European Economic Letters
ISSN 2323-5233
Vol 14, Issue 2 (2024)
http://eelet.org.uk

Empowering Healthcare through Information: Examining the Role of Health Screening Policies

[1]Dr. Yamini, [2]Dr Trishna Sarkar, [3] Ms. Arushi Joshi

[1] Assistant Professor, Department of Management, Indira Gandhi Delhi Technical University for Women
[2]Assistant Professor, Department of Economics, Dr Bhim Rao Ambedkar College, University of Delhi
[3] Assistant Professor, Department of Economics, Dr Bhim Rao Ambedkar College, University of Delhi

Abstract: This article explores the role of health screening as a strategy within preventive primary healthcare, focusing on its potential to mitigate information asymmetry and improve health outcomes. Non-communicable diseases (NCDs), including cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes, pose a significant global health challenge, driven by behavioral risk factors such as unhealthy diet, lack of physical activity, and tobacco and alcohol use. Addressing these risk factors requires a shift towards preventive primary healthcare. Asymmetric information in healthcare markets inhibits effective decision-making and can lead to preventable morbidity and mortality. Health screening programs offer early detection of diseases and promote healthy behaviors, thus addressing information gaps and improving overall quality of life. By examining international experiences and initiatives, including those in the US, UK, Canada, Australia, Singapore, South Korea, and Japan, valuable insights are derived for designing and implementing screening strategies at a national level in this article. In India, various organized screening programs target common NCDs and cancers, supported by initiatives like the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) and Ayushman Bharat Comprehensive Primary Health Care Programme. Despite these efforts, implementation challenges persist, including barriers faced by community health workers. It has been concluded that to optimize the effectiveness of health screening, policymakers and healthcare providers must address challenges such as low screening rates, overdiagnosis, and integration into primary care settings. Risk-stratified screening strategies, patient-centred care models, and leveraging technology can enhance screening uptake and follow-up care. Additionally, understanding cultural and socio-economic influences on individuals' perceptions of health screening is crucial for designing inclusive and effective screening programs. Balancing the benefits and harms of screening is essential to avoid overdiagnosis and overtreatment, emphasizing the importance of evidence-based guidelines and personalized approaches. Overall, integrating health screening into comprehensive primary healthcare is vital for addressing the growing burden of NCDs and promoting population health.

Keywords: preventive healthcare, health screening, asymmetric information, primary healthcare, health policies, information in healthcare

Introduction

The increasing burden of Non-Communicable Diseases such as cardiovascular diseases (CVDs), cancers, chronic respiratory diseases (CRDs) and diabetes share four behavioural risk factors –unhealthy diet, lack of physical activity, and use of tobacco and alcohol. (Giovino et al., 2012) Our existing health systems are ill-prepared to combat these risk factors as the focus has mainly been on the curative aspect of healthcare rather than preventive. With the rapid shift in disease burden to non-communicable diseases (India State-Level Disease Burden Initiative Collaborators, 2017) and growing burden on hospitals in India, the stress of National Health Policy 2017 on the preventive and promotive orientation of health policies is well understood. What is not so well understood, however, is what is the best way to improve health through primary healthcare. What strategies or models are most likely to achieve this goal? In which settings, would these strategies work the best? In this article, an attempt is made to explore the answers to these questions by inspecting one of the strategies of preventive primary health care i.e. health screening. A big problem in the healthcare system is that it's often hard for patients to get all the information they need. This makes it tough for them to make decisions about their health when there are lots of choices and things to consider.

1. Asymmetric Information in Health Markets

Imperfect knowledge about one's own health can inhibit critical health decision making and result in preventable elevated mortality and morbidity. Hence, the health systems should work towards making individuals aware about their health. Through early detection of diseases and adoption of healthy behaviours, preventive primary health care plays a pivotal role in minimizing the consequences of imperfect knowledge, leading to improved health outcomes and enhanced overall quality of life. (Gaziano et al., 2008)

This issue of asymmetric information in health sector was first studied by (Arrow, 1963) with respect to insurance, followed by several other authors who have looked at the impact of asymmetric information between patients and doctors on the quality and cost of medical services.(Ellis et al., 1986) (Ching et al., 1997) (De Fraja, 2000) These articles centre around finding the most effective approach for healthcare providers such as doctors, who face the challenge of one-sided asymmetric information, where they possess more knowledge about healthcare services and a patient's health than the patient does. This is referred to as information asymmetry and it can create a doctor-patient dynamic where patients rely on their doctor to inform them about the necessary health services they should utilize. While this is not inherently negative, if doctors neglect to inform their patients about preventive care services they may need, this information asymmetry can have severe consequences for the patient's health results. It is found that informed health choices can significantly suppress health expenditures. (Lim, 2007) The doctor is also in a position to determine demand for the service (acting on behalf of the patient, presumably for the patient's welfare) and the doctor is also the supplier of the services. In this case demand and supply are jointly determined by the same individual at the same time which can result in market failure. For example, if the doctor is driven by the profit motive, or is seeking higher income, the doctor might order more services than necessary (e.g. if he/she owns a laboratory or imaging equipment). This market failure is termed as "supplier induced demand". There are several studies that indicate evidence of supplier-induced demand in health care. (Fuchs, V. R. 1996)(McGuire, T.G. 2000) (Mwachofi et al., 2011) (Pauly, M. V. 1968). Information asymmetries between healthcare providers and patients often lead to inefficiencies and suboptimal outcomes in healthcare delivery (Arrow, 1963). The information imbalance between the doctor and the patient could also induce the problem of moral hazard i.e. individuals's ignored attention to their health in the absence of complete information affecting their health outcomes. To address these disparities, interventions such as health screening programs play a crucial role in empowering patients and mitigating information asymmetries. According to studies such as those by Charles et al. (1997) and Street et al. (2009), addressing information asymmetry can improve patient satisfaction, treatment adherence, and overall health outcomes, highlighting its pivotal role in enhancing patient-centered care.

Regular health check-ups provide an opportunity for early detection of health issues, allowing for timely intervention and treatment. These screenings may include blood pressure measurements, cholesterol checks, and assessments for various diseases such as diabetes and cancer. Preventive screenings focus on detecting diseases before symptoms manifest, reducing the impact of information asymmetries by enabling proactive management of health conditions. Examples include mammograms for breast cancer, colonoscopies for colorectal cancer, and Pap smears for cervical cancer (Gøtzsche & Jørgensen, 2013; Lin et al., 2016). Besides this, comprehensive health risk assessments evaluate lifestyle factors, family history, and other determinants of health to identify individuals at risk of developing chronic diseases. These assessments facilitate targeted interventions and health education initiatives to address modifiable risk factors and prevent disease progression.

Population screening programs are implemented through two primary approaches: organized and opportunistic. Organized screening entails identifying a target population, systematically inviting all eligible individuals, monitoring participation, evaluating program processes and outcomes, ensuring the delivery of high-quality services, and providing patient-centered follow-up and referrals. This method is typically centrally coordinated and closely overseen by a governing body to meet predefined benchmarks established during screening trials. Conversely, opportunistic screening, also known as case finding, occurs when healthcare providers offer screening tests to individuals upon request or when individuals accept such offers without targeting a specific population or employing systematic invitations. It lacks structured assessment procedures. Screening rates may

be assessed through population-based or health facility-based surveys or records. While countries like the Netherlands and Denmark predominantly employ organized screening, the USA relies more on opportunistic screening. Some countries, such as Switzerland, utilize both approaches simultaneously. (Sivaram et al., 2018)

2. An Overview of Screening Programs in India

In India, there are some organised screening programs for specific diseases. In order to prevent and control major NCDs, the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) was launched in 2010. Under NPCDCS, NCD Cells are being established at National, State and District levels for programme management, and NCD Clinics are being set up at District and Community Health Centre (CHC) levels, to provide services for early diagnosis, treatment and follow-up for common NCDs.[1]

As part of the Ayushman Bharat Comprehensive Primary Health Care Programme and the NPCDCS, India proposed a plan for launching a national cancer screening program in 2016 (MoHFW, 2018) (Bagcchi, 2016). Population-based screening for cervical, breast, and oral cancers is also being implemented under the National Health Mission (NHM) as part of comprehensive care, complementing the NPCDCS (Bharat A., 2018). Under this initiative, persons more than 30 years of age are targeted for their screening for the three common cancers i.e oral, breast and cervical. Screening of these common cancers is an integral part of service delivery under Ayushman Bharat – Health and Wellness Centres (LiveMint, 2024).

Some other recent initiatives have also been considered under NPCDCS. Several measures have been implemented to address the prevention and management of Chronic Obstructive Pulmonary Disease (COPD) and Chronic Kidney Disease (CKD) within the NPCDCS. These guidelines aim to mitigate the impact of these chronic respiratory and kidney diseases, which contribute significantly to NCD mortality rates.

To facilitate early detection of prevalent conditions like Diabetes, Hypertension, and common Cancers within communities, states are receiving guidelines for the initiation of "Population-based Screening of common NCDs." This initiative leverages frontline and health workers within the existing Primary Healthcare System to carry out screening activities and provide timely interventions. A pilot project integrating Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy (AYUSH) practices with NPCDCS services has commenced in six districts across the country. Here, AYUSH facilities and methodologies are merged with NPCDCS services to prevent and manage common NCDs, with a special focus on incorporating Yoga as an integral component of the intervention.

Efforts to prevent and control Rheumatic Fever and Rheumatic Heart Disease have been initiated through a pilot intervention under the platforms of NPCDCS and Rashtriya Bal Swasthya Karyakram (RBSK) in select districts such as Gaya (Bihar), Firozabad (Uttar Pradesh), and Hoshangabad (Madhya Pradesh). This initiative is slated for expansion to additional districts in a phased manner. Integration of the Revised National Tuberculosis Control Programme (RNTCP) with NPCDCS has been pursued as well, leading to the development of a "National Framework for Joint Tuberculosis-Diabetes collaborative activities." This framework aims to establish a national strategy for bi-directional screening, early detection, and enhanced management of Tuberculosis and Diabetes comorbidities across India. (National Health Mission, n.d.)

School health programme, as part of the Health and Wellness component, under Ayushman Bharat is another intervention by the government that considers health screening of children as one of their targets. RBSK is a significant initiative aimed at the early identification and intervention of health issues in children aged from birth to 18 years, covering four main aspects: Defects at birth, Deficiencies, Diseases, and Development delays, including disabilities. For children aged 0-6 years, management will be centralized at the District Early

1 For more details, refer to: https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=1048&lid=604#:~:text=For%20early%20detection%20of%20Diabetes%2C%20Hypertension%20and%20common%20Cancers%20in,the%20existing%20Primary%20Healthcare%20System.

Intervention Center (DEIC), while for those aged 6-18 years, existing public health facilities will manage their conditions. The DEIC will serve as a referral hub for both age groups. Following screening and referral from schools, it is ensured that necessary treatment and interventions are provided to the child's family at no cost. An electronic health record is envisioned for each student, with a Student Health Card incorporating health screening and service access data. Within the RBSK framework, all screening and referral records for school children will be digitized, and pertinent information regarding school health activities will be integrated into the existing electronic records maintained under RBSK. (WHO, 2021) (Press Information Bureau, 2022)

Table 1: Screening Programs for NCDs and Cancers in India

Type of NCDs	**Age of Beneficiary**	**Method of Screening**	**Frequency of Screening**
Hypertension	30 years and above (Normative Population: 370 people/1000 population; 182 women and 188 men)	Blood Pressure Apparatus-Digital or Aneroid Sphygmomanometer	Once a year
Diabetes	30 years and above (370 people/1000 population)	Glucometer	Once a year
Breast Cancer	30-65 years (182 women/ 1000 population)	Clinical Breast Examination (CBE)	Once in 5 years
Oral Cancer	30-65 years (370 people/ 1000 population)	Oral Visual Examination (OVE)	Once in 5 years
Cervical Cancer	30-65 years (182 women/ 1000 population)	Visual Inspection with Acetic Acid (VIA)	Once in 5 years (at the level of PHC to start with)

Source: MoHFW, GOI

While there are many disease specific screening programs in place, the implementation faces multiple bottlenecks. In a study by Kedar et al. 2021, it was found that the major barriers for Community Health Workers were difficulty in motivating the community, lack of support from supervisors and lack of motivation to work.

3. International Experiences of Health Screening

Exploring the global landscape of health screening practices reveals diverse strategies and outcomes. Delving into these country-specific experiences, valuable insights can be derived for setting up strategies at national level. The US is considered as one of the most expensive healthcare systems amongst the 11 high income countries. (News-Medical, 2023) Health screening policies in the US are often driven by insurance requirements and recommendations from medical organizations guided by various governmental and non-governmental organizations, including the United States Preventive Services Task Force (USPSTF), the Centers for Disease Control and Prevention (CDC), and professional medical associations. (Houston et al., 1998) (Woolf et al., 2001) However, the implementation of these screenings can vary depending on individual insurance coverage and healthcare providers. Many health insurance plans cover recommended preventive screenings at no additional cost to patients, following the Affordable Care Act's preventive services mandate. (ACA, 2010). Federal health insurance programs such as Medicare for adults above 65 years of age and certain individuals with disabilities, covers various preventive screenings, including mammograms, colonoscopies, and cardiovascular risk assessments. Medicaid, the joint federal-state program for low-income individuals, also covers preventive services, although coverage varies by state.

As opposed to the US, the healthcare system in the UK is heavily supported by government funding, with 80% of its healthcare expenditure on the National Health Service (NHS) which provides a comprehensive range of free health screenings to eligible individuals. This includes screenings for conditions such as breast cancer, cervical cancer, bowel cancer etc. and other infectious diseases such as HIV, hepatitis, and sexually transmitted

infections. (News-Medical, 2023) An expert group called the UK National Screening Committee **(**UK NSC) advises the NHS on which screening programmes to be practiced in the four countries of the UK which is reviewed every 3 years as new research becomes available. (NHS, 2024) These decisions on whether a screening programme should be introduced are based on the ten criteria described by Wilson and G. Jungner in 1968

Similar to the NHSin the UK, health screening policies in Canada are guided by recommendations from Health Canada and various provincial health authorities. Health screening programs in Canada are typically administered at the provincial and territorial levels, leading to variations in protocols and guidelines across different regions. Each province and territory may have its own screening programs and policies based on local epidemiological data, healthcare priorities, and available resources. Some provinces and territories have established population-based screening programs for certain diseases, such as breast, cervical, and colorectal cancer. These programs typically offer organized screening services, including invitations for screening, access to screening tests, follow-up procedures for abnormal results, and coordination of care between primary care providers and specialists. In addition to organized screening programs, there may be targeted screening initiatives focusing on specific populations or health conditions. For example, certain communities or demographic groups may be prioritized for screening based on higher risk factors or disparities in healthcare access. While Canada's healthcare system is publicly funded and administered by the provinces and territories, there are overarching guidelines and recommendations provided by federal agencies. (Canadian Task Force on Preventive Health Care, 2013) (Preventive Services Task Force, 2018).

The Australian government provides a range of health screening programs through Medicare, the country's public healthcare system. Australia has several national screening programs targeting specific diseases and conditions. These programs are implemented and managed by the Australian Government Department of Health in collaboration with state and territory health authorities. Key national screening programs include breast cancer screening (BreastScreen Australia), cervical cancer screening (National Cervical Screening Program), and bowel cancer screening (National Bowel Cancer Screening Program). BreastScreen Australia offers free mammograms to women aged 50 to 74 every two years. The program aims to detect breast cancer early when treatment is most effective. The National Cervical Screening Program provides free cervical screening tests (formerly Pap smears) to women aged 25 to 74 every five years. The program transitioned to primary HPV testing in December 2017. (Australian Institute of Health and Welfare, 2022).

Singapore also has a well-developed healthcare system that emphasizes preventive care. The government encourages regular health screenings through initiatives like the Screen for Life program, which offers subsidized screenings for conditions such as diabetes, hypertension, and certain cancers. (Health Promotion Board, 2018) Singapore also has workplace health screening programs and mandatory screenings for certain infectious diseases. The Singapore government conducts public health campaigns to raise awareness about the importance of health screening and preventive measures. These campaigns often target specific population groups or health issues.(Yeoh et al., 2006)

Similar to Singapore, the Korean government has also initiated a comprehensive health screening program since 1980 across the nation, progressively broadening its scope to include additional diseases and population groups according to different life stages (Lee et al., 2010). Over the span of four years from 2016 to 2019, it was estimated that between 74.1% to 78.6% of the eligible populace had engaged in this health screening initiative. The country has a national health screening program known as the National Health Insurance (NHI) Check-up, which provides biennial health screenings to all eligible citizens. These screenings cover a wide range of assessments including blood tests, urine tests, physical examinations, and screenings for conditions like cancer, diabetes, and cardiovascular disease. Moreover, the Korean government actively promotes participation in health screenings through public education campaigns and incentives. For instance, employers often provide paid time off for employees to undergo health screenings, and individuals who participate in screening programs may receive subsidies or discounts on healthcare services (Kang et al., 2017). Technology plays a crucial role in

facilitating access to health screenings in South Korea. Online platforms and mobile applications enable individuals to schedule appointments, access their health records, and receive reminders for upcoming screenings. This digitization of healthcare services enhances convenience and encourages greater participation in preventive care programs (Kim et al., 2024)

Japan has categorised medical examinations into legally mandated health check-ups and voluntary health check ups with the former encompassing various age groups and specific demographics, including infants, preschool children, school children, full-time employees, and individuals aged between 40 and 74, targeting the prevention of lifestyle-related diseases. These exams are conducted by local governments, companies and employee organisations. (OECD, 2017) One of the prominent examples of the latter is the"Ningen Dock" (human dock), which include assessments such as blood tests, urine tests, physical examinations, and screenings for conditions like cancer, diabetes, and hypertension, often credited for the country's long life expectancy. The cost of the screening in this program is borne by the individual himself (Lu, 2022).

Similar to Japan, many OECD countries offer free health check-ups for infants and preschool children, albeit with varying frequency and scope of coverage. For instance, while some countries like Austria provide annual health check-ups, others such as Belgium offer them less frequently, typically once during primary school and twice during secondary school. Additionally, dental checks are included in some countries' health check-ups, although others, like Sweden and Switzerland, provide dental checks separately, as basic health insurance often does not cover dental care (Ferré et al., 2014; Lai et al., 2013; Paris et al., 2016). Moreover, under Japan's Industrial Safety and Health Law since 1972, employers are obligated to provide core health check-ups to their full-time employees upon hiring and annually thereafter, free of charge. These health assessments aim to prevent deterioration of employees' health due to work-related factors, with employers mandated to address any identified health issues by improving working conditions accordingly (Ministry of Health, Labour and Welfare (MHLW), 2013).

The way forward

Despite the importance of health screenings in preventive healthcare, challenges remain in optimizing their effectiveness and reach across the world. These challenges include low screening rates, especially among certain demographic groups, overdiagnosis and overtreatment, and the need for better coordination and integration of screening services into primary care settings. (Patnode et al., 2017) (Williams et al., 2013)(Kathrikolly et al., 2020) To address these challenges, policymakers and healthcare providers are exploring innovative approaches such as risk-stratified screening strategies, patient-centered decision support tools, and leveraging technology to enhance screening uptake and follow-up care (Kempe et al., 2005) (Sabatino et al., 2021) Advances in genomics, biomarkers, and risk prediction models enable more personalized approaches to screening and preventive care. Risk-stratified screening strategies tailor recommendations based on individual characteristics, genetic predispositions, and lifestyle factors. Programs such as Precision Medicine Initiative in the US are already working in this direction.(Hudson et al., 2015)

It is imperative that integrating screening services into primary care settings can improve the coordination of care, facilitate follow-up testing and treatment, and enhance patient engagement in preventive health behaviors. Patient-centered medical homes and team-based care models support comprehensive screening and preventive care delivery. (Peikes et al., 2012) Telehealth platforms, mobile apps, and digital health technologies offer new opportunities to expand access to screening services, particularly in rural or underserved areas. Remote monitoring, virtual consultations, and electronic health records support seamless communication and care coordination.(Hollander & Carr, 2020)

Population health management initiatives leverage data analytics, population health registries, and care coordination strategies to identify high-risk individuals, implement targeted interventions, and track health outcomes at the population level. These approaches aim to improve screening rates, reduce disparities, and achieve better health outcomes across communities. (Kindig, 2007)Besides the role of technology, some

behavioural aspects of health screening needs evaluation too. Individuals' perception of health screening programs varies across different cultural and socio-economic contexts. For example, a study conducted by Peterson et al. (2021) in the United States found that individuals from marginalized communities often perceive health screenings as stigmatizing and invasive, leading to reluctance in participation. In contrast, Becker (2022) in China revealed a positive perception of health screenings due to the cultural emphasis on preventive healthcare. The willingness to follow up on screening results and engage in further diagnostic procedures or treatment varies among individuals. Socio-economic factors such as income, education, and access to healthcare services influence individuals' experiences with health screening programs. For instance, a study by Taylor et al. (2001) in Australia found that individuals from lower socio-economic backgrounds were less likely to participate in health screenings due to financial constraints and lack of awareness about available services.

Overuse of certain screening tests can also lead to over-diagnosis of conditions that may never cause harm and overtreatment with potential risks and costs. Balancing the benefits and harms of screening requires careful consideration of individual risk factors, preferences, and evidence-based guidelines (Esserman et al., 2013)

References

[1] ACA. (2010). Patient Protection and Affordable Care Act. Retrieved from: https://www.govinfo.gov/content/pkg/PLAW-111publ148/pdf/PLAW-111publ148.pdf

[2] Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *American Economic Review*, 53(5), 941-973.

[3] Australian Institute of Health and Welfare. (2018). BreastScreen Australia monitoring report 2018. Canberra. Retrieved from: https://www.aihw.gov.au/reports/cancer-screening/breastscreen-australia-monitoring-report-2018/contents/table-of-contents

[4] Australian Institute of Health and Welfare. (2022). National Cervical Screening Program: monitoring report 2022. Canberra. Retrieved from: https://www.aihw.gov.au/reports/cancer-screening/ncsp-monitoring-2022/summary

[5] Bagcchi, S. (2016). India launches plan for national cancer screening programme. *The BMJ*, i5574. https://doi.org/10.1136/bmj.i5574

[6] Becker, A. (2022, July 4). *How to tap into China's growing wellness culture*. Focus - China Britain Business Council. https://focus.cbbc.org/how-to-tap-into-chinas-growing-wellness-culture/

[7] Canadian Task Force on Preventive Health Care. (2013). Recommendations on screening for cervical cancer. *Canadian Medical Association Journal*, 185(1), 35-45. doi:10.1503/cmaj.121505.

[8] Charles, C., Gafni, A., & Whelan, T. (1997). Shared decision-making in the medical encounter: What does it mean? (or it takes at least two to tango). *Social Science & Medicine*, 44(5), 681-692.

[9] Esserman, L. J., Thompson, I. M., & Reid, B. J. (2013). Overdiagnosis and overtreatment in cancer. *JAMA*, *310*(8), 797. https://doi.org/10.1001/jama.2013.108415

[10] Fuchs, V. R. (1996). Economics, values, and health care reform. *American Economic Review*, 86(1), 1-24.

[11] Gaziano, T. A., & Galea, G. (2008). Reducing the growing burden of cardiovascular disease in the developing world. *Health Affairs*, 27(5), 1160-1170.

[12] Giovino, G. A., Mirza, S. A., Samet, J. M., Gupta, P. C., Jarvis, M. J., Bhala, N., & GATS Collaborative Group. (2012). Tobacco use in 3 billion individuals from 16 countries: an analysis of nationally representative cross-sectional household surveys. *The Lancet*, 380(9842), 668-679.

[13] Gøtzsche, P. C., & Jørgensen, K. J. (2013). Screening for breast cancer with mammography. *Cochrane Database of Systematic Reviews*, (6), CD001877.

[14] Health Promotion Board. (2018). Annual Report 2018/2019. Singapore. Retrieved from: https://www.hpb.gov.sg/docs/default-source/annual-reports/hpb-annual-report-2018_2019.pdf?sfvrsn=df71c372_0

[15] Hollander, J. E., & Carr, B. G. (2020). Virtually perfect? Telemedicine for COvid-19. *The New England Journal of Medicine*, *382*(18), 1679–1681. https://doi.org/10.1056/nejmp2003539

[16] Houston, T. P., Elster, A. B., Davis, R. M., & Deitchman, S. D. (1998). The US Preventive Services Task Force Guide to Clinical Preventive Services, AMA Council on Scientific Affairs. *American journal of preventive medicine*, *14*(4), 374-376.

[17] Hudson, K., Lifton, R., Patrick-Lake, B., Precision Medicine Initiative (PMI) Working Group, Gonzalez Burchard, E., Coles, T., Collins, R., Conrad, A., Denny, J., Desmond-Hellmann, S., Dishman, E., Giusti, K., Kathiresan, S., Kheterpal, S., Kumanyika, S., Manson, S. M., O'Rourke, P. P., Platt, R., Shendure, J., Jenkins, G. L. (2015). The Precision Medicine Initiative Cohort Program – Building a research Foundation for 21st century medicine. In *Precision Medicine Initiative (PMI) Working Group Report to the Advisory Committee to the Director, NIH*. https://acd.od.nih.gov/documents/reports/DRAFT-PMI-WG-Report-9-11-2015-508.pdf

[18] Kang, Y. J., Myong, J., Eom, H., Choi, B., Park, J. H., & Kim, E. L. (2017). The current condition of the workers' general health examination in South Korea: a retrospective study. *Annals of Occupational and Environmental Medicine*, *29*(1). https://doi.org/10.1186/s40557-017-0157-0

[19] Kathrikolly, T. R., Shetty, R. S., & Nair, S. (2020). Opportunities and Barriers to Breast Cancer Screening in a Rural Community in Coastal Karnataka, India: A Qualitative Analysis. *Asian Pacific journal of cancer prevention: APJCP*, *21*(9), 2569–2575. https://doi.org/10.31557/APJCP.2020.21.9.2569

[20] Kedar, A., John, A., Goala, S., Babu, R., Tapkire, R., Kannan, R., & Hariprasad, R. (2021). Barriers and facilitators in implementing population based common cancer screening through community health workers. *Ecancermedicalscience*, *15*, 1277. https://doi.org/10.3332/ecancer.2021.1277

[21] Kempe, A., Daley, M. F., Barrow, J., Allred, N., Hester, N., Beaty, B. L., Crane, L. A., Pearson, K., & Berman, S. (2005). Implementation of universal influenza immunization recommendations for healthy young children: results of a randomized, controlled trial with registry-based recall. *Pediatrics*, *115*(1), 146–154. https://doi.org/10.1542/peds.2004-1804

[22] Kim, D. J., Lee, Y. S., Jeon, E. R., & Kim, K. J. (2024). Present and Future of AI-IoT-Based Healthcare Services for Senior Citizens in Local Communities: A Review of a South Korean Government Digital Healthcare Initiatives. *Healthcare (Basel, Switzerland)*, *12*(2), 281. https://doi.org/10.3390/healthcare12020281

[23] Kindig, D. A. (2007). Understanding population health terminology. *The Milbank Quarterly*, *85*(1), 139–161. https://doi.org/10.1111/j.1468-0009.2007.00479.x

[24] Lee, Won-Chul & Lee, Soon-Young. (2010). National Health Screening Program of Korea. *Journal of the Korean Medical Association*. 53. 363. 10.5124/jkma.2010.53.5.363.

[25] Lin, J. S., Piper, M. A., Perdue, L. A., Rutter, C. M., Webber, E. M., O'Connor, E., ... & Whitlock, E. P. (2016). Screening for colorectal cancer: Updated evidence report and systematic review for the US Preventive Services Task Force. *JAMA*, 315(23), 2576–2594.

[26] LiveMint. (2024, March 5). Centre initiates population-based survey for prevention, control, and screening for common NCDs: Pawar. *LiveMint.* https://www.livemint.com/news/india/centre-initiates-population-based-survey-for-prevention-control-and-screening-for-common-ncds-pawar-11671196623047.html

[27] Lu, J. (2022). Ningen Dock: Japan's unique comprehensive health checkup system for early detection of disease. *Global Health & Medicine*, *4*(1), 9–13. https://doi.org/10.35772/ghm.2021.01109

[28] McGuire, T. G. (2000). Physician agency. In Handbook of health economics (Vol. 1, pp. 461-536). North-Holland.

[29] MoHFW, GOI. (2018). Comprehensive Primary Health Care through Health and Wellness Centers: Operational Guidelines. Retrieved from: https://www.nhm.gov.in/New_Updates_2018/NHM_Components/Health_System_Stregthening/Comprehensive_primary_health_care/letter/Operational_Guidelines_For_CPHC.pdf.

[30] MoHFW, GOI. Module for Multi-Purpose Workers (MPW)- Female/Male on Prevention, Screening and Control of Common Non- Communicable Diseases. Retrieved from: https://main.mohfw.gov.in/sites/default/files/Module%20for%20Multi-Purpose%20Workers%20-%20Prevention%2C%20Screening%20and%20Control%20of%20Common%20NCDS_2.pdf

[31] Mwachofi, A., & Al-Assaf, A. F. (2011). Health care market deviations from the ideal market. *Sultan Qaboos University medical journal*, *11*(3), 328–337.

[32] National Health Mission. (n.d.). National Programme for Prevention & Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke (NPCDCS). Retrieved from: https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=1048&lid=604

[33] News-Medical. (2023, February 25). Healthcaresystems around the world. https://www.news-medical.net/health/Healthcare-Systems-Around-the-World.aspx

[34] NHS. (2024, February 22). NHS screening. nhs.uk. https://www.nhs.uk/conditions/nhs-screening/#:~:text=Private%20screening,the%20benefits%20outweigh%20the%20harms.

[35] Organisation for Economic Co-operation and Development OECD. (2017). Health at a Glance 2017: OECD Indicators. OECD Publishing. https://www.oecd-ilibrary.org/sites/9789264311602-7-en/index.html?itemId=/content/component/9789264311602-7-en.

[36] Patnode, C. D., Evans, C. V., Senger, C. A., Redmond, N., & Lin, J. S. (2017). Behavioral Counseling to Promote a Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults Without Known Cardiovascular Disease Risk Factors: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. *JAMA*, *318*(2), 175–193. https://doi.org/10.1001/jama.2017.3303

[37] Pauly, M. V. (1968). The economics of moral hazard: Comment. *American Economic Review*, 58(3), 531-537.

[38] Peikes, D., Ph. D. ,. M. P. A., Zutshi, A., Ph. D., Genevro, J., Ph. D., Smith, K., Ph. D. ,. M. P. A., Parchman, M., M. D., Meyers, D., M. D., & Mathematica Policy Research. (2012). Early evidence on the Patient-Centered Medical Home. In Agency for Healthcare Research and Quality, *Final Report* (Final Report AHRQ Publication No. 12-0020-EF). https://www.ahrq.gov/sites/default/files/wysiwyg/ncepcr/tools/PCMH/early-evidence-on-pcmh-white-paper.pdf

[39] Peterson, C. E., Silva, A., Goben, A., Ongtengco, N. P., Hu, E., Khanna, D., Nussbaum, E. R., Jasenof, I. G., Kim, S. J., & Dykens, J. A. (2021). Stigma and cervical cancer prevention: A scoping review of the U.S. literature. *Preventive Medicine*, *153*, 106849. https://doi.org/10.1016/j.ypmed.2021.106849

[40] Press Information Bureau. (2022, December 29). Initiatives & Achievments - 2022. Retrieved from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1887285

[41] Preventive Services Task Force. (2018). Recommendations on screening for breast cancer in average-risk women aged 50-74. *Canadian Medical Association Journal*, 190(50), E1441-E1451. doi:10.1503/cmaj.180173.

[42] Sabatino, S. A., et al. (2021). Cancer screening test use—United States, 2018. *Morbidity and Mortality Weekly Rep*ort, 70(2), 29-35.

[43] Sivaram, S., Majumdar, G., Perin, D., Nessa, A., Broeders, M., Lynge, E., Saraiya, M., Segnan, N., Sankaranarayanan, R., Rajaraman, P., Trimble, E., Taplin, S., Rath, G. K., & Mehrotra, R. (2018). Population-based cancer screening programmes in low-income and middle-income countries: regional consultation of the International Cancer Screening Network in India. *The Lancet. Oncology*, *19*(2), e113–e122. https://doi.org/10.1016/S1470-2045(18)30003-2

[44] Street Jr, R. L., Makoul, G., Arora, N. K., & Epstein, R. M. (2009). How does communication heal? Pathways linking clinician–patient communication to health outcomes. *Patient Education and Counseling*, 74(3), 295-301.

[45] Taylor, R., Mamoon, H., Morrell, S., & Wain, G. V. (2001). Cervical screening by socio-economic status in Australia. *Australian and New Zealand Journal of Public Health*, *25*(3), 256–260. https://doi.org/10.1111/j.1467-842x.2001.tb00573.x

[46] Williams, D. R., & Mohammed, S. A. (2013). Racism and Health I: Pathways and Scientific Evidence. *The American behavioral scientist*, *57*(8), 10.1177/0002764213487340. https://doi.org/10.1177/0002764213487340

[47] Wilson, J. M. G. & G. Jungner. (1968). *PRINCIPLES AND PRACTICE OF SCREENING FOR DISEASE*. World Health Organization. https://iris.who.int/bitstream/handle/10665/37650/WHO_PHP_34.pdf?sequence=17

[48] Woolf, S. H., & Atkins, D. (2001). The evolving role of prevention in health care: contributions of the US Preventive Services Task Force. *American Journal of Preventive Medicine*, *20*(3), 13-20.

[49] World Health Organization. (2021). Grassroots screening to prevent and control non-communicable diseases. Retrievedfrom https://www.who.int/india/news/feature-stories/detail/grassroots-screening-to-prevent-and-control-non-communicable-diseases

[50] Yeoh, K. G., Chew, L., & Wang, S. C. (2006). Cancer screening in Singapore, with particular reference to breast, cervical and colorectal cancer screening. *Journal of medical screening*, *13 Suppl 1*, S14–S19.