



REVIEW ARTICLE

**Significance of Preventive Health Checkups in Enhancing Well-Being: A Comprehensive Review**

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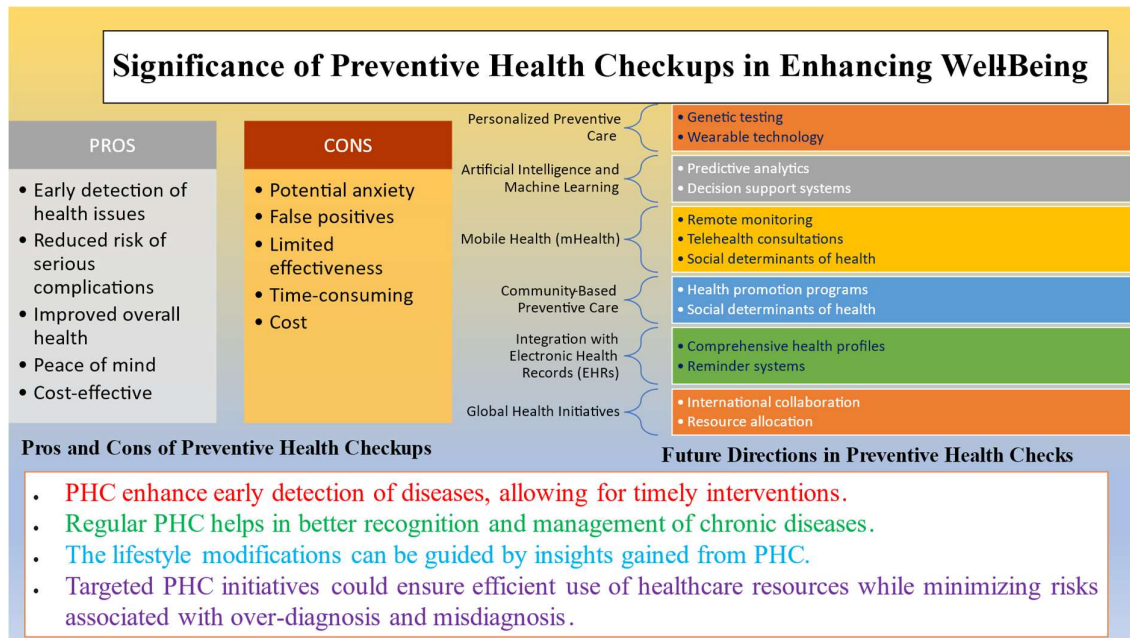
**Abstract**

**Background and Aims:** Preventive health checkups (PHC) are crucial in modern healthcare, aimed at early detection of health risks to facilitate timely intervention. This review evaluates the significance and impact of PHC in enhancing individual well-being in light of increasing lifestyle and environmental health risks. **Methods:** A comprehensive review of current literature on PHC was conducted, analyzing studies related to early disease detection, intervention, and health promotion. **Results:** PHCs empower individuals by identifying potential health risks before symptoms manifest, enabling proactive lifestyle modifications. The Centre for Disease Control also supports routine preventive measures, correlating them with improved health indicators. Research indicates that annual physical examinations can significantly lower all-cause mortality risk by 45% and improve chronic disease recognition, though some studies did not find a reduction in overall mortality. Factors influencing PHC effectiveness include financial literacy and targeted interventions for high-risk populations. Concerns regarding inappropriate use of PHC exist, with potential issues of over-diagnosis and false results highlighted in the literature. **Conclusions:** Preventive Health Checkups plays a vital role in early detection of health issues and promotion of overall well-being. While not a substitute for a healthy lifestyle, PHCs can complement healthy habits by providing essential insights. Future public health initiatives should focus on targeted PHC for individuals who stand to benefit most, ensuring that resources are used efficiently and effectively to improve health outcomes.

**Keywords:** Preventive Health, Disease, Lifestyle Risk Factors, Chronic Disease Prevention, Health Screening, Public Health Policy, Non-Communicable Diseases

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## Graphical Abstract



### Key Highlights

- Preventive Health Checkups (PHC) enhance early detection of diseases, allowing for timely interventions that can lead to improved health outcomes.
- Regular PHC helps in better recognition and management of chronic diseases, contributing to reduced morbidity and mortality, especially in high-risk populations.
- The lifestyle modifications, such as diet and exercise, which can be guided by insights gained from PHC, help in promoting overall well-being.
- There is a need for targeted PHC initiatives that focus on individuals who would benefit the most, ensuring efficient use of healthcare resources while minimizing risks associated with over-diagnosis and misdiagnosis.

### 1. Introduction

Preventive health checkups (PHC) form an indispensable pillar of modern healthcare. These routine evaluations aim

to identify potential health risks early on, allowing for timely intervention and prevention of serious illnesses. The PHC serves as a proactive approach to healthcare, empowering individuals to take control of their well-being. By detecting diseases or conditions in their early stages, these screenings offer a greater chance of successful treatment and improved outcomes. One of the primary advantages of PHC is its ability to identify potential health risks before symptoms manifest, giving individuals a sense of control and the opportunity to take proactive measures. This early detection allows for lifestyle modifications, dietary changes, or medical interventions to mitigate risks and reduce the likelihood of developing chronic diseases. Furthermore, PHC plays a crucial role in maintaining overall health and well-being. Regular checkups can also help to alleviate anxiety and stress associated with unknown health conditions [1-5].

The National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP) of the Centers for Disease

Control and Prevention (CDC), USA, are supportive of routine preventive care like blood pressure checks and cancer screenings, as they believe it can help detect problems early. CDC is committed to linking medical care to community resources that can help people prevent or slow down chronic diseases, avoid complications, and reduce the need for more health care. Their efforts have led to improvements in leading health indicators like high blood pressure control, physical activity, and teen pregnancy [1]. Lal et al., in a cross-sectional study, concluded that PHCs are an essential component of healthcare, as they can detect diseases early and thereby help reduce morbidity and mortality. Furthermore, they reported that financial literacy promotes PHC usage and helps reduce risky health behaviors like smoking, lack of exercise etc [2].

Pathak et al., in a meta-analysis, reported that annual physical examination was significantly associated with a 45% lower hazard of all-cause mortality for all participants [3]. Krogsboll et al., in a systematic review, found that health checks helped in a 20% increase in new diagnoses. However, they did not find the PHC to reduce morbidity or mortality [4]. Lis et al. also did not find PHC to reduce mortality or cardiovascular events. However, they found that they were associated with 'increased chronic disease recognition and treatment, risk factor control, preventive service uptake, and improved patient-reported outcomes' [5].

The PHC involves a comprehensive assessment of an individual's physical and mental health. This may include routine screenings for conditions like diabetes, high blood pressure, cholesterol levels, and certain types of cancer. Additionally, these checkups can provide insights into lifestyle

factors such as diet, exercise habits, and stress levels, which play a significant role in maintaining optimal health. While PHCs offer numerous benefits, they are not a substitute for a healthy lifestyle. Regular exercise, a balanced diet, and adequate sleep remain fundamental to maintaining good health. The PHC can complement these healthy habits by providing valuable insights and guidance.

Despite the apparent benefits of PHC, there have been concerns and doubts about its efficacy for the general population. Honnekeri et al. commented that an 'inappropriate use' of PHC is not beneficial as it is not only a financial and resource burden but may also lead to over-diagnosis and treatment and sometimes wrong diagnosis due to false-positive and negative results [6]. Krogsboll et al. also did not support the use of PHC in a general population. However, they advised for the continuation of public healthcare initiatives [5]. Khera et al. found limited and heterogeneous benefits of PHC. However, they can help in improving health behaviour and educate patients [7]. Christoffersen et al. advocated 'Targeted' PHC for those who would benefit from attending and have adequate resources [8]. Si et al. observed the usefulness of PHC in high-risk patients [9].

This review aims to evaluate the significance and impact of PHC in enhancing individual well-being amidst increasing lifestyle and environmental health risks. It synthesizes current literature and practices surrounding PHC, assessing their role in early detection, intervention, and overall health promotion. The review also examines the benefits and potential drawbacks of these checkups, considering factors such as cost, time, and psychological impacts. It identifies

populations that would benefit most from regular screenings and outlines the essential components of comprehensive checkups.

## **2. Methodology**

A comprehensive review of the literature regarding preventive health checkups (PHC) was done from 1<sup>st</sup> to 8<sup>th</sup> December 2024 to ensure scientific rigour and comprehensive coverage of the topic. The literature search was conducted across multiple academic databases, including PubMed, Scopus, Embase, Google Scholar, and databases specific to public health and preventive medicine, such as the Cochrane Library. The search strategy included a combination of keywords and phrases pertaining to preventive health checkups, such as "preventive health screenings," "early detection," "health promotion," "chronic disease prevention," and "healthcare policy." The search was limited to articles published in English.

We included only peer-reviewed articles, systematic reviews, meta-analyses, and clinical guidelines, focusing on diverse populations, including high-risk groups such as those with familial predispositions or lifestyle risk factors. Research that directly addressed the significance, outcomes, or components of preventive health checkups or related interventions was included. We excluded non-peer-reviewed articles, grey literature such as opinion pieces and editorials, and studies that did not specifically address PHC or that focused solely on treatment methods rather than preventive strategies.

Once the relevant articles were identified based on the established criteria, data extraction was performed. Essential information, including study design, population demographics, health outcomes

measured, types of checkups evaluated, and overall conclusions were documented.

## **3. Results and Discussion**

### **3.1 Who Should Undergo Preventive Health Checkups?**

The PHC are advisable for everyone, but specific groups may benefit more from regular screenings based on their health risks (Figure 1). Individuals with a family history of diseases such as heart disease, diabetes, cancer, or hypertension are at a higher risk and should consider frequent checkups. Those engaging in unhealthy behaviours, like smoking, excessive alcohol use, poor diet, or insufficient physical activity, should prioritize preventive care to mitigate their increased risk of health issues.

As the risk of chronic diseases escalates with age, individuals over 40 should undergo regular checkups to identify and manage potential health concerns, while those with existing medical conditions, including diabetes, hypertension, or heart disease, require regular monitoring to prevent complications. Additionally, gender-specific screenings are recommended at specific intervals, such as mammograms and Pap smears for women and prostate exams and colonoscopies for men, to help detect potential health issues early.

Evidence-based recommendations suggest that young adults prioritize annual physicals, Sexually Transmitted Infections (STI) screenings, and mental health check-ins. In contrast, middle-aged adults should focus on annual physicals, cancer screenings (colonoscopy, mammogram, PSA test), and cardiovascular risk assessments. Older adults should continue regular cancer screenings, including osteoporosis screening, and vision and

hearing should be monitored. Ultimately, family history, lifestyle factors, and individual health needs influence the frequency and type of screenings, making it crucial to consult with a healthcare provider

for personalized recommendations. Regular PHCs are considered essential for the early detection and prevention of diseases, contributing to improved health outcomes.

Young Adults (20-30 years)	Middle-Aged Adults (40-60 years)	Older Adults (60+ years)	Other Considerations
<ul style="list-style-type: none"> <li>•Annual Physical (BP, BMI, Lifestyle assessment)</li> <li>•Sexually Transmitted Infection Screening</li> <li>•Mental Health Check</li> </ul>	<ul style="list-style-type: none"> <li>•Annual Physical (BP, Lipids, Blood Sugar, BMI)</li> <li>•Cancer Screening</li> <li>•Cardiovascular Disease Risk Assessment</li> </ul>	<ul style="list-style-type: none"> <li>•Annual Physical (Review of medical history, medications and lifestyle)</li> <li>•Cancer Screening</li> <li>•Cardiovascular Screening</li> <li>•Metabolic Diseases Screening</li> <li>•Vision and Hearing Tests</li> </ul>	<ul style="list-style-type: none"> <li>•Family History</li> <li>•Life Style Factors</li> <li>•Individualized Recommendations</li> </ul>

Figure 1. Preventive Health Checks for different age groups

### 3.2 Common Conditions Detected by Preventive Health Checks

The PHC is crucial in the early identification and management of a wide array of health conditions, significantly improving the effectiveness of treatments (Table 1). These checks can uncover cardiovascular issues such as hypertension, dyslipidemia, and heart disease. They are also vital in detecting diabetes, particularly type 2 diabetes (T2D) before serious complications arise. Furthermore, they play a vital role in the early discovery of various cancers, including breast, cervical, colon, prostate, skin, and potentially lung cancer for high-risk groups, through recommended screenings like mammograms, Pap smears,

colonoscopies, and low-dose CT (Computed Tomography) scans. Besides these, preventive screenings can identify kidney and liver disease, thyroid disorders, osteoporosis, and sexually transmitted infections, which can all benefit from early intervention.

Preventive health checkups play a pivotal role in managing non-communicable diseases (NCDs). The NCDs are a major global health challenge, claiming the lives of 41 million people annually, constituting 74% of global deaths. Seventeen million people succumb to NCDs before reaching the age of 70, with a disproportionate 86% of these premature deaths occurring in LIC and LMICs, with

77% of all NCD deaths reported from these regions. Cardiovascular diseases emerge as the leading cause of NCD mortality, accounting for 17.9 million deaths yearly, followed by cancers (9.3 million), chronic respiratory diseases (4.1 million), and diabetes (2.0 million, including diabetes-related kidney disease deaths). Together, these four disease groups contribute to over 80% of all premature NCD deaths. Risk factors such as tobacco use, physical inactivity, harmful alcohol consumption, unhealthy diets, and air pollution significantly elevate the likelihood of NCD-related mortality [10]. Effective responses to NCDs necessitate a multifaceted approach encompassing detection, screening, treatment, and palliative care. Sathiyamoorthi et al. studied 337 participants from Southern India who

underwent a routine PHC and detected 12.3% with T2D and 37.7% with prediabetes. In addition, 54.1% were found to have anaemia, 42.2% with dyslipidemia, 11.5% with hypothyroidism, 27% with liver disorders and 6.5% with renal disorders. These cohorts were not aware of these underlying conditions [11].

Global health initiatives by organizations like the World Health Organization (WHO) and the United Nations (UN) aim to combat NCDs by promoting healthy lifestyles, ensuring timely access to healthcare, and addressing social determinants of health to reduce inequalities. Addressing the underlying risk factors and promoting PHC are critical strategies for significantly reducing the burden of NCDs and improving global health outcomes.

Table 1: Common Conditions Detected by Preventive Health Checks

Condition	Description
<b>Cardiovascular conditions</b>	Hypertension, dyslipidemia, heart disease.
<b>Diabetes</b>	Type 2 diabetes (T2D).
<b>Cancer</b>	Breast cancer, cervical cancer, colon cancer, prostate cancer, skin cancer, lung cancer.
<b>Other conditions</b>	Kidney disease, liver disease, thyroid disorders, osteoporosis, sexually transmitted infections

Some case scenarios illustrate how individuals successfully leveraged insights from PHC to improve their health outcomes:

- A 45-year-old man used early detection of prediabetes during his PHC to adopt healthier lifestyle changes, preventing T2D.
- A woman in her late 30s benefited from routine screenings that led to the early

detection of breast cancer, allowing for timely treatment.

- A 60-year-old woman, informed of her high blood pressure, engaged in dietary changes and stress management techniques, significantly improving her health.
- A 50-year-old man who lowered his cholesterol through lifestyle adjustments and a young woman who recognized and sought help for her

mental health challenges following screening.

- A 55-year-old man benefitted from a colonoscopy prompted by PHC discussions, resulting in the removal of precancerous polyps.

These case scenarios highlight the valuable role of PHC in facilitating proactive health decisions and improving overall well-being.

### 3.3 Essential Components of Preventive Health Checkups

Comprehensive PHC encompasses a variety of essential components aimed at assessing and promoting overall health (Table 2). It starts with a physical examination, which includes measuring vital signs (e.g., blood pressure, heart rate, respiratory rate, and temperature), along with evaluating body mass index (BMI) to determine weight status. The physical exam also involves a thorough evaluation of different body systems, including the heart, lungs, abdomen, and skin. Laboratory tests

play a crucial role, with blood tests assessing various markers like blood cell counts, cholesterol, glucose levels, and kidney and liver function. Urinalysis is conducted to detect signs of infection, kidney disease, or other conditions.

Screenings are tailored based on age and risk factors, including cancer screenings like mammograms, Pap smears, colonoscopies, and prostate exams, as well as cardiovascular screenings such as electrocardiograms (ECG) and lipid profiles for cholesterol levels, diabetes screenings through blood tests, and bone density tests for osteoporosis risk.

Additionally, a health history and lifestyle assessment are conducted to review medical and family health history, as well as lifestyle factors such as diet, exercise habits, smoking, alcohol consumption, and stress levels. Health education and counselling provide valuable information on healthy lifestyle choices, disease prevention, and support for making lifestyle changes.

Table 2. Preventive Health Checkup Components

Component	Description
<b>Physical Examination</b>	Measurement of vital signs, height, weight, and evaluation of body systems.
<b>Laboratory Tests</b>	Blood tests, urinalysis, and other diagnostic tests.
<b>Screenings</b>	Cancer screenings, cardiovascular screenings, diabetes screening, and others.
<b>Health History and Lifestyle Assessment</b>	Review of medical history, family history, and lifestyle factors.
<b>Health Education and Counselling</b>	Providing information and guidance on healthy lifestyle choices.
<b>Specialized Screenings</b>	Genetic testing, advanced imaging techniques, and functional medicine screenings.
<b>Early Detection Techniques</b>	Liquid biopsies, biomarkers, wearable health devices.
<b>Personalized Lifestyle Recommendations</b>	Nutrigenomics, personalized exercise plans, stress management techniques.

Advancements in PHC offer a more in-depth approach, incorporating specialized screenings like genetic testing and advanced imaging techniques to identify predispositions to diseases and detect abnormalities early. Early detection techniques such as liquid biopsies and biomarkers, along with wearable health devices, help in monitoring health metrics for potential issues. Personalized lifestyle recommendations, including nutrigenomics for dietary advice based on genetic makeup, personalized exercise plans, and stress management techniques, contribute to a tailored approach to preventive care. These advanced checkups (Table 2) aim for increased early detection, personalized care, and proactive health management, although they might involve higher costs and require specialized expertise.

The following examples illustrate the wide-ranging impacts of PHC across various demographics and health conditions, emphasizing their importance in promoting long-term health and well-being.

- *The Diabetes Prevention Program (DPP):* The DPP was a landmark study that demonstrated the effectiveness of preventive health measures in reducing the incidence of T2D among high-risk individuals. Participants with elevated blood sugar levels were assigned to either a lifestyle intervention group or a control group. Those in the lifestyle intervention group engaged in regular physical activity received dietary counselling and achieved modest weight loss. Results showed that participants in the lifestyle group had a 58% reduction in the development of diabetes over three years, emphasizing the importance of early

detection and proactive lifestyle changes [12]. Gilmer and O'Connor highlighted the need for early detection of diabetes and prediabetes through screening [13]. Duan et al. suggested economic models supported targeted screening for diabetes and prediabetes [14].

- *Breast Cancer Screening in Women:* Numerous studies have underscored the effectiveness of routine mammograms in detecting breast cancer at an early stage when treatment is most effective. For example, a 2019 study published in JAMA Oncology indicated that women who underwent regular mammography screenings had a 40% lower likelihood of dying from breast cancer compared to those who did not participate in screenings. This case highlights the critical role of preventive health checkups in early detection and the potential for better health outcomes [15].
- *Cardiovascular Risk Assessments:* A case study involving a cohort of middle-aged adults showed that regular cardiovascular risk assessments, including cholesterol and blood pressure monitoring, led to significant reductions in heart disease and stroke incidents. Participants who received tailored advice based on their risk profiles implemented lifestyle modifications, such as improved diet and increased physical activity, resulting in a 30% decrease in heart disease rates over five years compared to a control group that did not have regular assessments [16].
- *HPV Vaccination and Cervical Cancer Screening:* In a public health initiative focusing on young women,



a combination of HPV vaccination and regular cervical cancer screenings demonstrated a marked impact on reducing the incidence of cervical cancer. A study showed that communities that implemented both strategies saw a significant drop in cervical cancer rates, highlighting the importance of not just screening but also preventive measures like vaccinations as part of a comprehensive health approach [17,18].

- *Mental Health Screenings:* A program aimed at college students incorporated regular mental health screenings into student health services. This initiative led to the early identification of anxiety and depression among students who may otherwise have gone untreated. The implementation of counselling services and wellness programs resulted in increased help-seeking behaviour and improved mental health outcomes, illustrating the importance of preventive health checkups in recognizing and addressing psychological conditions [19].
- *Pediatric Preventive Care:* A case study focusing on pediatric preventive care demonstrated that children who received regular well-child visits and screenings were more likely to have timely vaccinations and early identification of developmental

delays. These early interventions helped reduce long-term health issues and ensure better overall development, emphasizing the lifelong benefits of preventive health care starting from a young age [20].

### **3.4 Pros and Cons of Preventive Health Checkups**

The PHC offer several advantages, including the early detection of potential health issues when they are typically easier to treat, reducing the risk of severe complications from untreated conditions, and promoting overall health by encouraging healthy lifestyle choices and informed health decisions. They also provide a sense of peace of mind through proactive health management. In the long term, these checkups can be cost-effective by preventing the need for more expensive treatments for advanced diseases [1-5].

However, there are downsides to consider [6-8]. Some individuals may experience anxiety at the prospect of undergoing screenings, and there is the potential for false positives, which can lead to unnecessary stress and further testing. While beneficial, PHC might not prevent all health problems. They can also be time-consuming and involve upfront costs, which may be a barrier for some people. Overall, the benefits of PHC generally outweigh the cons, but it is essential to consider these factors when planning for healthcare (Figure 2).

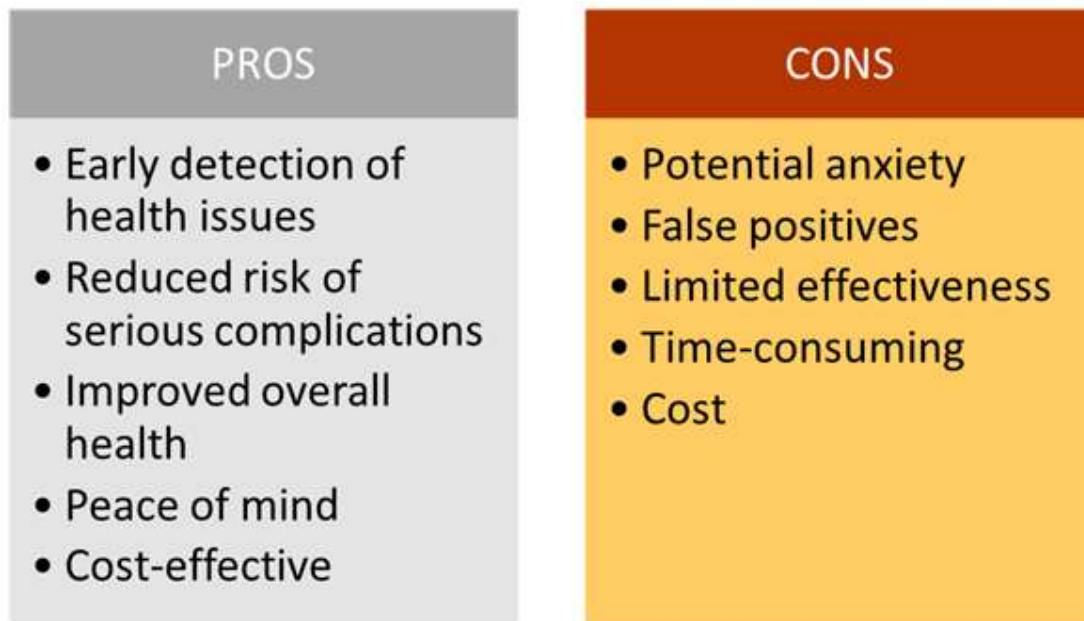


Figure 2. Pros and Cons of Preventive Health Checkups

### 3.5 Prevalence of Preventive Health Checks Worldwide

The prevalence of PHC worldwide shows significant variation across regions, primarily influenced by economic development, healthcare infrastructure, cultural beliefs, and government policies. In high-income countries (HICs), PHCs are well-established and widely accessible, supported by government-funded programs and health insurance coverage that make preventive care more affordable. Middle-income countries (MICs) display a varying prevalence of such checks, with some nations advancing through government initiatives. However, financial barriers and limited access in certain areas persist, especially for low-income populations. Low-income countries (LICs) face the most challenges, with PHC being less prevalent due to limited healthcare resources and infrastructure, financial constraints, and notable disparities between urban and rural areas [21-23]. Langlois et al. believed that primary healthcare is cost-effective in

achieving universal health coverage (UHC). However, these systems are not robust in many LICs and LMICs and, therefore, fail to provide comprehensive, people-centred, integrated care. They observed several challenges and limiting factors like the increasing burden of NCDs, under-resourced and poorly supported healthcare infrastructure, 40% of healthcare expenses were borne as out-of-pocket expenditure and inadequate health insurance schemes [21]. Cultural factors also play a significant role in the uptake of preventive health checks in these countries.

Globally, there is an increasing awareness of the importance of preventive health, spurred by international initiatives from organizations like the WHO and the World Bank, aimed at promoting preventive health and reducing NCDs. The expansion of digital health technologies, such as telemedicine and mobile health applications, is also improving access to preventive care, particularly in remote areas. Despite the progress being made in

many MICs and LICs, continued efforts are necessary to overcome the challenges that remain and ensure that everyone, regardless of their location or economic status, has the opportunity to benefit from preventive health care.

Around the world, countries have implemented various PHC programs tailored to their unique healthcare systems, economic capabilities, and public health needs. In HICs, such as the United States (US), the Affordable Care Act provides for no-cost annual checkups and screenings for insured individuals [24]. The National Health Service (NHS) of the United Kingdom (UK) offers accessible PHC, including screenings for cervical, breast, and bowel cancers [25]. The publicly funded healthcare system of Canada ensures universal access to preventive health services, including regular checkups and screenings [26].

The MICs and LMICs have also made strides in providing preventive health services. India's National Health Mission, encompassing the National Rural Health Mission and the National Urban Health Mission, focuses on primary healthcare services, including PHC, for rural and urban populations [27]. Brazil's public healthcare system, Sistema Único de Saúde, offers cancer screenings and cardiovascular checkups among its preventive health services [28]. South Africa's Department of Health promotes preventive health through initiatives like the National Health

Insurance Scheme, aiming for universal healthcare access [29].

In LICs, efforts to enhance preventive health are ongoing. Kenya's National Health Strategy emphasizes improving access to preventive health care, particularly in rural areas [30]. Bangladesh's government has launched health programs focusing on maternal and child health, highlighting preventive care [31]. Nigeria's National Health Policy prioritizes primary and preventive care services, with efforts to improve access, especially in rural communities [32].

### **3.6 Disparities in Preventive Health Checks in HICs and LMICs**

The disparities between HICs and LMICs in terms of PHC are significant, impacting public health outcomes (Table 3). In HICs, these checks are broadly available and accessible, supported by well-developed healthcare infrastructures and regular intervals of comprehensive screenings. Conversely, in LMICs, access is often hindered by economic, geographic, and infrastructural constraints, making preventive checks less comprehensive and more infrequent. Quality of care in HICs is generally high, driven by professional standards and modern equipment, whereas in LMICs, it varies widely due to resource limitations. While the cost in HICs is often offset by insurance or government programs, in LMICs, it poses a significant barrier, especially for those in poverty.

Table 3. Disparities in Preventive Health Checks Between High-Income Countries (HICs) and Low Middle-Income Countries (LMICs)

<b>Factor</b>	<b>HICs</b>	<b>LMICs</b>
<b>Availability and accessibility</b>	Wide availability and accessibility	Limited access due to factors such as poverty, geographic location, and lack of healthcare facilities.
<b>Scope and frequency</b>	Comprehensive checks, regular intervals	Less comprehensive checks, lower frequency.
<b>Quality of care</b>	High-quality of care	Varying quality of care, depending on resources and infrastructure.
<b>Cultural factors</b>	Generally supportive of preventive health	May have cultural beliefs or practices that hinder the acceptance of preventive care.
<b>Cost</b>	Often covered by insurance or government programs	It can be expensive for individuals, particularly those living in poverty.

Low Middle Income Countries (LMICs) face several challenges in implementing PHC, including limited financial and infrastructural resources, a shortage of healthcare professionals, and geographic barriers that exacerbate rural-urban disparities (Table 4). Cultural and social factors, alongside weak health systems and insufficient data, further complicate the delivery of preventive

services. Global health challenges like pandemics and climate change strain these systems further. Addressing these issues requires a comprehensive approach, including increased healthcare investment, infrastructure improvement, enhanced access, and culturally sensitive health education, alongside international cooperation to strengthen LMICs' PHC capabilities.

Table 4. Challenges in Preventive Health Checks in Low-Middle-Income Countries

<b>Challenge</b>	<b>Description</b>
<b>Limited resources</b>	Financial constraints, infrastructure deficits, shortage of healthcare professionals.
<b>Geographic barriers</b>	Rural-urban disparities, infrastructure challenges.
<b>Cultural and social factors</b>	Health beliefs and practices, social inequalities, and lack of health education.
<b>Health system challenges</b>	Weak health systems, limited data and information.
<b>Global health challenges</b>	Pandemics, epidemics, climate change.

### 3.7 Solutions to Overcome Challenges in Preventive Health Checks in Developing Countries

To effectively address the challenges faced by developing countries in rolling out PHC, a comprehensive strategy that involves strengthening healthcare

systems, expanding access to preventive care, addressing social determinants of health, improving cultural sensitivity, leveraging technology, and fostering international cooperation is needed (Figure 3).



Figure 3: Solutions to Overcome Challenges in Preventive Health Checks in Developing Countries

Investing in healthcare infrastructure, enhancing governance, and developing the healthcare workforce are crucial steps to strengthen healthcare systems. To expand access, community-based programs and mobile clinics could be established, and financial support and health insurance coverage for preventive care could be provided. Addressing social determinants requires efforts in poverty reduction, education, and gender equality to improve overall access to preventive care. Culturally sensitive approaches, including community engagement and collaboration with traditional healers, can help make preventive health programs more

acceptable and effective. Technology, through telemedicine and mobile health applications, offers innovative ways to overcome geographical and logistical barriers, improving access to preventive services. Finally, international cooperation through partnerships and resource mobilization can support the implementation and expansion of preventive health programs in developing countries. Together, these strategies can enhance the delivery of PHC and improve public health outcomes.

### 3.8 Psychological Barriers to Adopting Preventive Health Practices

While the benefits of PHC are well-documented, numerous psychological

barriers can impede individuals from engaging in these essential health practices (Figure 4).



Figure 4. Psychological Barriers to Adopting Preventive Health Practices

The major psychological barriers that hinder individuals from seeking PHC include fear of a potential diagnosis, health anxiety, and a perceived lack of control over health outcomes can lead to avoidance behaviors. Cognitive dissonance, where individuals hold conflicting beliefs about health, can also contribute to neglecting preventive care. Social influences and cultural norms can further discourage individuals from seeking medical attention. In a study from South India, it was found

that only 1/3<sup>rd</sup> of the respondents have previously done PHC. The prominent barriers against getting a PHC were ‘non-awareness, idleness, and uncomfortable testing, while the motivators are insurance or work-related factors, doctor's advice, and the presence of a health ailment’ [33].

Additionally, the demands of modern life, including stress and time constraints, can make it challenging to prioritize preventive health. To address these barriers, we suggest strategies such as

education, counselling, community engagement, and patient-centred approaches. By understanding and mitigating these psychological factors, healthcare professionals can encourage individuals to prioritize preventive health and improve overall well-being.

### **3.9 The Role of the Private Sector in Preventive Health Checks in Developing Countries**

The involvement of the private sector in providing PHC in developing countries is growing, driven by the expanding middle class and the corresponding increase in demand for healthcare services, including preventive care [10,34]. This trend is also fuelled by the profit potential private entities see in preventive health, encouraged by the global emphasis on the importance of such care and facilitated by technological advancements in medical diagnostics that enable affordable and accessible services. Private healthcare providers are increasingly establishing clinics and hospitals in both urban and rural areas, broadening the availability of preventive health services. Moreover, public-private partnerships (PPPs) are being formed, allowing governments and private entities to combine their strengths in delivering comprehensive preventive health services. In the realm of health insurance, private companies are creating affordable plans that cover preventive care, thereby expanding access to a more significant segment of the population.

Additionally, the private sector's investment in the development of innovative health technologies and diagnostic tools is enhancing efficiency and reducing the costs of preventive health checks. While the private sector's role in

enhancing preventive health services in developing countries is significant, it is crucial to ensure that these services are equitably accessible to individuals across all income levels and geographic areas. To avoid the emergence of a two-tiered healthcare system, governments and international organizations need to strive for universal access to preventive care, ensuring that advancements in healthcare reach all segments of the population.

### **3.10 Research Gaps in Preventive Health Checkups**

Despite the progress made in preventive healthcare, there are several areas where further research is needed to optimize the effectiveness and reach of PHC (**Table 5**). First, there is a need for more comprehensive studies on the long-term cost-effectiveness of these programs to better understand their financial sustainability and benefits over time. Additionally, more comparative studies between different models of PHC are needed, which could help identify the most efficient and practical approaches. Another area requiring attention is the development of tailored interventions that take into account individual risk factors, genetic predispositions, and lifestyle choices, as well as cultural and social determinants of health behaviour. This personalized approach to prevention could significantly enhance the efficacy of health interventions. The challenges of scaling up successful preventive health programs to benefit larger populations and ensuring their sustainability also demand further research. This includes identifying effective financing models and implementation strategies that can support the long-term operation of these programs.

Table 5. Research Gaps and Future Directions in Preventive Health Checkups

<b>Research Gap</b>	<b>Future Direction</b>
<b>Cost-effectiveness studies</b>	Conduct long-term cost-effectiveness analyses, compare different models, and explore personalized pricing strategies.
<b>Tailored interventions</b>	Develop personalized preventive health strategies based on genomics, lifestyle factors, and cultural preferences.
<b>Implementation challenges</b>	Scale up successful programs, ensure sustainability through adequate financing, and address cultural and social factors.
<b>Global health inequalities</b>	Address disparities through targeted interventions, community-based programs, and international collaboration.
<b>Emerging health challenges</b>	Develop preventive strategies for climate change, pandemics, and mental health.
<b>Personalized preventive care</b>	Integrate genomic medicine and digital health technologies into preventive checkups.
<b>Expanding access</b>	Implement community-based programs, mobile health units, and public-private partnerships.
<b>Improving quality and effectiveness</b>	Develop evidence-based guidelines, implement quality assurance measures, and promote professional development.
<b>Addressing emerging health challenges</b>	Develop preventive strategies for climate change, pandemics, and mental health.
<b>Global health equity</b>	Address disparities through targeted interventions, community-based programs, and international collaboration.

Moreover, addressing global health inequalities remains a pressing issue, with research needed to understand the barriers to access and develop strategies to ensure equitable distribution of preventive healthcare services across different regions and populations. Lastly, the emergence of new health challenges, including new diseases and risk factors, alongside the impact of rapidly changing environments such as climate change and urbanization, calls for ongoing research. This research should continually adapt and update preventive measures to meet evolving health needs.

Controversies surrounding PHC often arise from debates over the necessity and effectiveness of various screenings for different demographics. Critics argue that not all screenings are universally beneficial;

some may lead to over-diagnosis or unnecessary anxiety, particularly in low-risk populations. For example, discussions about the appropriateness of routine mammograms or prostate cancer screenings have led to differing recommendations based on age, gender, and individual risk factors. There are concerns that blanket recommendations may not consider the nuances of personal health histories or the potential harms of false positives. Additionally, disparities in access to healthcare resources can further complicate the effectiveness of PHC, as not all communities have equal access to advanced screening technologies or follow-up care. As a result, while PHC are designed to promote health and prevent disease, the ongoing debates highlight the need for tailored screening guidelines and



individualized approaches that consider demographic and contextual factors to optimize health outcomes across diverse populations.

The effectiveness of PHC can vary significantly due to several factors that contribute to differing study outcomes. Variations in study design, participant demographics, frequency and type of screenings, and health literacy levels can all impact results. The effectiveness of PHC is also influenced by the quality of follow-up care, socioeconomic barriers, and psychological effects, such as anxiety related to health risk information. Additionally, issues like over-diagnosis and cultural attitudes towards health can further complicate their effectiveness. Understanding these complexities is essential for accurately assessing the roles of PHC in improving health outcomes and for guiding future public health initiatives.

### 3.11 Future Directions in Preventive Health Checkups

The landscape of PHC is on the brink of transformation, propelled by

technological innovations, research breakthroughs, and evolving healthcare practices (Figure 5). A significant shift towards personalized preventive care is underway, with genetic testing and wearable technology at the forefront, enabling the identification of individuals at high risk for certain diseases and providing real-time health data [35-41]. Simultaneously, artificial intelligence (AI) and machine learning (ML) are revolutionizing preventive care through predictive analytics and decision support systems, enhancing the accuracy of health risk predictions and supporting healthcare providers in making informed care decisions. Further innovations include mobile health applications that offer remote monitoring and telehealth consultations, making preventive care more accessible and convenient. Community-based preventive care is gaining traction, emphasizing health promotion programs and addressing social determinants of health to tackle health disparities.

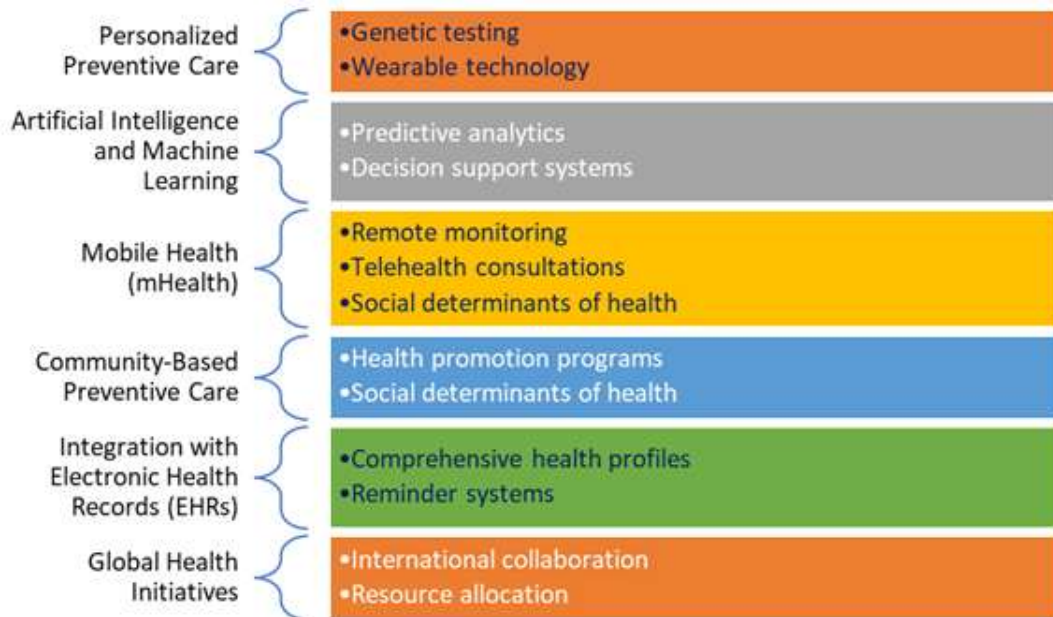


Figure 5. Future Directions for Preventive Health Checks

The integration of electronic health records (EHR) facilitates personalized care recommendations and automated reminders for screenings, while global health initiatives promote international collaboration and equitable access to preventive services. Despite these advancements, the future of preventive health checks face challenges, including concerns about data privacy, accessibility of technology, genetic discrimination, and the balance between personalized care and individual autonomy. Resource constraints, such as the cost of new technologies and a shortage of healthcare professionals, along with cultural and social factors like health literacy and beliefs, pose additional hurdles. Unintended consequences, such as an overreliance on technology and a false sense of security, also warrant attention. To navigate these challenges, a strategic, collaborative, and ethically grounded approach is essential.

PHC fit within larger public health strategies as essential tools for holistic health promotion, emphasizing early detection and proactive management of health risks. By integrating discussions about community health resources and support systems into the PHC framework, healthcare providers can enhance the effectiveness of these checkups, ensuring individuals have access to the resources needed to implement lifestyle changes and maintain their well-being. This comprehensive approach should enable communities to foster a culture of prevention, ultimately leading to healthier populations and reduced healthcare costs over time.

### **3.12 Limitations**

Despite its comprehensive analysis, this review has several limitations that

should be recognized. Firstly, the variability in study methodologies and definitions of preventive health checkups across the included literature can complicate the interpretation of results and reduce generalizability. Additionally, while the review highlights the potential benefits of PHC, it may not adequately address the long-term psychological impacts and the burden of healthcare costs associated with over-diagnosis and unnecessary treatments. Furthermore, the focus on high-risk populations may overlook the potential advantages for the general population, leading to an incomplete understanding of PHC's broader applicability. Lastly, the rapidly evolving nature of healthcare practices and public health policies means that the findings may require continual updating to reflect current evidence and trends in preventive care.

### **4. Conclusion**

This review emphasizes the critical role of preventive health checkups (PHC) in enhancing individual well-being through early disease detection and intervention. The findings suggest that PHC can significantly decrease health risks and improve health outcomes, particularly when utilized by high-risk populations. While PHC is associated with better chronic disease recognition and treatment, some studies indicate it may not universally lower mortality rates. Furthermore, the review highlights that the efficacy of PHC is influenced by factors such as financial literacy and targeted healthcare initiatives. Despite concerns regarding over-diagnosis and resource allocation, PHC remains a valuable component of public health. Ultimately, a balanced approach combining routine checkups with healthy lifestyle

practices is essential for optimal health management.

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#### **Conflict of Interest**

None of the authors have any competing interests to disclose.

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#### **Ethical Approval**

Not required for such bibliometric study

#### **Data availability**

The raw data is available with the corresponding author

#### **Author's Contribution**

RV: Conceptualization, Data Analysis, Literature Search, Manuscript writing, editing and final approval; AS: Conceptualization, Data Curation and Analysis, Literature Search, Manuscript writing, editing and final approval; SV, SK, SS, SSR: Data Curation and Analysis, Literature Search, Manuscript writing, editing and final approval; PCR: Conceptualization, Manuscript editing, and final approval.

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##### ***Use of AI tool***

Authors declare to have used Grammarly software to enhance the grammar and readability of the article, but have rechecked its contents before submission. We take the full responsibility of the contents and confirm that all the tables and figures are original and have not been copied from any published sources.

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