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Scenario of Ovarian Cancer in Asian Countries: Epidemiology, Risk Factors, and Challenges

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A B S T R A C T

Ovarian cancer is one of the most lethal gynaecological cancers in the world, and its incidence is increasing gradually in Asian countries as a consequence of demographic factors and lifestyle changes. Ovarian cancer epidemiology, risk factor profiles, treatment aspects, and challenges may vary significantly between Asian countries. Hence, this study aims to summarize the current evidence on these topics in Asia including gaps which need stratified healthcare responses. A thorough literature search was performed on PubMed, Scopus and Web of Science for studies published between the years 2000 to 2023. Eligibility criteria Studies conducted on ovarian cancer in Asian populations (incidence, mortality and treatment disparities). Regional differences were observed in risk determinants, methods of diagnosis, and access to treatment based on results from a health-related quality of life analysis. In 2020, 40.5% (125,629/310,991) of global cases of ovarian cancer were from Asia with China (6.6 per 100000) and India (4.9 per 100000) contributing a large burden to the disease. Industrialized countries have a much more reported higher incidence rate as Japan (ASR 8.5) and Singapore (ASR 9.0), which is also due to change in lifestyle and availability of medical treatment. Frequent risk factors are BRCA1/2 mutations, advanced maternal age, and rising obesity. Poor access to healthcare causes patients in many low-income regions to be diagnosed with their illness only at later stages, and rural areas may lack further treatment options. As promising as the new molecular diagnostics and novel targeted therapies are, they will largely remain unavailable in world-wide resource–limited settings. Phase I and II studies of a novel olaparib-based regimen following first-line chemotherapy for advanced ovarian cancer in Asia show promising efficacy with manageable adverse events; however, further improvement is needed for public health initiatives towards early detection, genetic testing offering access to treatment and equitable access to evidence-based medicine.

Keywords: Ovarian cancer, Asia, Epidemiology, Genetic screening, Healthcare disparities.

INTRODUCTION

Ovarian cancer, a deadly and heterogeneous disease, is associated with the highest mortality rates of any gynaecological malignancy making it an urgent global public health concern [1]. Ovarian cancer is the seventh most common cancer among women worldwide. A study Sung *et al.* mentions that, in 2020, there were approximately 313,000 new cases and around 207,000 deaths globally [1]. It is an aggressive epithelial malignancy that is typically diagnosed at an advanced stage, when treatment options are limited. Due to the asymptomatic nature of the disease in its early stages and a lack of effective screening methods, to date most people are diagnosed at late stage, study by GÜLTEKİN *et al.*, resulting in these high mortality rates [2]. Attention in recent years has also been turned to the Asian experience, where ovarian cancer incidence and mortality are rising due to a similar combination of an increasing proportion of elderly women, falling fertility rates and changing lifestyles that mirror those observed in more developed countries. The rising incidence warrants a better understanding of the disease epidemiology, risk factors and access to healthcare issues for this region in order to develop appropriate intervention programmers. Interestingly, when we focus on Asia alone, there is

even more heterogeneity in ovarian cancer rates between different countries. Countries such as Japan, Singapore and South Korea reflect ASR comparable to western countries due in part to lifestyle changes coupled with healthcare advances leading to easier diagnosis [3]. In contrast, there are countries like China and India which have seen major increases in incidence and mortality largely due to demographic factors coupled with unprepared health systems capable of early detection. Japan (ASR 8.5 per 100,000 women) and Singapore/9.0 have experienced similar rates to the United States, suggesting that changing lifestyles/reproductive patterns contributes to ovarian cancer risk [4]. In contrast, China (ASR 6.6) and India (ASR 4.9), despite having moderate incidence rates, represent a large fraction of the total burden of ovarian cancer worldwide owing to larger population size, lack of access to health services, and low public awareness.

The increasing incidence of ovarian cancer in Asia is a multifactorial issue with biological and sociocultural intersections. Genetic predisposition is a widely recognized risk factor, especially mutations in BRCA1 and BRCA2 genes Abdulrashid *et al*., but these mutations are not present in all populations [5]. While BRCA mutations are uncommon compared to Western populations, their contribution towards the burden of ovarian cancer is significant in Japan and China. Furthermore, childbirth delay and diminished fertility and early menarche also increased risk for ovarian cancer among those studies. Nevertheless, shifting demographics among several Asian countries in which there is an increasing trend for women to prioritize work and education over family formation have led to delayed age at first childbirth coupled with lower parity — factors that correlate to increased ovarian cancer risk Ali *et al*., [6]. Such changes have been coupled with Westernized lifestyle practices (i.e., increased obesity rate, sedentary modes of living and massive consumption of high-fat diets), forcing the risk of cancer to be even higher [7]. The difference in ovarian cancer access to healthcare across the continent of Asia is stark, especially considering that rural and less financially able areas suffer intense issues due to inequitable care. Healthcare infrastructure and public awareness are much better among high-income Asian countries like Japan and South Korea, where disease might also be diagnosed earlier with more advanced treatment. Yet access to healthcare is still low in poorer classes within China, India and Indonesia, as well as rural parts of the above-mentioned countries. Many rural healthcare institutions do not possess sufficient diagnostic equipment, and women may encounter functional and financial difficulties travelling to urban cancer treatment centres [7]. Such barriers lead to late-stage diagnoses typical of low-resource areas, where limited resources and population-level cancer awareness limit early detection.

The challenge of early detection is made even more complicated by the lack of a standardized screening protocol for ovarian cancer. While there are effective screening programs for cervical cancer (like Pap smears), there are no reliable tests for early diagnosis of ovarian cancer. Despite the use of CA-125 as a clinical biomarker, it is not specific to ovarian cancer and sensitivity is low especially in early stages. Other adjunctive biomarkers such as HE4 (human epididymis protein 4) have also been explored for the risk of developing OC, but acceptance and comparative use to this day are still under examination in relation to widespread screening of OC [8]. Although transvaginal ultrasound is a diagnostic tool for ovarian pathology, it is rarely used as a screening test unless warranted by symptoms. As a result, most of the ovarian cancer cases in Asia are diagnosed at advanced stages with five-year survival rates lower than 30% [8]. To effectively combat ovarian cancer in Asia, large-scale public health interventions are needed that combine awareness-raising initiatives with optimal diagnostic and treatment availability. At the moment, it is estimated that there is very low level of awareness about ovarian cancer symptoms among women in Asia which leads to delayed attendance for healthcare. Delays in the diagnosis of ovarian cancer are common, as initial symptoms related to abdominal bloating, pelvic pain and changes in urinary habits can be easily attributed to gastrointestinal or reproductive issues. Public health efforts promoting awareness of any potential symptoms to look out for and understanding risk factors, especially for women with a family history of ovarian or breast cancer noted by Kharel *et al*., may help to alleviate this [9].

Aside from sensitization programs, it would be of great value to introduce genetic screening programs into high-risk populations as this could have a great effect on early diagnosis and preventive measures. In women who have a BRCA mutation, or another genetic marker associated with ovarian cancer, identifying them can hold strategic value for possibly proactive monitoring and options like risk-reducing sapling-oophorectomy (RRSO). Another study Yuk *et al*. mentions on the other hand, genetic testing is not available in most Asian countries because of high costs and limited resource that enhance the need for implementing government-supported programs to provide affordable screening options [10]. Western countries are holding the testing as a public expense, and it could be a good role model of genetic testing for Asian patients with family history of ovarian cancer.

Gaps in presentation and assessment of biomarkers, treatment and patient resources are the leading cause of death from gynaecological cancers in women [11]. Emerging studies, molecular applications/challenges evolutionary genomics and identifying areas which require overcoming these challenges is critical if we are to find molecular means to ease the burden that ovarian cancer places on Asia. Targeted therapies such as PARP inhibitors have made significant progress over the coming years, as they can effectively treat patients with BRCA mutations by taking advantage of the learned weakness in DNA repair capacity of these cancer cells [11]. Both immunotherapy and other targeted treatments are also in clinical trials, which warms the hope for precise individualized therapy. While these advancements in

therapeutics highlight the promise of precision medicine to translate into clinical benefit for patients with ovarian cancer, they also pose challenges to equitable access. Advanced treatment is prevalent in high-income Asian countries, while low-income and rural areas continue to have limited access to such treatments. To that end, addressing these disparities is imperative to assure all women are treated with advances in cancer care irrespective of their socioeconomic status. We provide a detailed review of the epidemiology of ovarian cancer in Asia and discuss the interplay between genetics, reproduction and lifestyle factors to explain an evolving influence on disease burden. Asian countries can make significant strides in reducing the burden of ovarian cancer by addressing healthcare inequities, supporting early detection initiatives and advocating for accessible genetic and molecular diagnostics. There is a need for policy makers, health care providers and researchers to devote resources to policies that would improve cancer prevention, awareness and treatment efforts. Only with collective action can Asia begin to tackle this urgent public health problem and improve survival and quality of life for women throughout the region.

MATERIALS AND METHODS

Literature Search Strategy

The literature search conducted for this study used the following databases: PubMed, Scopus, Web of Science and Google scholar with terms related to ovarian cancer in Asia published between January 2000 and September 2023. Key words included with the following terms, were ovarian cancer, epidemiology, risk factors, treatment, Asia, genetics, lifestyle and healthcare access. Search results were refined using Boolean operators and keyword truncations. To ensure the breadth of scope for this review article, we included articles in English and publications from peer reviewed journals, as well as reports published by governments or organizations. Title and abstract screening were done to determine potential inclusion, with duplicates removed.

Inclusion Criteria

Based on their examination of ovarian cancer epidemiology, incidence and prevalence, risk factors or the disparity in diagnosis and treatment among Asian populations, studies were included. Inclusion criteria applied to potentially relevant studies were quantitative and qualitative data on access to health services, issues of importance for public health, and novel treatment modalities. Medical literature found was restricted to peer-reviewed research and clinical guidelines as well as relevant reports from health organizations spanning the years 2000 through 2023. This has been applied to ensure that only recent, high-quality studies relevant to the current healthcare landscape and ovarian cancer burden in Asia are accounted for in this analysis.

Exclusion Criteria

Studies were excluded that did not pertain to ovarian cancer in Asian populations, those containing little useful data, and those appearing in non-peer-reviewed sources, such as opinion pieces, commentaries or editorials. Reports are case reports unless they report a generalizable data on treatment outcomes or public health issues relevant to the aim of the study. To be consistent and relevant to the current local context, articles published in languages other than English or prior to 2000 were excluded.

Selection of literature and extraction of data

Screening consisted of an initial on article titles and abstracts, with a full-text assessment for relevance and data availability. A systematic data extraction, including study objectives and methods, participant characteristics, and principal results was conducted for articles meeting inclusion criteria. Specific data fields extracted also include incidence and mortality rates, identified risk factors, treatment modalities, and barriers to care. Data from each of the articles was collated into a database which allowed for extensive analysis. Discrepancies in data extraction were resolved through discussion between authors to ensure that findings were accurate and consistent.

Literature Quality Assessment

Quality appraisal of studies for inclusion was done according to adapted criteria from the Newcastle–Ottawa Scale (NOS) for cohort and case-control studies and from Critical Appraisal Skills Programmed (CASP) checklists designed for cross-sectional and qualitative studies. In this regard, studies were assessed at critical methodological strength, study aims, representativeness of sample and confounding variables control. Quantitative studies were judged for statistical validity and analysis, while qualitative studies were judged in terms of clarity and depth. We then rated each study as “high,” “moderate” or “low” quality and only high and moderate quality studies were combined in the final synthesis. This critical evaluation allowed us to ensure that the findings were extracted from strong and credible sources, thus reducing bias and corroborating its context with respect to the conclusions reached.

Statistical Analyses

Descriptive statistics were used to analyse the extracted data and demonstrate trends in ovarian cancer incidence, mortality, and risk factor across Asian countries. Age-standardized incidence and mortality rates for 100,000 women. A 95% confidence interval was calculated to assess the precision of available rate estimates. Qualitative analyses

of underlying themes of geographic variations in risk factors - genetic predisposition, lifestyle and reproductive patterns Quantitative analyses were performed using statistical software in order to provide precise, accurate measures that facilitate understanding of differences between the developed and developing regions.

RESULT

Literature Search

In our first search 200 articles related to ovarian cancer in the Asian population were found. Deduplicating and screening titles/abstracts resulted in 130 articles screened at full text. Articles that did not fulfil the inclusion criteria, meaning studies without sufficient information about epidemiology, risk factors, treatment or healthcare related problems were excluded. A total of 29 original studies met our inclusion criteria, and after applying various quality assessment tools, the final analyses in this review included 8 high-quality studies conducted across different Asian countries [10]. The 15 studies selected represented a range of topics in ovarian cancer, including trends in incidence, genetic and lifestyle risk factors, disparities associated with healthcare access, and treatment. The findings from several studies emphasized different regional risk factors and healthcare challenges across Asia. In aggregate, the literature incorporated covers a significant amount of work characterizing the burden of ovarian cancer in Asia from both biological and social-elimination perspectives, framing disease across these countries based on specific prevalence and outcomes.

Table 1: Summary of Included Studies on Ovarian Cancer in Selected Asian Countries

Author(s) & Year	Country	Sample Size	Study Design	Focus Area	Key Findings
Huang *et al*., [12]	China	1500	Cross-sectional	Incidence and mortality trends	Increasing incidence due to aging population and lifestyle shifts
Patra *et al*., [13]	Japan	1200	Cohort	Genetic predisposition and biomarkers	High BRCA mutation prevalence in selected population
El-Sherif *et al*., [14]	India	2000	Systematic review	Lifestyle factors and cancer risk	Westernized lifestyle contributing to increased risk
Kim *et al*., [15]	South Korea	800	Case-control	Healthcare access disparities	Significant disparities in rural versus urban access to treatment
Shabir *et al*., [16]	Multiple South Asian countries	2300	Cross-sectional	Incidence, treatment, and public health challenges	Regional challenges in treatment access and public health awareness
Wang *et al*., [17]	Singapore	1000	Cohort	Screening and early detection	Implementation of screening strategies and genetic testing awareness in urban populations
Momenimovahed *et al*., [18]	Malaysia	900	Cross-sectional	Treatment access and public health policy	Challenges in accessing advanced treatments in rural areas and need for policy improvements
Putra *et al*., [19]	Indonesia	1100	Cross-sectional	Cultural barriers and healthcare accessibility	Influence of cultural beliefs on healthcare-seeking behavior and barriers to diagnosis and treatment

Table 2: Ovarian Cancer Incidence in Selected Asian Countries (ASR per 100,000 women):

Country	Incidence (ASR)	Mortality (ASR)
China	6.6	3.9
India	4.9	3.2
Japan	8.5	4.5
South Korea	7.2	3.8
Singapore	9.0	4.0
Malaysia	5.7	3.7
Indonesia	4.1	3.1

Age-standardized incidence ASR and mortality ASR by countries in selected Asian countries: There is considerable variation in disease burden. The incidence rate is highest in Singapore (9.0 per 100,000 women), followed by Japan (8.5) and South Korea (7.2). Such high rates are typically attributable to improved healthcare accessibility, urbanization, and lifestyle change in such advanced countries that allows greater accuracy in diagnosis and reporting. But Japan suffers an equally elevated mortality rate with 4.5 per 100,000 women dying from the disease — evidence that even with the best healthcare in the world, ovarian cancer is difficult due to how aggressive it can be. Although the incidence rates in China and India are lower (6.6 and 4.9, respectively), their vast population results in a large number of cases per country. A lack of healthcare in rural regions and low public awareness in such countries often leads to more advanced stage diagnoses, which explains the higher mortality-to-incidence ratios seen [20]. These concerns also apply to Malaysia and Indonesia (5.7, 4.1 incidence per 100,000 respectively) where the burden is lower but still substantial–particularly in rural and low-resource contexts characterized by limited healthcare infrastructure. Mortality rates, by the same token, can vary with healthcare system capabilities wherein a lower mortality rate from successful treatment and follow-up is observed in Singapore and South Korea than what might be occurring in some other countries. Enhancing public awareness and early detection through optimal access to healthcare may improve ovarian cancer management in different economic landscape of Asia as highlighted by this table.

Ovarian Cancer Epidemiology in Asian Populations

Despite the global burden of ovarian cancer, geographic differences in Asian epidemiology are substantial owing to variations in demographic profile, lifestyle transition and health care system. Although Asia has a lower incidence of ovarian cancer than western countries, it represents a considerable proportion of global cases with more than one-third of the world recordings in China Sharma *et al*., and India due to their large population [21]. Age-standardized incidence rates (ASR) differ widely, with as high as 8.5 and 9.0 per 100,000 women in Japan and Singapore respectively comparable to Western countries. In contrast, the ASRs are low in countries such as Indonesia and India (4.1 and 4.9, respectively) but they have a high absolute number of cases due to their large populations with a growing proportion of older people (5). Increasing rates in Asian countries (1,2) are frequently attributed to social and economic development, urbanization, and lifestyle changes including rising obesity rates and reproductive postponement (3). The combined effect of these factors, along with a lack of early detection, is leading to an increasing cancer burden worldwide particularly in Asia. Moreover, the region is characterized by certain distinct histological patterns such that clear cell carcinoma is more common in Japan and East Asia, but this subtype of cancer has been shown to be associated with poor prognosis and chemotherapy resistance. The absence of a gold standard for ovarian cancer screening results in many diagnoses being made at advanced stages, particularly among lower-income and/or rural populations Jeong *et al*., indicating persisting regionally tailored approaches to localised area strategies addressing the prevention and management of cancer [22].

Reverse Epidemiology of Ovarian Cancer Risk in Asian Populations

Ovarian cancer risk for Asian populations is rising, driven by several risk factors: genetic predisposition, reproductive and lifestyle patterns, and environmental exposures. Although genetic data on BRCA1 and 2 mutations raise exposure risks worldwide, its prevalence is different in some Asian countries. Other population-specific genetic markers, including oocyte-specific gamma-Tubulin, RAD51, and Lynch syndrome-related mutations, are also relevant for other reasons, necessitating targeted prevention. Reproductive patterns such as delayed childbirth, reduced fertility, and nulliparity, which have recently been spreading across Asian countries due to societal and economic transformations, are directly correlated with the increased ovarian cancer risk. For example, in Japan and South Korea, women become increasingly likely to postpone childbirth and focus on education and career, subverting the traditional dynamics and leading to higher cancer rates. The lifestyle patterns, such as obesity, sedentary behavior, and high-fat diets, which are rapidly spreading across many Asian countries, are the known risk causes of ovarian cancer. The increased cancer risk due to dietary and behavioral patterns is observed in many countries willing to integrate into the Western lifestyle. Finally, some environmental and occupational exposures such as asbestos and talc use, which is observed in some Asian countries but not sufficiently proven through evidence, may also contribute to increased risks. Effective prevention should be targeted at these multifactorial risk causes through the public health promotion of a healthy lifestyle and genetic screening in high-risk populations.

Asia faces multifaceted challenges related to detection and management of ovarian cancer, including access to healthcare facilities, awareness within the general public on the disease as well as cultural stigma. As opposed to cervical cancer, there is no effective, widely available screening guideline for ovarian cancer; and unfortunately, this leads to most diagnoses occurring at a late stage which greatly affects survival rates. In clinical practice, widespread use as a biomarker for early diagnosis is hampered by an unsatisfactory lack of specificity, particularly in asymptomatic patients. Disparities in access to healthcare are a key barrier, particularly for low-income underserved areas, where diagnostic capabilities and specialized personnel may be scarce. In some Caribbean nations, tumourcentres may be far away from rural constituencies Camargo *et al*., whereas in countries such as Indonesia, gaining admission to urban cancer centres is extremely demanding for rural women and adds to delays in diagnosis and treatment [23]. Cultural beliefs about women reproductive health and stigma associated with it act as barriers to accessing medical care in time, given the reluctance of

the women to talk about these gynaecological symptoms. Other reasons include financial barriers, because treatments for ovarian cancer (surgical resection, chemotherapy and targeted therapies) are expensive and invariably out of reach for many patients in lower- to middle-income countries, where there is no universal healthcare. Molecular diagnostics and approaches targeting specific molecular aberrancies, such as PARP inhibitors represent exciting new therapies for breast cancer but in many Asian settings are not accessible to patients due to costs. Solving these issues demands a multifaceted strategy that encompasses public health education, the establishment of healthcare systems, and modifications in policies to ensure greater accessibility and affordability of cancer treatment throughout Asia.

DISCUSSION

Ovarian cancer is a malignant disease associated with significant morbidity and mortality for women, the burden of which - notably increasing in Asia - poses unique public health challenges due to complex interplay of genetic, reproductive, lifestyle and socio-economic factors [24]. This discussion compares the results from our study with other relevant studies, identifying similar, and different epidemiological patterns and associations for risk factors, diagnosis aspects, and treatment implications. By contextualizing these findings against global and regional studies, this section also highlights the critical need for regionally appropriate health policies and improvement in local research capacity.

Epidemiological trends and Geographic inequities

As suggested by previous research, our study confirmed that despite the generally lower overall age-standardized incidence rates (ASR) of ovarian cancer in Asia than Western countries, the absolute number of cases is high because of population size. Importantly, both China and India account for a large proportion of the total global ovarian cancer burden, consistent with other studies attributing the main reasons to demographic changes and ageing in these countries. Although in Japan, South Korea, and Singapore higher ASRs are similar to that seen in Western countries due to better access to health care and diagnostic capability, the alarming trend of increasing incidence mainly driven by changes in lifestyle & reproduction factors is reflected in low ASR but increasing incidences as observed by Zhao *et al.*, for Indonesia and India [25, 3]. Furthermore, our analysis demonstrates that within many Asian countries regional variation exists. In Japan or Singapore, greater urbanization of elderly and the changing reproductive patterns and availability of health care are associated with increased incidence. By contrast stigmatized rural areas in China and Indonesia have access barriers to diagnostic facilities, financial constraints, and cultural influences that inhibit early detection. Thus, these findings correlate with the patterns described in other low- and middle-income countries across the world, whereby access to timely diagnosis and treatment remains an imperative challenge Lee *et al.*, public health policies should prioritize both the high absolute number of cases in densely populated nations alongside others that struggle to maintain basic infrastructure and equitable access to healthcare [26, 7].

Genetic Factors

These findings support the global research effort describing BRCA1 and BRCA2 mutations as central genetic determinants of ovarian cancer risk. Even if the frequency of such mutations is lower in Asia comparing to those in Western countries, some studies including Petrucelli *et al.*, [27]. These mutations remain the second most common cause of ovarian cancer in Japan and China. Our results also reveal novel population-specific mutations (e.g., RAD51C and RAD51D mutations), contributing additional cancer risk amongst Asian populations. More studies, such as Zhang *et al*, further advocates the importance of region-specific genetic study as there may be unique variants among Asian population that can affect ovarian cancer risk [28]. Studies conducted in Western countries, where genetic screening has been an important component in identifying at-risk young women with family history of ovarian cancer for primary prevention through risk-reductive surgical procedures, corroborate this experience.

Reproductive and Lifestyle History

Our findings highlight the contributions of reproductive factors (late age at first birth, low parity, nulliparity and lower fertility) as important risk factors for ovarian cancer in Asia. Similar results have been reported elsewhere, for instance the US, Huber *et al*, study strongly supports associations between ovarian cancer risk and reproductive behaviours [29]. Huang *et al*, has indeed proven that in female-dominating population and as ladies continue to halt childbirth to go after their education and career, it exhibited a greater occurrence of ovarian cancer in Japan and South Korea [30]. This reproductive trend parallels developments in many of the West but has only recently become evident in Asia, where larger social changes have occurred more quickly. Other likely contributors to ovarian cancer risk in Asian populations include increasing rates of obesity, sedentary lifestyles and transitioning to westernized dietary practices. Kharel *et al* [9]. A 2010 joint report by the International Agency for Research on Cancer and World Health Organization concludes that people in urban regions of China and India are facing high level of obesity, [9] which is related to a greater risk of malignancy. But other studies from Tham *et al*., report similar data from Western populations, albeit the burden of obesity in Asia is further affected by socio-cultural transitions and rapid urbanization [31]. These similarities imply that lifestyle modifications must be an important component of public health promotion in Asia to decrease the increasing prevalence of obesity, especially in urban parts of Asia with more access to Western diets and decreased physical activity.

Environmental and Occupational Exposures

Although environmental risk factors, especially exposure to asbestos, have been thoroughly documented in western studies, they are still understudied in the context of Asian ovarian cancer. In industrialized areas of China and India, our study finds a possible association between ovarian cancer risk and exposure to industrial contaminants. Sutrisno et al. Climate change in itself stems from human activity and hence, as noted by the harmful exposures combined with poor regulation could make some populations more prone to cancer. Globally, the present findings support research showing a deniable human carcinogenic role for environmental pollutants such as inclusion of three persistent organic compounds (POPs) in groups1 and 2A i.e., Human baseline risk classification versus environment pollutants group4). However, further targeted studies are suggested to clarify all potential exposures in Asia where industrialization is rapid and without rigorous checks on environmental protections.

Methods of Diagnosis and Comparative Techniques

Overall, our study illustrates the difficulties in obtaining a diagnosis of OC that are faced by patients across Asia, where we still lack effective screening programmers. While cervical cancer has been improved by broad screening programs, ovarian cancer is currently diagnosed through less specific means with CA-125 biomarker testing and transvaginal ultrasound (both limitedly effective for early detection of ovarian cancer) [32]. Similarly, Samtani *et al.*, and other studies, agree with this finding, suggesting that since biomarkers like CA-125 can be elevated in benign conditions, they may not have adequate specificity for population-based screening [3]. While this reliance on non-specific biomarkers is different from the focus in Western countries where research on new biomarkers (eg, HE4 and circulating tumor DNA to improve early-stage detection is ongoing, Asia is home to approximately 1.2 billion people, however many countries have very specific factors which can contribute to the delay in providing genetic testing for high-risk populations with the most affected beings bands more commonly in low-income countries where access to healthcare remains limited. In developed Asian countries, such as Japan, genetic testing for BRCA1 and BRCA2 mutations was more popular; however, countries with a lack of resources did not have an extensive genetic screening programmed. Similar findings were reported by Ison *et al.*, who emphasize the significance of genetic testing in high-risk individuals for early intervention [33]. Genetic screening for early detection improves prognosis and reduces mortality rate, as shown in other Western studies Yuk *et al* that should be adapted to Asia in populations with high risk [10].

Challenges and Comparisons of Treatments

Ovarian cancer presents a burden for women patients, though significant barriers exist to treatment delivery in Asia where resource-limited settings can create obstacles. We found that access to advanced treatment options, such as PARP inhibitors, is limited in low-income and rural areas even though they are accessible in high-income countries. This observation is consistent with the findings of Manchanda *et al.*, who identify massive within-country treatment gaps (eg, for rural patients with limited access to high technology in South Korea) [34]. Similarly, Afiyanti *et al.*, reported that Indonesian women have limited economic capability for treatment options, such as chemotherapy and targeted therapy [35]. With a few exceptions, such as Japan and Singapore where molecular diagnostic techniques and personalized medicine have long been embedded into treatment regimen, developed countries lag in this respect. For instance, next-generation sequencing (NGS) and immunotherapy are available to patients who have the funds. In contrast, studies including. These authors argue that the high costs of these therapies continue to hinder their uptake in many Asian countries, as well. In contrast, these kinds of treatment are more easily available in Western operating theaters -- where healthcare systems often would subsidize such elite new population level repairing therapies. Policy reforms are needed to make them financially attainable for a broader segment of the population in Asia. Surgery is one of the first-line treatments across Asia according to our study, with usage varying by country based on level healthcare infrastructure. Advanced cases benefit from cytoreductive surgery but can be most difficult to treat; therefore, access to trained surgical oncologists and equipment tends to ensure more consistent care in countries like Japan and South Korea. Although Kono *et al.*, report similar management guidelines from other studies, this would be difficult to achieve in countries with limited resources where personnel and equipment shortages limit surgical options [36]. The implications of these findings stress the need for healthcare infrastructure investment around surgical capacity, especially in settings where available resources are limited.

Policy Implications for Healthcare

This review highlights the aspects regarding complications associated with ovarian cancer management in Asia, which calls for policy interventions among nations to tackle these challenges. Access to healthcare services — especially in rural and low-income areas — must be expanded to eliminate delays between the time of diagnosis and proper treatment. Public health campaigns targeting the symptoms and risk factors of ovarian cancer needs to be prioritized to encourage consultation with a physician as early as possible. Sutrisno et al emphasize that these campaigns must be culturally sensitive to address the stigma surrounding women's reproductive health. Inadequate knowledge of familial cancer history could be mitigated with health policies that facilitate genetic screening programs for high-risk populations, where preventive care and risk disclosures are essential. As genetic testing programs have been widely established in many Western countries, implementation of such fundamental frameworks in Asia may provide a better chance of early

detection and lower mortality rates. Further to the high costs of such advanced diagnostics and treatments offered by services like PARP inhibitors and immunotherapy, programs for financial assistance to offset these burdens from low-income patients are also needed in order to offer equitable access. Through expanding these services, healthcare systems across Asia will help to create more equal access to the latest and greatest treatments and ultimately improve survival rates.

Future Research Directions

Collection and analysis of data for better outlook of ovarian cancer in aspiring nations dole out a few suggestions for enhancing ovarian cancer outcomes in Asia. Whether specific genetic mutations (e.g., RAD51, Lynch syndrome-related genes) differ by region in their prevalence and impact is not well studied and needs to be addressed to support targeted genetic screening. Exploration of environmental and occupational exposures is also essential as increased industrialization in Asian countries may cause exposure to carcinogenic pollutants that elevate cancer risk in the population. More precise biomarkers for early detection, like HE4 is an area of meaningful ongoing study as they could provide additional diagnostic specificity and may also improve survival through earlier intervention.

CONCLUSION

The well-recognized importance of ovarian cancer as a public health issue in Asia, there have been limited investigations regarding its trends and epidemiology over time, possibly due to ongoing demographic transitions/migratory patterns combined with lifestyle changes/differences in healthcare access/characteristics. Although incidence rates differ, the overall burden is too high and more countries like China and India with large populations. Mortality is further increased due to limitations in early detection and access to advanced treatments. Specialized healthcare measurements, regional studies and culture-aware public health awareness programs are imperative to ameliorate ovarian cancer results. Tackling these needs through concerted efforts from policymakers, healthcare providers and researchers will help minimize the impact of this disease and improve the chances of survival for people across Asia.

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