Emerging Digital Technologies in Virtual Care in Clinical Nursing Practice: An Integrative Review of Ethical Considerations and Strategies

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EXECUTIVE SUMMARY

Background. Leveraging the potential practical benefits of emerging digital technologies (EDTs) like robots, artificial intelligence, virtual reality, and 3D printing to provide and improve nursing care outcomes in ethical, sustainable ways requires an understanding of the ethical considerations regarding EDTs in clinical practice to inform research, practice, and policy.

Objectives. To map and discuss the nature and scope of ethical considerations regarding EDTs in clinical nursing practice from published literature, and identify ethical approaches and strategies deemed effective to address such challenges.

Results. Three main categories of ethical considerations that comprised 12 key emerging themes of ethical concerns were identified: Ethical Concerns related to Meaningful Understandings in the local Moral Horizon of Significance in Nursing Practice; the Organizational Imaginary; and Societal Imaginary. The twelve identified emerging key themes of ethical concerns regarding EDTs in clinical nursing practice comprised: (i) the nurse-patient relationship and inauthentic care interaction; (ii) patient dignity, autonomy and [self]deception; (iii) privacy, confidentiality, trust and integrity; (iv) patient safety; and (v) [social] justice, bias, discrimination, and stigmatization; (vi) Informed Consent, Transparency, and Data management; (vii) [Dis]Trust in the Healthcare System; (viii) Job displacement, Losses, and Fading in Professional Competencies; (ix) Liability, Accountability, Interpretability (Explainability); (x) Social isolation and Depersonalization of Human-beings and Care; (xi) Surveillance: Disciplining, Exploitation, and Manipulation of Human-beings and Society; and (xii) Vulnerability and Moral Fading: Human, Moral Authority and Agency and Future.

Key messages. Emerging digital technologies offering promising benefits to help address disparities in care and improve the effectiveness of services. However, this requires a keen understanding of the nature and scope of ethical considerations with using emerging digital technologies such as robots, artificial intelligence, virtual reality, and three-dimensional (3D)-printing in clinical nursing practice. Understanding the identified ethical concerns and best-practice ethical strategies regarding EDT may help guide robust research, practice, and policy initiatives to generate, validate, and translate evidence on EDTs before use in virtual care. Moreover, evidence might be helpful to ensure the ethical design, applications, implementation, and evaluation of emerging digital tools and techniques for use in virtual nursing care in clinical practice to benefit and improve the health of vulnerable clients, nurses, and health systems in ethical and sustainable ways. Additionally, key ethical considerations regarding EDTs might be also help inform curriculum innovations to build capacity, cultivate ethical competency and responsiveness among nurses and other health professionals transitioning to a workplace amid digital ethics and technological disruptions to sustain good care and practice.

Methodology. We conducted an integrative review using a comprehensive three-step sequential search strategy to search and retrieve published English language, peer-reviewed articles and grey literature documents from databases like CINAHL, PubMed, Web of Science, and Philosopher’s Index and relevant, reputable platforms. For this review, our team used COVIDENCE (Extraction 2.0 version) as a gold standard process and workflow platform to streamline our title and abstract screening, conduct a full-text review, data extraction, quality appraisal, data abstraction, evidence synthesis and interpretation to create high-quality systematic reviews. Following the removal of duplicate articles, the remaining articles were screened for eligibility using a two-step process: (i) title and abstract screening and (ii) full-text review.
against a set of inclusion and exclusion criteria. All included articles were read thoroughly to gain an understanding of the material. Following the title and abstract screening and full-text review process, a final sample of (n = 64) documents were selected that met all our inclusion criteria. We used an electronic data extraction form and a combination of quality appraisal tools from the Johanna Briggs Institute and the Centre for Children’s Health Ethics and Law (CCHEL) to extract essential methodological information and appraise the evidence from sampled documents. We used a five-stage Framework Analysis approach to abstract and synthesized evidence. This analysis provided a schematic diagram of ethical considerations related to using EDTs in virtual care, thus guiding the final interpretation of the data set while remaining mindful of the objectives of this review. The results of the review are presented both narratively and in a tabular format. A detailed discussion of ethical concerns and best-practice strategies, along with implications for health policy, education, clinical practice, and future research, is presented.
1 INTRODUCTION

Scientific advancements in digital technologies (EDTs) continue to proliferate rapidly. Their potential uptake, application, and use in the provision and management and improvement of nursing care and healthcare service delivery are increasingly considered. Specifically, emerging technologies have been identified as a major topic in the ethics of technology.1 Emerging technologies are defined by Brey1 as “new, innovative, and still in their research and development phase since they employ new concepts, methods, and techniques and promise new and potentially superior solutions to complex problems” (p. 175). Emerging digital technologies (EDTs) for use in healthcare, such as virtual reality (VR), robotics, artificial intelligence (AI), and three-dimensional (3D)-printing, hold promise for innovative approaches in risk assessment, disease surveillance, diagnostics, chronic disease management, treatment prescribing therapeutics, decision making, communication, patient education, and the 3D-printing of organs and prostheses for transplant.2-4 While recognizing the potential practical impact of EDTs in improving the efficiency and cost-effectiveness of healthcare and care outcomes, their novelty, complexity, largely unregulated nature, and limited availability of evidence on their efficacy raise pertinent ethical dilemmas and issues.5 This integrative review will analyze and synthesize evidence from literature on ethical considerations regarding emerging digital technologies in virtual care in clinical nursing practice to inform research, practice, and policy in nursing.

2 BACKGROUND

In Canada, the use of digital applications and social media technologies (i.e., electronic health records, eHealth) in the provision of nursing care and health service delivery are now new4,6. However, there has been a pursuit of digital health strategies globally and in Canada, coupled with a growing interest in applying and use of emerging digital technologies like virtual reality, robotic, artificial intelligence, 3D printing in virtual care and home-based care settings. This interest, spearheaded by business and patient demand, is primarily driven by ongoing health service challenges for accessible, quality, and cost-effective care and is compounded by the impact of an ongoing COVID-19 pandemic, the global shortage of nurses and healthcare professionals, widening gap in social determinants of health, health disparities and inequalities, and an ageing Canadian population.7,8 Virtual care has been defined by Shaw et al.9 as “any interaction between patients and members of their circle of care, occurring remotely, using any forms of communication or information technologies with the aim of facilitating or maximising the quality and effectiveness of patient care.” (p. 609)

Virtual care nursing increasingly operationalized digital and emerging digital technologies hold promising benefits to help address ongoing nursing care challenges in sustainable ways, through supporting clinical decision-making processes, continuity of care, patient safety, and in providing a conducive work environment for keeping technically competent and highly educated nurses engaged at the bedside.10,11 Emerging digital technologies disrupting healthcare services provision and care functions like health screening, monitoring activities, aiding in mobility, activities of daily living, rehabilitation, and are increasingly incorporated in virtual nursing care.12 On the contrary, recognizing the impact such emerging digital technological innovation in virtual care could have in generating ethical and legal issues, government and healthcare stakeholders recommended that ethical and legal issues with the application and use of such technologies be anticipated to resolve regulatory ambiguities, and building consensus for the protection of patient privacy while enabling innovation in virtual care.
Ethical considerations, therefore, have been identified as one among eight priority issues in need of address with the application and use of EDTs in virtual care. 13

Current application and use of EDTs like care robotics (i.e., RIBA, Paro), AI machine algorithms, virtual reality, 3-D printing in virtual care in clinical practice and research in some countries (i.e., UK, Japan, UK, Europe, China) are shown to disrupt the provision of healthcare services in domains of care like health promotion, disease prevention, rehabilitation, primary healthcare, chronic disease management, to aid in the provision of care functions like health screening, monitoring activities, assisting in mobility, and activities of daily living, and rehabilitation in various healthcare care settings like stroke and neuro-degenerative illness, cardiovascular, dementia, and elderly care. Furthermore, some EDTs are also increasingly used by nurses and other health professionals to conduct risk assessments, estimate treatment success before implementation, chronic disease management and prevention of complications, support patient care and treatment, and conduct clinical research. 14,15 Evidence from emerging literature on the use of EDTs in virtual care in clinical practice reported on improvements in care access, uptake of preventive healthcare services and treatment, that it positively influences patient empowerment, health equity, reduce health disparities, strengthen healthcare systems, and outcome improvements in Sustainable Development Goals. 5,6,17 In clinical nursing practice, the use of EDTs is also shown to contribute to changes in standards of care through innovative applications in health and diagnostic screening, treatment, decision support systems, and the provision and care functions like monitoring activities, aiding in mobility, activities of daily living, and rehabilitation. 4

Leveraging the potential practical benefits of emerging digital technologies (EDTs) to provide virtual nursing care and improve care outcomes in ethical, sustainable ways requires understanding the ethical considerations regarding EDTs like robots, artificial intelligence, virtual reality, and 3D-printing in clinical practice. However, regulation uncertainties around many of these EDTs, their complexity, and limited available evidence on their efficacy, raising pertinent ethical concerns about them in clinical practice in nursing and healthcare. There is the perception among nurses that the application and use of the EDTs in clinical practice challenge the very foundations of nursing and potentially could disrupt nurses' ways of being and relationships with patients, fellow nurses, other healthcare professionals, and technology. Ethical challenges have been described as uncertainty about the ethical aspects of a situation and the correct course of action; familiar feelings of being torn between conflicting and competing values and responsibilities; moral distress; as doubt; as moral disagreements; and tensions between the widely accepted standards of excellence, including ethical values, goals, and principles.18-20 The dynamic and relational nature of nursing practice, including its values, the scope of practice, nurses’ relationships and interaction with patients, the care environment, and nursing philosophy suggest that ethical considerations regarding EDTs in virtual care in clinical practice are multi-level and multi-dimensional. While ethical considerations regarding robots and artificial intelligence in healthcare 21 and selected care settings22 have been synthesized, a quick search for systematic reviews on emerging digital technologies like virtual reality and 3D printing found that such a review lacks in clinical nursing practice. 

Ethical considerations regarding EDTs in virtual care in clinical nursing practice deserve attention and further exploration. 23 For nurses in clinical practice, there are compelling reasons to understand the nature and scope of ethical challenges EDTs posed and to ensure that they are used in ethically appropriate ways. 24 Ethical concerns as barriers to providing good nursing care
that is safe, competent, compassionate, and ethical have adversely impacted the quality of care and patient safety outcomes for individual patients, nurses, nursing practice, and health systems. Furthermore, nurses’ have an ethical responsibility to proactively anticipate and be responsive in preventing and addressing ethical concerns in clinical practice. Attentiveness and keen understanding of the nature and scope of ethical considerations regarding EDTs in virtual care is deemed an essential precondition for good nursing care, practice, and policy responsiveness by individual nurses and healthcare organizations, and requires the use of effective approaches and strategies to mitigate ethical challenges. Understanding and mobilizing the evidence on ethical considerations regarding EDTs in virtual care in clinical nursing practice could help inform policy, research and practice dialogue and decision-making in virtual nursing care and practice. Mobilising such knowledge could also be helpful to build capacity and strengthen ethical practice competence and responsiveness among nurses to practice in ethically responsible and sustainable ways amid digital ethical disruptions in virtual care in clinical practice.

3 OBJECTIVES

The purpose of this review is to (i) map and discuss the nature and scope of ethical considerations regarding EDTs like, robotics, artificial intelligence (AI), virtual reality (VR) and three-dimensional (3D) printing in virtual care in clinical nursing practice; (ii) identify approaches and strategies, including training and upskilling and interventions deemed effective to mitigate ethical challenges (iii) and mobilize this knowledge for evidence-informed agenda-setting in policy, research, and practice dialogue and decision making, and supporting nurses transition to the workplace and ethical practice amid digital-ethical disruptions. The following questions and sub-questions guided this review:

**Question:** In clinical nursing practice, what kind of ethical challenges do nurses face regarding emerging digital technologies like robots, artificial intelligence, virtual reality, and 3D printing in virtual care?

**Sub-question:** Which ethics approaches and strategies, including training and upskilling interventions, are considered effective to address ethical challenges and support nurses’ ethical practice amid digital disruptions?

4 METHODOLOGY: THE REVIEW

An integrative review methodological approach was completed over five stages, including problem identification, literature search and retrieval, data evaluation, analysis and synthesis, and presentation of findings. For this review, our team used COVIDENCE (Extraction 2.0 version), a gold standard process and workflow platform to streamline title and abstract screening, conduct a full-text review, data extraction and abstraction, and quality appraisal to create high-quality systematic reviews. For each of the review stages, we assigned three team members: Two team members decided which articles to consider for full-text review, data extraction, quality assessment of evidence, abstraction. Any disagreements or conflicts flagged in COVIDENCE were resolved through consensus by a third reviewer (usually the lead-PI). A combination of empirical papers (qualitative and quantitative designs), conceptual papers (i.e., ethical-philosophical essays, position papers of nursing organizations, editorials, opinion papers) and systematic review articles was retrieved.

**Search, Retrieval and Import of References.** We used a three-step sequential search strategy starting with (i) an initial search of limited scope screening titles, abstracts, and index
terms used to describe an article; (ii) an expanded search using all identified keywords, index terms; and (iii) a citation pearl-growing approach hand-searching the references lists of relevant review articles and articles for additional studies. We performed an extensive search for literature sources on electronic databases in CINAHL, PubMed (MEDLINE), Web of Science, and Philosopher’s Index on EBSCO, PROQUEST, and OVID platforms in the university library catalogue, as well as searching for grey literature on Google Scholar, Canadian Institutes of Health Information (CIHI), and the Public Health Agency of Canada (PHAC) platforms. Our search strategy used a combination of a comprehensive set of subject headings and keywords (32 in total) such as ethics*, ethical challenges, ethical concerns, ethical issues, ethical dilemmas, ethical strategies, nurs*, artificial intelligence, robotics, 3D-[bio]printing, and virtual reality. Boolean operators and medical subject headings (MeSH) were used to expand and narrow down searches and a citation pearl-growing approach to identify further pertinent articles. All identified references were stored in an electronic folder on ProQuest RefWorks and later exported to the COVIDENCE platform.

A total of (N = 907) identified references were imported into COVIDENCE. Duplicate articles (N = 107) have been removed, and the remaining papers (N = 800) were screened for eligibility using a two-step process: (i) title and abstract screening and (ii) full-text review. Initially, we screened all identified articles based on titles and abstracts against the inclusion criteria. Inclusion criteria for sample selection in this review are: English language, peer-reviewed and grey literature documents (i.e., articles, papers) published between 2011–2020; that incorporated empirical designs (qualitative, quantitative, mixed-method), systematic reviews, or conceptual papers that discussed ethical considerations (ethical challenges, issues, dilemmas, conflicts) with using emerging digital technologies like virtual reality (VR), artificial intelligence (AI), robotics, or 3D printing in nursing care, focusing on nurses experiences and perceptions with using such technologies in care; and report on ethical strategies to address emerging ethical challenges. Given the multi-disciplinary health interest in the topic, literature from related healthcare disciplines has also been included. No geographical restrictions were placed. Articles deemed irrelevant (N = 548) were excluded. Subsequently, we retrieved and reviewed the full text of articles that met our inclusion criteria. All included full-text articles were read thoroughly to gain an understanding of the material. A final sample (n = 64) of papers were selected that meet all our inclusion criteria.

**Data Extraction and Quality Appraisal.** We used an electronic data extraction form in COVIDENCE to extract and capture essential information and methodological features from the included articles, using the subheadings: “Author, Year & Country,” ‘Study Aim/Purpose,’ ‘Design & Methods,’ Study Setting/Sample Size, Characteristics & Population,’ ‘Key Results/Findings,’ ‘Implications,’ and ‘Quality Score/ Strength of Evidence.’ The content of each article was summarised under the subheadings of the data extraction form (Table 1). Given the diversity in the approaches and research designs of included papers, we used a combination of quality appraisal tools from the Johanna Briggs Institute (JBI) Qualitative Assessment and Review Instrument (JBI-QARI); Critical Appraisal Checklist for Qualitative Studies; Critical Appraisal Checklist for Text and Opinion Papers; and the Centre for Children’s Health Ethics and Law (CCHEL) Ethics Critical Appraisal Worksheet (ECAW) to appraise the evidence from the sample articles. These tools were deemed appropriate for assessing the credibility, dependability, confirmability, transferability, authenticity, and relevance of studies. Also, they are inclusive of papers that do not follow traditional methodological designs and approaches.
**Data Abstraction, Synthesis, and Interpretation.** Data abstraction and synthesis process consisted of re-reading, comparing, categorizing, recognizing emerging themes and sub-themes; making judgements about meaning, relevance, and importance of issues; about implicit connections between data, indexing references and annotating; and charting by lifting data from its original textual context and placed it in charts that consisted of headings and subheadings drawn during the thematic framework. We used a five-stage Framework Analysis approach proposed by Ritchie and Spencer\(^{29}\) to abstract and synthesize evidence: (i) familiarisation; (ii) identifying a thematic framework; (iii) indexing; (iv) charting; and (v) mapping and interpretation. Emerging themes in the thematic framework were initially abstracted and synthesized into seven preliminary categories. Following extensive indexing and charting, we analyzed and linked the emerging themes with quotes from the relevant articles from which it was derived. We analyze the key characteristics for mapping and interpretation as laid out in the charts (Table X). This analysis provided a schematic diagram of ethical concerns with using EDTs in virtual care in clinical nursing practice, thus guiding the final interpretation of the data set while remaining mindful of the objectives of this review. The results of the integrative review are presented both narratively and in a tabular format. A detailed discussion of ethical concerns and ethical best-practice and strategies, along with implications for policy, practice, and future research, will be presented. A summary of the methodological quality of the studies and the strength of the evidence is displayed in Table 1.

## 5 RESULTS

The review and analysis of the identified literature reveal the nature and scope of ethical considerations regarding EDTs like robotics, artificial intelligence (AI), virtual reality (VR) and three-dimensional (3D) printing in virtual care in clinical nursing practice, are multi-dimensional and multi-levelled. The emerging nature of the topic and subject matter implies that the literature on this topic is predominantly conceptual/philosophical with few empirical (qualitative and quantitative) studies. While the information and evidence from the reviewed literature comprised documents from reputable peer-reviewed and grey literature sources, including viewpoint, arguments, and expert opinions from authoritative subject matter experts, the results on the ethical challenges can be characterized as futuristic and sometimes speculative. The results are presented according to the questions that guided the review. Moreover, the dynamic interaction between ethics, technology, and practice in nursing, which is situated within a particular socio-historical context and shaped through the complexity and dynamics of the practice environment,\(^{30,31}\) highlight that the scope and nature of ethical considerations regarding EDTs in virtual care in clinical nursing practice are not reducible to particularistic concerns about nursing values only\(^{26}\), but also comprised ethical considerations related to the broader organizational and societal context in which nursing practice is embedded. Hence, ethical challenges as barriers to the provision of good care in nursing in a manner consistent and that are determined by its Code of Ethics, broadening scope, standards, and competencies of practice in nursing,\(^{32}\) the underlying philosophy of care and practice, and the care environment, are included in the scope of ethical considerations regarding EDTs in virtual care in clinical nursing practice.\(^{33}\) Furthermore, these ethical concerns were mapped based on Taylor’s ethical framework\(^{34,35}\) because of its applicability, coherence and consistency with the values and purpose of clinical and ethical practice in nursing.\(^{36}\) Thus, the three categories of ethical concerns identified comprised Ethical concerns related to Meaningful Understandings in the local Moral Horizon of Significance in Nursing Practice; the Organizational Imaginary and Societal Imaginary (Figure. 2).
5.1 Ethical Concerns Related to Meaningful Understandings in the Local Horizon of Moral Significance in Nursing Practice

This category of ethical considerations represents ethical concerns with EDTs as experienced or perceived by nurses, patients, and other healthcare professionals, based on aspirational and contextually meaningful self-understandings and shared understandings about fundamental moral commitments and responsibilities, the inter-personal relational nature of nursing, and the role and application of emerging technologies in care, which are embedded in a particular “socio-cultural historical context” of nursing as a profession and practice-discipline. Specifically, ethical concerns comprised of considerations about fundamental beliefs, values, intentions, attitudes, decisions, interactions, expectations, including moral emotions like compassion and empathy when contemplating the role and use of EDTs in clinical care and
practice in nursing. The ethical significance of these elements is nurses consider them as the essence and foundation of good nursing care. They form a morally meaningful orienting framework that enables nurses to connect the moral emotions, standards, and behaviours, that guide nurses’ ethical reflection and responsiveness toward emerging technologies in care and practice, including its role and implications. Also, it guides nurses’ responsiveness and actions when considering enacting and using technologies to provide good care while simultaneously illuminates the pathway toward a local horizon of moral significance that affirms the ethical and professional boundaries of nursing. Therefore, ethical considerations regarding EDT in virtual care in clinical nursing practice in this category have been dubbed Ethical concerns related to Meaningful Understandings in the local Moral Horizon of Significance in Nursing Practice. This category of ethical considerations comprised of five emerging key themes of ethical concerns regarding EDTs in virtual care, specifically: regarding the (i) nurse-patient relationship and inauthentic care interaction; (ii) patient dignity, autonomy and [self]deception; (iii) privacy, confidentiality, trust and integrity; (iv) patient safety; and (v) [social] justice, bias, discrimination, and stigmatization.

5.1.1 Nurse-patient Relationship and Inauthentic Care Interactions

Relationships are at the core of ethical practice in nursing and healthcare to provide good, patient-centred care. Specifically, the primacy of the nurse-patient relationship (NPR), which has been articulated by nurse scholars as nursing’s essence and foundation of good nursing care, forms the context in which patients and nurses in mutual interaction co-construct the meaning of good care, including using technology to accomplish the goals of care in clinical practice. 46-48 In this vein, Stokes et al. 39 contend that a synthesis view of caring requires a reciprocal relationship between the care provider (nurse) and the care recipient (patient) based on experience and context. Emotional underpinnings, especially moral emotions (i.e., compassion, empathy, gratitude, therapeutic touch, communication, and eye contact), are considered essential elements of the nurse-patient relationship and good care since it links moral standards and moral behaviour and shaped nurses’ ethical responsiveness in care and ethically challenging situations with using technology. 49

A few qualitative empirical papers 24,38,42, quantitative 41 and several conceptual papers 37,50-54 have consistently identified a significant concern about the impact EDTs might have on clinician-patient relationships. Several of these papers raised the concern that EDTs like artificial intelligence (AI) and robots may degrade the clinician-patient relationship and contribute to inauthentic care and care interactions. 39,51,52,55 Evident from qualitative empirical papers and systematic reviews 43 Qualitative found that such negative perceptions and attitudes toward EDTs, are based on how nurses’, patients, and other healthcare professionals’ experience emerging digital technology 50, that is based on mixed and incompatible understandings (thoughts, views, beliefs, intentions) of fundamental notions about ‘consciousness’ and ‘personhood’ 55,56, a good life, well-being, and friendship 50, companionship as well as attributions of roles, virtues, and relationships as between moral equals that value the virtue in the other; and as social entities. 50 In this vein, one conceptual paper philosophizes and raises the concern that EDTs’ (i.e., robots) will transform nurse-patient relations from “I-Though relationship” to “It-It relationship.”, which is considered an ‘inauthentic relationship’. 55

It is believed that currently available EDT like robots and AI, are viewed to be lacking specific essential elements fundamental to the therapeutic patient-nurse relationship, such as empathy, 55,57; friendship 50; mutual trust and human contact 38; insufficient time and, social
connection \textsuperscript{24} if the caregiver was a robot. Mistrust in the moral-technical capabilities of currently available EDTs (i.e., robots). In nursing practice, the regularity, frequency, and privacy of such interaction patterns are considered the bedrock of nurse-patient relationships that work well since these contribute to trust and allow the patient and nurse to share care concerns and problems. \textsuperscript{58} Similarly, in related health literature, the clinician-patient relationship or physician-patient relationship was a significant concern with EDTs like robots and AI. \textsuperscript{51,59-61} In this vein, Reddy et al. \textsuperscript{61} cautioned that deep learning algorithms in AI continuously fine-tune their parameters and evolving rules, based and non-transparent decision-making processes referred to as the “black-box” problem challenge the patient’s trust in the clinician-patient relationship. Metzler and Barnes \textsuperscript{55} raise the concern that the I-Though relationship nature of nurse-patient relations might be transformed by EDTs like robots to an It-It relationship, which is deemed an ‘inauthentic relationship.’ \textsuperscript{55}

Good virtual nursing care is not only dependent on a technological imperative characterized by the execution of instrumental care tasks, \textsuperscript{38,62} but is guided by a moral imperative. Caring involves conscientiousness, empathy, emotional engagement, and interaction with others. Hence, communication, mutual trust, and empathy \textsuperscript{38} are considered essential for good virtual nursing care in clinical practice. While self-conscious and autonomous emerging digital technologies like robots and AI in the future might be capable of mimicking human emotions, conscious states, or intentions, and be capable of simulating empathy and communicating with patients, they do not currently possess conscious experience, and thus might be incapable of authentic care. \textsuperscript{63} For example, in clinical practice, a cognitively vulnerable person, such as a patient living with dementia, may potentially have difficulty distinguishing whether an autonomously functioning robot or AI truly experiencing or is just simulating emotions, raises a problem with authenticity in such a relationship. Furthermore, some authors pointed out that emotional underpinnings of successful clinician-patient relations and communications may not translate to patient-machine interactions, especially when patients become aware that they do not interact with a human being. \textsuperscript{49} One qualitative descriptive study on nurses’ views on the potential use of robots in a pediatric unit identified that while nurses find such technology could help with nursing tasks, they also reduce nurses’ interactive communication with clients. \textsuperscript{24} Furthermore, while robots and AI’s might help instrumental care, their inability to show empathy, \textsuperscript{55} and lack of authenticity \textsuperscript{52} also raise fear about unintended consequences of misclassification, misdiagnoses, and biased care. \textsuperscript{21} Concerns have been raised in instances where caring relationships are dominated by EDTs like autonomous decision-making systems such as robots and AI, individualized and holistic care might become insensitive and over-medicalized, contributing to depersonalized and dehumanized care and caring relationships. In this vein, Stokes \textsuperscript{39} proposed the ethical division of instrumental caregiving tasks between such systems and human caregivers that maintain caring as a core value in nursing practice. \textsuperscript{39}

5.1.2 \textit{Patient Dignity: Autonomy and [Self]Deception}

The word dignity is derived from the Latin words \textit{dignitus} (merit) and \textit{dignus} (worth). Honouring Dignity, both as a human value (i.e., ‘human dignity’) or social value (‘social dignity’), is recognized and valued as an ethical value and responsibility in nursing. \textsuperscript{64} Respecting and honouring dignity has been recognized as a long-standing ethical value and human rights in nursing and healthcare discourse. \textsuperscript{65,66} Honouring of dignity is articulated and emphasized in professional guiding documents of national jurisdictional and international
organizational codes of nursing ethics. Dignity comprises respect, autonomy, rationality, communication, and empowerment, being respected.

Several qualitative studies and related papers in nursing and healthcare, conceptual papers and systematic reviews that focused on using EDTs like care robots and autonomous artificial intelligence in care settings identified concern for patient dignity as a second major ethical challenge. The significance of this concern for patient dignity using EDTs like robots and autonomous artificial intelligence in care settings is characterized by concerns about respect for patient autonomy and [self]deception including infantilization of vulnerable clients in care. Protecting user’s autonomy and being in control of such technology is considered essential. A qualitative study that used semi-structured interviews with healthcare personnel (i.e., nurses, medical doctors, nursing home managers) and researchers in various health disciplines (i.e., nursing, psychiatry, gerontology, neurology, neuropsychology) reported that these health professionals and researchers view patient autonomy as a major ethical priority concern with the use of intelligent assistive technology. Such a concern was particularly emphasized in the context of caring for patients with diminished cognitive or emotional abilities, such as patients living with dementia and some psychiatric challenges. Several papers in nursing and related healthcare expressed the concern that the use of EDTs like care robots and autonomous artificial intelligence in care settings might erode the dignity and autonomy of the care recipient.

Many qualitative studies that identified a concern with patient autonomy were conducted in care settings that serve patient populations with cognitive and emotional vulnerabilities, like the aged in the long term or residential care settings and patients suffering from mental health challenges in mental health facilities. Furthermore, the concern for patient autonomy was often attributed and reinforced by an attentiveness to and consideration of the vulnerability of the care recipient or the technology user, the care context (i.e., lack of resources), unrealistic expectations or false beliefs about the capacities of some technological innovations (i.e., carebots), loss of control, and the frequency of use and interaction with such technology. A similar concern about the loss of individual dignity and autonomy was expressed in related medical or health literature on the use of AI. Respecting a patient’s autonomy is a fundamental principle in nursing and healthcare provision. Respecting patients and nurses the autonomy while acknowledging their right to hold views, determining the course of their own life, making choices, and take actions based on their values, beliefs, and preferences are essential hallmarks of respecting autonomy. Failure to respect patients’ autonomy undermines their sense of self and identity. Hence, autonomy is a critical aspect in also honouring patient’s dignity. Autonomy contributes to preserving a sense of dignity and is essential for a respectful and effective patient-clinician relationship using EDTs in virtual care.

However, in the literature reviewed, perceptions about the potential impact of EDTs on individual autonomy are also inconsistent. Contrary to the fundamental concerns about patient autonomy that were largely negative, a few articles also opined a more positive stance towards the impact EDTs might have on patient autonomy. Some articles reported that interacting with some EDTs may enhance patient autonomy. For example, care robots like RIBA and Paro can assist patients with limited control over their bodily functions with lifting, transfer, bathing, hygiene, bathing, and grooming tasks. While the usefulness of these EDTs in the provision of instrumental care is recognized, care. Concerning autonomy, one qualitative study has raised
the concern that using EDTs in care used under certain circumstances might also qualify as a form of deception. 38

[Self]Deception. Deception or falsehood refers to an act or statement which misleads, hides the truth, or promoted a belief, concept, or idea that is not true. In the context of human interactions, including human-technology interactions, it implies that a person or “autonomous machine” can either be deceitful towards others (deception) or may hold false beliefs (self-deception). Whether intentional or unintentional, deception is ethically wrong because deceitfulness is often motivated by self-interest, violating respect for others or self. Doing so can lead to error in judgment and harmful consequences like a betrayal of trust, erosion of autonomy, and trust between patients and caregivers. 72,73 Deceptive behaviour can be enabled through language euphemisms, errors in perceptual causation, constraints induced by representations of the self [self-perceptions], and the slippery slope of decision-making.73,74

In the context of clinician-technology interactions in care, the potential for deception, whether unintentional or intentional, has been identified as a significant ethical issue by several nursing and healthcare-related literature. 38,39,71,75 The risk for deception can come from using language euphemisms that depict how people talk and think about technology. Several papers highlighted the use of language euphemisms like “empathy” (50,75 or “artificial empathy,” “friendships,” as “peers” or “companions” 52,76, caring entities, 77 “cooperative partners, and “co-workers” 76 to characterize, present, or humanized such technologies or “machines.” 39,43,52,55 Furthermore, the concern with deception have also been attributed to mistaken about the mental or emotional properties and capabilities of these technologies, 50,63; a person’s acquired skills from using virtual reality technology 78; spiritual interpretations about conscientiousness or conscious awareness in such technologies like robots or AI 52; the authenticity of machine-human relationships 63; and a lack of transparency in the marketing of the true utility or value of some EDT.79,80 Deception relates to confusion about ways of thinking, and language is also referred to as a ‘category mistake.’ 55 For example, in clinical practice, a vulnerable patient may ignorantly believe, whether consciously act or unconsciously, that a robot or AI machine they are interacting with can demonstrate empathy. 50,75 In addition, the potential for deception has also been attributed to the “black box problem.” In this vein, factors and processes AI algorithms rely on and make predictions and decisions about patient care are often obscured 59,80. The ethical significance of deception or self-deception in which truth is denied is feared could lead to errors in ethical judgment concerning the harm caused by the EDT, which in turn could violate patient dignity and patient safety. Moreover, deception with EDTs in virtual care potentially could also obscure moral responsibility and responsiveness in decision making, self-interested behaviours, moral insensitivity, and blindness as to the ethical implications of using EDTs in virtual care. 5,50,70,76

5.1.3 Patient Safety

The Canadian Patient Safety Dictionary defined patient safety as “the reduction and mitigation of unsafe acts within the healthcare system, as well as the use of best practices shown to lead to optimal patient outcomes.” 81 In nursing, patient safety is considered a moral and ethical imperative and professional standard to nursing care. Nurses have an ethical responsibility to take all necessary actions individually and collaboratively to prevent or minimize patient safety incidents. 26 This implies sensitivity and attentiveness to ethical concerns about patient safety incidents concerning the use of emerging technologies in care.
In this vein, the concern for patient safety has been identified as a significant ethical challenge with using emerging digital technologies like robots, AI, and 3-D printing in care. In related health literature, Wachsmuth raises the concern about self-conscious and autonomous robots and AI technologies and harm by highlighting the potential of conscious suffering in AI technologies since they potentially, might be able to perceive and interpret their sensory pain. Attributions of potential safety concerns regarding EDTs in virtual care are linked to several factors. Such factors include disruptions in intra-operative communication, teamwork, and equipment failure during robotic-assisted surgical interventions, issues with infection control and the potential for transferring pathogens in the 3D printing process and robots, and the competency of the user of such technological innovations. Additionally, factors such as technologies like AI medical software that does not align with current models of care delivery; the environmental situations between older adults and HCRs; potential breaches of personal information from stored data in cloud servers, and issues of access authority for HCRs’ stored data; automation complacency and automation bias have also been attributed to the use of EDTs in virtual care. Automation complacency refers to a person’s tendency to trust that a machine will do what they are programmed to do. For example, with the use of some EDTs, the more automated a procedure becomes, a nurse might grow comfortable with the technology and begins to become less sensitive and attentive to the task or function at hand. Complacency in care has been attributed to several patient safety incidents or adverse events. Automation bias refers to the tendency of an individual to favour suggestions from an automated system despite contradictory and correct information available from other sources.

Patient safety is also identified as an issue in clinical research protocols that trial emerging digital health products in clinical settings. Safety function mainly was equated with a monitoring function, and some studies reported that participants felt a tension between the notions of safety and privacy in SAR implementations. Some papers have made specific recommendations for the ethical use and design of AI care providers. Infection control and patient safety are critical responsibilities of nurses, both clinically and ethically. EDTs that comply with hygienic standards and pose no risk to the patient or nurse were preferred. Similarly, viewpoints on the benefits of using some EDTs in virtual care in clinical practice were also somewhat inconsistent in the literature. Some believe that the use of VR in medical education might increase patient safety since clinicians can practice specialized technical skills with simulated patients in controlled VR environments instead of actual patients.

5.1.4 Privacy and Confidentiality: Trust and Integrity

The pervasive nature and increase use of emerging digital technologies, including social media in clinical practice in nursing and healthcare provision, has exacerbated concerns about privacy and confidentiality. As an ethical and professional duty of care and responsibility, nurses recognize the importance of privacy and confidentiality in all care interactions and implement safeguards to protect client’s personal information in the context of a professional relationship.

In reviewed literature, a concern for privacy and confidentiality was identified as a significant ethical challenge regarding EDTs in virtual nursing care and healthcare services. Respect for privacy and confidentiality are valued principles that underscore the provision of nursing care and health services. In conventional understanding, privacy fundamentally deals with a right to be free from interference from others, control what aspects of one’s personal lives remain unknown to others, and the freedom to grant or withhold access to...
personal information, especially healthcare information. In contrast, confidentiality relates to the protection of personal and healthcare information. 92,93 Evident from reviewed literature, the increased application and use of EDTs in virtual care challenges conventional understandings of privacy and confidentiality. Current laws to safeguard and protect patient privacy might be inadequate or insufficient to protect patient privacy when using selected EDTs. 89 The literature appears to predominantly focus on concerns about informational privacy (i.e., granting or withholding access to personal and health information). However, one paper reported additional components to the right to privacy, such as physical, attentional, and decisional privacy, that should also be an important ethical consideration with the use of EDTs in virtual care. 89 Physical privacy refers to the capacity to restrict one’s personal physical space, whereas attentional privacy relates to the capacity to retain one’s attention from unsolicited phone calls, emails, etc. Decisional privacy refers to a person’s ability to choose a particular course of action without intrusion or interference from others, including emerging digital technological innovations. 89

In clinical practice, while ongoing monitoring of patient’s health status and the surveillance of infectious and communicable diseases in preventive care and health promotion are routine functions and responsibilities in practice, the constant monitoring and possible unauthorized surveillance of every aspect of an individual’s life that are enabled by emerging technologies (i.e., robots like Giraff, IA, videos, and sensors) contributed to concerns about privacy infringements or intrusions. 38,42,71,87,91 When clients provide health information to their caregivers during care interactions, they do so in confidence and trust that health professionals and healthcare providers will safeguard and protect such data from unauthorized access and misuse. Several papers have identified concerns regarding patient privacy and confidentiality with using EDTs like robots and artificial intelligence. 69,90 Breaches because of information disclosure, the potential invasion or infringements on a patient’s privacy and confidentiality, actively undermine their individual’s sense of self, dignity, autonomy, trust, and integrity. 22,49,57,91,94 In turn, the betrayal of trust resulting from the unauthorized access and misuse of information damages the integrity of healthcare providers and the profession 57 and losing control over privacy, raises concerns about autonomy 43, manipulation and discrimination 88

Evident from reviewed literature, privacy and confidentiality concerns often was attributed to concerns about data management practices, including data ownership, storage, unauthorized access, security, and sharing practices 5,38,42,54,71,76,82,95; a lack of transparency in data management practices 60,89,96; informed consent for data used 5; and the inadequacy or insufficiency of current laws to protect patient privacy when using emerging digital technologies. 5,54,57,61,88,90,97,98 Ethical concerns regarding potential breaches of privacy and confidentiality are shown to negatively influence health and social care professional intentions to use EDTs like robots (Liang et al., 2019). Therefore, nurses' role and ethical responsibility in strengthening safeguards to maintain the right of patients to privacy and confidentiality as articulated in practice guiding Code of Ethics 36 and legislative frameworks are becoming increasingly important with the application and use of EDTs in virtual care. Attentiveness to clients' privacy in their care and maintaining ethical practices ensure that patients' personal information is not digitally compromised is essential. 24

5.1.5 Social Justice and Bias: Unrepresentative Data, Exclusion, and Stigmatization

Justice refers to the obligation to treat people fairly and equitably. Fairness requires treating all people with equal respect and concern. Equity in care and service provision involves distributing health benefits and burdens to not unduly burden patients or deny them healthcare
benefits. Resource allocation, particularly the equitable and non-discriminatory distribution of limited healthcare resources, poses significant ethical concerns in health settings. Based on an ethical, social approach to distributing healthcare resources, the principle of justice is an essential consideration in nursing care prioritizing and healthcare resource allocation decisions. This expectation applies to decisions made by both humans and non-human agents such as robots and artificial intelligence. Based on such an approach, prioritizing the needs of others, especially vulnerable people, and not just the individual patient’s need, is an important consideration. 

Vulnerability and need are essential ethical considerations of fairness and equity in care. This implies special consideration of individuals or groups disproportionately affected by social determinants of health, life circumstances, and contexts such as with many ethnocultural minorities, the elderly, children, and those with diminished capacity for self-determination. The principle of justice in healthcare allocation choice requires that decisions should be based on sound clinical criteria and that all patients are entitled to unbiased and fair selection procedures regardless of socioeconomic or political background. The promotion of justice and safeguarding human rights in care are fundamental values and ethical responsibilities of nurses. This implies that nurses do not act in bias ways toward patients regardless of person, family, socio-economic and political circumstances, and ensure that such attributes do not affect allocation decisions and that the interest of those involved are considered.

A few papers reported that the application and use of EDTs in virtual care might help to improve care access, the uptake of preventive health services, or discretely reduce health inequities and disparities. However, several articles identified that using emerging digital technologies in virtual care may potentially reinforce disparities and injustices in health and healthcare outcomes, thus raising issues about social justice and bias. Concern regarding social justice and prejudice were referenced in relation to EDTs like AI, robots, 3D printing for organ transplanting, and virtual reality in virtual care. Biases can emerge either from the machine toward the care recipient or the user toward the machine. In terms of the latter, Weber observed that patients might demonstrate bias towards autonomous decision-making systems as a non-feeling, non-sentient, non-emotional entity. Ethically it is significant because such biases potentially could impede ethical responsiveness in care, identifying and addressing ethical questions that can arise in patient-machine interactions, choice over competing therapies, and shared decision making in the rationing and allocation of care and healthcare resources.

In the identified literature, social justice and bias concerns are attributed to unrepresentative data sets, data manipulation, exclusion, and stigmatization. Furthermore, bias from technology has also been related to the user of such technologies, risks for misclassification, misdiagnosing, detection, and selection of data. These biases are comprised of both desirable and undesirable biases that may be intended or unintended, including algorithmic bias that are of a social, methodological, and scientific nature. Potentially, biases may lead to systematic errors and random errors, raising concerns about their accuracy in clinical decision-making and predicting health behaviours. The affordability of intelligent assistive technology (IATs) was also a concern in terms of distributive justice. It is believed that systematic errors and random errors in AI algorithms may potentially adversely impact social determinants of health. This contributes to fears of unfair discrimination against vulnerable patients, such as individuals with mental health challenges, racial and gender minority individuals and groups, that in turn, could reinforce existing inequities and disparities in health outcomes. Thus, leveraging determinants to address algorithmic bias, prioritizing
accuracy and representativeness in data sets used in algorithmic decisions, has been identified as important strategies for consideration.  

5.2 Ethical Concerns Related to the Organizational Imaginary

Ethical considerations in this category relate to embodied responsible virtual nursing practice within the broader organizational context. As such, ethical considerations regarding EDTs in virtual care in this category relate to ethical concerns about broader structural dimensions (i.e., laws, regulations, policies, processes, and procedures) that govern ethical and clinical responsible practice and decision making in regards to the procurement, application, and use of emerging digital technologies and the processes and procedures that drive nurse decision-making in care and service delivery within the healthcare organizations. Hence, ethical considerations in this category are representative of ethical concerns that relate to the impact and implications EDTs may have on employment, competencies, institutional values, practices, standards, including policies and procedures.  

Considering the nature of nursing practice within healthcare organizations through a relational and collaborative lens, ethical considerations in this category based on Taylor’s clinical ethical framework are called Ethical concerns related to Organizational Imaginary. This category of ethical concerns comprised of four emerging key themes of ethical concerns regarding EDTs in virtual care in clinical nursing practice, specifically: (i) Informed Consent, Transparency, and Data management; (ii) [Dis]Trust in the Healthcare System; (iii) Job displacement, Losses, and Fading in Professional Competencies; and (iv) Liability, Accountability, Interpretability (Explainability).

5.2.1 Informed Consent, Transparency, and Data Management

Informed consent is the guiding operating principle in treatment and care in nursing and healthcare service provision. Patient autonomy is the ethical basis of informed consent. Apart from being a legal document, informed consent is also the expression of the ethical values and commitments that underscore healthcare provision and practice in nursing, including the nurse-client relationship. Informed consent, which is based on the ethical principle of autonomy, is, therefore, a hallmark of demonstrating respect to the patient’s choices as an autonomous moral agent and their ability to exercise such choices freely about care. When nurses use technology, including emerging digital technologies, for assessment, diagnosis, planning, implementation, and evaluation of clients receiving care, they have a duty of care and ethical responsibility to obtain their consent.  

Informed consent has been identified as a significant ethical concern in reviewed literature using emerging technologies like AI and 3D-in virtual care. The concern with informed consent was identified as a priority ethical issue in a qualitative study that explored professional stakeholders’ perceptions of ethical issues in developing and using intelligent assistive technologies in virtual care. In the context of using EDTs in virtual care, informed consent was deemed essential to avoid the exploitation of vulnerable patients. Concerns about informed consent were often attributed to practicalities related to lack of transparency and erroneous marketing by developers of emerging technologies on the actual capabilities and proven benefits of emerging digital technologies; the availability of truthful and accurate information around data-management practices, such as data sharing, ownership, and access in healthcare institutions. Transparency implies openness, communication, and accountability. It is crucial for informed consent and trust. The increased use of emerging intelligent autonomous technologies like robots, AI, and 3D printing in providing virtual care
raises many practical ethical challenges with informed consent. In clinical nursing practice, the provision of understandable information to patients is a prerequisite to informed consent to facilitate comprehension and accomplish the goal of respecting and protecting the autonomy and safety of patients, including the prevention of harm. However, from reviewed literature, this provision of information to facilitate informed consent is challenged with using EDTs in virtual care.

First, uncertainties about the algorithmic operations in AI technologies; the biofabrication of materials produced with 3D printing; availability and robustness of empirical evidence on the safety, efficacy, and effectiveness of emerging technologies may potentially make it difficult to provide or disclose information appropriately. The latter is crucial in terms of informed consent to ensure that patients fully understand the risks and benefits associated with emerging technologies. Secondly, there is also the lack of transparency in the representativeness of data sets used in AI machine algorithms to make predictions and decisions, and unfamiliarity and insufficient understanding of machine algorithm processes by clinicians. In instances where a nurse or clinician advised the use of such emerging technologies in care to patients, but do not have the sufficient understanding of the information about the internal workings used by of AI algorithms to make prediction and decisions, it is ethically problematic to expect of patients to provide meaningful informed consent for such use.

Thirdly, concerns related to data management with using EDTs that revolve around privacy, ownership, protection and security of personal information and data generated by predominantly artificial intelligence and robots. Practical concerns about how informed consent can be obtained and secured for use in data sets by AI algorithmic technologies to make predictions and choices. Another practical concern was attributed to the scope and magnitude of datasets used to operate algorithms in AI (i.e., deep learning algorithms) for application in care, which are believed, make the seeking of informed consent from individual patients for the use of their data in a particular dataset, impractical as an operating principle. Negative consequences associated with a lack of transparency can negatively impact trust in the nurse-patient relationship or healthcare provider-patient relationships.

5.2.2 [Dis]Trust in the Healthcare System

Trust is foundational in nursing and healthcare practice, the basis of the fiduciary nurse-patient relationship, and is essential to providing safe, competent, compassionate, and ethical care. Trust is also crucial to the acceptance and use of emergent technologies by health professionals. In nursing, trust, among other factors like social networks and performance expectations, positively influences nurses, health, and social care professionals’ intention to use robots. Trust in relation to the use of EDTs like robots and artificial intelligence was also communicated by language phrases such as “trustworthy” to describe technologies.

On the contrary, several papers have identified a concern regarding trust toward emerging technologies itself and in the healthcare system by patients as a significant ethical issue with the use of EDTs like robots and AI in healthcare and service provision. Besides contributing factors of distrust mentioned elsewhere in this paper, concerns about trust with the use of emerging digital technologies like AI and robots were often attributed to perceived deception in the use of technologies that simulate humans, breaches in privacy, and inconsistency between the information provided by AI’s and robots in the provision of care. Other attributing factors included a perceived lack of accountability and transparency, and shifting attributions of responsibility from human caregivers to machines; concerns
about epistemic authority; and inability to express emotion in care. Furthermore, these attributing factors were compounded by false marketing, unrealistic beliefs, and expectations about the capabilities and benefits of emerging data-driven technologies; conflicts of interest, and non-transparency in the responsible management of data privacy (i.e., consent for sharing of data with third-parties); negative healthcare staff attitudes towards these EDTs, and patients wariness of the role of such technologies in healthcare settings.

Additionally, the dual-use aspects of emerging digital technologies for multiple unintended purposes related to gaps in understanding and interpretability of decisions based on machine algorithms can further contribute to distrust by patients in EDTs used in virtual care. It also poses a threat to the trust patients have in healthcare professionals and the nurse-patient relationship. At a minimum, patients expect and trust that their care is grounded in best evidence and that nurses and other health professionals, as accountable professionals, base their clinical decisions and actions on data and information that are transparent, verifiable, and auditable. However, the opacity in the process used by AI algorithms to make predictions seems to undermine that trust, leading to distrust with using EDTs in virtual care.

5.2.3 **Job Displacement, Losses, and Fading in Professional Competencies**

An unexplored ethical challenge with EDTs like AI and robots is the impact automation may have on the jobs of nurses and other healthcare professionals. As these technologies become more automated and are increasingly incorporated in virtual care and health service provision, that is a concern that it will result in fewer ‘human practitioners,’ potentially increase unemployment, and in turn may adversely affect available job opportunities for healthcare professionals, both in terms of job displacement, changing the nature of such jobs, and competency development. From a clinical practice perspective, nursing shortages are viewed as a novel ethical concern from a nursing perspective because it raises concerns about good care, patient safety and nurse safety.

Hence, job displacement, job losses, and fading in professional competencies have been identified in the reviewed literature as a major ethical concern with using EDTs like robots, AI, and virtual reality in clinical nursing practice. One qualitative study on nurses’ views on the potential use of robots in a pediatric unit found that reduced employment opportunities for skilled nursing staff identified as a theme was identified as a significant issue of concern. Concerns about job displacement, job losses, and fading in professional competence were often attributed to concerns with the availability in opportunities for nurses to maintain clinical and interactive communication skills; the increased reliance on so-called “gig” or platform workers referred to as the ‘uberization’ of the healthcare workforce; the routinization of machine learning in care; the increasing shift of duties and responsibilities in decision-making and care to robots and AIs. In this vein, Fenech argue that the uberisation of the healthcare workforce and increase use of AI algorithms in care may impact the relationship between administrators and frontline care workers, the nature of work, creation of new roles and categories of jobs; incentivizing or “nudging” of health behaviours, which in turn could impact the relationship between patients, healthcare professionals, and society at large.

Furthermore, with the routinized use of EDTs (robots and AI machine learning) in practice and care, clinicians might lose clinical skills they do not regularly use or practice. The fading effect over time it may have on the competency levels of clinicians has been referred to as ‘skill deprivation in automation.’ The increased use and upscaling of EDTs like robots
and artificial intelligence may also lead to significant changes in professional roles and
hierarchies, human-machine role distribution competencies, and work profiles of nurses and
other healthcare professionals. In addition, clinician-machine interaction may also fundamentally
challenge healthcare professionals’ self-conceptions, self-perceptions, self-efficacy, the
structuring and organization work and teamwork in areas setting such as operating rooms. These challenges have significant implications for nursing education and health professional education regarding curriculum innovation, competencies development and assessment.

5.2.4 Liability and Accountability: Interpretability/Explainability and Conflict of Interests

In clinical practice, nurses as accountable professionals integrate laws, regulations, professional standards, best practice, and research in conjunction with ethical provisions in the Code of Ethics to guide ethical relationships, decision-making, and behaviours in care provision and work through ethical concerns in practice.

From a legal-ethical and professional perspective, several papers had identified liability and accountability issues with the application and use of EDTs like AI in virtual care in clinical practice as a major ethical concern. In the domain of virtual reality, one paper identifies that virtual avatar accessible via the internet may allow for the provision of services across jurisdictional boundaries. In the context of virtual care, using digital information and communication technologies, practice across jurisdictional boundaries coupled with the unregulated deployment of such systems via digital platforms raises ethical and legal implications if expectations for competence and patient safety are not strictly and consistently enforced. Secondly, the issue of liability in relation to explainability has been identified in reviewed literature as an important point. Scope of use and competence of automated decision-making systems (i.e., use of robots, AI care providers); confusion in conceptual understandings and lack of consistent definitions and terminology related to EDTs; lack of specific standards for the contractual obligations and role responsibilities of all involved care stakeholders (i.e., clinicians, agency, developers) raises fundamental concerns about liability and accountability with using emerging digital technologies in virtual care in clinical practice.

Concerns regarding liability and accountability with using EDTs like virtual reality, robots, and AI were often attributed to opaqueness in the operational decision-making processes of digitally automated systems like robots and artificial intelligence (AI). If nurses and healthcare professionals do not have insight in how automated digital systems like robots and AI algorithms make predictions and decisions, it raise an ethical concern about interpretability or explainability. Most importantly, clinicians like nurses, physicians, and other members of the inter-professional health team in clinical practice have a duty of care to foresee any possible harms that may arise from the application and use of technologies in the assessment, diagnosis, treatment, and care, because of the risk of liability for harms by these technologies.

Nurses are responsible for their actions and answerable for their practice. As accountable clinicians, blaming the technology in use for decisions that are made is, therefore, not a professional or clinically ideal outcome because of the risk to the safety and trust of the patients in nurses and the nurse-patient relationship, and the professional integrity of nurses, organization, and the profession. Fundamentally, responsible, and accountable practice are essential to maintaining care relationships. Understanding and being knowledgeable about the basic concepts, operating functions about emerging technologies, the legal and ethical risks they posed are crucial to evidence-informed judgments in care and accountable professional practice.
Accountability is defined by the SRNA 109 “as an obligation to accept responsibility or answer for (explain) one’s actions to achieve desired outcomes. Accountability resides in a role and can never be delegated away.” (p.13). Hence, from the view of virtual care in clinical nursing practice, actions, and decisions including algorithmic choices and predictions executed by emerging digital automated decision-making systems like robots and AI, raises a concern with accountability.

One paper highlighted the importance of what we mean by “robot” as these could include fully autonomous systems or an integrated robotic system that interacts with humans and other systems, such as electronic files and hospital information systems. 76 Furthermore, in the literature reviewed, different descriptions exist for the same type of EDT with not a generally clear and agreed-upon definition. 39,54,76 For example, in the domain of robotics, there are iterations like “humanoid robot,” “humanoid nurse robot,” “humanoid care robot,” 54 and “robot therapist,” which seemingly use to characterize an attribute of the technology, a role, or to (un)intentionally to humanize such technologies. Similarly, such confusion and inconsistency exist also in descriptions of artificial intelligence. 39 Inconsistent uses and descriptions of AI include “augmented intelligence” 90 “trustworthy artificial intelligence.”. From a regulatory viewpoint of medical technologies, confusion in conceptual understandings may potentially complicate the regulation of these machines for use in care. 76

When nurses using technological innovations to care for patients, accountable practice, presupposes specific expectations and requirements that nurses are knowledgeable and competent about the technological tools they use or supervised. This implies that when nurses use or supervised such technologies to care for patients, they have a basic understanding and grasp of the decision outcomes provided to them by such tools, including an understanding of the assumptions, characteristics, and features on which the results are based to make informed judgements about care. Such understandings allow nurses to assess and judge the legal, ethical, and clinical, appropriateness and implications of the results or technology use. In this regard, one study identified three domains of importance for explainability that comprised informed consent, liability, and certification and approval. 59 The inability of some digitally automated decision-making systems (AI algorithms, robots) for explainability or interpretability can lead to an inability to complete a task or activity in need of assistance by the EDT. This, in turn, may contribute to a gradual loss or “fading” of important aspects of a decision, care problem or situation. Thus, the lack of explainability or interpretability by EDTs can lead to a lack of accountability in decision-making. 59

Conflict of Interests. In a healthcare system predicated on values of person-centeredness in care and health service provision, patients reasonably expect that nurses and healthcare professionals will act and make decisions in their best interest, or at least consider their needs, values, and preferences. Acting in the best interest is a long-standing tradition in nursing and many health professions. However, concern about a potential conflict of interest and best interest was identified as a significant issue with using EDTs in virtual care. The enthusiastic marketing of or media enthusiasm for emerging technologies like robots and AI may facilitate concerns about conflict of interests. 88 In this vein, Weber 49 pointed out that autonomous robots may have other motivations when making judgments and decisions about care and service provision. 108 For example, robots may maximize profit, reduce patient interaction times, minimize their potential liability, and allocate resources according to their own needs and interest and not the
best interest of the patient. Furthermore, Baeroe et al. identified conflicting goals in healthcare and service provision as a significant ethical concern with artificial intelligence.

5.3 Ethical Concerns Related to the Societal Imaginary

Nurses’ practice is embedded in the broader socio-cultural and historical context and systems of meaning, including shared understandings of morally meaningful beliefs, assumptions, norms, values, principles, goals, and cultural practices of the society in which it exists and that shape the structuring and provision of healthcare. Ethical considerations regarding EDTs in virtual care in clinical nursing practice must therefore include considerations of the implications and impact thereof on society. As such, ethical considerations regarding EDTs in this category represent and take a much broader consideration of the impact of emerging digital technologies on society. Ethical concerns of this kind are philosophical as it includes considerations about the impact and implications on social values, goals, and human rights. Therefore, ethical considerations in this category were called Ethical concerns related to the Social Imaginary. This category of ethical considerations comprised of three emerging key themes of ethical concerns with using EDTs in virtual care clinical nursing practice, specifically: (i) Social isolation and Depersonalization of Human-beings and Care; (ii) Surveillance: Disciplining, Exploitation, and Manipulation of Human-beings and Society; (iii) Vulnerability and Moral Fading: Human, Moral Authority and Agency and Future.

5.3.1 Social Isolation and Depersonalization of Human-beings and Care

Social networks have positively influenced nurses, health, and social care professionals’ intention to use robots. Social interactions are considered an essential element of safe, competent, compassionate, ethical, and clinically effective care in nursing that can positively impact care outcomes of patients. Within the context of using EDTs in virtual care, concern about human contact has been identified as a priority ethical issue in qualitative studies that explored including nurses and other health professionals and social care workers perceptions on the development and use of intelligent assistive technologies in care.

While factors like access and functionality issues with technology, age and generational differences, confidence or training are shown to significantly influence nurses and other health professionals and social care workers reluctance to use digital technologies in clinical practice. Concerns about ethics were found to influence nurses’ intentions, perceptions, and attitudes significantly negatively in clinical practice to use emerging digital technologies in virtual care. In particular, social isolation, depersonalization, and dehumanization of care and humans have been identified as significant ethical concerns with using emerging digital technologies in virtual care. In reviewed literature, such concerns were attributed to perceptions that patients are reduced and seen as bodies acted upon by technology, which directly contrasts to a holistic understanding of patients as individuals and nursing as moral and social practice. And consequently, the use of emerging digital technologies in virtual care is seen to undermine not only the holistic approach to nursing practice and care, but the standardized approach to care by robots and AI algorithms also limit opportunities for integrating individual experiences of illness and health in the provision of good care. Furthermore, the delegation of core caring functions and clinical decisions to technological innovations like robots and AI limited opportunities for competency development and, more importantly, limited opportunities for personal and interpersonal connective and communicative care interactions between nurses and patients.
Others have pointed out that AI algorithm-driven predictions about individuals can adversely influence and shape clinicians’ perceptions of patients and patient’s self-understandings. In turn, EDTs may contribute to the gradual estrangement of nurses from their practice, and the eventual dehumanization on holistic nursing practice and the provision of good care to patients. In particular, reviewed literature on the social isolation, depersonalization, and dehumanization of care and humans, have been identified as significant ethical concerns that impact nurses and other healthcare professionals’ reluctance to use emerging digital technologies in care. In fact, social networks were found to positively influences nurses, health, and social care professionals’ intention to use robots. Concerns about ethics were found to affect their intentions negatively.

### 5.3.2 Surveillance: Exploitation, Manipulation, and Disciplining

In the reviewed literature, several empirical papers highlighted the positive impact the use of some EDTs (i.e., automated robots, AI, virtual reality) may have in the provision of patient care and health promotion. In the context of everyday clinical practice settings in nursing (i.e., ICUs, pediatric units, mental health facilitating, long-term and residential care units), disease prevention and health prevention, surveillance is used to ensure patient safety, through monitoring of care provision, clinical assessments, gathering of clinical and health data, screening and diagnosing in chronic disease management, and to uphold care standards. However, surveillance in healthcare and public health is not ethically neutral but raising significant ethical concerns in healthcare, but society at large.

Several papers have identified problems with the constant monitoring of every aspect of people’s lives and the impact it may have on the socio-cultural and historical value foundations and practices in society. Therefore, surveillance has been identified as a significant ethical concern with using EDTs in virtual care in clinical practice in nursing and health care. This ethical concern about constant surveillance has been attributed to fears of exploitation or discrimination, manipulation, and disciplining of human beings and society. Although in some countries like Canada, there are strict conventions (i.e., laws, regulations, standards, policies) to safeguard personal information and privacy and govern the use of digital technologies, few papers have raised the concern that the use of emerging digital technologies (i.e., like automated digital systems such as AI, robots, machine learning) may be repurposed for uses other than for which they were designed or develop, to potentially exploit or discriminate against vulnerable individuals or communities like the older adults, racial, sexual and gender minorities, people with disabilities, and people from low-income populations. Such concerns for example, were attributed to factors like the inability or failure of EDTs like AI and machine algorithms (i.e., deep learning, neural networks) to appropriately differentiate across people from diverse groups or populations; decisions based on unrepresentative data sets; generalizations, and breaches in privacy with the increase application and use of emerging digital technologies like AI, including machine learning algorithms, deep learning, and neural networks in society.

In the context of population or public health, such discriminatory acts by automated decision-making systems like AI, robots, machine learning algorithms may lead to potentially harmful health outcomes, stigmatization and discrimination against vulnerable populations because of underestimations or overestimations in risks assessments. One paper pointed out that while machine learning algorithms may be capable of identifying vocal features while screening patients with depression, they might not be able to differentiate vocal characteristics
between minority populations and those who are not. Surveillance enabled through emerging digital automated systems like robots, AI, including sensors, videos, and avatars to monitor every aspect of a person’s life, without their consent, is exploitative and is ethically wrong. Attributable stigma, that is, the reduction of a person to a single attribute that makes him or her different in perception from others, can lead to discrimination. Furthermore, the predictive nature in machine learning algorithmic decision making may lead to decisions based on generalizations and biases that failed to consider differences between people, especially those from low income and minority populations and those that are not.

While three-dimensional (3D) printing may enable the biofabrication of tissues and organs for transplantation, or the prevention and treatment of debilitating illness and conditions (i.e., degenerative diseases) made possible through innovations in tissue engineering and regenerative medicine, it may also allow for greater control over the structural positioning and allocation of such biomaterials, which in turn could be manipulated to development practices of human enhancements beyond what is necessary to restore or sustain health. Furthermore it is pointed out in one opinion paper that the integration of deep learning and neural networks in AI with biological systems (a process called, “neurohybridization”) leading to innovations of biohybrid systems that are capable of self-organization, evolvability, adaptability and robustness, that could potentially be used as treatment interventions, may challenge human emotions, personalities, future; disciplining and manipulation of human beings. In turn, such developments could potentially reinforce existing inequities and inequalities or contribute further structural inequality and disparities in health and society at large. However, it is also possible that using EDTs such as automated decision-making systems (i.e., AI, robots, machine learning, 3D printing, and virtual reality) in ethically appropriate ways could help resolve structural disparities and inequalities in health and society at large.

5.3.3 Vulnerability and Fading: Human Autonomy, Moral Authority, and Agency

Vulnerability, more generally and in nursing, is understood to mean being harmed in morally significant ways. All humans’ beings can be harmed, especially when rendered helpless by circumstances beyond their control. Nursing is also understood as a response to human vulnerability and, particularly, the vulnerability of people in terms of their health and well-being. Vulnerability more generally is classified, general vulnerability (i.e., errors in judgement when fatigue and that affect us all) and idiosyncratic vulnerability which arise from personal histories, personalities, habits, or character, also referred to as internal vulnerability in nursing, draw a distinction between general vulnerability or idiosyncratic vulnerability. Vulnerability has been recognized as a function of a person’s interaction with their environment.

Several papers have identified vulnerability related to the fading of human autonomy, moral authority, and agency as a significant societal level ethical challenge with the application and use of EDTs in virtual care in clinical practice in nursing and healthcare. This ethical concern arises from the overlapping of interacting ethical considerations identified before. Evident from the reviewed literature, the concern with human-beings vulnerability when using EDTS in virtual care stems from an over-dependency on emerging technology and the influence of the dominant social or institutional culture (i.e., social, organizational, medical) that shape relations with technology. While EDTs and autonomous decision-making systems like robots and artificial intelligence are hailed to enhance human capabilities (i.e., autonomy, physical function), they can simultaneously facilitate human dependency on such technology.
Furthermore, the concern about human vulnerability has also been raised regarding the extent to which emerging digital technologies (i.e., AI, robots, 3-D printing) could replace humans. The concern about the human vulnerability was often attributed to factors such as the threat EDTs posed to human-human relationships; a lack of transparency and epistemic authority; an increased hybridization between individual, clinician- or clinical team-machine interaction; human dependency on superior performing capacities (i.e., processing and calculating) by automated decision-making systems; role and responsibilities shifting; the and dehumanization of people by technology. In addition, the lack of transparency in the operations of AI machine learning-based decisions weakened the authority of clinicians, threaten patient’s and clinician autonomy; and jeopardize the nurse-patient relationship in the provision of good care, shared decision-making, and practice, and in turn, human agency. Some papers reported that the lack of transparency of automated decision-making systems (i.e., AI, robots) raises concerns about clinician-machine disagreements and epistemic support, which in turn may lead to a situation where clinicians might be coerced into dogmatically following decision-output from machines and thus challenge their accountability but also their autonomy and authority. Others have raised concern about whether automated decision-making systems like robots and AI will follow humans' advice and, in turn, could contribute to potential human-machine conflict. It is feared that a situation where power, expertise, and authority are attributed and dogmatically deferred to the EDTs, while clinicians or human beings is left feeling not in control or is unduly pressured or coerced to cooperate with the machine will also create an unequal context, including health outcomes. If automated decision-making systems are increasingly replacing nursing roles and function, it may potentially influence nurses identity as they may potentially question their self-conception, self-perceptions, and self-efficacy about their value and work.

Humans may devolve and lose motivations like their curiosity or the spirit of inquiry, which spell consequences for innovation in scientific advancements in care and health service provision. Thus, raising a concern that humans will become dependent on machines. Others have pointed out that ethical reflections on the use of EDTs in virtual care must address the social and moral status of these machines and the consequences that can arise. Related to the concern about human-machine role distribution is a concern about machine control over human beings. In this vein, humans could potentially be driven into dependency on machines, which can impact their self-conception as human beings, moral subjects, and agency, acting rationally and freely in terms of moral judgment, decision making, and actions.

5.4 Ethical Solutions: Approaches and Strategies

A coherent theme across reviewed literature is the ethical development, application and use of emerging digital technologies in virtual care. As a result, many have proposed innovative, ethical strategies as potential best-practice to accomplish this need. From reviewed literature, several papers have discussed approaches and strategies, including training and education innovations that considered to be effective to address ethical challenges and concerns and to support nurses transition to a workplace amid digital ethical disruptions in clinical practice. One such innovative approach proposed in nursing, include the middle-range theory of The Dance of Living Care as a relational model to help to understand “caring for” and “caring about” patients and people, specifically when emerging digital technologies like autonomous decision-making systems (i.e., robots, AI) are used in caring for patients. This model integrates key elements (i.e., assumptions, values, concepts, structures) from the caring philosophical
framework of the Nurse As Caring (NAC) theory and critical elements (i.e., care practice, actors, context, type of robot, the manifestation of care values) from the ethical framework on Care-Centered Value Sensitive Design (CCVSD) to offer an ethical approach to help guide the design, implementation and evaluation of care robots in ethically-sensitive ways, for application and use in caring practices like nursing. As a relational model, The Dance of Living Caring providing an understanding on “caring for” and “caring about” people while considering key areas of value congruence (i.e., recognition of the uniqueness of person to be cared for, essential of individualized care as an expression of dignity, intentional engagement) and value divergence (i.e., “caring,” “call,” and “Dance of caring” as opposed to “care,” “needs,” and “institutional privilege”), and resolutions to mitigate the latter, such as placing a greater emphasis on caring, including co-presence and mutuality; shifting from a focus on needs to calls for nurturance and intentional knowing and engagement; and recognizing the voices of all key care stakeholders, including patients, care providers, and the institution in the setting of value priorities in care as opposed to an institutional privilege.

In the context of care provision and caregiving, another innovative approach, proposed a philosophical-ethical framework, based on a socio-historical contextualization of the ethics of using socially assistive robots (SARs), to offer a rudimentary ethical decision-making process about SAR use in aged care based on three pillars: stakeholders intuitions about SAR use as sources of knowledge; interpretative dialogue as democratic spaces to discuss the ethics of SAR use; and the concretization of ethics in SAR use. The socio-historical contextualization framework offers a helpful way to critically reflect on the impact of emerging digital technologies in clinical practice in nursing and consider multi-dimensional ethical concerns with their use at the level of individual care provision by nurses in everyday practice, the level of the organization, and society.

Similarly, in related health literature, some have advocated for a fundamental rights approach to ethical guidance on developing trustworthy EDTs like AI. Other approaches include an ethics of care approach and rules-based approaches, and checklists to address ethical concerns with using EDT in virtual care. While considering the limitations of such rule-based approaches and checklists in ethical practice, others have proposed a “proportionate” and “ethically-mindful” governance models for the application of AI in healthcare (GMAIH), and principle-based ethics checklists of validated items covering five broad categories such as “description,” “privacy and transparency,” “security,” health-related risks,” and “bias” to serve as a guiding framework for the ethical design, development, implementation, and evaluation of EDTs like AI and robots for application and used in clinical practices and identification of ethical concerns. Several papers have proposed sets of ethical principles to address ethical and regulatory issues that arise with the application of AI in healthcare and ethical guidelines for the use of AI Care Providers (AICP); ethical guidelines for trustworthy AI. That could potentially also be applicable in the use of EDTs in clinical practice in nursing. In this vein, some of these principles include fairness, transparency, trustworthiness, accountability; respect of human autonomy, prevention of harm, fairness, and explicability.

Innovative tools such as visualizations, logical statements, and dimensionality reduction techniques can be use and implemented in autonomous decision-making systems like machine learning algorithms and computational tools to achieve interpretability. Other techniques include, setting-up and using digital experience teams which proactively gather information on impact of EDTs on virtual care and clinical work experiences, increase visibility about ethical
considerations of digital implementation; digital literacy, that incorporate tools such as leaflets, posters, information talks in digital format which can be leveraged to provide consultation between patients, clinicians, and clinical REBs to achieve the broader goals, such as informed consent, patient teaching, and empowerment. Evident from the reviewed literature, a one-fit-all approach and strategy might not be ethically appropriate and suitable in all contexts and with all people. Thus, considerations and incorporation of personal and cultural differences should also be an important consideration. For example, in the building of representative data sets on which the development of EDTs like autonomous decision-making system algorithms is based, especially for application and used in virtual care and ethical decision making in clinical nursing practice with care stakeholders from diverse backgrounds and experiences.

6 IMPLICATIONS

This section summarises key implications for research, practice, and policy for consideration with the application and use of EDTs in virtual nursing care in clinical practice.

6.1 Research

- Supporting empirical research that incorporate diverse, pragmatic and robust designs (i.e., pragmatic clinical trial, retrospective validation, and ongoing evaluation, commitment from clinical and operational partnership); that explored empirical questions, including for example, the development and testing of EDTs for application in care that meet patient-centered and human care needs and values; and that evaluate the impact of virtual reality and autonomous decision-making systems (i.e., AI, robots) with regard to patient safety and ethical decision-making impact using diverse ethical scenarios and settings in virtual care provision and management in clinical nursing practice. Research needed to examine the ways in which nurses respond to commercial influences on healthcare, and how health equity is affected with the use of EDT applications in virtual care; how the implementation of EDTs (i.e., virtual reality, autonomous decision-making systems like robots and AI) in virtual nursing care and practice in nursing influence and shape the nurse-patient relationship, teamwork changes, empathy in nursing. Support research to established representative and robust data sets about the ethical impact of EDTs on patients and ethical values; validate, operationalised, and evaluate criteria for good ethical guidance with use of EDT in virtual care and practice. Examples of possible research questions might be, to determine as a matter of fact, whether the patients are indeed be deceived by automated decision-making systems and whether their dignity in care, autonomy, privacy and confidentiality, safety, trust, and integrity are adversely effected with the use of EDTs in virtual care. Furthermore, supporting for qualitative research that explores and describes the meaning of ethical concepts and ethical principles from a multi-stakeholder perspective (i.e., patients, clinicians, and other healthcare stakeholders); assess the impact of healthcare team monitoring on benchmarks, standardization, and continuous improvement with the use of emerging digital technologies; and establishment of ethical practice to prevent unintended consequences with the application of EDTs in virtual care. Furthermore, support philosophical or conceptual inquiries that produce new theoretical insights into the meaning of traditional concepts such as autonomy, agency, responsibility, and decision making in the context of the application and use of emerging digital technologies in virtual care. In addition, support research that evaluate how human factors (i.e., culture, ideology, gender, age) can influence patients, nurses, and other health professionals’ perceptions, acceptance, and use of EDTs (i.e., robotic, AI systems) in virtual care. Research should evaluate the long-
term ethical, social, and public health implications and impact of EDTs. 
91 Researchers could also consider the scope and magnitude of the ethical, legal, and social impact in developing 
of various EDT tools and techniques for application and use in vulnerable individuals and 
populations. 
79  
6.2 Practice: Care, Education, and Policy-practice  
- Accepted and shared foundational values and ethical responsibilities guiding care and 
practice in nursing, including ethical relationships, behaviours, and decision-making such as 
safe, compassionate, competent, and ethical care, health and well-being, respect for people, 
preserving dignity, privacy and confidentiality, justice, and accountability must be reaffirmed 
and prioritised with the application and used of EDT in virtual care to protect patients and the 
practice of nurses. 23,42,51  
- Using a robust and inclusive process of multi-level and multi-lateral stakeholder analysis and 
engagement in virtual care. In collaboration and consultation with relevant local, provincial, 
and federal key healthcare stakeholders develop a shared or common understanding how to 
responsible and accountably regulate and provide oversight on the procurement, application 
and use of EDTs in virtual care; manage data to protect privacy; and unlawful surveillance of 
people while enabling emerging digital technological innovation; protect human and non-
human users; and maintain competencies through education and training programs. 94  
Update, strengthening and incorporate applicable legal-ethical and statue-based principles 
and safeguard measures regarding the application and use of promising EDTs in virtual care 
for the protection of patient safety, informed consent, privacy and confidentiality of personal 
data and information for the full cycle of data management, including collection, access, 
storage, ownership, use, dissemination, retention and sharing of information and data by both 
human users and autonomous decision-making systems like robots and AIs in virtual as users 
of such information. 57,71,76,126  
- Considering possible variations in current digital literacy and proficiency across diverse 
populations and settings, support the development of Digital literacy and competency 
through updating educational curriculum and competencies, delivery of continuous 
professional and lifelong learning develops to build capacity and competencies of EDT users. 
This should be guided by a coherent digital ethics and health professional education and 
training strategy. 23,24,97 Since nurses as frontline care professionals could be tasked with 
ascertaining the integrity of patient privacy and data produced by automated decision-making 
systems, topics on “digital considerations” in ethics should be introduced and addressed. 23  
Create and cultivate ethical awareness and sensitivity about ethical challenges with EDTs, 
including transparency about the demonstrated and validated capabilities and limitations of 
EDTs for used in virtual care, on current best-practice related to privacy and confidentiality, 
data management practices across the information cycle of data management, including data 
ownership, storage, unauthorized access, security, and sharing practices. Furthermore, update 
and strengthen existing roles, competencies, duties of care, responsibilities and obligations of 
nurses guided by using comprehensible and best-practice digital health literacy strategies and 
tools to preserve dignity, safeguard privacy and confidentiality, prevent and mitigate 
[self]deception, foster trust, 94 cultivate a positive experience with technology, build 
confidence and competencies with using them. 41,71,76,88,94
• Provide greater transparency on emerging digital technology procurement processes for application and use virtual care; responsibility for adverse events; informed consent processes, and the use of informed consent to address privacy issues and patient safety. Furthermore, leverage digital technology to achieve the broader goals of informed consent, fair access at individual and community levels, and equity in care through using appropriate best-practice strategies and tools (i.e., leaflets, posters, information talks, community forums) and consultation between patients, clinicians, and clinical REBs. Adapt and implement measures to foster and gain trust using information, educational strategies, transparency, while ensuring that ethical and technical standards in the development, implementation and use of EDTs are complied with. Ensure the trustworthy and ethical development and application of EDTs is guided and based on an agreed ethical framework. Preserve dignity, foster sensitivity and awareness about ethical challenges and concern regarding EDTs and the importance of ethics consultation with clinical ethics boards and preventive ethics to achieve ethics quality and patient safety. Manage deception through the provision of understandable information, careful collaboration and cooperation between patients and healthcare professionals. Integration of emotional and cognitive abilities and capabilities should be programmed into the next generation of social robots and AIs.

• Social Justice and Digital equity: To reduce bias, achieve fairness and promote social justice with the use of EDTs in virtual care, requires deep knowledge and understanding of the needs of prospective users of EDTs in virtual care. In addition to awareness and sensitivity training, ensure the quality and representativeness of data sets used in autonomous decision-making systems (i.e., robots, AI, machine learning algorithms) are crucial. Leverage social determinants of health and an intersectional approach to mitigate bias, and create ethical, socially just, and trustworthy EDTs and their application and use in virtual nursing care.

6.3 Policy

• Ethical Governance, Regulatory Oversight, and Ethical Processes: Existing professional ethical codes and standards be update and expanded to address nurse-patient-autonomous decision-making systems relationships (i.e., between patient sand AI, robots), competencies of users of such systems, scope of use, delegation of roles and responsibilities, and supervision requirements. Update of legal-ethical, professional, and regulatory frameworks and standards might be guided by the adoption of proactive models and approaches. Establishment appropriately constituted and representative governance structure of research and clinical ethics boards for research ethics review for the use of EDTs in virtual care and clinical research; full scope and approach of research ethics review and risk assessment, ethics consultation, and the development and application of fair approaches, including legal-ethical and statue-based principles and safeguard measures, procedures and operational guidelines to ensure EDT development and use compliance with and accountability in accordance to ethical best-practices, standards, and approaches.

• Cultivate and Address both the Ethical Culture of Virtual Care Spaces and Digital Technology. Integrating Culture and technology to meet dignified, patient-centered, and
culturally sensitive care needs, patient safety, and social justice in care. Ethical leadership and creating a positive digital-friendly experience, practice and organisational climate and environment. Cultivate an ethical practice, including values, standards, and guidelines to ensure compliance with best-practice standards to meet patient-centered and human care values and needs. Minimise discrimination and bias through ongoing update and incorporation of culturally appropriate viewpoints, including frameworks and principles, and ensure alignment and adherence of emerging digital policy, research, and care practices to it. Steer the development of emerging digital technologies (i.e., AI) in ways that accord with human values and needs. Focus on the ethics and robustness of AI while basing ethical guidance for trustworthy EDTs on ethics of care and fundamental rights approach, that intentionally incorporate ethical values and principles such as respect for human dignity and autonomy; harm prevention; social justice and fairness; and explicability.

7 CONCLUSION

This project reviewed and mapped ethical challenges regarding the application and use of emerging digital technologies (EDTs) like robots, artificial intelligence, virtual reality, and 3D-printing in virtual care in the clinical practice of nursing. It suggested that while it is important for healthcare stakeholders (patients, nurses and other health professional clinicians, managers, decision makers, and policy makers) to recognizing the promising benefits of the application and used EDTs in virtual care, that it is crucial to understand ethical challenges with using technology in virtual care and enact ethical responsive practice to address such challenges preventatively and responsibly. Moreover, that nurses maintain their moral sensitivity and awareness about these ethical challenges, develop ethical competence and clinical competency with using EDTs to provide care to clients and communities, that patients that nurses enact ethically responsible competent and responsive practices, including ethical best-practice strategies to prevent and manage such challenges to provide safe, compassionate, competent, and ethical care. It seems inevitable that advances in as the science emerging digital technology for application and used in virtual care in nursing practice and healthcare continue to proliferate, to maintain their moral awareness and sensitivity to ethical concerns. more importantly. Digital ethics competencies therefore should be incorporated as a standard in the preparation of nurses for transition and practice in a digital economy.

8 KNOWLEDGE MOBILISATION

BIBLIOGRAPHY


9 GLOSSARY OF TERMS

Artificial Intelligence (AI): Artificial intelligence (AI) refers to the use of computers to perform human-like activities such as learning, perception, emotions, problem-solving and playing games. AI is an umbrella term that comprised of machine learning techniques such as deep learning and neural networks. Machine learning refers to the ability of computers to improve their performance on a task without being explicitly programmed to do so. Deep learning, an extension of ML, is based on algorithms modelled after neural structures in human brain and is used to recognize patterns in image, sound, and text data.” (p. 9)

Augmented Reality (AR): Augmented reality (AR) is defined as “a technology that superimposes a computer-generated image on user’s view of the real world, thus providing a composite view.” (p. 19)

Emerging Digital Technologies (EDTS): Emerging digital technologies (EDTS) refers to new, innovative technologies, still in development. In the context of this review, it comprises artificial intelligence (AI), robotics (robots), virtual reality (VR), and three-dimensional (3D) printing.

Robotics: A robot is defined more generally as “a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer”. (p. 17) Emerging robots are powered by AI (i.e., Pepper) and is autonomous (5th generation technology). In the context of this paper, a robot is described as a fully autonomous system or an integrated robotic system, interacting with humans and with other systems to effect and optimize specific outcomes through interaction processes. (p. 17)

Three-Dimensional (3D) Printing: Three-dimensional (3D) printing is defined as “the process of making a physical object from a three-dimensional model, typically by laying down many thin layers of a material in succession.” (p. 18). For this purpose of this review the focus is on the use of 3D printing for biological application intended for treatment and care of patients.

Virtual Care: Virtual care is defined as “any interaction between patients and/or members of their circle of care, occurring remotely, using any forms of communication or information technologies with the aim of facilitating or maximizing the quality and effectiveness of patient care.” (p. 3)

Virtual care nursing: Virtual care nursing refers to the application, use, and operationalization of digital technology in the provision of care of patient to “support clinical decision-making processes, continuity of care, patient safety, and provides a work environment conducive for keeping technically competent and highly educated nurses engaged at the bedside.” (p. 147)

Virtual Reality (VR): Virtual reality is defined as a “the computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.” (p. 19)
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<tr>
<th>ID</th>
<th>Author, Year &amp; Country</th>
<th>Study Purpose</th>
<th>Design &amp; Methods</th>
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<th>Key Findings</th>
<th>Implications</th>
<th>Strength of Evidence</th>
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</table>
| 74 | Wangmo et al. (2019), Switzerland | -To explore and assess the ethical issues that professional stakeholders perceive in the development and use of intelligent assistive technology (IATs) in elderly and dementia care | -Qualitative study  
-Multi-site study  
-semi-structured qualitative interviews  
-Analyzed data using a descriptive thematic analysis  
-Interviews were audio recorded and transcribed verbatim in the language of the interview with the assistance of the transcript software.  
-participants recruited through using institutional homepages. | -Sample size (n=20)  
-Health professionals (medical doctors, nurses, and nursing home managers) and researchers in the fields of geriatrics, psychiatry, neurology, neuropsychology, gerontology, and nursing  
-Participants recruited from Switzerland, Germany and Italy using purposive sampling | -Ethical concerns: patient autonomy, informed consent; data management (data insecurity; privacy infringements; data access and data sharing).  
-Concerns about affordability and distributive justice would create a socio-economic disparity.  
-Concerns about IATs cannot replace human contact: technology-mediated replacement of human-delivered care is a suboptimal choice. | -Strengthening and updating ethical safeguards for informed consent, patient autonomy, data management and security, and social justice.  
-Research to examine impact on adequacy of informed consent in patient with cognitive impairment; lack of decision-making capacity; advanced directives to understand expressed wishes: assess the impact on deception; access and continuity of care.  
-Research to develop, implement and evaluate digital tool impact on educational outcomes, competencies, knowledge of end-users  
-Need for inclusive policies, legal and ethical regulatory oversight, and governance to improve accessibility and affordability of IATs for people who need them.  
-Limitations: sample size, purposive sampling, representativeness, and generalizability of findings, reporting bias | -Good  
-Used JBI Critical Appraisal Checklist for Qualitative Research |
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<tbody>
<tr>
<td>588</td>
<td>Kenwright, B. (2018), UK.</td>
<td>-Identify emerging ethical issues and best-practices with virtual reality (VR)</td>
<td>-Opinion paper -Conceptual analysis</td>
<td>-Healthcare - Virtual reality technology ethical challenges and dangers.</td>
<td>Ethical concerns: -Human rights issues: privacy, data protection, security -Legal responsibility issues: laws and regulation, management vs individual interest, punishment -Morality issues: culture, experience, age -Mentality issues: tolerance, trauma, state of mind, understanding</td>
<td>-Robust research to examine and evaluate the ethical, psychological, physiological, and social impact and effect of virtual reality on users, including patients, nurses, and other healthcare professionals. Research to rigorously test, validation of efficacy, and analyse digital and virtual tools, including capabilities, physiological, safety, and social influences. -The intersection of ethics and virtual reality focused primarily on individual ethical issues. -Multi-stakeholder collaboration and consultation to ensure the integration of ethical issues in the design, development, implementation, regulation and use of digital technologies for use in care.</td>
<td>Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>588</td>
<td>Liang et al. (2019), Taiwan</td>
<td>-To describe nurses' views on the potential use of robots in the pediatric unit.</td>
<td>-A qualitative descriptive design -Semi-structured interviews with</td>
<td>-Five hospitals, including medical centers and regional hospitals in Taiwan. -Registered nurses who worked in the pediatric unit were</td>
<td>-Robots in patient care have advantages and disadvantages -Advantages: reducing workload, meet functional care needs of patients and their families;</td>
<td>-Integrating technological innovation in education and training of nurses to develop competencies. -Integrated culture and technology to meet pa-</td>
<td>Good -Used JBI Critical Appraisal Checklist</td>
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<td>567</td>
<td>McElhinney et al. (2014), UK</td>
<td>Discusses the methodological challenges of using the 3D social virtual world (SVW) Second Life for research on research issues in the 'in-world culture.' Study aim to explore the health literacy skills of people who access health information in SVWs and the subsequent influence on their physical world health behaviours.</td>
<td>-Qualitative design -Semi-structure interviews</td>
<td>3D Social virtual world (SVW) Second Life for research using &quot;avatars&quot;, 3D web -people who access health information in SVW (n = 25)</td>
<td>-Main challenges: how to use the media and &quot;immerse&quot; themselves in the SVW. -Required skills needed: moving, flying, teleporting, using communication tools, building and manipulating scripts. -Ethical concerns: Inexperience of researcher perceived as a lack of respect for participants; fake identity using avatar, concerns about the researcher's profile (verifying, authenticity, credibility), concern about trust if a &quot;humanoid&quot; avatar, accessing participants; anonymity and confidentiality. -Solutions: use same avatar enabling level of &quot;continuity of relationships&quot;; recruitment tools interactive notecard giver, instant messaging, gatekeeping; design virtual interview area, use group and local chat with voice- and text-based interviews; time.</td>
<td>-Nurses undertaking research in social virtual worlds should spend time in-world and gain an understanding of the culture of the in-world -Acquired technical skills and soft skills (etiquette of communication) to conduct research in virtual spaces. -Importance of applying the same rules and regulations to &quot;avatars&quot; for data collection as with human participants -Several ethical, data collection and recruitment methods can be created, which can lead to successful research in 3D social virtual worlds Limitation: Sample characteristics unclear</td>
<td>Good</td>
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<td>643</td>
<td>Rantanen et al (2018), Finland</td>
<td>Examines attitudes of Finnish home care registered nurses, licensed vocational nurses and other health and social care personnel towards</td>
<td>-Cross-sectional study by Questionnaire -Guided by Ajzen's Theory of Planned Behaviour as</td>
<td>Home care facilities in 2 municipalities -Sample size (n=200) -Purposefully selected sample of Finish home care workers (registered</td>
<td>-Personnel behavioural intentions influence by perceived usefulness of care robots, collegial and supervisor expectations, capacity to learn to use robots. -Advantages of robots: provide reminders and guidance, promote safety</td>
<td>-Implications for the type and complexity of robots needed in virtual care -Important questions arise on the kinds of technology that is needed and how advanced it needs to be.</td>
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<td>the introduction and use of care robots in home care.</td>
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<td>-Concerns about robots (disadvantage): does not believe in robots could relieve anxiety and loneliness; fear about inhumane treatment, loneliness of older people, endanger employment.</td>
<td>-Robot related training essential for healthcare and homecare personnel</td>
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<td>-Behavioral intention and factors affecting it: readiness and motivated to introduce care robots, to enhance medication safety and overall safety.</td>
<td>-Training centering on programming and use of care robots.</td>
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<td>-intentions toward the introduction of care robots strongly correlated with attitudes, sense of control, and normative expectations.</td>
<td>-Creating a positive workplace climate</td>
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<td>1154</td>
<td>Gallagher et al. (2016), UK</td>
<td>Exploring ethical questions about robots in elder care</td>
<td>Editorial</td>
<td></td>
<td>-Care of Older people</td>
<td>-Caregiver attentiveness and responsiveness when carebots are used in virtual care</td>
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<td>-Care robots</td>
<td>-Ongoing educational developments and ethical competency of caregivers when robots are used in care.</td>
<td>Good Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>-Concerns regarding care robots replacing human caregivers; honesty regarding the capabilities of robots</td>
<td>-Possibility for future human-carebot collaborations for securing dignifying care</td>
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<td>-Concern regarding inability of robots to respond to some care situations</td>
<td>-Implications for the type and complexity of robots needed in virtual care</td>
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<td>-Concern about Dignity-compromising care</td>
<td>-Updating of current legal-ethical frameworks and across jurisdictional</td>
<td>Good</td>
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<td>-Concern about the ability of care robot to sense patient needs</td>
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<td>651</td>
<td>Yasuhara et al. (2019), Japan</td>
<td>The article examined ethical-legal</td>
<td>Literature study</td>
<td>-Literature study: data extracted from clinical trial data,</td>
<td>- Lack or inconsistency of definitions: No specific description of HCR</td>
<td>- Updating of current legal-ethical frameworks and across jurisdictional</td>
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<td>- Nursing in long-term care situations in Japan</td>
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<td>ID</td>
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| 485 | Stokes et al. (2020). USA | To review ethics of applications and use of artificial intelligence (AI) in nursing, describe ethical concerns; and explore dominant theories of ethics of caring and the two paradigmatic expressions of caring. | -Opinion paper  
-Ethical analysis and argument-based  
-Literature review | -Focus on use of HCRs and older adult patients. | - Ethical concerns: patient safety, liability, negligence with respect to setup, different beliefs and expectations on true nature and purpose of technology, privacy infractions and breaches in leaking of personal information and stored data and access authority. | -Affirm primacy of caring to nursing practice and centrality of an Ethics of Care in human-technology care relations and interactions. | -Good | -Used JBI Critical Appraisal Checklist for Text & Opinion Papers |

issues and existing Japanese law addressing interpersonal relationships in healthcare situations involving Humanoid Caring Robots (HCRs) and older adult patients.

- Conversations with older adults using robot Pepper in long-term care facilities; and analysis of current and laws regarding information on handling biologics and robotic equipment.

- Focus on use of HCRs and older adult patients.

- Ethical concerns: patient safety, liability, negligence with respect to setup, different beliefs and expectations on true nature and purpose of technology, privacy infractions and breaches in leaking of personal information and stored data and access authority.

- Considerations on the roles and functions of HCRs in medical and nursing care situations.

- Collaboration between technology developer, nurse researchers, lawyers, engineers, and other healthcare providers to engage in thinking about important questions about the meaning of HCRs, competencies, and accountability.

- Governance and compliance with safeguard measures to protect privacy.

- Affirm primacy of caring to nursing practice and centrality of an Ethics of Care in human-technology care relations and interactions.

- Guidelines for ethical division of roles and workload allocation between human and non-human caregivers.

- Need for human presence during direct and fundamental care; treating AI caregivers as...
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<tr>
<td>131</td>
<td>Metzler &amp; Barnes (2014), USA</td>
<td>To spotlight and frame some key elements of broad challenges of human-robotic interactions (HRIs) related to consciousness and personhood. Critical examination of the impact of emerging applications to be used for the care of older adults on the fundamental nature of humanity.</td>
<td>Opinion paper -Philosophical analysis employing the medium of Dialogue -Literature -Communities of nursing care of older adults -Human-robotic interactions</td>
<td>-Cuts in the number of human nurses; inauthentic relationships and caring; deception, confusion about ways of thinking and using language (referred to as a &quot;category mistake.&quot;) -Inauthentic empathy or &quot;artificial empathy&quot;, &quot;ghostly&quot; experiences -Conceptions of consciousness: received vs. perceived -Understanding consciousness: current science not equipped to render judgments on presence of consciousness; consciousness as a process of &quot;becoming&quot; (&quot;subjective conscious awareness&quot;); attribution of consciousness in robots a matter of culture and worldview. -Bi-directional nature of influences: asymmetrical relational</td>
<td>Human-to-human interactions; illusions of friendship, companionship, and social connection; manipulation and deception. -Ethical division of tasks be based on the principle of comparative advantage; human touch and human presence grounded in a partnership model.</td>
<td>-Awareness about how human-robotic interactions may alter basic understandings of humanity. -Attentiveness to challenges posed by human-robotic interactions and influence on person-centred care -Robust qualitative and quantitative research to examine notions of consciousness and personhood in the human-robot interactions. -Exploring different cultural perspectives of human-robot interactions</td>
<td>Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>639</td>
<td>Metzler et al. (2016), USA</td>
<td>To propose a hybrid computational architecture for AI modelling of human mental life through the review of human–robot interaction and characterized by inauthentic relationships, corresponding objections and concerns regarding potential psychological, moral, and spiritual implications, and offering a different assessment of such concerns.</td>
<td>-Opinion paper -Philosophical reflection &amp; conceptual analysis</td>
<td>-Nursing care of older people, human mental life of older people -Specifically, the use of android and humanoid ‘socially assistive’ robots (SARs) as machines for furnishing companionship -Exclude intelligent machines that perform nursing tasks. Population: robotic and artificial intelligence (AI) technologies</td>
<td>encounters challenge and transform nature of our understandings of “caring”, “companionship”, “love”, “personhood”, consciousness, relationships, and humanity. - “I-Thou” relationship becomes replaced by It-It relationships.</td>
<td>-Caring in nursing practice as having a subjective, sentient dimension that is more than instrumental behaviourism. -Need for clarity on specific definition of the intended role of “companion” SARs in nursing practice -Raising legitimate fundamental questions about human-machine interactions in care, their necessity, cost-effectiveness, intended purposes and use, and the meaning of care and being human. -Current classical computing systems are incapable of performing computations that plausibly can model the phenomenological becoming of conscious awareness.</td>
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-Used JBI Critical Appraisal Checklist for Text & Opinion Papers
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<tr>
<td>652</td>
<td>Schoenhofer et al. (2019), USA.</td>
<td>- To explore the intersections of the values and assumptions of two caring frameworks (Nursing as Caring theory and Care Centered Value Sensitive Design approach) to illuminate areas of convergence and divergence in these frameworks to guide nursing practice with robots.</td>
<td>- Theory development method: propose a middle-range theory that integrated NAC and CCVSD frameworks</td>
<td>- Nursing - Focus on healthcare robots in hospital and home settings</td>
<td>Value convergence: being intentionally and authentically present with those cared for; recognizing needs; engaging in appropriate care practices; uniqueness of the person cared for (care recipient); care as an expression of dignity of person; reciprocal nature of caring; intentional engagement. Areas of divergence: care vs caring; needs vs call; institutional privilege vs dance of caring person. - Middle-Range Theory: The Dance of Living Caring integrates as key elements (i.e., assumptions, concepts, structure) from Dance of Caring Person, Nursing as Caring; and CCVSD approach.</td>
<td>- Understanding care and caring; and providing ethical responsive care with patients. - Potential of Dance of Living Caring Model to maintain caring as nursing’s central value as robotic technology advances and guide virtual nursing care and practice with robotics.</td>
<td>- Good - Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>1195</td>
<td>Vandemeulebroucke et al. (2018), Belgium</td>
<td>- Review and understand how older adults experience, perceive, think, and feel about the use of socially assistive robots (SARs) in aged care settings.</td>
<td>- Systematic review on qualitative evidence derived from the literature; database search, snowballing, citation-chasing, sampling, critical appraisal of evidence; thematic synthesis.</td>
<td>- Literature on older adults (60 years and older) experiences and perceptions of socially assistive robots - Sample size (n=23) articles</td>
<td>Key themes: Role of SARs; interaction with SARs; Appearance of SARs; Normative issues. - Role of SARs: capable of fulfilling useful servant-like functions; complete safety system; link to cognitive assistance; source of entertainment; and companionship - Interaction with SARs: technical and human aspects - Appearance of SARs: human-looking; machine-looking; mixed appearance. - Normative issues: profound fear for dehumanized society; social isolation; safety and privacy concerns; perceived a threat to user autonomy; Infantilization of</td>
<td>- Research focusing on the complexity of using SARs in aged care, and peoples’ attitudes towards them. - Possibility to accomplish ‘democratic spaces’ should be an aim driving SAR development. - Conceptual reflection on meaning of relying on SARs in an aged care setting. - Evidence on complexity of SARs and attitudes of people towards them could be a positive incentive to produce ap-</td>
<td>- Very good - Used JBI Critical Appraisal Checklist for Systematic Reviews and Research Synthesis</td>
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<td>1201</td>
<td>Vandemeulebroucke et al. (2018), Belgium</td>
<td>To examine the ethical arguments and underlying concepts used in the ethical debate on care robot use in aged care. Identify ethical issues of SAR use in aged-care settings.</td>
<td>-Systematic literature review using innovative methodology consisting of three steps: a) Identifying conceptual-ethical questions, b) literature search, c) analyzing ethical arguments in connection with the conceptual-ethical questions</td>
<td>Literature -Sample size (n=28) articles -Aged-care practice settings -Care robots</td>
<td>-Universalist Ethical tradition (deontological and principalist arguments) vs Particularist Ethical tradition (i.e., objective-list approach/capabilities approach, Care ethics approach) -Ethical issues: social justice/equality of care; replacement of human caregivers, changes in society’s conception of aged care; human-robot interaction and about autonomy, dignity; deception and truth; social isolation and connectedness; objectification of older adults. -Objects of ‘SARs’: concerns about privacy; harms to physical &amp; psychological integrity; dehumanization of society and care settings</td>
<td>-Need for ongoing ethical reflection. -Shift conversation form debate on use of care robots toward what the use does with the care situation and the involved values. -Creation of “democratic spaces” in virtual care, including ethical assessment and reflection about care robots -“Democratic spaces,” in which all stakeholders in care have a voice in the ethical debate. -Ethical decision making and ongoing ethical reflection</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Systematic Reviews and Research Synthesis -Used Ethics Critical Appraisal Worksheet (ECAW)</td>
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<td>1212</td>
<td>Mathew et al. (2018), Ireland</td>
<td>To examine the evidence on factors affecting patient safety during robotic-assisted and laparoscopic surgeries.</td>
<td>A systematic review of papers: integrative literature review -Search and retrieve papers from CI-NAHL, Embase, and Medline databases -Nursing -Papers published between 2011 and 2016 -Operating room nursing in which robotic-assisted and laparoscopic surgeries are performed</td>
<td>-Intraoperative communication issues: complexities of communication interactions; differing patterns of communication; increased communication requirements; reduced vision ability; intra-operative communication failure -Teamwork: enhances safety and efficiency; better performance,</td>
<td>-Incorporate understanding of identified challenges in curriculum for education and training of nurses. -Importance of coordination, training, and effective utilization of communication skills in</td>
<td>-Very good -Used JBI Critical Appraisal Checklist for Systematic Reviews and Research Synthesis</td>
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| 1225 | Papadopoulos et al. (2018), UK | Overview of evidence on nurses and other health and social care workers views (including opinions and attitudes) on the use of assistive humanoid and animal-like robots | - Inclusion criteria outlining factors affecting safety in robotic-assisted and laparoscopic surgeries
- Quality appraised using the Critical Appraisal Skills Programme (CASP) | - Scoping review using computerised data base search set out by JBI
- Inclusion criteria (i.e., English language, the phenomenon of interest);
- Exclusion criteria: articles reflecting views of service users only, non-professionals caregivers. | Key Ethical concerns: patient safety and infection control; privacy concerns related to privacy breaches, information disclosure, use of video surveillance.
- Concerns about user of technology not having sufficient time to get used to a new type of caregiver (robot); social isolation; protecting user’s autonomy and being in control. | - Protection of user autonomy is essential.
- Research on patient-robotic interaction as an emerging area in nursing
- Research on the Cultural spaces and EDTs
- Safeguards for of privacy and patient safety when robots are used are imperative
- Need for workforce development and easily accessible technical support.
- Implications for the future of nursing and caring relationships. | Very good Note: Used JBI Critical Appraisal Checklist for Systematic Reviews and Research Synthesis |
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| 1258 | Vandemeulebroucke et al. (2020), Belgium | - To illuminate the process of socio-historical contextualization of the ethics of SAR use as a path forward that avoids the risks of conducting empirical research and ethical reflection. 
- Develop and formulate a rudimentary philosophical-ethical decision-making process as a framework to guide SARs' use in aged-care settings. | - Philosophical-ethical reflection 
- Dialogue between empirical-ethical knowledge & philosophical-ethical reflection 
- Using empirical-ethical results on what older adults and their caregivers intuit as ethical issues of SAR use in aged care. | - Literature 
- Aged care settings 
- Use of socially assistive robots (SARs) to support caregivers & older adults to guarantee care. | Socio-historical contextualization of ethics (Tronto’s ethics of care) vs. Socio-historical contextualization of technology (Feenberg’s distinction between “Instrumental theory of technology” and “Substantive theory of technology”) 
- Help older adults focus on the socio-historical context of care practices and the relational context from which such practices resulted. 
- Pillars of the rudimentary decision-making process about SAR use: 1) intuitions as sources of ethical knowledge, 2) interpretative dialogues as democratic spaces to discuss the ethics of SAR use and 3) the concretisation of ethics in SAR use. | - Framework for ethical reflection and decision-making 
- Importance of considering moral intuitions of clients and caregivers 
- Collaboration between empirical and philosophical-ethical fields and disciplines on research and practice 
- Socio-historical contextualization enables to focus on the interrelated dimensions of care and ethically just use of SARs in aged care. | - Good 
- Used JBI Critical Appraisal Checklist for Text & Opinion Papers |
| 202 | Barlett et al. (2017), UK | - Explore and discuss the role of digital technologies as truth-bearers in the context of nursing people with dementia 
- Attend to coral complexities involved when digital technologies | - Argument-based 
- Literature on truth-telling and digital technologies 
- Nursing practice and care of people with Dementia 
- Digital technologies (i.e., SenseCam) | - Role of digital technologies as truth-bearers are embedded in ways in which truth and agency are enacted through personhood; situated and relationally dependent nature of the truth-making process; socio-technical (material) networks and arrangements; and body-technology entanglements within particular care practices (i.e., caring observing, admission, etc.) in everyday healthcare settings | - Affirming truth as essential component in quality, person-centered care using digital technology 
- Experimenting with how technology can be used to “bear witness” to people’s experiences and decision-making 
- Research paying attention to how the introduction of novel digital technologies | - Good 
- Used Ethics Critical Appraisal Worksheet & - Used JBI Critical Appraisal Checklist for Text & Opinion Papers |
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| 622 | Grobbel et al. (2019), USA | Discuss the current state of robots, explore the ethical framework of the Care-Centered Value Sensitive Design (CCVSD) and the caring theory of Nursing As Caring theory as it relates to the sacred nurse-patient relationship. | - Literature study  
- Nursing care practice  
- Embodied robots | - Affirming the centrality of the nurse-patient relationship  
- Inability of robots to experience or express compassion  
- Robot’s inability to demonstrate emotion of bonding or patient-robot bonding  
- Attention to empathy in human-robot interactions  
- Touch by robots: Concerns about safety to humans/patients.  
- Concerns about boundaries: appropriateness of touch by robots; dilemma about prioritizing touch over safety.  
- Being with: Possibility or desirability of co-presence in robots; questions about valuing of the personhood of patients by robots | - Integrating both ethical and caring frameworks to protect the nurse-patient relationship.  
- Nursing to anticipate how, where, and what robot bonding will be in nursing care  
- Centrality of empathy in nurse-patient-care robot relationships  
- Research and development of tactile human-robot interactions should focus on encounters about safety | - Integrating both ethical and caring frameworks to protect the nurse-patient relationship.  
- Importance of situation-specific judgement of effects and potentialities of digital technologies  
- Research to generate evidence on how emerging digital technologies in virtual care can be effectively integrated into care advocacy to meet abovementioned | Good  
- Used JBI Critical Appraisal Checklist for Text & Opinion Papers |
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<tr>
<td>1157</td>
<td>Körtner (2016), Vienna</td>
<td>- Identify major [ethical] issues is use of social service robots in elderly care</td>
<td>-</td>
<td>-Care of older adults/ Elderly people</td>
<td>- Key Ethical concerns: deception, violation of dignity related to patronizing or infantilization of adults with dementia; social isolation; privacy, data storage, loss of control and autonomy; patient and staff safety; liability; vulnerability. - Strategies to identified mitigate ethical concerns: provision of comprehensible information, careful cooperation, basic understanding on scope of risks associated with technology risks with medical and care staff; informed consent; safe and anonymous storage of data, password protected hard drives; safeguards to protect patient privacy with use of technology.</td>
<td>- Reaffirm the imperative of person-centered ethical care that focus on needs of vulnerable people. - Research on digital ethics literacy and action on the useful ethical guidelines: - Research testing impact of technology on safety and improve predictability capabilities of emerging technology before using in virtual care. - Ongoing reflection on ethical issues and strengthening of clinical or institutional ethics boards consultation and compliance with ethics policies. - Focus on the culture and quality of digital space and environment to ensure patient safety and ethical care. for robots must be clearly identified.</td>
<td>Good</td>
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<td>389</td>
<td>Martin, M. (2020), USA</td>
<td>- Summarizes and evaluates key components of the 21st Century Cures Act related to health technology development - Discusses the relevance of discrete emerging</td>
<td>- Opinion paper</td>
<td>- Literature study - Focus on emerging digital health technologies in clinical settings.</td>
<td>- Components: related to breakthrough devices for effective treatment or diagnosis of life-threatening or irreversibly debilitating human disease or conditions; and breakthrough technologies for which no approved or cleared alternatives exist (i.e., digital health tracking devices, EHR) and combination products</td>
<td>- Update existing regulatory and ethical frameworks and policies for breakthrough devices and development of new approval pathways for vetting emerging digital health technologies in nursing</td>
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<td>243</td>
<td>Baumann et al. (2018), USA</td>
<td>-Explore how guided simulation, virtual reality (VR), and</td>
<td>- Perspective paper</td>
<td>- Literature study</td>
<td>- Key areas for global simulation, virtual or AR nursing: aesthetics, intelligence, ethics, politics, and health.</td>
<td>- Building global awareness and citizenship competencies in virtual care for health equity.</td>
<td>Good -Used JBI Critical Appraisal</td>
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Digital health technologies provisions to ethical concerns for nursing practice, research and policy. To ensure patient safety and compliance. -Research on how and in what ways nurses respond to commercial influences on healthcare, how digital products impact care and clinical work experience. -Research on ethical considerations of emerging digital health technologies and on policy analysis regarding the effect of digital health uptake within health systems.
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<td>1274</td>
<td>O’Brolcháin, F. (2019), Ireland</td>
<td>augmented reality (AR) can be used to prepare nursing students and nurses in practice to enrich global awareness and competencies. -The goal of this paper is to help nurses help their patients and themselves to benefit from globalization.</td>
<td>- Nursing practice in a global context and global ethics -Use of Technology: Simulation, Virtual reality, Augmented reality -No explicit sample</td>
<td>- Ethical strategies: Seeking out opportunities in nursing practice that are intentionally inclusive and address social structures that contribute to health inequity. - Considering the Human becoming perspective of Dignity as an ethical imperative and ethic of nursing practice. - Using digitally standardise scenarios, patient care situations; de-briefing using standardised questions to address ethical issues, concepts, and strategies; creating shared “sacred” ethical digital spaces to enhance spirituality and experiences in virtual care. - Usefulness of Virtual reality simulations to discern ethical values of advocacy, autonomy, beneficence, and nonmaleficence -Usefulness of post-debriefing standardized questions to address key ethical issues and concepts</td>
<td>- Taking responsibility for digital future and learning and developing tools to help facilitate understanding new reality and transition. -Simulation, VR &amp; AR simulations can be one means to provide training and capacity building in remote and resource-poor settings - Research on the impact of integrating and use of guided simulation, VR, AR on clinical care experiences and explore ethical issues related to health equity - Research to develop and translate digitized tools to develop competencies, evaluate impact and effect on ethical and health outcomes, including ethical awareness and global citizenship in virtual nursing care</td>
<td>- Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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| 70 | Mörch et al. (2020), Canada | -This paper investigates how to better identify and address ethical issues in AI, with a focus on mental health and suicide prevention | -Delphi methodology  
-Checklist design, stakeholder consultation and expert validation, (subjective; qualitative) | -Literature  
-Focus on mental health and suicide prevention with use of Artificial intelligence (AI) in care  
-Stakeholders: experts in Mental Health, Suicide Prevention, AI and New Technologies, AI entrepreneurs from Australia, Belgium, Canada, France, Italy, the Netherlands, and the United States.  
-Sample (n = 32) included professors, experts and researchers in suicide prevention and ICTs; mental health, ethics and AI; psychology or psychiatry; computer engineering; and entrepreneurs in mental health and suicide prevention. | -Checklist elements: Privacy and Transparency; Security; Health-Related Risks; Biases  
-Ethical concerns: trust; privacy, transparency, consent; EDT user safety; health risks; risks of stigmatization, discrimination, and exclusion.  
-Checklist is an ethical support and clarification resource and not to be used as post-hoc liability protection.  
- Strategies: Legal systems be updated to address new and emerging ethical challenges.  
-Institutions (i.e., privacy commissioners) provide guide to AI developers early at beginning stages of project design and development. | -Robust research to validated ethical tools and checklist and identify potential ethical risks.  
-Practice: help users assess the availability of information in organisations or project concerning potential ethical issues  
-Ethical risk assessment and consultation  
-Study limitations: subjective validation using the Delphi technique; contextual nature of checklist. | -Good  
-Used JBI Critical Appraisal Checklist for Qualitative Research and JBI Critical Appraisal Checklist for Text & Opinion Papers |
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<td>6</td>
<td>Sherman &amp; Greenbaum (2019), Israel</td>
<td>Discuss ethical concerns in relation to the use of artificial intelligence (AI) in transplant matching.</td>
<td>Opinion paper</td>
<td>Literature -Ethics, Healthcare, and organ transplantation -Technology: advanced AI algorithms use in assessment of donor-recipient compatibility and transplant matching.</td>
<td>Ethical concerns: black boxed or opaqueness of AI and machine-learning decisions (explainability); transparency of AI algorithm factors and processes; complexity of AI algorithms -Lack of accountability that leads to distrust and dissuasion of donors -Bias and safety</td>
<td>-Research to develop matching algorithms that can optimally and ethically match organs for transplant purposes. -Reinforcing safeguards to ensure transparency and accountability by members of the transplant networks -Need for transparency in processes and factors in AI clinical decision making -Research testing ethical design and development of matching algorithms in organ transplantation.</td>
<td>-Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<p>| 20 | Villongo &amp; Khan (2020), USA | Examines ethical and policy implications of using voice computing (VC) and artificial intelligence (AI) to screen for mental health conditions in low-income and minority populations. | Opinion paper -Ethical analysis based on literature | Mental health in low income and minority populations -Use of VC &amp; AI to screen for mental health conditions | Ethical concerns: Gender and racial biases, harm, unrepresentative data sets, culturally biased labelling; reinforcing gender and racial health disparities; data privacy and informed consent; emotional contagion and manipulation of user data; safety and data exploitation. -Regulatory and Policy concerns: lack of trust, unchecked risks, exploitation of regulatory and policy loopholes; social backlash; potential harm from falsely marketing of AI technology’s true utility; misutilization of recorded digital metrics for unintended purposes. | -Researchers to consider ethical, legal, and social impact when develop and testing automated decision-making systems (AI) tools for vulnerable populations. -Update and strengthen proactive &amp; robust legal &amp; ethical protections, guidelines &amp; regulatory oversight of AI design, development, and implementation in healthcare, and to protect vulnerable populations. -Research to examine the impact of using AI technology in virtual care on health, health | -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers |</p>
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| 24 | Rubeis, G. (2020) Germany | To analyze and conceptualized the risks of artificial intelligence (AI) in elderly care and present a “4d-risks” model and proposed strategy to circumvent such 4d-risks. | -Literature study  
-Conceptual paper  
-Creative conceptualization | -Gerontology and use of AI in virtual care with elderly population and practice | -Benefits of AI: predictive benefits in fall prevention; personalized care, data collection and processing according to context; participatory benefits allowing patient to actively contribute to the collection and processing of data; reducing hospital re-admission and mortality and cost in elderly care.  
-Ethical risks: data mining, de-personalization; challenge the holistic nature of nursing; discrimination; dehumanization of care; lead to mistrust between patients and healthcare professionals. | -Research to examine the impact when using AI-based gerontechnology to care for clients.  
-Institute and ensure compliance with safeguards to prevent de-personalization, discrimination, dehumanization, and disciplination: focus on minority groups and their needs, tailoring technologies to the needs of the people, question concepts of age and well being that are scripted into the data systems and applications.  
-Research to develop, text and evaluate ethical tools to address needs of vulnerable populations, and address identified ethical concerns | Good  
-Used JBI Critical Appraisal checklist for Text & Opinion |
| 34 | Bærøe et al. (2020), Norway | -Focus on the ethics and robustness of artificial intelligence (AI) | -Opinion paper  
-Focus on trustworthy AI | -Healthcare in a global context  
-Focus on trustworthy AI | -Key Ethical concerns: Conflicting goals (equality of access vs. equality of care quality; efficiency and cost-effectiveness vs | -Research to develop and test trustworthy AI tools for implementation in virtual care. | Good  
-Used JBI Critical Appraisal |
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-Unequal context, workforce replacement; risk and uncertainty; trade-off between promoting health and reducing inequalities vs. surveillance of society; opportunity cost; democratic deficits.  
-Key strategies: development foster trustworthy AI; deployment and use for global and transnational goals | -Research examining the impact of trustworthy AI in care, health equity, health personal shortages; and addressing ethics quality goals.  
-Securing the governance of trustworthy AIs in healthcare.  
-Policy decisions based on empirical evidence may distract from the risk associated with AI.  
-Research to develop and test global benchmarks and standards for the design, implementation, use, and evaluation of trustworthy AI. | Checklist for Text & Opinion Papers |

Checklist for Text & Opinion Papers

-Going towards the intersectional approach to examine the impact of AI on marginalized people’s health and health outcomes.
-Deep and multi-lateral stakeholder engagement to implement and evaluated AI in virtual care; address ethical issues with AI, and governance are imperative
-Paying attention to the intersectional (gender, race, age, culture) needs and well-being of marginalized populations.
-Use intersectional frameworks in data science.
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| 43 | Amann et al. (2020), Switzerland | -Assess the roles of explainability in medical AI and conduct an ethical evaluation of its meaning for the adoption of AI-driven tools in clinical practice | -AI-based clinical decision support systems as a case -Multidisciplinary approach to conceptually analyze relevance of medical AI from patient, legal, and medical perspective. | -Literature | -Technical viewpoint: role of explainability be considered in terms of how it can be achieved and what is beneficial from a development perspective. -Legal perspective: informed consent; certification, and approval of devices as core fields of explainability. -Patient and medical viewpoints: importance of interplay between humans and medical AI. -Ethical concerns: explainability, informed consent, bias, liability, epistemic authority, accountability, clinician-patient relationships, trust, conflict between clinicians and AI, risk to clinical judgement competencies of clinician: risks of bias/unconscious bias; discrimination against patients in care. | -Oversight and governance of informed consent processes and requirements. -Research that focus on the interaction between AI and clinicians, including nurses. -Integrate explainability in autonomous decision-making systems like AI. -Research assessing the impact of AI on trust, patient safety, nurse-patient relationships, health equity. -Sensitivity and bias training for all stakeholders and users of AI technologies. -Research to design, test, validate features in AI tools before use in care. | -

<p>| 54 | Steil et al. (2019), Germany | -Discuss ethical, legal, medical informatics viewpoints that challenges novel clinical team-machine interactions and the consequences for health information systems. | -Opinion paper -Conceptual analysis. -Within a multidisciplinary context, present thoughts on the ethical, legal, medical informatics viewpoints among others using robotic | -Team-Machine interactions in operating theater settings in healthcare teams -Surgical operating rooms -Robotic systems | -Expected changes in professional roles, interactions, and communication: machines substituting surgical work; influences on professional behaviors, self-conceptions, self-perceptions, self-efficacy, and the teamwork structures in health care. -Concerns: skill deprivation in automation; patient safety; liability and responsibility; privacy and anonymity; protection of | -Reconsider collaboration of surgical teams in operating theaters, including roles, competencies, and responsibilities of healthcare professionals and robotic systems. -Interdisciplinary research examining impact of robotic systems | -Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers |</p>
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<td>56</td>
<td>Fiske et al. (2019), Germany.</td>
<td>-To assess the ethical and social implications of translating embodied AI applications into mental health and develop preliminary recommendations on how to address these challenges.</td>
<td>systems in operating theaters.</td>
<td>data; trust; moral status and authority of machines; impact on moral self-conception of humans; conflict between moral and pragmatic autonomy vs robot autonomy; and moral agency</td>
<td>on people, personal interaction, relationships, team changes, patient safety; ethical care outcomes; role and workload distribution between humans and machines. -Adapt current ethical and legal frameworks to the technological developments and balance the interests—and ethical as well as legal responsibilities; provide legal and ethical oversight and governance, design, implementation, and use of robotic systems in virtual care.</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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| 67 | Blobel et al. (2020), Germany | Discusses the opportunities and challenges of AI and autonomous systems technologies from a humanistic and ethical perspective. | -Conceptual paper  
-Analyse organization, disruptive methodological and technological paradigm changes, ethical concerns, and propose principles and methodologies for mitigating them | -Healthcare  
-Context of personalized, preventive, predictive, participation, and precision (5P) Medicine  
-Autonomous Systems and Artificial intelligence | -Ethical concerns about trust, transparency.  
-Proposed ethical principles for mitigating ethical concerns are Transparency, Accountability, Controllability, Security, Value Orientation Ethics, Privacy, Safety, Risk, and User Assistance. | -Affirming Human responsibilities and Oversight over AI  
-Research to examined impact of AI on human needs and aspects of human values.  
-Research to evaluate and testing impact of Good Modelling Practices, including formalizing and harmonizing multi-disciplinary knowledge spaces on health and virtual care outcomes.  
-AI not to be used as a means for displacing human’s responsibility | Good  
-Used JBI Critical Appraisal Checklist for Text & Opinion Papers |
| 68 | Basu et al. (2020), USA | Discuss the application of Machine learning algorithms in patient healthcare and dermatological domains along with the ethical complexities involved | -Conceptual paper  
-Based on a review and analysis of academic publications in medical sciences using relevant keywords searches in PubMed database.  
-EDT: Machine Learning algorithms and applications in healthcare and dermatological care | -Applications include but not limited to patient diagnosis, prognosis and monitoring of progression, supporting the work of clinicians, providing patients with personalized treatment options and rug development.  
-Advantages of applications: scalability of care, supporting clinical decision making, access to initial diagnosis through mobile applications  
-Key ethical concerns: privacy: data privacy, data ownership, and secondary use of data challenges; fairness; transparency and conflict of interest; accountability | -Risk of different ethical standards on how to deal with similar ethical concerns between high-resource countries vs low-resource countries  
-Research to examine technology impact in terms of cultural differences, literacy rates, patient-provider relationships  
-Context-specific ethical judgement and decision making in addressing identified challenges between low-resource and high-resource countries. | Good  
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<td>72</td>
<td>Nebeker et al. (2019), USA</td>
<td>-Describe the ethics in the digital health research landscape supported by the artificial intelligence (AI), identify gaps to be addressed, and offer recommendations for socially responsible digital health research.</td>
<td>-Opinion paper -Derived from a literature study</td>
<td>-Governance and the use of AI in healthcare -vulnerable populations (i.e., mental health diagnosis)</td>
<td>(i) Governance in the digital &quot;wild west&quot;: identified involved new healthcare stakeholders (e.g., technology giants, digital therapeutic start-ups, citizen scientists). -Ethical review: respect for persons, beneficence, justice -Affirm emerging digital technologies demonstrated value with respect to outcomes (access, equity, privacy, accessibility, effectiveness, and utility) before use. -Ensure the technologies are designed and scientifically tested in keeping with accepted ethical principles (respect for persons, beneficence, justice) and robust data management plans. -Apply a digital health decision-making framework to ensure integrity of digital health research and facilitate sound decision-making. (ii) Disciplinary/ sector challenges: arise due to new, rapidly evolving technologies; data quantity: lack of regulatory controls or common standards to guide decision-making and governance of emerging digital technologies. - Digital health literacy challenges: lack of awareness and skills of stakeholders to evaluate technologies</td>
<td>-Ensure the technologies are designed and scientifically tested in keeping with accepted ethical principles. -Raising awareness about ethical concerns related to AI use in healthcare. -Research to examine gaps and disconnection in understanding and competencies of digital health stakeholders; and identify strategies to reduce gaps and improve meaningful connections between these groups that are integral to digital health research and the use of AI in the health care sector. -Inter-disciplinary research to develop and test new digital tools and AI-enabled technologies for the healthcare market with people in accordance with best-practice ethical and regulatory standards. -Ethical oversight and regulation: update common ethical and legal framework and standards (i.e., ESLI, CORE, PERVERSE), expertise to conduct risk</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>79</td>
<td>Vaisman et al. (2020), Canada.</td>
<td>To outline important ethical concerns faced by low- and middle-income countries that may benefit from the implementation of Artificial intelligence (AI) technologies to diagnose &amp; managed tropical diseases in low-resource settings.</td>
<td>-Opinion paper</td>
<td>-Field of tropical disease care and management delivery in low- and middle-income countries. -Artificial intelligence-driven diagnoses of neglected tropical diseases in low-resource settings.</td>
<td>-Key ethical concerns: interrelationships between stakeholder engagement, consent, data security, privacy, accessibility of technology, adhering to current and evolving care standards and deciding how to effectively use resources. -Implementation of AI technologies could unintentionally draw resources away from other programmes</td>
<td>-Awareness about and the implementation of legal and ethical safeguard measures to addressed identified ethical issues. -Informed consent to adhere to the highest legal and ethical standards. -Broad and multiple stakeholders’ involvement and engagement from low- and middle-income countries in the development of AI tools and identification of research priority areas. -Pairing teams of data scientists and engineers would enable capacity building in low- and middle-income countries. -Research on how technologies affect (local) standards of care, assessing of impact, and improvements.</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>80</td>
<td>Baric-Parker &amp; Anderson (2020), USA</td>
<td>Describes ethical and social problems observed in recent patient data-sharing collaborations with AI companies</td>
<td>-Opinion paper -Literature analysis and Ethical and Religious Directives for Health Care Services (ERDs) guiding principles</td>
<td>-Large healthcare system and largest Catholic healthcare provider in collaboration with Google -Operating 150 hospitals, 2,500 doctors</td>
<td>-Key Ethical concerns: patient privacy and Confidentiality; questions about sufficiency of current to protect patient privacy when using emerging technologies; informed consent and lack of transparency; negative impact</td>
<td>-Research testing AI in research setting before widespread dissemination in clinical care or standardized practice. -Research to produce clear evidentiary stand-</td>
<td>Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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| 81 | Thompson & Morgan (2020), Scotland | -This paper discusses the issues highlighted within the code of conduct and the ethical concerns associated with addressing them to successfully integrate artificial intelligence within the NHS | -Opinion paper | -Healthcare provision | -Opinion paper | -Ethical concerns: data privacy breaches; failure to obtain informed consent; lack of accountability, transparency, loss of human control over decisions by AI; trust in healthcare system | -Developers and providers of technology comply with data regulation and control | -Good
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<td>95</td>
<td>Sharkey, A. (2011), UK</td>
<td>Review the ethical cost/concerns of adopting robots in eldercare.</td>
<td>-Opinion paper -Analytical discussion on.</td>
<td>-No specific setting -No sample sizes -Focused on eldercare</td>
<td>Ethical concerns: infringement on privacy and personal freedom; consent; erosion of autonomy, liberty, and control; increase feelings of objectification and insensitive use; reduction in human contact and companionship; deception and infantilization; dignity. -Lack of ability to distinguish between robot an actual living thing (deceit), with impact on quality of the relationship -Concern robots overall may not serve the well-being of the elderly.</td>
<td>-Cross-disciplinary working model between academics and lawyers alongside NHS partners to inform implementation. -Need for academic research and embedded stakeholder engagement to inform policy development and advocacy and appropriate science-based communication approaches for multiple public audiences -Development of clear guidelines before the introduction of robots in the healthcare system -Robust research needed on robotics ability and human social networks &amp; companionship. -Design and development should be programmed to enable and empower users to have control over robots. -Research to create and test interactive robots'; assess impact on the satisfaction of needs for companionship. -Considerations of cultural needs and diversity in the design and development of robots.</td>
<td>-Good -Used JBI critical Appraisal checklist for Text &amp; Opinion</td>
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| 142 | Luxton, D.D. (2014), USA | Identifies and reviews ethical issues associated with artificial intelligent care providers (AICPs) in mental health care and other helping professions and makes specific recommendations for the development of ethical codes, guidelines, and the design of AICPs. | -Opinion/discussion paper  
-Review and foundational overview of applicable ethical principles and emerging ethical issues regarding the use of AICPs | -Mental health care and other helping professions  
-Use of Artificial intelligent care providers (AICPs) | -Ethical Issues: Therapeutic relationship; competence and scope of use, accountability, and Liability; respect for privacy and trust; patient safety.  
-Recommendations for Ethical codes and guidelines: appropriateness of use; disclosing nature of services and limits of services by AICPs; data use and access limitations, and dispositions of data records; ensure system users understand capabilities, scope of use, and limitations of AICPs.  
-Human supervision, monitoring and risk assessment; transparency; follow privacy laws and rules; systems capabilities meet and follow established clinical best practices.  
-End of patient-AICP interactions provides continuity of care, sensitivity to the emotional nature of patient-AICP interactions; provide a mechanism for feedback and reporting of complaints  
-Recommendations for design: follow appropriate ethical codes and guidelines; identify and provide specifications of use and limits of the autonomy of AICP system and end-users.  
-Test safety and ethical decision making of AICP: include a capability for data logs/audit trails to track and explain AICP decision making; build-in safeguards to assure services provision are | -Deep understanding of ethical and moral aspects regarding the use of AICP systems.  
-Consideration of issues by policymakers and regulatory boards.  
-Considerations of risk of the perception of and the actual loss of private thoughts, in communication  
-Abuse of information collected by AICPs and restrictions of personal freedoms  
-Applicableness of existing ethical principles and standards regarding other technologies serve as guide for the way forward.  
-Research to examine technology impact on safe, ethical decision-making, competencies, health equity. | -Very good  
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<td>233</td>
<td>Char et al. (2018), USA</td>
<td>Discusses ethical concerns inherent in implementing machine learning in health</td>
<td>Conceptual paper</td>
<td>Healthcare practice</td>
<td>-ML algorithms mirror human biases in decision making; reflects biases inherent in the data used to train them; propensity for racial discrimination; deception and cheating</td>
<td>-Research and user education on ML development, testing of data sets they are built on, and limitations. -Ongoing monitoring of ML systems that complicate care practices -Rethink of medical ethics and bio-ethical principles</td>
<td>Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>278</td>
<td>Bali et al. (2019), India</td>
<td>Discuss why a strong computation/ AI bioethics framework is required.</td>
<td>Guest Editorial</td>
<td>Artificial intelligence</td>
<td>-Lack of legislative and regulatory oversight (context-specific) -Concerns about third-party data sharing and processors. -Blurring lines between data controllers and data processors. -Liability concerns; lack of transparency; AI challenging Human Authority; failure of oversight</td>
<td>-Regulatory and legislative oversight. -Strengthen and ensure compliance with privacy safeguards. -Robust research to evaluate data management practice to ensure privacy and confidentiality. -Research on informed consent from patients</td>
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<td>296</td>
<td>Otto et al. (2016), The Netherlands</td>
<td>-To highlight important points of existing ethical discussions, to draw attention to emerging issues specific to 3D bio-fabrication in bench and bedside research and the translation to society.</td>
<td>-Review of literature -Ethical assessment -Regenerative medicine -Bio-fabrication highlighted regarding animal experimentation, cell source and biobanking</td>
<td>-Bench issues: consent and privacy in biobanking; privacy protection and anonymity issues in data management; informed consent; retention of ownership of the donated tissue once separated from the body; commercialization of products originating from residual tissue -Bedside Issues: patient safety; damage to public perception; risks and benefit due to lack of prior comparators; product variability and complexity; undesirable effects and loss of human control; products may elicit unwanted effects; use of sham procedures in control group carry inherent risk and burdens; therapeutic misconception; exploitation of vulnerable patient groups; difficulty with disclosing information related to product uncertainty -Society issues: inflated expectations; disillusionment; waning public enthusiasm and trust with clinical application; concerns of human enhancement practices that improve human form or function and healthcare professionals’ views on data sharing practices with third parties. -Providing patients up-front with information about use of data. -Research to develop and test strong bioethical and computational ethics framework</td>
<td>-Striving towards coproduction and constructive dialogue between science, technology, ethics, and society -Research on comprehensive analysis of the ethical implications of bio-fabrication technologies -Research on consent for the use of human materials and the choice of relevant animal models -Research to evaluate the impact of technology on society, especially impact on equity -Collaboration between scientists and clinicians actively taking up the role as an actor to drive responsible technological innovation -Compliance with certain safety standards when evaluating bio-compatibility and safety</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>314</td>
<td>Guan, J. (2019), China</td>
<td>- Discusses aspects of artificial intelligence (AI) in medicine and healthcare, including application, promises, special ethical concerns, and summarizes suggestions on ethical governance ideas and guidelines.</td>
<td>-Opinion paper</td>
<td>-Healthcare and Medicine -Artificial intelligence (AI)</td>
<td>Applications and promises of AI in healthcare: optimizing clinical trials of innovative drugs and therapies; predicting clinical outcomes; simplifying process management; lowering complexity and cost; guide clinical and screening decision making; diagnoses and treatments; assisting patients or attending surgeons; and communication Ethical concerns: biomedical research related to “double effect”; safety, efficacy, privacy; information and informed consent; right to decide, the &quot;right to try&quot;; access and costs - Concerns regarding AI virtual care (individual level): safety, autonomy, manipulation of brain mechanism underlying intentions, emotions, and decisions; privacy, identity, agency, and equality - Societal level concerns: concerns about the goals, ethics (rights/wrong) of specific technologies, risks and benefits of personalized medicine; &quot;neuro-biohybridization&quot; raises challenges about personality, emotion, and humanity's future</td>
<td>of biomaterials in the short and long term. -Fostering trust in public perceptions and expectations through awareness and education</td>
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- Digital literacy through calculations, real-time feedback using digital solutions (numeracy); transparency regarding cost and quality (navigation); tracking of biometric information or patient-reported measures; giving greater voice and empowerment as active participants (communication); shared decision-making (decision-making)  
- Digital health literacy best practices must be personalized, relevant, interactive, and action-oriented experience  
- Solutions: enhance an individual's belief and confidence; allows them to communicate with a support system in a mobile-friendly environment; address the emotional state of learner through managing emotions, reduce stress, and build resilience  
- Use a behavioural approach to strengthen engagement and build commitment, using motivational interviewing  
- Tools: in addition to phone, video interactions, AI, Chabot’s, use flashcards, taxonomies, scaffolding to deliver digital personalized and relevant support system content. | - Strengthen digital literacy in health and patient education.  
- Culture of physical learning environment and digital spaces are important for feasibility of adoption and implementation.  
- Research to produce evidence on the effectiveness of using emerging digital technologies to develop literacy.  
- Translating best-practice and application of digital technologies in ethical ways to established support systems in group settings  
- Challenges of assessing health literacy in clinical settings. | -Good  
- Used JBI Critical Appraisal Checklist for Text & Opinion Papers |
| 351 | Racine et al. (2019), Canada | To highlight three potentially   | -Opinion paper  
-Reflective method | -Healthcare  
-Domains of imaging, diagnoses, risk | - Dynamic information and consent issues: intrusiveness of health data collection; recorded | -Adapting consent strategies and documents to | -Good |
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<th>ID</th>
<th>Author, Year &amp; Country</th>
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<td>problematics of artificial intelligence (AI) use in healthcare and discuss their impact on the patient, clinician, and health institution values and suggest ways to tackle this impact.</td>
<td>analysis, lifestyle management and monitoring, health information management, and virtual health assistance. -Clinicians, healthcare providers, and technology developers -Artificial intelligence (AI)</td>
<td>data being used for a variety of unintended purposes; affect consent processes -Values impact: Primacy of consent for trustful patient-provider relationships, respect for patient preferences and beliefs. -Transparency and ownership issues: lack in algorithms transparency; data inclusion/exclusion, decision-making process; explainability and biases; data ownership -Values impact: Trusted institutions are expected to protect patients/clients from the harm of discontinuity of care created by proprietary issues. -Privacy and discrimination issues: possibility of misuse of data, cyber-hacking, governing institutions. -Values impact: AI use in healthcare challenge conventional understandings of privacy and confidentiality -Strategies: Adapting consent strategies reflecting the evolving nature of health information and its changing implications for patients/clients; demonstration of honesty and transparency about the limited foreseeability of AI applications by healthcare organizations and developers; need for health organizations and clinicians to become acquainted with new upcoming requirements for information protection and data management.</td>
<td>reflect the evolving nature of health information and its changing implications for patients/clients -Research examining value and impact for consenting research participants to monitor the evolution of research/interventions, update their consent accordingly. -Research examining the impact of digital systems on honesty and transparency of data use, limitation of AI applications -Reaffirmation of the fiduciary responsibilities of healthcare institutions as trusted entities, proactive oversight and monitoring of the development, implementation, and use of AI in health settings -Research examining stakeholder engagement and involvement about issues of accountability, ownership; protect confidentiality and privacy. -Clinician to critical reflection on the proper clinical and ethical use of AI in healthcare and -Research to evaluate impact of digital tools</td>
<td>-Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>354</td>
<td>Kluge, E-H. W. (2020), Canada</td>
<td>-Discussion sketches the distinct ethical concerns that are relevant to the two kinds of AI.</td>
<td>-Healthcare</td>
<td>-Ethical concerns: clinician-patient relationship; trust; best interest of patients based on values; informed consent; privacy and confidentiality; substitute decision making; appropriateness using technical tool used; precision of technical tools. -Valuational issues related to AI design: concerns about the type of data recognized by AI and how it is weighed; valutational bias leading to questionable diagnoses, biased recommendations, or inappropriate actions.</td>
<td>Research to examine the impact of emerging digital technology regarding patient safety, privacy; values; care outcomes. -Curriculum innovation and redesign to incorporate and foster competencies on emerging digital ethics and regulatory changes. -Ethical and regulatory oversight of AI applications to ensure they meet set standards when use in virtual care. -Robust research to develop, test, implement, and evaluated AI tools; assess the impact on values and virtues of care professional users of AI’s. -Develop and implement best-practice standards and virtues on which to base the robust design and ethical performance of AI applications and agency in virtual care.</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>385</td>
<td>Bærøe et al. (2020); Bergen, Hordaland, NO (Norway)</td>
<td>-Critique on the structural and epistemic underpinnings of the Char et al; (2020) Commentary and ethical argument and critique -Argue for distinc-</td>
<td>Machine learning healthcare applications (ML-HCA)</td>
<td>Key Ethical concerns: -ML-HCA unable to explain reasoning and care decisions -Lack of transparency and accountability</td>
<td>-Need for a methodological approach toward ethical assessment of ML-HCAs -Need for relevant and appropriate ethical</td>
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| 392 | Carter et al. (2020), Australia | -Review the ethical, legal, and social implications of using AI systems in breast cancer care. | -Conceptual paper  
-Consider the values encoded in algorithms, the need to evaluate outcomes, potential effects for patients, and provide some social science explanations for the apparent rush to implement AI solutions | -Healthcare: Breast cancer care  
-Artificial intelligence t | -Key Ethical concerns:  
-Issues about values reflected in AI systems: conscious and unconscious bias in human coders  
-Explainability/Interpretability related to Blackbox problem  
-Bias and Transferability, data management  
-Data ownership, Confidentiality, Consent,  
-Legal risk, responsibility (moral, and professional).  
-Impact on patient experiences, knowledge, choice, and trust, including trust in healthcare system.  
-Failed promises that never got materialised. | -Need for proactive role for government, regulators, and professional groups to ensure introduction of AI systems in robust research contexts,  
-Need to develop a sound evidence base regarding real-world effectiveness of AI systems in care  
-Need for detailed public discussion on the acceptability of AI is required to optimise outcomes for health systems, professionals, society and those receiving care.  
-Affirmation by healthcare stakeholders that AI enabled care is | -Very Good  
-Used JBI Critical Appraisal Checklist for Text & Opinion Papers |
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<td>456</td>
<td>Fenech &amp; Buston (2020), UK</td>
<td>- Review ten ethical, social, and political challenges raised by novel data-driven technologies such as artificial intelligence and approaches to address them.</td>
<td>- Policy &amp; Practice Review</td>
<td>- Healthcare and use of data-driven AIs - Artificial intelligence</td>
<td>Ethical concerns: impact on healthcare professional-patient relationships, and between caregivers/relatives, administrators and between patients and society; conflict between care and treatment goals between HCP and AI and the impact on patients - Liability issue due to device errors; patients may respond to AI-derived errors; informed consent, data collection, access, use, storage, and sharing; privacy and confidentiality; transparency and explainability; health inequities. - Concerns about ensuring the needs of the public are met; trust in healthcare systems and algorithms; safety concerns related to automation complacency - Approaches: stakeholder engagement; robust inclusive process of stakeholder analysis; deep understanding of the needs of prospective users; openness as a determinant of trust to engage with the development of AI tools.</td>
<td>- Detailed treatment of processes and standards related to the safety of technologies. - Regulation to protect users and patients - Education and training programs for HCP to address safety concerns related to automation complacency, and de-skilling - Need for more research to understand patient responses to AI-derived errors - Qualitative research to help understand the needs of prospective users of these novel technologies</td>
<td>- Good - Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>459</td>
<td>Cirillo et al. (2020), Spain</td>
<td>-The purpose of this review is to highlight the main available biomedical data types and the role of several AI technologies to understand sex and gender differences in health and disease.</td>
<td>-Review article&lt;br&gt;-Specific methods not described</td>
<td>-Healthcare and biomedicine&lt;br&gt;-Artificial intelligence</td>
<td>-Undesirable biases related to AI: stigma and discrimination; unrepresentative samples; adverse reactions; ineffective treatment&lt;br&gt;Desirable biases related to AI: enhance the understanding of sex and gender differences; enhance effective treatments for each sex/gender; enhance the well-being of patients&lt;br&gt;-Other Ethical concerns: black box problem; explainability or explicable justification; interpretability and completeness&lt;br&gt;-Strategies: Bias detection frameworks for fairness; removing sensitive information; fair affirmative action for algorithmic discrimination; ensure the quality of data; awareness and deep knowledge of intersectional differences in health; achieve interpretability through the implementation of visualizations, logical statements, and dimensionality reduction techniques in computational tools; mitigating undesirable bias through instruction.</td>
<td>-Incorporate ethical concerns in every stage of technological development&lt;br&gt;-Philosophical conceptualization producing new theoretical insights on the meaning of desirable vs undesirable bias in virtual nursing care.&lt;br&gt;-Research to establish quality data; understanding the context-specific nature of fairness; increase awareness of unintended bias.</td>
<td>-Satisfactory&lt;br&gt;-Used JBI Critical Appraisal Checklist for Systematic Reviews and Research Synthesis</td>
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<td>467</td>
<td>Walsh et al. (2020), USA</td>
<td>-To help the informatics community reach the potential for AI to impact behavioral healthcare&lt;br&gt;-To share recommendations for designing and deploying intelligent systems in</td>
<td>Perspective opinion paper&lt;br&gt;-Behaviour and mental health&lt;br&gt;-Adult Americans&lt;br&gt;-Mental health disorders&lt;br&gt;-Applied AI</td>
<td>-Ethical concerns: lack of quality data; stigma and silence (i.e., under-reporting &amp; under-coding); unreliable biomarkers &amp; objective measures; algorithmic biases; danger of inappropriate use due to gaps in interpretability, trust, and privacy concerns.&lt;br&gt;-Strategies: foster trust through education and transparency; leverage social determinants of health to address algorithmic</td>
<td>-Rigorous, prospective evaluation and testing of AI is necessary to ensure outcomes improve with minimum unintended consequences.&lt;br&gt;-Research to examine the impact of AI on care outcomes of trust, health equity, and collaboration.</td>
<td>-Good&lt;br&gt;-Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>479</td>
<td>Reddy et al. (2020), Australia</td>
<td>-To discuss the ethical and regulatory aspects of the application of AI in health care. -Propose a governance model to address the ethical and regulatory issues and stimulate discussion about the governance of AI in health care.</td>
<td>-Opinion paper</td>
<td>-Healthcare delivery in clinical settings -clinical decision making and care -Artificial intelligence (AI) use</td>
<td>-Ethical concerns: biases; privacy; breach of data through adversarial attacks or malicious manipulation; patient and clinician trust; lack of transparency in clinical decision-making with certain AI algorithms. -Regulatory concerns: safety and efficacy of digital applications in clinical environments; liability. Proposed Governance model: Structure: principles of fairness, transparency, trustworthiness, accountability -Monitoring and evaluation based on a three-stage process including approval, introduction, and deployment. -Process: integration of AI application in clinical workflow and governance through clinical workflow assessment; workflow redesign: changes to digital infrastructure; clinical and executive leadership; and workforce training.</td>
<td>-Implications for future governance in healthcare -Formalization of regulatory standards to assess AI algorithmic safety and impact -Updating of current medicolegal guidelines on boundaries of responsibility when AI agents guide clinical care -Importance for staff training and awareness-raising about ethical and regulatory concerns and new obligations. -Incorporation of basic elements essential to the safe and ethically responsive use of in health care -Need for ongoing discussions about AI regulation in health care.</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>607</td>
<td>Chiberska, D. (2018), England</td>
<td>-This article presents current knowledge about the use of robotic animals in dementia care, with a focus on challenges and ethical</td>
<td>-Discussion/ Conceptual paper -Discussing research findings from published literature</td>
<td>-Care of people with Dementia -Focus on socially assistive robots (i.e., Paro)</td>
<td>-Uses of robots in dementia care: agitation and depression improvement; social interaction, alleviating distress, entertainment, communication, bathing, eating, grooming -Ethical concerns: Human contact challenges; reduction in human contact in vulnerable people; reduce the focus on interpersonal relationships; inability of robots</td>
<td>-Research examining the impact of robots on deception, interpersonal relationships -Education and Curriculum revision: Role of nurse educators to raise awareness about ethical issues and uses of robots.</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>638</td>
<td>Iserson, K.V. (2018), UK</td>
<td>This article examines the beneficial and adverse ethical and social consequences of using virtual reality (VR) to teach and test clinical procedures, both those that normally require patient participation and those that do not.</td>
<td>-Medical education and testing of clinical procedures  -High-fidelity, computer programed and simulated Virtual reality (VR) systems</td>
<td>-Care of older people (in their so-called &quot;fourth age&quot; of their life’s)  -using social robots (i.e., Paro); human-robot interactions</td>
<td>to love and respect; control or devalued by robot; intrusiveness to privacy; serving the interest of caregiver rather than the care receiver (client); deception and infanticilization; accountability issues related to unpredictability of robots; concerns about responsibility (liability)</td>
<td>-Need for education and information about robots.</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>1118</td>
<td>Misselhorn et al. (2013), Germany</td>
<td>-Argument for a more differentiated ethical evaluation of the possibilities and risks (ethical issues) involved with the use of social robots in care.</td>
<td>-Critical discussion surrounding the capabilities approach to the ethical evaluation of quality of life and -develop an ethical framework appropriate to the care of the oldest old.  -At a methodological level suggest a procedure to ethically evaluate the</td>
<td>-Care of older people (in their so-called “fourth age” of their life’s)  -using social robots (i.e., Paro); human-robot interactions</td>
<td>-Analyze relevant issues in two categories: bodily health and psychological conditions  -Bodily health issues such as problems with walking, climbing stairs, getting out of the chair, shopping driving, writing; holding objects; using telecommunication.  -Psychological impairments include such as depression and dementia; robot engendered a different form of social interaction;</td>
<td>-Employment of a context-dependent approach to the ethical evaluation of new technologies in the care and therapy of older adults.  -Research to examine the impact of robots on health, care, and ethical outcomes.  -Context-sensitive ethical evaluation of robot</td>
<td>-Good -Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>1159</td>
<td>de Graaf, M.M.A. (2016), The Netherlands</td>
<td>-Discuss ethical concerns of human-robot relationships and whether these bonds could contribute to the good life</td>
<td>-An ethical evaluation &lt;br&gt;-Conceptual analysis &lt;br&gt;-Socially interactive robots &lt;br&gt;-Literature</td>
<td>Social settings and hum-robotic relations and interactions</td>
<td>-Elements of friendship: reciprocal and mutually acknowledged relation of good will and affection; help realise virtues and happiness in person. &lt;br&gt;-Ethical concerns: deception and Delusion, interaction and communication limitations; mistaken beliefs about properties of the robot; failure of robots to apprehend the world. &lt;br&gt;-Concerns about the degree of authenticity in human-robot interactions; counterfeit emotions and behaviours; inability to discern perceptions of what is real or unreal in human-robot interactions; subconscious processes involved in human-robot interactions; and misplaced trust</td>
<td>-Robust research using longitudinal design and observations to examine impact of robotics on patient-clinician-robot relationships, friendships, interactions, social reactions, and good will in care. &lt;br&gt;-Research to design better measurement instruments to evaluate the consequences of innovations like robots. &lt;br&gt;-Education and training to raise awareness about possible consequences associated with innovations like robots. &lt;br&gt;-Multi-disciplinary consultation and participation of healthcare end-users in all stages of robot development, including conceptualization, design, implementation and evaluation.</td>
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<td>1161</td>
<td>Ienca et al. (2016), Switzerland</td>
<td>- Delineates ethical, legal, and social implications to be considered in the development of assistive and social robots and recommendations to protecting vulnerable populations.</td>
<td>- Opinion paper</td>
<td>- Social and Assistive robots in Dementia Care</td>
<td>- Ethical and social challenges: Informed consent, undue influence and coercion of people living with dementia; privacy (informational, physical, attentional, decisional); data security; safety, autonomy; equity and fair distribution. - Social implications: low adoption related to translational gap; limited evidence on effectiveness; unmet user expectations and disillusionment with product.</td>
<td>- Research examining impact on ethics and rights with use of robots in different cultural settings and contexts.</td>
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<td>1214</td>
<td>Wachsmuth (2018), Germany</td>
<td>The study investigates the issue of whether robots could substitute for human care, given the challenges in aged care induced by</td>
<td>- Opinion paper based on result of an earlier survey</td>
<td>-Population- elderly or aged adults -Information used in this analysis was from a survey that was conducted in 27 EU countries with more than 26,000</td>
<td>- Concerns about deception, dignity, robot’s incapable of true caring, lack conscious experience, emotionally uninvolved. - Robotic emotions (or conscious states or intentions) are not directly observable but need to be</td>
<td>- Human care could be substituted by robots. - Design of Ethical robots for use of virtual care. -Need for empirical research on the impact</td>
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<td>1234</td>
<td>Nwosu et al. (2019), UK</td>
<td>-Examine future impact of medical robotics on palliative, supportive care, and end-of-life care; discuss the strengths, weaknesses, opportunities, and threats (SWOT) of this technology.</td>
<td>-A SWOT analysis. -Methods: public engagement debate, group discussion with a multi-professional audience, computer science seminar with computer scientist, data experts, and healthcare professionals; and an oral presentation.</td>
<td>European citizens that responded to it</td>
<td>inferred; risk to human independence.</td>
<td>and usefulness of robots on care and ethical outcomes.</td>
<td>Opinion Papers</td>
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<td>2660</td>
<td>Rigby (2019), USA</td>
<td>Discuss ethical complexities on budding AI technology in healthcare</td>
<td>-Conceptual paper; argument-base</td>
<td>-Not specific setting. -Literature focus on clinical practice</td>
<td>- Key Ethical concerns: risk to patient privacy and confidentiality; threats to informed consent, patient autonomy, reporting of incidental findings, and data security.</td>
<td>-Reinforcing and updating legal-ethical standards. - Strengthening ethical-legal safeguards to</td>
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<td>2677</td>
<td>Gerke et al., (2020), USA</td>
<td>To clarify artificial intelligence and analyze ethical and legal challenges of AI in healthcare.</td>
<td>- Opinion paper</td>
<td>- Healthcare - Literature providing an overview on ethical and law of AI in healthcare</td>
<td>- Blurring physician-machine role boundaries in patient care - Threats to - Legal and health policy conflicts (i.e., medical malpractice, product liability with use of “black-box” algorithms. - Lack of Accountability: users’ inability to provide logical explanations for algorithm decision outputs; policy gaps in safeguarding video/photographic images; reporting of incidental findings, and data security</td>
<td>maintain privacy and confidentiality - Health professional curriculum re-design and update to shift focus from knowledge recall focus to student-AI interaction - Strengthening of ethical dialogue and ethics education - Developing a realistic sense of benefits of AI; need to design quality, clinically validated AIs</td>
<td>Opinion Papers</td>
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<td>2685</td>
<td>Fenech (2018), UK</td>
<td>Understand how AI is and should be used in healthcare, and discuss ethical, social, and political challenges</td>
<td>- Reviewing of literature - Interviews with 70 experts around the world - Used expert roundtables</td>
<td>- Healthcare - Multi-disciplinary experts from countries like UK, Australia, Europe, US (n = 13); patients and members of the public (n =16)</td>
<td>- Understanding of Artificial intelligence (AI): conceptualized as Machine learning and Deep learning including neural networks - Concerns about transforming patient-clinician relationship; informed consent; safety and transparency; algorithm fairness and biases; data privacy - Concern about legal challenges: safety, effectiveness of medical devices, decision support software, software functions; liability; data protection and privacy: cybersecurity and intellectual property</td>
<td>- Rethink and update current legal-ethical and regulatory frameworks - Stakeholder collaboration to address identified challenges; ongoing discussions on the ethics of AI-driven healthcare - Transparency and regulatory oversight and ethical governance - Need for high standards of safety and effectiveness and optimal liability</td>
<td>Good - Used JBI Critical Appraisal Checklist for Text &amp; Opinion Papers</td>
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<td>their prospective used presents.</td>
<td>- To examine current and emergent ethical issues in medical robotics considering future possibilities of robotic machines based on extrapolation from current and projected lines of research development.</td>
<td>- Conceptual paper -Literature study and philosophy reflection</td>
<td>- focused on Artificial intelligence</td>
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<td>2688</td>
<td>Weber (2018), Qatar</td>
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Good
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