Effectiveness of Online Learning Modules in Changing Patient Management

A Literature Review

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A capstone project submitted to the Faculty of Graduate Studies of The University of Manitoba

in partial fulfillment of the requirements for the degree of

MASTER OF PHYSICIAN ASSISTANT STUDIES.

Master of Physician Assistant Studies

University of Manitoba

May 15, 2024

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ABSTRACT

Introduction: Online learning modules are increasingly utilized for continuing education to enhance healthcare providers' patient management competencies. However, evidence of sustained practice improvements is limited. This literature review evaluated online learning's effectiveness in changing providers' skills and behaviors for patient care.
Methods: Studies published over 20 years assessing the impact of online modules on diagnosis, treatment recommendations, referrals, or patient outcomes were reviewed. Outcomes of interest were skill decay over time, changes in management practices, and learner's self-reported benefits.
Results: Information acquired from online learning persisted until a year before the gradual decline. Initial gains in diagnosis accuracy and guideline-concordant treatment rates diminished by 12 months. Among nurses, 75% reported lasting confidence improvements in blood loss estimation, but only 42% felt competent in judging severe hemorrhages.
Conclusion: Online learning successfully disseminates foundational knowledge to spur short-term patient management skills. However, sustaining intrinsic practice changes requires recurring boosters and accountability mechanisms. Though beneficial for conveying information, online education should integrate long-term reinforcement strategies to bridge enduring knowing-doing gaps.

INTRODUCTION

The lifelong acquisition of new skills or improvement of professional quality in the medical field of health care professionals is known as Continuing Medical Education (CME). For this literature review, healthcare professionals include physicians, registered nurses, and nurse practitioners. In the context of the paper, it will introduce evidence highlighting the practice of healthcare providers in the field of online learning modules with the perspective of affecting their behavior of interaction with patients. Even though there is an abundance of information doctors can get, some come from reputable sources, yet the low turnout points to this option not being fully used (1). Healthcare professionals are significantly hindered from attending face-to-face conferences or continuing in-person education. Considering this trend, one of the reasons that could lead to it is the physically and emotionally demanding working conditions of healthcare service providers, which leaves them with little time and money for continuing education (1). For example, despite a global CME sector revenue of US$8.24 billion, the same projected revenue dropped to $5.34 billion in the matching year, with figures indicating financial problems and restraints in CME taking place (1). The primary purpose of CME, in this case, is to summarize the most up-to-date research in the clinical setting in a way that will ensure good patient care. Lectures remain the teachers' option, but to make them more up-to-date, interactive sessions, practical skill training, case discussions, and team exercises, as well as using gamification, will support the engagement of learners (2).

Online learning, the modern solution grounded on leveraging internet technology for less hectic access and overlying geographical barriers, has surfaced as an innovative approach. E-learning modules are user-friendly and can be accessed anywhere at any time, thus enabling clinicians to manage the gap between general practice and specialist care (1). Hence, we can

acquire new knowledge and skills and stay updated on new medical developments (3). Internet-based learning has successfully equipped various providers with expertise in numerous areas. With nearly 100 percent of doctors participating in smartphones, the upsurge in internet connectivity has rapidly increased online CME courses, which now are more than living events (3).

Reddy et al.[4] reported that 75% of physicians and other healthcare professionals preferred to gain accredited CME hours via virtual events (versus the previously popular conferences), a ratio that increased drastically due to the logistical impediments imposed by COVID-19. In the ocean interweaved with different modes of online CME, internet searches were the most visited sources (73%) after instructional (45%) and video (44%) fragments (4). Consequently, online CME is one of the most fundamental tools for comprehensive professional training for workers. Plus, being an ongoing education has increasingly become a requirement for professionals in the healthcare field to be certified and licensed, and students are more willing to try what online education can offer in pursuit of better patient care (4).

Online Learning in Healthcare

This section describes the different formats of online learning that have emerged as innovative educational approaches in healthcare, including their potential advantages and limitations. Key aspects covered include asynchronous online courses, synchronous web-conferencing, serious gaming, virtual reality simulations, intelligent tutoring systems, and blended models. This section will also compare advantages like flexibility and expanded access to disadvantages like the need for specialized technical expertise.

Hodroj et al.[5] categorized prevalent online learning formats into asynchronous online courses, synchronous web-conferencing, serious gaming, virtual reality simulations, intelligent

tutoring systems, and blended models (5). Asynchronous online learning involves self-directed engagement with pre-designed instructional content over weeks. This encompasses textual documents, PowerPoint presentations with audio-visual integration, and online discussion forums to reflect and clarify concepts among learners and instructors (5).

Nevertheless, the trends are that the self-exploration of serious gaming strategies for online learning, applying realistic decision-making based on real-life situations solved with features 'employing scoring systems' and 'perceived fun' keep the user engaged for the long term (6). A more sophisticated form of assisted learning tool is the Intelligent Tutoring System (6), which mimics the human tutor environment to offer guidance in an online setting where students are constantly monitored with dynamic progress and guidance provided to improve mastery (6). Blended learning combines online training procedures such as recorded lectures, knowledge assessments, and face-to-face training procedures of skill to enjoy the blend of instruction-led advice and web-based learning (6).

Caprara[7] argued that online learning fosters a better learning experience than traditional learning methodologies because the online environment provides unlimited access to learning resources outside socioeconomic disparities and, hence, supports self-regulated learning that is not tied to standardized geographical locations or time-bound schedules (7). This improves student agency, individual academic experiences according to personal requirements for each student's needs, and availability (8). The other advantage is that uniform quality content delivery and computerized objective assessment of standards skills are provided across cohorts (8). Potential opportunities also exist concerning the cost of online training regarding travel, physical infrastructure, and human resources (8).

Nevertheless, increased technical skills such as computer knowledge are necessary for optimal online learning course development to facilitate learner engagement (9). Integrating instructional design specialization with learning analytics allows for creating educationally viable multimedia content based on learning objectives, sequential actions, custom interactions, and looped feedback (9). Thus, more clarity is needed to apply Internet-based learning to clinical practice. At the same time, an almost complete lack of instructional strategies limits the transformation of knowledge gain into changed behavior, as indicated by Schettino & Capone (10). This highlights the need for educational technology expertise and subject matter knowledge for impactful online learning translations.

Evaluation of Online Learning

Assessment of outcomes is vital to gathering evidence regarding the effectiveness of online learning interventions. This review covers the evaluation framework that Kirkpatrick and Kirkpatrick (2016) proposed, which has become standard across four levels: reaction, learning, behavior, and results.

Reaction level based on the framework indicates learner satisfaction with the online instructional experience, usability, convenience, and engagement quality (11). The learning level examines learners' acquisition of intended knowledge, skills, attitudes, confidence, and commitment after participating in online education. This is typically measured through multiple-choice questionnaires before and after the intervention. Behavior level checks for on-the-job applications by learners when performing regular workplace tasks are based on competencies gained through online learning (11). Finally, the results level assesses tangible improvements in organizational metrics like productivity, quality, and cost savings enabled by changed behaviors (11).

Most studies, like Beckett (1) and Longhini (2), that evaluate online learning, have focused on learners' reactions, satisfaction, material relevance, and peer recommendations. The other predominant focus has been on immediate learning outcomes regarding knowledge, skills, and attitude gains measured mainly after the online intervention compared to pre-test values (2). Campbell et al.[12] highlighted a vital evidence gap in limited assessments of actual practice change and the long-term impact on patient care outcomes resulting from enhanced provider competencies due to online education (12). Therefore, while reaction and learning provide a functional formative evaluation of learner perspectives and knowledge improvements immediately after online learning implementations, follow-up evaluations after months of assessing behavior change along clinical practices and patient health indicators are essential for summative judgments of effectiveness. Addressing this research gap can significantly strengthen the value of online learning for the continued development of healthcare professionals by establishing a clear correlation between practice improvement and patient benefits in addition to the acquisition of information.

Reviews like Campbell (12) have assessed online learning for healthcare professionals regarding reaction, education, practice change, and patient outcomes. For instance, Sinclair et al.[13] analyzed 90 studies conducted in Canada, Latvia, Greece, the United States, Israel, the United Kingdom, Spain, Uganda, South Africa, Australia, Korea, and New Zealand. They found that online CME improved knowledge, skills, and practice outcomes but had little impact on practice behavior, with negligible changes to patient benefit (13). The results by Sinclair revealed a need for long-term assessment, with the median follow-up being from the end of the intervention to 3 months only (13). Also, George et al.[14] noted online CME increased knowledge, attitudes, skills, behaviors, and patient benefits compared to no interventions. Still, the quality of

evidence could have been better, with insufficient follow-up to assess retention over months (14). de Leeuw et al.[15] concluded multimedia instructional design principles enhanced learning and satisfaction with online CME (15). However, minimal data correlated knowledge gain to change in practice to benefit patient care. In addition, Tenison et al.[16] found e-learning improved nursing students' knowledge, attitudes, and skills, but the evidence was weak for translation into clinical practice (16).

The efficacy of online learning depends considerably on the instructional design and appropriate media fit for content type and complexity (14). Amaka & Goeman[17] show multimedia presentations combining narrations with animations/visuals, per Mayer's cognitive theory of multimedia learning, promote better retention than alone. Intelligent tutoring systems simulate human tutors through interactive problem-solving with tailored feedback to develop expertise (17). Serious gaming provides experiential learning coupled with perceived entertainment, amusement, and scorekeeping (17). However, healthcare providers prefer case-based online learning on patients' diseases as they can be directly applied to patient care scenarios (18). Reinforcing supportive interventions assists them in sustaining practice change. Varied underlying behavior change theories inform the design of customized online learning solutions. The Technology Acceptance Model indicates ease of use and perceived usefulness drive the adoption of technology innovations like online learning. The Theory of Reasoned Action and Transtheoretical Model also explains the drivers of practice change intention and readiness to progress across motivational stages (19).

Most studies like Longhini (2), Jayas (3), and Masoomi (9) have evaluated satisfaction with the online learning experience and pre-post knowledge immediately after module completion. Few studies have assessed long-term retention of knowledge, objective practice

change through patient chart audits, and patient health indicators over follow-up periods beyond a year (13). This is a significant gap that needs to be addressed through further research on the effectiveness of online learning courses in improving patient care by healthcare providers.

PURPOSE OF THE STUDY

This literature review aims to evaluate the existing evidence on the effectiveness of online learning modules in changing patient management skills and behaviors among healthcare providers in clinical settings. The analysis will focus on continuing medical education (CME) interventions delivered to healthcare professionals involved in inpatient or outpatient care.

This study will evaluate the existing evidence on the effectiveness of online learning modules in changing healthcare providers' patient management skills and behaviors. The analysis will focus on three key objectives: First, to assess deterioration in skills, knowledge, confidence, and practice changes over time after completing online learning modules, including comparisons to baseline levels and immediate post-module assessments. The second objective is to measure the effect of online learning concerning the disease identification rate, treatment recommendations counselling, and patient referral before and after; this reduces the doctor's lifestyle and patient care quality. The third objective is to analyze providers' self-reported data on changes in self-confidence, knowledge, and clinical practices that they attribute to online module completion.

METHODS

A literature review was conducted to identify studies that rated online learning modules' effectiveness for changing clinicians' patient care skills and behaviors. The pre-set criteria were utilized to search PubMed, Scopus, and CINAHL databases.

Search Strategy

A comprehensive literature search was conducted using PubMed, Scopus, and CINAHL databases to identify studies evaluating the impact of online learning modules on healthcare providers' patient management knowledge, skills, and behaviors. The key search terms used included: ("online learning" OR "e-learning" OR "web-based learning" OR "online module") AND ("patient management" OR "patient care" OR "clinical practice") AND (physician OR nurse OR "healthcare provider").

Searches were limited to English language studies published in peer-reviewed journals within the last 20 years (2004-2024). PubMed was utilized as it contains the most extensive collection of health sciences literature. Scopus was included as an interdisciplinary database containing health and social sciences research. CINAHL was also searched, given its focus on nursing and allied health. Search results from the three databases were imported into Mendeley reference management software, and duplicates were removed.

Article Screening and selection

Table 1. Study Selection Criteria

Inclusion criteria	Exclusion criteria
Published in English in the last 20 years (2004 – 2024)	Not explicitly focused on patient management outcomes resulting from online education programs
Evaluating online continuing medical education (CME) or continuing nursing education (CNE)	Published before 2013

Assessed outcomes related to patient diagnosis, treatment recommendations, referral rates	Did not include baseline measurements for comparison to post-intervention outcomes.
Included surveys, knowledge assessments, or practice evaluations before and after the online education intervention to allow for comparisons	Only evaluated provider knowledge acquisition alone
Focused on physicians, physician assistants, nurses, or other direct healthcare providers	-

RESULTS

After duplicates were removed, 457 studies were retrieved. After the title and abstract, 34 studies were selected for full-text review. An additional 7 relevant studies were identified from the reference lists of the 34 studies selected for full-text review, resulting in 41 studies undergoing full-text analysis.

Upon further review, five studies most closely aligned with the research objectives and were selected for final data extraction and analysis in this paper. This section will describe the articles and how they relate to the research objectives, as summarized in Table 2. Two studies concentrated on the decay of skills and practice changes over time after online learning completion (Objective 1). Two studies focused on quantifying changes in diagnosis, treatment, and referral rates before and after online education exposure (Objective 2). Two elicited healthcare providers' self-reported gains in confidence, knowledge, and clinical practices attributed to online learning (Objective 3). Other studies were excluded due to insufficient

follow-up durations, irrelevant outcome measures, or lacking baseline comparisons. Five empirical studies spanning the three research objectives were utilized to compile evidence on the sustained impact of online continuing medical education on patient management.

Objective 1: Assess Decay in Skills and Practice Changes Over Time

The five studies evaluated decline in skills, knowledge retention, confidence levels, and practice behaviours at two-time points: 1-12 months after post-online learning module completion and after 12+ months (20). Knowledge retention showed minimal decline within the first year after the online learning intervention across multiple studies but a more significant reduction beyond 12 months (20). In a study of blood loss estimation skills, median error improved from -47.8% at baseline to -13.5% post-training but increased to -34.6% at 9-month follow-up with underestimation of large volume bleeds (21). For child abuse training, mean knowledge scores (out of 10) were 7.38 at 6-10 years post-training compared to 7.22 at 0-5 years, indicating gradual knowledge decline (22).

Braschinsky et al.[23], regarding the practice behaviors and skill application, modules on headache management and blood loss estimation showed initial changes post-training that declined by 12 months (23). Rates of inappropriate headache diagnoses decreased after online education but resurged close to baseline levels during longer-term follow-up (23). The frequency of underestimating blood loss increased between the post-module tests and the 9-month follow-ups (21).

For confidence gains, 73% of providers reported increased confidence in visually estimating blood losses at a 9-month follow-up compared to baseline (21). In contrast, only 42% felt competent in accurately estimating large volume bleeds after nine months, requesting annual refreshers (21). This indicates differential decay patterns by skill domain.

Objective 2: Impact on Diagnosis, Treatment, and Referrals

Specifically focusing first on diagnosis practices, the data indicates substantial improvements in the accuracy and specificity of clinical assessments after online learning exposures compared to baseline skills. For instance, in primary care settings, non-specific headache diagnoses encompassing a wide symptom cluster dropped remarkably from being applied in over 60% of cases to just 22% of patients a year after family physicians had undergone online training (23). Simultaneously, rates of correctly identifying and coding debilitating migraine headaches among patients almost quadrupled from 10% to over 40% (23). This signifies knowledge gains and measurable progress in precise headache classifications that can enable appropriate treatments.

The other diagnosis scenario of blood loss estimation during obstetric complications or surgery also showed accuracy improvements from a median visual estimation error of -47.8% underestimating actual values before online education to -13.5% post-module completion (21). Though some skill decay was observed during the 9-month follow-up, with the median error rising to -34.6%, this still represents a substantial gain over baseline competencies (21). Collectively, across the two studies, the collated findings strongly indicate online learning participation enhanced provider diagnostic capabilities.

Progressing to impacts on treatment plan quality, evidence again shows positive transformations aligned with best-practice recommendations. For headache management in particular, the proportion of patients receiving guideline-concordant treatments shot up remarkably from 58% at baseline to over 80% post-online training (23). This includes initiating appropriate abortive or prophylactic pharmacological therapy, avoiding contraindicated

medications, advising lifestyle modifications, referring intractable cases for specialty consultation, and managing mild presentations directly with evidence-based quality care (23).

The third patient management parameter of referral rates and volumes to specialist care also underwent favorable changes, indicating better care coordination after primary providers completed online learning. For headaches, specialist referrals saw a vast almost 50% drop from close to 40% of patients at baseline to 20% at one-year follow-up post-online education (23). For migraine cases specifically, the referral rate plunge was even more substantial, falling from 45.8% initially to just 6.7% after family physicians strengthened their knowledge of diagnostic criteria and initial treatment through e-learning (23). By enabling competent primary care management for larger shares of patients, overtraining and overtreatment expenditure can be contained while enhancing access and timeliness of care.

Objective 3: Learner Self-Reported Changes

In terms of the blood loss estimation modules and modules completed by obstetricians and nurses, around 74% of respondents said that they had sustained confidence levels when rapid visual estimates were given for this, as well, and this feeling lasted up to nine months without relapse of hesitations at the beginning (21). This is one dimension that facilitates rapid response times in caring for patients.

Reinforcing this belief even more, 86% of the majority acknowledged divesting transitional dependence upon equipment-defined blood volumes and nurturing habits related to personally picturing blood flow as a clinical ability target after passing through online learning (21). This is conclusive subjective proof that e-learning is an agent of intentional transition, like months after learning specific tasks that are known in the knowledge itself. It is not merely passive learning.

This is different from saying that this degree of homogeneity prevails across specialties on the level of perceived skill-retention needs that may affect the recommendations for the frequency of learning module boosters. For example, 53% of pediatricians and 44% of family practitioners suggested repeating online circumspection of child abuse spotting modules every five years (22). However, only 31% of surgeons and 36% of internists shared this need for refresher despite their poorer performance on knowledge assessments (22). So, while self-evaluated confidence to apply learnings remained high across groups at the 1–2-year mark, those lacking mastery may still overrate capabilities, suggesting that needs-based assessments for refreshers may optimize value (22).

The concern regarding potential decay in accurately estimating large-volume blood losses provides another perspective. Despite broadly reporting comfort with basic blood loss visual skills even at 9-month follow-up, 42% of nurses simultaneously expressed worries about losing precision for judging severe hemorrhage volumes, specifically unless the online module is repeated annually (21). This indicates certain complex sub-skills are perceived to undergo faster erosion. These self-identified vulnerabilities can help target content for refresher modules to sustain high-stake competencies.

DISCUSSION

Summary of findings

The findings from the first objective reveal that, while online learning conferred persisting knowledge gains up to 12 months post-training, application to clinical behaviors and skills showed more significant deterioration, with initial improvements diminishing by 12 months across studies (21). Knowledge and abilities most prone to decline must be identified for targeted refreshers.

In the analysis period in objective two, which is 1-2 years, the reconciled results show significant improvements in the patient management performance measures that have the great potential to influence improvement in the quality of care, coordination, and cost-efficiency (23). This emphasizes the effectiveness of continuing education through online learning in boosting the capacity of healthcare providers to improve their capabilities, leading to better patient care delivery. However, a limitation across these studies was the need for follow-up periods extending beyond a year. So, while favorable gains emerged across parameters of diagnosis, treatment, and referrals attributable to online learning in the short-term, longer-term sustainability beyond 12-18 months remains unvalidated (23). As the emerging evidence indicates a waning effect or some dilution of knowledge and practice change by one year after initial training, investigations of the tracking indicators over the years can demystify the durability issues.

As revealed in objective three results, analyzing the affirmative sustained self-improvements and selective self-doubts reported via provider surveys offers a balanced perspective on the learner-estimated longevity of online education interventions (22). Synthesizing insights across specialties and domains prone to perceived decay further allows data-driven decisions on skill-specific booster modules to optimize retention of practice changes (22).

Analysis

Analyzing the first objective, which evaluated the decline in skills, knowledge retention, confidence levels, and practice behaviours at two time points, 1-12 months after post-online learning module completion and after 12+ months, provides mixed implications. On the one hand, knowledge gains quantified through scores demonstrate retaining information up to a year before gradual decline. This aligns with adult learning theories, just like those emphasized by

Tennant[24], which state that adults can store new knowledge in short-term memory with relative stability and proper reinforcement. However, more than merely retention is needed to capture translation into application. As emerging skills and practice behaviors showed faster reversals towards baseline states by 12 months despite initial changes post-training, the sticking power of online learning on intrinsic habits appears limited (23).

Potential reasons could entail a lack of opportunities to repeat newly acquired skills in actual clinical workflows frequently enough to imprint habits (16). In addition, the absence of short-looped in-time performance feedback from coaches and the inability to be accountable for the actual implementation in patients in clinical training follow-up phases may cause a dropdown (16). That is, while knowledge building is accumulated, the actions derived from the insights require more than that infrastructure. This explains why essential confidence gains persisted, but nurses' perceived ability to handle complex skills like significant blood volume estimations deteriorated remarkably from 73% to 42% over months (21). The critical implication is that online modules succeed at disseminating information access but do not change behaviors, which requires ongoing reinforcement.

Drilling down on dimensions of knowledge most vulnerable to decay is also vital. Discrepancies were found in the fact that the understanding of some clinical training documents can only be retained with consistent practice, unlike basic concepts (22). Similarly, estimation abilities declined faster than conceptual knowledge of blood loss management principles (21). Hence, tailoring booster content to skill and specialty needs is critical.

The quantified improvements in diagnosis, treatment plan quality, and appropriate triaging through referrals in the short term after online learning are promising. With vast absolute percentage point differences demonstrated on indicators like non-specific headache diagnoses

dropping from 60% to 20% and guideline-recommended treatments climbing from 58% to over 80%, online education seemingly promotes positive changes (22,23). This data compels investment in online continuing education by health systems seeking quality improvements.

However, two factors necessitate caution against over-extrapolation. Only a few studies followed impact sustainability for over a year (25). Second, determining causal attribution between online education in isolation of the other co-occurring interventions or temporal trends presented incapability of the statistical definition because of evaluation limitations (25). Even so, the significant improvements in the measures well known to demand extra provider competency boost gathered through online learning, as stated by Amaka (17), a viable path with potential tangible gains, are an excellent reason to consider further propagation.

The subjective reports of the surveyed also demonstrate that e-learning helps generate sustainable self-perceived self-confidence, knowledge, and practice commitment in healthcare professionals. Nurses were willing to volunteer information about the volume of blood loss they have estimated actively, with frequencies from 0 up to 86% immediately after feeling newly equipped and up to 75% of them obtaining persistent confidence gains (21). At the same time, however, 80% wanted an annual refresher that bore a clue of competence doubt (21). This is a matter of incorporating these learner perspectives in the process designed to create content online to create adhesion purposefully. Triangulating these self-reported gains with the performance demonstrated due to the related values obtained from the measured metrics helps to balance the evaluation.

Generalizability is a crucial point to be considered when discussing how far the findings of a study in question can be transferred to a broader population or context. A case in point is that the conclusions' applicability solely to a particular group of healthcare providers in specified

settings can be limited, which means that the role of generalizability is of great importance. Several colliding variables can affect the independent factor (online learning) and the dependent variable (knowledge pace, clinical behavior). Therefore, the proportionality between two attributes can be misestimated. An example of a pitfall could be when a healthcare provider involved in the online study also gains additional contact training or mentoring during that period.

Biases that are also interrelated with misinterpretation of study results. An example of selection bias is when some healthcare providers are more likely to engage in online learning programs, thus leading to circumstances that depict only the general population. Furthermore, publication bias, in which studies with positive outcomes are often published more than those with neutral and negative ones, can distort the perceived impact of online information in healthcare. Keeping these biases in view, opting for randomized controlled trials, and transparent reporting of methods are some precautions that must be taken to yield reliable and unbiased medicine (22). Despite the results that online learning can be a powerful tool for retaining knowledge and measuring performance in the short to medium term, generalizability issues, along with the potential for confound and bias demands, that this research be viewed as tentative and further exploring should be undertaken to ascertain if the benefits are sustainable and applicable in all settings in healthcare.

In summary, online modules can reliably deliver basic knowledge if stretched appropriately but rarely independently cause permanent behavior transformation due to a lack of ongoing application support and behavior enforcement mechanisms. This explains, therefore, the reason why most reforms in health are stalled regardless of early intensity and strategic calls for systems thinking (26). Moreover, the isolated interventions inform the pattern of progress on the

motivation and capability drivers for some time. Still, greater awareness is directed to leveraging enabling circumstances drivers and pushing practice responsibility, which is required to accommodate the position of walking away.

STRENGTHS AND LIMITATIONS

One strength of this literature review is its comprehensive search strategy spanning multiple databases to gather high-quality evidence on the research question. Using different databases such as PubMed, Scopus, and CINAHL to capture studies across health and nursing fields was essential to ensure the sources' reliability. Additionally, the use of well-defined inclusion and exclusion criteria to identify the most relevant studies evaluating online learning's impact specifically on patient management outcomes has a significant strength.

Although this review has produced useful synthesized information on online learning outcomes, the study has several limitations. A significant limitation was the limited availability of studies involving the control or follow-up groups exceeding 12 months of the intervention group, with the median follow-up period being only 3-6 months. This hinders definitive pronouncements on sustainability; additional quasi-experimental investigations of the retention decay process regarding trained provider cohorts on longitudinal follow-up against controls may help provide a better causal assessment. Qualitative research about why some competencies and specialties degrade more rapidly may be used to inform fifty-five shape designs of online learning.

FUTURE DIRECTION

Other areas with optimal effects and uses to be investigated include the ideal training frequencies and certain content to prevent atrophy. The assembly of the evidence enables the

emergence of a fundamental requirement for periodic refresher systems for cyclical training models in place of alternative isolationistic modules. Further research must help to establish and guide the best repetition cycles. In addition to the foundational knowledge, upper lever points penetrating application of knowledge in an actual job, visible changes in practice due to point chart audit, and organizational results are vital examinations. Pursuing the maturation of online learning evaluations along this scale can allow for growing respectability and worth.

CONCLUSION

In conclusion, this literature review has provided important information on the effectiveness of online education in enhancing healthcare professionals' capacity to manage patient services. This review's outcomes imply that online learning effectively transfers fundamental knowledge and fosters initial short-term improvements in diagnosing treatment and referral practice. Still, it takes much more longevous, comprehensive interventions than a single training implementation, such as the needle practice implementation, which must be moved to be effective on the level of the intrinsic behavioral change. It is important to remember that the delicate study of ongoing decline patterns in skill and specialty collapse is the backbone of sustaining long-term transformations for recurring repeater training and customization of contents. With the evolvement of medical dynamics characterized by cases of rapid advancements, lifelong learning is crucial in ensuring the provision of quality care packages and online platforms are flexible enough to facilitate this vision. However, the essence rests on applying these as dialogic systems that inspire behavioral change and provide capabilities that promote and empower the acceptance of the change. In contrast, traditionally, they were merely delivery means.

IMPLICATIONS

The findings from this literature review have essential implications for continuing medical education. The results show online learning effectively understands foundational knowledge by providing short-term improvement in patient care. While useful for information relay, pure online teaching must eliminate the distinctions between knowing and doing. This research will inform the ideal time to repeat online modules to prevent skill and knowledge decay. This review highlights gaps in existing literature and areas needing further research on the longevity of online education's impact; just as Campbell et al. (12) revealed in an earlier review, there are gaps in the existing research about the long-lasting effects of online training on healthcare professionals. Its findings will contribute significantly towards establishing evidence-based online learning guidelines for healthcare professionals.

The critical implication is that online modules succeed at disseminating information access but do not independently change behaviors, which requires ongoing reinforcement through complementary interventions. For instance, embedding skills practice through simulation scenarios, using job aids as reminders for applying diagnostic protocols, having mentors provide timely feedback, and instituting monitoring systems to track adherence can help bridge the knowing-doing gap (26). With a supportive learning culture facilitating reflection, continued competency development pathways, and intrinsic motivation, online learning can positively contribute as an initial step towards practice transformation rather than being relied upon as the sole intervention.

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Appendix: Definition of Terms

CME (Continuing Medical Education): This refers to ongoing training and education that healthcare professionals such as physicians, nurses, and even technicians engage in to maintain their competencies and learn about advances in their field.

NPAs (Nurse Practitioner Associations): Professional Associations and advocacy groups for nurses.

Online learning: Educational courses that are delivered using the internet to ensure flexible access. They include self-paced modules, videos, discussion forums, etc.

Learning modules: These are structured lesson units that are focused on specified topics that make up an online course. They can feature multimedia, assessments, interactivities, etc.

Healthcare providers: These include physicians, nurses, physician assistants, technicians, pharmacists, and other clinical staff directly involved in patient care.

Patient management handles patient care, including diagnosis, testing, treatment, education, referrals, etc.

Skills and behaviors: Competencies as well as habits that are applied in caring for patients.

Tables and Diagrams

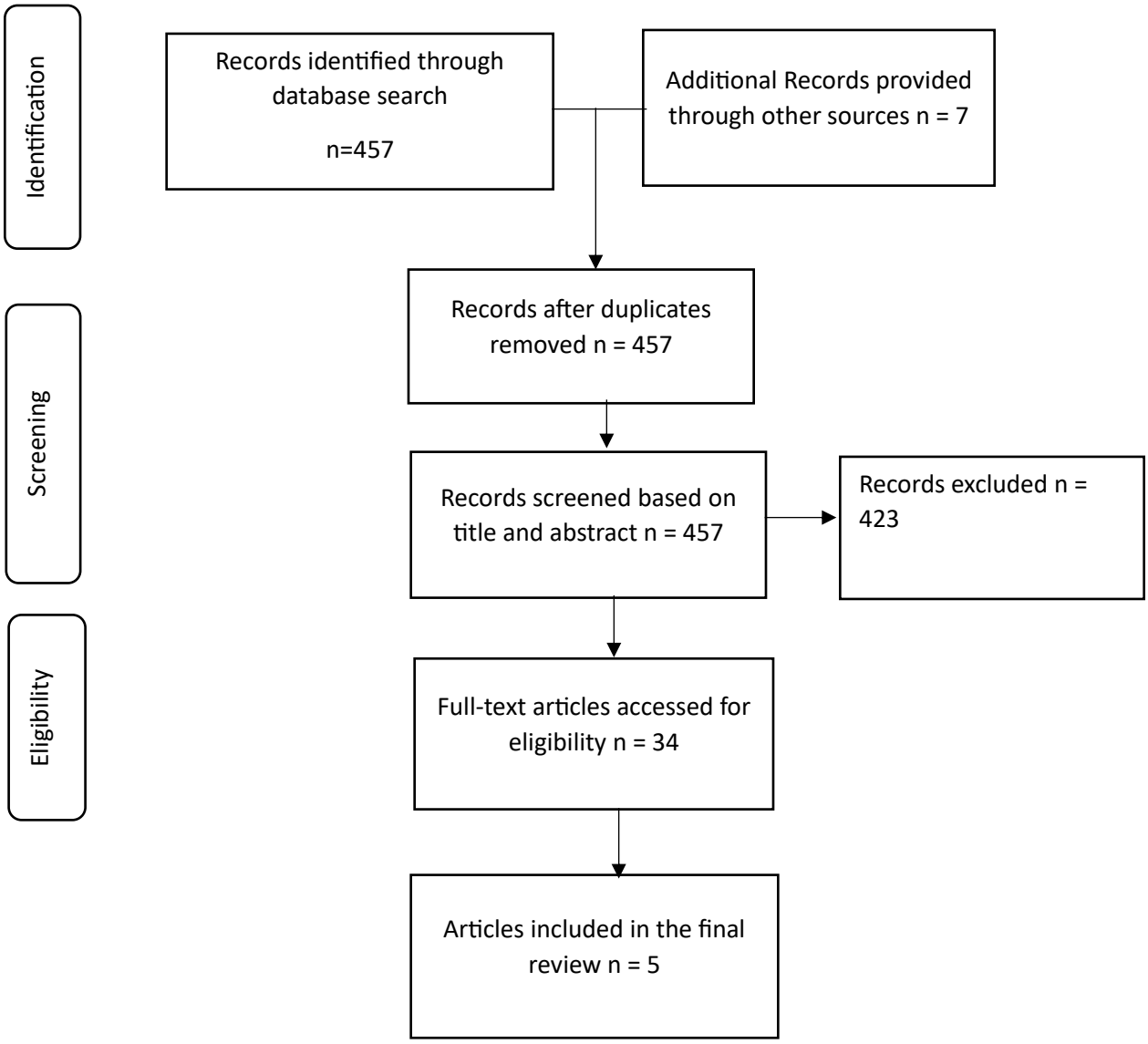

Figure 1: Prisma diagram identifying the search results.

Table 2. Summary of the five articles used in this literature review, including the study design, objective, population and sample size, outcomes, conclusion, and limitations.

Author	Study Design	Objective	Population	Sample Size	Outcomes	Conclusions	Limitations
Khan et al. (2005) (22)	Two-part study design utilizing a web-based survey of pediatricians and a mail survey of all specialty physicians who took the course	Evaluate the effectiveness of the child abuse training course on physicians' knowledge, ability to recognize child abuse cases, and reporting behaviors	Pediatricians and specialty physicians who took the mandatory child abuse training course	799	Knowledge gained from the course, ability to recognize child abuse cases, reporting behaviors	The child abuse training course positively impacts physicians' knowledge and reporting behaviors.	Limitations may include self-reporting bias and limited generalizability to physicians outside New York State.
Braschinsky et al. (2018) (23)	Prospective long-term follow-up observational study of the same GPs from an earlier pre-post intervention study	Determine the long-term impact of the educational intervention on GP management of headache patients	General practitioners (GPs)	6		The educational intervention leads to sustained improvements in GP management of headache patients.	Limitations may include potential biases from long-term follow-up and reliance on self-reported data.
Toledo et al. (2012) (21)	A prospective follow-up study of providers who underwent initial web-based training and testing on blood loss estimation	Assess the long-term retention of accuracy in visual blood loss estimation post-training	Providers who underwent web-based training on blood loss estimation	44	Percent error between estimated and actual blood volumes	The accuracy of visual blood loss estimation declines over time after initial training.	Limitations may include variations in clinical settings and potential biases in assessing accuracy.
Stewart et al. (2005) (25)	Randomized controlled trial comparing the effectiveness of an online CME	Assess the impact of the online CME program on family physicians' knowledge	Family physicians	58	Knowledge questionnaires, chart audits, standardized patient visits	The online case-based CME program improves family physicians' knowledge	Limitations may include small sample size and potential biases from self-reported data.

	program for family physicians	, practice quality, and targeted behaviors				and targeted behaviors.	
Jerome-D'Emilia et al. (2018) (26)	Randomized controlled design with rural community health centers assigned to intervention or control group	Evaluate the impact of distance education on rural nurses' knowledge of mammography screening guidelines	Rural nurses	17	Pre/post tests on nurses' knowledge, nurses' satisfaction with technology, patient outcomes related to mammography screening	Distance education improves rural nurses' knowledge of mammography screening guidelines.	Limitations may include limited generalizability to non-rural settings and potential biases in self-reported data.