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Roam with Integrated Medicine; Roam with Health Check-ups & Revel the Positive Health's Glory: Discover & use the Most Iconic Preventive Check-ups

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1. Abstract

Waiting for symptoms could be too late. Early screening, lifestyle changes, and awareness are the only way forward," emphasized Dr. Prathap Reddy, Chairman, Apollo Hospitals on 9 April 2025 releasing **"the Health of the Nation 2025 report"** which summarizes India's health as "Millions of Indians Living with Silent Health Conditions". We live in a world where we get many things at our fingertips without moving from the couch, resulting in leading an active life seems like a thing of the past. A sedentary lifestyle invites health issues, like diabetes, heart disease, and cancer. At least one thirds of Indian population would answer in negative if they are asked if ever, they stretched without feeling stiff or bent downwards without a tug in the back or knees. Desk or computer, or laptop or Mobile bound routines to screen heavy lifestyles every day are taking toll on how our Flexibility, body movements and sleep debts. Although there are many candidate biomarkers only a few have been sufficiently evaluated to justify their use in developing drugs, monitoring progress of a disease with or without treatment or making treatment decisions. Tumor size as biomarkers for cancer clinical endpoints, C-reactive protein (CRP) for inflammation, Troponin for (high-sensitivity cTn) as a safety biomarker, Lipoproteins (LDL 4 & HDL) as biomarkers for cardiovascular risk, serum iron, Vitamin D and B12 as biomarkers of importance nutrition issues, and a recent test of measuring levels of the protein MTBR-tau243 a biomarker of tau tangles in the brain that may be a more accurate measure of tau pathology to successfully distinguish between patients at different stages of Alzheimer's Disease (AD) progression.

Materials and Methods: The present article focuses on the clinical view of biomarkers in a few cases known to the author and a reverse design, addressing how a biomarker program should appear if it is expected to create an impact on personalized medicine and patient care.

Outcomes: Three cases out of the seven reported succumbed for want of early checkups and four cases were benefited by the Diagnostic Biomarker tests.

2. Keywords

Preventive check-ups, Allopathy medicine, Modern medicine, Precision medicine, Personalized medicine, Translational medicine, Biomarkers, Imaging techniques, Clinical trials, Companion diagnostics, Therapy

3. Introduction

We live in a world where we get many things at our fingertips without moving from the couch, resulting in

leading an active life seems like a thing of the past. A sedentary lifestyle invites health issues, like diabetes, heart disease, and cancer. Desk or computer, or laptop or Mobile bound routines to screen heavy lifestyles every day are taking toll on how our flexibility, body movements & sleep debts. **Waiting for symptoms could be too late, Early screening, lifestyle changes, and awareness are the only way forward** [1]**.** At least one thirds of Indian population would answer in negative if they are asked if ever, they stretched without feeling stiff or bent downwards without a tug in the back or knees [2].

Every day we hear of a sudden cardiac death or getting stroke and paralyzed, among the young and aged population alike. It is not just because of lifestyles, bad luck or Covid-19 infection in the past but because of an undiagnosed pre-existing heart disease. A proactive way of maintaining good health, reducing disease risks and management of potential health issues through early screening and diagnosis is the need of time.

Although many candidate biomarkers have been reported, few have been sufficiently evaluated to justify their use in developing drugs, monitoring progress of a disease with or without treatment or making treatment decisions- i) tumor volume in cancer, which highlights the need for rigorous analytical validation. ii) C-reactive protein (CRP), as a biomarker for both clinical care and drug development, including for risk stratification, prevention, screening, diagnosis, prognosis, patient selection, and pharmacodynamics. Potential uses of CRP include risk prediction, prevention, drug development activities, and as a surrogate endpoint for drug or health claim approval. iii) Troponin, as a surrogate endpoint, does not exist but is used as safety indicator. iv) low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, biomarkers frequently used as surrogate endpoints need to be carefully evaluated prior to each use and v) beta-carotene, which highlights the importance of biomarkers in nutrition-related settings.In the last decade serum iron, Vitamin D and B12 levels have been added as biomarkers of importance [3]. Recent test measures levels of the protein MTBR-tau243 - microtubule-binding region of tau containing the residue 243 - a biomarker of tau tangles in the brain that may be a more accurate measure of tau pathology than other established biomarkers to successfully distinguish between patients at different stages of Alzheimer's Disease (AD) progression & identify whether cognitive decline was likely due to AD or other causesand may also help doctors decide which treatments are best for their patients.

A resilient, inclusive, and innovation-driven healthcare ecosystem in India and other developing countries must reachunderserved urban and rural populations as a moral imperative, not just a strategic goal [4,5].

This article is a review of existing preventive check-ups including biomarkers and imaging tools and appealing all populations and National Health Schemes to provide them to the population as vaccination for children to emerge as a global leader in healthcare innovation.

4. Case Reports

Cardiac arrest in a laboratory

A senior male citizen aged about 70 years went to check up his blood test for sugar and cholesterol levels in the last week of March 2025 in a city in Kerala India. As he was waiting for post prandial BS sample collection, he collapsed and died with an hour.

On Thursday the 10 April 2025, an Air India express pilot, after landing the flight safely from Srinagar to Delhi, went to toilet and collapsed after vomiting, efforts to revive in airport health unit and later in a private hospital failed and he died. Thank God it happened after landing, imagine if it were to happen in the air, though the co-pilot may have taken over! An ECG that morning would have given clue to the risk.
These 2 cases are an example of the cost we pay for not getting periodical checkup despite knowing the problem

Bone density testing leading to treatment

Mrs. Prabha, a 74-years old lady, went for her routine annual mammography imaging after 2 years in December 2024. She is a known patient of Rheumatoid arthritis under Ayurvedic treatment and scared of undergoing knee transplant surgery. She was prompted by an offer by the center in Delhi of Bone Density Testing and got it done for INR 4000. Her husband thought it was a waste of money. Anyway, the report shocked both husband and wife as it showed Osteoporosis in 4 out of 5 sites. This led to initiating consultation with an orthopedic surgeon who advised Denu injection half yearly (a medicine used in the treatment of osteoporosis in postmenopausal women and in men at increased risk of fractures half yearly) and Supracal tablets 1000mg {contains- Calcium citrate (1000 mg) + Vitamin D3 (200IU) + Zinc Sulfate (4 mg) + Magnesium Sulphate (100 mg) daily for 2 months. A follow up on 9 April 2025 showed much improvement and she was asked to continue the tablets for alternate months and take the injection in June 2025. In about 3 months of treatment, she reported 50% reduction in her joints pain.

Mild hepatomegaly with Gr 1 fatty infiltration

Nitin Kulkarni a 32-year-old priest, had minor gastric upset in first week of June 2024 and was investigated for biomarker and abdominal imaging in a private hospital in Bengaluru. Clinical examination showed an abdominal fat accumulation, mild tenderness in right upper quadrant of the abdomen and left iliac fossa. Laboraotry examination of Stools for ova and cysts was normal, however it showed Mucus and Bacteria. USG of abdomen reportedMildly enlarged liver with increased echo structure suggestive of Gr I Non-alcoholic Fatty liver. Among other biomarkers tested his Blood Cholesterol 216 mg/dl (borderline), Triglycerides 281mg/dl (high) were abnormal. He was advised to reduce his weight by 5 Kg in next 3-4 months and reduce consumption of saturated fats (Ghee). In January 2025 he had reduced his weight by 6 Kg and doing fine now.

Sudden cardiac death due to TB myocarditis

A 35-year-old man presented to a district TB Centre with the history of productive cough, breathlessness and some weight loss over several weeks. He had a past medical history of asthma, eczema and expectorating sputum with hemoptysis at times over the past 3 months. A smoker of 10-15 cigarettes per day, complained of vomiting, precipitated by eating. There were no bowel or urinary symptoms. He was married, lived with his wife and three young children, denied any alcohol use and had no previous contact with tuberculosis (TB) patients.On clinical examination the patient was unwell, with temperature of 35.8 ℃. BP = 98/62 mmHg, Pulse+ 110 beats/min, respiratory rate 16 breaths/min. He had bilateral pedal oedema with no clinical evidence of deep vein

thrombosis. There were no palpable lymph nodes. CVS was normal. He was subjected to investigations of Blood (full blood count, urea and electrolytes, CRP, hepatitis and autoimmune screening), chest radiography, ECG, echocardiogram, and sputum for acid-fast bacilli. His blood tests showed a marginally raised white cell count (WCC) of 12.5 × 109 per L and a hyponatremia of 133 mmol/L. The patient had deranged liver function tests and a low glucose level of 2.1 mmol/L. His chest radiograph showed cardiomegaly & inflammatory changes in the right lung middle lobe. An ultrasound scan of his abdomen showed that the gall bladder was thick walled with pericholecystic fluid. The liver parenchyma was normal. Hepatic venous and inferior vena cava (IVC) congestion, and bilateral pleural effusions were noted. On day 2 of the admission the patient became agitated & suffered a cardiac arrest. He underwent cardiorespiratory resuscitation for over 45 min but could not be resuscitated and unfortunately died. His postmortem showed that the lungs were markedly edematous throughout.The pleura appeared healthy, but bilateral straw-colored pleural effusions were present. The heart was enlarged weighing 450 g, but the valves were normal. Both ventricles appeared dilated. A thrombus was adherent to the wall of the left ventricle and the ventricle muscle underlying this area of thrombus appeared pale. Sections from this abnormal area of myocardium showed florid granulomatous inflammation with multinuclear giant cells, consistent with TB. The lungs showed pulmonary edema&mild emphysema, but there was no histological evidence of TB.

CT Scanning in head related issues of elderly

In 2023 the authors had a minor fall in the bathroom that caused bleeding lacerated wounds. ACT-scan ruled out intracranial bleeding, fractures, guiding timely treatment and improving outcomes.

Revived ventricular fibrillation

A 39-year-old male patient experienced chest pain during an appointment in a tertiary care private hospital. Attending Cardiologist witnessed the ventricular fibrillation and successfully treated with a 200-J shock. On arrival the patient was alert, with a blood pressure of 122/80 mm Hg and a heart rate of 85 beats/min.The patient, a non-smoker gave a history of chronic back pain for which he was prescribed pregabalin and paracetamol. Prehospital electrocardiography (ECG) demonstrated ST-segment elevation in leads V2 to V5. Emergency coronary angiography demonstrated patent coronary arteries Optical coherence tomography (OCT) findings were suggestive of plaque erosion within the left anterior descending (LAD) coronary artery, but with no evidence of thrombus, dissection, or vasospasm. The initial troponin level was normal (< 26 ng/L) and peaked at 301 ng/L by 12 hours. A transthoracic echocardiogram on day 1 demonstrated good biventricular function with no regional wall abnormalities. Following admission, the patient remained hemodynamically stable, with no further episodes of chest pain or ventricular arrhythmia (VA) and downward trending troponin. On day 3, the patient was discharged with a diagnosis of VF secondary to myocardial ischemia. A cardiac magnetic resonance (CMR) 1 week after discharge showed good biventricular function with no evidence of myocardial infarction or fibrosis on contrast imaging.

5. Discussions

Health is a consolidation of physical, mental, social and spiritual well-being, which we can regularly improve through a balanced diet, physical exercise, adequate rest and recreation, and managing stress. Despite taking the required steps to stay healthy, we are at risk of developing several illnesses unexpectedly. Working individuals between the ages of 30 and 60 are at an increased risk of developing lifestyle diseases due to unhealthy choices, family history of health issues, and sleep deprivation. Health check-ups identify & reduce potential health risks before they progress to severe or critical stages requiring expensive treatments, financially burdening the Individual, the family and the healthcare system. Sustaining a positive health status depends upon preventing / reducing the risk of onset & progression of chronic illnesses by regular health screenings [1].

“Health of the Nation 2025 report” in India released on 7 April 2025 by Apollo hospitals screening 2.5 million people across the country says many people who appear normal weight fall into Obese group based on their Waist/Hip ratio or carrying access fat around the abdomen [1]. Preventive health check-ups at Apollo Hospitals have surged by 150% from 1 million in 2019 to 2.5 million in 2024. This reflects growing awareness, but the data surprisingly reveals that many people show no symptoms despite serious underlying conditions. Alarmingly, 26% had undiagnosed hypertension and 23% were diabetic. The report highlights non-alcoholic fatty liver disease (NAFLD) as a rising health threat. Among 2.57 lakh people screened, 65% had fatty liver-85% of whom had never consumed alcohol. This trend, driven by poor diets and sedentary lifestyles, often goes unnoticed in standard lab reports, requiring advanced diagnostics for detection. The data reveals that women’s health sharply declines after menopause. Diabetes in women increases from 14% to 40%, obesity from 76% to 86%, and fatty liver becomes even more prevalent. It also reveals that Obesity is no longer just an adult issue as 8% of primary school children and 28% of college students were overweight or obese. Alarmingly, 19% of college students showed signs of pre-hypertension, signaling early heart disease risks.Even in asymptomatic individuals, 46% showed early signs of heart disease via calcium scoring. Notably, 2.5% of those affected were under 40, emphasizing the need for routine heart screenings in young adults.Of 47,000 people screened, 6% showed signs of depression, most of them women aged 40-55. 1 in 4 were at high risk for Obstructive Sleep Apnea (OSA), with prevalence rising with age. Despite this, both conditions are frequently misattributed to stress or fatigue.The report also mentions that the median diagnosis age for cervical, breast, and lung cancer in India is significantly younger-by about 10 years-than global averages. Anemia affected 45% of women and 26% of men. Vitamin D deficiency is widespread, impacting 77% of women and 82% of men. Vitamin B12 deficiency among individuals under 40 also poses a risk. These deficiencies impair energy, cognition, and metabolism. The report found that 61% of those who were screened were obese and 18% were overweight. This excess weight is a major contributor to India’s growing non-communicable disease burden. It is time for Integrating BMI, Waist/Hip ratio, Blood/serum tests, internal organs imaging and metabolic checks into annual health routines. If this is the story of who got preventive tests done, due to some motivators, if we look at the overall population with either access problem or cost issues the situation may be much worse. A switch to an active lifestyle including preventive health checks by the national health system will help identify & prevent certain health issues [1].

In clinical practice, a screening test detects potential chronic health conditions in apparently healthy individuals at increased risk of disease, helps initiate lifestyle modifications, and, if needed, a management approach and help gauge requirements for additional follow-up tests and consultations to consolidate a diagnosis.In the context of clinical medicine, Imaging and biomarker-related processes are divided into six groups: (i) Risk assessment biomarkers assess the risk of a disease evolution; (ii) Screening biomarkers to screen for subtle subclinical illnesses; (iii) Diagnostic biomarkers to objectively differentiate between the subjective diagnostic perceptions of physicians; (iv) Staging biomarkers to identify and monitor the staging and severity of illnesses; (v) Predictive biomarkers to foresee a potential course of disease; (vi) Personalizing biomarkers to select personalized biomarkers, which is plausible with the advances in genomics technology and other "omics" [3].

All medical systems practiced world-over emphasize on preventive step for minimizing the complications and suffering from both communicable and non-communicable diseases. While primary prevention which includes health promotion and specific protection address occurrence of illnesses, secondary prevention in terms of early detection and treatment help in minimizing the illness period and development of complications and tertiary prevention of disability limitation and rehabilitation facilitate minimizing the development of disabilities due to illness & rehabilitation tries to make a person independent & self-sufficient to lead day-todays life without the need for somebody's help. All these efforts add to making a country's Healthy Ageing Live Expectancy (HALE) Improve [5].

6. Allopathic System

In the allopathic medicine system, preventive check-ups play a crucial role in early disease detection, risk factor identification, and promoting healthy lifestyles, ultimately leading to improved health outcomes and reduced healthcare costs. Allopathic medicine has a specialized branch called preventive & social medicine or public health or community medicine, which focuses on preventing disease and promoting health through various interventions. Examples of Preventive Check-ups in allopathy include i) Vaccinations to prevent infectious diseases like Diphtheria, Pertussis, Tetanus, Measles, Shingle, Influenza, Pneumonia etc.ii) Screenings are tools used to identify the conditions like cancer, diabetes, and high blood pressure iii) Lifestyle counseling to promote healthy habits iv) Regular monitoring for individuals with chronic conditions like Diabetes, Hypertension, Asthma, Rheumatoid arthritis, COPD etc. A summary of the benefits are: i) Regular check-ups allow healthcare professionals to identify potential health problems at an early stage, when they are often easier and more cost-effective to treat ii) Preventive check-ups can help identify individuals at higher risk for specific diseases like cardiovascular disease (CVDs), diabetes (D), or certain cancers etc., based on family history, lifestyle, Biomarkers and Imaging techniques iii) Check-ups also provide an opportunity for patients to interact with their physicians and be guided for adopting healthier habits like appropriate diet, exercise, reducing alcohol or drugs abuse and smoking cessation, which significantly reduce the risk of developing chronic diseases iv) Early detection and treatment of health problems through preventive check-ups can lead to lower long-term healthcare costs compared to treating diseases at a later stage v) Preventive check-ups allow healthcare providers to tailor make the health plans to individual needs and risk factors, professional compulsions, ensuring that interventions are targeted and effective [3,4,10,11].

7. Ayurveda System

In a world that's increasingly leaning towards modern medicine & fast-paced living, Ayurveda, an ancient system of medicine, beckons with its timeless wisdom and holistic approach to health. Ayurveda, at its core, is about maintaining health and preventing diseases. Rather than merely addressing symptoms, it emphasizes the prevention of illness through a personalized approach that balances the mind, body, and spirit. The key to Ayurveda's effectiveness in preventing diseases lies in its recognition that everyone is unique, with their constitution, needs, and susceptibilities.Central to Ayurveda are the doshas-Vata, Pitta, and Kapha. These doshas represent the fundamental energies governing our physical & mental processes. Understanding an individual's unique dosha constitution is essential for preventive healthcare.

1. **Vata:** Associated with the elements of air and space, Vata-dominant individuals are typically creative, energetic, and enthusiastic. To maintain balance, they should focus on warm, ground foods and routines.
2. **Pitta:** Pitta is linked to the elements of fire and water. People with a dominant Pitta constitution tend to be intelligent, passionate, and driven. To prevent imbalance, they should embrace cooling foods, moderation, and relaxation.
3. **Kapha:** Kapha is related to the elements of earth and water, and Kapha-dominant individuals are usually calm, nurturing, and strong. To maintain health, they should engage in movement, stimulation, and variety.

Traditional Ayurvedic Diagnosis (TAD) emphasizes a multi-sensory approach to diagnosis, including observation (darshana), palpation (sparshana), listening (shravana), and smelling (ghrana). Ayurvedic concepts like doshas (vata, pitta, kapha), dhatus (tissues), and mala (waste products) are used to understand an individual's constitution and imbalances, which are seen as the root of disease [6,7].

In the Ayurveda system, preventive check-ups, emphasizing a holistic approach to health, focus on maintaining balance through lifestyle modifications, dietary choices, and practices like Panchakarma, aiming to prevent disease rather than solely treating it. A summary of Ayurvedic system includes: i) As Ayurveda views health as a state of balance between the body, mind, & spirit, emphasizes the importance of maintaining this equilibrium to prevent illness. ii) Ayurveda emphasizes adhering to a regular daily routine, called Dinacharya like early rising, proper sleep, and mindful eating, to maintain balance and promote well-being. iii) It's Ritucharya (Seasonal changes in Routines) advocates seasonal guidelines for diet and lifestyle that help the body to adapt to changes in the environment and maintain balance. iv) Ayurveda emphasizes the importance of ethical behavior and positive thinking for maintaining mental and physical health and is called **Sadvritta** (Ethical Conduct). v) Panchakarma is a set of therapeutic procedures that detoxify the body and rejuvenate tissues, preventing the accumulation of toxins (ama) that can lead to disease. vi) Rasayana are therapies that aim to enhance longevity & vitality by strengthening the body's natural defenses. Just like Allopathy

Ayurvedic Preventive Check-ups are advocated for i) early detection of imbalances & potential health issues, enabling timely intervention &prevention of chronic diseases. ii) An individual's unique constitution (prakriti) and lifestyle are assessed to provide personalized recommendations for maintaining health and preventing disease. iii) As Ayurveda emphasizes the importance of lifestyle modifications, like diet, exercise, and stress management, to promote overall well-being and prevent diseases. iv) It recognizes the link between mental & physical health, emphasizing the importance of stress management techniques like yoga and meditation to prevent stress-related illnesses. v) It provides guidelines for choosing foods that are appropriate for an individual's constitution & season.

7.1. Biomarkers in ayurveda

Biomarkers are physical properties in human body that are considered as indicators of normal phenomenon. They indicate various biological processes, pathological processes and drug intervention response**.** No biomarker was identified, validated or recommended in Ayurveda. However, the concept of biomarkers has been explored in Ayurveda in recent years, by researchers investigating potential biomarkers for various conditions and treatment responses. Studies have explored the correlation between: i) Ayurvedic concepts like Prakriti (individual constitution) and genetic markers. ii) Use of biomarkers to assess the effectiveness of Ayurvedic treatments. iii) Imaging is not a core part of Ayurvedic practice, but of late some practitioners have started using modern imaging techniques increasingly as complementary tools to gain a more comprehensive understanding of a patient's condition, clinching diagnosis and prognosis monitoring by using imaging techniques like MRI and CT scans in conjunction with Ayurvedic principles [7].

7.2. Current research

There is ongoing research exploring the integration of modern biomarkers and imaging techniques into Ayurvedic practice to validate and standardize Ayurvedic diagnostic methods and treatments. The future of Ayurveda may involve a more integrated approach that combines traditional diagnostic methods with modern tools like biomarkers and imaging leading to more precise& personalized treatment plans based on an individual's unique constitution and condition. Research is needed to fully understand the potential of biomarkers & imaging in Ayurveda promoting healthy digestion & preventing imbalances.

Ayurvedic practitioners are exploring the use of biomarkers, such as blood tests, urine analysis, and pulse diagnosis, to assess an individual's doshas (humors) and imbalances, which are key to understanding an individual's constitution and health status. Similarly, though not as common as in allopathic medicine, imaging techniques like ultrasound and MRI are starting to be integrated into Ayurvedic practices for specific conditions, helping in visualizing internal organs and assessing their health. For example, Ayurvedic practitioners are using biomarkers like blood sugar levels, cholesterol levels, and inflammation markers to assess the effectiveness of Ayurvedic treatments for conditions like diabetes and heart disease. Ultrasound is being used to assess the health of the uterus & ovaries in women's health conditions, MRI is used for assessing the brain & spinal cord in neurological conditions [6,7].

8. Homeopathy Medicine

Homeopathic medicine is a branch of integrative medicine that has been gaining increasing popularity. To improve the understanding of homeopathy, observational studies-which monitor the effects of homeopathy in real-life clinical settings-are helpful adjuncts to randomized controlled trials.However, its clinical application remains controversial.While some homeopathic practitioners and researchers explore biomarkers and imaging tests to assess treatment effectiveness or understand the body’s response, they are not a standard part of homeopathic treatment or diagnosis [5].

The Core Principles of Homeopathy focus on holistic healing & use of highly diluted substances to stimulate the body's natural healing abilities. Homeopathic practitioners primarily rely on a patient's unique symptoms and overall "totality of symptoms" to choose a remedy, rather than relying on objective tests or biomarkers. Therefore, there is limited scientific evidence to support the efficacy of homeopathy for specific health conditions. However, some researchers are exploring the potential of biomarkers and imaging in homeopathy, but these studies are still in their early stages and haven't been widely validated. For example, i) some studies investigate telomere length as a potential biomarker for homeopathic treatment effectiveness, ii) the use of imaging techniques to understand brain activity or other physiological changes associated with homeopathic remedies, iii) the potential of nanoparticles in homeopathy and their detection using advanced imaging techniques. It's essential to consult with a qualified healthcare professional before making decisions about any treatment approach and Homeopathy must not be considered a substitute for conventional medical care [8,9].

Telomere length and telomerase enzyme activity play an important role in maintaining cellular vitality, biological longevity, and physiological homeostasis. Telomere shortening functions as a biomarker of vital imbalance and is associated with numerous diseases and health disorders. On the other hand, health-promotion practices neutralize the pathological shortening of the telomeres, acting therapeutically in diseases or age-dependent health disorders. A study to understand the role of the telomere-telomerase complex in cell vitality, biological aging, and the health-disease process. The use of telomere length as a biomarker of the vital force state and the effectiveness of homeopathic treatment concluded that as a hypothetical biomarker of the vital force state, an intra-individual analysis of the mean leukocyte telomere length before, during, & after homeopathic treatment is used as a biomarker of therapeutic effectiveness [5].

A significant reduction in the frequency of onset of RTIs was found in both the homeopathic medicine and untreated groups. The reduction in the mean number of RTI episodes during the period of observation vs. the year before inclusion in the study was significantly greater in the homeopathic-treated group than in untreated patients (-4.76 ± 1.45 vs. -3.36 ± 1.30; $p = 0.001$). The beneficial effect of homeopathic medicine was not significantly related to gender, age, smoking habits or concomitant respiratory diseases when compared to the effect observed in untreated patients [8].

9. Traditional Chinese Medicine (TCM)

TCM practitioners utilize biomarkers like tongue and pulse diagnosis, along with blood tests and urine analysis, to assess the balance of Qi (vital energy) and Yin-Yang (complementary forces) in the body.TCM is exploring imaging techniques like ultrasound and MRI to visualize internal organs and assess their function, although these are not as central to TCM as in allopathic medicine, for examples) TCM practitioners use biomarkers like blood sugar levels, cholesterol levels, and inflammation markers to assess the effectiveness of TCM treatments for conditions like diabetes and heart disease ii) Ultrasound is being used to assess the health of the uterus and ovaries in women's health conditions, and MRI is used for assessing the brain and spinal cord in neurological conditions [11].

10. Unani and Siddha Medicine Systems

Unani and Siddha, are also exploring the use of biomarkers and imaging techniques to enhance their diagnostic and therapeutic capabilities.These systems are integrating modern scientific approaches with their traditional knowledge to provide more comprehensive and effective healthcare.

11. Translational Medicine

The exchange between laboratory (bench) and the clinic (bedside), is decidedly taking on a vital role. Many companies are now focusing on a translational medicinal approach as a therapeutic strategy in decision making upon realizing the expenses of drug attrition in late-stage advancement. The utility of biomarkers in clinical decision, therapy guidance seeks to improve the patient outcomes & decrease wasteful or harmful treatment. Efficient biomarkers are crucial for the advancement of diagnoses, better molecular targeted therapy, with clear advantages in a broad spectrum of various diseases [10].

12. Innovation Gap

Despite recent advances in the discovery of biomarkers, the advancement route to a clinically validated biomarker remains intensely challenging, and many of the candidate biomarkers do not progress to clinical applications, thereby widening the innovation gap between research and application.

12.1. Utilization of biomarkers

A preventive approach practices of many urban literates, like regular check-ups screenings reduce morbidity, complications and disabilities and mortalities. However, these practices are limited as less than one third of the urban population and negligible rural population go through such efforts. While there's no precise national statistic for the exact proportion of Indians undergoing annual check-ups/screenings, Redcliffe Labs reports suggest that about 25% of the Indian population gets regular health checkups while a significant 75% only get diagnostic tests when they are sick.

A study in Rural District of Tamil Nadu in later half of 2021 reported that the mean ± SD of the age of the general population was 52.27 ± 21.09. Out of 436 participants, only 130 (29.82%) had undergone preventive health check-ups in the past. The subjects with young age ($p = 0.006$), those who obtained COVID-19 vaccination ($p = 0.001$), subjects with stable occupation ($p = 0.002$), and those with higher education ($p < 0.001$) (chi-square test) had preventive health check-ups. A significant association was found between motivators and barriers for age, gender, education, occupation, marital status, comorbidities, and vaccination status against COVID-19 [4]. This study reported that lack of awareness of the health check-up, lazy to go for a health check-up and the procedure is uncomfortable as the barriers and Insurance/work-related factors motivated, a known health condition and a doctor's advice as the motivators.

12.2. Barriers for regular health checkups

i) Preventive Healthcare costs are a barrier for many, especially in rural areas, ii) while some people are not aware of the importance of regular check-ups and iii) many rural people rely on self-treatment or home remedies rather than seeking professional medical advice. Most people in developing countries do not realize the fact that investing in regular checkups & screening will reduce sickness care costs, minimize sickness (hospitalizations) days and maintain productivity. It also empowers individuals to take control of their health, making informed decisions to improve their quality of life.

12.3. Benefits of integration

Biomarkers and imaging techniques can provide more accurate and objective information about a patient's condition, leading to better diagnosis & treatment planning. By understanding an individual's unique biomarkers and physiological characteristics, healthcare providers can tailor treatments to their specific needs. The integration of modern science with traditional medicine systems can lead to improved health outcomes and a more holistic approach to healthcare. As lifestyle diseases are spiking among young professionals' early detection and management is important. Most pressing health issues in the younger population today like Hypertension, Diabetes, heart diseases, Asthma, COPD, which often develop silently without any noticeable symptoms at least in the early stages. For example, a diabetic person in the initial stages may just have mild fatigue or increased thirst which they overlook, attributing to overwork or climatic conditions. Similarly, a heart condition may not show an explicit symptom until enough damage has occurred. Regular health check-ups are the only way to detect them. A diabetic patient who maintains optimal blood sugar through preventive care will be less likely to experience life threatening complications of kidney (CKD) failure or diabetic coma. Similarly, a well-managed Hypertensive patient with appropriate medicines can minimize heart failure, heart attacks and strokes [11,12].

12.4. Biomarkers

Biomarkers or molecular markers or signature molecules are traits that doctors ask to get measured in our blood, body fluids, and tissues, which are the signs of our body fluids compared with normal ranges of the population or our body functions or conditions, diseases, during a healthy status or when something goes wrong. Biomarkers are also used to see how well our body reacts to treatments for a disease. Biomarkers are classified into several groups; each group informs the doctor of something different in our body namely:

i. **Diagnostic biomarkers** - Help our doctor make a more specific diagnosis.
ii. **Monitoring biomarkers** - Doctors look at this over time to see how a health condition progresses over hours,

days, weeks, months, or years to decide if the disease improves, gets worse, or stays the same.

iii. **Predictive biomarkers** - These help to tell ahead of time whether a patient may respond well to a certain treatment.

iv. **Susceptibility or risk biomarkers** - These biomarkers suggest how likely a person can get a particular condition, before a disease is even in our body.

v. **Prognostic biomarkers** - These provide a good picture of how a patient's future with a disease will look after a diagnosis and start the intervention to see how the condition may progress.

vi. Pulse, Blood pressure, Respiratory Rate, Blood Oxygen saturation, X-ray results, CAT scan results are simple biomarkers and Lab tests of our blood, other fluids (CSF, pleural effusion, abdominal Ascitic fluids) and tissue and Molecules made by tumors in our body that are related to cancer are a complex set of biomarkers.

13. A List of Health Checks based on Age

1. A general health check-up must be done every year for all aged 30 years and above
2. Individuals over 40 years, annual check-up must include metabolic, Cardiac & Organ function Tests.
3. Elderly people must additionally get tests for Osteoporosis, nutritional deficiencies like Vit D & B12, Iron etc. Women over 50 years to add hormonal changes.
4. People identified as Pre/diabetics, Asthma, COPD, Rheumatoid arthritis etc. need frequents tests.

14. Scanning Technologies

Scanning technologies like CT scans, MRIs, ultrasounds, and X-rays providedetailed images and help radiologists identify diseases, injuries, abnormalities, and guiding treatment decisions, & monitoring disease progression.

14.1. Computed tomography (CT) scans

CT scans use X-rays to create cross-sectional images of the body, allowing radiologists to see internal structures in detail and i) diagnose tumors, infections, blood clots, and injuries, ii) Evaluate the effectiveness of chemotherapy, radiation therapy, and surgery iii) Guide procedures of biopsies & surgeries, iv) Detect problems in the chest, abdomen, pelvis, or spine by assessing the extent & location of problems. CT scans are fast & provide detailed images of bones, muscles, organs, & blood vessels.

14.2. Magnetic resonance imaging (MRI)

MRI uses strong magnetic fields and radio waves to create detailed images of the body's internal structures. Apart from diagnosing conditions like tumors, injuries, & certain heart problems. It helps evaluating soft tissues, like muscles, ligaments, & tendons, and distinguishing between white and gray matter in the brain. MRI provides excellent contrasts of soft tissues, is non-invasive & painless.

14.3. Ultrasound scans

Ultrasound uses high-frequency sound waves to create images of internal organs and tissues. It is used for i) examining abdominal and pelvic organs, musculoskeletal and vascular systems, ii) checking fetal development during pregnancy iii) Assessing blood flow in vessels and iv) Diagnosing kidney stones, appendicitis, diverticulitis.Ultrasound is non-invasive and can be used to assess real-time images and blood flow.

14.4. X-rays

X-rays use electromagnetic radiation to create images of bones and other densestructures. It is used for, i) diagnosing fractures and other bone injuries, ii) Identifying abnormalities in the chest, such as pneumonia or lung tumors, iii) Assessing the size and shape of organs. X-rays are quick and relatively inexpensive.

14.5. Nuclear imaging (SPECT and PET scans)

Nuclear imaging uses radioactive tracers to visualize the body's organs & tissues and is used for, i) Assessing organ function, blood flow, & metabolism, ii) Detecting and monitoring the effectiveness of the treatment of cancer at an early stage, iii) Nuclear imaging provides information of the function of organs & tissues**.**

15. Advancements in AI

Artificial intelligence enhances the ability to interpret & analyze medical images, leading to faster and more accurate diagnoses. Improved performance of large language models (LLMs) on traditional reasoning assessments has led to benchmark saturation, leading to the efforts to develop new benchmarks, like synthetic computational simulations of clinical practice involving multiple AI agents. AI's limitations and its inability to replicate human creativity, moral agency, and the capacity for error-driven discovery, must be considered in the evolving role of AI in knowledge production and the enduring value of human effort in shaping wisdom and innovation. Therefore, it is crucial to ground such efforts in extensive human validation and to evaluate LLMs for clinical practice [12].

16. Banes of Imaging

Medical imaging technologies, while invaluable for diagnosis and treatment, present potential risks like radiation exposure, cost, and overutilization. Some imaging techniques, like X-rays and CT scans, use ionizing radiation, which pose a risk of like cancer. Advanced imaging equipment is expensive, & inaccessible to poor rural, tribal, & urban poor patients & healthcare facilities. Some imaging procedures require the use of contrast agents, which cause allergic reactions or other adverse effects in some individuals. Medical imaging is being overused, leading to unnecessary radiation exposure, increased healthcare costs, and patient anxiety. The scope for error or insufficient result is always there due to human error. Some patients may experience claustrophobia during MRI scans. The presence of metal implants or devices can interfere with the quality of MRI images. X-rays are highly effective in visualizing bone structures but have limitations regarding soft tissue contrast.

17. A List of Check-Ups would include [3]

1. A complete Blood Count (CBC), which helps to detect variations in blood cell parameters.
2. Diabetes and Thyroid profiling are essential as metabolism slows with age, increasing the risk of Diabetes, Hypo or Hyper thyroidism
3. Kidney (KFT) and Liver Function Tests (LFT) monitor lifestyle factors like alcoholism, processed food intake and non-alcoholic Fatty Liver (NAFL)
4. Lipid Profiling monitors Cholesterol levels which indicate Heat Health.

5. 2D Echocardiogram and tread meal tests evaluate Heart Health.
6. Clotting time, Bleeding time, Vit D & B12 levels, ECG, Inflammatory markers like CRP and ESR, identify underlying deficiencies and silent inflammation.
7. Prostate specific Antigen (PSA) test for men helps detecting Prostate related problems
8. Similarly, women should get annual Mammograms, Pap smears, to detect Breast and Cervical cancer and Bone Density Tests for identifying osteoporosis.
9. Pelvic MRI helps identifying problems like Fibroids, endometriosis, Prostate enlargement etc.

18. Cost of Health Care Check-Ups in India

Most Laboratories in Urban India offer various health checkup packages with prices ranging from ₹483 to ₹23,980, depending on the package and the tests included. For example, Basic Full Body Check costs ₹483, Regular Full Body Health Check: ₹1099 (₹1832), Prime Full Body Checkup: ₹1700 (₹2833), Prime Plus Full Body Checkup: ₹2000 (₹3333), Superior Full Body Checkup: ₹3000 (₹5000), Full Body Checkup - Essential: ₹4300 (₹7167), Full Body Checkup Male - Advance: ₹5323 (₹8871, Full Body Checkup Female - Advance: ₹5323 (₹8871) and ProHealth Senior Citizen – Female package costs ₹23,980.

18.1. The Packages Include

18.1.1. Young & agile Men's health check (Under 40) - Rs. 6900/: i) Blood Pressure Resting digital blood pressure, ii) Type 2 Diabetes Mellitus Tests - HbA1C, Post Prandial Blood Sugar, Fasting Blood Sugar, iii) High Cholesterol Lipid Profile, iv) Anemia, Blood Cell Disorders, Hemogram, v) Inflammatory Markers- ESR, URIC ACID, vi) Liver Function Test/LFT, vii) Kidney Function-Fasting Renal Function Test/Rft (Includes Fasting Blood Sugar), viii) Ultrasound Abdomen & Pelvis, ix) Urine Routine &Microscopy, x) Thyroid Function- TSH, xi) Screening For Future Cardiovascular Risk- Cardiovascular Disease Risk Scoring, xii) Heart Disease- Screening Echo, Resting ECG, Treadmill Test/TMT, Preventive Cardiology Consultation, xiii) Lung Disease- Chest X Ray, xiv) Vision-Ophthalmology Check + Consultation, xv) Medical Assessment- Health Check Physician, Surgical Assessment, xvi) Nutrition & Lifestyle- Nutritionist Consultation, xvii) Colon Cancer Prevention + Liver Disease Prevention Counseling, xviii) Gastroenterology Consultation.

18.1.2. ADD-Ons for ₹5200: i) Extended Lung Check-Spirometry, ii) Bone Health, iii) Vitamin D, iv) Nerve Health, v) Vitamin B12, vi) Male Reproductive Screen-Testosterone, vii) Viral Hepatitis B, viii) HBS AG (CMIA), ix) Viral Hepatitis C, x) HCV (CMIA).

18.1.3. Complete Senior Men's wellness check (Age 65 and above) - Rs. 10,800/-Senior men's wellness check includes - i) Full body metabolic and organ wellness check, ii) Cardiac risk screening with CT coronary Calcium scan, iii) Stroke risk testing, iv) Hormonal and essential vitamin profile, v) Bone health screening, vi) Age-appropriate cancer screening/tests, vii) Resting digital blood pressure, viii) Type 2 Diabetes Mellitus- HbA1C, Post Prandial Blood Sugar, Fasting Blood Sugar, High Cholesterol, ix) Lipid Profile, x) Anemia, Blood Cell Disorders Hemogram, xi) Inflammatory Markers- ESR, URIC ACID, xii) Thyroid Disorders- TSH, xiv) Liver Disease And Nutrition- Liver Function Test/LFT, xv) Kidney Function- Fasting Renal Function Test/Rft (Includes FBS), Ultrasound Abdomen & Pelvis, Urine Routine & Microscopy, xvi) Vision-Ophthalmology Check + Consultation, xvii) Screening For Future Cardiovascular Risk Cardiovascular Disease Risk Scoring, Heart Disease-Screening Echo, Resting ECG, Ct Coronary Calcium Scan, Heart Disease Counseling, Cardiology Consultation, xviii) Stroke Risk Screening- Carotid Doppler, xix) Lung Check-Chest X Ray, Spirometry, xx) Surgical Assessment, xxi) general Surgeon Consultation, xxii) Senior Citizen Medical Assessment-Geriatrician Consult, xxiii) Prostate Cancer Screening, PSA, xxiv) Nutrition and Lifestyle- Nutritionist Consultation, xxv) Colon Cancer Prevention + Liver Disease Prevention Counseling, xxvi) Gastroenterology Consultation.

ADD ON - 1 | ₹4500: Colon Cancer Screening-Colonoscopy
ADD ON - 2 | ₹2100- Bone Health- Vitamin D, Nerve Health- Vitamin B12
ADD ON - 3 | ₹1400- Viral Hepatitis B, HBS AG (CMIA), Viral Hepatitis C, HCV (CMIA)
ADD ON - 4 | ₹800-Vision- Advanced Digital Fundoscopy

18.1.4. Complete Senior Women's wellness check (Age 65 and above) - Rs. 10,800/-

Women's Health Assessment: All the tests listed above for men and Gynecology Consultation, Geriatrician Consult-Breast Cancer Screening- Mammography (TILL AGE 75), Bone Health- Dexa HIP and LS Spine. **Nutrition and Lifestyle women's wellness check-** Full body metabolic and organ wellness check.

I am sure the list is not all inclusive and therefore deters many to elect only a few based-on family physicians' advice.

19. Preventive Health Checkups Recommendations

In India annual check-ups for men above 35 and women above 40 years are recommended universally. If there's a family history of a particular disease, other members must start screening tests 10 years before the youngest family member suffered [1,2,3].

20. Conclusion

The National Health Report 2025 is the story of people who got preventive tests done in a private sector due to some motivators. If we look at the overall population with either access problems or cost issues the situation may be much worse. A switch to an active lifestyle including preventive health checks by the national Health system will help identify & prevent certain health issues.

Though preventive health check-ups have surged in the last 5 years between 2019 and 2024, reflecting growing awareness.

However, available data reveals thatnearly a quarter (about 25%) people show no symptoms despite serious underlying undiagnosed hypertension and diabetes.

Two thirds of the people tested having Non-alcoholic fatty liver and shockingly 85% of whom had never consumed alcohol. This trend, driven by poor diets and sedentary lifestyles, often goes unnoticed in standard lab reports, requiring advanced diagnostics for detection.

Alarmingly, one in five college students showed signs of pre-hypertension, signaling early heart disease risks.

Another bad news is in asymptomatic individuals, 46% showed early signs of heart disease via calcium scoring, with 2.5% of those affected being under 40 years. Therefore, experts urge lowering screening age thresholds and increasing awareness across urban and rural populations.

Nutrition challenges call for nationwide nutrition education. Country must think of incorporating health screenings into school curriculums, corporate wellness programs, insurance plans and even general population through public Health Care system just like well-baby clinics we used to have in 1960's.

All developing countries' healthcare must be guided by purpose, not just profit, for them to emerge as a global leader in healthcare innovation, leveraging its strengths in IT, talent, and generics.

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