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REVIEWS, THEORETICAL PAPERS, AND META-ANALYSES

Training for compassionate care delivery when using digital health technology: a scoping review of primary care education

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Abstract

Background: Rapid integration of digital technologies, including electronic health records, virtual care, and artificial intelligence, has transformed primary care practice. While these technologies may improve efficiency and care access, they also introduce challenges to delivering compassionate care. While training programs increasingly emphasize digital competencies, it remains unclear how compassionate care is addressed in education for primary care providers using these technologies. This scoping review aimed to map existing literature on how digital health technologies influence compassionate care in primary care education.

Methods: A scoping review was conducted to map the current evidence. Articles were searched across seven databases, and included peer-reviewed articles published in English, between 2015-2025. Data were extracted on study characteristics, educational interventions and outcomes. Analysis of educational outcomes was guided by Kirkpatrick's framework.

Results: Fourteen studies were included. Most (92.9%) employed quantitative methodology. Family medicine learners were the primary audience for the educational interventions in 85.7% of studies. Training primarily focused on using electronic health records and virtual care, with no identified studies addressing AI. Educational approaches included workshops, simulations, role play, and observed clinical encounters. No studies explicitly addressed compassionate care; instead, they focused on related concepts such as communication skills, patient-centered care, and rapport building. Outcomes largely assessed participants' reactions to training and short-term learning gains, including changes in knowledge, skills or attitudes.

Conclusion: Interventions focused mainly on communication and technical skills, without explicitly addressing compassion, highlighting a gap in compassionate care education and training. As digital technologies become more embedded in primary care, intentional curricular strategies are needed to ensure that compassionate care remains central.

Formation à la prestation de soins empreints de compassion dans le cadre de l'utilisation des technologies de santé : une revue exploratoire en contexte de formation en médecine générale

Résumé

Contexte : L'intégration rapide des technologies numériques, notamment les dossiers médicaux électroniques, les soins virtuels et l'intelligence artificielle, a transformé la pratique de la médecine générale. Si ces technologies peuvent améliorer l'efficacité et l'accès aux soins, elles posent également des défis en matière de prestation de soins empreints de compassion. Alors que les programmes de formation mettent de plus en plus l'accent sur les compétences numériques, on ignore encore comment les soins empreints de compassion sont abordés dans la formation des praticiens de médecine générale qui utilisent ces technologies. Cette étude de portée visait à recenser la littérature existante sur l'influence des technologies de santé numériques sur les soins empreints de compassion dans la formation en médecine générale.

Méthodes : Une étude de portée a été menée afin de recenser les données disponibles. La recherche d'articles a porté sur sept bases de données et a inclus des articles évalués par des pairs, publiés en anglais entre 2015 et 2025. Les données extraites concernaient les caractéristiques des études, les interventions pédagogiques et les résultats. L'analyse des résultats pédagogiques s'est appuyée sur le modèle de Kirkpatrick.

Résultats : Quatorze études ont été retenues. La plupart utilisaient des devis quantitatifs, 78,6 % d'entre elles évaluant des interventions pédagogiques destinées aux personnes étudiantes en médecine de famille. La formation portait principalement sur l'utilisation des dossiers médicaux électroniques et des soins virtuels. Aucune étude ne traitait de l'IA. Les approches pédagogiques comprenaient des ateliers, des simulations, des jeux de rôle et l'observation de consultations cliniques. Aucune n'abordait explicitement les soins empreints de compassion. Les écrits se concentraient plutôt sur des concepts connexes tels que les compétences en communication, les soins centrés sur le patient et l'établissement d'une relation de confiance. Les résultats ont principalement évalué les réactions des participants à la formation et les acquis d'apprentissage à court terme, notamment les changements en matière de connaissances, de compétences ou d'attitudes.

Conclusion : Les interventions se sont principalement concentrées sur les compétences communicationnelles et techniques, sans aborder explicitement la compassion. Cela met en évidence une lacune dans l'enseignement. À mesure que les technologies numériques s'intègrent davantage dans les soins primaires, des stratégies pédagogiques ciblées sont nécessaires pour garantir que les soins empreints de compassion restent au cœur de la démarche.

Introduction

The relationship between patient and physician has been a core principle of family medicine for decades.[1,2] Within that longitudinal and comprehensive therapeutic alliance, opportunities for trust and compassionate care emerge.[1,2] Compassionate care, broadly defined as recognizing suffering and acting accordingly to address that suffering, is critically important to the practice of medicine, with implications for patient well-being, satisfaction, and health outcomes.[3,4] Facilitators and barriers to compassionate care delivery are multi-fold, manifesting at the individual and organizational levels.[5] Education and training exist at the intersection of these individual and organizational factors; however, professional development in the delivery of compassionate care has been limited, with calls for the design of more effective and evidence-based offerings to address this deficiency.[6] A further challenge to

teaching compassionate care is the ubiquitous use of health technologies, which has arguably created distance between patients and healthcare professionals.[7]

The rise of digital technologies in medicine and primary care, catalyzed by the COVID-19 pandemic, has led to an evolution of medical care provision.[8] With this shift to clinical digital spaces and technologies, it is unclear how education and training in compassionate care have adapted to compensate. There is a desire to renew national competency frameworks with virtual care in mind and scope the literature on interventions to enhance digital competence.[9] Despite this, a recent consensus statement on the necessary competencies for medical learners in digital spaces never mentions empathy or compassion as essential to this skillset.[10]

Compassionate care in medicine is primarily conceptualized, learned, and enacted through the delivery of in-person clinical care and training.[6,11] While definitions vary, compassionate care has five key elements: *"(i) awareness of another's experience of suffering or need, (ii) feeling "moved" and concerned for another person's suffering or need, (iii) appraising one's own social role and abilities within the context of the suffering, (iv) making judgments about the person who is suffering and their situational context, and (v) feeling driven to help*".[3]

In training, this type of care is often taught through a combination of experiential and reflective approaches, including role modeling, clinical simulation, reflection, debrief, and engaging in the medical humanities.[6,11] Immersion and exposure in the clinical workplace appear more effective at achieving learning outcomes in compassionate care as compared to simulation.[12] Compassionate care learning outcomes are study-dependent; however, Sinclair and colleagues suggest that these outcomes include key domains of recognition, response, attention, and relational aspects of care, as outlined in the Patient Compassion Model.[13] These approaches are noted to be effective at improving self-reported achievement of learning outcomes; however, studies have simultaneously shown variable employment of compassionate care definitions, limited use of competency frameworks and mapping to narrow dimensions of compassion.[6] In addition, most educational interventions are aimed at physicians and nurses in training, with limited continuing professional development programs in practice.[6] Studies to date have also lacked rigour in their design and evaluation approaches, revealing inherent limitations in compassionate care training, with no discussion of how this education translates to digital contexts.[6]

Experts have called for a renewed definition of compassion in digital spaces, novel conceptual models for compassionate care, and the establishment of associated competencies.[14] Recognizing a patient need remains central to this re-conceptualized approach to digital compassion, but the responses may differ from an in-person encounter. For example, a compassionate response in a digital setting may include leveraging online tools, patient health data, and automated, personalized prompts to support patients in a novel way.[14] How these approaches are codified, enacted, implemented and assessed in medical education and primary care training programs remains unclear.

As efforts to define and teach digital compassion evolve, attention must also be directed to the technologies that shape contemporary primary care encounters. Digital technology in primary care encompasses multiple tools including virtual care (VC), electronic health records (EHR), and emerging applications of Artificial Intelligence (AI) (e.g., ambient AI scribes).[15] These technologies lead to myriad benefits for both patients and healthcare providers, including improved access to care and efficiency.[16] However, despite the demonstrated benefits and potential equivalency with in-person care in certain contexts, there is limited evidence on the impact on patient-centeredness and equity.[16,17] For instance, limitations of VC include challenges with interpretation of non-verbal cues and rapport building.[18] EHRs add to the democratization of health data, improve team-based communication and productivity, but they may also take the provider's attention away from the patient encounter, leading to decreased eye contact and focus on the clinical interaction.[19,20] AI as an emerging technology has shown great promise. By improving the workload of the primary care workforce through ambient AI scribes, this may allow for improved engagement with patients.[21,22] Initial data also suggests that AI-generated asynchronous mes-

sages may be perceived as more empathic than messages written by a healthcare provider; however, patients also expressed opposition to these bot-developed messages.[23] Despite the noted benefits of these technologies, shifting the focus away from the patient remains a risk to practice and an opportunity for further education.[24] This scoping review will focus on these technologies due to their widespread prevalence in primary care and potential risk of disrupting the physician-patient relationship.

Taking into consideration the rapid rise of Digital Health Technology (DHT) use in primary care, well-known gaps in education and training in compassionate care, and a lack of clarity on how educational programs have adapted their in-person approaches to online spaces, a scoping review meth--dology was undertaken to map the current litera--ure for contemporary practices while also identifying research and training gaps.

Review questions

What is known about how DHTs, including EHR, VC, and AI influence the delivery of compassionate care in primary care education and training?

We also aimed to address the following sub-question: What teaching, curricula or best practices are in place to ensure that compassionate patient care is centred in an encounter where the clinician in primary care is using a digital technology, including EHR, VC, or AI?

These technologies were chosen as they have been structurally integrated into routine primary care workflows and have been described to alter how providers interact with patients.[17,25]

Methods

Using a scoping review methodology we mapped the extent and nature of the emerging literature.[26] This approach was chosen to encapsulate a diversity and breadth of evidence, identify key concepts and approaches in primary care curricula and assessment, describe reported educational outcomes, and highlight gaps and areas for future study and advocacy. We followed Arskey and O'Malley's methodological approach for scoping reviews,[26] further refined by Levac,[27] to support a systematic approach to the literature. The review was registered on Open Science Framework (10.17605/OSF.IO/V7TSF), and a protocol was published a priori.[28] This review adhered to the reporting standards outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.[29]

Ethics

Ethics approval was not required as this work involves a synthesis of data published in peer-reviewed literature.

Search strategy

In collaboration with a health sciences librarian (EW), an iterative process of search strategy refinement was undertaken to ensure accuracy and comprehensiveness of terms based on study questions. The search terms were applied to a database inquiry conducted on March 14, 2025. The following databases relevant for health sciences and education research were searched: OVID MEDLINE/PubMed, OVID Embase, EBSCO CINAHL, OVID Cochrane Database of Systematic Reviews, U.S Department of Education ERIC, Joanna Briggs Institute Evidence Based Practice, and Clarivate Web of Science. Multiple databases were searched to ensure comprehensiveness across clinical practice, education, and research. MEDLINE and CINAHL allowed for broad coverage of indexed articles in medicine and allied health, including nursing, and ERIC provides a depth of peer-reviewed research across the education spectrum. The search strategy included both medical subject headings (MeSH terms) and keywords covering essential concepts related to primary care providers, DHTs, educational interventions, and primary care. Eligible articles related to the clinical practice of digitally mediated compassionate care is reported separately.

Definitions

For this review, the population focused on primary care providers (i.e., family physicians and nurse practitioners), and learners from these professions.[30] Given primary care's focus on comprehensive, longitudinal, patient care throughout the life

span that centres the patient-physician relationship[1] we chose this as the context to explore compassionate care principles. The exposure, or concepts, included DHTs embedded within primary care education and training. EHR or medical records were defined as digital documentation and information management systems used during clinical encounters;[31] VC was defined as synchronous or asynchronous interactions using information and communication technologies between the provider and patient;[32] while AI captured artificial intelligence-enabled applications that were integrated within the EHR or virtual care platforms to support documentation, decision-making or patient communication.[33]

When examining compassionate care, we leveraged the Oxford handbook's definition as previously described.[3] To ensure conceptual breadth, we drew on search terms from previous work in compassionate care and digital health by Wiljer and colleagues, which includes terms such as empathy, relationships, and communication.[4,34] Outcomes of interest included educational curricula, program development, assessments, and evaluations. The complete, reproducible search strategies are available in Supplementary File 1.

Eligibility criteria

The search was limited to peer-reviewed articles, published between 2015 to 2025, to ensure recency and relevance of data. The 10-year timeframe was agreed upon by the study team to capture contemporary evidence in DHTs, which are progressing at a rapid pace, while facilitating a more manageable scope of review. Only English language studies were included in the review as this is the language of expertise of the study team. Focusing on English language studies allowed for accuracy of screening, data review, data extraction and interpretation without needing to access translation resources. No restrictions were set for methodological design; however, grey literature, review articles, commentaries, and conference proceedings were not included. The grey literature was excluded from review as the study team aimed to focus on a synthe-is of peer-reviewed literature that has undergone prior scholarly review and associated rigour of methodology. For reference, the complete scoping review protocol was previously published.[28]

Study selection

Three study team members (GS, AE, VJ) independently screened articles for inclusion at both the title/abstract level and full-text review stages. Consensus among two reviewers was required for an article to be included for full text review. To ensure consistency and reliability, an initial pilot test was conducted using the first 30 articles, with an agreement threshold set to 80%. Reviewers achieved 83% agreement before proceeding with full screening. At the full text review stage, consensus among two reviewers was needed to identify articles for full data extraction. Any discrepancies were resolved through discussion and consensus among the three reviewers. The Covidence platform was used to manage both screening stages.

Following the screening process, two reviewers (GS, AE) conducted backward and forward citation searching to identify additional relevant studies. Backward citation searching involved reviewing the reference lists of included articles, while forward citation searching was performed using Google Scholar to identify newer studies that cited the original list of included articles.

Data items and data collection process

Key study characteristics (e.g., article title, publication year, country of study) were extracted using a standardized data extraction template. This template was developed by a subset of the research team (GS, AE, VJ) and was subsequently reviewed and validated by the broader team, which included practicing primary care clinicians, a clinician with leadership experience in digital health and a patient partner. The patient partner was involved in multiple steps of the scoping review, including research team meetings, iterative development of literature search terms, full text review of selected articles, data interpretation discussions and final manuscript review. Study characteristics were extracted by one of four team members (GS, AE, PK, JM) and verified within Covidence for completeness and accuracy. Study results and outcomes were extracted separately using NVivo 14 (Lumivero), a qualitative analysis software that supports thematic analysis of narrative findings.

Data analysis

We analyzed the data using a directed content analysis approach.[35] This approach involved organizing data into predefined categories based on the review question and organizing them into educational or clinical practice contexts. Within the education-related studies, information about each was extracted and organized, depending on whether the paper included an educational intervention. This included taking an inductive approach to create codes to capture descriptions of its aims, content, intervention type, target learners, and other relevant characteristics. Educational outcomes were coded deductively, using the Kirkpatrick framework,[36] which organizes impact across four distinct levels: learner reactions, knowledge and skill acquisition, behavioural change, and patient or organizational outcomes. Findings were compared across the studies with respect to the outcome level achieved in each study.[35] Analysis was performed by two coders (GS and AE). Analytic memos were written and maintained to document coding decisions and interpretation of the findings. These findings were also regularly shared and discussed with the broader re-earch team to ensure relevance and validation. Coding and analysis were also managed on NVivo 14 (Lumivero).

Patient and public involvement

We involved our patient partner (PK) throughout the review process, from initial scoping to completion. The patient partner participated in regular monthly meetings with the core research team (GS, AE, VJ) to provide input on the research questions, the scope of the review, and the interpretation of emerging findings. They were also engaged during the screening and data extraction stages, including reviewing extracted data to provide perspectives on the relevance and interpretation based on their lived experience.

Results

A total of 6355 studies were identified via the literature search, and 10 studies were identified via citation searching. After duplications were removed, 4854 studies moved to abstract/title review with 167 studies included for full text review. On completion of full text review, 14 studies were relevant to education and training (Figure 1).

Study characteristics

A total of 14 articles met inclusion criteria for an educational initiative, which reflects 0.002% of all studies identified via the search strategy. Studies were primarily conducted in the United States (n = 9; 64%). All studies were published between 2015 and 2025, with the greatest proportion appearing after 2022 (n = 7; 50%) (Table 1).

Most studies employed quantitative study designs (n = 9; 64%), followed by mixed-methods approaches (n = 4; 28.6%). Educational interventions were reported in most studies (n = 11; 78.6%). A summary of the studies, including aims, participants, study design, digital technology employed, educational outcomes and relevant findings for compassionate care are reported (See Appendix A).

Characteristics of educational interventions

Most studies (*n=12;* 85.7%) included education for family medicine learners, with fewer studies (*n=5*; 35.7%) including family physicians in practice. Half the studies (n = 7; 50%) were focused on the EHR as the DHT employed during the education intervention, followed by VC (or telehealth) in just less than half (n = 6; 42.9%). No studies addressed or incorporated the use of AI in education and training for compassionate care. A variety of educational modalities were used including didactic sessions, workshops, observed clinical encounters, patient simulation, role play, and reflection (n = 11; 78.6%) (Figure 2). The included studies emphasized practical and experiential elements of education and training with a broad range of instructional methods.

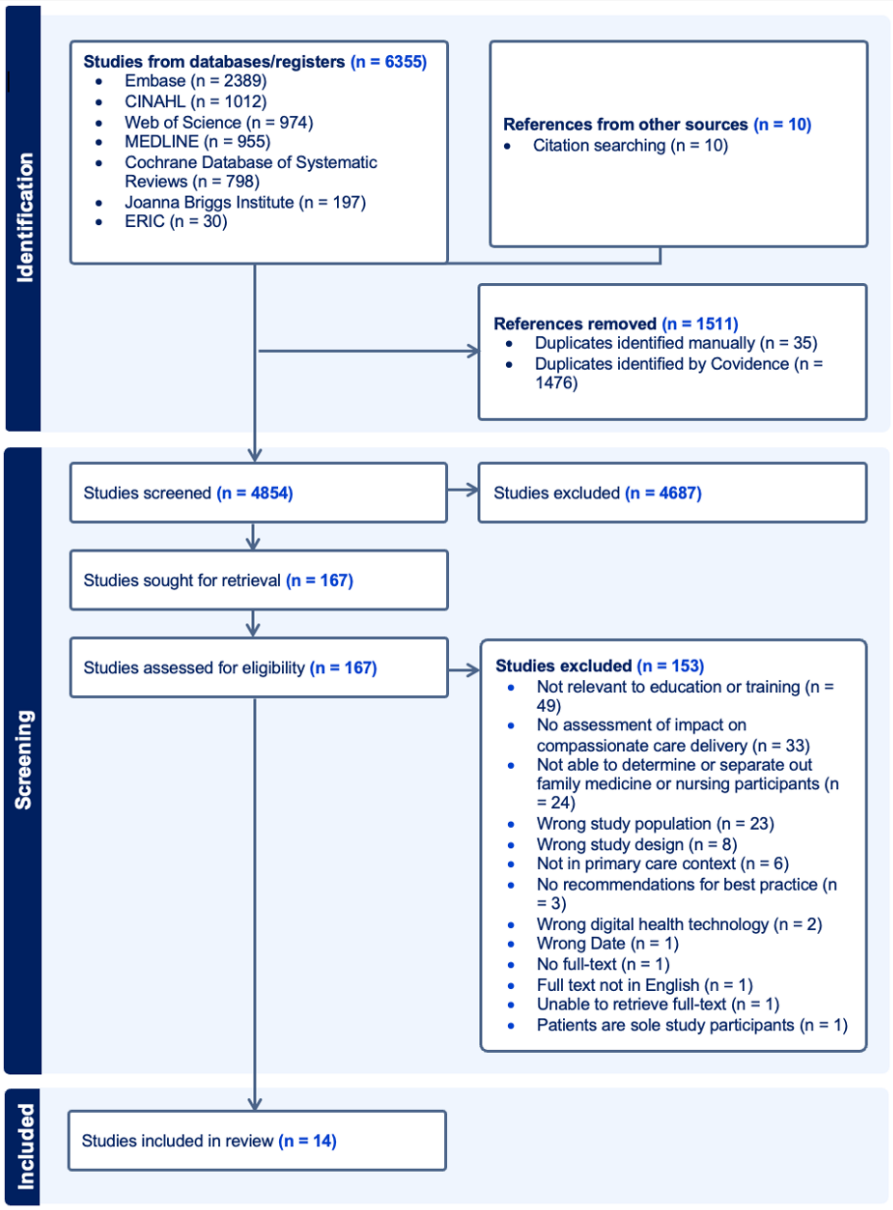

Figure 1. Flow chart of included studies

Across the included studies, compassion or compassionate care was not explicitly framed as the primary focus of training interventions. Instead, educational interventions more commonly emphasized related competencies such as communication skills, therapeutic rapport, and patient-centered care concepts. While these constructs overlap with aspects of broader definitions of compassion,[3] they were generally addressed as discrete communication or relational skills rather than as part of a broader compassionate care framework.[4,13,34]

Theoretical and pedagogical foundations

Few studies described an explicit theoretical or pedagogical foundation for curriculum design. One study applied the ATTEND framework for efficiency and clear communication when the EHR is used as part of their workshop design.[37] In the ATTEND approach for patient-centered care, six elements are emphasized: (A) acquaint themselves with the EHR, (T) take time to establish rapport prior to EHR use, (T) triangulate the computer so the patient can see, (E) use the EHR to engage and educate the patient, (N) no more screen (i.e., disengage from the EHR when discussing sensitive information and emotions), and (D) do not forget to log

out when leaving the room. A study looking at the development of an assessment tool for learner communication during EHR use applied the SEGUE approach (Setting up the stage, Eliciting information, Providing information, Understanding patient perspective, Ending/Concluding the interview).[37,38]

Most studies (*n=12*; 85.7%) did not identify a theory-informed or paradigm-based approach to curricular design. Barksdale et al. reported using Adult Learning Principles in the design of their teach-back curriculum for family medicine residents.[39] Greenhalgh et al discussed multiple theory-informed elements of their qualitative exploration of training needs and recommendations in the DHT space, although this was not applied to specific curricula.[40]

Table 1. Study characteristics of included studies

	No. out of 14 (%)
Country	
Germany	1 (7.1)
Lebanon	1 (7.1)
Portugal	1 (7.1)
United Kingdom	1 (7.1)
United States	9 (64.3)
Methodology	
Qualitative	
Ethnography	1 (7.1)
Quantitative	
Non-randomized Experimental (quasi-experimental)	2 (14.3)
Descriptive – Cross-sectional	4 (28.6)
Descriptive – Longitudinal	1 (7.1)
Descriptive - Observational	2 (14.3)
Mixed Methods	
Sequential Explanatory	3 (21.4)
Sequential Exploratory	1 (7.1)
Year of Publication	
2015	3 (21.4)
2016	0 (0.0)
2017	1 (7.1)
2018	1 (7.1)
2019	1 (7.1)
2020	1 (7.1)
2021	0 (0.0)
2022	2 (14.3)
2023	2 (14.3)
2024	3 (21.4)
2025	0 (0.0)

Evaluation of educational impact

Of these studies, most (*n* = 9; 64.3%) evaluated Kirkpatrick Level 1 (participant reactions) and Level 2 (impact on attitude, knowledge, and skills) rather than behaviour change or system/patient level impacts.[37,39,41-47] A minority of the studies (*n* = 2; 14.3%) explored the design, implementation, and validity/reliability of assessment tools for feedback and competence development in key aspects of VC in the primary care setting.[38,44]

Recommended approaches for delivering compassionate care

Recommendations for enhancing clinical care when DHT is employed included improvement of EHR associated communication skills, rapport building and patient centeredness, with no specific mentions of compassionate care delivery specifically.[37,42,43,45] Training programs for VC (telehealth) explored skill development in communication skills, breaking bad news, teach-back techniques for patient education and rapport building, with once again no specific mention of compassionate care.[39,41,46,48,49]

Greenhalgh et al. explored training needs, competencies, and group learning recommendations for virtual care,[40] while others explored the physical environment and practice of interacting with a computer and EHR.[47,50] Some authors noted that clinicians generally developed their DHT-based clinical skills in the workplace, rather than through formalized education and training programs.[40,47] Trainee-based studies made note of the additional need for further VC (telehealth) education and training.[41,50]

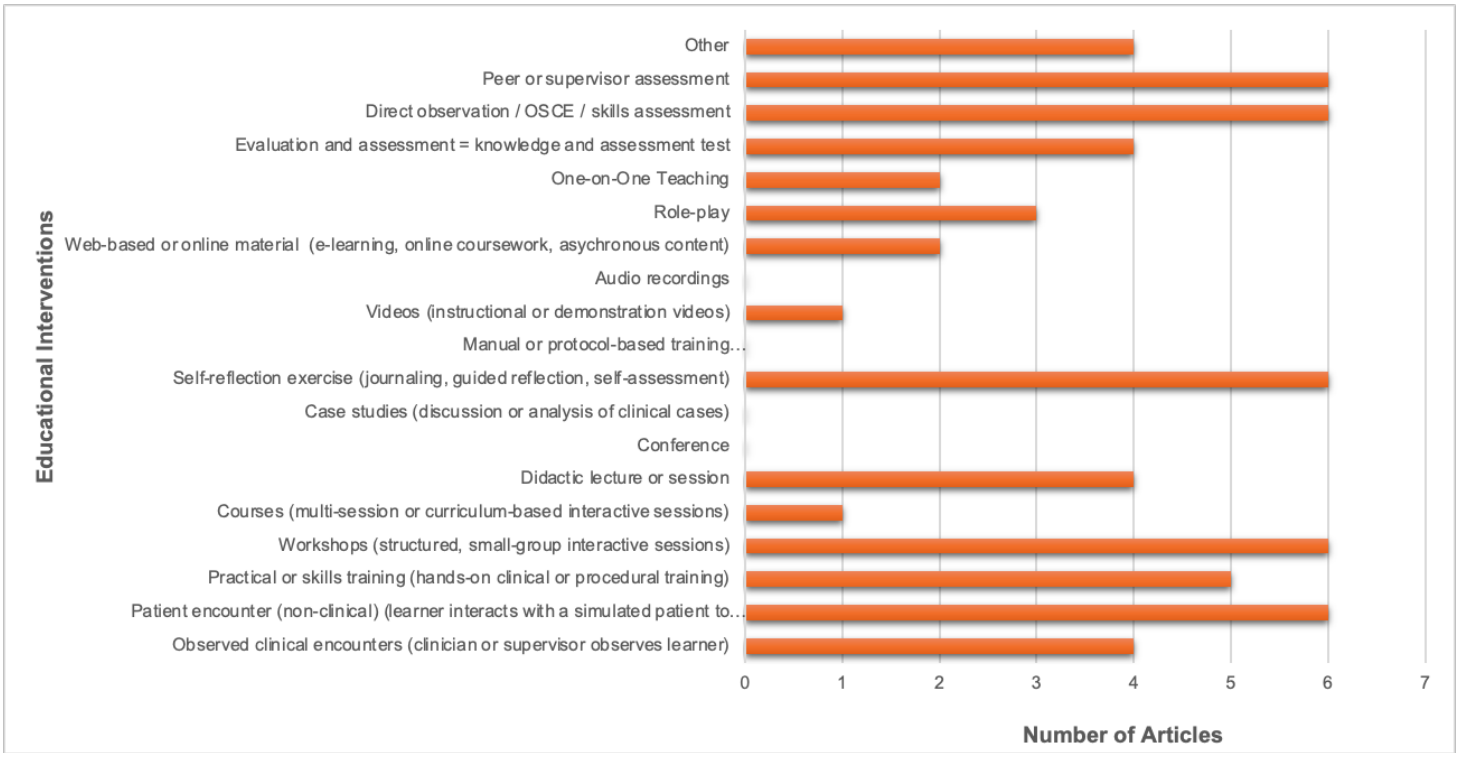

Figure 2. Educational intervention

Discussion

This scoping review methodology was undertaken to map the existing literature, knowledge gaps, and research opportunities at the intersection of primary care, compassionate care, and DHTs. The most significant finding is the lack of explicit focus on compassion in primary care education and training when DHTs are employed. There is a paucity of literature in this space, with only 14 studies meeting criteria for study inclusion. In addition, the focus of these studies was on surrogate markers of compassion, like communication skills, patient-centred care, and therapeutic rapport. This suggests that compassionate care is either an assumption or illusory in the DHT education and training space for primary care.

Challenges with teaching and assessing compassionate action in primary care stem from multiple issues, including incertitude with its conceptualization and definition. Although Seppälä and colleagues' definition of compassionate care in the Oxford Handbook provides general guidance on its key components, this does not allow for sufficient specificity for an educator to operationalize a curriculum.[3] Several studies included in this review utilized frameworks for effective communication with use of the EHR, but none of the identified studies use compassionate care competency frameworks.[37,38] Helpful approaches to the conceptualization of compassionate care include the Patient Compassion Model, which identifies five domains of compassion that can guide the development of learning outcomes and program evaluation: virtuous response, seeking to understand, attending to needs, relational communication, and relational space.[6,13] A further challenge in compassion education, as uncovered by Sinclair et al in a systematic review, is that training to-date is mostly limited to the virtuous response dimension, while largely eschewing the other critical dimensions of holistic compassionate care.[6] This finding is also reflected in the studies identified by this scoping review of DHT in primary care. At present, the focus seems to be on communication skills development, which aligns with the virtuous response dimension, but this is only one dimension of the complex construct of compassion.

Previous work has provided guidance on which behaviours denote compassionate care in the clinical setting, including "(1) sitting (versus standing) during the interview; (2) detecting patients' non-verbal cues of emotion; (3) recognizing and responding to opportunities for compassion; (4) non-verbal communication of caring (e.g. eye contact); and (5) verbal statements of acknowledgement, validation, and support." (p.1-2)[11] While helpful for in-person clinical care, this guidance is difficult to implement in

the DHT setting. This review identified studies that helped learners gain skills such as making eye contact through webcams, adjusting tone for sensitive conversations, and recognizing the subtleties of mood and affect using virtual, simulated encounters, and OSCEs.[41,46-48] This purposeful shift of educational programming to the DHT space is necessary as the required knowledge, attitudes, and skills in the virtual setting do not readily translate from the in-person training environment. Initiatives have been developed to support the development of competencies in VC and EHR use, the focus at the intersection of primary care, compassion, and DHT is seemingly lacking.[51,52] Leadership is beginning to emerge in this nascent area through educational organizations and institutions developing competencies and resources; however, broad-based uptake and application of these initiatives remain elusive.[9,10,52,54]

In their curricular design, educators must look toward competency frameworks for compassionate care that are designed specifically for the DHT space. Wiljer and authors developed a framework that incorporates both the professional behaviours and technologic parameters required to enable compassionate care in DHT.[14] These interprofessional competencies link concepts from both traditional definitions of compassionate care, with the behaviours that healthcare providers need to enact in the DHT space before, during, and after a clinical encounter to support compassionate care. Competency statements can be used as a starting point for educators looking to design curricular tools and/or assessments in this sphere.[14] In addition, Wu and colleagues emphasized the critical importance of patient perceptions of compassionate care in VC, which include embedding "patient autonomy, holistic care, patient security, encounter-based presence, and a collaborative approach" in each encounter (p.77).[55] These frameworks and priorities provide educators with a road map to better educational design for the primary care learner and professional.

In the design of educational interventions, the studies in this review used a breadth for instructional approaches with a focus on experiential learning, including role play, simulation, and observed clinical encounters. This emphasis on hands-on practical training, observation, and feedback is critical to attitudinal and behavior change in health professions education. Most studies in this scoping review were focused on primary care learners, with less emphasis on continuing professional development for individuals in practice. Although both groups would benefit from DHT-focused training, primary care providers in practice are more likely to have learned their skills in an ad hoc manner in the workplace.[56] As such, faculty and professional development for this group, through institutionally required training, is critical to both excellent patient care and supporting positive role modelling for learners.[42] As outlined by Greenhalgh et al training should "[shift] from basic competence to being able to provide an advanced level of communication and support to the patient (for example, building and maintaining rapport, attentiveness, and trust), making complex clinical and operational judgements, ensuring that they understood and worked within the limits of technologies, coordinating multi-professional care in a distributed environment, implementing and embedding new technology supported workflows, and training both patients and fellow staff members" (p. e24).[40] This is no small feat and requires active planning, coordination, design, and implementation across the educational spectrum.

In terms of educational outcomes, most studies that described curricula were evaluated at Kirkpatrick Level 1 or 2, focusing on either participant satisfaction with the intervention or self-reported attitudinal or knowledge change.[57] Emphasis on these outcome levels in medical education research is a well-known gap and is not confined to this topic or scoping review.[36,58] Exploration of how education and training outcomes impact learner behaviour in the workplace and ultimately how patient care is improved through these interventions would be the gold standard for research of this type.[57]

A final gap to highlight in this review is the relative lack of discussion around theory or paradigm-informed elements of the interventions described. Employing educational paradigms to curricular design and assessment helps provide cohesion and a unifying perspective, while simultaneously helping inform when challenges are encountered.[59] In addition, theory-informed approaches to curricular design can help illuminate both conceptualization and navigation of the inherent complexity of compassionate care training.[60] Future studies can look to paradigms like humanism and transformative learning, as well as theories of situated and experiential

learning as potential guides to help navigate this curricular challenge.[59,61,62]

Limitations

The authors note several limitations to this scoping review. One limitation of this work is the focus on primary care learners and providers in practice. Confining the review to primary care constrained the scope, potentially leading to missed educational interventions or approaches in other spheres of medicine. The authors opted to focus on primary care for two main reasons: 1) the importance of the longitudinal patient relationship in primary care and the potential for compassionate care to be part of that relationship, and 2) the rapid rise of DHTs in primary care over the course of the pandemic. Our study focused on primary care physicians and nurse practitioners from a practical and feasibility perspective. As such, curricula involving primary care nurses or physician assistants may have been overlooked. Furthermore, this work is limited by the lack of patient perspectives, which is an important consideration and next step in both curricular design and program evaluation. As part of our exclusion criteria, non-English studies were not part of this scoping review. This limits diversity of perspectives and narrows the richness of the identified literature. The exclusion of grey literature in this review potentially limits the findings as educational best practices or guidelines may have been overlooked, limiting the breadth of this report. However, the goal of this review was to capture the contemporary, empirical evidence on this topic. Lastly, this study did not identify any papers at the intersection of primary care, compassionate care, education, and AI. The landscape of AI in primary care is changing so quickly, that many relevant studies may have been missed since the time of the initial literature reviews.

Future directions

Future areas of study should have an explicit focus on digital compassion competencies, assessments to drive learning, including experiential and workplace-based feedback, along with program evaluation incorporating patient-reported metrics of compassion. Training should move beyond learners in undergraduate and postgraduate programs to ensure that primary care providers in practice have the opportunity for faculty and continuing professional development, rather than ad hoc, on-the-job learning that may be contrary to best practice. Paradigm and theory-informed approaches to curricular design, assessment tools, and program evaluation will more meaningfully inform this complex area of study.

AI in primary care is a burgeoning field with vast potential for improving documentation, efficiency, and clinical decision-making. What is not yet known is how AI will impact the relational aspects of the patient-primary care provider relationship and whether it will enhance or detract from the practice of compassionate care. This is a key area for further study, especially as the focus with AI thus far has been on the implementation and implications of ambient scribes. In a separate scoping review by the authors on the impact of DHT on compassion in primary care practice, the need to de--elop and apply adaptive expertise to this domain was one of the main themes identified. As such, questioning how adaptive expertise is taught, modelled, and assessed in the DHT sphere will be a critical area of future study.[63]

Conclusion

DHTs have become ubiquitous in primary care. Further integration of VC, EHR, and AI promises to be unprecedented in the coming years with the advent of innovations across modalities. This scoping review has revealed that the development and incorporation of education and training at the intersection of DHT, compassion and primary care has been limited thus far. Compassion is a complex concept to define and operationalize, leading to challenges for educators and curricular developers. However, with deliberate educational design, application of competency frameworks for the digital sphere, development of assessment tools, and rigorous program evaluation, the authors envision that DHTs can in fact be compassionate. Haphazard and antiquated approaches to addressing patient suffering in the DHT setting are a risk to patients in primary care that must be overcome with judicious approaches to education and training.

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Appendix A. Summary of included studies

Author (Year)	Country	Study Objectives	Study Design	Participant Composition	Digital Technology Used	Educational Interventions	Kirkpatrick Level	Education Theory Referenced	Recommendations or Best Practices for Compassionate Care
Sieck (2022)[44]	United States	Using a Resident-as-Teacher model, pairs of junior and senior learners work together to navigate the EHR during a patient encounter by acting as each other's scribes.	Mixed Methods - Sequential Explanatory	Family Medicine Residents *N* = 19	EHR	Participants in the junior-senior pairs had 15% more patient encounters in the study year. Resident pairs got to know each other better and discuss clinical decision-making along with opportunities for collaboration and reflection through shared use of the EHR. This experience was shifted to telehealth during the COVID-19 pandemic	Levels 1, 2	N/A	Intervention facilitated rapport-building and communication among team members. Residents perceived that this approach improved patient-centered care.
Barksdale (2023)[38]	United States	A pilot, cluster, non-randomized trial evaluating the feasibility of patient-centered, telehealth-focused teach-back training for family medicine residents	Mixed Methods – Sequential Explanatory	Family Medicine residents *n* = 12 (Intervention arm), *n* = 14 (Control arm)	Telehealth/ Virtual Care	Developed the POTENTIAL (Platform to Enhance Teach-Back Methods in Virtual Care Visits) curriculum. Residents all received SMS text reminders to use the Teach-Back Methods In the intervention arm, 50-75% of residents in the intervention used plain language, tried to make eye contact in the virtual setting and asked the patient to use their own words to explain what was discussed. Post-intervention increased resident confidence in their ability to use teach-back methods.	Levels 1, 2, 3	Adult-learning theory guided development of the POTENTIAL curriculum	Resident training in teach-back methods can help improve empowerment and engagement of patients in the virtual care environment using tools like whiteboards, chat and optimizing visual and auditory cues.
Särchen (2022)[45]	Germany	A S.W.O.T. (strengths, weaknesses, opportunities, threats) analysis of a digitally synchronous distance seminar for medical students to practice video consultations in a family practice setting.	Mixed Methods-Sequential Explanatory	Medical Students *N* = 12	Telehealth/ Virtual Care	The intervention improved familiarity with family medicine, positive/ negative aspects of teleconsultation. Students reflected on the important aspects of communication in the virtual setting, including (i.e. speak slowly, maintain eye contact, introduce self, summarizing, repeating)	Levels 1, 2	N/A	Virtual consultations can be leveraged as a tool for communication skill development specific to video-based visits.
Sobral (2015)[46]	Portugal	To determine the impact of computer, use during clinical visit on the patient-provider relationship and communication	Quantitative Descriptive – Cross Sectional	Family Physicians *N* = 65; Family Medicine Residents *N* = 41; Patients *N* = 392	Digital Technology (Computer)	No educational intervention reported	N/A	N/A	Physicians in practice were more likely to report communication skills acquisition through clinical practice, whereas trainees had this training more formally. Skills in computer use during a patient encounter were primarily gained through practice, as opposed to formal training. Physicians and patients held contrary views on the impact on clinical communication of computer use, with clinicians perceiving the impact on eye contact and active listening more negatively. Computer position seen as a barrier to patient-physician communication. Implications include the need for more formal training at the faculty level around communication skill development.
Phillips (2024)[47]	United States	Study utilized unannounced standardized patients (USPs) to evaluate the integration of a telehealth workflow and	Quantitative Descriptive – Cross Sectional	Family Physician, Nurse Practitioner, Physician Assistant, *N* = 16	Telehealth/ Virtual Care	Areas for improvement in telemedicine include use of non-verbal communication skills and acknowledging emotion. USP's rated general communication highly.	Level 3	N/A	Standardized patient encounters, clinical observation and structured feedback can be utilized to improve communication skills in the virtual environment.

Author (Year)	Country	Study Objectives	Study Design	Participant Composition	Digital Technology Used	Educational Interventions	Kirkpatrick Level	Education Theory Referenced	Recommendations or Best Practices for Compassionate Care
		clinicians' virtual communication skills.							
Deming (2024)[48]	United States	A pilot study to evaluate an educational intervention to improve family medicine residents' skills in delivering difficult news via telephone or videoconference.	Quantitative Descriptive-Longitudinal	Family Medicine Residents *N* = 12	Telehealth/ Virtual Care	Self-reported confidence in establishing trust, discussing goals of care, delivering serious news, and end of life via phone and video encounters increased immediately after the workshop. Self-reported gains were not retained at 6 months. The experiential learning aspect of the workshop, with realistic scenarios and best practice discussions was noted as helpful.	Level 1, 2	N/A	Experiential workshops with role play can help improve self-reported confidence in breaking bad news in a virtual setting, but those gained are not necessarily sustained. Ongoing, workplace-based reinforcement of these skills, along with observation, feedback and assessment would be beneficial to sustain these workshop-related gains.
Greenhalgh (2024)[39]	United Kingdom	"To identify training needs, core competencies, and learning methods for different staff groups, which would enable virtual and telephone primary care"	Qualitative- Ethnography	Family Physicians *N* = 22; Family Medicine Residents *N* = 3; Nurses *N* = 2; Allied Health *N* = 55	Telehealth/ Virtual Care	No educational intervention reported	N/A	Experiential learning, competence and capability, social learning theory, how leader-follower relationships shape learning, sociomateriality, organizational-level theories of complex knowledge routines	Acknowledged that formal training is needed for telehealth, but there are time and resource barriers, including lack of protected time. Communication style, rapport-building, information giving must be adjusted for the virtual modality. Prioritized certain learning modalities as more effective, including shadowing, debriefs, case-based tutorials, on-the-job training and group-based case discussions. Competencies and capabilities for virtual care outlined.
Asan (2015)[49]	United States	"To explore and compare residents' interaction with electronic health records during primary care encounters and whether those behaviors differ by residency year level."	Quantitative Descriptive-Longitudinal	Family Medicine Residents *N* = 12; Patients *N* = 38	Electronic Health Record	No educational intervention reported	N/A	N/A	Senior residents spent more time than junior residents viewing the EHR during a clinical encounter. It is unclear whether this is due to increased workload, clinical demands or increased familiarity with patients; patients felt these visits were more frustrating and less personalized. No residents had formal training on how to incorporate the EHR into their communication with patients.
Kim (2015)[43]	United States	"To design and test a secure messaging competency assessment for family medicine residents in a patient-centered medical home (PCMH)."	Quantitative Descriptive - Observational	Family Physicians *N* = 11; Family Medicine Residents *N* = 20	Electronic Health Record, Secure Messaging	Designed, implemented, and evaluated an assessment tool for feedback on secure, electronic heath record messaging in a primary care setting. Content validity and reliability of the tool evaluated. Deficiencies in resident performance primarily noted on communication dimensions, as opposed to knowledge dimensions. Feedback on secure messaging performance incorporated into semi-annual resident reviews.	N/A	N/A	An assessment focusing on communication skills and empathic rapport in electronic health record secure messaging can be incorporated into resident performance portfolios as a formative feedback tool.
Lanier (2017)[42]	Switzerland	Assess the impact of a training program on resident communication and patient-centredness when utilizing the electronic health record	Quantitative - Non-randomized Experimental	Family Medicine Residents *N* = 17	Electronic Health Record	Resident self-reported improvement in EHR related skills including maintaining patient centredness, patient engagement when using EHR, maintaining contact when typing and typing at strategic points. After the intervention, residents used "more signposting of EHR use, increased links with patients while using EHR, more use of EHR related to medical and therapeutic topics and less use associated with psychosocial issues."	Level 1, 2, 3	N/A	Experiential, multi-modal learning through discussion of best practices, guided self-reflection and review of clinical encounter videos can facilitate improved patient-centredness and connectedness during clinical en--ounters.
Lee (2018)[41]	United States	Pilot of a training program to support patient-centred EHR use for family medicine physicians in practice.	Quantitative - Non-randomized Experimental	Family Physicians *N* = 5; Allied Health *N* = 27	Electronic Health Record	Faculty showed significant improvement one-month post- training on 7 of the 9 skills assessed by the electronic-Clinical Evaluation Exercise (e-CEX). Most significant changes seen in (1) optimal positioning for shared screen viewing; (2) maintaining a conversational flow and	Level 1, 2, 3	N/A	A modified workshop that includes, didactic, OSCE and clinical observation can be adapted for a faculty development setting to optimize the clinical encounter for patient centredness. The e-CEX is a validated assessment that can

Author (Year)	Country	Study Objectives	Study Design	Participant Composition	Digital Technology Used	Educational Interventions	Kirkpatrick Level	Education Theory Referenced	Recommendations or Best Practices for Compassionate Care
						explain what you are doing in the EHR; (3) encouraging patient interaction with the computer; (4) integrating EHR use into natural flow of visit and integrating patient need; (5) honoring the golden minute and allowing patients to start with their concerns before introducing the computer; (6) proficiency in EHR use; and, (7) utilizing the EHR to promote individualized and collaborative care.			be utilized to address patient-centredness in EHR use.
Cantone (2019)[40]	United States	Evaluation a telemedicine OSCE (TeleOSCE) standardized patient simulation for medical students	Quantitative Descriptive - Cross-sectional	Medical Students *N* = 287	Telehealth/ Virtual Care	The TeleOSCE was intended to address interpersonal communication skills including patient counseling, empowerment and responding to emotion. Students self-reported increased awareness of differences in assessing mood and affect virtually vs in-person. Students felt more comfortable connecting with patients virtually including making eye contact.	Level 1, 2	N/A	A TeleOSCE allows students to learn and gain competency in patient-centred encounters in a safe, simulated environment while highlighting the unique aspects of assessing mood and patient connection in a virtual space.
Skelly (2020)[36]	United States	Workshop aim was to teach a structured, comprehensive approach to using the EHR to facilitate both efficiency in the clinical encounter and key communication strategies.	Mixed Methods – Sequential Explanatory	Family Medicine Residents, Fellows, Faculty and Physician Extenders *N* = 86	Electronic Health Record	Time to note completion was the primary outcome, with a trend suggesting improved clinical efficiency. Agenda setting was seen by participants as an important skill set and one of the most relevant parts of the workshop. There was high learner satisfaction with the intervention including clarity and relevance of the content.	Level 1, 2, 3	N/A	Workshop focus on the ATTEND pneumonic for patient-centred care provided an actionable skill set for addressing elements of clinical care when utilizing the EHR: (A) acquaint themselves with the EHR, (T) take time to establish rapport prior to EHR use, (T) triangulate the computer so the patient can see, (E) use the EHR to engage and educate the patient, (N) no more screen—disengage from the EHR when discussing sensitive information and emotions, and (D) do not forget to log out when leaving the room.
Antoun (2023)[37]	Lebanon	"To develop an assessment checklist that assesses the general and Electronic Medical Record-specific communication skills and evaluates their content validity and reliability."	Quantitative Descriptive - Observational	Family Medicine Residents *N* = 8	Electronic Health Record	Designed, implemented, and evaluated an assessment checklist for general and EHR specific communication skills.	N/A	N/A	Tool developers used the SEGUE framework (setting up the stage, eliciting information, providing information, understanding patient perspective, concluding the interview) to create a 28-item tool to assess resident competence in EHR associated communication skills.