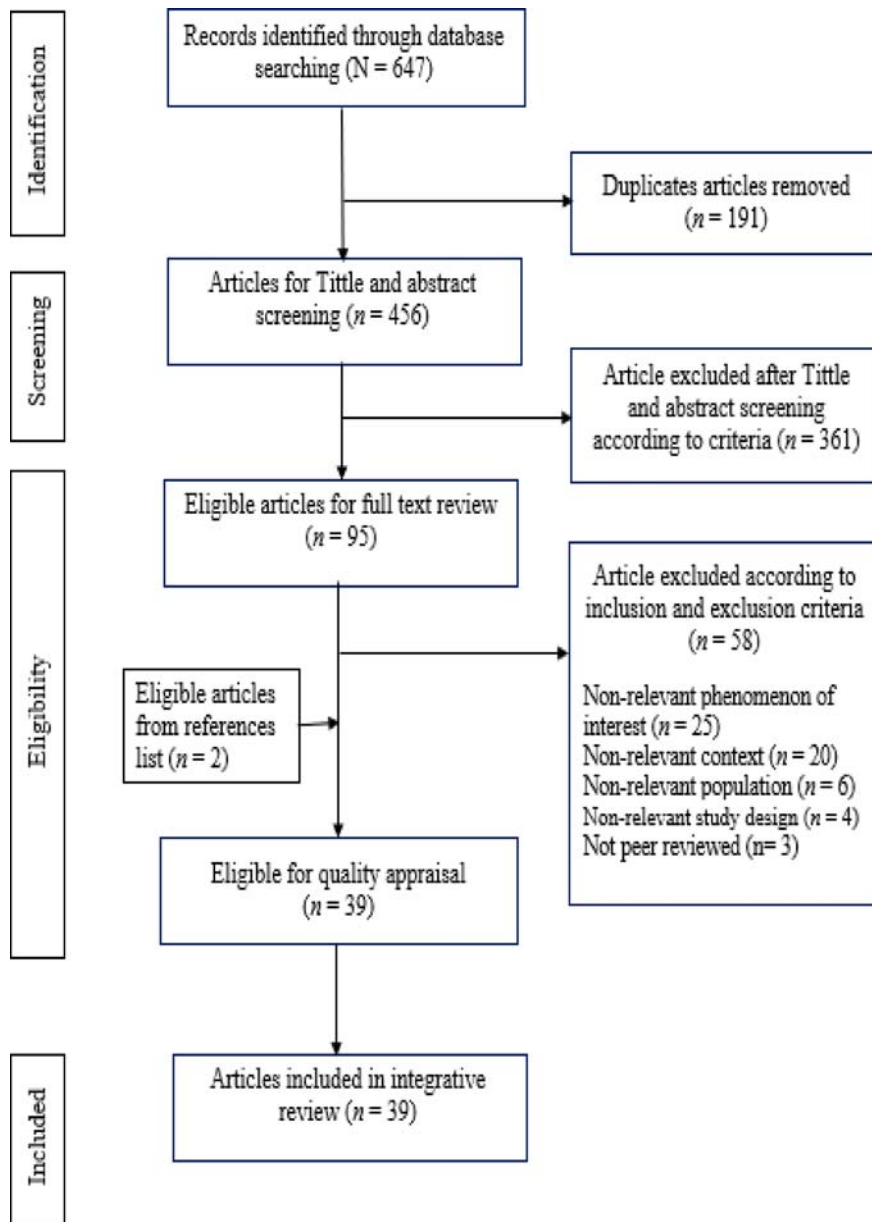


Figure 1. Flow diagram of the literature search.

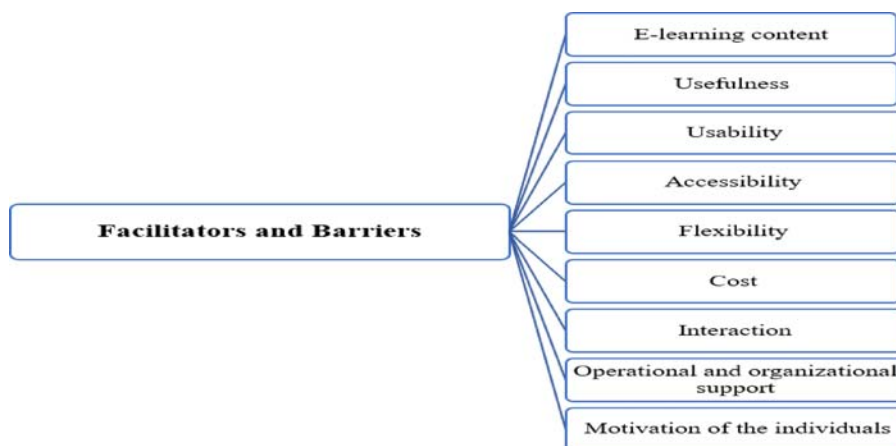


Figure 2. Data display: facilitators and barriers.

complained about the lack of information in the study by Gulati et al. [32]. Similarly, most of the participants in the study by Harvey et al. [33] indicated their need for additional information before

implementing strategies or skills in their practice. The information in the study by Lim et al. [20] was not new and was repetitive in the study by Pusa et al. [1]. Participants in the study by Heartfield et al.

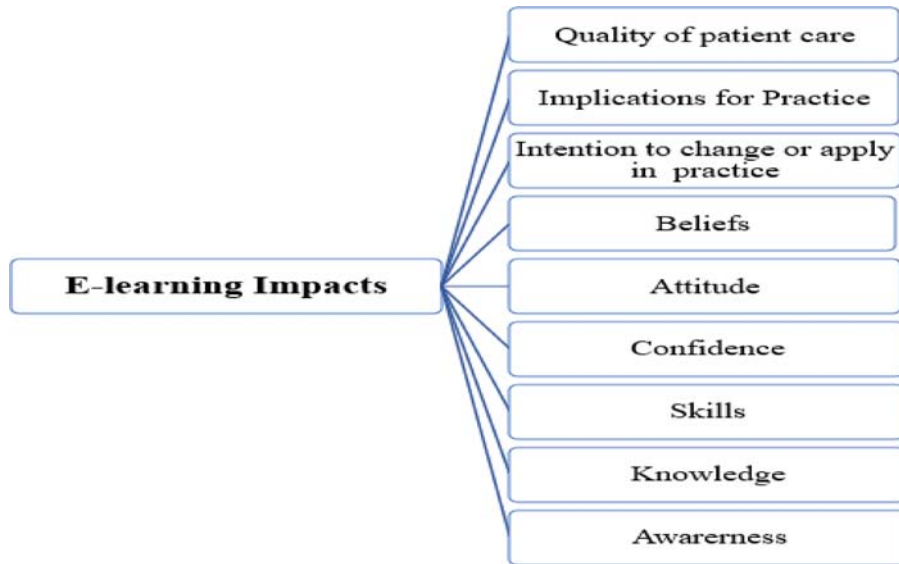


Figure 3. Data display: e-learning impacts.

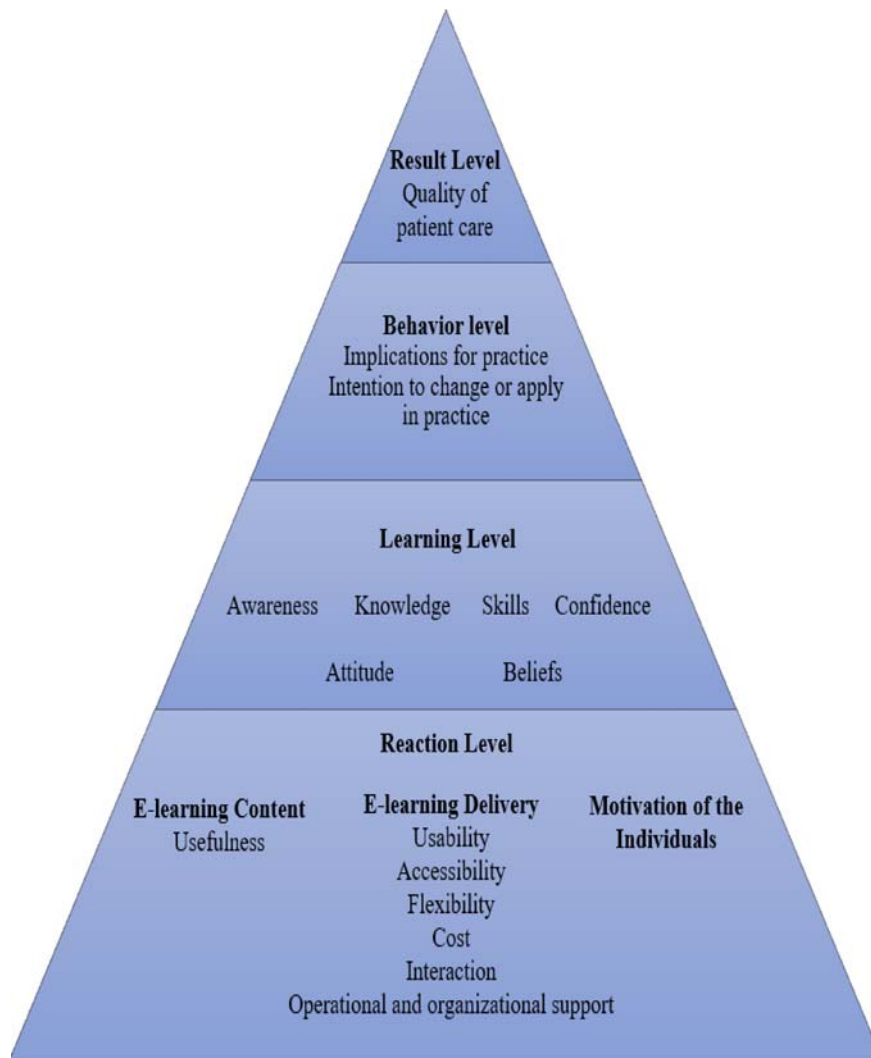


Figure 4. Themes and subthemes based on Kirkpatrick’s model.

[34] could not discriminate between resources offered to different HCPs in different settings. In addition, the e-learning content was moderately complex, as reported by 77% of participants in the study by Carrizosa et al. [31], which did not allow participants to

complete it on time. Participants in the study by Leece et al. [35] perceived their e-learning course to be complex and required a lot of time and effort to get familiar with the content. Similarly, Pusa et al. [1] found that some of their participants had difficulty with

scientific articles that were time-consuming due to language barriers.

Usefulness. E-learning courses have been found to be useful for the practice of HCPs [18–20,28,36,37]. E-learning content was useful for several reasons. Participants found that e-learning content was relevant to their practice [19,20,23]. Most participants in the studies by Heartfield et al. [34], Lineker et al. [23], and Usher et al. [30] found that e-learning content met their learning needs. Participants in the study by Lim et al. [20] reported that e-learning content was appropriate and consistent with their learning and practice experience. The majority of participants (98%) in the study by Salema et al. [37] as well as physicians in specialist training (88.6%) and general practitioners (51.3%) in the study by Lukaschek et al. [9], and 94% of participants in the study by Carroll et al. [24] found that e-learning content was relevant to their practice. Participants (78%) in the study by Jackson et al. [18] reported that e-learning content was relevant to their primary care practice, while 73.8% said it was relevant to their clinical practice. The majority of participants (92.9%) in the study by Ollershaw et al. [28] found the online Dementia Pathways tool to be useful in their practice.

Characteristics of e-learning delivery

The effective delivery of e-learning content was based on usability, accessibility, flexibility, cost, interaction, and operational as well as organizational support.

Usability. The usability of the e-learning platform proved to be a key factor for the delivery of e-learning. The e-learning program in the study by Hanssen et al. [38] was designed to facilitate movement between different sections of the program. Most of the participants (76%) in the study by Carroll et al. [24] reported that push emails for delivering the e-learning activity improved usability. Pusa et al. [1] found that some expert or non-expert participants with similar learning platforms perceived the learning platform to be easy to use or operate. However, participants in the study by Heartfield et al. [34] with no or little experience in using e-learning reported difficulties in navigating an e-learning course.

The usability of e-learning attracted HCPs to use e-learning courses. Participants in five studies reported that ease of navigation in e-learning courses increased usability [18,22,25,34,35]. Similarly, the majority of participants (93.2%) in the study by Salema et al. [37] found their e-learning course easy to use. Most learners (78%) in the study by Cueva et al. [25] found that cancer education models were easy to use. Pusa et al. [1] reported that their participants perceived e-learning as useful because the structure and set-up were appropriate, well balanced, and understandable. However, participants in the study by Lawani et al. [19] reported difficulties in navigating the e-learning website, and participants in the study by Leece et al. [35] reported difficulties in navigating the e-learning course due to technical glitches.

Accessibility. Accessibility has been found to encourage participation in e-learning courses. Five studies [18,19,30,31,39] found that ease of access to e-learning was valued by participants. The participants in the study by Kimura et al. [27] valued access to past sessions and handouts. Moreover, Kimura et al. [27] stated that primary care physicians saved their money because they could access webinars on their personal computers without having to buy a camera or microphone to attend the webinars.

Accessibility could also be influenced by computer literacy and the infrastructure of healthcare organizations. Many practice nurses in the study by Heartfield et al. [34] reported challenges in using e-learning courses due to limited computer literacy. These difficulties occurred during registration and lasted for several hours until they knew where to find the relevant information and how to navigate between content, activities, and resources in the course. Moreover, the availability of the internet and hardware as well as software equipment has an impact on access to e-learning courses. Participants in the study by Heartfield et al. [34] reported that the organization's infrastructure was a common challenge when they had difficulties accessing space for learning at their workplace. Moreover, these participants faced challenges in accessing their computers' hardware and software. Participants in the study by Lawani et al. [19] reported difficulties in accessing the internet which was considered a technical barrier. Similarly, some participants in the study by Lim et al. [20] had problems accessing an e-learning course at work due to a firewall. However, some primary care physicians in the study by Kimura et al. [27] had access to the internet and computers with a web camera and microphone for attending webinars in their organizations, thereby facilitating their access to e-learning.

Flexibility. HCPs prefer e-learning courses that are delivered in a flexible way and allow them to decide when, how, and where they want to learn [1,20,27,30,34,38]. Participants in the study by Hanssen et al. [38] could choose which parts of the content they wanted to focus on, select the locations where they accessed and used e-learning, and access e-learning content again when necessary. Participants in the study by Heartfield et al. [34] reported that e-learning gave them the opportunity to learn while saving travel time and remaining at work. Similarly, participants in the study by Pusa et al. [1] reported that an e-learning course allowed them to take the course whenever they had the energy and their workload allowed without being absent from work. However, participants in the study by Kimura et al. [27] valued their e-learning course because it was presented at various times before working hours in a given week.

Cost. The cost of e-learning was found in one study to have an impact on HCPs' access and use of e-learning. The participants in the study by Leece et al. [35] reported that the registration costs for their e-learning course related to the number of CPD points were high. They considered this expense as a barrier to participating in the e-learning course.

Interaction. Interactions between participants and educators take place via different types of communication during e-learning courses. These interactions provide users with the opportunity to exchange their experiences and knowledge. Kimura et al. [27] and Usher et al. [30] found that an e-learning course designed as a webinar allowed participants to share their experiential knowledge and ideas. Moreover, the use of the chat system in the study by Kimura et al. [27] made the interaction between participants easier. However, some participants in their study could not speak or interact with others because they could not see their facial reactions. Similarly, some participants in the study by Pusa et al. [1] felt a little lonely during asynchronous learning because they could not interact with others and ask questions.

Operational and organizational support. Participants may require support during e-learning courses. The most common support provided in the studies included in this review is technical support. Participants in the study by Heartfield et al. [34]

reported that they accessed their e-learning course from home, where they could find support from their friends, family members, or private information technology (IT) because this support was missing at work. Support also came from the managers of study participants. According to Hanssen et al. [38], the management from the four settings in their study supported the participants by allowing them to use an e-learning course during work. However, 21% of participants in the study by Heartfield et al. [34] did not use an e-learning course due to the workload.

Motivation of the individuals

This review found that e-learning courses both motivate and demotivate learners. Kimura et al. [27] found that participation in the webinars in their study depended on participants' motivation. Most of the participants (71.3%) in the study by Jackson et al. [18] found e-learning content to be stimulating or motivating. Participants in the study by Pusa et al. [1] felt motivated by the topic of the e-learning course. However, participants' motivation decreased in one setting of their study because the e-learning course was mandatory.

3.2. Level 2: learning

The learning level of Kirkpatrick's model includes the impact of e-learning courses on HCPs' awareness, knowledge, skills, confidence, attitudes, and beliefs.

Awareness

One of the impacts of e-learning courses on HCPs is increased awareness of their practice with patients. Participants in the study by Włodarczyk et al. [8] had an increased awareness of older patients' expectations of disease and treatment explanations and their motivation for active participation in treatment and health. Participants in the study by Ahmed et al. [17] became aware of using life expectancy to inform cancer screening in older adults. Bentley et al. [40] found that their participants were more aware of managing patients with dementia. Similarly, Jackson et al. [18] reported an increased awareness of genetic conditions among their participants. Participants in the study by Hanssen et al. [38] reported increased awareness of the importance of involving and collaborating with informal caregivers. Lawani et al. [19] found that their participants had increased awareness in decision-making. The awareness of participants in the study by Usher et al. [30] on community resources for palliative care patients improved after completing e-learning courses.

Knowledge

One of the main goals of using e-learning is to improve the knowledge of HCPs. Fifteen studies have shown an improvement in their participants' knowledge after completing an e-learning course [6,17,19,22,25,28,30,31,35,37,40–44]. Post-tests in five studies have shown an improvement in participants' knowledge [18,26,29,39,45]. The knowledge of participants in the intervention group in the study by Yoshioka-Maeda et al. [46] increased more than that of participants in the control group. However, participants' knowledge increased in both the intervention and control groups in the study by Stoner et al. [21]. Conversely, Gonzalez Salas Duhne et al. [45] found that their participants' theoretical knowledge improved after completing an e-learning course, while their practical knowledge did not improve.

Skills

HCPs' skills may or may not be positively influenced by e-learning. Participants' skills were found to improve after

completing e-learning courses in only nine studies [9,18,28,30,33,37,40,41,46].

Confidence

Improving HCPs' confidence was found to be a goal of e-learning courses in this integrative review. This improvement in confidence resulted from an improvement in knowledge and skills. Participants in 16 studies have shown improved confidence in different topics in their practice [17,18,20,21,23,25,28,30–33,36,38,40,41,47]. However, participants' confidence in recognizing the signs of skin cancer was low in the study by Gulati et al. [32].

Attitude

E-learning courses in this review have shown to have an impact on HCPs' attitudes. Participants in the study by Bentley et al. [40] showed an improved attitude towards dealing with dementia. Participants in the study by De Gagne et al. [22] had an improved attitude towards urinary incontinence. Creupelandt et al. [36] found that their participants had improved attitudes towards prescribing first-line non-drug treatment and short-term medication use. Similarly, participants' attitudes towards prescribing medications improved in the study by Salema et al. [37].

Beliefs

E-learning courses were found in this review to have an impact on HCPs' beliefs about their practices. Participants' beliefs changed after completing e-learning courses [1,36,38]. Pusa et al. [1] found that their participants' beliefs about their role changed from advising to supporting. Creupelandt et al. [36] found that their participants' beliefs changed from believing they could not to believing they could motivate patients with sleeping problems to use non-drug treatment. Hanssen et al. [38] found a change in participants' beliefs about the ability of informal caregivers to understand and collaborate in patient care.

3.3. Level 3: behavior

The behavior level includes the intention to change or apply in practice and implications for practice.

Intention to change or apply in practice

HCPs intend to change their practices after completing e-learning. The results of five studies showed that participants were ready or intended to change their practices [20,24,36,38,42]. The majority of participants (92%) in the study by Carroll et al. [24] indicated that their practice about genetics would be changed or improved after an e-learning course. Creupelandt et al. [36] found that almost three times as many participants were ready to change their prescribing behavior after completing an e-learning course. Many participants in the study by Narayan et al. [42] were encouraged to change their discussion and education practices about opioids and adopt an opioid-sparing approach with their patients. Participants in the study by Hanssen et al. [38] recognized the need to change their collaborative practice with caregivers. Some participants in the study by Lim et al. [20] intended to make changes in their practice by involving patients in decision-making regarding prescribing antibiotics and directing them to relevant resources.

The results of nine studies showed that their participants had the intention to apply knowledge from e-learning in their practice [9,17,19,24,25,33,40,41,48]. Participants in the study by Bentley et al. [40] intended to apply a systematic framework to manage dementia patients. Almost half of the participants (40%) in the

study by Carroll et al. [24] indicated that they would apply the knowledge of genetics gained through e-learning to at least one of their patients. More than half of the participants (59%) in the study by Grad et al. [48] reported that they would use or apply the information from an e-learning program on treatment recommendations to at least one patient. Harvey et al. [33,41] found that their participants (>75%) planned to apply their new knowledge about the care of cancer survivors following an e-learning course. The majority of participants (96.5%) in the study by Ahmed et al. [17] intended to apply the learned knowledge about communication strategies for stopping cancer screening in older adults. Participants in the study by Cueva et al. [25] planned to talk more to their patients about cancer screening (79%), quitting smoking (76%), eating healthy (74%), and physical activity (73%). The results of the study by Lukaschek et al. [9] showed that participants' intention to apply motivational interventions was high among physicians in specialist training (88.6%) and low among general practitioners (38.6%) after completing their e-learning course. Conversely, Lawani et al. [19] found that participants' intention to apply shared decision-making was high from the beginning of their e-learning course and remained high after the course. However, Sinclair et al. [49] found that the intention of their intervention group to start a kidney health check was not significantly different from that of the control group because both groups were exposed to the same e-learning modules.

Implications for practice

Implications for practice included application in practice, practice change, and practice improvement.

Application in practice. HCPs apply the knowledge learned from e-learning courses in their practice. Participants in five studies stated that they applied the knowledge acquired from e-learning courses in their practice [17,19,26,36,45]. Most participants in the study by Lawani et al. [19] reported that the e-learning content about shared decision-making was easy to apply in their practice. According to Ahmed et al. [17], 90% of their participants used communication strategies and 46% used ePrognosis tools in their practice, which were learned from an e-learning course. Creupelandt et al. [36] found that their participants applied non-drug treatment interventions in their practice following an e-learning course. Participants (30%) of the study by Gonzalez Salas Duhne et al. [45] reported that after an e-learning course, they motivated patients to set goals and implement strategies to achieve their goals. However, Houwink et al. [26] found that the majority of their participants (90%) applied the acquired knowledge about genetics in their practice once a month, 5% of participants applied this knowledge once a week, and no participants applied this knowledge daily.

Practice change. Participants in eight studies in this review reported changes in their practice after applying what they learned or gained from topics of e-learning courses [1,18,25,30,31,36,37,42]. Participants in the study by Jackson et al. [18] had changes in their practice regarding genetic conditions. The practice change reported in the study by Carrizosa et al. [31] was about epilepsy management. In addition, participants' practice changed regarding communication and interaction with patients and family members in the study by Pusa et al. [1]. Participants in the study by Usher et al. [30] changed their practice by adopting a more comprehensive assessment of the needs of palliative care patients. Salema et al. [37] found that their participants reported

changes in their prescription of medications, especially in medication reviews. Similarly, participants in the study by Narayan et al. [42] reported changes in their prescribing patterns of opioids and sedatives after a webinar. The majority of learners in the study by Cueva et al. [25] talked to their patients about physical activity and healthy eating (85%), as well as screening and quitting smoking (77%). Months after completing the e-learning course in the study by Creupelandt et al. [36], the majority of their participants (85%) reported changes in their drug prescription for sleeping problems.

Significant changes in practice were not found in all studies. Only 20% of participants in the study by Ahmed et al. [17] reported adhering to changes in their practice. Similarly, in the study by Lim et al. [20], only a few participants changed their practices regarding communication and family involvement in decision-making practices related to antibiotic prescribing. The results of the study by Gulati et al. [32] showed that there were no significant changes in urgent referrals and diagnoses among the participants who used or did not use e-learning course content during the study period. Similarly, almost half of the participants (48%) in the study by Ahmed et al. [17] did not change their practice of considering life expectancy for cancer screening in the elderly after completing an e-learning course.

Practice improvement. The results of seven studies in this review showed improvement in participants' practices [8,21,23,35,43,47,50]. Participants in the study by Leece et al. [35] reported an improvement in their safer implementation of opioid prescribing and patient education practices after completing their e-learning program. Little et al. [50] found that antibiotic prescribing improved among participants after completing e-learning courses. Participants in the study by Lineker et al. [23] had improvements in their arthritis management practices. Participants reported an improvement in screening for depression in the study by Starkey et al. [47], and in screening, intervention, and referral to treatment for alcohol, tobacco, and other drugs in the study by Stoner et al. [21]. Participants in the study by Raffoul et al. [43] reported improvements in screening the pediatric population with eating disorders and referring them to services. Włodarczyk et al. [8] found that their participants' practice in self-assessed communication with older patients improved after an e-learning course.

3.4. Level 4: result

The result level includes the impact of e-learning courses on the key performance indicators of the healthcare organization, which could ultimately be manifested in the quality of patient care. Few studies showed an improvement in the quality of patient care in their results. Gonzalez Salas Duhne et al. [45] stated that the application of motivational interviewing learned in an e-learning course increased the average number of patients who created their implementation plan. The results of the study by Kronman et al. [51] showed that the rate of antibiotic prescribing in patients with acute respiratory tract infections decreased after completing their e-learning program. Similarly, the prescription of benzodiazepines was minimized by participants in the study by Creupelandt et al. [36] several months after completing an e-learning course. According to Gulati et al. [32], urgent referrals and diagnoses of skin cancer increased from 2011 to 2012 after completing an e-learning course on proper diagnosis and referral. Moreover, the number of appropriate referrals increased from 21.3% to 32.3% in their study.

Starkey et al. [47] found that the detection and diagnosis of patients with depression increased from 17.6% to 60.8% after completing an e-learning course. Moreover, they found that more patients were screened for alcohol abuse (17.6%) and substance abuse (14.8%). The use of suicide risk assessment increased by 23.9% after completing the e-learning course in the study by Starkey et al. [47]. It is worth noting that the organizational-level impact may have many confounding factors, making it more difficult to measure the direct impact of e-learning.

4. DISCUSSION

Understanding the facilitators and barriers to e-learning is important before designing e-learning CPD courses to improve their accessibility and use by HCPs. Furthermore, it is important to understand the impact of such a design on HCPs' learning, their practices, and organizational outcomes in primary care settings, especially in providing the best quality of patient care.

4.1. Facilitators and barriers

Facilitators and barriers to the accessibility and use of e-learning for CPD are related to the reaction level of Kirkpatrick's model. These factors can be facilitators or barriers depending on their availability for HCPs. The findings of Picciano [52] as well as Koohang and Paliszkiwicz [53] support the findings of this integrative review, showing that content is the foundation of e-learning. This content must be clear and concise, contain new information, relate to previous knowledge, and be useful and relevant to practice. Similarly, the findings of the integrative review by Stevens et al. [54] and the literature review by Choudhury and Pattnaik [55] identified usefulness as an important factor in the success of e-learning. When designing e-learning professional development for HCPs, it is important to provide content that facilitates its access and use. If the content does not have the features highlighted in this review, HCPs may not be able to access or use e-learning courses, which may negatively impact their level of knowledge and practice improvement.

Accessibility and usability are key characteristics for successful e-learning. Other literature has also found that e-learning facilitates access to information [54–57]. It is important to note that computer literacy is essential for accessing e-learning, as demonstrated in this review and the literature review by Choudhury and Pattnaik [55]. The findings in this review are supported by Picciano [52] and Harerimana and Mtshali [58], who stated that learners need to gain experience in accessing and navigating between the immense amount of information that is constantly changing. However, learners with insufficient computer literacy are reluctant to use e-learning [58]. Lack of computer literacy could impact access to and use of e-learning. In the literature review by Choudhury and Pattnaik [55], it was found that the easy use of an e-learning system is an important factor in the success of e-learning. The importance of ease of use in terms of structure, navigation, and operation of the platform, as noted in this review, is supported by the literature [53,59,60]. Arghode et al. [59] suggested that e-learning platforms should be well-structured and user-friendly. Moreover, the literature review by Choudhury and Pattnaik [55] found that the use of a suitable platform ensures effective e-learning delivery.

Flexibility was found in this review to be an important characteristic in e-learning delivery. The asynchronous approach

is expected to provide more flexibility than the synchronous approach. The finding in this review that flexibility in accessing e-learning anywhere and at any time is important to its success is supported by other literature [55,58,59,61,62]. Moreover, this review found that the flexibility of e-learning saves learners' time and travel. Also, Sayiner and Ergönül [63] and Somayeh et al. [57] found that e-learning is time-saving. In addition, the literature review by Choudhury and Pattnaik [55] and the systematic review by Abdull Mutalib et al. [62] found that e-learning can reduce travel time and cost. The finding of this integrative review that HCPs do not need to spend money on transportation to access CPD courses, making e-learning cost-effective, is similar to the findings of the integrative review by Stevens et al. [54] and the systematic review by Abdull Mutalib et al. [62]. The lack of flexibility in e-learning could have a negative impact on its accessibility and use, which in turn could have a negative impact on the learning and practices of HCPs.

As noted in this review, interaction is essential for creating and exchanging knowledge, ideas, and experiences with others. This finding is supported by other literature [52,55,59,64]. Arghode et al. [59] stated that social interaction is a fundamental factor in knowledge creation. On the one hand, the interaction between learners and instructors is important to facilitate learning and refine learners' knowledge [52,64]. On the other hand, designing e-learning courses without interaction could deter the creation or exchange of knowledge and ideas. The findings of this review revealed that interaction is readily available in blended and synchronous e-learning, whereas the asynchronous approach has more limitations in fostering interaction between participants.

Managerial and operational support such as IT was considered important to the accessibility and use of e-learning in this review. The literature review by Choudhury and Pattnaik [55] supports the finding that a lack of management support results in limited access to and use of e-learning by learners. Operational support depends largely on resources. The findings of Picciano [52] support the finding of this review that the internet is the most important resource because it is needed to facilitate continuous learning and knowledge creation. Without internet access, learners cannot exchange or access web-based information.

Motivation is another essential component of learning [52], which can be external or internal. The findings of this review and the literature review by Choudhury and Pattnaik [55] have shown that interactive and relevant e-learning content can externally motivate learners. Internal motivation could be a result of learners feeling that e-learning is interesting. This finding is supported by other literature that found learners who are intrinsically motivated learn better [54,59,64].

4.2. Impacts of e-learning

This review has shown that HCPs can improve their learning, practice, and organizational outcomes by accessing and using e-learning-based CPD. This finding from this integrative review and other literature [56,65] implies that access to and use of e-learning courses improves HCPs' awareness of different topics. The findings in other literature have also confirmed that participants' knowledge increases after completing e-learning courses [54,66–68]. Moreover, the findings of the literature review by Somayeh et al. [57] and the systematic review by Rouleau et al. [66] point out that e-learning supports HCPs in gaining and improving necessary skills. In addition, other literature [54,65,66] confirms that

e-learning improves HCPs' confidence in the topics learned through e-learning. Similar to the findings in this review, other literature [65,66,69] also indicate that learners' attitudes improve after completing e-learning courses. Improving the awareness, knowledge, skills, confidence, and attitude of HCPs is the foundation for practice improvement.

The application of learned knowledge and skills was found in this review to engender change and improve the practices of HCPs. Similarly, participants in the studies by Chase et al. [67] and Wang et al. [68] intended to change or apply the knowledge and skills acquired from e-learning courses in their practice. Moreover, the finding of this review that e-learning improves the practices of HCPs is supported by the literature [54,56,65,69,70]. Improving the practices of HCPs is directly positively related to improving the quality of patient care. Thus, the goal of healthcare organizations to improve the quality of patient care through the development of HCPs' learning and practices could be achieved by providing CPD via e-learning. This finding is supported by other literature [54,67,69] and highlights the fact that the quality of patient care could not be improved if healthcare organizations do not support the ongoing CPD of their HCPs.

PHCC has recognized the importance of HCPs who are committed to continuous development and usage of information and technology to achieve person-centered care in Qatar as key performance indicators [71]. Another target area for this organization is to improve patient experience and standardized quality of care. These organizational key performances can be positively impacted by e-learning. For example, PHCC reported that their HCPs engagement in e-learning increased from 77.4% in 2021 to 81.4% in 2022 because of the easy access to e-learning courses that lead to promote the values of self-directed CPD (personal communication, February 8, 2024). As a result, the performance of those who attended the relevant e-learning courses improved. For example, patient identification process was improved from 90.2% in 2022 to 94.2% in 2023 and hand hygiene practice improved from 93.5% in 2022 to 97.3% in 2023 after attending related e-learning course (personal communication, February 8, 2024). As a result, patient satisfaction increased from 83.8% in 2022 to 85.9% in 2023 which is one of the key performance indicators of PHCC (personal communication, February 8, 2024).

4.3. Strengths and limitations

This integrative review has several strengths and limitations. One of these strengths is the systematic and rigorous methodological approach based on the framework of Whittemore and Knafl, which allows the inclusion of diverse methodological approaches to have a deeper understanding of the phenomenon under study. In addition, an expert librarian assisted in identifying the appropriate databases and search terms for this review, which led to the inclusion of the most current high-quality primary studies. The screening process was another strength of this review as it was conducted independently by the primary and secondary authors who met at the end of each step to resolve any conflicts. In addition, the same authors critically appraised the included studies using a valid and reliable tool. The extraction, analysis, and presentation of the data were based on Kirkpatrick's model, which has been comprehensively used in evaluation learning programs as it simplifies the complex process of evaluation. Furthermore, this integrative review summarizes and comprises all

past research on the facilitators, barriers, and impacts of e-learning on HCPs in primary care settings. Moreover, this review meets the same standards of rigor and clarity as in primary research. As such, this review highlights the gap in research on this topic in the State of Qatar. Therefore, this review is considered the first review on this topic conducted in Qatar.

The limitations in this review are related to the included studies. The original aim of this study was to understand the access to and use of e-learning by nurses in primary care settings, but the number of studies focusing on nurses was limited. Therefore, the search was expanded to include HCPs from different disciplines, which limited the understanding of nurses' access to and use of e-learning. Moreover, the included studies were only in the English language and were mostly conducted in America, Europe, Australia, and East Asia, with no studies conducted in the Middle East or the Gulf region. Another limitation is the type of e-learning found in the included studies. The majority of studies used asynchronous e-learning, three studies used synchronous e-learning, and five studies used blended e-learning, which may limit the understanding of the synchronous and blended approaches. Additionally, only one study included a result on the cost of e-learning for participants, which limits the understanding of cost as a facilitator or barrier.

4.4. Implications and recommendations

The findings of this integrative review can inform the design of e-learning for HCPs. CPD providers should consider the importance of e-learning content while designing e-learning for HCPs. The content should be concise and include new information that is relevant to the practice and settings of HCPs. The delivery of the content is also important for effective e-learning-based CPD. Asynchronous delivery of e-learning content is more flexible, while synchronous delivery is more interactive. Therefore, the use of blended e-learning could be beneficial as it can combine the main advantages of synchronous and asynchronous approaches. The use of blended e-learning could increase the opportunity for HCPs to engage in and continue their professional development. Moreover, this approach could allow HCPs to communicate with instructors and other colleagues to exchange their knowledge, experiences, and ideas as well as ask questions to better understand the content. However, further research should be conducted in this area to fully understand the impact of such an approach. In addition, future research in the Middle East, especially in the Gulf region, should focus on understanding the facilitators, barriers, and the impact of different types of e-learning on HCPs.

It is also important that healthcare organizations and managers support their HCPs by providing them with an allocated time to complete and the necessary resources to access e-learning programs. Designing e-learning activities with appropriate content as well as flexible and interactive delivery for HCPs with the support of healthcare organizations can improve the quality of both e-learning and patient care. Continuous evaluation of access to and use of e-learning will help stakeholders in PHCC to understand the weaknesses and strengths of e-learning. This continuous evaluation can be part of the yearly quality improvement planning project. In addition, the Accreditation Department of QCHP may consider adding the findings of this review to current resources for CPD providers who wish to design and deliver e-learning courses. The results of this review can also

be a complement to the current QCHP regulation, accreditation, and monitoring process to ensure the adequacy and quality of e-learning in the State of Qatar and PHCC in particular.

5. CONCLUSION

This integrative review was conducted to understand the facilitators, barriers, and impact of the accessibility and use of e-learning among HCPs in primary care settings. The findings of this review suggest that the characteristics of e-learning content and delivery, as well as the motivation of HCPs, form the basis for creating or designing an e-learning course. Moreover, HCPs' learning through an e-learning approach can increase their awareness, knowledge, skills, confidence, attitudes, and beliefs. Applying this new learning in practice can result in change or improvement in practice. This change in practice by HCPs can ultimately improve the quality of patient care in PHCC. The findings of this review can also have implications for the design and

evaluation of e-learning courses, with the hope of improving the quality of e-learning. Moreover, the findings could complement the current CPD standards and regulations surrounding e-learning for HCPs in the State of Qatar. Further research on synchronous and blended e-learning in the Middle East is highly recommended.

Competing interests

The authors have no conflicts of interest to declare.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' contributions

Hana Al-Yazidi chose the integrative review design and framework. Hana Al-Yazidi and Ameneh Tossi analyzed the data. Hana Al-Yazidi, Ameneh Tossi, and Daniel Forgrave wrote and edited the manuscript.

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Appendix A

List of abbreviations.

Abbreviation	Definition
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CPD	Continuing Professional Development
EBSCO	Academic Search Complete
HCPs	Healthcare Professionals
IT	Information Technology
MEDLINE OVID	Medical Literature Analysis and Retrieval System
MMAT	Mixed Methods Appraisal Tool
PHCC	Primary Health Care Corporation
QCHP	Qatar Council for Healthcare Practitioners

Appendix B

Extraction table.

Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
Kimura et al. (2018) Characteristics and perceptions of twice-weekly webinars for primary care physicians in Japan: A qualitative study Japan	To explore the characteristic features and perceived value of free twice-weekly webinars predominantly focusing on the continuing professional development of primary care physicians in Japan	Qualitative Descriptive phenomenology	Six primary care physicians Primary care settings	Synchronous	Reaction	In the webinar, topics were presented at various times, which provided a good balance with topics of more national scope 24/7 access to the archives of past handouts and sessions Primary care physicians have access to computers and the Internet They can participate in the webinars without having to buy equipment save for a web camera and a microphone for when they are the webinar’s main speaker Participants can participate in the webinars as long as they have a personal computer and access to the Internet, which makes location no longer a barrier Webinars are held twice a week throughout the year Participants appreciated the value of the chat system because it greatly lowered the threshold for interaction Utilizing the chat system made the interaction easy for even young participants to ask questions or give comments

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
Usher et al. (2022) Project ECHO: Enhancing palliative care for primary care occupational therapists and physiotherapists in Ireland	To evaluate the impact of delivering education using the ECHO model on occupational therapists and physiotherapists self-reported confidence in their clinical knowledge and skills in addressing the palliative care needs of patients they work with in primary care settings	Mixed method Quasi-experimental design One group pretest-posttest design Qualitative descriptive study	26 HCPs (16 occupational therapists and 10 physiotherapists) Primary care settings	Synchronous	Reaction	<p>education around opioids, and adopting a sparing approach towards opioid initiations</p> <p>Many participants stated that the technology used in ECHO allowed them to engage in education that would have been otherwise difficult to access, due to geography and time pressures</p> <p>Participants appreciated the program because it ran over a number of months instead of one- or two-day intensive course with much information at the time</p> <p>95% of participants felt that ECHO met their learning needs</p> <p>Participation in ECHO allowed establishment of a network of HCPs working in palliative care</p> <p>Participants reported it was useful to hear about practice across the country and that HCPs in different counties were experiencing similar challenges and were adopting similar approaches in their efforts to provide quality services and also that this allowed sharing of ideas</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						<p>Participants valued the ease of accessibility the online format offered, its interactive nature and the benefit of not having to travel to attend</p> <p>Learning</p> <p>Confidence improved significantly in post-ECHO evaluations in their knowledge and skills of Principles of Palliative Care and of Care Planning and Collaborative Practice</p> <p>Participants reported being more confident to engage in a more comprehensive assessment and treatment approach</p> <p>Participants described having more confidence in assessment and treatment approaches and better awareness of community resources</p> <p>Participants reported increased confidence in facilitating difficult conversations, having adopted a more comprehensive assessment, which led to better patient outcomes</p> <p>Statistical analysis of scores in knowledge and skills demonstrated that overall scores were significantly</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
Ahmed et al. (2021) A novel curriculum on using life expectancy to inform cancer screening in older adults USA	To describe the development and evaluation of a novel curriculum that teaches primary care physicians to use life expectancy to	Quantitative quasi-experimental design One group pretest–posttest design	86 primary care providers Primary care settings	Asynchronous	Reaction	<p>higher post-ECHO across the six competencies for both knowledge and skill</p> <p>Participants described enhanced knowledge about palliative care approaches</p> <p>Participants described having a better awareness of community resources</p> <p>Behavior</p> <p>Participants had changed their practice to ensure they adopted a more thorough assessment of the needs of the palliative care patient</p> <p>Acceptability of the curriculum after completing the module was high</p> <p>The subject matter was clearly presented (97.7%)</p> <p>The length of this course was appropriate (97.7%)</p> <p>Learning</p> <p>Knowledge in communication strategies improved from 55% to 97%</p> <p>The baseline confidence in predicting life expectancy increased from 5.72 to 8.04 after module completion</p> <p>The baseline confidence in discussion screening cessation was 6.72; this</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						increased to 8.41 after module completion Importance of life expectancy was increased from 9.02 to 9.52 after module completion
					Behavior	We found that 48% participants reported no change in their practice, 20% reported higher frequencies used life expectancy cancer screening, and 32% reported lower frequencies used life expectancy cancer screening We found that 46% participants reported using the ePrognosis tools at least sometimes and 90% reported using the communication strategies to discuss stopping cancer screening at least sometimes 96.5% of participants reported that they would apply what they learned in their work
Bentley et al. (2019) Behavioural change in primary care professionals undertaking online education in dementia care in general practice Australia	To describe and understand the effect of undertaking the program on knowledge, confidence and attitudes, and behavioural intentions of PNs and IMGs	Mixed method Quantitative quasi-experimental design One group pretest–posttest design Qualitative descriptive study	25 participants (14 international medical graduates (IMGs); 11 practice nurses (PNs)) Primary care settings	Asynchronous Learning	Learning	Participants' knowledge about dementia increased after completing the modules. Baseline mean scores for the DKAS were 34.1 for PNs, which increased by 28% to 43.6 for PNs Participants' confidence and attitudes about dementia increased after completing

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						the modules, from 11.2 to 13.0 for PNs PNs reported improved skills in using a systematic approach to working with people with dementia PNs reported improved awareness Participants' confidence and attitudes about dementia increased from 11.2 to 13.0 for PNs
					Behavior	Participants have strong intentions to apply a systematic framework to identify and manage patients with dementia
Carrizosa et al. (2018) Epilepsy for primary health care: A cost-effective Latin American E-learning initiative: A report from the Education Commission of the International League Against Epilepsy Latin America	To enhance primary health care physicians' knowledge on epilepsy by online course to improve their diagnostic and therapeutic management of patients with this problem	Quantitative non-experimental design Descriptive research	129 primary care physicians Primary healthcare	Asynchronous	Reaction Learning	77% rated the content with moderate complexity 68% of students found the online methodology easy to access Knowledge of epilepsy increased from 5.8% before the course to 67.8% afterwards Self-confidence increased in one's ability to manage patients with epilepsy from 21.4% to 72.6% after the course
					Behavior	All stated that they had significantly changed their practice
Carroll et al. (2016) The gene messenger impact project: An innovative	To determine the value of emailed Gene Messengers as a continuing education (CE)	Quantitative non-experimental design	1,402 family physicians Primary care settings	Asynchronous	Reaction	The vast majority were satisfied with Gene Messengers 88%

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						<p>their disadvantages, non-drug alternatives are as effective as BZDs, non-drug treatments do not need to be supported with medication</p> <p>The intervention significantly influenced the way GPs perceived patients with sleep problems. Months after the intervention, participants were less convinced that it took a drug prescription to satisfy a patient and they agreed less that it was difficult to motivate patients to choose a non-drug treatment</p> <p>Behavior 95.8% of the participants evaluated the intervention as 'meaningful' and months after the intervention more than 85% stated that the module did change their prescribing practice</p> <p>Participants reported implementing several of the demonstrated, non-pharmacological interventions in their practice: every approach included in the e-module was used by most participants</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						<p>On the follow-up survey, 23% of respondents reported feeling even more confident (4.5) to talk about cancer</p> <p>Behavior They planned to talk with their patients more often about cancer as a result of the modules, including talking more about cancer screening (79%), cutting down on tobacco use or quitting tobacco (76%), eating healthy (74%), being physically active (73%), or something else (40%)</p> <p>85% reported that they had talked with their patients more often about physical activity, 85% about eating healthy, 77% about screening, and 77% about cutting down or quitting tobacco use after completing e-learning course</p>
De Gagne et al. (2015) A urinary incontinence education online course for community health nurses in South Korea South Korea	To develop and pilot an online education program to educate these nurses about the effective management of UI care for community-dwelling older women living in rural communities and to examine the effectiveness of this online program	Quantitative quasi-experimental design One group pretest–posttest design	24 nurses Primary healthcare posts, public health centers, and community settings	Asynchronous	<p>Reaction</p> <p>Learning</p>	<p>Participants’ top rankings about the e-learning course were about the containing of the recent information and reliable content Participants give the highest rank to the program’ construction that used easily</p> <p>The mean knowledge score increased to 27.28</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
England	referral behaviour to secondary care	Qualitative descriptive study	Primary care			recognizing different skin lesions suspicious of skin cancer was lower in 2013 Confidence in knowledge of the appropriate referral pathways for malignant skin lesions was higher in 2013
					Behavior	There were no significant changes in the number of urgent GP referrals for suspected skin cancer, diagnoses of melanoma, or diagnoses of non-melanoma skin cancer in these time periods between the toolkit user and non-user groups
					Result	The absolute numbers of urgent skin cancer referrals and melanoma and non-melanoma diagnoses increased from 2011 to 2012 The proportion of appropriate referrals increased from 21.37% in 2011 to 32.3% in 2012
Hanssen et al. (2017) How can web-based training facilitate a more carer friendly practice in community-based health and social care services in Norway? Staff experiences and implementation challenges	To explore factors that influenced the implementation of the program and whether or not using it affected health and social care practitioners' attitudes and perceived capacity for collaboration with carers	Mixed method Quantitative quasi-experimental design One group pretest–posttest design Qualitative descriptive study	In quantitative: 83 health and social care practitioners In qualitative: 14 health and social care practitioners A home-based service, a nursing home, and two health and social care agencies	Asynchronous	Reaction	The user can choose which parts to focus on E-learning program's flexibility made it feasible to reach all staff, independent of shift work, highly useful for educating non-native staff, providing easy

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
Norway						<p>access to knowledge about Norwegian culture and regulations, and decreasing language difficulties by repeating sections as-needed</p> <p>The management in all four settings had approved the program's introduction and allowed the staff to use it during working hours</p> <p>Learning</p> <p>They gained confidence in their approach to careers, and they felt more competent to handle challenges in their collaborations with careers and patients/users</p> <p>E-learning program made participants more aware of the importance of involving informal careers and had led to collaboration with careers</p> <p>Practitioners who had used the CBP valued collaboration with informed careers in handling caring situations became easy</p> <p>Participants experienced fewer conflicting interests between patients/users and careers</p> <p>Participants' perception that patients/users did not want careers to be involved was reduced</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						<p>Their experience that informal careers did not understand their professional work had decreased as well as perceived conflicts with careers</p> <p>Behavior</p> <p>Participants discover the need for change in their practices by introducing some new procedures related to careers' collaboration</p>
Harvey et al. (2020a) Initial outcomes of an online continuing education series focused on post-treatment cancer survivorship care USA	To evaluate the effectiveness of the e-learning series in learner confidence in defined cancer survivorship learning objectives	Quantitative quasi-experimental design One group pretest–posttest design	1,341 healthcare professionals Primary care settings	Asynchronous	Learning	<p>A majority of learners (91.59%) agreed or strongly agreed that their knowledge was enhanced</p> <p>There was an increase in mean self-confidence rating for aggregated learning objectives from pre to post for each module, which ranged from 0.66 to 0.92</p> <p>They gained new strategies/skills/ information and they could apply to practice (83.41%)</p>
					Behavior	<p>A majority of learners (75.38%) planned to implement strategies/skills/ information that gained from e-learning course into practice</p>
Harvey et al. (2020b) Addressing the care of cancer survivors: Evaluation of an online training	To evaluate within and between group differences in self-reported confidence gains for primary care versus oncology	Quantitative quasi-experimental design One group pretest–posttest	1,138 primary care providers and oncology specialists Primary care settings	Asynchronous	Reaction	<p>52.3% of primary care providers and (30.2%) of oncology providers indicated they needed additional</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
for interprofessional learners USA	learners across all learning objectives of the series	design			Learning	<p>information before being able to implement skills/strategies into practice</p> <p>Most oncology (91.9%) and primary care providers (90.9%) either agreed or strongly agreed that their knowledge was enhanced</p> <p>Learners confidence improved in meeting learning objectives from pre- to post-assessment</p> <p>They gained new skills/strategies that could apply to practice (85.4% oncology, 84.3% primary care)</p>
Heartfield et al. (2013) E-learning competency for practice nurses: An evaluation report Australia	To evaluate e-learning competency from practice nurses' experiences	Quantitative non-experimental design Descriptive research	Approximately 500 responses from practice nurses General practice/primary healthcare	Asynchronous	Reaction	<p>They did not always discriminate between resources offered for different health professionals, or practice-specific information such as details for different settings</p> <p>Practice nurses were dissatisfied with the time taken to complete all aspects of the modules because they followed each link and read everything</p> <p>Over half of practice nurses reported that their learning</p>
					Behavior	<p>They planned to implement skills/strategies into practice (77.5% oncology, 79.1% primary care)</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						<p>needs were entirely met</p> <p>The ability to go back and forth, double check and pick up where they left off within the online learning resources was highly rated</p> <p>Many practice nurses had little or no previous experience with e-learning and reports of difficulties with registration and navigation that persisted for the first few hours until they learned where to find the relevant information and how to move efficiently between content, resources and activities</p> <p>Difficulties accessing computers and the designated space at work to study as well as support were frequent</p> <p>Hardware and software were common problems, with nurses describing access to computers without sound cards to enable listening to audio and video, outdated software and/or limited broadband facilities</p> <p>Avoiding travel and time away from work to study</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
primary care in six European languages UK	professionals with genetic skills relevant for practice by using Kirkpatrick’s framework for educational outcomes	Descriptive research Qualitative descriptive study	Primary care settings		Learning	<p>navigate by 78.8%, while 87.5% reported that the resources were presented with an appropriate level of detail</p> <p>Some general practitioners had feedback that some of the modules were quite long</p> <p>Learners reported that the Gen-Equip resources were easy to use</p> <p>Learners reported that the Gen-Equip resources were easy to access</p> <p>Learners reported that the Gen-Equip resources were useful, interactive, and applicable to practice</p> <p>73.8% reported that the module was highly or very relevant to their own clinical practice, while 78.8% believed that it was highly or very relevant to primary care practice generally</p> <p>71.3% of participants found it stimulating</p> <p>Every module resulted in a significant increase in post-test scores</p> <p>Average increase in knowledge was 34.7%</p> <p>Learners’ confidence increased when talking about genetic results and genetic testing</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						with families and when taking a family history Average increase in skills was 46.8% An increase in their awareness of red flags that should raise suspicion of a genetic condition, referral criteria, understanding of genetic aspects of disease and inheritance patterns, and knowing what to ask when taking a family history
					Behavior	Participants were more likely to ask more questions about the family history, to seek advice from genetics colleagues, and to refer to specialist services
Lawani et al. (2020) Professional training on shared decision making with older adults living with neurocognitive disorders: A mixed-methods implementation study Canada	To study the implementation of a professional training program featuring an e-learning activity on shared decision making and five Decision Boxes on the care of people with neurocognitive disorders, and measured the program's effects	Mixed method Quantitative quasi-experimental design One group pretest–posttest design Qualitative descriptive study	In quantitative: 47 healthcare professionals In qualitative: 11 healthcare professionals Family medicine clinics and homecare services	Asynchronous	Reaction	Training program was easy to understand and visually appealing It provided practical training It was concise and clear They appreciated the short modules of the e-learning activity that made it easier to retrieve information Training allowed them to become aware of the DBs and other patient decision aids DBs covered topics of interest for practice and meet their clinical needs The technical barriers were difficulties

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
Leece et al. (2020) Improving opioid guideline adherence: Evaluation of a multifaceted, theory-informed pilot intervention for family physicians Canada	To assess changes in Canadian family physicians' knowledge and practices after completing the Opioid Self-Assessment (OSA) package	Mixed method Quantitative Quasi-experimental design One group pretest–posttest design Qualitative descriptive study	9 family physicians Primary care settings	Asynchronous	Reaction	<p>accessing the Internet access or navigating the website</p> <p>Most mentioned ease of access to the training program</p> <p>They perceived the training program as useful for learning about SDM</p> <p>Learning Knowledge about risk communication was statistically improved Statistically significant improvements in HCPs' awareness and perceived awareness of the options after training</p> <p>Behavior They mentioned that it was easy to do Intention to adopt SDM was high at baseline, and remained high after training</p> <p>The main barriers as participants' perceptions were the time and effort required to become familiar with the guidelines' contents and perform the necessary documentation Some participants reported that the tool was easy to navigate, while other users encountered technical glitches and found navigating the site difficult</p>

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						Several participants found that the online module was expensive relative to the number of points
					Learning	Knowledge improved significantly on completing the online module
					Behavior	Improvement and change on partial or full implementation for safer opioid prescribing
Lim et al. (2020) Theory-based electronic learning intervention to support appropriate antibiotic prescribing by nurse and pharmacist independent prescribers: An acceptability and feasibility experimental study using mixed methods England	To assess the acceptability and feasibility of using a theory-based electronic learning intervention designed to support appropriate antibiotic prescribing by nurse and pharmacist independent prescribers for patients presenting with common, acute, uncomplicated self-limiting respiratory tract infections (RTIs)	Mixed method Quantitative quasi-experimental design One group pretest–posttest design Qualitative descriptive study	11 nurse and 4 pharmacist prescribers Primary care settings	Asynchronous	Reaction	E-learning intervention was appropriate and easy to understand and consistent with their own previous learning and practice The information in the intervention was not new to prescribers Prescribers agreed that the intervention could be completed during work time because it was a short learning session They agreed that the intervention was applicable and would be useful to them as prescribers The intervention was useful in helping prescribers refresh their memories, consolidate learning and prompted self-reflection on prescribing for patients presenting with RTIs

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
						<p>E-learning intervention was relevant to their practice</p> <p>E-learning was flexible</p> <p>A few prescribers experienced problems accessing the intervention at work due to the National Health Service (NHS) firewall</p>
					Learning	<p>High to very high levels of confidence were reported</p> <p>It appeared to increase their confidence in their current practice and in refusing to prescribe antibiotics, when appropriate</p>
					Behavior	<p>A few prescribers have already changed their practice</p> <p>They intended to make changes to their practice specifically around involving the patient more in decision-making and directing patients to relevant information resources</p>
Little et al. (2019) Antibiotic prescribing for acute respiratory tract infections 12 months after communication and CRP training: A randomized trial UK	To report the impact of the Internet-based physician training on use of a CRP point-of-care test and on enhanced communication skills using an interactive patient booklet to reduce antibiotic prescribing after	Quantitative experimental design Randomized controlled trial	372 clinicians General practices	Asynchronous	Behavior	For patients with LRTI, communication was still effective compared with usual care at 12 months, but CRP was not Although antibiotic prescribing decreased with usual care during follow-up

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
	12 months					out to 12 months, communication training remained more efficacious at that time, whereas CRP training did not
Lukaschek et al. (2019) Applicability of motivational interviewing for chronic disease management in primary care following a web-based e-learning course: Cross-sectional study Germany	To report participants' opinion on the practicality of MI (as learned in the course) in daily practice, stratified by the level of education	Quantitative non-experimental/observational study Descriptive research	255 general practitioners (GPs) and 123 physicians in specialist training (PSTs) Primary care	Asynchronous	Reaction Learning Behavior	Participants rated the applicability of the skills and knowledge gained by the course as positive. PSTs: 88.6% excellent; and GPs: 51.3% excellent Communication skills for general practitioners and physicians in specialist training were improved They had the intention to use MI in the future: 88% of the PSTs and 38.6% of GPs
Ollerenshaw et al. (2018) Towards good dementia care: Awareness and uptake of an online Dementia Pathways tool for rural and regional primary health practitioners Australia	To investigate the awareness and usage of the DPT for GPs and nurses	Quantitative non-experimental design Descriptive research	42 participants (21 general practitioners and 21 nurses) Primary care settings	Asynchronous	Reaction Learning	Practitioners valued the content and the availability of local resources Most respondents (92.9%) found the DPT useful The majority of respondents indicated that the DPT was either useful or very useful in complementing their knowledge about dementia Over half of the respondents reported that the tool had improved their knowledge and skills across several dementia topic domains Respondents reported improved confidence in several areas

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Authors, year, title, country	Aim	Study design	Samples and settings	E-learning approaches	Kirkpatrick model levels	Findings
Pusa et al. (2019) Nurses' perceptions about a web-based learning intervention concerning supportive family conversations in home health care Sweden	To describe the perceptions that municipal primary healthcare nurses and municipal registered nurses had about a web-based learning intervention concerning supportive family health conversations in municipal home health care	Qualitative descriptive phenomenology	21 nurses municipal primary healthcare/home healthcare	Asynchronous	Reaction	<p>since the launch of the DPT</p> <p>Nurses perceived the structure and set-up of the web-based learning as well-balanced, appropriate and understandable</p> <p>The learning platform was perceived as suitable and easy to use and described as intuitive</p> <p>It was perceived as an advantage for those who had experience of the same or similar learning platforms</p> <p>Nurses who considered themselves less technically knowledgeable or those who did not have previous experience of web-learning perceived the structure of the web-based learning and the learning platform as well-functioning and easy to operate</p> <p>The web-based learning was associated with the perceived flexibility</p> <p>Nurses perceived the structure of course well suited as it enabled them to take part of it whenever their work and energy level allowed them to</p> <p>The web-based design enabled nurses to study at</p>

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						<p>a pace they chose and to pause and rewind</p> <p>This set-up was perceived to be time saving as it reduced travelling to classes and the set-up did not require a specific time and place to study</p> <p>Some nurses experienced the design of web-based learning to be a little bit lonely when not being able to just put up their hand and ask questions</p> <p>Nurses described that their motivation increased because the topic was vital and interesting</p> <p>Nurses in one setting did not have the opportunity of free choice if they wanted to take the course that led to a decreased level of motivation</p> <p>The course affected both how nurses perceived their role as nurses and how they now regarded the families they met during their workdays</p> <p>Nurses perceived that the theoretical content was adequate and instructive</p> <p>The content was perceived as informative and vigorous, rich</p>
					Learning	

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						with an understandable language The content was described by some nurses to have repetitious as difficult and time consuming Some nurses perceived the scientific articles Behavior They perceived that they more frequently asked about the experiences and feelings of patients and family members with increased receptiveness and responsiveness to the families' stories Nurses had begun to communicate in a different way, asking more reflective questions and embracing the positive impact of silence on the reflection process
Raffoul et al. (2022) Evaluation of a one-hour asynchronous video training for eating disorder screening and referral in U.S. Pediatric Primary Care: A pilot study USA	To pilot-test the efficacy of a 1-h, online asynchronous video training, complemented by spaced-education prompts, in improving pediatric PCP comfort in screening and referrals, knowledge about EDs, and behaviors related to screening for EDs and referral to services	Quantitative quasi-experimental design Pre- and post-survey	84 primary care providers (nurse practitioners, registered nurses, physicians, and others) Primary care settings	Asynchronous	Learning Behavior	There were significant improvements in participants' knowledge Participants were significantly more comfortable in screening and making referrals for each of AN, BN, BED, ARFID, and OSFED in pediatric populations There was a significant increase in PCPs who reported using any specific screening tools for

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Rhodes et al. (2019) Rapid E-Learning for professional development in school-based diabetes management USA	To assess the effectiveness of a rapid e-learning module for school nurse professional development in school-based diabetes management	Quantitative quasi-experimental design One group pretest–posttest design	678 school nurses (school nurses were considered as primary care providers) School sites	Asynchronous	Learning	EDs in the past 2 months The module was effective at improving nurses’ knowledge on the content of the module Knowledge scores showed a statistically significant improvement from pre-test to post-test
Salema et al. (2021) The evaluation of an e-learning prescribing course for general practice UK	To explore the e-learning prescribing course impact on prescribing and acceptability as perceived by users	Quantitative quasi-experimental design One group pretest–posttest design	2,164 healthcare providers General practice/primary care	Asynchronous	Reaction	93.2% of the respondents agreed/strongly agreed that the e-learning course was easy to use Higher proportion (98%) of the respondents agreed/strongly agreed that the e-learning course was a useful part of their CPD
					Learning	The majority of respondents reported that the e-learning course had positively impacted on their prescribing knowledge The majority of respondents reported the e-learning course had positively impacted on their prescribing skills The majority of respondents reported the e-learning course had positively impacted on their prescribing attitudes
					Behavior	The majority of respondents reported change in prescribing practice

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Sinclair et al. (2019a) The CKD-DETECT study: An RCT aimed at improving intention to initiate a kidney health check in Australian practice nurses Australia	To evaluate the effectiveness of an asynchronous web-based e-learning module on GPNs' behavioral intentions in relation to opportunistic screening practices in people at risk of CKD	Quantitative experimental design Randomized controlled trial Theoretical (include hypothesis)	212 general practice nurses General practice/primary care	Asynchronous	Behavior	There were no significant differences in behavioral intention between the intervention and control groups because all participants were exposed to e-learning modules
Sinclair et al. (2019b) An evaluation of general practice nurses' knowledge of chronic kidney disease risk factors and screening practices following completion of a case study-based asynchronous e-learning module Australia	To report the results of a study that evaluated: (a) the effect of an asynchronous web-based e-learning module to develop GPNs' knowledge about CKD risk factors and screening practices; and (b) GPNs' perceived satisfaction with the e-learning module	Quantitative experimental design Randomized controlled trial	207 general practice nurses Primary care settings	Asynchronous	Reaction Learning	Participants (85.8%) rated their satisfaction with the e-learning modules highly The high satisfaction scores reflected that the modules were well designed to deliver each of the criteria CKD knowledge was significantly improved from 3.77 to 5.48
Stoner et al. (2014) Web-based training for primary care providers on screening, brief intervention, and referral to treatment (SBIRT) for alcohol, tobacco, and other drugs USA	To evaluate the educational effectiveness of SBIRT-PC, compared to online provision standard SBIRT training manuals, among PCPs across the U.S.	Quantitative experimental design Randomized controlled trial Theoretical (include hypothesis)	37 physicians, 35 physician assistants, and 20 nurse practitioners Primary care settings	Asynchronous	Reaction Learning Behavior	The material was easy to read and understand Participants' knowledge increased from baseline to post-training All provider types showed significant increases in SBIRT-related self-efficacy All provider types showed significant increases in SBIRT-related clinical practices
Wlodarczyk et al. (2017) Enhancing doctors' competencies in communication with and activation of older patients: The	To examine the effects of a computer-based educational intervention designed for general practitioners	Quantitative experimental design Randomized controlled trial	225 general practitioners Primary care settings	Asynchronous	Learning	The strongest effect on changes in GPs' perception of older patients' expectations for the medical encounter that was about

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promoting active aging (PRACTA) computer-based intervention study Poland	(GPs) to promote active aging					explaining the patient's disease was changed in the e-learning group GPs' perception of older patients motivation to actively participate was significantly high in the e-learning group
					Behavior	The communication practice changed in the e-learning group
Yoshioka-Maeda et al. (2019) Impact of web-based learning for health program planning competency, knowledge and skills among mid-level public health nurses: A randomized controlled trial Japan	To evaluate the impact of web-based learning modules for health program planning competency, recognition, knowledge and skills among public health nurses (PHNs)	Quantitative experimental design Randomized controlled trial	244 public health nurses (PHNs) Community health	Asynchronous	Learning	The scores for knowledge in the intervention were significantly higher than those in the control group The participants significantly improved their knowledge The scores for skills in the intervention were significantly higher than those in the control group The participants significantly improved their skills
Kronman et al. (2020) Reducing antibiotic prescribing in primary care for respiratory illness USA	To evaluate a distance learning program's effectiveness for reducing outpatient antibiotic prescribing for ARTI visits	Quantitative experimental design Randomized controlled trial	57 clinicians Community-based primary care pediatric practices	Blended e-learning	Result	The DART QI program decreased the overall rate of antibiotic prescribing among all ARTI visits, and this effect was sustained in the 2- to 8-month post-intervention period
Lineker et al. (2019) Getting a grip on arthritis online: Responses of rural/remote primary care providers to a	To develop and evaluate the GRIP Online focusing on the evidence-based management of RA and OA in	Quantitative quasi-experimental design One group pretest–posttest	89 primary healthcare professionals Primary care settings	Blended e-learning	Reaction	A majority of respondents agreed that the modules were consistent with stated objectives, rural settings

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web-based continuing medical education programme Canada		design				addressed their learning needs, were relevant to practice, and were credible and nonbiased A majority of respondents agreed that the modules were relevant to practice
					Learning	Participants reported significant and clinically important improvements in confidence for recommending or prescribing corticosteroids, completing the MSK examination, ordering serologic tests, managing common MSK conditions, and recommending a knee injection and nonsteroidal anti-inflammatory drugs (NSAIDS)
					Behavior	The participants' ability to manage arthritis improved significantly immediately following both the OA and early RA modules
Pereira et al. (2015) Alcohol abuse management in primary care: An e-learning course Brazil	To verify if the Alcohol Abuse Management in Primary Care (AAMPC) was able to enhance healthcare professionals' alcohol-related problems knowledge	Quantitative quasi-experimental design One group pretest – posttest design	33 primary care providers Primary care settings	Blended e-learning		Reaction Participants rated the course load as excellent (24%) and good (64%) and course length as excellent (20%) and good (68%) Learning There was a significant improvement in the alcohol knowledge from pre- to post-course

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Starkey et al. (2016) Improving depression care through an online learning collaborative USA	To examine the impact of a practice improvement intervention on screening and managing patients with depression in primary care	Quantitative quasi-experimental design One group pretest–posttest design	16 physicians Primary care settings	Blended e-learning	Learning Behavior Result	More physicians felt very confident in managing patients with depression after completing the intervention Participants increased usage of the PHQ-9 following completion of the online educational intervention The use of PHQ-9 to detect and/or diagnose patients' depression increased from 17.6% to 60.8% in 17.6% post-intervention, and also used the PHQ-9 to gauge treatment success for more patient's post-intervention. Data showed that practices screened more patients for alcohol (17.6%) and substance abuse screening (14.5%) post-intervention; Chart audits showed an increase in suicide risk assessment (23.9%) post-intervention
Wei et al. (2019) The effect of a web-based training for improving primary health care providers' knowledge about diabetes mellitus management in rural China: A pre-post intervention study China	To explore the effect of web-based training for improving knowledge about DM management among primary health care providers	Quantitative quasi-experimental design One group pretest–posttest design	808 primary healthcare workers Primary care settings	Blended e-learning	Learning	Three months after the training, the township health workers and the village doctors had increased their knowledge about DM