Health Policy and Planning, 36, 2021, 407–417
doi: 10.1093/heapol/czaa157
Advance Access Publication Date: 10 March 2021
Original Article

Cost of scaling-up comprehensive primary health care in India: Implications for universal health coverage

Diksha Singh[1], Shankar Prinja[1,*], Pankaj Bahuguna[1], Akashdeep Singh Chauhan[1], Lorna Guinness[2], Sameer Sharma[1] and PVM Lakshmi[1]

[1]Department of Community Medicine and School of Public Health, Post Graduate Institute of Medical Education and Research, Chandigarh, India
[2]Centre for Global Development (Europe), Great College St, Westminster, London SW1P 3SE, UK

*Corresponding author. School of Public Health, Post Graduate Institute of Medical Education and Research, Sector-12, Chandigarh 160012, India. E-mail: shankarprinja@gmail.com

Accepted on 2 November 2020

Abstract

India has announced the ambitious program to transform the current primary healthcare facilities to health and wellness centres (HWCs) for provision of comprehensive primary health care (CPHC). We undertook this study to assess the cost of this scale-up to inform decisions on budgetary allocation, as well as to set the norms for capitation-based payments. The scale-up cost was assessed from both a financial and an economic perspective. Primary data on resources used to provide services in 93 sub-health centres (SHCs) and 38 primary health care centres (PHCs) were obtained from the National Health System Cost Database. The cost of additional infrastructure and human resources was assessed against the normative guidelines of Indian Public Health Standards and the HWC. The cost of other inputs (drugs, consumables, etc.) was determined by undertaking the need estimation based on disease burden or programme guidelines, standard treatment guidelines and extent and pattern of care utilization from nationally representative sample surveys. The financial cost is reported in terms of the annual incremental cost at health facility level, as well as its implications at national level, given the planned scale-up path. Secondly, economic cost is assessed as the total annual as well as annual per capita cost of services at HWC level. Bootstrapping technique was undertaken to estimate 95% confidence intervals for cost estimations. Scaling to CPHC through HWC would require an additional ₹ 721 509 (US$10 178) million allocation of funds for primary healthcare >5 years from 2019 to 2023. The scale-up would imply an addition to Government of India's health budget of 2.5% in 2019 to 12.1% in 2023. Our findings suggest a scale-up cost of 0.15% of gross domestic product (GDP) for full provision of CPHC which compares with current public health spending of 1.28% of GDP and a commitment of 2.5% of GDP by 2025 in the National Health Policy. If a capitation-based payment system was used to pay providers, provision of CPHC would need to be paid at between ₹ 333 (US$4.70) and ₹ 253 (US$3.57) per person covered for SHC and PHC, respectively.

Keywords: cost, scale-up, primary health care, universal health coverage, health and wellness centre

Introduction

Comprehensive primary health care (CPHC) is widely regarded as the cornerstone of strategies to universal health coverage (UHC) (Sharma *et al.*, 2017; Angell *et al.*, 2019; WHO, 2019). The World Health Organization (WHO) also argues that primary health care is the most cost-effective strategy for achieving UHC (Watkins *et al.*, 2017). Consequently, the coverage of primary healthcare services constitutes an essential component of the measurement matrices

Key Messages

- The Government of India, under the 'Ayushman Bharat' program, has embarked upon scaling up of 130 000 sub-health centres and 25 000 primary health centres to health and wellness centres (HWCs) for delivering comprehensive primary healthcare services.
- From a financial perspective, the scale-up to HWCs would require an additional INR 721 509 (US$10 178 million) million funds to be budgeted for primary healthcare.
  - If the delivery of comprehensive primary health care services were to be purchased and paid on a capitation-based provider payment model, the Government would have to pay INR 333 (US$4.70) per capita at SHC and INR 253 (US$3.57) per capita at PHC level.
  - The study findings are relevant for budgetary planning both from supply side and demand-side financing mechanisms. These findings could also be used to subsequently evaluate the cost–effectiveness of comprehensive primary healthcare.

developed for assessment of UHC at global, national and sub-national levels and achieving high coverage of quality primary healthcare services, which is equitably delivered, has become an essential pre-requisite for achieving the targets set under the sustainable development goals framework (World Bank, 2015; Prinja *et al.*, 2017; Rosa and Morin, 2017; WHO, 2017).

A major limitation of existing primary healthcare systems' organization has been its limited focus on reproductive, maternal and child healthcare and communicable diseases. This was considered appropriate, given the historically high morbidity and mortality burden among women during reproductive period and children under 5 years of age (Sartorius and Sartorius, 2014; Vital Statistics Division, 2019). However, with the epidemiological transition and the rise in non-communicable diseases, mental health issues, care for elderly, etc., it has become important to expand the scope of primary health care and scale-up the services under its basket (Vos *et al.*, 2016; Icmr, 2017). Globally, there has been a move in this direction (Van Lerberghe, 2008; Watkins *et al.*, 2017).

In India, the sub-health centres (SHCs) and primary health centres (PHCs) form the base of the pyramid for healthcare delivery system and provide primary health care to a population size of about5000 and 30 000, respectively (Prinja *et al.*, 2014). In 2018, the Government of India announced the 'Ayushman Bharat' programme, which envisages scale-up of 156 231 SHCs and 25 650 PHCs in India to 'health and wellness centres (HWCs)' with the aim of providing CPHC (NHSRC, 2018a). The service coverage has been increased from about 5 to 13 services. The range of services will now include care in pregnancy and childbirth, neonatal and infant health care, childhood and adolescent health care, family planning and other reproductive health care, management of communicable diseases including the national health programmes, out-patient care for acute simple illnesses and minor ailments; screening, prevention, control and management of non-communicable diseases, basic oral health care, care for common ophthalmic and ear problems, elderly and palliative healthcare services, emergency medical services and screening of mental health ailment. To enable the provision of this broader range of services, a new cadre of health workforce—mid-level health provider (MLHP) has been created at the HWC in parallel with the augmentation in terms of provision of drugs and general infrastructure to provide services.

The scale-up of CPHC naturally has implications for health care financing. Key financing questions from a policy makers' perspective include 'what is the increase in the budget', 'how to pay providers', 'how much to pay providers' and 'how will additional funds be mobilized'. Globally, estimates of the cost of financing UHC use a UHC index to estimate the resource gap between current coverage and the UHC goal and look at the overall costs of achieving UHC (Dieleman *et al.*, 2018; Moses *et al.*, 2019). However, to our knowledge, there has been no country-level analysis of the resource gap associated with CPHC in India to date. In addition, a recently conducted systematic review which analysed the evidence for financing interventions in primary health care pointed to several of these gaps in existing evidence including appropriate provider payment mechanisms(Angell *et al.*, 2019). Changes in the budget will depend on how much providers are paid and the method of payment. Standard methods of payment for primary health care include global budgets, fee for service or capitation. The current system is dependent on global budgets but where increased coverage of services is a health system goal, capitation type payments can provide a useful incentive mechanism. In the context of the provision of primary health care, several recent consultations in India have encouraged piloting the idea of undertaking models of primary healthcare provisioning by public or private sector, wherein the providers could be paid on a capitation basis (Rao *et al.*, 2005). This raises the need for evidence on how much to pay the service providers at a per capita basis for population covered.

While there are recent papers reporting on the cost of provision of primary and secondary healthcare services in India (Prinja *et al.*, 2013; Prinja *et al.*, 2017; Bahuguna *et al.*, 2019) and the creation of a National Health System Cost Database (PGIMER 2018) all of these have assessed the cost in the context of the erstwhile SHCs or PHCs and are based on the current healthcare delivery infrastructure—which is known to fall short of current norms. These studies provide full economic costs, which are useful in determining efficiency (Prinja *et al.*, 2017, 2018; Bahuguna *et al.*, 2019a; Chugh *et al.*, 2019), but can over-estimate in the context of budgeting or fiscal decisions for program planning. An improved understanding of both the total and marginal cost of increasing coverage is needed to complement this information, to show where the resource gap and likely need for additional funding is the greatest (Wong and Skead, 2019). In order to bridge this gap in evidence, we undertook the present study to assess the incremental cost of scaling-up the existing health facilities to HWCs for the provision of CPHC—both from financial and economic perspective for India. Further, we also estimate the per capita cost of providing primary health care through HWCs, which could be used to determine the norms for capitation-based payments.

Material and methods

Context

Public sector healthcare services in India are delivered through a system which covers both the rural and urban areas, and provides primary, secondary and tertiary care (MOHFW, 2017b). The lowest level of health facility is a SHC, which caters to a population of 5000. At this level, an auxiliary nurse midwife provides mainly reproductive, maternal and child health services, as well as outpatient care for routine communicable diseases. The first point of contact with a doctor is a PHC, which caters to a 30 000 population and provides basic outpatient and inpatient primary health services. A community health centre is the first referral centre for cases referred from PHC, where specialist services in medicine, surgery, obstetrics and gynaecology and paediatrics ought to be provided. However, availability of these specialists is highly variable in practice, and shortfalls are frequently reported (Central Bureau of Health Intelligence, 2019).

HWCs (NHSRC, 2018a) will provide an expanded list of services including a set of 13 services at SHCs and PHCs. The training for creation of the MLHP—the new cadre of health functionary to be posted at HWC, has already begun in several Central and State level nursing institutes and universities (NHSRC, 2018b). A total of 19 487 health facilities have been upgraded to HWC by 2019 and it is expected that all SHCs and PHCs will be upgraded to HWCs by 2023 (MOHFW, 2019).

Analytical overview

The financial and economic costs of providing comprehensive primary health care through the HWC were estimated (Figure 1). Financial costs inform budgetary decisions, while economic costs would be important for setting capitation payments for providers, or to inform health technology assessments (HTAs) by assessing the cost–effectiveness of comprehensive primary health care. The incremental financial cost was assessed to inform a 5-year budget (2019–23). Financial costs were estimated separately for the first year in which the costs of upgrading the health facilities were included; as well as subsequent years to reflect the recurrent cost of providing healthcare services in the upgraded facilities. Economic costs were then estimated by calculating the annual total cost per health facility and cost per capita (per person covered in catchment area).

To take account of the potential increase in uptake of health services associated with improved care, we estimated the cost of provision of primary healthcare services with different scenarios of increase in utilization. In order to do so, we classified the resources at the HWC into two categories—fixed and variable. The cost of building, equipment, non-consumables (e.g. furniture and other items which have a life of over 1 year) and human resource costs were defined as fixed, that is, do not change with changes in levels of utilization. As health workforce norms for health facilities are set by government, human resource costs, were considered fixed for our analysis and assumed not to vary. The value of resources such as

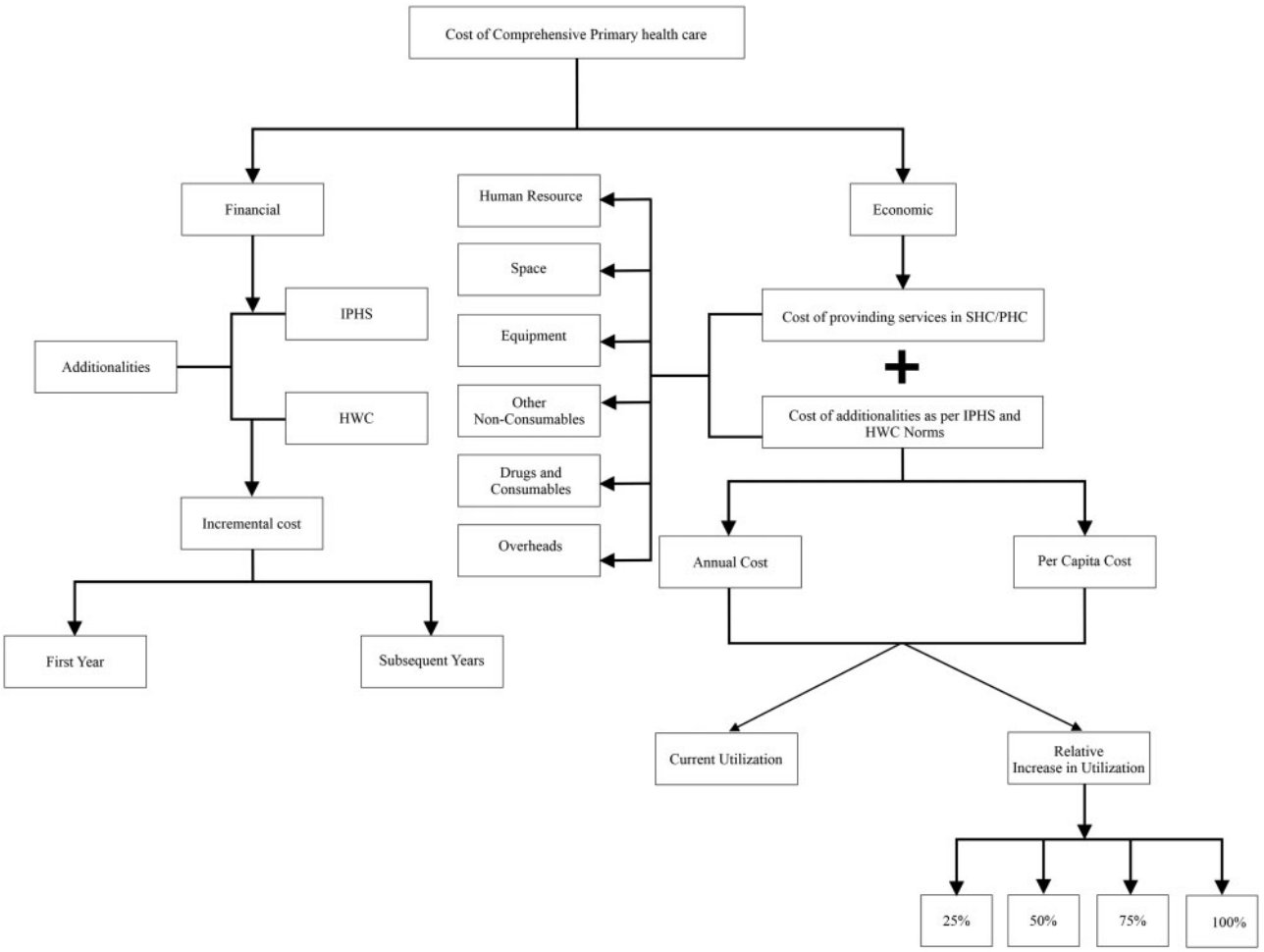


Figure 1 Overview of scale-up financial and economic costing methodology

drugs, consumables and overheads were defined as 'variable costs', and their consumption was increased in line with increasing utilization of services. For drugs and consumables, the increase in consumption followed the standard treatment or program guidelines. For overheads, we assumed a linear increase in costs with utilization. In addition, we also varied the team-based performance incentive at the HWC in line with increased utilization.

The incremental cost of scaling up the SHC and PHC to HWC was estimated using a 3-step approach (Figure 2). First, the cost of upgrading the physical infrastructure, human resource shortfall, equipment, drugs and consumables was estimated as per the norms set under the Indian Public Health Standards to (IPHS) (MOHFW , 2012). Secondly, the cost of scaling-up the health facilities to HWC was estimated using the normative standards prescribed by the Ministry of Health and Family Welfare (NHSRC, 2018a). This second stage involved, first, assessing and costing the difference between the current availability of human resources, space, equipment, drugs, incentives, etc., and the IPHS standards and then the HWC guidelines for the current set of services. To determine the unit costs (including drugs, consumables and overheads) of the additional services to be provided under HWC, standard treatment guidelines were used. Potential demand for the new services was estimated using evidence on the respective disease burden of the associated conditions and observed healthcare utilization rates (International Institute of Population Sciences, 2020) combined with current and projected state-specific population based on Census of India estimates (Census Registrar of India, 2020). Finally, the incremental economic cost was estimated for a variety of scenarios using current utilization rates, and scenarios that reflected levels of increased utilization at HWC, that is, +25, +50, +75 and +100%, relative to current utilization. Cost estimates are presented as the annual total cost at each HWC, and the per capita cost at the population level. The per capita cost was calculated by dividing the total cost by the size of the catchment population. Detailed calculations specific to each drug and consumable have been provided in the Supplementary material (A3.1, A3.2, A3.3.).

The incremental financial cost was assessed to calculate a 5-year budget. The cost was estimated separately for the first year when the health facility is upgraded [including capital space, equipment, human resources (salaries and training), and drugs and consumables], and the subsequent years which involve the recurrent cost of providing services (salaries, drugs and consumables) (Figure 1). The financial cost includes the expected expenditure on additional resources—capital and recurrent, required for the upgradation, to achieve both IPHS and HWC standards.

Data

The primary data, collected as part of previous costing studies from six Indian states (Prinja *et al.*, 2012, 2013; Prinja *et al.*, 2017) and housed on the National Health System Cost Database (PGIMER 2018), was used for the present analysis. The states were selected based on health system performance, availability of health system infrastructure/human resources and service utilization in addition to geographic location. A multi-stage stratified random sampling was followed for the selection of the health facilities in each of the states. All the health facilities were rural (Prinja *et al.* 2019). These datasets comprise data on resources, volume of services, prices of inputs such as drugs and consumables; and costs of services like outpatient consultations, antenatal care, immunization, institutional delivery, etc. from 93 SHCs and 39 PHCs from Haryana, Punjab, Himachal Pradesh, Tamil Nadu, Kerala and Odisha. The states were selected based on health system performance, availability of health system infrastructure/human resources and service utilization in addition to geographic location. A multi-stage stratified random sampling was followed for the selection of the health facilities in each of the states. All the health facilities were rural (see Supplementary Appendix for a description of the sample). Standard bottom-up costing methods were used to collect data. The data were collected during two time periods—2013–14 and 2015–16. Further details on the methods of the data collection and analysis of primary data are available elsewhere (Prinja *et al.*, 2012, 2016; Prinja *et al.*, 2017, 2018).

The quantity of drugs required for the new services to be introduced in HWC was estimated using WHO guidelines and the standard treatment guidelines prescribed by the Department of Health and Family Welfare, Government of Chhattisgarh (Department of Health & Family Welfare, 2003). The mean procurement rate of drugs was computed based on price information available from the State Medical Corporation, National Health Mission, Tamil Nadu State Corporation, Rajasthan Medical Service Corporation, Central Government Health Services and National Health System Cost Database (PGIMER, 2018; Government of Tamil Nadu, 2019; National Health Mission, MoHFW, 2020; RMSC, 2020). The demand for healthcare services was estimated using the disease burden extracted from the National Family Health Survey (NFHS) fourth

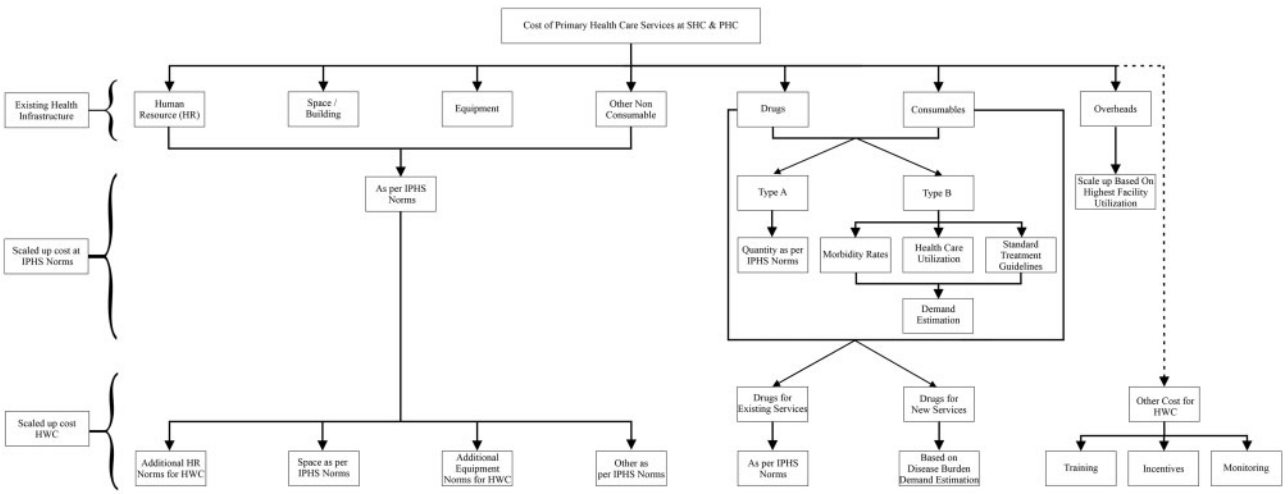


Figure 2 Estimation methods for scale-up costing of comprehensive primary health care

round data at the district level, and published evidence from cross-sectional representative surveys (see Supplementary material A3 for a full list of sources) (NSSO, 2017). Demand for specific services such as immunization, family planning, sanitary napkins, insecticide treated bed nets and specific services for non-communicable diseases was estimated using the respective programme guidelines of Ministry of Health for demand estimation and provision of services (NHM, 2016; MOHFW, 2017a; Partapuri, 2017). The data from National Sample Survey, 71st round (2014) and the NFHSwere used to estimate the care seeking for curative and preventive services, respectively, at the SHC and PHC in individual states (NSSO, 2017).

Data analysis

Financial costing

Resources were broken down into: human resources, drugs and consumables, building space and equipment. The incremental cost of upgrading to the new standards was estimated by assessing the shortfall in a particular resource for each sampled health facility, and multiplying the quantity of shortfall with the unit price of the resource. The shortfall in human resources and capital was estimated by comparing the data from each health facility with the IPHS and HWC guidelines. The volume of the shortfall in consumables and the respective costs were estimated using the procedures outlined in Supplementary material A3.5 (Boxes 1–3). The wage rate, procurement prices and public works department construction costs in the respective state governments were used as unit costs for human resources, drugs and consumables and building space, respectively (Prinja *et al.*, 2016; CPWD, 2019; Government of Tamil Nadu, 2019; RMSC, 2020).

The financial cost for the first year of the HWC included all capital and start-up costs to reach the specified new standard. For the subsequent years, only the recurrent nature of incremental costs was assessed, that is, human resource salaries, drugs, consumables and overheads. To project the overall increase in fiscal outlay which will be required for scaling up comprehensive primary health care, it was assumed that the scale-up would occur in a phased way between 2019 and 2023. For each year, start-up costs were multiplied by the number of health facilities upgraded in that year. This cost was then added to the recurrent costs of all the upgraded health facilities. The total annual incremental cost was then compared with the annual health budget and gross domestic product (GDP) to give an indication of affordability. Annual projections for GDP growth rate were used to estimate the GDP for years onwards 2019 (Plecher, 2019).

Economic costing

The economic costs of the HWCs were defined as the value of all the resources utilized in the delivery of services as per current levels of infrastructure, as well as those that will be added under the IPHS and HWC guidelines. Each resource was valued using the approaches outlines in Supplementary material A3.5. Any capital resources such as equipment and non-consumables were annualized using a discount rate of 3% in accordance with international guidelines, as well as Indian HTA guidelines (Attema *et al.*, 2018; Department of Health Research, MOHFW, 2018) The cost of building was estimated by multiplying the area (measured in square feet) with the market rental price. Cost of the drugs and consumables was estimated by multiplying the procurement price with quantity.

To estimate the per capita cost of providing primary health care services in each of the three scenarios—current SHC and PHC, health facilities upgraded to IPHS standards and health facilities upgraded to HWC—the overall annual cost in each health facility was divided by the respective catchment population. Each of the annual and per capita costs was estimated at current utilization levels, as well as scenarios that reflected different relative increases in utilization—25, 50, 75 and 100% increase. As utilization increases, 'fixed costs' (such as building, equipment) do not change and are spread over an increasing number of service outputs. The 'variable' cost items such as drugs, consumables, vary proportionately with the level of use. To estimate the total cost for each utilization scenario, the total fixed costs were therefore assumed to be constant while the variable costs, as per their definition, increased with utilization levels. The overall annual cost for each scenario was then divided by the catchment population of the health facility. Bootstrapping techniques was used to estimate the 95% confidence intervals (CIs) around base cost estimate (Prinja *et al.*, 2013, 2016, 2014). All costs are presented in ₹2019 prices and reported in US$ using an exchange rate of 1 US$ = ₹70.89 (OECD 2019).

Results

Financial cost

The mean incremental start-up cost of upgrading an SHC and PHC to HWC standards in the first year was estimated to be ₹1.78 million (95% CI ₹1.68–1.97 million) and ₹6.57 million (₹6.43–8.68 million), respectively (Table 1). In the subsequent years, the incremental cost of delivering health care at the HWC was found to be ₹0.996 million (₹0.94–1.05 million) at SHC and ₹2.24 million (₹2.11–2.97 million) at PHC, respectively. The increase in initial annual cost for setting up a SHC–HWC was found to be the lowest in Tamil Nadu state [₹1.18 million (₹ 1.06–1.33 million)], and the highest in Himachal Pradesh—₹2.25 (₹2.01–2.47 million). The increase in first year cost of delivering the new comprehensive primary healthcare package at HWC for PHCs was the lowest in Haryana state, and the highest in Orissa, followed by Himachal Pradesh (Table 1). While the cost of building construction explained 39% of the increase in incremental start-up financial cost in SHC–HWC, followed by human resource (34%); the building construction cost explained 64% of the total incremental cost at PHC level (Figure 3). As a proportion of the recurrent part of the financial cost at SHC–HWC, human resources alone had a share of 63%, followed by drugs (16%); while it is 74 and 13%, respectively, at PHC–HWC level (Figure 3).

Table 2 shows the projected financial outlay of shifting to the HWC comprehensive primary health care package using a phased scaling up programme. The overall incremental financial outlay of converting the SHCs and PHCs to HWC in India would be ₹40 145 (US$566) million in Year 1 of expansion, which will go up to ₹254 556 (US$3591) million in the last year when all health facilities would be upgraded (Table 2). This implies an increase in health sector allocation of 0.15% of GDP or in other words, a relative increase of 12% in the public health budget (Table 3). Once the phased upscaling of all the existing SHCs and PHCs to HWCs is completed, the estimated operational cost of these upgraded health facilities each year will be ₹187 628 (US$2647) million. If we ignore the phased implementation, the cost of augmentation of all the primary health centres including the annual recurrent cost would be 0.245% of India's GDP.

Economic cost

The average annual economic cost of SHC and PHC facilities upgraded to IPHS standards was found to be ₹1.13 (US$0.02) million and ₹6.43 (US$0.09) million, respectively (Supplementary

Table 1 Incremental financial cost for providing comprehensive primary health care at health and wellness centre level in India

States	SHC–HWC				PHC–HWC			
	First year cost, ₹ (US$)	95% CI in ₹ (LL, UL)	Subsequent year cost, ₹ (US$)	95% CI in ₹ (LL, UL)	First year cost, ₹ (US$)	95% CI in ₹ (LL, UL)	Subsequent year cost, ₹ (US$)	95% CI in ₹ (LL, UL)
Haryana	1 418 005 (20 003)	(1 131 764–1 730 377)	857 029 (12 090)	(830 348–884 648)	3 490 991 (49 245)	(2 229 491–5 828 720)	1 521 742 (21 466)	(668 178–1 961 497)
Himachal Pradesh	2 255 777 (31 821)	(2 010 127–2 471 931)	901 502 (12 717)	(815 340–1 003 040)	8 609 258 (121 445)	(5 969 577–10 899 210)	3 727 814 (52 586)	(2 803 632–4 670 757)
Kerala	2 155 580 (30 407)	(1 750 614–2 485 369)	1 008 528 (14 227)	(887 726–1 191 864)	5 863 253 (82 709)	(3 671 070–7 868 722)	1 799 618 (25 386)	(1 269 923–2 354 157)
Odisha	1 800 909 (25 404)	(1 558 615–2 061 975)	1 325 445 (18 697)	(1 240 206–1 408 311)	11 121 040 (156 877)	(10 143 622–12 331 531)	3 704 921 (52 263)	(3 293 170–4 333 754)
Punjab	1 893 259 (26 707)	(1 428 779–2 314 738)	953 825 (13 455)	(778 251–1 150 758)	3 949 411 (55 712)	(644 096–7 254 727)	1 144 984 (16 152)	(565 153–1 724 814)
Tamil Nadu	1 178 598 (16 626)	(1 056 359–1 328 781)	931 006 (13 133)	(871 798–1 010 696)	6 389 643 (90 135)	(4 582 238–8 710 563)	1 560 732 (22 016)	(1 305 011–1 867 097)
Overall	1 783 688 (25 161)	(1 682 695–1 977 752)	996 223 (14 053)	(943 108–1 046 750)	6 570 599 (92 687)	(6 429 147–8 679 144)	2 243 302 (31 645)	(2 109 719–2 977 481)

Note: LL= lower limit; UL= upper limit.

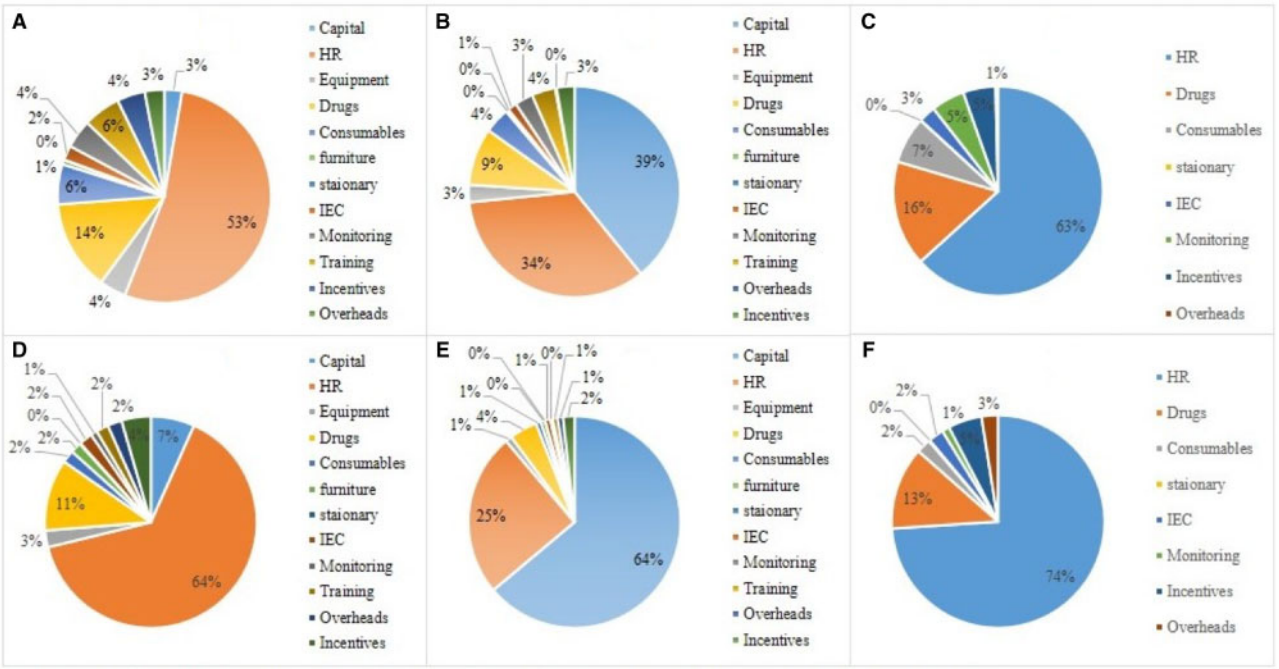
Appendix A3). Similarly, the annual economic cost of SHC and PHC upgraded to HWC standards was found to be ₹1.96 (₹1.89–2.04 million) and ₹7.12 (₹6.57–7.74 million), respectively (Table 3). Again, the increase in economic cost of SHC–HWC varied from 93% in Haryana to 286% in Orissa. The breakdown shows that human resource salaries are the most important component of economic costs, comprising 53 and 64% at SHC and PHC, respectively.

The mean per capita cost of comprehensive primary health care services at HWC was estimated to be ₹333 (₹320–349) and ₹253 (₹233–275) at SHC and PHC level, respectively. Increasing the utilization of primary healthcare services on a relative scale by 25, 50, 75 and 100% of the current utilization, we found that the annual per capita cost in SHC–HWC standards was ₹348 (US$4.89), ₹362 (US$5.09), ₹376 (US$5.31) and ₹390 (US$5.5) per person covered. Similarly, the per capita cost of implementing PHC–HWC was ₹260 (US$3.67), ₹268 (US$3.77), ₹275 (US$3.86) and ₹282 (US$3.96) per person covered (Table 3). Considering a full scale-up scenario at current utilization level, the overall estimated cost of comprehensive primary health care for India is ₹781 089 (US$11 018) million. Around half of the total cost (50.7%) will be additional given the estimated cost of the pre scale-up scenario. The total estimated cost at increased utilization by 25, 50, 75 and 100% will be ₹809 070 (U$11 413), ₹837 061 (US$11 808), ₹866 385 (US$12 222) and ₹894 375 (US$12 616) million, respectively.

Discussion

Aspiration for UHC has once again reinstated interest in revitalization and expansion of comprehensive primary health care in India. However, the scale-up of primary health care to increase the population coverage and service coverage has fiscal challenges. Information on how much it would cost becomes pivotal for planning—whether in the setting of a supply-side budgetary system, or a model of contracting where providers are paid by capitation. In this study, we provide the information from both the perspectives. Scaling up comprehensive primary health care would imply a 12.14% increase in budgetary outlay. In order to augment primary healthcare services alone, the Government of India would ultimately have to increase the allocation to the health sector by 0.15% of GDP. In addition, we found that for providers to cover their catchment population at current levels of healthcare utilization a capitation payment of ₹333 (US$4.70) for SHC and ₹253 (US$3.57) for PHC per person would be the appropriate norm. However, if utilization increases, as expected under improved care, the capitation rates may need to be adjusted to reflect the changes in predicted economic costs.

The findings also show how the gap between infrastructure and human resource at the existing facilities relative to the IPHS guidelines are the key factor in determining the differences in the cost of scale-up across states (Supplementary Figure A4.1–Figure A4.6). At SHCs and PHCs, the share of human resources in the total incremental cost of scale-up varied between 4 (Himachal Pradesh) to 47% (Tamil Nadu) and 11 (Punjab) to 38% (Himachal Pradesh), respectively. This difference in the human resource costs was, in part, influenced by the mean wage rate of medical officers and staff nurses which ranged from ₹33 000 (Odisha) to ₹100 000 (Himachal Pradesh) and from ₹8000 (Odisha) to ₹32 000 (Haryana), respectively. The share of capital in incremental costs ranged between 11–57% and 50–72% at level of SHCs and PHCs, respectively. Again, both the shortfall in the infrastructure and the rental rates accounted for the difference in capital costs across states. The



Note: A) SHC -HWC: Incremental Economic Cost, B) SHC -HWC: Incremental Financial Cost, C) SHC -HWC: Incremental Financial Recurrent Cost D) PHC-HWC: Incremental Economic Cost, E) PHC-HWC: Incremental Financial Costs; F) PHC -HWC: Incremental Financial Recurrent Cost
HR: human resources, IEC: effective information education and communication materials, SHC: Sub health centre, PHC: Primary health care centre, HWC: health and wellness centre

Figure 3 Distribution of incremental financial and economic cost of comprehensive primary health care

Table 2 Fiscal implications of comprehensive primary health care at health and wellness centres in India

Year	Facilities to be upscaled to HWC	Percentage of facilities to be upscaled to HWC	Number of facilities to be upscaled		Annual cost, ₹ (US$) million			Increase in Public Health Budget (%)	Additional budget for HWC (as % of GDP)
			SHCs	PHCs	SHC to HWC	PHC to HWC	Total		
2019	15 000	10	13 058	2565	23 292 (329)	16 584 (238)	40 145 (566)	2.54	0.03
2020	25 000	17	21 764	4275	51828 (731)	33 843 (477)	88 619 (1250)	5.24	0.07
2021	30 000	20	26 116	5130	81273 (1146)	49 051 (692)	135 655 (1914)	7.47	0.1
2022	40 000	27	34 822	6840	1 22 818 (1733)	71 795 (1013)	202 534 (2857)	10.38	0.13
2023	40 000	27	34 822	6840	1 57 509 (2222)	87 139 (1229)	254 556 (3591)	12.14	0.15
Total	150 000	100	130 581	25 650	4 36 720 (6161)	2 58 683 (3649)	721 509 (10 178)	–	–

average shortfall in the building infrastructure per facility across states ranged from 73 (Haryana) to 557 (Odisha) and 801 (Haryana) to 2611 (Odisha) square feet for SHCs and PHCs, respectively. The mean incremental capital cost for the PHCs in Haryana was 1.68 times that for PHCs in Odisha state. Whereas at SHC level, the mean incremental capital cost in Odisha was 1.14 times compared with Haryana. Current levels of utilization of primary health care facilities and difference in the prevalence of diseases in different states also contributed to the differences between states. The differences in scale-up cost across the states highlight the importance of understanding the variations in gaps in coverage, existing healthcare workforce and infrastructure and levels of need in helping prioritize new investment.

Standard microeconomic theories suggest that simply using the average cost and multiplying this by number of persons utilizing individual services may not generate accurate estimates of the costs of scaling up, as the overall cost of scaling-up is dependent on several factors (Kremer and Glennerster, 2011). These factors include quantity and type of services provided in the current scenario versus scaled-up scenario, wage indices, inflation and client characteristics, etc. As a result, econometric analyses are quite often used to determine the cost of scaled-up scenario, by observing the relationship of these independent factors with total or unit cost in the current scenario, and applying the changes which are likely to take place in the scaled-up scenario (Johns *et al.* 2005; Ochoa-Moreno *et al.*, 2020). Alternatively, the cost of a scaled-up scenario can be evaluated by making assumptions about the production process during the 'short-run' and the 'long-run'. In the short-run, it is assumed that the variable resources will increase, while the fixed inputs will remain constant; while in the long run both the fixed and variable inputs can vary.

Several approaches to estimation of scale-up costs have been reported (Johns *et al.*, 2005). This systematic review identified 15 studies which evaluated the cost of scaled-up services found that majority of the studies has been done in the context of disease-specific programme scale-up, such as human immunodeficiency virus services (Kumaranayake and Watts 2000), child health (Department of Child and Adolescent Health and Development and Department of Health System Financing 2005), maternal health (Department of

Table 3 Economic cost of providing comprehensive primary health care in India

State	Sub-Health centre–health and wellness centre											
	Annual cost, million				Annual per capita cost, ₹ (US $)							
	Current cost, ₹ (US $)	HWC cost, ₹ (US $)	95% CI (₹)		Current utilization				Increased utilization scenarios at HWC			
			Lower	Upper	SHC	95% CI in ₹ (LL, UL)	HWC	95% CI in ₹ (LL, UL)	25% Increase	50% Increase	75% Increase	100% Increase
Haryana	1.07 (0.02)	2.07 (0.03)	1.92	2.22	173 (2.44)	(148, 197)	334 (4.71)	(311, 359)	340 (4.80)	345 (4.87)	350 (4.94)	355 (5.01)
Himachal Pradesh	0.89 (0.01)	1.95 (0.03)	1.8	2.07	219 (3.09)	(186, 254)	479 (6.76)	(440, 508)	488 (6.88)	497 (7.01)	506 (7.14)	514 (7.25)
Kerala	0.73 (0.01)	1.89 (0.03)	1.73	2.07	111 (1.57)	(91, 130)	290 (4.09)	(264, 316)	300 (4.23)	312 (4.40)	323 (4.56)	334 (4.71)
Odisha	0.51 (0.01)	1.97 (0.03)	1.85	2.07	99 (1.40)	(89, 109)	378 (5.33)	(356, 398)	395 (5.57)	411 (5.80)	426 (6.01)	438 (6.18)
Punjab	1.07 (0.02)	2.28 (0.03)	1.9	2.69	120 (1.69)	(94, 155)	252 (3.55)	(211, 299)	262 (3.70)	270 (3.81)	278 (3.92)	286 (4.03)
Tamil Nadu	0.53 (0.01)	1.59 (0.02)	1.51	1.68	84 (1.18)	(77, 91)	251 (3.54)	(238, 265)	263 (3.71)	274 (3.87)	285 (4.02)	295 (4.16)
Overall	0.82 (0.01)	1.96 (0.03)	1.89	2.04	139 (1.96)	(127, 151)	333 (4.70)	(320, 346)	348 (4.91)	362 (5.11)	376 (5.30)	390 (5.50)
	Primary health care centre–health and wellness centre											
Haryana	3.76 (0.05)	5.75 (0.08)	3.08	8.45	97 (1.37)	(49, 153)	138 (1.95)	(74, 203)	140 (1.97)	142 (2.00)	144 (2.03)	145 (2.05)
Himachal Pradesh	4.53 (0.06)	8.99 (0.13)	7.57	10.44	203 (2.86)	(107, 317)	395 (5.57)	(332, 458)	396 (5.59)	396 (5.59)	397 (5.60)	397 (5.60)
Kerala	5.28 (0.07)	7.44 (0.10)	6.65	8.29	164 (2.31)	(134, 200)	229 (3.23)	(205, 255)	236 (3.33)	242 (3.41)	248 (3.50)	254 (3.58)
Odisha	1.70 (0.02)	5.70 (0.08)	5.28	6.3	76 (1.07)	(64, 88)	252 (3.55)	(233, 279)	259 (3.65)	266 (3.75)	272 (3.84)	277 (3.91)
Punjab	6.89 (0.10)	8.28 (0.12)	6.72	9.84	214 (3.02)	(142, 286)	257 (3.63)	(209, 306)	259 (3.65)	261 (3.68)	263 (3.71)	265 (3.74)
Tamil Nadu	5.02 (0.07)	7.05 (0.10)	6.08	8.11	180 (2.54)	(146, 224)	249 (3.51)	(215, 287)	253 (3.57)	257 (3.63)	260 (3.67)	263 (3.71)
Overall	4.21 (0.06)	7.12 (0.10)	6.57	7.74	150 (2.12)	(126, 176)	253 (3.57)	(233, 275)	260 (3.67)	268 (3.78)	275 (3.88)	282 (3.98)

Making Pregnancy Safer (FCH/MPS) and Health Systems Financing (EIP/HSF) for the World Health Report 2005) and tuberculosis, and have focussed on scale-up defined as the increase in the coverage of population, by reaching additional geographic areas, or hard to reach populations such as the poorest. Methodologically most (11 of 15) studies use micro-costing methods to determine average cost, and multiply this with predicted scaled up utilization of services to estimate total costs, adjusting the average cost for changes in geography and infrastructure, human resource costs, extent of fixed and variable costs and the costs of managing the process of scale-up.

We found that the cost of scaling-up comprehensive primary health care would require a relative increase in government investment, of 2.54% in the first year, rising to an increase of 12.14% of current government healthcare spending for full scale-up. This has important implications in terms of the fiscal space for expanding healthcare allocations. Globally, fiscal space analysis for health care spending identifies four factors that need to be considered—macroeconomic growth, budget reprioritization and efficiency of healthcare spending, ear-marked funds, for example, social insurance contributions and donor assistance (WHO, 2016). Earmarked funds and donor assistance play a relatively small role in the funding of the Indian health sector (6.3 and 0.7%, respectively) (National Health Systems Resource Centre, 2018). However, macroeconomic growth is likely to be of considerable important in influencing healthcare spending. While GDP growth has been consistently above 3% for over a decade, the novel coronavirus 2019 (COVID-19) pandemic has had a significant impact on the economy. Preliminary estimates suggest a 23% decline in India's economic growth in quarter 2 of 2020 compared with previous year. This, together, with diverting existing health care resources for COVID-19 care implies that significant challenges for garnering funding for primary health care. At the same time, while likely to have less impact than the economic shock, priority setting and improvements in efficiency are is increasingly recognized as important in India. The establishment of the HTA in India (Downey *et al.*, 2017; Prinja *et al.*, 2018; Bahuguna *et al.*, 2019b) and commissioning of cost–effectiveness studies for generation of evidence for policy making demonstrates a willingness to include efficiency criteria in decision-making (Bahuguna *et al.*, 2019a; Chugh *et al.*, 2019; Chauhan *et al.*, 2020; Jyani *et al.*, 2020; PGIMER, 2020; Singh *et al.*, 2020). Alongside these factors, the federal structure of governance and the absorptive capacity at the State level pose two other unique challenges for India (Berman *et al.*, 2010). While the growth of the Union government spending in real terms between 2004–05 and 2009–10 was 13.85%, it then fell in real terms, from 2010–11 to 2014–15 by −0.31%, (Sundararaman *et al.*, 2016). It has been argued that if the additional money allocated remains unutilized and hence an increase in budgets is unwarranted. But, the gap between allocations and expenditures for most of the period from 2005–06 to 2010–11 has been lower than that for the latter years indicating that this is becoming less of a problem.

Our analysis is unique in several ways—first, we have developed a model to predict the cost of scaling-up primary healthcare services and inform two aspects of this process—the cost of increasing infrastructure, that is, fixed inputs to meet the existing standards, and the cost of expanding the number of services. The latter, that is, scale-up in terms of the expansion of services, which involves both an increase in the fixed inputs as well as variable inputs, has not been evaluated in previous studies. Secondly, we used robust primary micro-costing data from the Indian National Health System Cost Database, and assessed the incremental costs as a result of changes in individual inputs, rather than developing an overarching econometric model which may have uncertainties. Thirdly, by using normative standards for infrastructure (space, equipment, drugs, etc.) and processes (treatment guidelines), our estimates implicitly take account of quality of care. In addition, we also evaluated the cost of scale-up when the service utilization increases relative the current scenario. Fourthly, by comparing existing health facility resources with the prescribed norms for the HWCs and valuing the shortfall for each input, we are able handle the fixed and variable resources separately and avoid assuming a linear relationship between unit health service costs and health service utilization and the estimates are not affected by the structural uncertainties of assumptions inherent in any cost-function. Finally, we have presented both financial and economic analyses. In this way, the findings are useful for preparing budgetary implications, as well as setting the norms for provider payment in a system which has a purchaser–provider split and for evaluating the efficiency or cost effectiveness comprehensive primary health care.

Our study has a few limitations. Firstly, our sample comprised of the rural SHCs and PHCs. As geography is an important factor influencing cost, lack of an urban health facility could limit the generalizability. However, we do not consider the location of our sampled study facilities to confound the study results for a number of reasons. The majority of facilities proposed for upgrade, that is, 98 and 83% of all the SHCs and PHCs, respectively, are in the rural areas (National Health Mission, MoHFW, 2019). Moreover, the infrastructure and the staffing do not differ significantly between the urban and rural facilities and the unit costs of urban and rural primary healthcare facilities have been shown to be similar (Anand *et al.* 1993). Secondly, we have assessed the cost from a health system perspective, excluding patient costs on travel to reach to the health facility, or indirect cost such as any wage loss. However, a break-up of the direct out-of-pocket expenditure (OOPE) in India suggests that the travel expenditure constitute a very minor fraction of primary healthcare costs (NSSO 2017). The bulk of the OOPE is on drugs and diagnostics which is comprehensively valued in our normative assessment. Lastly, while we have estimated the overall per capita cost it is not possible to present the scale-up costs disaggregated by disease or service areas. This is an important area of future research, which would also have significant implications for several assumptions which are used in extensions of national and state level health accounts to be undertaken for disease areas (National Health Accounts, 2016; Bahuguna *et al.*, 2018).

Conclusion

The Government of India has embarked on the ambitious plan to provide comprehensive primary health care to achieve universal health coverage. Our study is a unique insight into the cost implications. If implemented appropriately, the full scale-up would require an additional ₹721 509 million (US$10 178 million) allocation of funds for primary health care. Further, if a capitation-based payment system was used to pay providers, provision of comprehensive primary health care would need to be paid at ₹333 (US$4.70) for SHC and ₹253 (US$3.57) for PHC per person covered. The estimates of cost reported in our study could also be used to further evaluate the cost–effectiveness of comprehensive primary health care.

Supplementary data

Supplementary data are available at *Health Policy and Planning* online.

Conflict of interest statement. None declared.

Ethical approval. Ethical approval was obtained from the Institute Ethics Committee of the authors institute (Letter No: INT/IEC/2019/00150, Dated 08/08/2019).

References

Anand K, Kapoor SK, Pandav CS. 1993. Cost analysis of a primary health centre in northern India. *The National Medical Journal of India* **6**: 160.

Angell B, Dodd R, Palagyi A *et al*. 2019. Primary health care financing interventions: a systematic review and stakeholder-driven research agenda for the Asia-Pacific region. *BMJ Global Health* **4**: e001481.

Angell BJ, Prinja S, Gupt A, Jha V, Jan S. 2019. The Ayushman Bharat Pradhan Mantri Jan Arogya Yojana and the path to universal health coverage in India: overcoming the challenges of stewardship and governance. *PLoS Medicine* **16**: e1002759.

Attema AE, Brouwer WBF, Claxton K. 2018. Discounting in Economic Evaluations. *PharmacoEconomics* **36**: 745–58.

Bahuguna P, Khanduja P, Prinja S. 2019. Economic analysis of delivering postpartum intrauterine contraceptive device services in India. *Indian Journal of Community Medicine: official Publication of Indian Association of Preventive & Social Medicine* **44**: 147.

Bahuguna P, Mukhopadhyay I, Chauhan AS *et al*. 2018. Sub-national health accounts: experience from Punjab State in India, *PloS One* **13**: e0208298.

Bahuguna P, Prinja S, Lahariya C *et al*. 2019a. Cost-effectiveness of therapeutic use of safety-engineered syringes in healthcare facilities in India. *Applied Health Economics and Health Policy* **18**: 393–411.

Berman P, Ahuja R, Tandon A, Sparkes S, Gottret P. 2010. *Government Health Financing in India: Challenges in Achieving Ambitious Goals*. Washington, DC: The World Bank.

Census Registrar of India. 2020. Provisional Population Totals-India. New Delhi. Central Bureau of Health Intelligence

Central Bureau of Health Intelligence. 2019. *National Health Profile*. https://www.cbhidghs.gov.in/, accessed 16 February 2020.

Chauhan AS, Prinja S, Srinivasan R *et al*. 2020. Cost effectiveness of strategies for cervical cancer prevention in India. *PLoS One* **15**: e0238291.

Chugh Y, Dhiman RK, Premkumar M *et al*. 2019. Real-world cost-effectiveness of pan-genotypic Sofosbuvir-Velpatasvir combination versus genotype dependent directly acting anti-viral drugs for treatment of hepatitis C patients in the universal coverage scheme of Punjab state in India. *PLoS One* **14**: e0221769.

CPWD. 2019. *Plinth Area Rates*. Central Public Works Department Government of India. New Delhi. Central Bureau of Health Intelligence.

Department of Child and Adolescent Health and Development and Department of Health System Financing. 2005. *Methodology and assumptions used to estimate the cost of scaling up selected child health interventions technical working document*. Geneva. WHO.

Department of Health & Family Welfare. 2003. *Standard Treatment Guidelines for Medical Officers*. Chhattisgarh: Government of Chhattisgarh.

Department of Health Research, MOHFW. 2018. *Health Technology assessment in India—A Manual*. https://htain.icmr.org.in/index.php/documents/publications/htain-manual, accessed 1 February 2020.

Department of Making Pregnancy Safer (FCH/MPS) and Health Systems Financing (EIP/HSF) for the World Health Report 2005. 2005. *Estimating the Cost of Scaling-up Maternal and New Born Health Interventions to Reach Universal Coverage: Methodology and Assumptions Technical Working Paper*. Geneva.WHO.

Dieleman JL, Sadat N, Chang AY *et al*. 2018. Trends in future health financing and coverage: future health spending and universal health coverage in 188 countries, 2016–40. *The Lancet* **391**: 1783–98.

Downey LE, Mehndiratta A, Grover A *et al*. 2017. Institutionalising health technology assessment: establishing the Medical Technology Assessment Board in India. *BMJ Global Health* **2**: e000259.

Government of Tamil Nadu 2019. *Tamil Nadu Medical Services Corporation Ltd*. https://www.tnmsc.tn.gov.in/, accessed 16 February 2020.

Plecher H. 2019. *GDP of India: Growth Rate Until 2024*. https://www.statista.com/statistics/263617/gross-domestic-product-gdp-growth-rate-in-india/, accessed 16 February 2020.

Icmr P. 2017. *Health of the Nation's States—The India State-Level Disease Burden Initiative*. New Delhi: Indian Council of Medical Research, Public Health Foundation of India and Institute for Health Metrics and Evaluation.

International Institute of Population Sciences. 2020. National Family Health Survey. http://rchiips.org/Nfhs/districtfactsheet_NFHS-4.shtml, accessed 27 September 2020.

Johns B, Torres TT, WHO-CHOICE 2005. Costs of scaling up health interventions: a systematic review. *Health Policy and Planning* **20**: 1–13.

Jyani G, Chauhan AS, Rai B *et al*. 2020. Health-related quality of life among cervical cancer patients in India. *International Journal of Gynecologic Cancer* **30**: 1887–92.

Kremer M, Glennerster R. 2011. Improving health in developing countries In: *Handbook of Health Economics*. Amsterdam: Elsevier, 201–315.

Kumaranayake L, Watts C. 2000. HIV/AIDS prevention and care interventions in Sub-Saharan Africa: an econometric analysis of the costs of scaling-up'. *The South African Journal of Economics* **68**: 455–67.

MOHFW. 2012. *Indian Public Health Standards Guidelines for Sub-Centres Revised*. New Delhi: Ministry of Health and Family Welfare, Government of India.

MOHFW. 2017a. '*Guidelines for ITNS and LLINS*. New Delhi: Ministry of Health and Family Welfare, Government of India.

MOHFW. 2017b. *National Health Policy*. New Delhi: Ministry of Health and Family Welfare, Government of India.

MOHFW. 2019. *Ayushman Bharat | HWC Portal*. https://ab-hwc.nhp.gov.in/, accessed 16 February 2020.

Moses MW, Pedroza P, Baral R *et al*. 2019. Funding and services needed to achieve universal health coverage: applications of global, regional, and national estimates of utilisation of outpatient visits and inpatient admissions from 1990 to 2016, and unit costs from 1995 to 2016'. *The Lancet Public Health* **4**: e49–e73.

National Health Accounts. 2016. *Estimates for India (2013–2014)*. New Delhi.National Health Systems Resource Centre.

National Health Mission, MoHFW. 2019. *Rural Health Statistics 2018–19. New Delhi*. Ministry of Health and Family Welfare Statistics Division, Government of India.

National Health Mission, MoHFW. 2020. *Drug Rate List of Various States Medical Corporation*. https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=1107&lid=629, accessed 14 February 2020.

National Health Systems Resource Centre. 2018. *National Health Accounts Estimates for India (2015–16)*. New Delhi.NHSRC, Ministry of Health and Family Welfare.

NHM. 2016. *Menstrual Hygiene Scheme (MHS)*. New Delhi: Ministry of Health and Family Welfare, Government of India.

NHSRC. 2018a. *Comprehensive Primary Health Care through Health and Wellness Centers: Operational Guidelines*. New Delhi: Ministry of Health and Family Welfare, Government of India.

NHSRC. 2018b. *Guidance Notice on Bridge Programmes in Community Health for Nurses and for Ayurveda Practitioners*. New Delhi: Ministry of Health and Family Welfare, Government of India.

NSSO. 2017. *Health in India NSS 71st Round (January–June 2017). 574 (71/25.0)*. New Delhi: Ministry of Statistics and Programme Implementation, Government of India.

Ochoa-Moreno I, Bautista-Arredondo S, McCoy SI *et al*. 2020. Costs and economies of scale in the accelerated program for prevention of mother-to-child transmission of HIV in Zimbabwe. *PLoS One* **15**: e0231527.

OECD 2019. *PPPs and Exchange Rates*. https://www.oecd-ilibrary.org/economics/data/aggregate-national-accounts/ppps-and-exchange-rates_data-00004-en, accessed 26 September 2020.

Partapuri T. 2017. *Immunization Handbook for Medical Officers*. New Delhi: Ministry of Health and Family Welfare, Government of India.

PGIMER. 2018. *National Health System Cost Database for India*. https://www.healtheconomics.pgisph.in/costing_web/, accessed 15 February 2020.

PGIMER. 2020. *Outcome report of health technology assessment of population based screening for type 2 diabetes & hypertension in India*.

Department of Health Research, Ministry of Health and Family Welfare, Government of India.

Prinja S, Bahuguna P, Faujdar DS *et al.* 2017. Cost-effectiveness of human papillomavirus vaccination for adolescent girls in Punjab state: implications for India's universal immunization program. *Cancer* **123**: 3253–60.

Prinja S, Bahuguna P, Gupta A *et al.* 2018. Cost effectiveness of mHealth intervention by community health workers for reducing maternal and newborn mortality in rural Uttar Pradesh, India. *Cost Effectiveness and Resource Allocation* **16**: 25.

Prinja S, Bahuguna P, Pinto AD *et al.* 2012. The cost of universal health care in India: a model based estimate. *PLoS One* **7**: e30362.

Prinja S, Balasubramanian D, Jeet G *et al.* 2017. Cost of delivering secondary-level health care services through public sector district hospitals in India. *The Indian Journal of Medical Research* **146**: 354–61.

Prinja S, Chauhan AS, Bahuguna P *et al.* 2019. Cost of delivering secondary healthcare through the public sector in India. *PharmacoEconomics* 1–13.

Prinja, S., Downey, L.E., Gauba, V.K. et al. 2020. Health Technology Assessment for Policy Making in India: Current Scenario and Way Forward. PharmacoEconomics Open 4, 249–61. 10.1007/s41669-017-0037- , , ,

Prinja S, Gupta A, Bahuguna P, Nimesh R. 2018. Cost analysis of implementing mHealth intervention for maternal, newborn & child health care through community health workers: assessment of ReMIND program in Uttar Pradesh, India. *BMC Pregnancy and Childbirth* **18**: 390.

Prinja S, Gupta A, Verma R *et al.* 2016. Cost of delivering health care services in public sector primary and community health centres in North India. *PLoS One* **11**: e0160986.

Prinja S, Gupta R, Bahuguna P *et al.* 2017. A composite indicator to measure universal health care coverage in India: way forward for post-2015 health system performance monitoring framework'. *Health Policy and Planning* **32**: 43–56.

Prinja S, Jeet G, Verma R *et al.* 2014. Economic analysis of delivering primary health care services through community health workers in 3 North Indian States. *PLoS One* **9**: e91781.

Prinja S, Mazumder S, Taneja S *et al.* 2013. Cost of delivering child health care through community level health workers: how much extra does IMNCI program cost? *Journal of Tropical Pediatrics* **59**: 489–95.

Rao KS, Nundy M, Dua AS. 2005. *Financing and Delivery of Health Care Services in India*. New Delhi: National Commission on Macroeconomics and Health, 89–104.

RMSC 2020. *Drugs, Surgical and Sutures*. http://rmsc.health.rajasthan.gov.in/content/raj/medical/rajasthan-medical-services-corporation-ltd-/en/Approved-Rate-Lists/DrugsRC.html, accessed 16 February 2020.

Rosa W, Morin KH. 2017. Transforming our World by 2030: leadership requisites to guide the global village. A New Era in Global Health. Nursing and the United Nations 2030 Agenda for Sustainable Development, 109.

Sartorius BK, Sartorius K. 2014. Global infant mortality trends and attributable determinants—an ecological study using data from 192 countries for the period 1990–2011. *Population Health Metrics* **12**: 29.

Sharma D, Prinja S, Aggarwal A *et al.* 2017. Out-of-pocket expenditure for hospitalization in Haryana State of India: extent, determinants & financial risk protection. *The Indian Journal of Medical Research* **146**: 759–67.

Singh MP, Chauhan A, Rai B, Ghoshal S, Prinja S. 2020. Cost of treatment for cervical cancer in India. *Asian Pacific Journal of Cancer Prevention* **21**: 2639–46.

Sundararaman T, Mukhopadhyay I, Muraleedharan V. 2016. No respite for public health. *Economic and Political Weekly* **51**: 39–42.

Van Lerberghe W. 2008. *The World Health Report 2008: Primary Health Care: Now More Than Ever*. Geneva.World Health Organization.

Vital Statistics Division. 2019. SRS Bulletin. New Delhi: Office of the Registrar General, India, Ministry of Home Affairs, Govt. of India. Vol. 52, No. 1. http://censusindia.gov.in/vital_statistics/SRS_Bulletins/Bulletins.html, acessed 14 February 2020.

Vos T, Allen C, Arora M *et al.* 2016. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *The Lancet* **388**: 1545–602.

Watkins DA, Jamison DT, Mills A *et al.* 2017. Universal health coverage and essential packages of care. In: Jamison DT, Gelband H, Horton S, Jha P, Laxminarayan R, Mock CN, Nugent R (eds). *Disease Control Priorities: Improving Health and Reducing Poverty. 3rd ed*. Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2017 Nov 27. Chapter 3. PMID: 30212154

WHO. 2016. *World Health Statistics 2016: Monitoring Health for the SDGs Sustainable Development Goals*. World Health Organization.

WHO. 2017. *Tracking Universal Health Coverage: 2017 Global Monitoring Report*. WHO. Available at: http://www.who.int/healthinfo/universal_health_coverage/report/2017/en/, accessed 14 February 2020.

WHO. 2019. *Countries Must Invest at Least 1% More of GDP on Primary Health Care to Eliminate Glaring Coverage Gaps*. https://www.who.int/news-room/detail/22-09-2019-countries-must-invest-at-least-1-more-of-gdp-on-primary-health-care-to-eliminate-glaring-coverage-gaps, accessed 30 September 2020.

Watkins DA, Jamison DT, Mills T., Atun T., Danforth K, Glassman A, Horton S, Jha P, Kruk ME, Norheim OF, Qi J, Soucat A, Verguet S, Wilson D, Alwan A. Universal Health Coverage and Essential Packages of Care. In: Jamison DT, Gelband H, Horton S, Jha P, Laxminarayan R, Mock CN, Nugent R, editors. Disease Control Priorities: Improving Health and Reducing Poverty. 3rd ed. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2017 Nov 27. Chapter 3. PMID: 30212 ,

World Bank. 2015. *Monitoring and Evaluation Framework*. 99306. The World Bank, 1–4. http://documents.worldbank.org/curated/en/932561468190775475/Monitoring-and-evaluation-framework, accessed 14 February 2020.