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Integrating genomics into Canadian oncology nursing policy: Insights from a comparative policy analysis

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Abstract

Aim: To learn from two jurisdictions with mature genomics-informed nursing policy infrastructure—the United States (US) and the United Kingdom (UK)—to inform policy development for genomics-informed oncology nursing practice and education in Canada.

Design: Comparative document and policy analysis drawing on the 3i + E framework.

Methods: We drew on the principles of a rapid review and identified academic literature, grey literature and nursing policy documents through a systematic search of two databases, a website search of national genomics nursing and oncology nursing organizations in the US and UK, and recommendations from subject matter experts on an international advisory committee. A total of 94 documents informed our analysis.

Results: We found several types of policy documents guiding genomics-informed nursing practice and education in the US and UK. These included position statements, policy advocacy briefs, competencies, scope and standards of practice and education and curriculum frameworks. Examples of drivers that influenced policy development included nurses' values in aligning with

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

evidence and meeting public expectations, strong nurse leaders, policy networks and shifting healthcare and policy landscapes.

Conclusion: Our analysis of nursing policy infrastructure in the US and UK provides a framework to guide policy recommendations to accelerate the integration of genomics into Canadian oncology nursing practice and education.

Implications for the profession: Findings can assist Canadian oncology nurses in developing nursing policy infrastructure that supports full participation in safe and equitable genomics-informed oncology nursing practice and education within an interprofessional context.

Impact: This study informs Canadian policy development for genomics-informed oncology nursing education and practice. The experiences of other countries demonstrate that change is incremental, and investment from strong advocates and collaborators can accelerate the integration of genomics into nursing. Though this research focuses on oncology nursing, it may also inform other nursing practice contexts influenced by genomics.

Keywords

genetics; genomics; nursing; oncology; policy

1 | INTRODUCTION

Approximately 40% of Canadians will be diagnosed with cancer in their lifetime (Canadian Cancer Statistics Advisory Committee, Canadian Cancer Society, Statistics Canada, & the Public Health Agency of Canada, 2021), and cancer remains the leading cause of death in Canada (Brenner et al., 2022). Informed by genomics (we use the term genomics in this article unless the term genetics is used specifically in a policy document, see Table 1 for definitions), precision healthcare can lead to new models of care that have significant potential for minimizing the cancer burden in Canada through earlier detection, risk reduction, faster and more precise diagnosis, better symptom management and targeted treatments (Beamer et al., 2013; Brittain et al., 2017; Eggert, 2017; Peterson et al., 2019; Sabour et al., 2017; Vu et al., 2022). Cancer also disproportionately affects those with lower socioeconomic status, people living in rural Canada and Indigenous peoples (Ahmed & Shahid, 2012; Walker et al., 2019; Withrow et al., 2017). Given the prevalence of cancer and the disproportionate impacts on certain groups (Ahmed & Shahid, 2012; Vaccarella et al., 2019), concerted strategies are needed to ensure safe and equitable integration of genomics into cancer services. An important element of this strategy is the development of policy infrastructure (Tonkin et al., 2020a) to guide the education and practice of oncology nurses.

2 | BACKGROUND

Nurses represent approximately 44% of the Canadian health workforce and practice in all areas within the health system. Oncology nurses play a vital role in cancer care and are well-positioned to ensure that patients and society experience the benefits of cancer genomic advancements. They interact with patients and families throughout the cancer care continuum including prevention, screening, diagnosis, treatment and palliative care. However, existing scholarship suggests that Canadian nurses are generally underprepared

to engage in genomics-informed practices such as assessing and supporting those with hereditary cancer risk (Hébert et al., 2022) and integrating pharmacogenomics into practice (Swadas et al., 2022). Policies and practice guidance can inform the development of education and assist oncology nurses in fully participating in delivering interdisciplinary and equitable genomics-informed care.

Nursing policy documents such as practice standards, competencies, scope of practice statements and position statements govern nursing practice and establish nurses' roles, responsibilities, accountabilities, knowledge, skills and judgement. Within the Canadian context, there is a notable absence of policy to inform genomics-informed nursing education and practice (Puddester et al., 2023). From a global perspective, the United States (US) and the United Kingdom (UK) are leaders in integrating genomics into healthcare and have well-established nursing policy infrastructure (Calzone et al., 2018a, 2018b). In the US, organizations such as the American Academy of Nursing (AAN) support the need for institutional and regulatory policy to enable nurses' involvement in precision healthcare (Starkweather et al., 2018). In the UK, significant developments in policy have helped shape nurses' roles, education requirements and regulatory responsibilities related to genomics (Kirk, Campalani, et al., 2011; Nursing and Midwifery Council [NMC], 2018, 2019a). Previous literature suggests that nursing policy development in the US and UK has been critical to guiding education and practice initiatives (Hickey et al., 2013; Kronk et al., 2023; Wilkinson et al., 2020; Williams et al., 2011). As a result, we chose to explore the features of these policy documents and the drivers that led to their development to inform genomics integration in Canada that has yet to unfold across the country (Limoges et al., 2022; Puddester et al., 2023).

3 | THE STUDY

This article reports on findings from phase one of a three-part project to generate evidence to inform policy recommendations for the Canadian Association of Nurses in Oncology (CANO)—the national professional association for oncology nurses—and the Canadian Association of Schools of Nursing (CASN)—the national professional association representing schools of nursing in Canada. In phase one, we aimed to develop a working framework of policy features and drivers based on the US and the UK. The research questions that guided this phase of the study were: (1) what are the core policy features in policy documents guiding genomics and nursing in the US and the UK? (2) what policy drivers can help accelerate safe and equitable genomic nursing practices? and (3) how do the policy features within the US and the UK policy documents compare with typical oncology nursing policy infrastructure for education and practice within Canada?

We used the results of this phase to inform the subsequent two phases of the study (a qualitative study exploring the perspectives of Canadian nurses and patient representatives and the development of policy recommendations for CANO and CASN through a policy dialogue) which are reported separately.

4 | METHODS

4.1 | Design

An international and interdisciplinary advisory committee of subject matter experts working across research, education, clinical practice and policy domains, in medicine, genetic counselling, pharmacy and nursing guided this study. We conducted a comparative document (Bowen, 2009; Coffey, 2014) and policy analysis of the genomics and nursing context in the US and the UK. While we acknowledge that there are other jurisdictions that Canada can learn from, we chose to focus on the US and UK because they have more mature policy infrastructure and continue to be global leaders in advancing genomics-informed nursing (Calzone et al., 2018a, 2018b).

4.2 | Theoretical framework

The 3i + E framework (Gauvin, 2014; Hall, 1997; Pomey et al., 2010) informed our analysis of policy drivers that influenced policy development and the integration of genomics into nursing. The central premise of the framework is that ideas, interests, institutions and external factors influence policy development. It can be used to prepare for policy development and, retrospectively, to analyze policy decisions or outcomes. We identified this as a suitable theoretical framework as it enabled us to consider the wide range of factors that led to genomics-informed nursing policy development in the US and the UK.

Ideas refer to knowledge or beliefs about what is and/or views about what ought to be (Pomey et al., 2010). Values, culture and how opinions are presented and understood can shape policy decisions. Ideas also include evidence rooted in research, expert opinion or lived experience (Gauvin, 2014). *Interests* refer to stakeholders' agendas, such as government, civil society, researchers, nurse leaders and policy entrepreneurs, and the assumption that these agents may unduly influence the process to further their desires (Gauvin, 2014; Pomey et al., 2010). In addition, interests pertain to who will benefit from or be disadvantaged by policy (Gauvin et al., 2014). *Institutions* refer to the 'formal or informal rules, norms, precedents, and organizational factors that structure political behaviour' (Pomey et al., 2010, p. 709). Institutions include government structures, existing policies and policy legacies influencing policy development (Hall, 1997; Pomey et al., 2010). Further, policy networks that bridge collaboration between the government and those in other sectors can be integral to accelerating policy development (Gauvin, 2014). *External factors* refer to political and economic changes, media coverage, the release of news reports, practice developments and advances in science (Pomey et al., 2010). These factors can either propel an issue into the spotlight to facilitate policy development or hinder its progress by detracting from the issue.

4.3 | Data collection

We included both academic and grey literature in our review. With the aid of a professional librarian, we conducted a rapid review (Tricco et al., 2017) of documents identified through a database search of CINAHL and Medline (see Supplementary File S1 for the search strategy). Our search included policy documents that guide genomics-informed nursing education or practice in the US and the UK; documents that discussed the development

of adopted nursing policy or specific policy documents related to genomics from the US and the UK; and documents that discussed any work focused on integrating genomics into nursing education and practice in the two jurisdictions of interest. The purpose of including these documents was to extract key policy features and the drivers that led to their development. We recognized that interprofessional genomics policy documents may also be relevant and did not limit our search to only nursing-specific documents. We limited our search to documents from 2000 to align with significant developments in genomics, such as the completion of the Human Genome Project (see Supplementary File S2 for the inclusion and exclusion criteria).

We searched for documents specific to oncology nursing and general genomics nursing that could apply to oncology. Our search was intentionally broad and not restricted to oncology nursing because general genomics nursing policies are likely relevant to many specialty nursing practice contexts. Further, there is limited availability of policy specific to genomics-informed oncology; therefore, our goal was to review policy documents from a generalist perspective and compare the specialized oncology policies we might find to inform our recommendations for the practice setting of oncology. Given our aim to inform policy recommendations for genomics-informed oncology nursing at a national level, we focused on national documents in the US (rather than state-specific) and documents that applied across the UK (rather than specific countries in the UK).

We imported documents into Covidence, a review management software, and, with duplicates removed, screened 606 articles (see Figure 1). In addition to the database search, we asked subject matter experts from the project advisory committee to identify documents that were influential in accelerating genomic nursing practices within their jurisdictions. Further, we conducted a targeted website search of global and national nursing and health service organizations from the US and the UK that focused explicitly on oncology or genomics to locate policies that could inform Canadian oncology practice and education. Documents shared by subject matter experts and articles included in the database search informed our targeted website search. Through these sources, we included 43 additional documents. Three reviewers (P.C., A.G., R.P.) piloted the title and abstract screening process with 10% of the documents and revised the inclusion and exclusion criteria for clarity. Two reviewers screened titles, abstracts, and full-text articles, and we resolved discrepancies through consensus meetings. We retrieved Canadian policy documents supporting oncology nursing practice and education to situate our findings within the Canadian context. We identified these documents in consultation with our advisory committee.

4.4 | Data analysis

We included 94 documents in our analysis—64 from the US, 28 from the UK and two which discussed both jurisdictions. We extracted data from these documents using a data extraction form and refined it based on our pilot using 10% of the documents (Supplementary File S3). We first analyzed each jurisdiction as a single case, followed by cross-case comparisons. We also compared core policy features from our US and UK document analysis against Canadian oncology nursing policy documents to identify similarities and differences. The lead author (P.C.) imported extracted data into Quirkos version 2.3.1 (2020), a qualitative

data analysis software to support data analysis and shared findings regularly with the research team for feedback. Data related to policy features were coded into categories using an inductive approach. Data related to policy drivers were coded into categories using both a deductive and inductive approach (Fereday & Muir-Cochrane, 2006); first, data were categorized into components of the 3i + E framework and later categorized inductively into more specific categories under each component. Our advisory committee provided feedback on our initial findings to help us contextualize the evidence.

5 | FINDINGS

5.1 | Policy features

We categorized policy documents into four key types: (1) position statements/policy advocacy briefs, (2) competencies, (3) scope and standards of practice and (4) education or curriculum frameworks. We noted certain differences in the structure of US and UK nursing policy documents and identified overlap with these four categories. For example, in some instances, competencies were combined with education frameworks or standards of practice. See Figure 2 for a visual summary of findings and Table 2 for a summary of the types of policy documents and descriptions of their features.

5.1.1 | Position statements and policy advocacy briefs—In the US, several professional nursing organizations such as the Oncology Nursing Society (ONS), the American Nurses Association (ANA), AAN, and the International Society of Nurses in Genetics (ISONG) have developed position statements and policy advocacy briefs on a wide range of genomics topics relevant to nurses (AAN, 2009; Badzek et al., 2008; Bjerkerot, 2003; ISONG, 2013, 2018a, 2018b, 2020, 2021a, 2021b, 2021c, 2022a; Lea, 2002; ONS, 2000a, 2000b; Starkweather et al., 2017, 2018). While we acknowledge that ISONG is an international organization, the leadership and membership are heavily represented by US nurses, and the organization is most influential in that jurisdiction. As a result, we categorized ISONG documents under the US. Unlike the US, we found few position statements and policy advocacy briefs within the UK (Middleton et al., 2023). Discussions with subject matter experts from our advisory committee suggested that genetic counsellors have historically provided the bulk of specialized genomic services in the UK, and only recently has there been more emphasis on nurses integrating genomics into their practice and the development of the genomic nurse role which might explain the limited number of position statements.

5.1.2 | Competencies—We found various competency documents that outline the behaviours and actions of different healthcare providers relevant to genomics in the US. For example, we identified competencies developed by the National Coalition for Health Professional Education in Genetics [NCHPEG] for all healthcare professionals (Jenkins et al., 2001), competencies for all nurses (Consensus Panel on Genetic/Genomic Nursing Competencies, 2009), specialty nursing areas such as oncology and informatics (Calzone et al., 2002; McCormick & Calzone, 2017) and nurses at the graduate level (Greco et al., 2011a). We identified a fundamental policy document in the UK outlining competencies and

guidance to support education (Kirk, Tonkin, & Skirton, 2011). Last updated in 2011, this document organizes competencies into similar categories to US competency documents.

5.1.3 | Scope and standards of practice—In the US, ISONG and the ANA jointly developed a draft third edition of their scope and standards of practice document for nurses in genomics (ISONG, 2022b). We found specific mention, though brief, of genetics and/or genomics in regulatory standards developed by the Nursing and Midwifery Council (NMC)—the nursing and midwifery regulator in the UK (NMC, 2018, 2019a, 2022).

5.1.4 | Education and curriculum frameworks—Finally, we found a key education and curriculum framework from the US (Consensus Panel on Genetic/Genomic Nursing Competencies, 2009). This document guides curriculum development and provides a variety of implementation strategies for education and professional development. We also found a brief mention of genomics in general nursing education policy documents that were not specific to genomics at the baccalaureate and master's levels (American Association of Colleges of Nursing, 2008, 2011). Similarly, a key document guiding education and curriculum from the UK (which we also categorized under 'competencies' above) was identified (Kirk, Tonkin, & Skirton, 2011).

5.1.5 | Canadian oncology nursing policy infrastructure—To contextualize the findings described above, we identified existing national policy documents that guide oncology nursing education and practice within Canada and compared them to the policy features identified from the US and UK. We retrieved 12 documents by consulting subject matter experts on our advisory committee representing CANO and CASN. While content related to genomics was minimal, the documents guiding oncology nursing and education in Canada were similar to those of the US and the UK, including position statements (CANO, 2015a, 2015b, 2016a, 2016b, 2020, 2021); competency, scope and standards of practice documents (CANO, n.d.-a, n.d.-b, 2006) and education or curriculum frameworks (CANO, 2018; CASN, 2022).

5.2 | Policy drivers

5.2.1 | Ideas—Drawing on the 3I + E framework, we identified two key ideas that influenced policy development and the integration of genomics into nursing practice and education in the US and the UK. These included (1) nurses' values in aligning with evidence and meeting public expectations and (2) evidence demonstrating gaps in knowledge, skills and competence. To illustrate the overlapping evidence found across multiple documents, references supporting this section of the findings are in Table 3.

Nurses' values in aligning with evidence and meeting public expectations: Prompted by the completion of the Human Genome Project in 2003, the literature emerging from the US promoted an urgency for all healthcare professionals, including nurses, to keep pace with advances in the field and enhance genomic literacy in their practice. Nursing leaders, healthcare organizations, research and funding bodies and government all recognized the impacts of scientific advancements on the transformation of healthcare and nursing, including screening, diagnostics, therapeutics and prevention. These advancements

expanded public interest, increased demand for genomic health services and raised expectations of healthcare providers. The reviewed documents illustrated the value that nursing leaders placed on ensuring nurses have the requisite knowledge, skills and competencies to meet public expectations, provide patient and family education and referrals, understand genomic contributions to diseases, address ethical issues and deliver routine genomic healthcare. This awareness cut across all nursing specialties, highlighting the importance of preparing nurses to lead genomic and precision healthcare. A vital part of establishing nurses as leaders in genomics involved engaging nurses in research and positioning them as central to policy development.

In the UK, the growing demand for genomic healthcare technologies is exceeding the capacity of specialist genomic services. Findings suggest increases in referrals to specialists, interest in cascade testing among patients and families and general interest in genomic health services. Like the US, UK stakeholders identified the ability of genomic technologies to revolutionize healthcare and the need to develop new models of care. To better prepare the nursing workforce, considerable attention was placed on developing education, strengthening nursing leadership and policy and exploring specialist roles. As in the US, documents emphasized the significant role of nurses as the largest group within the healthcare workforce and how they could optimize the integration of genomics to improve health outcomes.

Evidence demonstrating gaps in nurses' knowledge, skills and competencies: In the US, the expansion of genomics led to new nursing roles and responsibilities. The lack of knowledge in genomics within the nursing workforce prompted the development of competencies, education frameworks and standards to guide education and practice. Likewise, a key driver for developing policies in the UK was the evidence highlighting gaps in genomic-related knowledge, skills, competency and confidence among healthcare providers. This lack of knowledge was linked to factors such as poor understanding of the importance of genomic healthcare in professional practice, a shortage of educators with subject matter expertise and the inconsistent delivery of education. Health system leaders recognized that policies were needed to incorporate genomics into formal education and professional development. Priorities included integrating content into the curriculum, providing professional development for students and practising nurses, enhancing interdisciplinary collaboration, and supporting educators, mentors, nurses, and managers to respond to a rapidly developing field and investing in specialist education.

5.2.2 | Interests—As with any introduction of innovative technologies, healthcare services or nursing practices, the integration of genomics in both jurisdictions saw the involvement of a wide range of stakeholders. Our analysis identified three key groups that were instrumental in supporting the integration of genomics into nursing education and practice, including (1) nurse leaders, (2) professional organizations and interdisciplinary groups and (3) government, health service organizations and funding organizations.

Nurse leaders: In the US, the development of policy and the integration of genomics into nursing education and practice was heavily influenced by strong nursing leadership and champions who collaborated, advocated and pushed the boundaries through research,

policy development and advocacy. As early as the 1990s, US nursing leaders identified the need for robust infrastructure to integrate genomics into nursing practice, including national strategies, academic frameworks, accreditation, education, certification programs and interdisciplinary collaboration. This was evident through nurses' participation on government advisory committees, various national and global steering and working committees comprising nurse leaders from different domains of nursing, funding and research outputs and leadership in professional nursing organizations. We noted ongoing efforts by policy entrepreneurs to increase awareness of genomics and policy development to strengthen integration. Documents illustrated the process of developing and revising policy, ways to apply competencies into practice and education and recommendations for the profession to continue advancing genomics into nursing practice. We also noted that scholars, many affiliated with professional nursing organizations, disseminated this knowledge through various venues, such as peer-reviewed journals and newsletters/journals of professional nursing organizations, to support the diffusion of genomics into practice, education and research.

The UK documents contained similar calls to develop infrastructure, including research capacity, collaborative partnerships, National Health Service (NHS) resources and genomics integration into standards of practice. Like the US, nurse leaders in the UK played a significant role in policy, advocacy, research and infrastructure development. Notable examples of nurse leadership included the Task and Finish Group, which led policy work focused on visioning a future for genomics in the UK by identifying key issues and solutions to inform future action. We also found evidence of significant advocacy by nurse leaders to incorporate genomics into regulatory standards and to develop and update a revised competency-based framework for nurses. As with the US, nurse leaders in the UK raised awareness of genomics through academic publications.

Professional organizations and interdisciplinary groups: Within the US, nursing and healthcare organizations and collaborations among experts across disciplines drove policy development and the integration of genomics into nursing education and practice. A notable collaboration began in the 1990s between the ANA, the American Medical Association and the National Human Genome Research Institute to develop national genetics education through the NCHPEG. Both academic and grey literature illustrated the efforts and progress made over the last two decades through professional nursing organizations and coalitions, such as the ANA, Association of Colleges of Nursing [AACN], ISONG, ONS, NCHPEG and the Global Genomics Nursing Alliance (G2NA), health service institutions and academic institutions to support the development of policy, practice, education and research.

In the UK, the interests of stakeholders, including patients and families, individuals from relevant fields of healthcare, and national and global bodies such as the NMC, the G2NA, the Association of Genetic Nurses and Counsellors, the Clinical Genetics Society, the Genetic Alliance UK and the Foundation for Genomics and Population Health influenced the integration of genomics into education and practice. Several documents mentioned a whole-systems approach centred on collaboration across professional groups, disciplines, specialties and entities within the NHS. We noted fewer professional nursing and health

organizations in the UK compared to the US, which may be a result from differences in size, population, and health system structures.

Government, health service organizations and funding institutions: In the US, interest from government and federal funding institutions related to nursing, genomics, and oncology enabled the development of research, policy and education. Some key stakeholders included the National Institutes of Health (NIH), the National Institute for Nursing Research (NINR), the National Human Genome Research Institute (NHGRI) and the National Cancer Institute (NCI). Documents revealed that research, policy development and education initiatives were made possible due to federally funded projects and the involvement of these collaborative partnerships. While nurse leaders and champions have primarily driven support from government and funding institutions in the US, one vital difference is that in the UK, the government and the NHS have provided mechanisms to accelerate action on developing national strategies and plans about genomics.

In the UK, there was significant political drive and interest within the government to accelerate genomics integration in healthcare, as evidenced by strategic plans and policy documents developed by the government and the NHS over the last two decades. In the early 2000s, the UK's Department of Health released a white paper, followed by a progress review in 2008, emphasizing the importance of educating health professionals to translate advances in genetics into practice. Government support was also evident through the Science and Technology Committee hearings and responses to expert evidence, which recommended strengthening infrastructure and mechanisms to support education and training and incorporating genomics into the NMC's regulatory standards. A review of documents indicated significant investment in integrating genomics into healthcare from organizations such as the Medical Research Council, Cancer Research UK and the National Institute for Health Research (NIHR). Strategic visions and operational plans and reports provided recommendations and a vision towards the required organizational infrastructure, funding, education, training, research needs and the role of professional organizations in strengthening the integration of genomics into healthcare.

5.2.3 | Institutions—Government and organizational structures significantly impact the acceptability of healthcare innovations and the speed of diffusion across the system. Further, policy networks are central to supporting collaboration between governments and healthcare systems. Our analysis identified that the composition and strength of policy networks and infrastructure played a significant role in developing policy to support the integration of genomics into nursing education and practice.

Policy networks and infrastructure: The US government began developing policy networks and infrastructure to examine the implications of genetics as early as the 1990s in response to calls from the US Deputy Surgeon General for nurses to participate in the Department of Health and Human Services Secretary Advisory Committee on Genetic Testing. Documents that provided historical context illustrated that genetics was a priority on the nursing profession's policy agenda as early as the 1980s, and the initiation of policy discussions amongst organized groups such as ISONG and the interdisciplinary team began in the 1990s. Collaboration and strategic partnerships among stakeholders

enabled the establishment of infrastructure to integrate genomics into professional nursing practice. For example, the government funded the Genetic/Genomic Nursing Competency Initiative (GGNCI), which paved the way for competency development. The initiation of the NCHPEG supported education across disciplines and the development of a Genomic Nursing Science Blueprint guided research to inform nursing practice and regulation. Further, the exploration of credentialing led to the development of a genomic nursing credential through the American Nurses Credentialing Center. Our analysis also revealed that work had been done through policy networks to integrate genomics into healthcare institutions such as Magnet hospitals.

Stakeholders within these policy networks grew over the years, with increased global collaboration through organizations such as the G2NA—a unified international voice dedicated to promoting and accelerating the integration of genomics into nursing practice. National nursing organizations led policy development in collaboration with educational institutions, certifying bodies, regulatory agencies, funding institutes and representation from interdisciplinary teams. Part of this infrastructure also involved developing the necessary governance structures and mechanisms to enable policy advocacy through professional nursing associations.

The integration of genomics within the UK was also heavily supported by strong policy networks and infrastructure comprising government, the NHS, subject matter experts, patients and families, national and global professional organizations, the Council of Deans and Heads of Faculties for Nursing and Health Professionals and funding bodies. Multiple documents indicated that stakeholders within these policy networks remain committed to positioning the UK as a leader in genomics health, research, development and innovation. From a governance perspective, there were early calls for collaboration among devolved governments to establish centralized infrastructure such as the NHS National Genetics Education and Development Centre. Compared to the US, the UK infrastructure is more centralized and robust, likely due to a combination of population, size, health system structures, level of government support and a centralized national health service organization. Several national research councils, networks, alliances and programs supporting the integration and expansion of genomics in healthcare have been developed as part of the broader policy network to support a nationally coordinated and locally delivered network. Similar to the US, engagement with global nursing organizations such as the G2NA contributed to expanding policy networks.

5.2.4 | External factors—We identified two themes related to external factors that influenced the integration of genomics into nursing practice and education in the US and the UK, including (1) advances in the science of genomics and contributions to healthcare and (2) changing healthcare and policy landscapes nationally and globally.

Advances in the science of genomics and contributions to healthcare: Since the completion of the Human Genome Project and subsequent notable milestones, such as President Obama’s 2015 launch of the Precision Medicine Initiative, genomics remains a priority for US healthcare. Analysis of documents in the UK also revealed the impact of scientific advances on preparing nurses to keep pace using the most updated knowledge. As

in the US, notable milestones in the UK, such as the launch of the 100,000 Genomes Project, have heightened awareness of the potential of precision health. In both jurisdictions, the rapid pace of genomic discoveries, increased funding for research and programs, increased media coverage, public awareness and proliferation of genomic technologies created a sense of urgency to adequately prepare nurses.

Shifting healthcare landscapes nationally and globally: Global and national legislation and regulatory policy developments beginning in the late 1970s supported the advancement of genomics-informed healthcare and the development of the genomic nursing specialty across different jurisdictions. Over time, the US government introduced legislation such as the *Genetic Information Non-Discrimination Act* of 2008, the *Affordable Care Act* of 2010 and the *21st Century Cures Act* of 2016 to address discrimination related to genetic information, access to health services, and the use and sharing of genomic data. These legislative changes influenced nurse leaders to respond to changing policy landscapes. Developments in other professions also influenced the nursing profession's infrastructure needs. For example, documents that included historical overviews of genomics and nursing developments revealed that in the early 1990s, the American Board of Medical Genetics recognized genetics as a specialty and created a separate certification pathway for genetic counsellors. This created gaps in certification options for nurses specializing in genetics, leading to the development of nursing-specific infrastructure. We also noted the impact of interdisciplinary collaborations through groups such as NCHPEG, which developed core competencies for all healthcare professionals. From a global perspective, there was a significant reference to policy, education, and other infrastructure developments in the UK and a discussion about what could be learned and applied in the US.

We found multiple references to priorities in foundational reports in the UK, such as the *2003 White Paper* by the Department of Health and the release of subsequent national government and NHS plans and strategies. These strategies and policy directions played a role in strengthening the integration of genomics into nursing education and practice as they laid out policy priorities to accelerate education and practice nationally. Experts on our advisory committee from the UK also shared documents that influenced genomic nursing strategies globally. Like the US, cross-jurisdictional influences and collaboration were apparent in the UK documents with references to the policy work done in other countries and the importance of collaboration and learning from global partners.

6 | DISCUSSION

Policy infrastructure is critical for supporting and advancing professional practice in all healthcare disciplines. As identified in our analysis, policy infrastructure from an advocacy, regulatory and education perspective is essential for establishing boundaries for a specific practice area. This can be achieved by identifying the nature and scope of practice, responsibilities and accountabilities of healthcare professionals and the knowledge, skills and competencies required to provide high-quality patient care.

Our US and UK document analysis identified a meaningful context to benchmark Canadian nursing policy needs and readiness for accelerating genomic integration into oncology

nursing practice. To ensure that genomic integration efforts across nursing are lasting and impactful, nursing leaders and policymakers can learn from global genomics advocates who have created well-established policy infrastructure in their respective jurisdictions (Tonkin et al., 2020b). Using a systematic approach guided by the 3i + E framework, we identified key features of nursing policy infrastructure in the US and UK and the drivers that influenced its development. In this discussion, we explore how our findings can inform subsequent stages of the genomics implementation process for the Canadian oncology nursing context. Though this study focuses on oncology nursing, our findings may inform other nursing practice contexts.

6.1 | Considerations for genomics-informed oncology nursing policy in Canada

6.1.1 | Establish the scope of nursing policy infrastructure—Due to the similarities in features when comparing the US, UK and Canadian nursing policy documents, oncology nursing leaders in Canada can look to these existing documents to inform genomic policy development for nursing. From a policy advocacy perspective, oncology specialty groups are well positioned to advance nurses' role in genomics by developing position statements to establish the role of oncology nurses in the delivery of genomics-informed healthcare and to identify the priority actions required to integrate genomics into oncology health services. While some policy documents from the US and the UK focused on genomics and specialty practice contexts, many were developed to guide the integration of genomics into nursing more generally. These findings suggest that Canadian oncology nursing leaders should think critically about how genomics can be linked to existing scope of practice documents, standards of practice, education frameworks and competencies and what specific guidance is required for oncology nursing (Milani et al., 2023). Further, in developing competencies, standards, and curriculum frameworks, Canadian oncology nursing leaders should explore the merit of developing policy and guidance across the generalist to specialist and novice to expert continuums. The broad scope of nursing and the proliferation of nursing specialties have led to a wide range of policy documents that often lack interconnectedness. Given that genomics-informed nursing is in its infancy in Canada, oncology nursing leaders have an opportunity to reflect more deeply on how the development of oncology nursing policy infrastructure can lay the foundation for genomics-informed nursing more broadly.

While the US and the UK have a more mature policy infrastructure for genomics-informed nursing than Canada, implementation challenges persist, and there are 'teachable moments' to be gleaned from these experiences (Thomas et al., 2023). For example, in the US, where genomic competencies for nurses exist, Calzone, Jenkins, et al. (2018) implemented a multi-site, year-long intervention to increase nurses' genomic competency in Magnet hospital settings. Although they observed benefits from these interventions, they identified that a persistent barrier to sustained integration of genomics across nursing is the lack of nursing-sensitive quality and outcome measures for nurses' genomic competencies. Similarly, although the UK has been a global leader in developing infrastructure to support a genomics-competent healthcare workforce, Carpenter-Clawson et al. (2023) recently found that nurses in the NHS still experience limited confidence in providing genomics-informed care. Therefore, leaders engaged in developing policy for genomics-informed nursing must

clearly articulate the relevance of genomics to nursing practice and patient outcomes and identify mechanisms to apply standards of practice, competencies, education and curriculum frameworks, and advocacy recommendations. Further, to assess the benefits of genomics-informed nursing interventions on patients and families, a policy priority must include developing evaluation and outcome measures to inform decision-making, continuous improvement, and to drive research across nursing and genomics to expand the evidence base.

6.1.2 | Embed interdisciplinarity in policy development—Healthcare in the 21st century is delivered through interprofessional teams, and it is essential for leaders developing policies to consider how nurses can optimize interdisciplinary collaboration to improve patient satisfaction and outcomes. This is especially important for genomics-informed healthcare as there is an overlap in scopes of practice with other providers, such as genetic counsellors. Nurses play a critical role in coordinating and navigating patient care and must work effectively in the interdisciplinary context. While our search was broad to include interprofessional policy documents, aside from the NCHPEG competencies developed in the US, there was limited guidance for interprofessional genomics education and practice. This finding suggests a window of opportunity exists for Canadian nurses to lead in developing interdisciplinary policy infrastructure and promising practices that could be influential globally.

6.1.3 | Develop policy guidance to address unique equity considerations— The extant literature suggests that while genomic technologies can improve health outcomes, they can also perpetuate and create more significant health inequities among populations who are already experiencing health disparities (Balogun & Olopade, 2021; Curtin, 2022; Gross et al., 2022). However, we found little focus on equity in nursing policy documents and a lack of policy direction on nurses' roles and responsibilities in addressing equity concerns pertaining to genomics. While the existing code of ethics, standards of practice and competencies already articulate nurses' roles in addressing inequities, Canadian oncology nursing leaders can explore whether current policy direction is sufficient and whether greater clarity is required to help oncology nurses navigate the unique equity issues associated with genomics-informed healthcare. A comprehensive review of the available evidence on genomics-informed strategies to address health inequities is needed to develop practice and policy guidance addressing these issues.

6.1.4 | Establish policy guidance for navigating unique legal and ethical implications—Finally, our analysis revealed ethical and legal considerations related to genomics-informed healthcare, highlighting a need for nursing leaders to be involved in developing policy and practice supports to ensure nurses are positioned to address these issues. Concerns about discrimination associated with genetic test results in Canada led to the enactment of the *Genetic Non-Discrimination Act* (Government of Canada, 2017) to protect individuals against discrimination when purchasing insurance, gaining employment and other situations. Recent commentary has outlined the clinical practice implications of this legislation for Canadian physicians, including what patients should be educated on, services patients can be offered, and safeguards for collecting, using, and disclosing health

information (Cowan et al., 2022). The proliferation of direct-to-consumer genomic testing also introduces new concerns around regulatory standards, marketing practices, privacy, informed consent and the risks of misinterpreting results (Ann VerStrate & Mahon, 2023). As genomics becomes increasingly embedded into the delivery of health services and patients become more interested in a wide range of genomic testing options, nurses must be prepared to address these complex legal and ethical risks. As a result, Canadian nurses would benefit from policy and practice direction to better support individuals and families in making informed decisions about genomics-informed healthcare.

Identifying drivers to accelerate genomics-informed oncology nursing in Canada: The policy drivers identified in our analysis provide a helpful starting point to accelerate the integration of genomics into oncology nursing in Canada. Through global collaboration, critical success factors that can guide the strategic integration of genomics across nursing have been established (Tonkin et al., 2020a). Considering the current Canadian policy landscape, there are specific drivers that oncology nursing leaders can leverage when contemplating nursing policy development.

6.1.5 | Capitalize on the nursing profession's core values—First, a key idea that influenced the integration of genomics into nursing education and practice in the US and the UK was the value the nursing profession placed on aligning with evidence and meeting public expectations. In a recent national survey by Genome Canada (2022) with over 3000 Canadians, 70% indicated they were interested in learning more about genomics, and 78% indicated they wanted more or comparable investments for genomic healthcare and research in Canada. The survey findings also indicated that public awareness, perceptions and support for genomics increased following the COVID-19 pandemic. Across Canada, multigene panel testing is also becoming embedded into cancer centres as routine care for certain cancers (Richardson et al., 2020). The current advances and appetite for genomic technologies across Canada can be leveraged and amplified as a driver to integrate genomics into nursing education and practice. The increase in public interest suggests the need to engage meaningfully with patients and public groups to develop policies for genomics-informed oncology nursing. It will be essential to promote public engagement and awareness of genomics and to ensure that policies for genomics-informed oncology nursing are responsive and sensitive to patient and societal expectations and values (Thomas et al., 2023).

6.1.6 | Galvanize nursing leadership—A consistent policy driver in the US and the UK was sustained nursing leadership. Leadership is identified as a critical success factor (Tonkin et al., 2020a), and this is cause for optimism in Canada, given the recent resurgence of Canadian nursing leaders committed to advancing the integration of genomics across nursing. For example, in 2020, nurse leaders (some of whom were part of this study) developed the Canadian Nursing and Genomics (CNG) Initiative and have engaged extensively with various national and international stakeholders within and beyond nursing. We have also noted an increase in genomic nursing scholarship over the past three years in Canada (Carlsson & Limoges, 2022; Dewell et al., 2020, 2021; Hébert et al., 2022; Limoges & Carlsson, 2020; Limoges et al., 2022; Puddester et al., 2023; Swadas et al., 2022). The

recent inclusion of genomics into CASN's (2022) National Nursing Education Framework, used to accredit nursing programs, serves as a key driver to integrate genomics into curriculum. Professional organizations that accredit or approve nursing education programs can play a critical role in developing competency documents that guide the development of undergraduate and graduate-level education focused on foundational and specialist genomic knowledge.

Our findings suggest that more than motivation is needed; infrastructure is required to recruit and assist nurse leaders to develop genomic literacy. For example, in the US, for over 20 years, the National Institute of Nursing Research sponsored the Summer Genetics Institute (SGI), a 2-month intensive training program in genetics for nurses. Many graduates from the SGI have gone on to publish nationally funded genetic research, provide genomic education in their institutions and integrate genomics into patient care (Hickey et al., 2013). The success of the SGI and other examples from the US and the UK inspire what Canada can achieve with continued national nursing leadership and the necessary infrastructure to support developing nursing expertise in genomics. From a global nursing leadership perspective, we noted that US and UK nurses with genomics expertise collated their expertise across boundaries (primarily through ISONG and the G2NA), which has not only benefited these jurisdictions but has also contributed to international efforts in genomic nursing integration, including in developing countries (Abad & Sur, 2022). The ability to foster collaboration and leverage resources and international subject matter experts from the G2NA is currently a policy driver in Canada (Limoges et al., 2022).

6.1.7 | Leverage funding windows of opportunity—Much of the infrastructure in the US and UK has been possible through government and funding institutions' continued prioritization and investment in genomics education for healthcare providers. In Canada, federal funding commitments are sparse and are far less than in other countries. However, there is evidence of a current upswing in genomics funding in Canada. In 2022, federal funding amounted to $400 million as part of a pan-Canadian genomics strategy (Government of Canada, 2022). Additionally, the Institute of Genetics within the Canadian Institutes of Health Research (CIHR, 2022), Canada's primary federal health research funding agency, developed a 5-year strategic plan titled *Sequencing our Future*, outlining plans to see genomic integration as routine care. To realize this plan, the Institute of Genetics (CIHR, 2022) noted the importance of interdisciplinary health professional genomics training programs and explicitly listed nurses as part of the interdisciplinary team that 'can bring about a level of knowledge and awareness such that patients and society can benefit from genomic medicine' (p. 23). Including nurses in this strategic plan illuminates an opportunity for nursing researchers, policymakers, educators and organizations such as CANO to leverage the association between funding, infrastructure and genomics nursing leadership.

6.1.8 | Foster strategic interdisciplinary partnerships—In both the US and the UK, a key policy driver was interdisciplinary collaboration. For example, the formation of NCHPEG in the US supported the development of interprofessional competencies and education. In the UK, the Genomics Education Programme (established in 2005 as the

NHS National Genetics Education and Development Centre) has educated employees in the NHS, including partnering with seven universities to offer a master's program in genomics in healthcare for multidisciplinary team members (Carpenter-Clawson et al., 2023). This highlights that interdisciplinary approaches to developing policy, practice guidance, and education surrounding roles for various members of the oncology care team (e.g. nurses, physicians, pharmacists) may represent a practical approach to ensure that long-term strategies to integrate genomics are successful (Hoxhaj et al., 2021; Lepre et al., 2021; Spanakis et al., 2020). Prior momentum by nurses in Canada in the early 2000s was not sustained (Puddester et al., 2023), and Canadian physician groups have experienced parallel genomic medicine implementation challenges (Carroll et al., 2019). Our findings suggest that interdisciplinary collaboration and approaches may be beneficial to avoid repeating previous genomic integration challenges and help achieve a viable and sustainable genomics network in Canada.

7 | LIMITATIONS

While we undertook a rapid review using a systematic process, findings are limited to included documents published between 2000 and our search date of April 2023. There are likely documents that can provide additional evidence on policy features and drivers at local levels (e.g. regional or state); however, we focused on the national context, given our aim of informing policy recommendations for national Canadian nursing organizations. To mitigate some of these concerns, we sought feedback from subject matter experts from our international advisory committee with representation from the US and the UK before and after the analysis. Further, the experiences of other countries may inform the integration of genomics in practice. However, this analysis does not reflect these experiences, as we focused on the US and the UK since they have the most robust policy infrastructure and continue to be global leaders in advancing genomics-informed nursing. Despite these limitations, our findings provide a helpful starting point to inform subsequent actions to integrate genomics into oncology nursing across Canada.

8 | CONCLUSION

Canadian oncology nurses must prepare to engage in genomics-informed practice. Canada urgently needs policy to guide practice, education and research for genomics within nursing. Examining the policy features and drivers of jurisdictions with robust infrastructure is a beneficial way to inform policy development. The experiences of the US and UK demonstrate that change is incremental, and sustained investment from government and health service organizations, funding bodies, nurse leaders and interdisciplinary partners are essential to drive the acceleration of genomics-informed healthcare. Robust nursing policy infrastructure will create the necessary foundation to integrate and accelerate genomics into the Canadian oncology nursing practice context and inform other practice settings. Creating a genomically competent nursing workforce is important to ensure all citizens fully benefit from advances in genomic technologies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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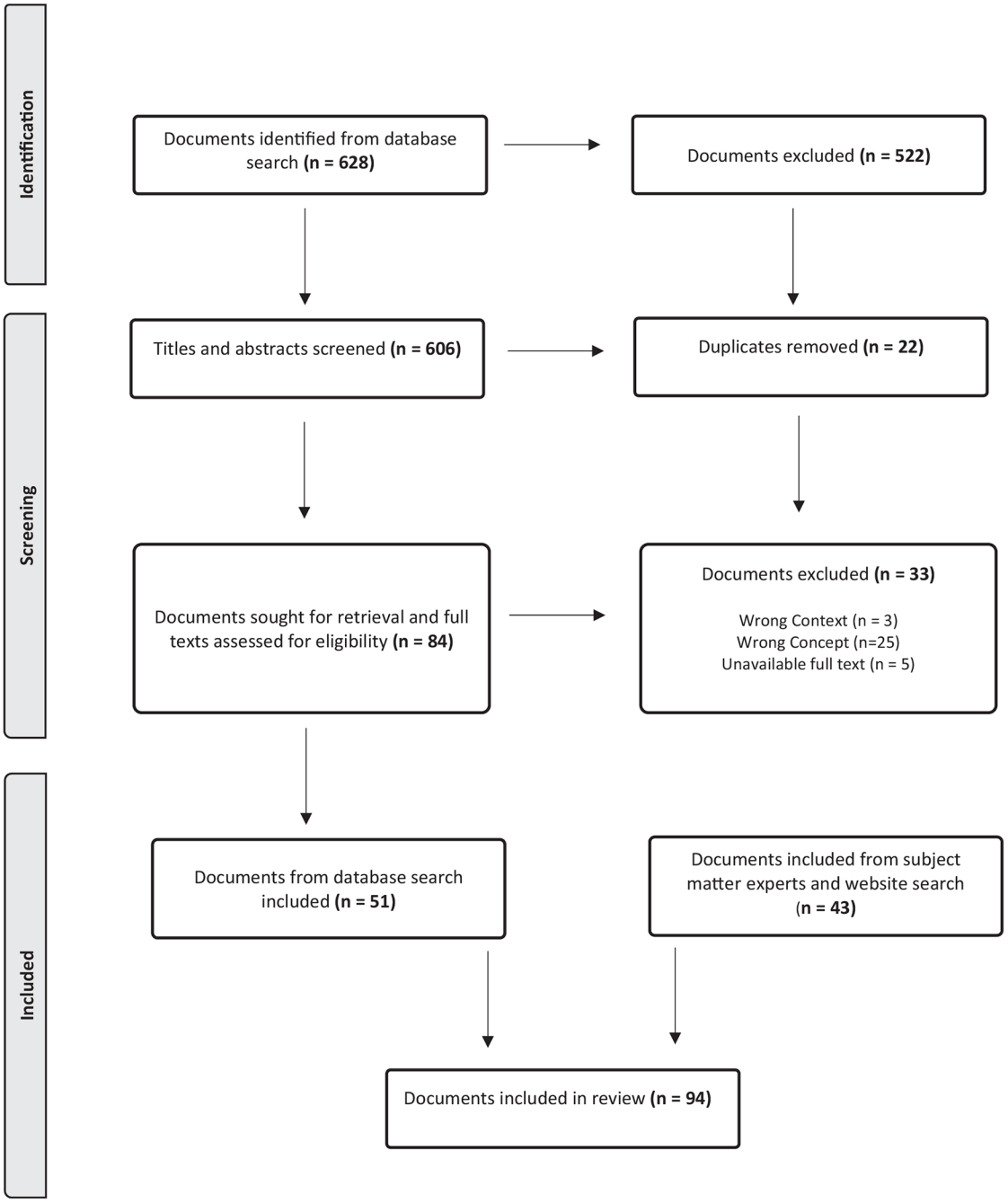

FIGURE 1.
PRISMA Flow Diagram adapted from Page et al. (2021).

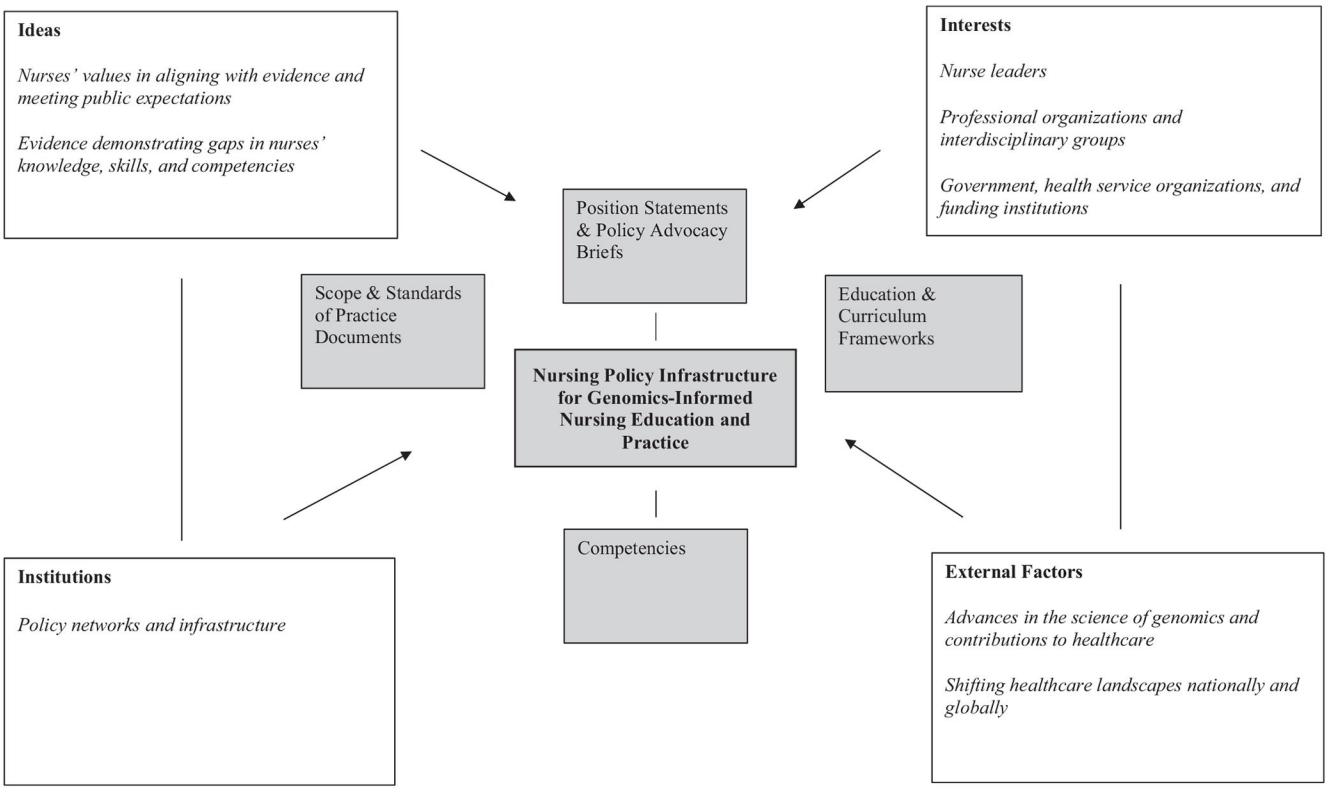

FIGURE 2.
Visual summary of findings.

TABLE 1

Definitions.

Term	Definition
Genomics	The study of all the genes in a person's DNA (their genome), including interactions of those genes with each other and the environment and their influence on the growth, development, and function of the body (National Human Genome Research Institute (NHGRI), 2022; National Health Service (NHS), 2023). In this article, we use genetics and genomics simultaneously.
Genetics	The study of genes and the roles in disease inheritance (NHGRI, 2022).
Policy	Statements of direction communicated in the form of standards of practice, competencies, scope of practice statements, position statements, and accreditation standards.
Policy Infrastructure	The wide range of policy documents, stakeholders, and institutions that guide, support, and advance practice.
Policy Features	The content, characteristics, and structures of policy documents.
Policy Drivers	The ideas, interests, institutions, and external factors that can influence, or have influenced, the development of nursing policy in genomics.
Precision Health	Precision medicine, sometimes called precision healthcare, is an innovative approach to personalized treatment using genetic information and lifestyle and environmental variables to provide a predictive and tailored patient preventative or treatment plan (National Health Service [NHS], 2020).

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TABLE 2

Summary of nursing policy documents and features.

Document type	Features (US)	Features (UK)	Canada[a]
Position statements and policy advocacy briefs	*Scope*: Statements regarding • Teamwork across professions • Informed decision-making and consent • Privacy and confidentiality • Newborn screening • Genetic counselling for vulnerable populations • Direct-to-consumer testing • Education, policy, leadership and research	*Scope*: Statements regarding • The scope of practice for different professional groups	*Scope*: Statements regarding • The role of oncology nurses, the nature of their work and education for specific areas of oncology nursing practice • Professional development and certification • Leadership
Competencies	*Scope*: Competency documents for all healthcare professionals, all nurses and specialty nursing areas. *Characteristics*: Competencies related to • Knowledge of the state of science • Disease processes and treatment options • Benefits and risks • Assessments • Patient-centred and tailored care • Communication and patient education • Ethical, legal and social issues related to genomics • Continuing competence • Research and quality improvement • Recognizing personal biases and ideas • Advocacy	*Scope*: Competencies for undergraduate nursing education. *Characteristics*: Competencies related to • Knowledge of genetics/genomics • Disease processes and treatment options • Patient and family centred and tailored care • Ethical, legal and social issues related to genomics • Recognizing personal biases and ideas • Continuing competence • Communication and patient education • Advocacy • Referrals	*Scope*: Scope of practice, standards, competencies, roles and practice expectations for oncology nurses and oncology nursing practice in systemic therapy. *Characteristics*: Standards and competencies related to • Comprehensive health assessment • Supportive and therapeutic relationships • Management of cancer symptoms and treatment side effects • Teaching and coaching • Facilitating continuity of care and navigating the system • Decision-making and advocacy • Professional practice and leadership
Scope and Standards of Practice	*Scope*: Outlines the scope of genomic nursing practice, features of the nursing role, levels of genomic nursing practice (e.g. basic and advanced), practice settings relevant to genomics and ethical implications. *Characteristics*: Key standards and competencies at the basic and advanced levels are mapped against each standard. Standards are organized by the following: • Assessment • Diagnosis • Outcome identification • Planning • Implementation • Evaluation • Ethics • Advocacy • Respectful and equitable practice • Communication • Collaboration • Leadership • Education • Scholarly inquiry • Quality of practice • Professional practice evaluation	*Scope*: Regulatory standards (general standards for registered nurses, nursing associates and specialty areas) include brief statements that articulate the expectations of nurses demonstrating and applying knowledge of genomics to support patient health and well-being. *Characteristics*: Practice standards for specialty or advanced practice nurses and midwives had more frequent mention of genomics competencies than those for registered nurses, or those with a more limited scope of practice.	*as indicated above under competencies.

Document type	Features (US)	Features (UK)	Canada[a]
	• Resource stewardship • Environmental health		
Education and Curriculum Frameworks	*Scope*: Genomics-specific and general education and curriculum frameworks. *Characteristics*: Genomics-specific document guides curriculum development and provides a variety of implementation strategies for education and professional development. General nursing education frameworks include statements about the need to recognize the relationships of genomics to health prevention, maintenance and treatment and the importance of incorporating emerging and current evidence into practice.	*Scope*: Genomics-specific education and curriculum framework. *Characteristics*: Maps practice indicators and learning outcomes for each level of undergraduate nurse training against eight key competency areas.	*Scope*: General nursing and oncology-specific education frameworks. *Characteristics*: Maps essential elements for different education levels (e.g. foundational to specialized and undergraduate to graduate education).

[a]Canadian documents focus specifically on oncology nursing.

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TABLE 3

Supporting evidence and references for policy drivers.

Policy drivers	US	UK
Ideas	Evidence and references	Evidence and references
Nurses' values in aligning with evidence and meeting public expectations	• Recognition of the impacts of scientific advancements on the transformation of healthcare and nursing (Anderson, Monsen, et al., 2000; Badzek et al., 2008; Calzone et al., 2002, 2014, 2021; Greco & Salveson, 2009; Greco et al., 2011b; ISONG, 2022b; Jenkins, 2002; Jenkins et al., 2001; Jenkins & Calzone, 2007; Lewis, 2001; McCormick & Calzone, 2017). • Expanded public interest, needs and expectations (AAN, 2009; Anderson, Monsen, et al., 2000; Calzone et al., 2011; Consensus Panel on Genetic/Genomic Nursing Competencies, 2009; Friend et al., 2021; Greco et al., 2011b; ISONG, 2022b). • Recognition of the importance of ensuring nurses have the knowledge, skills and competencies (Badzek et al., 2008; Consensus Panel on Genetic/Genomic Nursing Competencies, 2009; Greco & Salveson, 2009; Kurnat-Thoma et al., 2021; Williams et al., 2006). • Recognition of impact on professional practice (Anderson, Monsen, et al., 2000; Engstrom et al., 2005; Jenkins, 2011). • Need to prepare the nursing workforce to lead genomics and precision healthcare (AAN, 2009; Anderson, Monsen, et al., 2000; Calzone et al., 2011, 2021; Greco & Salveson, 2009; Tonkin et al., 2020a). • Ensuring nurses are engaged in research and policy development (AAN, 2009; Anderson, Monsen, et al., 2000; Feetham et al., 2005; Kurnat-Thoma et al., 2021; Lewis, 2001).	• Recognition of increased referral rates to specialist services, interest in cascade testing among patients and families and general interest in genomic health services (Burton & Zimmern, 2005; Davies, 2017; Kirk, 2013; Kirk, Campalani, et al., 2011; NMC, 2019b; Topol, 2019). • The need to develop new models of care and infrastructure to support disease prevention, diagnostics, personalized management and targeted therapeutics across the continuum of care from rare to common diseases (Burton, 2011; Government of the United Kingdom, 2020; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk, 2013; Kirk et al., 2008, 2013; Kirk, Campalani, et al., 2011; Kirk, Tonkin, & Skirton, 2011; NHS, 2022; Topol, 2019; Welsh Government, 2017). • Development of education, strengthening nursing leadership and input in policy and the exploration of specialist roles (Burton, 2011; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk et al., 2008, 2013; Kirk, Campalani, et al., 2011; Topol, 2019). • Recognition of the role and potential of nurses, as the most considerable portion of the health workforce, to optimize the contributions of genomics to improve health (Andrews et al., 2014; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk, Campalani, et al., 2011).
Evidence demonstrating gaps in nurses' knowledge, skills and competencies	• Lack of knowledge in genomics within the nursing workforce (Badzek et al., 2008; Consensus Panel on Genetic/Genomic Nursing Competencies, 2009; Engstrom et al., 2005; Greco & Salveson, 2009; Jenkins & Calzone, 2007; Pestka, 2003; Williams et al., 2006). • Efforts to integrate genomics into all levels of nursing education and professional development (AAN, 2009; Badzek et al., 2008; Calzone et al., 2002, 2011, 2014, 2021; Calzone, Jenkins, et al., 2018; Friend et al., 2021; Greco et al., 2011b; Jenkins, 2011; Kelly, 2009; Lewis, 2001; McCormick & Calzone, 2017). • The development of policy to support entry-level, graduate-level and continuing education (American Association of Colleges of Nursing, 2008; Anderson, Monsen, et al., 2000; Badzek et al., 2008; Calzone et al., 2002, 2011, 2014; Greco & Salveson, 2009; Greco et al., 2011b; ISONG, 2022b; Jenkins, 2002; Kurnat-Thoma et al., 2021; Pestka, 2003; Regan et al., 2019; Williams et al., 2006).	• Low levels of knowledge in genomics due to a lack of understanding of the importance of genomic healthcare in professional practice, a shortage of educators with subject matter expertise and the inconsistent delivery of education (Burton & Zimmern, 2005; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk, 2013; Kirk et al., 2008, 2013; Kirk, Campalani, et al., 2011; Kirk, Tonkin, & Skirton, 2011). • The need to ensure that nurses at all levels of practice gain the necessary competence to deliver genomics-informed healthcare (Government of the United Kingdom, 2020; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk, Campalani, et al., 2011; Kirk, Tonkin, & Skirton, 2011; McDonald et al., 2003; NHS, 2022; Secretary of State for Health, 2009; Topol, 2019; Welsh Government, 2017).
Interests		
Nurse leaders	• Identified need by nursing leaders to develop robust infrastructure to support the integration of genetics into nursing practice, including policy, research, nursing education, clinical support tools and interdisciplinary collaboration with health organizations (AAN, 2009; Anderson, Monsen, et al., 2000; Calzone et al., 2021; Jenkins et al., 2001; Kurnat-Thoma et al., 2021; McCormick & Calzone, 2017; Regan et al., 2019; Starkweather et al., 2018; Tonkin et al., 2020a). • Nursing leadership through participation on government advisory committees related to genetics, various steering and working committees, secured funding and research output, leadership in professional nursing organizations and the development of infrastructure (Anderson, Read, & Monsen, 2000; AAN, 2009; Badzek et al., 2008; Calzone et al., 2007, 2011, 2021; Calzone, Jenkins, et al., 2018; Consensus	• Leadership in the development of policy, advocacy, research and the development of infrastructure (Burton & Zimmern, 2005; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk et al., 2008, 2013; Kirk, Campalani, et al., 2011; Secretary of State for Health, 2009; Tonkin et al., 2020a). • Recognition of the importance of research to translate scientific and clinical advances into nursing practice and the need to develop the evidence-base for outcomes of genetically/genomically competent care (Government of the United Kingdom, 2020; Kirk, Campalani, et al., 2011; NHS, 2022). • Recognition of the importance of including genetics/genomics into regulatory standards (House of Lords Science and Technology Committee, 2009a, 2009b; Kirk, Campalani, et al., 2011; Secretary of State for Health, 2009).

Policy drivers	US	UK
	Panel on Genetic/Genomic Nursing Competencies, 2009; Friend et al., 2021; Greco & Salveson, 2009; Greco et al., 2011b; ISONG, 2022b; Jenkins, 2011; Jenkins & Calzone, 2007; Jenkins et al., 2001; Kelly, 2009; Kirk, Calzone, et al., 2011; Kurnat-Thoma et al., 2021; Lea, 2002; Lewis, 2001; Sheets Cook et al., 2003; Tonkin et al., 2020a; Williams et al., 2006). • Leadership in policy development and raising awareness (AAN, 2009; Anderson, Monsen, et al., 2000; Anderson, Read, & Monsen, 2000; Badzek et al., 2008; Calzone et al., 2007, 2014, 2021; Eggert, 2017; Feetham et al., 2005; Greco et al., 2011b; Greco & Salveson, 2009; ISONG, 2022b; Jenkins, 2011; Jenkins et al., 2001; Kerber & Ledbetter, 2017; Kurnat-Thoma et al., 2021; Lea et al., 2005; Lewis, 2001; Lewis et al., 2006; Pestka, 2003, 2008; Sheets Cook et al., 2003; Tluczek et al., 2019; Trossman, 2006).	• Identified need for organizational policy and resources within the NHS (House of Lords Science and Technology Committee, 2009a, 2009b; McDonald et al., 2003; Topol, 2019). • Raised awareness of genomics through academic publications (Kirk, 2013; Kirk et al., 2008; Yeomans & Kirk, 2004)
Professional organizations and interdisciplinary groups	• Continued collaborations between organizations such as ISONG, ANA, American Association of Colleges of Nursing [AACN], G2NA, health service institutions and academic institutions supported the development of policy, practice, education and research (Anderson, Monsen, et al., 2000; Badzek et al., 2008; Calzone et al., 2007; Consensus Panel on Genetic/Genomic Nursing Competencies, 2009; Greco et al., 2011b; ISONG, 2022b; Jenkins & Calzone, 2007; McCormick & Calzone, 2017; Tonkin et al., 2020a).	• Collaboration with patients and families, individuals from relevant fields of healthcare and national and global bodies such as the NMC, the G2NA, the Association of Genetic Nurses and Counsellors, the Clinical Genetics Society, the Genetic Alliance UK and the Foundation for Genomics and Population Health (Burton, 2011; Kirk, 2013; Kirk et al., 2008; Kirk, Calzone, et al., 2011; McDonald et al., 2003; Middleton et al., 2023; NMC, 2019b; Tonkin et al., 2020a). • Need for a whole-system approach centred on collaboration across professional groups, disciplines, domains, specialties and entities within the NHS (Government of the United Kingdom, 2020; Kirk et al., 2008; Kirk, Campalani, et al., 2011; McDonald et al., 2003; NHS, 2022; Secretary of State for Health, 2009; Tonkin et al., 2020a; Topol, 2019).
Government, health service organizations and funding institutions	• Federally funded projects and the involvement of these key stakeholders supported research, policy development and educational resources (AACN, 2011; AAN, 2009; Badzek et al., 2008; Calzone et al., 2007, 2011; Jenkins & Calzone, 2007; Kelly, 2009; Kirk, Calzone, et al., 2011; Kurnat-Thoma et al., 2021; Lea et al., 2005; McCormick & Calzone, 2017; Regan et al., 2019; Tonkin et al., 2020a).	• Government interest in accelerating genomics integration in healthcare (Andrews et al., 2014; House of Lords Science and Technology Committee, 2009a, 2009b; Kirk, Calzone, et al., 2011; McDonald et al., 2003; Secretary of State for Health, 2009). • Investment from organizations such as the Medical Research Council, Cancer Research UK and the National Institute for Health Research (NIHR) (Davies, 2017). • Strategic and operational plans and reports from government and entities across the NHS (Andrews et al., 2014; Burton & Zimmern, 2005; Davies, 2017; Government of the United Kingdom, 2020; Government Office for Science, 2022; Kirk et al., 2013; McDonald et al., 2003; NHS, 2022; Topol, 2019; Welsh Government, 2017).
Institutions		
Policy networks and infrastructure	• Priority for government and nursing beginning in the 1980s (Anderson, Read, & Monsen, 2000; Jenkins & Calzone, 2007) and the initiation of policy discussions among organized groups such as ISONG and the interdisciplinary team began in the 1990s (Anderson, Monsen, et al., 2000; Feetham et al., 2005, ISONG, 2022b). • Collaboration and strategic partnerships among stakeholders enabled the establishment of infrastructure to support the development of policy, education and resources to facilitate the integration of genomics into professional nursing practice (Anderson, Monsen, et al., 2000; Boyd et al., 2017; Calzone, Jenkins, et al., 2018; Jenkins & Calzone, 2007; Kirk, Calzone, et al., 2011; Kurnat-Thoma et al., 2021; Lea et al., 2005; McCormick & Calzone, 2017; Williams et al., 2006). • Increased global collaboration through organizations such as the G2NA (Tonkin et al., 2020a). • The development of nursing policy was led by national nursing organizations and included the involvement of educational institutions, certifying bodies, regulatory agencies, funding institutes, and representation from the interdisciplinary team (AACN, 2008; Badzek et al., 2008; Consensus Panel on Genetic/Genomic Nursing Competencies, 2009; Greco et al., 2011b; Kelly, 2009; Pestka, 2008; Trossman, 2006). • Development of governance structures and mechanisms to enable policy advocacy	• Strong policy networks and infrastructure comprised of government, the NHS, subject matter experts, patients and families, national and global professional organizations, Council of Deans and Heads of Faculties for Nursing and Health Professionals, and funding bodies (Government of the United Kingdom, 2020; Government Office for Science, 2022; Kirk et al., 2008; NHS, 2022; Secretary of State for Health, 2009; Topol, 2019). • The development of several national research councils, networks, alliances, programs and advisory and strategy groups (Government of the United Kingdom, 2020; Government Office for Science, 2022; House of Lords Science and Technology Committee, 2009a, 2009b; McDonald et al., 2003; NHS, 2022; Secretary of State for Health, 2009; Yeomans & Kirk, 2004). • Increased global collaboration through organizations such as the G2NA (Tonkin et al., 2020a).

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Policy drivers	US	UK
	through professional nursing associations (AAN, 2009; Badzek et al., 2008; Calzone et al., 2021).	
External Factors		
Advances in the science of genomics and contributions to health care	• The rapid pace of genetics/genomic discovery, increased funding for research and programs, increased media coverage and public awareness and proliferation of genomic technologies (AACN, 2008, 2011; AAN, 2009; Badzek et al., 2008; Calzone et al., 2002, 2021; Friend et al., 2021; Greco et al., 2011b; ISONG, 2022b; Jenkins, 2002; Lewis, 2001; McCormick & Calzone, 2017; Pestka, 2003).	• The rapid pace of scientific advances, notable milestones such as the launch of the 100,000 Genomes Project and the continued integration of genomics into both specialist and mainstream services (Davies, 2017; Government of the United Kingdom, 2020; Government Office for Science, 2022; Kirk, Campalani, et al., 2011Kirk, Tonkin, & Skirton, 2011; Kirk et al., 2013; NHS, 2022; NMC, 2019b).
Shifting healthcare landscapes nationally and globally	• Introduction of legislation to address discrimination related to genetic information, access to health services, and the sharing and use of genomic data through legislation such as the *Genetic Information Non-Discrimination Act* in 2008, *Affordable Care Act* in 2010 and *21st Century Cures Act* in 2016 (Anderson, Monsen, et al., 2000; ISONG, 2022b; Starkweather et al., 2018). • Changes to certifications and specialization in other professions, such as medicine and genetic counselling (Anderson, Read, & Monsen, 2000; Lewis, 2001). • Influence of other disciplines through initiatives such as NCHPEG (Anderson, Read, & Monsen, 2000; Jenkins et al., 2001). • References to policy, education and other infrastructure developments in the UK and discussion about what could be learned and applied in the US (AAN, 2009; Calzone et al., 2007, 2011; Consensus Panel on Genetic/Genomic Nursing Competencies, 2009; Greco et al., 2011b; Kelly, 2009; Tonkin et al., 2020a; Williams et al., 2006).	• Foundational reports such as the *2003 White Paper* by the Department of Health (Andrews et al., 2014; Burton, 2011; Burton & Zimmern, 2005; Yeomans & Kirk, 2004) and the release of subsequent national government and NHS plans and strategies (Burton, 2011; Government of the United Kingdom, 2020; Kirk, Campalani, et al., 2011; NHS, 2022; Secretary of State for Health, 2009). • Global nursing and genetic/genomic strategies (WHO, 2020, 2022). • Overlap in scope amongst the interdisciplinary team continues to shape the integration of genomics in nursing education and practice (Kirk et al., 2008; Kirk, Campalani, et al., 2011; Middleton et al., 2023). • References to the policy work done in other countries and the importance of collaboration and learning from other countries (Kirk et al., 2013; Kirk, Campalani, et al., 2011; McDonald et al., 2003; Tonkin et al., 2020a).