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REVIEW ARTICLE

A scoping review of the development of genetic counseling practices in Asia

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Abstract

Access to genetic and genomic healthcare is rapidly expanding globally, contributing to the emergence of genetic counseling practice in various parts of Asia. This scoping review maps the current genetic counseling practices in Asia and the challenges faced by these countries in establishing genetic counseling services. The review was informed by the Joanna Briggs Institute methodology, and five databases were systematically searched. Forty-one unique papers were identified. The data was charted to summarize all available evidence regarding the status of current practices in Asia, which include the composition of the local workforce, their scope of practice, and the problems encountered by countries when instituting genetic counseling practices. Our results indicate countries are at varying stages of establishing practices and experience a host of interdependent challenges that impede the effective provision of services. Challenges include a lack of funding and legislation by governments, a cadre of genetically trained professionals with limited scope of practice, a population with low genomic literacy, coupled with varying language, cultural, and religious practices that influence genetic counseling practices. The findings call for Asian countries to adopt a multi-faceted approach that collectively engages various collaborators, including government and the healthcare workforce, to tackle existing barriers hindering the development of genetic counseling practices locally. Establishing ongoing dialogue between countries could help institute novel solutions to developing genetic counseling services in each country to enhance the advancement of genomic medicine in the region.

KEYWORDS
Asia, genetic counseling, genetic services, public health, underrepresented populations, workforce

1 | INTRODUCTION

Advancement of genetic and genomic research has driven the implementation of genomic medicine in clinical practice. Research developments have seen the breakthrough of rapid sequencing technologies to accurately diagnose conditions and impact treatment outcomes (Horton & Lucassen, 2019).

Increased understanding of the perceived benefits of genomic technology has prompted research focused on developing innovative and cost-effective testing solutions (Horton & Lucassen, 2019).

Simultaneously, advancements in genetic and genomic research have deepened our understanding of genetic and genomic findings, allowing for more accurate and comprehensive testing methods (Stark et al., 2019). The amalgamation of improved technology and increased knowledge has made clinical genetic services more accessible and affordable, leading to a surge in demand, further propelling the growth of the industry. Population genomic programs such as newborn screening are also seeing increasing interest and uptake (Stark & Scott, 2023). While this trend is beneficial for economies, an appropriately trained workforce to accurately assess and explain complex genetic information to consumers is urgently required (Laurino et al., 2017).

The genetic counseling profession emerged in the 1970s as genetic counseling services became an integral component of healthcare practice (Heimler, 1997). Genetic counseling services were initially provided by medical professionals before transitioning toward an allied health profession of genetic counselors (Abacan et al., 2019). Many countries have since established the profession of genetic counselors (Abacan et al., 2019) and some countries have established regulatory boards to govern the profession (Hoskins et al., 2021; Ormond et al., 2018).

Genetic counseling is a "communication process, which aims to help individuals, couples and families understand and adapt to the medical, psychological and familial implications of genetic contributions to specific health conditions" (Resta et al., 2006). This definition embraces the growing field of genetic counseling as a professional practice. Many papers use the terms 'profession' and 'practices' interchangeably. For the purpose of this review, we refer to genetic counseling as a 'practice' as it encapsulates the activity of genetic counseling being conducted by a range of healthcare professionals, including geneticists, genetic counselors, and other health professionals (Yeates et al., 2020).

In 2006, the Transnational Alliance of Genetic Counseling (TAGC) was instituted to enhance communication within the global genetic counseling community (Edwards, 2013). TAGC highlighted that while most countries aimed to expand genetic counseling practices, they were developing at different paces. Practices that worked for one country were not directly transferrable to another, due to differences in healthcare systems, funding, professional norms, and culture (Abacan et al., 2019). This is especially true in Asia, the world's most densely populated region. Asia comprises 48 countries, each with diverse political, economic, and social systems (United Nations Department of Economic and Social Affairs, 2022). Many Asian countries have adopted the Anglo-centric approach, a model primarily developed in Western healthcare contexts with established infrastructure and resources to support genetic counseling. However, Asian countries are adapting and regulating genetic counseling services to suit their population needs, addressing diverse cultural and familial norms common across Asian societies (Abacan et al., 2019; Yashar & Peterson, 2013).

Asia, as with many other parts of the world, faces a shortage of appropriately trained healthcare personnel, including genetic counselors and geneticists, who can explain complex genetic information and provide psychosocial support to individuals impacted by hereditary conditions (Abacan et al., 2019). The Royal College of Physicians United Kingdom (UK) recommends 6–12 genetically trained personnel per million people (de la Cutiongco-Paz et al., 2019). For Asia, with a population of approximately 4.4 billion (United Nations Department of Economic and Social Affairs, 2022), 26,400 to 52,800 genetically trained personnel are needed. While the number of genetically trained personnel in Asia has increased from about 350 individuals in 2017 to approximately 1070 personnel, there is still an urgent need to address the shortfall (Ormond et al., 2018, 2024).

What is known about this topic

Asia, the most densely populated region in the world, is currently navigating the implementation of genomics across healthcare services. Asian countries face a shortage of a genetically trained workforce like their Western counterparts, as well as challenges that are unique to the region.

What this paper adds to the topic

This review provides a comprehensive overview of current genetic counseling practices in Asia, the challenges faced in establishing practice, and potential solutions to building the workforce required for the region. We hope that the results will be of assistance in generating solutions to enhance genetic counseling practice in Asia.

Based on a World Health Organization (2022) report, genetic services should be tailored to the country, accounting for its health infrastructure, population demographics, and competing priorities. As healthcare costs rise globally, countries must prioritize resources to meet population needs while balancing trade-offs between essential spending and future healthcare investments (Wiseman et al., 2016). While genetic technologies have the potential to improve health and quality of life, not all countries have equal access to the latest advancements in technologies. Therefore, we grouped and analyzed Asian countries by income classification as stated by The World Bank (2022) to determine if the ability to establish genetic counseling practices varies by income bracket of a country. Where there were more similarities than differences, data were reported collectively.

High-income economies are better positioned to implement genomic medicine into practice, whereas low–middle-income countries may lack the necessary resources (World Health Organization, 2022). Individuals in wealthier countries typically have greater access to healthcare and a better understanding of the potential benefits of genetic health information, driving demand for genetic services and related technologies (Baird, 2001; The World Bank, n.d.).

While several studies have explored the progression of genetic counseling including in Asia, there have been few publications that have brought the data together. Given the growing interest in genetic counseling practices across Asia, it is timely to scope the literature to map what is known about genetic counseling practices in the region (Peters et al., 2015). We aimed to examine existing genetic counseling practices in Asia and the potential barriers faced by countries when developing and implementing practices.

2 | METHODS

This scoping review was informed by the Joanna Briggs Institute (JBI) Methods Manual for scoping reviews (Aromataris & Munn, 2020) and reported using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (Prisma-ScR) checklist (Tricco et al., 2018).

2.1 | Eligibility criteria

The review examined available evidence about the development of genetic counseling practices in Asia since inception. This review included articles which covered: healthcare professionals who engage in genetic counseling practices in Asia; current practices, development of services, and challenges faced in one or more Asian countries; empirical literature and service development reports which specifically discussed Asia. Service development reports described country-specific genetic counseling, which often included demographics of professionals providing these services and challenges faced. Non-English resources and reviews were excluded.

2.2 | Search strategy

The search strategy was developed with a librarian, according to the 3-step methodological framework for scoping reviews as outlined by the JBI Manual for Evidence Synthesis: (1) initial search of two databases: MEDLINE (Ovid) and Embase (Ovid), followed by the analyses of the titles, abstracts, and index terms of retrieved papers; (2) second search of all included databases using identified keywords and index terms; (3) screen reference lists of all resources included in this review to identify additional related materials (Aromataris & Munn, 2020).

All members of the research team mutually agreed upon the final search terms. Given the nascency of genetic counseling in Asia, the search strategy was designed to be broad. A textword search was used, and any articles that contained the search terms were included (See Table S1 for example search). No limits were placed on the publication year in hope of capturing the development of genetic counseling practices in Asia since inception. Five databases were used to search for relevant literature: MEDLINE (Ovid), Embase (Ovid), Scopus, CINAHL, and JBI EBP database. Gray literature was screened through ProQuest dissertation and theses. The search was initially conducted in December 2022 and subsequently updated in December 2023, establishing an upper limit of December 2023.

2.3 | Study selection

Search results were imported into Covidence and de-duplicated (Veritas Health Innovation, 2023). Eligibility criteria were piloted by two reviewers (T.L. and A.M.) and the inclusion criteria were adjusted to clarify definitions of Asia and genetic counseling practices. The decision to include service development reports was made to ensure the extent of genetic counseling activities was captured. Screening was conducted in two stages. The primary reviewer (T.L.) completed 100% of the title and abstract screening, followed by full text screening, while (A.M.) conducted 20% and 30% respectively. Conflicts were discussed, with any disagreements resolved by a third reviewer (L.D.). Inter-rater reliability demonstrated a substantial level of agreement (Cohen's kappa = 0.79 and 0.73 respectively) during title and abstract and full-text screening (McHugh, 2012).

2.4 | Data extraction and synthesis

A data extraction tool adapted from JBI Manual for Evidence Synthesis was used to compile data from multiple sources (Aromataris & Munn, 2020). The aims, population, context, current state of practice, barriers faced when instituting genetic counseling practices, and other key findings relevant to this review were recorded in an Excel spreadsheet.

T.L. completed data extraction, and A.M. verified and validated each item. To minimize variations in terminology and reporting styles, the authors iteratively organized and synthesized the results by categorizing similar characteristics and concepts together. T.L. conducted narrative synthesis in discussion with the research team, and data items were summarized under 4 broad topics: composition of workforce, scope of genetic counseling practices in Asia, availability of local training programs and regulatory bodies, and challenges faced by countries in establishing practices (Popay et al., 2006).

3 | RESULTS

3.1 | Study characteristics

The PRISMA flow diagram shows the number of papers identified, screened, excluded, and included (Figure 1). A total of 41 papers were included. The year of publication ranged from 2001 to 2023, with 37 papers published after 2011. More papers about the status of genetic counseling practices have emerged from Asian countries in recent years, with an average of four papers yearly for the past 4 years. The majority of papers were service development reports (24/41), followed by quantitative studies (9/41), mixed methods (5/41) and qualitative studies (3/41; Table 1).

Of the 41 papers included in this review, 35 were country-specific articles and 6 covered multiple countries from the region. Papers that covered multiple countries had data reported for individual countries where possible. Papers were representative of 16 Asian

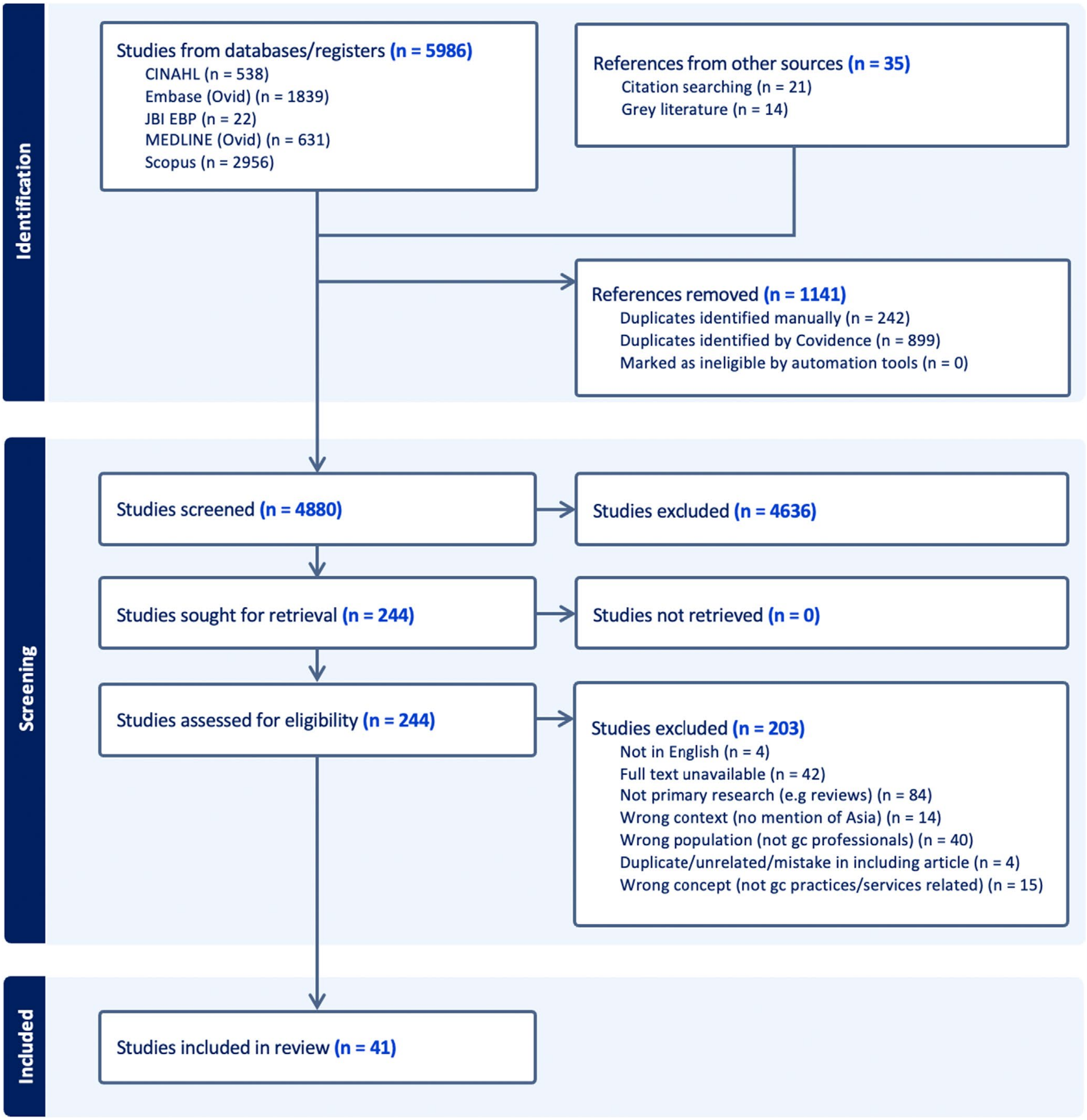

FIGURE 1 PRISMA flow diagram.

countries: Bangladesh, China, Hong Kong, India, Indonesia, Japan, Malaysia, Nepal, Pakistan, Philippines, Saudi Arabia, Singapore, South Korea, Taiwan, Thailand, and Vietnam (Figure 2). For the purpose of this review, countries were categorized according to their respective income brackets as classified by the World Bank (The World Bank, 2022). Ten papers originated from low–middle-income countries, six from upper-middle-income countries, and seven from high-income countries. Where there were no differences in findings between countries with different income brackets, data was grouped according to similarities.

3.2 | Professionals providing genetic counseling services (workforce composition)

3.2.1 | Low–middle-income economies

Countries in this income bracket include Bangladesh, India, Indonesia, Nepal, Pakistan, the Philippines, and Vietnam. As seen in Table 1, Bangladesh did not report the demographics of healthcare professionals providing genetic counseling services. Nepal reported a workforce of doctors, whereas Vietnam had doctors and allied

TABLE 1 Table showing research methods, countries mentioned in the selected studies, the income bracket of the countries based on The World Bank (2022) classification, and the type of professionals engaging in genetic counseling practices.

	Research method					Income bracket of country mentioned			Professionals who engage in GC practices		
References (author, year)	**Qualitative**	**Quantitative**	**Mixed methods**	**Service development report**	**Country mentioned**	**LMIE**	**UMIE**	**HIE**	**Doctors**	**Genetic counselors**	**Other allied health professionals**
Laurino et al. (2018)				×	Australasia			×	×	×	
Laurino et al. (2017)			×		Australia, Canada, Hong Kong, India, Indonesia, Malaysia, Philippines, Singapore, Taiwan, Thailand, USA, and Vietnam[a]	×	×	×	×	×	×
Nakamura et al. (2016)				×	Bangladesh	×			[b]	[b]	[b]
Hosen et al. (2021)				×	Bangladesh				[b]	[b]	[b]
Sui (2009)				×	China		×		×		
Zhao et al. (2013)				×	China		×		×		×
Nakamura et al. (2016)				×	China		×		[b]	[b]	[b]
Chair et al. (2019)				×	China		×		×	×	×
Sun et al. (2019)				×	China		×		×		
Dong et al. (2022)			×		China		×		×	×	
Sui (2009)				×	Hong Kong			×	×	×	×
Zayts et al. (2013)				×	Hong Kong			×	×		×
Nakamura et al. (2016)				×	Hong Kong			×	[b]	[b]	[b]
Laurino et al. (2018)				×	Hong Kong			×	×	×	
Chair et al. (2019)				×	Hong Kong			×	×		×
Verma and Bijarnia (2002)				×	India	×			×		
Aggarwal and Phadke (2015)				×	India	×			×		
Nakamura et al. (2016)				×	India	×			[b]	[b]	[b]
Laurino et al. (2018)				×	India	×			×	×	
Neogi et al. (2020)	×				India	×			×	×	×
Zayts et al. (2013)				×	Indonesia	×			×	×	
Nakamura et al. (2016)				×	Indonesia	×			[b]	[b]	[b]
Laurino et al. (2018)				×	Indonesia	×			×	×	
Kohzaki (2014)				×	Japan			×	×	×	

(Continues)

TABLE 1 (Continued)

References (author, year)	Research method Qualitative	Quantitative	Mixed methods	Service development report	Country mentioned	Income bracket of country mentioned LMIE	UMIE	HIE	Professionals who engage in GC practices Doctors	Genetic counselors	Other allied health professionals
Nakamura et al. (2016)				×	Japan			×	[b]	[b]	[b]
Yoshida et al. (2020)	×				Japan			×	×	×	
Aizawa et al. (2021)				×	Japan			×	×	×	
Lee and Thong (2013)				×	Malaysia		×		×	×	×
Ngim et al. (2013)		×			Malaysia		×		×		×
Zayts et al. (2013)				×	Malaysia		×		×	×	×
Nakamura et al. (2016)				×	Malaysia		×		[b]	[b]	[b]
Laurino et al. (2018)				×	Malaysia		×		×	×	
Lee et al. (2022)		×			Malaysia		×		×		
Yoon et al. (2022)		×			Malaysia		×		×	×	
Pokharel et al. (2017)			×		Nepal	×			×		
Nakamura et al. (2016)				×	Pakistan	×			[b]	[b]	[b]
Ahmed et al. (2017)		×			Pakistan	×			×		
Ashfaq et al. (2022)			×		Pakistan	×			×	×	
Ehsan et al. (2022)				×	Pakistan	×			×	×	
Laurino et al. (2011)				×	Philippines	×			×	×	
Laurino and Padilla (2013)				×	Philippines	×			×	×	
Padilla and de la Cutiongco-Paz (2013)				×	Philippines	×			×		×
Zayts et al. (2013)				×	Philippines	×			×	×	
Nakamura et al. (2016)				×	Philippines	×			[b]	[b]	[b]
Padilla and Cutiongco-de la Paz (2016)				×	Philippines	×			×		×
Laurino et al. (2018)				×	Philippines	×			×	×	
Tumulak et al. (2021)				×	Philippines	×			×	×	
Abad et al. (2024)				×	Philippines	×			×	×	×
Qari et al. (2013)				×	Saudi Arabia			×	×	×	
Balobaid et al. (2016)				×	Saudi Arabia			×		×	

TABLE 1 (Continued)

References (author, year)	Research method				Country mentioned	Income bracket of country mentioned			Professionals who engage in GC practices		
	Qualitative	Quantitative	Mixed methods	Service development report		LMIE	UMIE	HIE	Doctors	Genetic counselors	Other allied health professionals
Nakamura et al. (2016)				×	Singapore			×	[b]	[b]	[b]
Laurino et al. (2018)				×	Singapore			×	×	×	
Chiang and Ngeow (2020)				×	Singapore			×	×	×	
Chin et al. (2020)		×			Singapore			×	×	×	
Lewis et al. (2021)	×				Singapore			×	×	×	
Lee et al. (2013)		×			South Korea			×	×		×
Nakamura et al. (2016)				×	South Korea			×	[b]	[b]	[b]
Kim et al. (2020)		×			South Korea			×	×	×	×
Kim et al. (2022)		×			South Korea			×	[b]	[b]	[b]
Seo et al. (2024)		×			South Korea			×	×	×	×
Chien et al. (2013)				×	Taiwan			×	×	×	
Nakamura et al. (2016)				×	Taiwan			×	[b]	[b]	[b]
Laurino et al. (2018)				×	Taiwan			×	×	×	
Chair et al. (2019)				×	Taiwan			×	×	×	×
Dhamcharee et al. (2001)			×		Thailand		×		×		×
Zayts et al. (2013)				×	Thailand		×		×	×	
Nakamura et al. (2016)				×	Thailand		×		[b]	[b]	[b]
Laurino et al. (2018)				×	Thailand		×		×		×
Nakamura et al. (2016)				×	Vietnam	×			[b]	[b]	[b]
Laurino et al. (2018)				×	Vietnam	×			×		×

Note: The color shades correspond to the income status of each country.

Abbreviations: HIE, high-income economies; LMIE, low-middle-income economies; UMIE, upper-middle-income economies.

[a] Paper reported on these countries collectively.

[b] Information was not specified in the paper.

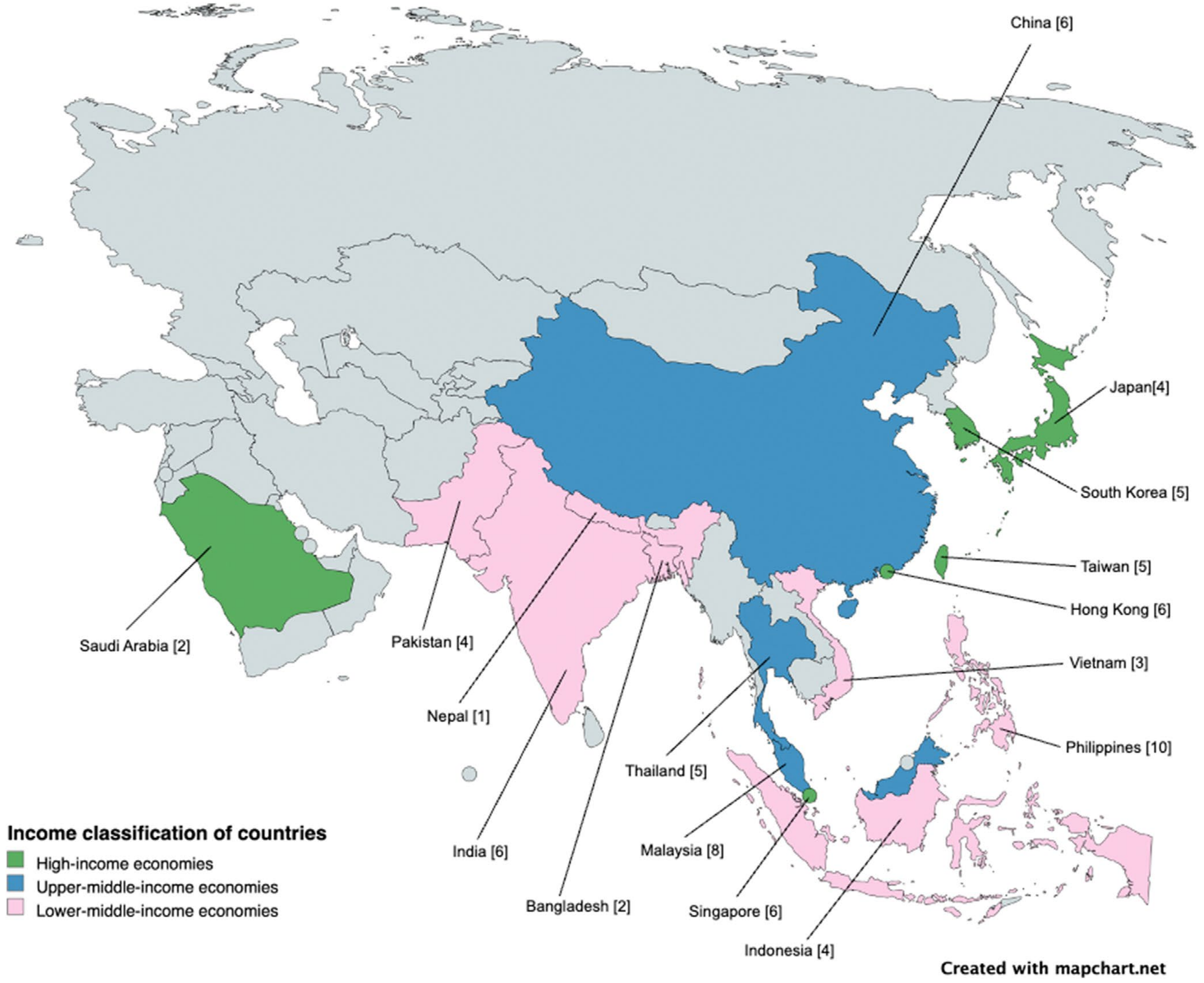

FIGURE 2 Map of Asia highlighting countries whereby genetic counseling practices have been reported. Countries have been color coded according to their income classification and the number of times a country was mentioned in the included papers is in brackets. Adapted from "MapChart," (mapchart.net). Copyright 2024 by MapChart. CC BY-SA.

health professionals providing genetic counseling (Laurino et al., 2018; Pokharel et al., 2017). Genetic counseling services in Indonesia and Pakistan were provided by doctors and genetic counselors (Ahmed et al., 2017; Ashfaq et al., 2022; Ehsan et al., 2022; Laurino et al., 2018; Zayts et al., 2013). India and the Philippines engaged a range of healthcare professionals to provide the service, including nurses and medical technologists (Abad et al., 2024; Aggarwal & Phadke, 2015; Laurino et al., 2011, 2018; Laurino & Padilla, 2013; Neogi et al., 2020; Padilla & Cutiongco-de la Paz, 2016, 2013; Tumulak et al., 2021; Verma & Bijarnia, 2002; Zayts et al., 2013).

3.2.2 | Upper-middle-income economies

Countries in this income bracket include China, Malaysia, and Thailand. Genetic counseling services in these countries were provided by doctors, genetic counselors, and allied health professionals including nurses and social workers (Table 1; Chair et al., 2019; Dhamcharee et al., 2001; Dong et al., 2022; Laurino et al., 2018; Lee et al., 2022; Lee & Thong, 2013; Ngim et al., 2013; Sui, 2009; Sun et al., 2019; Yoon et al., 2022; Zayts et al., 2013; Zhao et al., 2013).

3.2.3 | High-income economies

Countries in this income bracket include Hong Kong, Japan, Saudi Arabia, Singapore, South Korea, and Taiwan. Japan and Saudi Arabia reported a workforce of medical doctors and genetic counselors (Aizawa et al., 2021; Balobaid et al., 2016; Kohzaki, 2014; Qari et al., 2013; Yoshida et al., 2020). Doctors, genetic counselors, and allied health professionals provided genetic counseling services in Hong Kong, Singapore, South Korea, and Taiwan (Table 1; Chair et al., 2019; Chiang & Ngeow, 2020; Chien et al., 2013;

Chin et al., 2020; Kim et al., 2020; Laurino et al., 2018; Lee et al., 2013; Lewis et al., 2021; Seo et al., 2024; Sui, 2009; Zayts et al., 2013).

3.3 | Type and scope of genetic counseling practice

All 16 countries reported genetic counseling activity in the cancer setting. Ten countries reported prenatal and neonatal genetic services, seven reported general genetic services, and six reported pediatric genetic services (Table 2). Though specialized genetic services exist in fields such as oncology and cardiology, the provision of genetic counseling is often embedded within other services, especially when non-genetically trained doctors provide genetic counseling (Chair et al., 2019; Pokharel et al., 2017). For example, in China, oncologists and obstetricians provide genetic counseling in addition to their traditional clinical roles (Chair et al., 2019; Sun et al., 2019).

Genetic counseling sessions consisted of pre-test and post-test counseling in all 16 countries. Pre-test counseling included collecting medical history, providing psychosocial support, risk assessment, and genetic information to help clients make informed decisions (Balobaid et al., 2016; Chiang & Ngeow, 2020; Hosen et al., 2021; Kohzaki, 2014; Laurino et al., 2018; Lee & Thong, 2013; Neogi et al., 2020; Pokharel et al., 2017; Sun et al., 2019; Tumulak et al., 2021; Yoshida et al., 2020). Post-test counseling sought to promote client adaptation and facilitate the management of genetic conditions (Ashfaq et al., 2022; Kohzaki, 2014; Laurino et al., 2018; Lee & Thong, 2013; Nakamura et al., 2016; Yoshida et al., 2020). Often, professionals navigate through complex psychosocial issues arising from knowing one's genetic status (Kohzaki, 2014; Zayts et al., 2013).

Apart from providing genetic counseling, professionals in India, Malaysia, Hong Kong, and Singapore also reported ordering genetic tests and attending to other administrative tasks (Laurino et al., 2018). Upper middle-income (Malaysia) and high-income economies (Hong Kong and Singapore) reported activity in research, training of other healthcare professionals in genetics, and attempts to raise awareness about genetic conditions among the local population (Chiang & Ngeow, 2020; Laurino et al., 2018; Lee et al., 2022).

3.4 | Local training programs and regulatory bodies

Local training programs for genetic counseling were present in 10 countries: India, Indonesia, Philippines, China, Malaysia, Hong Kong, Japan, Saudi Arabia, South Korea, and Taiwan (Table 2; Aizawa et al., 2021; Balobaid et al., 2016; Chair et al., 2019; Chien et al., 2013; Laurino et al., 2011, 2018; Laurino & Padilla, 2013; Nakamura et al., 2016; Neogi et al., 2020; Ngim et al., 2013; Qari et al., 2013; Tumulak et al., 2021; Yoshida et al., 2020; Zayts et al., 2013). In countries with no local genetic counseling programs, professionals were reportedly trained in the United States (US), UK, or Australia (Ehsan et al., 2022; Laurino et al., 2018; Lee & Thong, 2013).

To meet demand from the local population, training options range from skill-based training to undertaking a 2-year master's degree in genetic counseling. Skill-based training consisted of short genetics modules in postgraduate programs or specific training in relation to certain diseases, such as Thalassemia, which are prevalent in the local population (Chair et al., 2019; Neogi et al., 2020; Zayts et al., 2013). Standalone genetic counseling master's programs equip graduates with in-depth knowledge and skills to offer population-specific genetics information while providing psychosocial support (Chair et al., 2019; Laurino et al., 2018; Neogi et al., 2020; Tumulak et al., 2021; Yoshida et al., 2020).

Even though 10 countries had local training programs, only China, India, Japan, Saudi Arabia, and Taiwan reported having a form of regulatory body to govern genetic counseling activity (Chien et al., 2013; Dong et al., 2022; Kohzaki, 2014; Neogi et al., 2020; Qari et al., 2013; Yoshida et al., 2020). Professionals seeking certification in India, Japan, and Taiwan are required to pass a written examination, and professionals in India and Taiwan are required to fulfill a set number of supervised sessions (Chien et al., 2013; Neogi et al., 2020; Yoshida et al., 2020).

3.5 | Challenges associated with establishing practices

Thirty-three papers reported challenges hampering the implementation of genetic counseling services in Asian countries. The challenges can be grouped into 3 main categories: governance challenges, workforce challenges, and challenges faced by the population (Table 3).

3.5.1 | Challenges associated with governance

Lack of government funding and legislation is among the factors that have hindered the development and integration of genetic counseling services into healthcare systems (Table 3). Fourteen papers cited insufficient public health funding for genetic testing as a barrier to offering genetic counseling services (Chair et al., 2019; Kim et al., 2020, 2022; Laurino et al., 2018; Padilla & de la Cutiongco-Paz, 2013, 2016; Seo et al., 2024; Verma & Bijarnia, 2002; Zhao et al., 2013). Most services in Asia send samples to accredited laboratories overseas due to limited capacity to process samples locally, thereby increasing the cost of testing (Ahmed et al., 2017; Aizawa et al., 2021; Ashfaq et al., 2022; Chiang & Ngeow, 2020; Hosen et al., 2021; Laurino et al., 2017; Nakamura et al., 2016; Pokharel et al., 2017). Furthermore, Bangladesh, Pakistan, and Malaysia have reported a dearth of infrastructure and resources to establish genetics-related facilities (Ashfaq et al., 2022; Hosen et al., 2021; Lee & Thong, 2013).

Insufficient legislation governing genetic counseling practices has contributed to inconsistent service provision standards (Abad et al., 2024; Ahmed et al., 2017; Aizawa et al., 2021; Chair et al., 2019;

TABLE 2 Scope of practice and availability of local training programs and regulatory bodies.

Paper	Countries mentioned in report?	Clinical area of practice	Scope of practice	Availability of local training programme	Availability of local regulatory body governing practice	Type of genetic counseling training received by workforce
Laurino et al. (2017)	Australia, Canada, Hong Kong, India, Indonesia, Malaysia, Philippines, Singapore, Taiwan, Thailand, USA, and Vietnam[a]	Not specified	Not specified	Yes for some countries	Not specified	GC qualifications, skill-based training
Laurino et al. (2018)	Australia/NZ	Unspecified	Not specified	Yes	Yes	GC qualifications, skill-based training
Nakamura et al. (2016)	Bangladesh	Cancer	Not specified	No	Not specified	Not specified
Hosen et al. (2021)	Bangladesh	Not specified	Risk assessment, discuss clinical genetics and testing options, provide psychosocial support, facilitate adaptation and coping with results	No	No	None
Verma and Bijarnia (2002)	India	Pediatric, General	Not specified	Not specified	Not specified	Not specified
Aggarwal and Phadke (2015)	India	Not specified	Not specified	No	No	Skill-based training
Nakamura et al. (2016)	India	Cancer	Not specified	*Yes*	Not specified	Not specified
Laurino et al. (2018)	India	Not specified	Risk assessment, discuss clinical genetics, provide psychosocial support, molecular lab work, administration	Yes	In progress	GC qualifications, skill-based training
Neogi et al. (2020)	India	Not specified	Risk assessment	Yes	Yes	Not specified
Zayts et al. (2013)	Indonesia	Prenatal, Neonatal, Pediatric, General	Not specified	Yes	Not specified	GC qualifications, skill-based training
Nakamura et al. (2016)	Indonesia	Cancer	Not specified	No	Not specified	Not specified
Laurino et al. (2018)	Indonesia	Not specified	Not specified	Yes	No	GC qualifications, skill-based training
Pokharel et al. (2017)	Nepal	Cancer	Discuss clinical genetics and testing options	No	No	None
Nakamura et al. (2016)	Pakistan	Cancer	Not specified	No	Not specified	Not specified
Ahmed et al. (2017)	Pakistan	Prenatal, Neonatal	Not specified	Not specified	Not specified	Not specified

TABLE 2 (Continued)

Paper	Countries mentioned in report?	Clinical area of practice	Scope of practice	Availability of local training programme	Availability of local regulatory body governing practice	Type of genetic counseling training received by workforce
Ashfaq et al. (2022)	Pakistan	Not specified	Discuss clinical genetics and testing options, interpret results, facilitate adaption and coping with results	No	No	GC qualifications, skill-based training
Ehsan et al. (2022)	Pakistan	Cancer	pre-test and post-test counseling	No	No	GC qualifications, skill-based training
Laurino et al. (2011)	Philippines	Prenatal, Pediatric, Cancer, General	Discuss clinical genetics and testing options, provide psychosocial support	Yes	Not specified	Not specified
Laurino and Padilla (2013)	Philippines	Not specified	pre-test and post-test counseling	Yes	No	GC qualifications
Padilla and de la Cutiongco-Paz(2013)	Philippines	General, Pediatric	Not specified	Yes	Not specified	GC qualifications, skill-based training
Zayts et al. (2013)	Philippines	Not specified	Not specified	Yes	Not specified	Not specified
Nakamura et al. (2016)	Philippines	Cancer	Not specified	Yes	Not specified	Not specified
Padilla and Cutiongco-de la Paz (2016)	Philippines	General, Pediatric	Not specified	Yes	Not specified	GC qualifications, skill-based training
Laurino et al. (2018)	Philippines	Not specified	Risk assessment, discuss clinical genetics and testing options, provide psychosocial support	Yes	No	GC qualifications, skill-based training
Tumulak et al. (2021)	Philippines	Not specified	Risk assessment, discuss clinical genetics and testing options, provide psychosocial support	Yes	Not specified	Not specified
Abad et al. (2024)	Philippines	Prenatal, Neonatal, Pediatric, Cancer, Neurology	pre-test and post-test counseling	Yes	No	GC qualifications
Nakamura et al. (2016)	Vietnam	Cancer	Not specified	No	Not specified	Not specified
Laurino et al. (2018)	Vietnam	Not specified	Discuss testing options, provide psychosocial support, facilitate adaptation and coping with results	No	No	Skill-based training
Sui (2009)	China	Prenatal	Risk assessment, discuss clinical genetics and testing options	No	No	None

(Continues)

TABLE 2 (Continued)

Paper	Countries mentioned in report?	Clinical area of practice	Scope of practice	Availability of local training programme	Availability of local regulatory body governing practice	Type of genetic counseling training received by workforce
Zhao et al. (2013)	China	Prenatal, Neonatal	Not specified	No	No	Not specified
Nakamura et al. (2016)	China	Cancer	Not specified	No	Not specified	Not specified
Chair et al. (2019)	China	Prenatal, Neonatal, Cancer	Unspecified	Yes	Not specified	Skill-based training
Sun et al. (2019)	China	Not specified	Promote and facilitate decision making	No	No	Not specified
Dong et al. (2022)	China	Not specified	Not specified	Yes	Yes	Skill-based training
Lee and Thong (2013)	Malaysia	Not specified	Discuss clinical genetics and testing options, provide psychosocial support, promote and facilitate decision making	No	No	GC qualifications, skill-based training
Ngim et al. (2013)	Malaysia	Prenatal, Neonatal	Risk assessment, discuss clinical genetics and testing options	Yes - Thalassemia specific	No	Not specified
Zayts et al. (2013)	Malaysia	Not specified	Not specified	Yes	No	Skill-based training
Nakamura et al. (2016)	Malaysia	Cancer	Not specified	No	Not specified	Not specified
Laurino et al. (2018)	Malaysia	Not specified	Risk assessment, discuss clinical genetics, provide psychosocial support, administration, research, train other healthcare professionals, raising public awareness, liase with multiple stakeholders	Yes	No	GC qualifications, skill-based training
Lee et al. (2022)	Malaysia	Cancer	pre-test and post-test counseling, discuss clinical genetics	Not specified	Not specified	Not specified
Yoon et al. (2022)	Malaysia	Cancer	pre-test and post-test counseling	Not specified	Not specified	Skill-based training
Dhamcharee et al. (2001)	Thailand	General	pre-test and post-test counseling	No	No	None
Zayts et al. (2013)	Thailand	Not specified	Not specified	No	No	Skill-based training
Nakamura et al. (2016)	Thailand	Cancer	Not specified	No	Not specified	Not specified
Laurino et al. (2018)	Thailand	General	Not specified	No	No	Skill-based training
Sui (2009)	Hong Kong	Prenatal	Risk assessment, discuss clinical genetics and testing options	No	No	Skill-based training

TABLE 2 (Continued)

Paper	Countries mentioned in report?	Clinical area of practice	Scope of practice	Availability of local training programme	Availability of local regulatory body governing practice	Type of genetic counseling training received by workforce
Zayts et al. (2013)	Hong Kong	Prenatal, Neonatal, Pediatric, Cancer, General	Risk assessment, discuss clinical genetics and testing options, provide psychosocial support, facilitate adaptation and coping with results	Yes	No	GC qualifications, skill-based training
Nakamura et al. (2016)	Hong Kong	Cancer	Not specified	No	Not specified	Not specified
Laurino et al. (2018)	Hong Kong	Not specified	Risk assessment, discuss clinical genetics, provide psychosocial support, administration, research, train other healthcare professionals, raising public awareness, liaise with multiple stakeholders	Yes	No	GC qualifications, skill-based training
Chair et al. (2019)	Hong Kong	Not specified	Not specified	Yes	No	Skill-based training
Kohzaki (2014)	Japan	Not specified	Discuss clinical genetics and testing options, provide psychosocial support, promote and facilitate decision making, facilitate adaptation and coping with results	Not specified	Yes	GC qualifications
Nakamura et al. (2016)	Japan	Cancer	Not specified	*Yes*	Yes	GC qualifications
Yoshida et al. (2020)	Japan	Not specified	Discuss clinical genetics and testing options, provide psychosocial support, promote and facilitate decision making, facilitate adaptation and coping with results	Yes	Yes	GC qualifications, skill-based training
Aizawa et al. (2021)	Japan	Not specified	Not specified	Yes	Yes	GC qualifications, skill-based training
Qari et al. (2013)	Saudi Arabia	Prenatal, Neonatal, Pediatric, General	Discuss clinical genetics and testing options, interpret results, facilitate adaption and coping with results	Yes	Yes	GC qualifications, skill-based training
Balobaid et al. (2016)	Saudi Arabia	Prenatal, Cancer, Cardiology, Metabolic, General	Risk assessment, discuss clinical genetics and testing options, provide psychosocial support	Yes	Not specified	GC qualifications

(Continues)

TABLE 2 (Continued)

Paper	Countries mentioned in report?	Clinical area of practice	Scope of practice	Availability of local training programme	Availability of local regulatory body governing practice	Type of genetic counseling training received by workforce
Nakamura et al. (2016)	Singapore	Cancer	Not specified	No	Not specified	Not specified
Laurino et al. (2018)	Singapore	Not specified	Risk assessment, discuss clinical genetics, provide psychosocial support, facilitate adaptation and coping with results, administration, research, train other healthcare professionals, raising public awareness	No	No	GC qualifications, skill-based training
Chiang and Ngeow (2020)	Singapore	Cancer	Discuss testing options, provide psychosocial support, liaise with multiple stakeholders, train other healthcare professionals	Not specified	In progress	GC qualifications
Chin et al. (2020)	Singapore	Cancer	Pre-test counseling	Not specified	Not specified	Not specified
Lewis et al. (2021)	Singapore	Prenatal	Post-test counseling	Not specified	Not specified	Not specified
Lee et al. (2013)	South Korea	Cancer	Not specified	No	Not specified	Skill-based training
Nakamura et al. (2016)	South Korea	Cancer	Not specified	*Yes*	Not specified	Skill-based training
Kim et al. (2020)	South Korea	Not specified	Risk assessment, discuss clinical genetics, facilitate adaptation and coping with results	Yes	Not specified	GC qualifications
Kim et al. (2022)	South Korea	Prenatal, Cancer, General	Discuss testing options, provide psychosocial support, facilitate adaptation and coping with results	Not specified	No	Not specified
Seo et al. (2024)	South Korea	Prenatal, Cancer, General	Not specified	Yes	No	Not specified
Chien et al. (2013)	Taiwan	Prenatal, Pediatric, General	pre-test and post-test counseling	Yes	Yes	GC qualifications, skill-based training
Nakamura et al. (2016)	Taiwan	Cancer	Not specified	Yes	Not specified	Not specified
Laurino et al. (2018)	Taiwan	Not specified	Not specified	Yes	Yes	GC qualifications, skill-based training
Chair et al. (2019)	Taiwan	Cancer	Not specified	Yes	Not specified	GC qualifications, skill-based training

Note: The color shades correspond to the income status of each country.

[a] Paper reported on these countries collectively.

Kim et al., 2022; Laurino et al., 2017, 2018; Neogi et al., 2020; Seo et al., 2024; Sun et al., 2019; Zhao et al., 2013). Asian countries described the lack of protection against genetic discrimination, which may discourage individuals from seeking genetic counseling services (Nakamura et al., 2016).

3.5.2 | Issues encountered by the workforce

Asia faces a shortage of genetically trained healthcare professionals, contributing to long wait lists and limited access to services (Abad et al., 2024; Ahmed et al., 2017; Aizawa et al., 2021; Ashfaq et al., 2022; Chair et al., 2019; Dhamcharee et al., 2001; Ehsan et al., 2022; Hosen et al., 2021; Kim et al., 2020, 2022; Kohzaki, 2014; Laurino et al., 2017, 2018; Laurino & Padilla, 2013; Lee et al., 2013; Lee & Thong, 2013; Nakamura et al., 2016; Neogi et al., 2020; Padilla & de la Cutiongco-Paz, 2013, 2016; Pokharel et al., 2017; Sun et al., 2019; Yoshida et al., 2020; Zhao et al., 2013). To combat this workforce shortage, Singapore and the Philippines have adopted alternative models, such as telephone intakes and virtual consultations to improve the reach of genetic counseling services (Chin et al., 2020; Tumulak et al., 2021).

The workforce expressed concerns regarding career progression, citing limited scope and lack of recognition by other healthcare professionals hindering their ability to provide coordinated, comprehensive care for patients, and to explore roles beyond the clinical setting (Abad et al., 2024; Aizawa et al., 2021; Chair et al., 2019; Kohzaki, 2014; Laurino et al., 2017, 2018; Nakamura et al., 2016; Neogi et al., 2020; Yoshida et al., 2020). Additionally, the nascent stage of genetic services in Asia means there are inadequate population-specific databases to understand local prevalence of certain genetic conditions (Table 3; Ashfaq et al., 2022; Chiang & Ngeow, 2020; Hosen et al., 2021).

3.5.3 | Challenges brought about by societal factors

There is limited awareness about the availability and function of genetic counseling services due to language barriers, low literacy, and diverse cultures, religions, and traditions (Table 3). Professionals in non-English-speaking countries, especially in the Philippines, Pakistan, and Thailand, struggle to translate complex genetic terms into their native language (Dhamcharee et al., 2001; Ehsan et al., 2022; Tumulak et al., 2021). Lower literacy rates in Nepal, Pakistan, and the Philippines further hinder comprehension of complex genetic information (Ahmed et al., 2017; Pokharel et al., 2017; Tumulak et al., 2021).

Cultural and religious beliefs, practices, and values influence society's attitude toward genetic testing (Balobaid et al., 2016; Laurino et al., 2017; Lee & Thong, 2013; Tumulak et al., 2021; Zayts et al., 2013). In Pakistan, healthcare professionals follow religious rulings on pregnancy termination (Ahmed et al., 2017), while in Nepalese culture, the diagnosis of an illness is often communicated to family members instead of patients (Pokharel et al., 2017). Societal attitudes and stereotypes surrounding genetic conditions have been reported in Malaysia, China, Saudi Arabia, and Japan. Without appropriate legislation, individuals feared discrimination if tests revealed a genetic predisposition (Balobaid et al., 2016; Kohzaki, 2014; Lee & Thong, 2013; Sui, 2009; Yoshida et al., 2020). Fear may be perpetuated by the lack of patient support groups providing emotional and practical support upon receiving a genetic diagnosis (Ashfaq et al., 2022; Laurino et al., 2017).

4 | DISCUSSION

This scoping review describes genetic counseling practices in Asia, including the composition of the workforce, scope of practice, availability of local training and regulatory programs, and identifies a range of systemic challenges faced by countries when establishing practice. The review highlights the growing demand for genetic counseling practices in Asia and the need for Asian countries to anticipate and prepare for this burgeoning field. The findings support the WHO Science Council's emphasis to prioritize equitable access to genomic services across countries in order to realize its full potential benefits for public health (World Health Organization, 2022).

Forty-one papers representative of 16 countries in Asia were included. Countries were categorized and analyzed by their gross national income (GNI) per capita, an indicator of the general standard of living and health outcomes in a country (The World Bank, n.d.). Our scoping review revealed that the wealth of a country alone does not determine its ability to provide genetic healthcare services. Factors like government spending priorities, healthcare infrastructure, and workforce efficiency also play crucial roles (Sterck et al., 2018).

4.1 | Diverse workforce with varied genetic-based training

Countries in Asia engage various healthcare professionals to deliver genomic healthcare (Table 1). Given that Asia has a cadre of genetically trained workforce, countries have engaged additional healthcare professionals to provide genetic counseling services. Our review suggests that all professionals had skill-based training at minimum, and some had genetic counseling qualifications. Skill-based training was often provided on the job to upskill existing healthcare professionals (Laurino et al., 2018).

Upskilling existing medical professionals is aligned with mainstreaming, a practical approach to alleviate the burden of genetic conditions in resource-limited countries (Beard et al., 2021; Bokkers et al., 2022). Integrating genomic testing into mainstream clinics is becoming a mainstay, especially in high-income and certain upper-middle-income economies (Ginsburg & Narod, 2018; McNeill, 2022). For example, the UK has successfully integrated genomic testing into various specialty clinics, enabling clinicians across diverse healthcare disciplines to provide genetic counseling services (Middleton et al., 2023). Furthermore, mainstreaming has opened up avenues for

TABLE 3 Challenges as highlighted in included studies.

	Hosen et al. (2021)	Pokharel et al. (2017)	Ahmed et al. (2017); Ashfaq et al. (2022); Ehsan et al. (2022)	Laurino and Padilla (2013); Padilla and de la Cutiongco-Paz (2013); Padilla and Cutiongco-de la Paz (2016); Tumulak et al. (2021); Abad et al. (2024)	Verma and Bijarnia (2002); Laurino et al. (2018); Neogi et al. (2020)	Laurino et al. (2018)	Dhamcharee et al. (2001); Laurino et al. (2018)	Lee and Thong (2013); Ngim et al. (2013); Lee et al. (2022)
	Bangladesh	Nepal	Pakistan	Philippines	India	Australia/ NZ, HK, India, Indonesia, Malaysia, Philippines, Singapore, Taiwan, Thailand, Vietnam	Thailand	Malaysia
Government								
Lack of public health funding	×	×	×	×				
Limited legislation governing genetic counseling practices			×	×	×	×	×	
Inadequate legislation against genetic discrimination								
Limited infrastructure and resources	×		×					×
Incomplete integration of genetic services into healthcare					×	×		
Workforce								
Lack of trained healthcare professionals	×	×	×	×	×	×	×	×
Profession not well recognized by other healthcare professionals				×	×	×		
Limited scope of practice						×	×	
Lack of population-specific databases	×		×					
Population								
Lack of awareness about genetic counseling			×	×	×			×
Low literacy rates		×	×	×				
Varying traditions/ religion that impact practice		×	×	×				×
Language barrier			×	×			×	
Diverse cultures		×		×		×		
Limited access to services		×	×	×				
Social stigmatization surrounding genetic conditions								×
Lack of patient support groups			×					

Note: The color shades correspond to the income status of each country.

Sui (2009); Zhao et al. (2013); Sun et al. (2019)	Balobaid et al. (2016)	Chiang and Ngeow (2020)	Lee et al. (2013); Kim et al. (2020); Kim et al. (2022); Seo et al. (2024)	Kohzaki (2014); Yoshida et al. (2020); Aizawa et al. (2021)	Zayts et al. (2013)	Nakamura et al. (2016)	Laurino et al. (2017)	Chair et al. (2019)
China	Saudi Arabia	Singapore	South Korea	Japan	Hong Kong, Thailand, Malaysia, Indonesia, Philippines, UK	Korea, Japan, Malaysia, Singapore, Hong Kong, China, Indonesia, Thailand, Philippines, India, Bangladesh, Pakistan, Taiwan, Vietnam	Australia, Canada, Hong Kong, India, Indonesia, Malaysia, Philippines, Singapore, Taiwan, Thailand, USA, and Vietnam.	Hong Kong, Taiwan, China
×		×	×	×		×	×	
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×			×	×		×	×	
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					×		×	
	×				×		×	
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×	×			×		×		
							×	

genetic counseling professionals to support clinicians in non-genetics specialties (Do et al., 2025; Quinn & Mazur, 2022). Nevertheless, effective implementation of mainstreaming requires clear guidelines delineating the scope of practice for relevant professionals.

4.2 | Scope of genetic counseling practices

Asian countries are at varying stages of establishing genetic counseling practices. While all 16 countries reported genetic counseling activity in cancer care, not all had equivalent services in prenatal, pediatric, or general healthcare settings. The prevalence of cancer genetic services could be reflective of the advancements in cancer genetics research, which enhanced our comprehension of medical genetics and demonstrated potential to reduce the global cancer burden (Forman & Sotelo, 2020; Ginsburg & Narod, 2018). For instance, genetic testing has the potential to guide treatment selection and surgical decisions, which increases the demand for cancer genetics services, particularly in mainstream settings (Yoon et al., 2022). Furthermore, established guidelines for cancer genetic counseling make it more feasible for professionals, especially those trained on the job, to effectively deliver genetic services.

Genetic counseling practices also extend beyond cancer genetics, into specialties such as cardiology (Ingles et al., 2020). This expansion is supported by mainstreaming efforts and alternative models of service delivery (Middleton et al., 2023). While Asia has yet to fully adopt similar practices, there is potential for countries to learn from and adapt these models to suit local healthcare environments.

Our studies elucidated the practice of training existing healthcare professionals in Asia to provide genetic counseling, particularly in countries with prevalent genetic conditions. For example, in Malaysia and Thailand, nurses and social workers are trained to provide comprehensive care and support for patients and families living with Thalassemia (Laurino et al., 2018; Lee & Thong, 2013; Ngim et al., 2013). An earlier study about Thailand had identified that some counselors lacked prior training before providing genetic counseling for thalassemia (Dhamcharee et al., 2001) indicating changes over time. As establishing standardized guidelines for genetic counseling practice has the potential to enhance service delivery, it is imperative for countries to ensure that the quality of services provided is not undermined.

4.3 | Service delivery models

Asian countries are actively exploring ideas to expand genetic counseling services beyond traditional approaches. The use of decisional aids, chatbots, and virtual consultations has shown potential to increase the scalability and efficiency of genetic counseling services (Bombard et al., 2022; Buchanan et al., 2016; Rashkin et al., 2019; Stoll et al., 2018). Serendipitously, the COVID-19 pandemic accelerated the adoption of digital solutions in healthcare, demonstrating increased convenience, higher patient satisfaction, and improved access to care (Uhlmann et al., 2021).

In Asia, innovative strategies like decisional support tools, telephone intakes, telehealth appointments, and community outreach clinics have streamlined consultations and increased accessibility (Buchanan et al., 2016; Chin et al., 2020; Rashkin et al., 2019; Stoll et al., 2018). Such approaches optimize limited resources while ensuring individuals receive necessary healthcare support. Digital solutions have particularly enhanced access to genetic services, especially for remote and underserved populations (Ashfaq et al., 2022; Bamshad et al., 2018; Chatterjee & Saraswathy, 2016; Tumulak et al., 2021). However, disparity in technological infrastructure and connectivity across countries hinders the universal adoption of these models, undermining efforts to improve access (Otten et al., 2016; Tumulak et al., 2021).

It is important to emphasize that a subset of patients benefit from conventional in-person genetic counseling. For instance, providers could evaluate the feasibility of telemedicine for those with limited access or experience with technology, and for people living with disabilities like hearing impairments (Lam et al., 2020; Uhlmann et al., 2021). Countries could consider tailoring alternative service expansion approaches based on specific population needs. This proactive step would allow providers to identify potential limitations early, enabling them to troubleshoot and incorporate additional strategies to ensure accessibility for individuals who may face barriers to utilizing new modes of service delivery.

4.4 | An integrated approach to challenges

Finally, our review revealed the interconnected nature of challenges in establishing genetic counseling practices across countries. To address these challenges, countries could adopt a systems thinking approach that considers broader context and interdependencies within the healthcare system. Various determinants of health, including economic conditions, healthcare infrastructure, governance, workforce capacity, and public awareness, form a complex interdependent system whereby changes in one area can affect others (Bamshad et al., 2018; Sterck et al., 2018). Countries could develop a multipronged approach which recognizes these interconnections yet meets the diverse needs of their population.

4.4.1 | Adaptive governance

Governments could establish adaptive governance frameworks to regulate genetic counseling practices and define the genetic counseling scope of practice. Currently, certification in Asian countries is the domain of professional societies (Aizawa et al., 2021; Chien et al., 2013; Neogi et al., 2020). Clarification of training and certification pathways and the scope of practice would enable the workforce to function and contribute effectively within the healthcare system (Aizawa et al., 2021; Rantanen et al., 2008).

The advent of precision medicine necessitates proactive government action to pre-empt and address ethical, legal, and social challenges associated with genetic health information (Brothers & Rothstein, 2015; World Economic Forum, 2019). Collaboration between public and private sectors is essential to develop forward-thinking solutions that promote industry growth while safeguarding public health and privacy (World Economic Forum, 2019). Furthermore, Asian countries could benefit from international collaborations to collectively share best practices, address shared challenges, and pool expertise and resources together to advance genetic counseling practices in their respective countries.

Notably, success hinges on a country's capacity and resources. Governments must strive for balance between fostering industry growth, improving access to services, and protecting public health. Health policy advisors, funding bodies, and healthcare leaders could demonstrate the utility of genetic services through cost–benefit analyses to justify funding (Ananthapavan et al., 2021). Adequate funding could enable investments in equitable financing mechanisms, accessible service delivery models, and a competent workforce capable of integrating innovations into clinical practice and serving their population (Legido-Quigley & Asgari-Jirhandeh, 2018).

4.4.2 | Robust workforce

To initiate the establishment of genetic counseling practices, it is important to nurture an intrapreneurial workforce of genetically trained professionals. Intrapreneurs, who possess an entrepreneurial mindset within an organization, often play a pivotal role in driving positive change (Antoncic & Hisrich, 2003). By cultivating an innovative environment, genetic services can empower their workforce to creatively address systemic challenges. A small but dedicated workforce would be well positioned to develop tailored population-specific measures to address governance-related obstacles and meet population needs effectively.

Addressing the need of an adept workforce requires upskilling current healthcare professionals and training future professionals to keep pace with technological advancements in genetics (Campion et al., 2019). To attract and retain a qualified workforce, regulations and licensing procedures need to be established to safeguard patient safety, provide a framework for professionals to operate within, and enhance the profession's visibility and recognition within the healthcare system (Hoskins et al., 2021; Legido-Quigley & Asgari-Jirhandeh, 2018).

Currently, knowledge about Asian genomes remains relatively limited, though Asia makes up 60% of the world population (Chan et al., 2022). Improved knowledge based on Asia-specific genomic data could increase diagnostic accuracy and thereby demonstrate the importance of local genetic counseling services; such knowledge is also essential to inform government policies and increase workforce visibility. Strengthening the local genetic workforce, including in research roles, may contribute to generating population-specific genetic data. As more people access genetic counseling services locally, enhanced genomic reference databases that more accurately reflect local populations are urgently required. Collective efforts could contribute to the integration and recognition of genetic counseling among the local population, thereby advancing genomic medicine and benefiting individuals seeking these services.

4.4.3 | Informed population

Many studies highlighted a general lack of awareness about genetic counseling among local populations. Addressing public awareness requires a collaborative effort involving government intervention and a skilled workforce to educate individuals about the utility of genomic medicine. Education will equip individuals to make informed decisions about their genetic health, thereby accessing the potential benefits of genomic medicine.

However, individuals in different countries may encounter challenges associated with affordability, accessibility, and autonomy. Our scoping review revealed that individuals in Asia face unique socio-cultural factors due to diverse cultural, linguistic, and religious backgrounds (de la Cutiongco-Paz et al., 2019; Laurino et al., 2018). Furthermore, individuals within and across countries were found to have varied worldviews that were influenced by their upbringing and acculturation (Ormond et al., 2018; Zayts-Spence et al., 2021). Official languages often coexist with local dialects, which complicates the communication of genetic terminology (Zayts et al., 2013). To overcome these challenges, countries could train a local workforce skilled in navigating these socio-cultural influences to provide genetic counseling practices tailored to the population's needs.

Strategies to increase awareness could be accompanied by services provided by a proficient local workforce who can provide judicious and accultured advice while promoting informed decision making. By considering these factors collectively, governments and healthcare providers can ensure individuals have the desire and means to access and benefit from genetic counseling services.

4.5 | Study limitations

Given the multilingual composition of Asian countries, only including papers published in English may have limited the representation of some Asian countries in our scoping review. Most data came from service development reports, which were informed by individuals rather than organizational insights. Few papers focused on the process and outcome of genetic counseling in local populations. Mixed reporting standards about the same country across included papers also hindered an accurate understanding of current practices. Lastly, no quality assessment was conducted, so the implications for practice cannot be determined accurately.

4.6 | Practice implications

As precision medicine advances in Asia, the genetic counseling workforce is poised to play an increasingly significant role. Their foundational skillsets enable them to bridge the gap between clinicians and essential partners (including healthcare administrators, patients, and technology developers) and navigate the integration of medicine, technology, and genomics. However, the workforce must embrace new technologies and actively engage in planning, developing, testing, and implementing new approaches to service delivery, education, and research (Bamshad et al., 2018; Stoll et al., 2018). This proactive approach will ultimately enhance clinical care and maximize the potential of precision medicine. Although this transformation may involve uncertainties, the potential rewards are ultimately beneficial for families who will utilize genetic counseling services.

5 | CONCLUSION

Genetic counseling services in Asia are advancing toward delivering quality care to local populations. This scoping review highlights the experiences of various Asian countries, each with distinct medical systems and unique socio-cultural factors influencing the quality of healthcare delivered, including genetic counseling practices. Asian countries are exploring ways to establish and expand genetic counseling access despite limited resources. However, interdependent challenges such as the lack of government legislation, funding, trained professionals, and low genetic literacy persist. These challenges could potentially be addressed through a systemic approach with sustainable solutions that align with the dynamic nature of each healthcare system. On a macro level, this work provides valuable insight into the experiences of other countries in similar stages of establishing genetic counseling practice. Considering the ongoing shortage of the genetic counseling workforce, a collaborative regional approach may be needed. By engaging in regional discussions, countries can adapt and customize genetic counseling practices to meet their specific population needs.

AUTHOR CONTRIBUTIONS

Tiffany Qing Lim was responsible for the development of methods, data extraction, analysis, draft manuscript, and the final revision of the manuscript. Prof. Alison McEwen was involved in the conceptualization of the project, supporting methods development, second reviewing, and reviewing the manuscript before the final submission. Dr. Lisa Dive was involved in the conceptualization of the project and manuscript review. All authors confirm that they had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors gave final approval of this version to be published and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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SUPPORTING INFORMATION

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