

Review Article

Routine health check-ups: A boon or a burden?

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ABSTRACT

Healthcare provider institutions in India now offer structured health check-up 'packages' for routine screening of common diseases. While some tests included within their ambit are in keeping with international and Indian recommendations, some are entirely unwarranted. Unnecessary and inappropriate screening tests may cause more harm than benefit. Besides financial and resource burden, there may be over-diagnosis and over-treatment, psychological distress due to false-positive test results, harm from invasive follow-up tests, and false reassurance due to false-negative test results. Clinicians must ensure a net benefit from tests and interventions in order to efficiently deliver preventive services. We reviewed current screening guidelines for cardiovascular disease and common cancers, and surveyed multiple 'packages' provided at 8 centres in Mumbai, India. We put forth our recommendations for routine health screening in asymptomatic adults in India.

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INTRODUCTION

'Prevention is better than cure', said Desiderius Erasmus some

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500 years ago. This indisputable adage has acquired renewed significance and acknowledgement in urban India, with an increasing proportion of people periodically undergoing routine health check-ups.^{1,2} These are often mandated pre-employment, for life insurance and by corporations for their staff. Diagnostic centres and hospitals offer several health check-up 'packages' to cater to this need. These health check-ups include a battery of investigations, some of which are inappropriate due to their poor diagnostic yield and cost implications.³

The aim of a routine health check-up should be to unearth a latent disease or prevent its manifestation by modifying the risk factors.^{4,5} However, routine health check-ups are typically broad in their approach and assess multiple organ systems simultaneously to ascertain whether an individual is healthy or not. Sutton's law (one should look for diseases where they are most likely to be) exposes the contradiction of this generalist approach. This non-specific method may cause more harm than good because of over-diagnosis, over-treatment, distress or injury from invasive follow-up tests, anxiety due to false-positive test results, false reassurance due to false-negative test results and possible continuation of adverse health behaviours due to negative test results.

We review current guidelines for specific tests for cardiovascular disease (CVD) and common cancers relevant to India. We also survey tests commonly included in routine health check-up packages provided in an urban area (Mumbai) in India to assess their benefits in terms of cost and diagnostic relevance.

METHODS

Data collection and interpretation

We searched PubMed and Google Scholar to obtain published data for current guidelines for specific tests commonly included in routine health check-up packages, which screen for CVD, lipid profile, diabetes mellitus and for cervical, breast and prostate cancers. Besides using keywords for disease conditions, we looked for 'prevention', 'screening' and 'guidelines' in various combinations in English language publications. We also studied how various guidelines have evolved over the past two decades. We evaluated 25 health check-up packages of various combinations of tests offered in eight diagnostic centres and hospitals in Mumbai.

SCREENING METHODS FOR SPECIFIC DISEASE GROUPS

Cardiovascular disease. Globally, CVD is the most common cause of morbidity and mortality.^{6,7} In 1994, a European Joint Task Force suggested guidelines for prevention of CVD, which is based on multiple established risk factors. These guidelines were

revised in 1998, 2003, 2007 and 2012.⁷ Similarly, the American College of Cardiology/American Heart Association (ACC/AHA) have guidelines for prevention of CVD (the latest version published in 2013).⁸ Several risk factors for CVD are modifiable and these guidelines suggest that routine health check-ups, which screen for hypertension, diabetes and dyslipidaemia, lead to early detection and treatment of CVD.

The prevalence of hypertension among Indian adults has been estimated to be 29.8% (rural areas 27.6%; urban areas 33.8%).⁹ This is comparable to the prevalence of hypertension in USA and Europe. A recent Indian Council of Medical Research–India Diabetes (ICMR–INDIAB) study has estimated the prevalence of dyslipidaemia in India at around 37%; the urban areas having estimates comparable to that in the USA.¹⁰ The prevalence of diabetes mellitus among the adult population in India at about 7.5%, is also comparable to the estimates in western countries.¹¹ These similarities in the CVD disease burden suggest that health check-ups in India, especially in urban regions, may be aligned with the European and American guidelines. There is substantial evidence of the benefit in assessing each individual's absolute risk of having a CVD event, using one of several widely available statistical tools such as the Framingham score. The Framingham score recommends aggressive intervention to reduce risk factors among patients at high risk of CVD ($\geq 20\%$ risk in 10 years).¹²

The current guidelines for prevention of CVD generally aim to be comprehensive in listing all risk assessment tests and grading their utility. However, clinical decisions should be based on regional specificities and resource settings. Several tests to assess the risk of CVD such as highly-sensitive C-reactive protein (hs-CRP), ankle–brachial index, presence of periodontal disease, carotid artery intima–media thickness, electron beam CT scan and homocysteine level have a low diagnostic value in asymptomatic individuals.⁸ Despite this, many of these tests are included in annual health check-up packages, resulting in unnecessary and frequent testing of healthy individuals.

The American Diabetes Association recommends testing for diabetes or pre-diabetes in all adults with BMI ≥ 25 kg/m² and one or more additional risk factors for diabetes. However, in individuals without risk factors, testing should begin only after the age of 45 years. Treadmill stress test is commonly done as part of preventive health check-ups in adults. However, the United States Preventive Services Task Force (USPSTF) recommends against screening with resting or exercise ECG for the prediction of CVD in asymptomatic adults at low risk for coronary events.¹² Random stress testing leads to a considerable number of false-positive results, especially in women.¹³ One should also consider the 'healthy volunteer bias'. Those who report for cardiovascular health check-ups are more likely to be educated and conscious of their health. Therefore, irrespective of screening, they would follow a healthy lifestyle and hence have less CVD events (which would be falsely attributed to health check-ups).

Cancer

The American Cancer Society (ACS) guidelines comprehensively summarize the current screening guidelines for breast, cervical, colorectal, endometrial, lung, prostate and skin cancers.¹⁴ Of these, the early detection tests for breast, cervical and prostate cancers are commonly included in routine check-ups, which we have included in this review. A screening test for cancer needs to be carefully assessed for any risk of the screening procedure itself as well as false-positive results.

Breast cancer

The ACS guidelines recommend periodic clinical breast examination for women aged 20–40 years, preferably at least every 3 years, while it should be annual for women aged >40 years.¹⁴ The objective of a mammogram is to detect non-palpable breast cancers that are smaller than clinically palpable ones. In general, small breast cancers confer a better prognosis than larger ones. A long follow-up study of a large Canadian cohort by Narod *et al.* did not find any reduction in breast cancer mortality with routine mammography in women aged 40–59 years.¹⁵ The study found that 22% (106/484) of screen-detected invasive breast cancers were over-diagnosed. Survival in the context of a screening programme is not predictive of reduced mortality because of several key biases. These biases include:

- *Lead-time bias*: Survival time for a cancer found mammographically includes the time between detection and the time when the cancer would have been detected because of clinical symptoms, but this time is not included in the survival time of cancers found because of symptoms.
- *Length bias*: Mammography detects a cancer while it is preclinical, and preclinical durations vary. Cancers with longer preclinical durations present more opportunities for discovery and therefore are more likely to be detected by screening; these cancers tend to be slow-growing and to have better prognoses, irrespective of screening.

In specific situations, mammography has undeniable benefits, but its use must be tempered by an understanding of the limitations, such as:

- *False-negative results*: Screening mammograms miss about 20% of breast cancers. False-negative results occur more often among younger women, leading to delay in treatment and a false sense of security.
- *False-positive results*: All abnormal screening mammograms should be followed up with additional testing (diagnostic mammograms, ultrasound and/or biopsy) to determine whether cancer is present. False-positive results are more common in women who are younger, have had previous breast biopsies, have a family history of breast cancer and those who are taking oestrogen. False-positive results can lead to anxiety and other forms of psychological distress. The additional testing required to rule out cancer can be costly and time-consuming and can also cause physical discomfort.
- *Radiation exposure*: Mammograms require very small doses of radiation. The risk of harm from this radiation exposure is extremely low, but repeated X-rays increase the risk of developing cancer.

Cervical cancer

The current ACS guideline for cervical screening recommends that it should begin approximately 3 years after a woman begins having vaginal intercourse, but not later than 21 years of age.¹⁴ The latest WHO guidelines also target developing nations and recommends an age of 30 years to start screening because of a higher risk of cervical cancer. Priority should be given to screening women aged 30–49 years, rather than maximizing the number of screening tests in a woman's lifetime. Screening even once in a lifetime would be beneficial. Screening intervals may depend on financial, infrastructural and other resources. Common screening tests are for human papillomavirus (HPV), cytology (Pap test) and unaided visual inspection with acetic acid (VIA).

Studies show that 80% of cervical cancers can be prevented by well-organized, regular Pap smear screening programmes,¹⁶ and mortality can be reduced by 90%.¹⁷ However, there are some inherent pitfalls of cytology-based screening: relatively low sensitivity of a single Pap smear test, high rate of false-negative results,¹⁸ burden on infrastructure and resources required for implementing the programme in a uniform manner; and frequent screening leading to anxiety, over-treatment and excess cost for the subjects. Newer screening techniques based on HPV testing have proved superior to cytology for screening; however, these are not as cost-effective.¹⁹ Though VIA is less effective than cytology, it is cheaper, and can be carried out in rural India after integration with primary health services.²⁰

Population education on hygienic sexual practices is crucial in preventing cancer of the cervix. This cancer has been found to be much less common in communities that practise male circumcision.²¹

Prostate cancer

It is the most commonly diagnosed non-skin cancer among men in the USA, with a lifetime risk for diagnosis currently estimated at 15.9%.¹⁴ Most cases of prostate cancer have a good prognosis, even without treatment, but some are aggressive; the lifetime mortality risk of prostate cancer is 2.8%.¹⁴ Prostate cancer is rare before 50 years of age and very few men die of prostate cancer before 60 years of age. Seventy per cent of deaths due to prostate cancer occur after 75 years of age. In India, prostate cancer ranks second among men in large cities while it is less common in the rest of the country.²²

The ACS guidelines recommend that men who have at least a 10-year life expectancy should have an opportunity to make a decision with their doctor about whether to be screened for prostate cancer by digital rectal examination or prostate-specific antigen (PSA) test, after receiving information about the benefits, risks and uncertainties associated with prostate cancer screening. Mass screening for prostate cancer is an obsolete concept. The use of PSA as a screening test is also on the decline. The European Association of Urology suggests that current evidence is insufficient to warrant widespread population-based screening by PSA and it should be done on an individual basis.²³ Systematic prostate biopsies under ultrasound guidance and local anaesthesia are the preferred diagnostic methods. Thus, the approach towards screening for prostate cancer has changed over the past decade to the present approach of individualized assessment.

'Over-diagnosis bias' is an extreme form of length bias; screening may find cancers that are very slow-growing and would never clinically manifest in one's lifetime. Many cancers detected by routine PSA testing are so indolent that many of these patients would have died due to some other cause such as CVD.

ASSESSMENT OF GENERALIZED HEALTH CHECK-UP PACKAGES

We also evaluated eight diagnostic centres and hospitals in Mumbai which provide a total of 25 packages of various combinations of tests. Information on these packages was obtained directly from the centres as well as from their websites. The cost of these packages ranged from ₹1650 for a 'mini' health check-up to ₹59 500 for a 'deluxe' package. The most common categories were general tests (i.e. complete blood counts, erythrocyte sedimentation rate, blood group), tests for diabetes, lipid profile and tests for cardiac function. The more comprehensive packages included tests such anti-nuclear antibody (ANA), HLA-B27, whole body magnetic resonance imaging (MRI), glucose-6-

phosphosphate dehydrogenase (G6PD), acid phosphatase and numerous others, none of which are recommended by any guideline. A review of existing evidence and guidelines affirms that screening for individual ailments in a highly selected population may be beneficial in reducing morbidity and mortality, but subjecting asymptomatic individuals to all these investigations without any index of suspicion may lead to more harm than benefit, and hence is not justified.

International guidelines are systematically updated in alignment with clinical practice. However, in India, resources are widely uneven in urban and rural regions.

DISCUSSION

Bayes' theorem tells us that the positive predictive value of any abnormal test result is directly proportional to the pre-test probability of the disease, which in turn depends on the population chosen.²⁴ Thus, any positive result will have more value in a carefully selected population, which is at high risk for that particular illness, rather than in a non-specific population. Consequently, every test in a routine health check-up for detecting an illness needs to be evaluated for three questions:

1. How good is the diagnostic test, if one is to be performed, in terms of sensitivity, specificity, simplicity, cost, safety and acceptability?
2. How great is the burden of suffering caused by the condition in terms of the '4 Ds'—death, disability, discomfort and destitution?
3. How good is the available subsequent treatment, in terms of efficacy, safety and cost-effectiveness?

Providing effective preventive care is a complex and multifactorial issue. A recent meta-analysis found that general health check-ups did not reduce morbidity or mortality, neither overall nor for CVD or cancer, although they increased the number of new diagnoses.^{3,4} In order to efficiently deliver preventive services, clinicians need to decide which tests to recommend for individual patients, and which to discourage to prevent net harm from inappropriate tests or interventions.

SUGGESTIONS FOR GENERAL HEALTH CHECK-UPS IN INDIA

Health check-ups should be for at-risk groups based on age, gender, occupation, etc. rather than based on a 'whoever comes— whoever wants— whoever affords' approach. Health check-ups should fulfil minimum quality assurance standards at a reasonable cost. At the grassroots level, paramedical staff, multipurpose workers, *gram sevaks*, etc. may be trained in uniform screening protocols to test for anaemia in women in the reproductive age, hypertension and diabetes.

Based on the current guidelines, we propose a preventive health check-up and early detection approach for various disease conditions in the Indian context (Table I).

All adults who visit a doctor should be screened for hypertension. Routine screening of all men/women aged $\geq 35/45$ years, respectively for dyslipidaemia may be discouraged; however, the information for a healthy diet and lifestyle, and prevention for atherosclerosis should be disseminated. Screening for hypertension in men (aged 35–45 years) and women (aged 45–55 years) may be done if they have other risk factors for atherosclerosis. Routine screening for men/women over 45/55 years of age seems more appropriate. Routine screening may be discouraged for people >70 years of age.

TABLE I. Asymptomatic adult screening: Our recommendations

Disease	Target population
<i>Cardiovascular disease (CVD)</i>	
Hypertension	Anyone who visits a doctor
Dyslipidaemia	Routine screening for men >45 years and women >55 years of age. (Men 35–45 years and women 45–55 years of age may be screened when they have other risk factors for atherosclerosis.)
Screening for type 2 diabetes mellitus	Age ≥ 30 years Body mass index ≥ 25 kg/m ² >1 risk factor for CVD
Treadmill stress test	Men >40 years/post-menopausal women having diabetes mellitus and/or multiple risk factors for CVD
<i>Screening for cancer</i>	
Breast cancer with clinical breast examination	20–40 years: 3 yearly >40 years: annually
Cervical cancer with Pap smear	Women 30–49 years of age who have been sexually active
Prostate cancer	Nil

Diabetes mellitus: It is reasonable to test for diabetes or pre-diabetes in all adults over 30 years age, BMI ≥ 25 kg/m² and multiple risk factors for CVD. Either glycosylated haemoglobin (HbA1c), fasting plasma glucose or 2-hour oral glucose tolerance test (OGTT) is appropriate for testing. If the tests are normal, the patient should be re-tested after 3 years.

Breast cancer: Women should be educated about breast self-examination. For women aged 20–40 years, clinical breast examination should be done every three years; for older women, it should be done annually. Mammography should be reserved for women >40 years with risk factors such as family history of breast cancer, early menopause and absence of breastfeeding.

Cervical cancer: Nationwide VIA-based screening can be instituted as this would be most economical. However, for health check-ups, Pap smear is a better test.²⁵ HPV testing is the most reliable of all screening modalities, but it is expensive and logistically challenging. In the general population this may be conducted among women above 30 years of age. Priority should be given to screening women aged 30–49 years. Routine screening may stop by 60 years of age. Screening even once in a lifetime would be beneficial. Screening intervals may depend on financial, infrastructural and other resources and may vary from 5 to 10 years. Women who have undergone total hysterectomy for benign disease should discontinue screening for cervical cancer.

Prostate cancer: PSA for every elderly male is the most overused and least helpful screening modality. Routine screening by PSA should be stopped. At-risk groups (e.g. strong family history) may undergo transrectal ultrasound or systematic biopsies after counselling for pros and cons of such invasive tests and the indolent course of the cancer even without treatment.

In conclusion, we believe that routine health check-ups as practised in urban India are counterproductive within the framework of community healthcare. Apart from the tests tabulated above, there is no rationale for performing other tests such as vitamin D, vitamin B12, thyroid stimulating hormone, electrolytes, pulmonary function tests, etc. as part of 'health check-up' for the general population.

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