A Handbook of Health System Costing

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Table of Contents

ACKNOWLEDGEMENT	5
LIST OF ABBREVIATIONS	6
EXECUTIVE SUMMARY	12
1 BACKGROUND	
Chapter 1.1 Indian Health System & Healthcare Financing	17
Chapter 1.2 Need for Cost Data in Healthcare Decision-making Dr Sudha Chandrashekar	27
2 PRINCIPLES OF COSTING FOR HEALTHCARE DECISION-MAKING IN INDIA	
Chapter 2.1 Basic Concepts of Costing Dr Akashdeep Singh Chauhan	39
Chapter 2.2 Costing Methodology Dr Akashdeep Singh Chauhan & Dr Shankar Prinja	49
Chapter 2.3 Data Collection and Quality Assurance	57
Chapter 2.4 Data Collection Instruments Dr Oshima Sachin & Ms Jyotsna Naik	69
Chapter 2.5 Cost Data Analysis	82
3 EXPERIENCES OF COSTING IN HEALTHCARE	
3.1 International experience in costing	
Chapter 3.1 International Experiences in Costing for Healthcare Decision-making	97
3.2 Indian experience in costing: Costing of Health Services in India (CHSI) study	
Chapter 3.2.1 Costing of Healthcare Services in India: Study Methodology Dr Maninder Pal Singh	110
Chapter 3.2.2 Use of Cost Information for Policy and Research Dr Maninder Pal Singh	127
Chapter 3.2.3 Costing - The Indian Experience	135

Chapter 3.2.4 Fir	irst hand Experience of Data Collection for Costing	149
Dr Prakash Patel,	, Prof Gajanan D Velhal & Dr Amit Bhondve	
4 OTHER COSTIN	NG RESOURCES	
Chapter 4.1 The I	Healthcare Cost Database of Indiaingh Chauhan	165
Chapter 4.2 Usef	eful Resources and References for Costing of Healthcare Servi	ce178
Dr. Aamir Sohail, I	Dr. Akshay Chauhan & Dr Maninder Pal Singh	
5 ANNEXURE		190

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List of Abbreviations

AB PM-JAY Ayushman Bharat Pradhan Mantri-Jan Arogya Yojana

ABC Activity-Based Costing

AHPI Association of Healthcare Providers India

AIDS Acquired Immunodeficiency Syndrome

AMC Annual Maintenance Contract

ANC Antenatal Care

ATIH Technical Agency for Hospital Information

CD-ROM Compact Disc Read Only Memory

CEA Cost Effectiveness Analysis

CGHS Central Government Health Scheme

CHC Community Health Centres

CHE Current Health Expenditure

CHOICE Choosing Interventions that are Cost-Effective

CHSI Cost of Health Services in India

CHW Community Health Worker

CMC Comprehensive Maintenance Contract

COI Cost of Illness

CPD Central Purchase Department

CRD Central Registration Department

CTVS Cardio Thoracic & Vascular Surgery

DALY Disability Adjusted Life Year

DHR Department of Health Research

DMO District Malaria Officer

DRGs Diagnosis Related Groups

DSA Deterministic Sensitivity Analysis

ECHS Ex-Servicemen Contributory Health Scheme

ECOSOC Established under United Nations Economic & Social Council

EHR Electronic Health Records

EHSP Essential Health Service Package

EUAC Equivalent Uniform Annual Cost

FICCI Federation of Indian Chambers of Commerce & Industry

FTE Full Time Equivalent

GHCC Global Health Cost Consortium

GHE Government Health Expenditure

Gol Government of India

GSDP Gross State Domestic Product

HBP Health Benefit Package

HIPDC Health Insurance Policy Deliberation Committee

HIRA Health Insurance Review and Assessment

HIV Human Immunodeficiency Virus

HMIS Hospital Management Information Systems

HOD Head of Department

HR Human Resource

HRG Healthcare Resource Group

HSCRC Health Services Cost Review Commission

HTA Health Technology Assessment

HTAIn Health Technology Assessment India

HWC Health & Wellness Center

ICMR Indian Council of Medical Research

ICPD International Conference on Population and Development

ICU Intensive Care Unit

IDCC Immunisation Delivery Cost Catalogue

IDSP Integrated Disease Control Program

IHPA Independent Hospital Pricing Authority

IMA Indian Medical Association

IMNCI Integrated Management of Neonatal and Childhood Illness

InEK Institute for the Payment System in Hospital

IPD Inpatient

JLN Joint Learning Manual

LMIC Lower-Middle Income Country

LSHTM London School of Hygiene and Tropical Medicine

M&E Monitoring & Evaluation

MCGM Municipal Corporation of Greater Mumbai

MDGs Millennium Development Goals

MIS Management Information system

MLHP Mid-Level Healthcare Provider

MoHLW Ministry of Health Labour and Welfare

MRU Multidisciplinary Research Unit

NACO National AIDS Control Program

NGO Non Government Organisation

NHA National Health Authority

NHIC National Health Insurance Corporation

NHS National Health Service

NHSB National Health Security Board

NHSO National Health Security Office

NIDDCP National Iodine Deficiency Disorders Control Programme

NISP National Institute of Public Health

NLEP National Leprosy Eradication Programme

NMHP National Mental Health Programme

NPCB National Programme for Control of Blindness

NPCDCS National Programme for Prevention & Control of Cancer, Diabetes, Cardiovascular

Diseases and Strokes

NPHCE National Programme for Health Care of the Elderly

NPPCD National Programme for the Prevention and Control of Deafness

NPPCF National Programme for Prevention & Control of Fluorosis

NSSO National Sample Survey Organization

NTCP National Tobacco Control Program

NVBDCP National Vector Borne Disease Control Programme

OBG Obstetrics & Gynaecology

OOPE Out of Pocket Expenditure

OPD Outpatient Department

OT Operation Theatre

PEPFAR President's Emergency Plan for AIDS Relief, United States

PGIMER Post Graduate Institute of Medical Education & Research

PHC Primary Health Centre

PHFI Publicly Financed Health Insurance Scheme

PPIUCD Postpartum Intrauterine Contraceptive Device

PSA Probabilistic Sensitivity Analysis

RBSK Rashtriya Bal Swasthya Karyakram

RNTCP Revised National TB Control Programme

RSBY Rashtriya Swasthya Bima Yojana

SC Sub-Centre

SECC Socio-Economic Caste Census

SRH Sexual Reproductive Health

STG Standard Treatment Guidelines

STW Standard Treatment Workflow

TA Time allocation

TB Tuberculosis

THE Total Health Expenditure

UCSF University of California San Francisco

UCT University of Cape Town

UHC Universal Health Coverage

UK United Kingdom

UMIC Upper-Middle Income Countries

UN United Nations

UNAIDS Joint United Nations Programme on HIV/AIDS

UNFPA United Nations Population Fund

US United States

USD United States Dollar

UW University of Washington

WHO World Health Organization

Executive Summary

The Indian health system is undergoing significant reforms and moving towards more evidenceinformed health policy as the country strives toward the achievement of Universal Health Coverage. Cost information plays a key role in the evidence base for Universal Health Coverage-oriented policy by informing decisions such as setting reimbursement rates for government-sponsored health insurance packages of care, strategic purchasing of health services, and in prioritizing available resources to maximize value of health sector investments. The Department for Health Research (DHR) have been instrumental in starting to build the evidence-base for these decisions. DHR has set up Health Technology Assessment India (HTAIn) to collate and generate evidence related to the clinical effectiveness, cost-effectiveness, and safety of medicines, devices and health programs using the Health Technology Assessment (HTA) approach. To facilitate the generation of standardised evidence for decision-making, HTAIn has published an HTA manual that outlines the broad methods for HTA. this Costing Handbook complements the HTA manual. It forms part of DHR's programme to increase cost data availability, developed in recognition of a cost data gap and the need for standardisation in costing methods. The manual describes the imperative for improved cost information in the Indian context and explains recommended methodologies for costing health services in India drawing on best practice literature, case studies from India and international experience. As a guide for those wanting to learn the methods of costing and how to apply them, each chapter addresses a key set of learning objectives.

The first section of the manual provides a background to costing health services in India. Healthcare in India is provided by a mix of government run healthcare facilities, private clinics, corporate hospitals and non-regulated healthcare providers. Government run facilities range from the sub-health centre through to tertiary institutes and provide curative and preventive care as well as public health programmes. The private sector plays a dominant role in health care provision, but this is primarily involved in provision of curative care. On the financing side, out of pocket expenditures account for the majority of healthcare spending while direct government spending accounts for 30% of total health expenditure. The role of insurance is growing. Although only 5% of households are covered under prepaid private insurance, the expansion of publicly funded insurance includes the Government of India's flagship scheme, Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) will provide financial risk protection against catastrophic health expenditure for over 10 million vulnerable families.

The multitude of providers and different payment schemes has implications for the cost of delivering healthcare services as well as the methods used to estimate the costs. Healthcare costs vary significantly from one type of health centre to other due to differences in the type and structure of delivery of services. Methods used to measure the costs of services will also vary according to who incurs the costs. Hence, to ensure all costs are captured, when planning cost-analysis it is of utmost importance to understand all the functions of a given healthcare facility as well as the way the care provided by a facility is financed.

Cost analysis is used to inform accountability, efficiency, assessing priorities, making cost projections, considering cost recovery and ensuring sustainability in any health system. However, cost information in India is limited, largely coming from one of studies. There are now efforts by DHR to support collecting timely good quality cost data at the national level and the development of a national health system cost database. Policy-makers are also demanding cost information to inform the reimbursement rates under the various publicly funded insurance schemes. Carrying out costing studies to fill this gap will face a number of challenges including a sufficient number of participating hospitals, reluctance to share data, lack of standardised and soft copy data and poorly maintained patient records. Recommendations to overcome this include encouraging further costing studies, building capacity for costing and documenting the experiences of costing in order to learn and develop systems further.

The next section of the manual addresses the technicalities of costing. The manual provides definitions and explains the critical terminology involved in cost analyses and for planning a cost study. Cost is precisely defined as the value of resources used to produce something. Price is the amount of money paid by the customer for purchasing that final product. As well as the difference between cost and price, the manual distinguishes between financial and economic or opportunity cost and the difference between health system cost (incurred by the provider or third-party payer) and patient cost or out of pocket expenditures (incurred by individuals or households). Costing can take the perspective of provider or payer, the healthcare sector or society. The healthcare sector perspective includes both the patient and provider healthcare costs; a societal perspective additionally so includes non-medical expenditures and lost productivity. The healthcare sector perspective is important in India, where out of pocket expenditures are so critical.

Costing methods are shaped by the purpose of the analysis but also driven by the resources available to carry out the costing exercise, including both budget and data availability. Before commencing the costing, the time period and the cost centres need to be specified. Top down approaches are used when granular data are not available for the resource inputs. This approach firstly, assesses the data on the cost of total resource use by a health facility or department and then allocates it to the various services delivered within the department. A bottom up approach is a type of costing approach that estimates the cost of a particular narrowly defined service through direct measurement of resource use for that service. Another alternative is normative costing that measures the resource use for a particular health service based on standard treatment guidelines.

Key steps to then follow in any cost data collection are as follows: outline the aims and objectives; decide the study perspective, time horizon and approach, prepare the data collection tools, collect the data, check the data for adequacy and quality and, finally, complete the analysis and dissemination. The manual describes cost data collection tools used by the DHR supported "Costing of Health Services in India" (CHSI) study that apply these processes and explains how to use the tools. These tools are available for download. An important consideration is how to build in quality assurance into the cost data collection. Key quality assurance strategies that are recommended include four levels of quality checks, namely checks during data collection, data entry, data sharing and finally on receipt of the data by the central team.

Section 2 ends with an overview of cost data analysis and the standard procedures required. During data collection, costs are classified as either capital or recurrent. Capital costs are then annualised, taking into account both depreciation and time preferences. Shared costs from the different cost centres are allocated to the service under evaluation using standard apportioning statistics. The manual explains how to choose these statistics and to apply these. This chapter also explains the importance of addressing an uncertainty and how to implement sensitivity analyses to explore the impact of this uncertainty on the final cost estimates.

Section 3 focusses on the use of cost analysis in policy and research in practice. A brief overview of the role of cost information in decision-making and evidence base policy internationally is provided, using case studies. The following chapter then describes how the cost data from the DHR supported CHSI study has been used in setting reimbursement rates for AB-PMJAY in India. The lessons learned from India continue in the next chapter with a process evaluation of the CHSI study.

This summarises the key lessons and challenges encountered in implementing a nationally representative cost study where many stakeholders are unfamiliar with costing, there are limited electronic records and systems are not designed to capture costing information. Researchers from the CHSI study sites then provide reflections on the implementation of cost data collection

The manual's final section provides some key resources for users of cost data and those carrying out cost analysis in India. The manual describes the Indian national health system cost database. This database provides access to unit cost data from a sample of 200 facilities from sub-health centres to district hospitals in 6 states. The data held on the website include cost data broken down by input and activity. In addition, the website provides access to a unit cost predictor for states not included in the database sample and other useful resources for cost practitioners including price data, publications and useful website links. The final chapter identifies a selected set of other useful costing resources including cost databases from around the world and sources of best practice methodologies in costing.

Cost information is critical for health policy and decision-making. This manual is a welcome resource for costing practitioners and HTA researchers in India. It provides a guide to the role of cost data in policymaking and how to obtain cost data through primary data collection or secondary resources for the Indian setting.

Background

Chapter 1.1 Indian Health System & Healthcare Financing

Dr Malkeet Singh & Dr Gaurav Jyani

Overview

This chapter describes the structure and functions of the Indian healthcare system, and the healthcare financing mechanisms. The chapter explains the sources and pathways of healthcare financing for different modalities of healthcare provision. The majority of healthcare services are financed by patients themselves through out-of-pocket expenditure (OOPE). Other modes of healthcare financing include public and private health insurance and funding of public healthcare facilities. This chapter gives an overview of the components of expenditure on healthcare, as well as the need for and resulting challenges of the estimation of the cost of healthcare services in the country.

Learning Objectives

By the end of this chapter, the reader will be able to:

- 1. Understand the complex healthcare system of India, which includes different regulated and unregulated healthcare providers spread across rural and urban regions.
- 2. Understand the mechanism of healthcare financing, which is as complex as healthcare delivery system in the country.
- 3. Explain the need for evidence pertaining to the cost of delivery of healthcare services in the country.
- 4. Describe the potential opportunities and barriers in estimation of costs of healthcare services in India.

Key definitions

- National Health Accounts: A tool to describe health expenditures and the flow of funds in both Government and private sector across the country.
- **Healthcare Providers:** An individual or institution that provides preventive, curative, promotional, or rehabilitative health care services in a systematic way to individuals, families or communities.

- Mid-Level Health Care Providers (MLHCP): Community workers who are not doctors but who have been trained to diagnose and treat common health problems, to manage emergencies, to refer appropriately and to transfer the seriously ill or injured for further care.
- Out-Of-Pocket Expenditure (OOPE): It is the expenditure borne directly by a patient to avail healthcare services. This includes self-medication, physician fees, drugs, diagnostics and other expenditure paid directly by the patient on the time of availing services.
- Gross Domestic Product (GDP): It is the total market value of goods and services produced by a country's economy during a specified period of time. It includes all final goods and services—that is, those that are produced by the economic agents located in that country regardless of their ownership and that are not resold in any form.

Introduction: The Healthcare System in India

Across the globe, healthcare services are provided through a mix of public and private providers. Providers are reimbursed for services that are provided either directly by patients or through third party payers including insurers or governments. In the simplest form, third party payers collect premiums from patients or consumers and in turn provide insurance coverage. For publicly provided services, where the third-party payer is the government, taxation and, in some cases donor funds, become major the sources of funds for healthcare coverage. Publicly funded health services can be provided through public providers - comprising of government institutions organised within the national healthcare systems - or through public-private partnerships, with private providers,- comprised of self- employed practitioners, for- profit hospitals & healthcare providers, and not-for-profit hospitals & healthcare facilities (including non- governmental organisations, trusts and faith-based organisations) - reimbursed by the state for services provided. While public healthcare provision system tends to be used more by the poor and , the private sector is often considered to be more efficient and, in some cases of better quality.(1) Based on this broad classification, health providers across the globe may be classified under the following six categories

- A. Multinational and national for-profit corporations
- B. Formal individual private providers (individual physicians or other healthcare providers operating in smaller scale healthcare facilities or private clinics)
- C. Informal for-profit providers (unlicensed, unregulated providers including shop owners, traditional healers, and birth attendants)
- D. Not-for-profit providers (hospitals/ dispensaries run by civil society, non-governmental, faith-based groups, charitable trusts and community and social enterprises)

E. Public hospitals, health centres, and clinics (country/ province and district-level hospitals and clinics, with varying degrees of accessibility and user fees for patients, often having providers that also participate in private sector healthcare delivery)

India, having a federal structure and being the seventh largest and second most populous country of the world, has a very complex healthcare delivery system. Healthcare service providers in the country ranges from tertiary care institutes like medical colleges and super- speciality corporate hospitals to district hospitals, small private clinics, CHCs, PCHs, HWCs, Sub-centres, AYUSH clinics, Mohalla Clinics (a form of primary care facility in Delhi) and Naturopathy centres as well as various forms of un-regulated service providers.

In the public sector, the Sub-Centre (SC) is the most peripheral unit of the healthcare system and the first contact point for community. There is one SC for every 5,000 people in the plains and 3,000 people in hilly/difficult to reach/tribal areas. Primary Health Centres (PHCs), where a medical officer is available, provide limited curative and other preventive healthcare services for a population of 30,000 in the plains and 20,000 in hilly/difficult to reach/tribal areas. To strengthen primary care and ensure the delivery of comprehensive primary healthcare services, the government is converting all SCs and PHCs to Health and Wellness Centres where a trained Mid-Level Healthcare Provider (MLHP) will be available to deliver an expanded range of services. At the next level, Community Health Centres (CHCs) are established at the block level(1 per 120,000 in the plains/80,000 in hilly/difficult to reach/tribal areas) to provide medical specialists viz.- surgeon, physician, gynaecologist/obstetrician and paediatrician and are equipped with an operation theatre, X-ray, labour room and routine laboratory facilities. Next in the hierarchy are the district hospitals (and sub-district hospitals) which provide comprehensive palliative and curative services to the community in addition to emergency services. In 2018, the number of SCs, HWCs, PHCs, CHCs and District Hospitals in the country were 148366, 38106, 24049, 4833 and 722, respectively.(2)

Apart from these core elements, the public healthcare system also constitutes facilities owned and maintained by other public sector institutions like Atomic Energy, Railways, Port Trust, Reserve Bank and Armed Forces etc. for their employees.

The public healthcare system also provides preventive, supportive and curative services to community through various vertical and integrated programs, for example the Revised National TB Control Programme (RNTCP), the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Strokes (NPCDCS), and the National Tobacco Control Program etc.

In spite of the extensive public healthcare system across the country, the private sector dominates healthcare service provisioning. However, the private healthcare sector is primarily involved in provisioning of curative services, ranging from small dispensaries, clinics, nursing homes and hospitals (Allopathic, Ayurvedic, Homeopathic and Unani) to large corporate hospitals or chains of hospitals which provide multi-speciality services.

There are estimates that 93% of all hospitals and 64% of the hospital beds of the country are in private sector.(3) Similarly, about 85% of total allopathic doctors in the country and other practitioners of Indian system of medicines are practicing in the private sector .(3,4) According to one study, a vast majority of the population (72% in rural sector and 79 % in urban sector) seeks curative OPD services from the private healthcare sector.(5) In contrast about 90% of immunization services and 60% of antenatal services in the country are publicly provided.

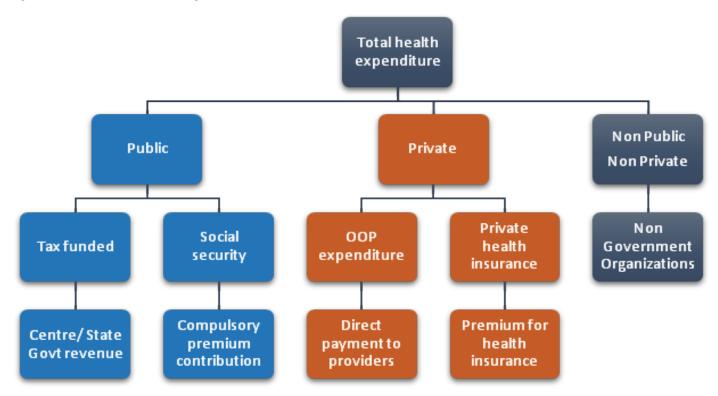
Unfortunately, a significant proportion of the population seek healthcare services from untrained practitioners in the country. In the mid 1990s, a study made a conservative estimate that there were 1.25 million non-qualified rural medical practitioners, double the count of formally trained healthcare providers at that time.(6) The majority of these untrained practitioners and fait healers, local birth attendants and priests' practice in rural and remote areas where the primary healthcare system is not as strong as in urban settings.(3,4)

Healthcare Financing in India - Sources

The financing of healthcare services in India is also very complex. Most healthcare services are financed through out-of-pocket expenditure by the patients at the time of availing services. Other sources include development assistance for health from various national and international agencies, prepaid private expenditure (including private health insurance purchased by people from various agencies), and public expenditure or expenditure by government, including the budgetary allocation to run the healthcare system explained above, and publicly funded social health insurance programs.

The healthcare financing mechanism of the country is briefly summarized in the figure 1. For the year 2016-17, Total Health Expenditure (THE) for India is estimated at Rs. 5,81,023 crores (3.8% of GDP and ₹4,381 per capita). THE constitutes current and capital expenditures incurred by Government and Private Sources including External/Donor funds.

Figure 1: Healthcare financing mechanism in India



1. Out of pocket expenditure

Out of Pocket Expenditure (OOPE) on healthcare are direct payments made by patients to purchase healthcare services or related goods. OOPE comprise direct health expenditure, including doctor consultation fees, expenditure on purchasing medicine, laboratory charges and diagnostics fees and hospital charges (e.g. bed/ ward/ room/procedure charges), and direct non-health expenditure including s expenditure on travel, boarding and lodging during seeking healthcare. OOP 64% of total healthcare expenditure in India. (Healthcare in India: Current state and key imperatives", Review of National Health Policy 2015-Draft and National Health Accounts 2016-17). If OOP expenditures exceed a household's ability to pay, the household can be pushed into coping strategies such as taking loans or even into poverty. Nationally and state representative estimates of out-of-pocket expenditures can be derived from surveys conducted by the National Sample Survey Organisation every five years. The 2016-17 National Health Accounts estimate total household OOPE on health (OOPE) to be Rs. 3,40,196 crores (58.7% of THE, 2.2 of GDP, Rs. 2,570 per capita)

2. Public expenditure on health

Direct government spending on healthcare has historically been relatively low, levelling off at near 1 percent of total GDP for decades. Although, per capita public expenditure on health in nominal terms has gone up from Rs 621 in 2009-10 to Rs 1112 in 2015-16 (7); India's rank is 157 among 190 countries position according to per capita government spending on health (\$ 44 PPP). India's per capita public health spending is 35 percent of the total health expenditure.(8) According to the National Health Accounts-2016-17, direct Government Health Expenditure (GHE) including capital expenditure was Rs. 1,88,010 crores (30.6 % of THE, 1.18% GDP and Rs. 1261 per capita).(7) This amounts to about 4.4% of General Government Expenditure in 2016-17. Of the GHE, the Union Government share is 31.4 % and State Government share is 68.6%.

3. Health insurance

Insurance schemes play an increasing role in health care financing India. The majority of the insurance schemes, , are publicly subsidised by the Union or state budgets. In 2018, Government of India launched its flagship insurance scheme, Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY), providing a health cover of up to Rs 5 lakhs per family per year, for secondary and tertiary care hospitalization to over 10.74 crore poor and vulnerable families (approximately 50 crore people). AB PM-JAY has been designed to provide financial risk protection against catastrophic health expenditure that impoverishes an estimated 6 crore people every year. Health cover of up to Rs. 5,00,000 per family per year, for secondary and tertiary care hospitalization 1,573 procedures covering treatment, food, drugs and supplies, and diagnostics services. Over 10.74 crore poor and vulnerable families (or 50 crore people) are covered as per specific deprivation criteria identified under the Socio-Economic Caste Census (SECC), 2011. PM-JAY, being centrally sponsored, is fully funded from the consolidated fund of India and the budget allocated is received from Government of India as recurring grant-in-aid. The budget allocation for the fiscal year 2019-20 is Rs. 6,400 Crore. In addition, to PMJAY are a number of pre-existing publicly funded insurance schemes. Expenditures by all Government Financed Health Insurance Schemes combined are Rs. 7,705 crores in 2016-17.

Prepaid private expenditure through voluntary health insurance in the country is not a common mode of payment for healthcare services with only five percent of households covered in this way.(9) Private Health Insurance expenditure is Rs. 27,339 crores (4.7% of THE).

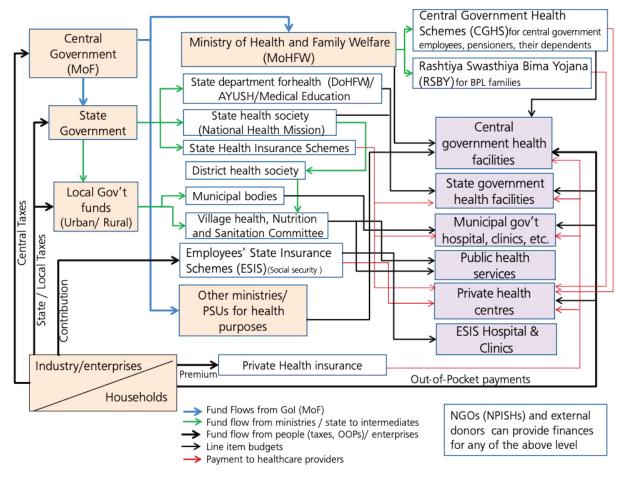
4. Donor assistance for health

Assistance for health from international agencies has historically been very minimal at about 2% of total health spending of the country. It has been focussed on specific programs for disease control especially infectious diseases like Tuberculosis, HIV/AIDS and malaria etc. This comprises aid from World Bank and Global Fund to fight AIDS Tuberculosis and Malaria to control communicable diseases like smallpox, polio and guinea worm etc. which eventually helped country to focus and address issues like HIV spread in the country. Also, assistance was received during the era of 1990s, which was primarily focused on the development of infrastructure in the country and to extend primary healthcare services to the community. External/donor funding contributes to about Rs. 3,462 crores (0.6%).

Tracking the Expenditure on Healthcare

To understand the flow of funds in the Indian healthcare system National Health Accounts (NHA) can be reviewed. The NHA elaborates health and health related expenditure including the core health services as well as expenditures on water, sanitation, and nutrition etc., which directly impact health outcomes (see figure 2) to obtain an estimate of total expenditure commitment towards health.

Figure 2: Monetary flow in Indian healthcare system



Source: WHO SEARO: Adapted from National Health Accounts (2013-14)

Costing Handbook 2

An important characteristic of the fund flows in the Indian health system is the expenditures by ministries other than MoHFW including Labour and Employment, Youth Affairs and Sports, Communication and Information Technology amongst others.

The NHA also provide an analysis of where and how funds are spent within the system (see figure 3). The major portion of current health expenditure is due to inpatient care (34.4% of total). Outpatient services constitute around 17.3% of total expenditure. Other significant areas of expenditure are medicines (both prescribed and over the counter drugs) (27.8% of the total). Expenditure on preventive healthcare services in India is 6.9% of total health expenditure and 11.9% of total CHE is spent on Traditional, Complementary and Alternative Medicine.

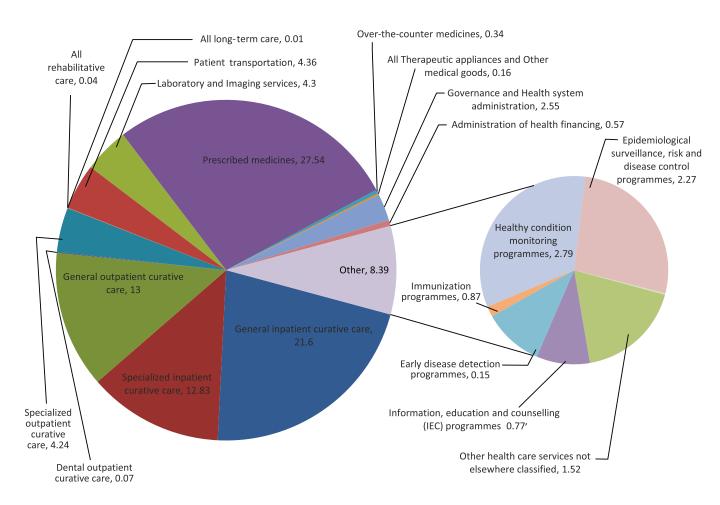


Figure 3: Current Health Expenditures (2015-16) by Healthcare Functions

Source: National Health Accounts (2015-16)

Impliations for costing healthservices

The cost of healthcare delivery varies significantly from one type of health centre to other due to differences in the very basic structure of delivery of services. As a result, methods to estimate the cost of delivery of these services should be comprehensive enough to capture the

Costing Handbook 24

funds flow and should be selected in accordance with the way those services are delivered. For instance, costing methods should comprehensively cover the out-of-pocket expenditure at a private clinic or a corporate hospital since a significant part of overall expenditure may be on drugs purchased by patients from pharmacy, other consumables from the market and any donations in the form of drugs, equipment or furniture to the healthcare facility, which may not reflect in financial records of hospital. Similarly, methods should be robust enough to accurately capture the components of healthcare delivery, on which a major amount of overall expenditure is made. The majority of healthcare spending is on in-patient care, out-patient services and diagnostics and therefore costing need to focus on these areas. Hence, before planning cost analysis at any level and type of healthcare facility, it is of utmost importance to understand the form of given healthcare facility, the different services provided at the facility, as well as the way given healthcare facility is financed.

Conclusion

India has a complex healthcare system which includes government run healthcare facilities, private clinics, corporate hospitals and non-regulated healthcare providers. Healthcare is funded by a mix of direct out of pocket payment by the patient at the time of availing services, government subsidies including the government health insurance programs, donors and charitable organisations and pre-paid full or partial health insurance. When undertaking cost analysis, it is important to take this complexity into consideration and account for the type of health facility, the range of services provided as well as the way services are financed.

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Chapter 1.2 Need for Cost Data in Healthcare Decision-making

Dr Sudha Chandrashekar

Overview

This chapter will deal with different aspects of costing, cost drivers, and how they can influence evidence-based priority setting. It will also help to understand the need for costing health care in India with particular focus on its relevance to set provider payments under Government-sponsored health schemes in India as a part of the efforts to provide universal health coverage.

Learning Objectives

After completing this chapter the reader will understand:

- The role of cost analysis and the determinants of costs
- The utility of cost data to fix appropriate benefit package rates under large scale health scheme

Costing health services

Public resources are scarce, but the demand for health care is increasing steadily. Ethical, socio-political and economic imperatives make it necessary to use resources efficiently. Cost information is essential to understand the resource requirements of the health sector and improve the economic efficiency of health care in any state.(1) Alongside this an appropriate costing methodology is vital to ensure good quality cost information and so reduce the potential for ill-informed decisions.(2) There is a consensus in the literature that costing exercises should preferably be undertaken within a specified decision-making framework(3-5). Cost information can be used for different purposes like:

Accountability: Keeping track of spending. Program managers need information on all levels of program performance, including cost data.(6)

Efficiency: A health program is defined as being more efficient when it provides more beneficial effects from a given set of resources than the alternative to which it is being compared. Costing analyses can provide in-depth information on the efficiency, as well as estimate of the value of additional efforts needed to improve efficiency, often in terms of staff labour and other inputs.(7-8)

Assessing priorities: Costing analyses are useful tools when assessing financing options for national programs. In resource-constrained countries, the additional costs of improvements into a country program are an important consideration in deciding whether or not to proceed with their use.(9)

Making cost projections: Costing analyses provide useful information about actual resource needs or inputs required to provide a service. They also allow program managers to evaluate different options for program improvements by estimating the resource requirements for each. **Considering cost recovery:** Cost of health services/program is one of the pieces of information that must be known if a country is considering introducing user charges as one of the sources of financing.

Sustainability of funding: Using these data and analyses, program managers can work with local institutions, international donors and cooperating partners to develop financing plans for long term sustainability.(10,11)

The aim of a costing exercises is therefore important to identify and can include economic evaluation to help "maximise the benefit of resource utilisation according to the ethical value of the society" informing pricing decisions, understanding the cost of illness or a priority setting exercise. Clarifying the purpose for which the cost information is to be used is important to identify the type of costs and which costs to include in an analysis. Importantly, the definition of cost can change according to the purpose of the analysis.

Types of cost

Costing analysis helps in planning and policy decisions by providing an overview of total resources required, assessing the use of different inputs, contributing to the understanding of the relative efficiency of different interventions and informing decisions on the best ways to expand and replicate activities. The cost analysis can be classified based in the following ways:

By type of input:

Recurrent items - those inputs that are used up in a year

Capital items - those inputs that last more than one year such as equipment.

- By function or activity: e.g., diagnosis, consultation, counselling, drug/vaccine/condom provision, development of diagnostic/treatment protocols, training, management and administration
- By organizational level: e.g., site, district, state
- By type of outcome measure e.g., number of people reached, volume of activity

A costing analysis differs from an expenditure analysis in that it estimates the actual value of resources used whereas expenditure analysis reports on the financial transactions. The quantity of resources used for the goods or service is estimated and its value calculated, assuming that every resource has an opportunity cost and could have an alternative use.(12) Other ways in which costs differ from expenditures is that costs also include an estimate of the value of in-kind costs such as donated goods or volunteer time. In addition, the costs of capital goods, are calculated differently than for expenditures and are annualized (see chapter 2.5), to make them comparable with recurrent costs.

Total costing involves examining all costs of the provision of services, no matter who bears the costs. These include not only the costs of operating the program on a daily basis but also the costs of setting up the program or investment costs.

Program managers should use **incremental or additional** costing analysis when they want to estimate the cost of adding an activity to their program. Incremental analysis provides information on the extra costs of changing program activities or adding additional activities to existing ones. Program managers may do incremental costing to make decisions about the benefits and costs of undertaking additional activities, such as introducing the Hepatitis B vaccine to the existing program. This cost information can be used to make informed decisions about future costs to the program as a whole.

Marginal costing examines the additional cost incurred to produce one additional unit of output. For example, the cost of increasing immunization coverage by one percentage point can be estimated. This information informs program managers or policymakers of how much it will cost to reach a goal of increasing coverage or reaching more children in harder-to-reach areas. Along with information on the average cost, the marginal cost indicates whether the average costs will increase or decrease as activity levels change. This relationship can change over time since average costs may decline as infrastructure costs are shared as more immunization services are provided, and then increase as more immunizations are provided in hard-to-reach areas and relatively more resources are required to vaccinate one extra child.

In summary, costs are defined as the value of the resources used to produce or provide a good or service. It is important to remember that "cost" is different from "price," in that the price is the amount charged to consumers, usually set by the producer of a good, and it may vary from the actual cost of production of the good. Different types of costs are used to inform different decisions and it is important to know what costs are relevant to any decision.

Cost Drivers

In using cost data, it is important to understand the different factors that might influence the total or average cost of health service delivery. Some key factors to consider are:

Scale

Scale or volume of activity is an important variable that influences both total and average cost. Economies of scale are mainly seen when the long-run average total costs fall as output increases. Theory suggests that economies of scale can be achieved through distribution of fixed (those that don't vary as service volume increases) costs, bulk purchasing of supplies, improving the efficiency of personnel, technological innovations and learning by doing.(13) If the average costs increase as output rises it means the presence of diseconomies of scale. Here the marginal cost, i.e., the cost to produce one more additional unit of the same output is higher than the average cost. This is due to increase in factor prices and decreasing returns to scale.(12) The scale of a project can be measured in different ways like coverage (proportion of people reached by the intervention), the volume of services provided (condoms distributed) and the level at which they are delivered (community, district, state or national).(14) It is possible to estimate the marginal cost for different output levels by using a cost function. The cost function examines the relationship between input prices and output quantity.(15) The presence of economies or diseconomies of scale can then be assessed by comparing the estimates of marginal costs derived from the cost function with average cost estimates from the same data set.(16,17)

Program Maturity

The costs of running a program in its early years are normally higher than a mature program. This is mainly due to the high investment costs of early years in terms of infrastructure, training and low outputs due to lower scale of services. As programs mature they are able to improve their performance both due to increasing efficiency (learning by doing) as well as scale.(18)

Contextual Factors

The geographic location like urban/rural/difficult terrain/remote locations/political stability, the local stakeholders and general community support, distribution of the target population (dispersed/compact) can impact the cost of delivering the intervention. They can affect the input prices like higher staff or space costs as in urban locations, increased travel costs in regions with difficult access(19) or by decreased uptake of services in case of a sparse population.

Program Management Costs

Most cost studies in health services consider costs at the service level only and many of the costs incurred at other levels like state or national level are rarely quantified.(20,21) The nature of contracting of the agencies implementing the intervention and the organizational structures and the governance mechanisms may vary across the implementing agencies and so influence the costs costs.(12) Better understanding of program management costs is needed as they may have a significant bearing on the unit costs and offer opportunities to improve the efficiency and reduce wasteful spending.

Healthcare costing in India

Until recently there have been no central efforts to systematically collect health service cost data in India. There are some costing studies of large-scale disease specific interventions collected alongside programs as they expand. Most of the other cost data has been collected alongside clinical trials/pilot programs, which are done in conditioned environments. The costing studies vary in the methodologies adopted and assumptions considered, are retrospective in nature, generally small scale and over a short time period and differ in the comprehensiveness and levels at which costs are collected. Standardised primary cost data collection is both resource and time-intensive but nevertheless very much needed to address this information gap. The capacity of institutions to collect timely, good quality cost data and follow standardized method of analysis is critical. As part of an effort toward this, the Department of Health research (DHR) has set up "Health Technology Assessment in India" to build the capacity of technical partners at the state level to conduct cost studies and economic evaluations. DHR conducts regular trainings for all stakeholders and researchers to enhance their skills and develop state teams to undertake specific studies in selected intervention sites. There have also been efforts initiated to develop a costing database providing access to multi-site costing studies conducted in India for data analysis (https://www.healtheconomics.pgisph.in/costing_web/index.php).

The need for these costs data is critical. Policy makers at various levels are engaged in developing cost-effective health interventions that ensure accessible and affordable quality care that concurrently serves the poor and vulnerable groups. They are also increasingly functioning as purchasers of care example, government schemes like Rashtriya Bal Swasthya Karyakram (RBSK) has negotiated and set the package rate to reimburse private provider treatment of beneficiaries for certain conditions.

RBSK arrived at the estimated package costs based on a comparison of the reimbursement rates used by different state public insurance schemes to estimate the budget requirement. However, to enable evidence-based decision making, policy makers also need information about the nature of health services costs to help in estimating the amount of resources required to provide healthcare services; become a basis for planning of budgets at the block, district, state and national levels; and could become a base for negotiating with private healthcare providers on payment modalities.

Studies on costing health care packages play an important role in ensuring appropriate reimbursements to hospitals for Government sponsored health schemes and is also considered a priority area to inform strategic purchasing from private providers. The World Bank supported costing studies in Chhattisgarh and Karnataka, focussing on highly utilized packages of secondary and tertiary care of Government sponsored health care scheme of Rashtriya Swasthya Bima Yojana in Chhattisgarh and Vajpayee Arogyashree Scheme in Karnataka. These studies were then considered during negotiations with private providers in revising the scheme package rates. There is a need to put in place a process to produce rationally worked out procedural costs in tune with the present market conditions to help maintain a healthy participation of public and private sector health care providers in providing secondary and tertiary care.

Costing considerations in Government sponsored health insurance schemes: The case of Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY)

The Government of India is committed to ensuring that its population has universal access to good quality health care services without anyone having to face financial hardship. Under the ambit of Ayushman Bharat, Pradhan Mantri Jan Arogya Yojana (AB PM-JAY) was launched in September 2018 to reduce the financial burden on poor and vulnerable groups arising out of hospital episodes and ensure their access to quality health services. AB PM-JAY covers medical and hospitalization expenses for almost all secondary care and most tertiary care procedures, bundled as 1,393 treatment packages (revised health benefit package 2.0 includes 1,573 packages) including surgery, medical and day care treatments.(22)

Implications for costing of healthcare services

The cost of healthcare delivery varies significantly from one type of health centre to other due to differences in the very basic structure of delivery of services. As a result, methods to estimate the cost of delivery of these services should be comprehensive enough to capture the

The packages and rates for AB PM-JAY were mostly adapted from Rashtriya Swasthya Bima Yojana (RSBY) and other state sponsored health schemes. Since the launch of AB PM-JAY there have been requests by empanelled providers to review the rates fixed for reimbursement for these based on detailed costing of packages. In response, DHR initiated the costing of health care packages under Ayushman Bharath Pradhan Mantri-Jan Arogya Yojana (AB PM-JAY) in 13 states to inform both State Governments and the National Health authority, which is the implementing agency for this AB PM-JAY. The estimates from phase I of the study were considered by the expert committee of the National Health Authority (NHA) in the process of finalizing the revised package rates (Health Benefit Packages 2.0) However there are continuing challenges to collecting these data (see chapter 3.2.3) Many of the challenges can be addressed by adopting a hybrid model (top-down and bottom-up) and engaging stakeholders early and often (e.g., provier consultation). The costing team should ensure neutrality, objectivity and standardization of approach at all stages and take feedback from stakeholders through interim analysis presentations and clarifications of assumptions and grey areas. It is also important that procedure costs inclusions/exclusions as per the scheme guidelines such as food, travel, post-discharge, medications, follow-up, complications management are accounted for in final cost projections.

Requirements for costing in large-scale health insurance programs

When costing is used on a routine basis it can help negotiate better with stakeholders and avoid setting prices at unreasonable rates. Evidence on the actual costs of the procedure can help negotiating parties in coming to a consensus. Reasonable package rates prevent incentives that distort uptake of particular services by hospitals arising when there is under-pricing and overpricing. In both the state schemes as well as in AB PM-JAY low price procedures are less utilized while there is higher utilization of overpriced packages. For example, in one state the total hip replacement and knee replacement rates were very high which led to both overuse and abuse of those packages. To ensure that quality of care is also taken into consideration differential rates can be worked out once base rates are fixed. Package rates can be varied to take into account a number of factors such as location, accreditation and incremental costs for add-on facilities, case mix, etc.

There is a need to develop a standardized costing template to report costs annually or bi-annually. The costing reports would feed into updates of the package rates by AB PM-JAY on an ongoing basis. The review of the costing data would be required at regular intervals maybe once a year or at least every 2 years to have comparative data in place for decision making purposes

It also enables transparency and providing paying patients with an appropriate estimate of the cost of treatment and minimum rates for each state to adjust as required. This would help ensure that beneficiaries are not overcharged. To facilitate these updates, in-house capacity building to update costs regularly, review methods and appropriately interpret the results will be needed.

The finalization of package rates is not only dependent on the cost results. There will always be contextual factors that need to be identified and will help decide the agreed rates along with stakeholder inputs. For example, the volume of services expected can help in driving the costs down. Many times, the rates for rare surgeries requiring highly skilled manpower (rare congenital heart diseases) may be priced higher due to limited use, while commonly used procedures may be priced lower. Sometimes procedures prone to abuse such as appendicectomy, hysterectomy are also fixed at just the cost price so that there is no incentive to perform more of such procedures.

Other factors beyond the procedure which may dictate the rates include the prices of implants and consumables. For example, the rates at which consumables can be procured at government facilities using large tenders may not be available to small hospitals to negotiate with vendors. As a result, caution is required in choosing the appropriate procurement rates of specific consumables when deciding the package.

Finally, good cost data can also help in moving to advanced provider payment methods like diagnosis related groups (DRGs) to reimburse the health care providers.

Suggested key steps to improve cost data in India

- Encourage costing studies alongside program evaluations and strengthen cost accounting at healthcare facilities
- Enhance capacities of researchers to conduct costing using standardized approaches by developing costing templates and providing access to online courses and inclusion of mandatory module in public health courses
- Costing of public and private sector healthcare could also help as many governments sponsored health insurance schemes purchase health care services from public and private alike.
- Continue to document the experiences of the costing teams so that the data collection, analysis limitations are understood
- Use insurance claims data broken down by disease area both from private and Government funded schemes as a useful source to help understand utilisation and costs of services.

Summary

This chapter has dealt with different types of cost analysis, need and utility of cost data, key challenges for improving healthcare cost information in India and the importance of cost information to decision makers to make well-informed decisions.

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Principles of Costing for Healthcare Decision-making in India

Chapter 2.1 Basic Concepts of Costing

Dr Akashdeep Singh Chauhan

Overview

The present chapter focuses on understanding the technical concepts and terminologies related to costing with the special emphasis on the health system. Broadly, the chapter focuses on basic fundamentals in terms of defining the cost and its various classifications along with the perspective of costing. Each of the classifications is elaborated by giving various illustrations for better understanding and easy application in the real-world scenario.

Learning Objectives

After going through this chapter, the reader should be able to:

- 1. Understand the difference between health system cost and out of pocket expenditure
- 2. Differentiate between financial and economic cost
- 3. Understand different type of cost classification
- 4. Comprehend the perspective of costing exercise

Key definitions

- Cost: It is defined as the value of resources used to produce a given good or service or the amount of money spent by the producer in order to procure raw material in the form of capital, human resource or labour, material, etc. to produce the final product.
- **Price:** Price is the amount of money paid by the customer for purchasing that final good or service.
- Opportunity cost: The value of the next best alternative forgone as a result of the decision made.
- Marginal cost: It is the cost of production of one extra unit of output.
- Capital cost: These are expenditure incurred on those input resources that are expected to last usually for more than a year.
- Recurrent costs: These are outlays on those resources that are consumed within a year and needs to be regularly replaced within the year.
- **Fixed cost:** These are those costs that tend to remain fixed irrespective of the volume of output.

- Variable cost: These are those costs that vary with the increase or decrease in the volume of output. Cost of human resource paid as performance-based incentives, expenses on drugs, consumables, stationary, etc. are classified as variable costs.
- Start-up costs: Start-up costs are usually one-off expenditure incurred in the pre-launch period of a program or intervention.
- **Perspective:** The perspective is the viewpoint for costing that determines which type of costs is to be considered in the analysis. The perspective can be that of the health system, provider, patient, or society.

Defining the term "cost"

The words 'Cost' and 'Price' are often used interchangeably while purchasing any commodity. For example, the commonly used jargons are "What is the price of a particular therapeutic regimen or diagnostics" or "How much does a particular treatment or medicine cost"? However, there is a specific and distinct meaning of each of these terms. Cost is precisely defined as the value of resources used to produce something or the amount of money spent by the producer in order to procure raw material in the form of capital, human resource or labour, material, etc. to produce the final product. Price is the amount of money paid by the customer for purchasing that final product. In terms of business the difference between the price paid by the customer and cost incurred by the producer is the profit earned through this transaction. For example, if a customer pays ₹ 1000 for purchasing a particular drug and the company spent ₹ 800 for producing an selling of that drug, the company makes a profit of ₹ 200 on the sale of that drug.

With respect to health sector, the amount of money spent on the input resources i.e., on salaries/wages, building, equipment, medicines, material supplies, administration and other overheads is the actual cost of the health care. It is distinguished from health expenditures, often referred to as out of pocket (OOP) expenditure, as the amount of money paid for the services in the form of fees which refers to the amount charged, regardless of the cost.

Understanding and estimating the total cost of health care in India, is a somewhat complex issue. Health care in India is delivered both by public health facilities (through different levels of health system) as well as by private (both for profit and non-profit) clinics and hospitals. In the case of public sector, health care is financed by the government (referred to as health system cost) as the cost of inputs in the form of the salaries of human resource and expenditure on building/space, equipment, supplies and overheads is paid by the health system and patients are supposed to pay

highly subsidized price (OOP expenditure) in the form of user fees for accessing the public health services. But, in addition to this, patients also tend to supplement cost by purchasing medications, diagnostics and other consumables from the market since these may not be available free of cost in the facility .(1, 2) Thus, while estimating the total cost of health care in public health facilities; one needs to take into consideration the cost incurred on inputs both by the health system as well as expenditure incurred by the patients. However, the private (especially for profit) health sector operates purely on the principles of business, where by, the total cost of service is paid by the patients (i.e., OOP expenditure) for purchasing the health care. But here, one needs to be cautious and remember that price paid by the patients is not the actual cost of production of health care, as it includes a significant portion of profit also. (3) However, as we will see later, that from a societal perspective the OOP expenditure incurred by patients represents the cost of care in private for profit sector.

Financial versus Economic cost

Financial cost is the actual expenditure paid on the inputs for producing goods and services, reflecting how much money has been spent. Specifically, it "measures of loss of monetary value when a resource is acquired or consumed in order to carry out an activity." (4) It is primarily used to prepare budgets for financial planning and reporting purposes.

Economic costs are defined as the full cost borne by society irrespective of who pays for it. An economic evaluation is based on the concept of opportunity cost, or the cost of the next best alternative foregone. The economic cost of any health care intervention 'A' is the value of health benefits from other program such as 'B' which can no longer be pursued as resources in question are put into the first program. This is also known as the 'opportunity cost' of investing in program A. In other words, resources utilized in one programme are not available for use in other programs, and, as a result, the benefits that could have been achieved have now been sacrificed. Technically, the economic costs also include the cost of those resources (in terms of their opportunity cost) which are not reflected in the financial records such as volunteer time and cost of donated items. For example, a community health worker (CHW) working on a purely voluntary and unpaid basis, places an opportunity cost to the society. The time spent by CHW on health care service provision could have been used in doing some other alternative activities such as household chores or cultivating land. Another example is the opportunity cost of those unpaid intern students in a hospital, who in addition to their internship training also supports their supervisors in providing the health care.

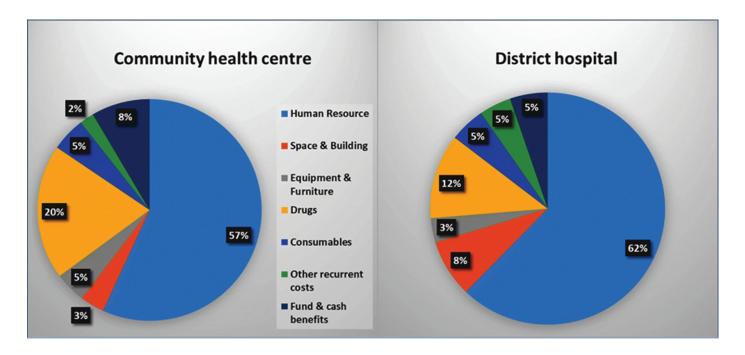
Cost Classifications

Costs are traditionally divided into based on traceability i.e., direct and indirect costs.(5) Direct costs are attributed directly to the implementation or continuation of a particular health intervention or service. These are further divided into direct medical and direct non-medical cost. Direct medical cost includes the cost of all those resources, such as human resource, capital, drugs, consumables, etc., used up in providing health care. Direct non-medical cost includes the additional expenditure (incurred by the patients) on transport, boarding/lodging, food, etc., while accessing the health care.

Indirect costs are expenses that are secondarily incurred in order to access service, but not on resources for direct provision of care. These could be due to cessation or reduction in the work productivity of the patients due to morbidity or pre-mature mortality caused by the illness. Indirect cost due to morbidity represents the lost earnings caused by loss in the work time because of the illness or disease. The indirect cost of premature mortality represents the loss in the future earnings by those patients who died prematurely.

Another important way to further classify direct costs is into capital and recurrent costs based on the inputs used. (5, 6) Capital costs are expenditure incurred on those input resources that are expected to last and provide services usually for more than a year. It constitutes cost of buildings/space, medical and non-medical equipment, furniture, vehicles, etc. Recurrent costs are outlays on those resources that are consumed within a year and need to be regularly replaced during that time period. It includes salaries of the staff and expenditure on drugs and material supplies. It also includes monthly payments on overheads like electricity, water, telephone, internet, postage, petrol/diesel, etc. Maintenance and operating cost of building and equipment are also considered a part of recurrent cost. A study on the cost of delivering secondary health care through public sector in India found that among the various inputs used in the provision of health services, recurrent expenditure on salaries constituted the major proportion of total cost, followed by spending on drugs and consumables as shown in Fig. 1.(7)

Figure 1: Input level distribution of annual cost at the level of community health centre and district hospital

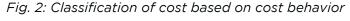


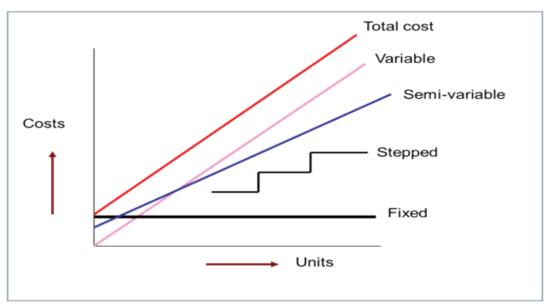
Source: "Cost of Delivering Secondary Healthcare Through the Public Sector in India", by Prinja S et al, 2020, PharmacoEconomics - Open, 4(2), p. 249-261(7)

Another classification divides the direct cost into fixed, variable, semi-variable and stepped cost based on the type of cost behaviour.(5) Fixed costs do not vary with the level of output, especially in the short run period. These costs are even incurred when there is no production or zero output (Fig. 2). Cost of human resources paid as monthly salaries (unless overtime is paid) and purchase price of equipment (not taking into consideration operating and maintenance cost) are some examples of fixed costs. In comparison to fixed costs, variable costs vary with the increase or decrease in the volume of output. Cost of human resource paid as performance-based incentives, expenses on drugs, consumables, stationary and other medical/non-medical supplies are variable cost. Considering the example of a laboratory in a hospital, monthly fixed salaries of the scientists/technicians and other administrative staff, cost of the equipment (like autoclave, microscope, freezer, incubator, centrifuge machine, etc.) and rental price of the space are classified as fixed costs as these expenses are ought to be incurred irrespective of the number of diagnostic tests performed by the laboratory. Further, the cost of supplies like reagents, polymer consumables, pipettes tip, etc. tends to increase or decrease based on the level output and is categorized under variable cost.

Stepped costs are a type of fixed costs that remain constant with the particular level of service output and increase to a higher level when the activity level reaches its threshold. For example, a doctor in an outpatient clinic of a health facility can provide consultation to a certain number of

patients per day (say 90-100 patients)). But, if the number of outpatient consultations is to be increased (i.e., beyond 100 patients), an additional doctor is required to be hired. Thus, the cost of labour has to be increased, if the health facility wants to provide outpatient consultation beyond the present threshold or capacity. Lastly, semi-variable cost has both fixed and a variable component. Considering an example of district malaria office (DMO), salaries of the regular staff are paid irrespective of the spread of malaria and thus are classified under fixed cost. But during the malaria season, wages paid to those contractual staff hired for household spray in the affected areas constitutes the variable component.





Another cost classification is based on the timing i.e., during the implementation phase of the program or intervention. In such manner, costs are classified as start-up and post start-up costs. (6, 8) Start-up costs are a type of fixed costs that are usually one-off expenditure incurred in the pre-launch period of a program or intervention. Thus, the investment during the period between the decision to start a health care program and its launch is defined as the start-up costs. The cost of micro-planning, developing material, training/mentoring, sensitizing/awareness constitutes the start-up costs. Subsequently, post start-up program costs are recurrent costs incurred on a regular basis after the launch and during the implementation phase of program. It includes the salaries of the implementation staff, expenditure on consumable supplies, overheads, project management meetings, annualized depreciative cost of the capital items and other maintenance/operational cost.

Lastly, an important distinction that needs to be understood is between the average and marginal cost. Average cost is defined as total cost divided by total output or number of services produced. Marginal cost, on the other hand, is the cost of producing an extra unit of output. It measures the

changes in the additional cost as level of output increases by one unit at a time. Marginal cost may not necessarily remain constant as levels of service output increases. Generally, with increase in level of output, marginal cost tends to decrease because of economies of scale. However, once the level of output increases beyond the maximum capacity of the production unit, given available resources, there is a sudden increase in the marginal cost. For example, if a surgical unit has reached its maximum capacity of operating, then one more surgery could only be carried out if an additional operation theatre (OT) is built and a new surgeon is hired. When performing an extra surgery well within the existing capacity of the OT may require a modest additional cost i.e., the cost of additional recurrent resources. On the other hand, while carrying out an extra surgery well beyond the capacity of the OT, will increase the marginal cost substantially because of the additional fixed costs related to building of new OT and hiring of the additional surgeon.

Perspective of costing

While undertaking any costing study, it needs to be very clear that what type of costs need to be considered in the analysis. The perspective is the point of view from which the costs are estimated. The 'perspective' decides which stakeholder's cost is to be included in the study. Ultimately, the choice of perspective is also dependent on the user (of the cost evidence) and their needs. There are three main perspectives (specifically relevant to Indian health system) i.e., health system, patient and societal perspective.(8-10) The health system perspective focuses solely on the cost incurred by the health system or government. The patient perspective includes cost such as the loss of patient's income and direct cost of treatment to the patient. The societal perspective is the broadest and considers all costs irrespective of who pays it (patients, the health system and all other relevant sectors). The societal perspective takes into account the opportunity cost of using healthcare, not only within the health system but from the effects that it has on the entire consumption of resources in society. In addition to these 3 perspectives, another way of looking at the point of view for cost assessment (based on the type of financing mechanism of a nation) is from a payer's perspective. When the health care is delivered through supply side financing system, payer's perspective tends to become equal to a health system perspective. However, in the case of a demand side financing (DSF) mechanism such as insurance, when the payer purchases care from a mix of public and private hospitals using case-based payments, payer's perspective for costing should ideally be equal to a societal perspective. However, cost estimates in this case are a bit underestimated. This is because valuation of certain recurrent resources, that were supposed to be purchased by the patients (in both public and private hospitals), is based on the

procurement prices set by the Government as against the true market prices that the patient would actually pay as OOP expenditure.

Health care providers or policy makers solely interested in estimating the government expenditure incurred on implementation of various public health programs (such as Revised National Tuberculosis Program (RNTCP), National AIDS control program (NACO), or Integrated Disease Control Program (IDSP)) or running public health facilities (sub-centre or a district hospital) should undertake the cost analysis from a health system perspective. On the other hand, a researcher solely interested in patient level expenditures incurred on the treatment of an illness, should carry out a study from a patient perspective. Estimates of health care expenditure released by the National Sample Survey Organization (NSSP) are typical example of patient level OOP expenses (direct cost) incurred on the treatment of various illnesses (separately for public and private hospitals) across states in India. It is crucial to specify a viewpoint since an item may be a cost from one viewpoint but not from another. For example, the costs incurred by patients in travelling to the health facility are costs from the patient's perspective and from the societal viewpoint but not a cost to the health system.

A researcher interested in a cost effectiveness study should ideally undertake a societal perspective so as to incorporate all the costs and benefits accrued from the intervention under study. Consider an example of economic evaluation of Indian Integrated Management of Neonatal and Childhood Illness (IMNCI) programme. This program aims at not only reducing morbidity but also seeks to bring about a change in the treatment seeking behaviour of the population to increase utilization of community health workers (CHW) through their skill up gradation and reduce child mortality by early treatment seeking/timely referral and improved clinical practice of healthcare providers along with strengthening of supply of drugs and consumables in public health facilities. Given that most health expenses are borne OOP by the households in India, if the researcher had considered only the program health system costs, he/she could have missed the large amount savings on account of decreased OOP expenditure due to both reduced morbidity as well as change in treatment seeking from the private to the public sector. Thus, a complete societal perspective seems to be more sensible in highlighting the economic benefits of implementing an IMNCI program.

Conclusion

The present chapter states the need of having a clear understanding of some basic concepts and terminologies related to cost analysis. It starts with the importance of having a complete understanding on the type of cost and its relevance in how to

analyze the cost data followed by mentioning the significance of choosing the appropriate perspective for the costing study. Lastly, the chapter also states the importance of estimating cost in different ways for different purposes.

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Chapter 2.2 Costing Methodology

Dr Akashdeep Singh Chauhan & Dr Shankar Prinja

Overview

Before undertaking any type of costing exercise, one needs to decide on the perspective, appropriate time horizon and a costing approach. The previous chapter gave a detaile description on the type of perspectives. The present chapter describes the importance of the appropriate time horizon to be considered for the costing analysis. The chapter then describes the various costing approaches that are used and the advantages/disadvantages of each of them. The last section of the chapter focuses on determining the appropriate costing approach for estimating the cost of health care delivery in India.

Learning Objectives

After going through this chapter, one would be able to:

- 1. Determine the appropriate time horizon for cost data collection
- 2. Understand the process of cost measurement by various methods
- 3. Learn about the advantages/disadvantages of each of the costing approach
- 4. Determine the ideal approach for estimating the health care costs in India

Key definitions

- **Time Horizon:** The time period for which resource use is measured and valued for estimating cost in a study.
- Cost centres: Cost centres are well defined service units involved in the delivery of a specified service or activity.
- **Top-down costing:** A top-down approach to costing assesses the data on the cost of total resource use by a health facility or department and then allocates it to the various services delivered within the facility or department.
- **Bottom-up costing:** A bottom-up approach to costing estimates the cost of a particular narrowly defined service or activity through direct measurement of resource for that defined service or activity.

• **Normative costing:** Normative costing is a special type of bottom-up costing approach that measures the resource use for a particular health service based on standard treatment guidelines instead of resource use in practice.

Time horizon in costing

Estimates of a costing study can be based on the data covering different time periods from a week or a month, to a quarter or half year or even a complete year. Before initiating the data collection, it is important to decide the appropriate time horizon or data period of the costing study.(1-4) Inappropriate time horizons can bias the results and mislead decision-makers. A researcher should consider choosing a time period that will be able to capture the current clinical practice and utilization patterns. Usually, an annual time frame is considered to be appropriate for a costing analysis, because it captures one complete budgeting cycle and can account for seasonal variability in the pattern of service utilization and resulting resource utilization for their treatment and management. Selecting a time frame that extends beyond one year or to multiple years is usually not recommended, as there can be a significant regulatory changes and modifications in clinical practice over a long-time horizon.

Costing Approaches

Costing approaches differ by the methods and principles used to classify and capture resource use for estimating the cost in the production of an activity. The two most commonly used approaches for estimating cost of delivering health care services are the top-down and bottom-up approaches.(2,5-9) The main difference between these two approaches is that the bottom-up technique relies on direct measurement of the resource use for estimating the cost of a narrowly defined health service, while the top-down approach, firstly assess the data on the cost of total resource use by a health facility or department and then allocates it to the various services delivered within the department.

Top- down approach

Top-down costing starts by capturing the total cost of entire resources consumed by the health facility. The total facility cost is then allocated downwards to various departments and finally to various services delivered within the department. Expenditure data available in the accounts and management records of the health facility is often used to assess the total health facility or department cost in the top-down approach.

In this method, department level cost is either directly assessed (based on the availability of data from the accounts record) or total facility cost is divided among the various departments of the facility either equally or based on some allocation statistic such as building usage, staff numbers, etc. After assessing the department cost, it is then further allocated between various services centers (such as outpatient clinics or inpatient ward) either equally or based on certain allocation criteria (e.g., staff time and number). Finally, the cost assigned to each service center is divided by its service volume (e.g., number of outpatient consultation, hospitalizations, etc.) to estimate the average cost of the resource use in providing that service. The average costs, as estimated in the top-down approach, are presented in the form of cost per outpatient consultation, cost per hospitalization or bed-day, cost per procedure or surgery, etc.

The following example of estimating the average cost of a surgery and hospitalization in the surgical department of a multispecialty-hospital demonstrates the use of top-down approach. Firstly, the total cost of all resources spent by the surgical department are either directly measured or estimated by dividing the total facility cost among its various departments. This department cost includes salaries of the department staff (both medical and administrative), expenditure on consumables (drugs, medical supplies) and overheads and depreciated price of capital items (medical/non-medical equipment, building, furniture, etc.). In addition to this, cost is also allocated from departments that provide indirect or logistic support (laboratory, catering, laundry, etc.) to the clinical departments. After obtaining the total departmental cost, this is further either equally or proportionally allocated (based on allocation criteria) between the various service units of the surgical department, i.e., outpatient clinics, inpatient ward and operation theatres. Allocation between the different services is done using a statistic that captures the likely balance of resource use, for example, floor space or staff time. Finally, to arrive at the average cost of surgery and hospitalization, the cost allocated to the operation theatre and inpatient ward is divided by the number of surgical procedures performed and number of patients admitted respectively.

Bottom- up approach

The bottom-up approach aims to estimate the cost of a narrowly defined health service or patient group through direct estimation of the resource use for that service or patient. Under this approach, "unit cost estimates are built from the individual service or patient level upward, and then the average cost for a particular service or patient group is constructed".(9) This approach measures the actual quantity of resources consumed in the delivery of a specific health service or treatment of a particular patient group and then assigns a monetary value to each of those

resources to estimate the unit cost of a respective health service or patient treated. This method requires primary data collection for measuring the resource use (Table 1). The data collection can be employed prospectively or retrospectively using medical records, questionnaires, direct observation or expert opinion. For example, direct observation and medical records are sought to assess the doctor's time spent and the quantity of various drugs and other medical supplies consumed in delivering a specific health service respectively. However, in the case of overheads, instead of direct estimation of resource use, the consumption of overhead across each patient or individual service is usually based on overall hospital or department consumption and allocation statistics, as also used in the top-down approach.

The following is an illustration of estimating the average cost of performing a cardiac artery bypass grafting (CABG) surgery in the department of cardiovascular and thoracic surgery (CVTS), explaining the steps followed under bottom-up approach. Firstly, the quantity of all the resources consumed in the delivery of cardiac bypass surgery is directly estimated. This involves documenting the time spent by various staff member (doctors, nurses, and other medical staff), measuring the time usage of various capital items including space and equipment (e.g., operation table, suction, scissors, forceps, needle holders, occlusion clamps, etc.) and estimating the quantity of various consumables and medical/non-medical supplies consumed during the surgery. The mean estimates of such resources consumed per patient is estimated based on either a prospective data collected over a sample of patients or retrospectively based on analysis of existing medical records. Further, as overhead consumption is available either at the level of department or service center, overheads are either equally distributed across every type of surgeries undertaken in cardiology department or are proportionally divided across specific type of surgery based on certain allocation criteria such as proportional operating theatre time used for CABG. The second step involves identifying the monetary value for each of the resources consumed in performing the surgery and multiplying it with the volume of resource consumption (for material supplies) or time spent/time usage (in case of human resource and capital items) to estimate the cost of resources consumed while performing the CABG. This unit cost measurement is repeated for a series or sample of patients undergoing cardiac bypass surgery, to construct the average cost of a bypass surgery.

Normative costing

Normative costing, also known as costing based on clinical care pathways, is a special type of bottom-up costing approach that measures the resource use for a particular health service based

on a standard treatment guidelines instead of the data from the actual settings. This type of costing process is suggested when one believes that costing should be based on the standard clinical guidelines instead of how they are delivered in the field settings. Thus, normative costing provides results for "what ought to be" instead for 'what actually is'. In some cases, due to time and data constraints, researchers use this approach for estimating the unit costs of interventions.

Table 1: Comparison between top-down and bottom-up approaches to costing

Parameters		Top-down	Bottom-up
Resource assessme nt	Personnel	Total expenditure incurred on salaries is determined at the facility level, which is then allocated among services delivered within various departments.	Personnel time spent on individual service or patient is directly estimated and its cost is determined.
	Materials (Drugs and supplies)	Total expenditure incurred on the materials used by the health facility is determined and is then allocated among services within various departments.	Quantity of materials consumed on particular health service or for individual patient is directly measured and its cost is determined
	Capital items (space and equipment)	Depreciated price of all capital items (currently in use) in the health facility is determined and is then allocated among services within various departments.	Time usage of various capital items used in the delivery of particular health service is directly measured and its cost is determined
	Overheads (administrative costs and utilities)	Total expenditure on overhead incurred by the health facility is estimated and is then allocated among services within various departments irrespective of the idle time.	Total overhead use is estimated at the department level is estimated and is then allocated to individual service delivered within the department.
Advantages		Less resource and time consuming	Standardized data collection methods on the resource consumption
		Easier to implement as it relies on routinely documented accounts data	Ability to trace the contribution of each input to the cost of individual health services.
		Permits use of more aggregate data	Allows undertaking cost analysis in relation to difference in the volume and mix of resources.
Disadvantages		No account of the extent of inefficiency or idle capacity.	More time and resource consuming
		Accuracy of cost estimates is dependent upon the availability, quality and transparency of the secondary data.	Requires a comprehensive medical records or hospital information system (HIS) to be in place.
		Does not provide any information on cost differences related to difference in the resource mix or volume, price and treatment guidelines.	Being very complex, it is difficult to cost each and every service delivered by the health provider

Advantages and disadvantages: Top-down versus bottom-up

There are certain advantages and disadvantages of using each of these methodologies (Table 1). In some instances, due to lack of detailed data on the resource utilization, the top-down approach is the only feasible option. Further this approach is also usually cheaper, faster and simpler to perform, since it requires overall facility cost data that is routinely collected in the accounts and management records of the facility. The main disadvantage of top-down valuation is that there is no account on the extent of inefficiency or idle capacity. However, this can be corrected during the analysis using standardization methods. Further, the specific contributions of different types of resource input towards the cost of a particular service may not be as accurately identified as in a bottom-up approach.(10) The bottom-up approach with a more detailed and comprehensive methodology directly assesses the consumption of each and every resource consumed in the delivery of a service and removes any idle capacity or inefficiency. However, the accuracy of this approach must be weighed against its limitations. Firstly, it can be very time consuming and costly. It also generally requires comprehensive medical records or health information system (HIS) to be in place for providing rich data on quantity of each input used in the delivery of specific services. Moreover, this approach may overlook or underestimate those resources that are consumed outside the observation period.

A study comparing these two approaches based on national data from United States of America, concluded that both of the approaches might be accurate but have different objectives. The top-down approach is ideally suited to monitor national long run average costs, while the bottom-up method is more suitable to assess the facility level differences in cost estimates.(5) Another study on assessing the cost of scale up of tuberculosis program by applying these 2 distinct approaches, concluded that the cost estimates were highly dependent upon the type of methodology used. An approach which clearly identifies the resource use data together with measurement of capacity utilization was recommended to be a pragmatic approach.(6)

Determining the type of costing approach for India

The appropriate costing approach to be followed is dependent on the country context, time/resource availability and based on the trade-off between advantages and disadvantages of each of the costing approach. Although, some stakeholders argue that bottom-up costing is more appropriate because of accuracy in the cost estimates, however, estimating the cost of each individual service for every patient group becomes an exhaustive task due to the complex nature and time and monetary constraints in the direct measurement of resource use. On the other hand, while top-down approach is less time consuming and less costly to implement, it suffers from its shortcomings. Considering the organizational nature of health financing in India, a proportion of

total resources (both capital assets as well as material supplies) present at the health facility could be either donated or the procurement may have been done above that level of health facility. Since the account records of the health facility would only include the details on expenses incurred by the facility itself; it does not capture the data on cost of the resources received directly from higher levels and for which payment was done elsewhere. So, measuring the total resource use based on the information from account records, may miss out the expenditure incurred on certain items that may leads to underestimation in the final cost.

Considering the pros and cons of both the costing approaches, a type of costing approach is required that is both cheaper and easier to implement than the bottom-up methods and also tends to be more accurate than top-down technique. Considering the mechanism of financing in India, a variant of the classical top-down approach which we term as - fine or granular top-down technique -is recommended as it accomplishes both the above-mentioned objectives. This approach aims to directly estimate the value of resource use at the level of service centres rather than entire department or health facility and then allocates it downwards to various services delivered within the service centres. Secondly, instead of allocating the cost of a cost centre to individual services equally, time allocation statistics such as proportional time spent on individual services are used. As a result, this approach directly measures the volume of resources (including the donated items) consumed in the delivery of health care. In addition, it does involve making observation or interviewing the staff for time allocation on various activities. Finally, by estimating the resource use at the level of service centre and not for individual patients or services simplifies the data collection and saves time and resources.

Conclusion

This chapter shows how it is essential to have a complete understanding of the services to be costed and the process of cost measurement by both top-down and bottom-up approach before undertaking a costing study. In addition, when carrying out cost analysis the country context, the drawbacks of each of the approach and resource constraints within this context must be considered before choosing between costing approaches.

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Chapter 2.3 Data Collection and Quality Assurance

Dr Jyoti Dixit

Overview

Economic costing of health services involves several sequential steps including identification of input resources, estimating resource use, valuing resources in monetary terms and determining the service outputs. The number of steps and complexities of cost data collection make it a challenging task especially in mixed health systems, such as the three tier Indian public health care system, with its dominant private sector, and where there is no or limited routine cost data. At the outset of data collection, it is essential to be clear of the purpose of the costing and determine and outline the best way to undertake this complex task in respect of this. This chapter elaborates on the standard approaches to cost data collection and the data collection process for all cost centres, identifies the sources of various types of data and finally proposes measures to ensure the data adequacy and quality.

Learning Objectives

By the end of this chapter the reader will be able to:

- Identify the reliable methods for cost data collection
- Identify the various sources of data for costing of health care services.
- Understand the key challenges faced during cost data collection and the potential solutions
- Determine adequacy and quality cost data.

Approaches to cost data collection

Health system costs refer to the cost of resources consumed in the process of developing, implementing, operating and delivering a health service. Conventional costing methods are characterised by how the two main cost components are addressed i.e. the identification and valuation of inputs. Micro-costing or gross costing are used in the identification of inputs whereas top-down or bottom-up approaches are used for valuation.(1)

In gross costing, a highly aggregated cost of service is used, such as cost per bed-day hospitalisation or total cost provided for implementing a programme.(2) According to Global Health Cost Consortium (GHCC), a gross costing approach simply estimates all relevant costs, typically from program expenditure data, and divides this by the associated outputs such as patient episodes. Gross costing may also be done using tariffs and fees.(3) However, there is a

more accurate and detailed method to estimate intervention costs using a micro-costing approach. Micro-costing involves direct enumeration and costing of each input resource consumed for delivering the health care service.(4) Micro-costing is also a foundational principle of activity-based costing (ABC) wherein resource use is identified and quantified for each of a defined set of mutually exclusive and exhaustive activities to determine how costs are allocated across the activities.

Top-down and bottom-up costing can be used in both micro-costing and gross costing.(5) Top-down costing involves the allocation of resources across different activities/cost centres and is usually used in the case of shared resources and those resources which contribute a small proportion of overall unit cost such as overheads. The bottom-up approach requires the identification and valuation of each input for a specific service and is most often used for resources which are exclusive to a given service or contribute a large proportion of the overall cost such as Human Resources. In this chapter, we focus on methods of data collection for micro-costing to estimate the costs of intervention inputs, although the methods described below could potentially be applied to measuring overall costs in the context of gross costing approach as well.

Processes in cost data collection using different costing approaches

For the costing exercise to be undertaken efficiently and in line with the needs of stakeholders, a clear work plan needs to be agreed and followed. Inadequately planned costing exercises may lead to repeated visits to healthcare facilities, increasing the time and resources spent on data collection and even irrelevant data. It is recommended that a stepwise approach should be followed when carrying out any type of costing exercise – as laid out in (Figure 1):

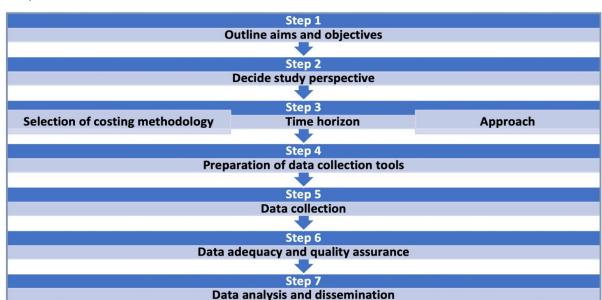


Figure 1: Steps to undertake cost data collection

Step 1: Outline the aims and objectives of the costing exercise.

First, the aims and objectives need to be clearly described and all the services to be costed need to be listed. Researchers should identify any existing data sources, facilitators and likely barriers in obtaining data, the timeline for conducting the study and financial considerations. It is also important to involve all stakeholders in the process before the initiation of actual data collection. This will streamline the data collection process and help ensure the acceptance of results.

Step 2: The perspective of the study should be decided on the basis of policy question.

The perspective indicates which costs should be included. There are four types of perspectives namely healthcare sector (includes all health service-related costs incurred by either patient/ provider), health system (costs incurred by the provider only), patient (costs incurred by the patient only) and societal perspective (all costs including health system and patient-direct and indirect).(6) The patient perspective includes assessment of both direct health care costs i.e. the costs incurred on drugs, user fees, laboratory investigations, surgery, transportation, informal payments etc. by the patients and indirect costs due to loss of productivity or wages. Researchers should clearly define the inclusion and exclusion criteria for the costing study. For example- whether to include the indirect patient costs due to productivity losses or not, keeping in consideration the time constraints, budget and aims of the study. The choice of perspective also depends upon the context and nature of the service being delivered. For example-in order to estimate the cost of reimbursement packages for surgical procedures, the cost of implant incurred by the patient also needs to be incorporated. Hence, the healthcare sector perspective is preferred.

Step 3: Selection of the costing methodology

Costing methods in economic evaluation generally fall on a spectrum between a bottom-up approach and a top-down approach. These two methods come with trade-offs between accuracy, precision and research burden. The choice of costing methodology should be based on stakeholder priorities and availability of resources and data. Key indicators like time horizon, approach for data collection (whether prospective/retrospective) and data period (whether year or months or hours) must also be well defined.

Step 4: Preparation of Cost Data Collection Team and Tools

An important task for ensuring the proper conduct of cost data collection is to focus on building a strong data collection team and their training. Further, hands on training and on-site support

from the Central Supervisory team after the initial training should be promoted. The staff should be informed in terms of medical terminologies, time allocation measurement and steps to be followed while collecting cost data in various kinds of cost centres (outpatient department, operation theatre, Laundry, Dietetics etc.) There should be more time spent on practical activities during the training and frequent (quarterly) trainings and workshops should be held. Visit to data collection sites by the supervisory team should be done to overlook data collection and provide guidance, especially with regards to data collection on revenue, time allocation and shared costs.

Quality assurance

Quality assurance is of great importance, to ensure standardisation and comparability especially in the context of a multi-centre study. Key quality assurance strategies that need to be considered include four levels of quality checks, namely checks during data collection, data entry, data sharing and finally on receipt of the data. During data collection, correctness and appropriateness of data should be checked, for instance cross checking of time allocation hours. At the time of data entry, correctness of entry should be checked. Before sharing with the central team, the data needs to be verified by a field supervisor. Finally, the central team should identify data gaps and discrepancies and communicate these with the field teams. Teams should then address those gaps by clarifying doubts, recollection of required data and re-entry of any incorrect data.

Data collection tool

The data collection tool should be comprehensive enough to include all sources: all capital or recurrent resources consumed for delivering the health care services during the reference period; the data required for computing apportioning statistic for shared resources (for example, in order to estimate the cost incurred on medical equipment used in a specific surgical intervention); and data on the use and cost of specific surgical equipment used in the operation theatre. Service use data is important for generating the apportioning statistics for estimating the share of total cost incurred on shared medical equipment, for example, a particular surgical intervention.

Micro-costing data collection tools include a number of different items including standardized comprehensive questionnaires, targeted questionnaires, activity logs, administrative databases, and direct observation (see Ch 3.2 of this manual for more details). These tools are not mutually exclusive and often used in combination. Each of these has certain merits and limitations and some may be more useful than the others under different circumstances. Considered application of micro-costing data collection tools appropriate to the context can produce quality cost estimates.

Step 5: Cost data collection

Data collection needs to take place across different cost centres within a single facility. Cost centres are well-defined services, products (departments or service units) for which costs are accumulated.(7) The first stage of cost data collection is therefore to identify all cost centres in a given sample of health care facilities. The cost centres can be classified as primary and secondary care cost centres. The primary care cost centres are further divided into direct and indirect care cost centres. The direct care centres include outpatient department, inpatient department (General and private wards), operation theatre while indirect care centres include pharmacy, diagnostic laboratory etc. The secondary care cost centres include overheads such as dietetics, laundry, central registration department, electricity, water, reception, administration, maintenance, transport (ambulances), security, telephone etc.

For each cost centre, all resources being used should be identified with the help of the data collection tool. The volume/number of resources being used should be measured and finally, the unit cost of each resource consumed should be collected in order to compute total expenditure incurred on each resource used. In addition, data on service outputs and beneficiaries is required. During the cost data collection careful attention should be paid to those resources that account for the major portion of total costs. All cost data should also be categorised under five domains- Human resources, Building space, Drugs and Consumables, Medical equipment and Non-consumables and Overheads. General principles for collecting data for each of these items are outlined below.

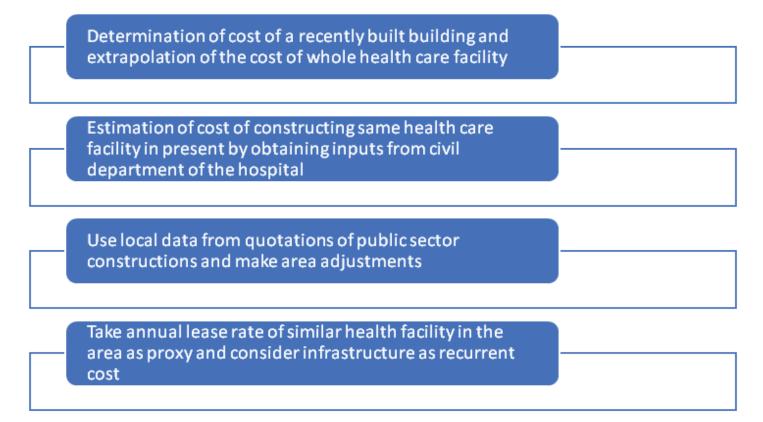
Human Resources: Data on cost incurred on human resources is determined by estimating the time spent by health personnel in delivering each health care service. All levels of staff (whether regular or contractual) involved in delivering the health care services including consultants, resident doctors, nurses, operation theatre assistant, laboratory technician, health attendants, sanitary attendants etc. should be included. Time spent by each cadre of staff on different services/activities can be obtained by various methods with actual observation being the most reliable one. Other methods used for assessing the proportional time spent by the health care provider are review of duty rosters; direct face to face interviews; and proxy interviews in the absence of the health personnel to be interviewed (e.g.-resident doctors interviewed in place of consultants for collecting data on daily activities of the consultant).

The HR cost should be evaluated for resources used in a specific cost centre only. If human resources are involved in multiple cost centres or activities, they should be interviewed to obtain information on their time in each cost centre/activity to estimate the proportional cost to each cost centre/activity.

Data on salary, along with other allowances (including housing, per dimes etc.), also needs to be obtained for each staff member in order to estimate the full value of their time dedicated to aparticular activity. The salary slips can be obtained from the accounts department of the institute or health facility. In the absence of such records, the researchers may consider collecting this data by interviewing the health personnel.

Building space: Information regarding space can be collected by obtaining building map records from the hospital engineering department of the institute. Records of area may not be available hence physical measurement of area may be required, which can be resource and time intensive. Most of the hospitals have tiled flooring, counting the number of tiles multiplied with size of tile gives a good estimate of the area. After obtaining the data on building space, estimation of land and building costs should be done. However, it is challenging in Indian context because data pertaining to cost of construction and renovation is not available. This is usually done by making some realistic assumptions or proxies as illustrated below in Figure 2:

Figure 2: Alternative Proposed Methods for the Estimation of Land and Building Costs



Drugs and Consumables: Data on quantity of drugs and consumables can be obtained from stock registers of respective cost centres/departments. For shared resources, data on consumption/use should also be obtained for computing the share of total cost incurred for a particular speciality/treatment. The optimal source of data on the use of drugs is observation of drug usage. Where observation is not possible due to data quality or time constraints, the next best alternatives are standard treatment guidelines (which recommend the list of specific drugs and quantity to be used for a particular health condition) and expert opinion. Additionally, unit prices of drugs and consumables need to be obtained to derive the total cost incurred on drugs and consumables. Price data is often found in hard copy form and can be obtained from the concerned officials (store head/pharmacist) of the central procurement store of the facility. Where price data is not available from the central procurement branch, a market survey or interviews with experts can be done. However, the use of market prices may result in overestimation of the cost as, depending on the facility, drugs and consumables are purchased through bulk purchasing at a reduced price.

Medical Equipment and non-consumable items: These two categories of input fall into capital resources (used for more than a year time span). Information on the quantity of medical equipment and non-consumables used can be collected from stock registers of respective departments. This can be obtained by consulting the technical-in-charge of the unit. Data on year of purchase and prices of medical equipment and non- consumables can be obtained from the purchase department/cost centre in charge/ store head and in the absence of these, market surveys may be done. It is important to note that physical observation should be done along with the record review as there may be discrepancies between records and physically present equipment. In addition, it is important to collect data on the average life of capital equipment. In the case of hospital services, the use of equipment in different surgical procedures must be collected as equipment account for major costs for these services, resulting in a need for greater detail. These data may be obtained from staff involved in the surgical procedure such as O.T. assistant, technician, nurses, resident doctors or consultants. The annualized cost of these capital resources is then estimated considering the expected length of life of the equipment and a discount rate of 3% (see also chapter 2.5).(8)

Overheads (e.g. utilities): Data on overheads including water supply, electricity, laundry, maintenance etc. is usually not available for a specific cost centre/department. In such cases, pooled facility level data may be obtained, and cost centre specific data can be calculated by apportioning the entire facility level cost based on various criteria. Methods for apportioning can be elicited from the literature, for example- cost incurred on water supply and electricity for a specific cost centre can be computed by apportioning based on floor area.(9-10) Therefore, additional data on floor area of entire health facility and cost centres must be obtained to compute the apportioning statistic. For other overheads like laundry, data on number/weight (of bedsheets, gowns etc.) washed in last one year would be required. In the absence of physical records, actual observation can be done to have an average number of items or weight of items washed in last one week/month and then extrapolating it to one year.

Data on beneficiaries/service outputs: Information on number of beneficiaries such as outpatient consultations, inpatient admissions, inpatient bed days is required in order to compute the unit cost per outpatient consultation, per bed day, per hospitalisation etc. This information can be obtained from medical records at the Central Registration Department (CRD) of the facility. To obtain details on surgical procedures carried out, information on number of surgeries may be obtained from operation theatre registers etc.

The types of data sources for each input category will vary across facilities. Figure 3 describes typical sources of data for the various data items as found in a sample of 11 tertiary facilities.(11) At this time, there is little data available electronically in India. As a result, it is important to factor in time for recording and entering data.

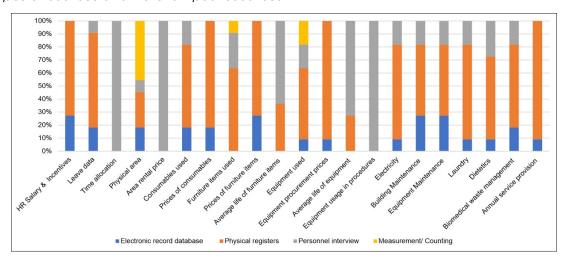


Figure 3: Types of sources of different input resources

Source: Reprinted from "Process evaluation of health system costing - Experience from CHSI study in India", by Prinja S et al, 2020, PLOS ONE 15(5): e0232873.

Step 6: Ensuring data adequacy and quality assurance

During data collection the data collected needs to be validated and ensured for data adequacy and quality, using reliable methods. This quality assurance is of great importance, in particular when ensuring standardisation and comparability in multi-centric studies. Quality can be ensured by having different levels of quality checks, namely checks during data collection, data entry, data sharing and finally on receipt of the data. As numerous input resources with distinct data collection methods are required, checks need to be rigorous and are time consuming. Examples of data checks include: the correctness and appropriateness of data, for instance cross checking of time allocation hours; and correctness of data entry.

Additionally, factors such as nature of costing (prospective or retrospective), costing methodology (top down or bottom up), form of data, number of people involved and willingness to share data, define the kind of challenges and time delays that may be faced during data collection.(12) Operational and methodological issues in cost data collection are further enhanced in developing countries like India with increased time taken to collate, input and assure data quality due to limited data availability, multiplicity of sources and unavailability of digitized data.(13-14) Recommendations for addressing key challenges in data collection processes are provided below (domain wise):

- Human resources: Collecting data on human resource time allocation involves personnel interviews and requires willingness and time of the personnel which makes it a challenging task. Another concern is that people generally tend to over report the time devoted to a particular activity in routine. This can be rectified by aggregating the time reported by the personnel on different activities and assess if it is more than their total working hours. In such cases, re-interviewing of those personnel concerned is the only option.
- Building area & valuation: Determination of building rental price is also challenging with wide variation in the estimates from different sources. The most common sources are market survey and housing rentals in the same area. The different sources can be used to obtain a range of estimates for triangulation or to obtain a mean value.
- Equipment & furniture: Determining the average useful life of equipment & furniture items is a difficult exercise due to the absence of records. The most used method is expert opinion for this estimate. Secondly, physical observation of health facility is also important in order to cross check equipment & furniture lists with physical observation was found to be essential, to determine the functional status of the items. The items which are not used or are non-functional during the reference period cannot be attributed to patient care and would lead to overestimation of cost estimates.

- Price data sources: The price data for consumables, furniture items and equipment are often scattered, and multiple sources are required to obtain complete information. The most common source of consumable and equipment prices is the procurement office or central store, followed by online sources (such as online price databases, procurement portals). However, the prices obtained from online sources tend to be higher than the procurement prices as centrally procured items are purchased through bulk purchasing mechanisms and hence have lower prices than market prices. Additionally, information from the State Medical Procurement and Supplies department may also be sought for equipment prices. For furniture items prices, the central and departmental stores of the health facility are the main sources.
- Lack of availability of electronic databases: The most common source of data available is physical records maintained in respective departments of the hospital. Permission is required to photograph and due to the huge volume needs more time for collection and data entry. In other cases where the required data is not available, expert opinion can be sought. However, expert opinion might overestimate the cost estimates as they are more likely to be driven from standard treatment guidelines and would differ from actual clinical practice and consumptions of resources for delivering the service for a particular ailment. Therefore, the source of data needs to be taken care considering its implications on final cost estimates.
- Shared costs: Shared resources often require additional data collection to enable apportioning of shared costs. The additional data includes the duration of procedures conducted in the same premises collected through staff interview, number of patients sharing common resources collected from hospital records, time schedule of operation theatre collected from the hospital administration and use of consumables /equipment in different procedures.

Step 7: Data analysis and dissemination of results

After ensuring all the relevant data has been collected, ensuring the data adequacy and quality, analysis is done to arrive at the unit cost estimates of health care services/interventions. This should include aggregation of the data and sensitivity analysis. Sensitivity analysis is a way to address the extent of uncertainty in the results and outcomes of health system cost data analysis due to underlying assumptions in terms of methods used (gross costing or micro-costing, top down/bottom up), source of price data (online sources/procurement prices), apportioning statistics used (number of beneficiaries/ times taken to deliver the health service) etc. Analytical approaches are discussed in chapter 2.5. Finally, dissemination of cost estimates is done for policy implications.

Conclusion

Improving methodology and practical implementation of costing studies will improve the quality of estimates being generated and ultimately aid national priority setting. For implementation of costing studies, having clearly outlined outputs, conducting a pilot test, having a quick communication between the data collectors and central team, specific quality checks and assumptions, are key considerations. In addition to practical aspects, it is essential to strengthen the health system to aid costing studies. Developing electronic health records, having nationally representative cost data databases for reference in case of data unavailability and developing guidelines on costing in Indian settings are key challenges. The considerations discussed in this chapter require careful forethought, and proper application can produce quality cost estimates, which in turn will enhance the usefulness of economic evaluations to inform resource allocation decisions, planning and sustainability for effective health interventions. Future research can address the standardisation, validity and reporting of cost data collection tools, which can further improve the confidence and utility of intervention cost estimates in practice.

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Chapter 2.4 Data Collection Instruments

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Overview

This chapter introduces the cost data collection instruments, highlighting the practical aspects and instruction for field workers about data collection. The important aspects of the cost data collection tool are broken down into several snapshots and explained. This chapter also provides an overview on how data is collected, and the cost data collection questionnaires are completed.

Learning Objectives

By the end of this chapter, the reader will be able to:

- Use the cost data collection tool for engaging with officials of a health facility for gaining permission for data collection
- Understand about the type of cost data required from a whole health facility-public / private or a particular cost centre of a health facility.
- Understand the practical aspects that need to be taken care of while collecting cost data.

Introduction

The aim of this chapter is to detail out healthcare cost data collection instruments, tailored for the Indian healthcare system. The cost data collection tools have been designed to collect data for the estimation of healthcare facility costs as well as the health benefit packages of public health insurance programs in India. The instruments or tools outline the type of cost information needed from different types of health care facilities in India and can be used by researchers and practitioners carrying out cost data collection in any public or private facility in India. The data collection instruments are based on day-to-day experiences of a network of international and local experts and can be adapted to a variety of contexts. Conceptualized by the Joint Learning Network with countries from South East Asia,(1) they have also been tested in cost studies from India.(2-5)

Cost data collection tools are used in many low- and middle-income countries where the information required to estimate health services costs might not be fully recorded and digitized across different types of healthcare facilities. While the Government of India is in the process of full digitization of healthcare provider facilities and many state governments have taken positive

steps in this regard, many healthcare facilities still lack this capability.(6) Digitization of health management information systems and medical records at the healthcare facility level would simplify the cost data collection and compilation of these The cost data collection instruments follow the methodology recommended by the HTAIn reference case. (7) Accordingly, the costing exercise uses a health system perspective, estimating the full costs of providing treatment. A bottom-up approach to costing is used as far as possible where all resources used for providing health services are documented and valued at the current market prices. Guidance is also provided for adaptations to this approach where cost data is not available and further data is required to apportion costs between different procedures or units in a particular cost centre of a healthcare facility. Thus, ultimately unit costs of providing a healthcare service at a particular healthcare facility is derived.

This chapter outlines the data needs and general instructions to fieldworkers carrying out the data collection; a list of all the data requirements and finally some practical considerations for the fieldworkers and data entry team when compiling the data.(8,9) These can also be found on the HTAIn website and the National Health System Cost database.

(https://www.healtheconomics.pgisph.in/costing_web/)

General approach to data collection

Identification of the data needs

A bottom-up costing methodology requires data on all the inputs used to produce an output. The following list identifies the broad data needs for the study that should be collected for each specialty/facility to be costed:

- 1. List of human resources: Includes doctors- Consultants (Professors), Associate Professors, Assistant Professors, Anaesthetist, paramedics, OT Technicians, Senior Nursing Officer (S.N.O), Nursing Officer (N.O), all support staff etc.
- 2. Salary of human resources: Gross salary of all the human resources (Consultants, Professors), Associate Professors, Assistant Professors, Anaesthetist, paramedics, OT Technicians, Senior Nursing Officer, Nursing Officer, all support staff etc.)
- 3. Procedures: Name and number of each procedure conducted in all the specialty of the facility in the financial year (reference year).
- 4. Physical Infrastructure: Unit wise covered physical space allocated for each specialty within facility.
- 5. Drugs: Name, quantity and prices of all drugs consumed in each specialty of the facility along with apportioning data i.e. list of procedures for which each item is used.
- 6. Equipment: List of name and numbers of equipment in each unit along with the prices and

details such as date of purchase, annual maintenance contract/ comprehensive maintenance contract (AMC/CMC), apportioning data i.e. used in which all procedures.

- 7. Consumables: List of consumables consumed in each unit along with the prices, apportioning data i.e. used in which all procedures.
- 8. Non-consumables: List of non-consumables consumed in each unit of their facility along with their prices (includes furniture)
- 9. Overhead costs: Expenses on electricity, water, biomedical waste, maintenance cost broken down by each unit of the facility if possible etc.
- 10. Interviews of key staff members (Time allocation interviews): In order to collect data on work pattern, some staff members will be interviewed on the allocation of their time between the various services.

Instructions for field workers carrying out data collection

The cost data collection process for gathering the information above entails three main steps:

1. Acquiring authorization

Before starting cost data collection, it is important to obtain authorization to do so. As the data required may be distributed across different departments of a healthcare facility, this may entail discussions with different section in-charges even after due administrative approvals at the highest level. To facilitate this process, the standardized cost data collection tool can be used by data collectors to initiate discussions about the type of cost information required. This process will be different in different types of providers.

For a public hospital

- i. The first step in the administrative process is an official letter to the hospital in charge, State Principal Health Secretary, State Insurance Nodal Officers, Trust Hospital in charge.
- ii. During the first visit to a health facility, the first task of the investigator is to meet with the Person in charge (Medical superintendent & HODs concerned for tertiary hospital, Senior Medical officer in case of district hospital, Chairman & Managing Director for private hospitals) of the facility and introduce himself (do carry the hard copy of the letter as follow up). After that, the investigator is required to explain the purpose of the visit and the objective of the study and obtain the consent from him/her before proceeding further.
- iii. Getting the hard copy of the letter marked by the Person in charge to the HOD concerned will expedite the process.

For a private hospital

In the case of a private hospital, while taking administrative approvals, there is need of a nondisclosure form by both parties to be processed which would guarantee confidentiality of the cost data obtained from the private healthcare provider.

2. Identifying the time frame for the data

The data needs to be collected for the financial year also known as the reference period for the study. If some data are not available for the whole year, it is possible to choose a sample period. In this case, the time period for which it is collected like number of days/weeks/months needs to be decided and communicated in the approval process.

3. Data Collection using standardised tools/forms

The data collection tools (provided as Annexures) for each type of health facility consist of different sections, each of which enlists data in different areas according to the data needs. At each site, the data collection tools provide a way to obtain information on the number and type of services delivered and the quantity and value of the following: personnel, annual services detail, building space, equipment, furniture, consumables, utilities diet & laundry, time allocation interviews. In addition, at the speciality level of a tertiary care facility/medical college or department level of a district hospital, information is needed from cost centres within each speciality/department i.e., outpatient department (OPD), intensive care unit (ICU) inpatient ward (IPD), laboratory and operation theatre (OT). Sample screenshots of the forms (A1- A9 & B1-B8 below) for a tertiary hospital are provided here. The full forms for all facility levels can be found in the Annexures.

Sample data collection tools for a tertiary facility

The following screenshots are of the data collection tools for a tertiary facility. The first set of forms (A1-A9) are for data collection at the specialty level. In addition to the speciality wise cost centre information collected in these tools, basic information of the hospital including total area covered and open area of the health facility, total population catered to, total number of outpatients, inpatient and ICU admissions of the entire hospital and total surgeries conducted in the entire hospital.

The data collection forms for the district hospital are similar to those for the tertiary facility (Annexure 1 and 2). Further data required at this level also include details regarding population covered at the facility, annual services delivered (record based), equipment present, consumables, time allocation separately for each of the unit of department, signage/ IEC material on display in the unit, vehicle details, laboratory/ radiological investigation/procedure fees, details of referral transport, cash benefits paid to patients and a record of the number of days of stay of 100 random patients of facility in the reference year.

The data collection tools for a community health centre, primary health centre, sub centre & a private hospital are also based on those outlined for the tertiary hospital. The detailed data collection tools for private hospitals are provided in the Annexure 3.

The data collection tools provided are templates. Additional sheets/columns/rows can be added wherever necessary. For example, due to regional variations some names/headings will be missing. In these cases, all relevant heads as per local need like various state government schemes etc can be added.

Cost data collection tool: Human resource

Data collection forms for the specialty/ departmental level

Section A1: Interview with the head of the facility or person In-charge

	Facility type: Tertiary Care	
Interview Date:	State Name:	
Institute Name:	Department Name:	
Section A1: Interview with	n the head of the facility or person In-charge	
A. Please tell me how mar	ny days per week this facility is closed?:	(Days per
week)		
B. Please tell me how mar	ny hours per day this facility is open?:	(Hours per
day)		
C. If the facility remains o	closed on Public holidays, then mention total pu	ublic holidays in
last year:(D	ays in year)	
All human resources of a pa	articular cost centre should be included on form A1	. For any person
who is retired during the fina	ancial year, the number of months for which he/she h	as worked should
be included in the data colle	ection. Any intern/trainee should be included if they	are contributing
to the output of the facility.	For the intern, the salary should reflect the remuner	ation of a person
who would have been emplo	oyed in their absence.	
Section A2: Human Resou	urce-Salary and fringe benefits details (Details	for each person
congrately using codes air	van balaw)	

separately using codes given below)

It includes all the staff involved in OPD/IPD-ICU/OT i.e., doctor (Specialist), senior resident, junior resident, staff nurse, technician, data entry operator, pharmacist, helper, etc.

Seria I No.	Job title (Doctor/ Resident/Staff Nurse/ Technician, etc.)	Speciali ty	Utility (OPD /IPD/ICU/ Operation theatre)	Monthly gross salary (inclusive of all allowances or deductions)	Annual Incentive received for trainings (TA/DA received for trainings)	Period/days of posting in the reference year	Days of absence from this health facility in the period of posting in the reference year

Section A3: Details of human resource annual allowances received

Staff	Government	Government residence			nment residence Transport facility Uniform provided/ allowance			allowance	
Code									
	Square feet of the house building, or rooms provided i.e. covered area (Do mention the unit of data collection	Square feet of the open area in the accommodation provided (Do mention the unit of data collection)	Amount paid in a year or How much would you pay if you would rent this house i.e. monthly rental price*12?	Amount paid in a year	Vehicle name and year of make, if provided free	Times per year (a)	Unit cost of uniform (b)	Amount incurred on uniform (a*b) or If unit cost not available ask, "For how much it will be available from market, if bought on its own?"	Any other allowance or Special allowance

Section A4: Physical infrastructure

Table 1: Particulars	Specify
Area of the building (Total area in Sq. ft.) (Covered + open space)	
What is the rental price of 100 sq. ft place where this Public Health centre is	
located?	
Was there any expense on construction of building or renovation during the	
period of data collection	

Section A5: Details of Stationary/Sanitary Items (Overall for whole of the department)

Item	Quantity	Expenditure

Section A6: Utilities (Overall for whole of the department)

	Expenditure (Annual)
1. Building	
Electricity	
Water	
Maintenance	
Telephone	
Kerosene	
Other	
Total (If available)	
2. Equipment	
Maintenance	
Repairs	
Other	
Total (If available)	
Others	

Section A7: Utilization of funds and grants

Amount spent in the reference year	List services for which it is used. Write serial number codes from Tables on time sheet allocation

Section A8: Sources of Revenue

		Amount collected during the reference year
1	Procedure fee	
2	Others (specify)	
3	Total user fee from the reference year	

Section A9: Time allocation sheet

Staff Member Code (Enter Code as entered in Section 1):

Service	Activity name	Type of ac	tivity	Fixed schedu	le activity	1	Routine a	ctivity	
code no		Fixed schedule	Routine schedule	Frequency (once in a week/once in month/twic e a week etc.) *	Hours per day of activity	Days for which the activity was done during the reference year	Time per person (in minutes) (a)	Number of beneficiaries on a routine day (b)	If not (a) and (b) then how much time to do the activity
1.	OPD			-					
2.	IPD								
3.	Operation Theatre								
4.	General Administration								
5.	Teaching/Training								
6.	Workshop/ Conference								
7.	Outreach								
8.	Meetings								
9.	Research								
10.	Others (Specify)								

^{*&#}x27;1' for once a year participation, '2' for twice a year, 3 for thrice a year participation, 4 for quarterly participation, 5 for once every two months, 6 for monthly participation, 7 for fortnightly participation, 8 for weekly participation, 9 for twice a week participation, 10 for thrice a week participation.

A time allocation (Section A9) for personnel undertaking multiple activities would involve routine activity (e.g.: daily consistent activity like IPD rounds etc.) and fixed activities like service delivered on a specific fixed day/date like OPD on fixed days or a room used for paediatric vaccinations on specified days etc.

Data collection forms for the cost centre (e.g. ICU, IPD, OPD and OT) level

In addition to the specialty level details collected in the forms above A1-A9, the following data also need to be collected for each cost centre within a specialty/department (OPD/IPD/OT/ICU) of a health facility. Samples of these forms (B1-B8) are also presented here.

Section B1: Human Resource (List the number of visiting consultants /residents from other departments visiting the cost centre of the selected department.)

S. No.	Designation	Speciality	Monthly gross salary	Average visits per week in the inpatient ward of the selected department	Average time per visit (in minutes)
1					
2					

Information also needs to be collected on visiting consultants examining patients admitted in inpatient or intensive/critical care units.

Section B2: Annual Service Details of a cost centre (e.g.: IPD)

S. No.	Number of patients admitted in the inpatient ward/ICU of the department	Specific reason of admission (if any)
1		
2		

Section B3:Room Wise Dimension of every room of a cost centre

S. No.	Room Name	Dimension (in sq. feet)
1		
2		

Section B4: Details about non medical items (e.g.:furniture) in a cost centre (e.g.: IPD)

Name of the		Quantity of functioning items in each room									
non-medical equipment or furniture	IPD Ward no. 1	IPD Ward no. 2	IPD Ward no. 3	IPD Ward no. 4	IPD Ward no. 5	IPD Ward no. 6	IPD Ward no. 7	IPD Ward no. 8	IPD Ward no. 9	Corridor	Corridor

Section B5: Details of Equipment in a cost centre

Room No.	Equipment	Quantity	Year of purchase	Unit price	Expected/useful life of the equipment

Section B6: Details of drugs consumed in a cost centre

S. No.	Name of Drug	Quantity consumed	Quantity expired	Unit price

Section B7: Details of consumables (Material and Supplies) consumed in a cost centre

S. No.	Consumables	Quantity	Price

Section B8: Personal Interview with key personnel conducting each of the procedure /surgery in a cost centre

S.	Name	of	Average	Average	Average	Number	of specific	Number of	various	List of cor	nsumables
No.	the		time taken	length of	length of	personnel	involved in	diagnostic	tests	for each	of the
	surgery		for	stay in	stay in	the	surgery	performed	on a	procedure	(list of
			performing	the	the	(Consultant	, Senior	patient un	dergoing	consumables	5
			the	intensive	inpatient	resident,	Junior	the procedu	re	purchased	by the
			procedure	care unit	ward	resident, A	naesthetist,			patient	before
			in the	(if any)		Residents	of			undergoing s	urgery)
			operation			anaesthesia	, OT				
			theatre			technicians	etc.)				
						Designation	Number	Name of	Number	Name of	Quantity
								diagnostic		consumable	
								test			

The section on OT, aims to capture more detailed information on specific procedures, including the number of different surgeries performed by the respective department during the particular reference period, and inputs in term of use of equipment and supplies. This includes the following information to be collected from key surgery personnel (Section B8)

- a. Time taken in performing a particular surgery.
- b. Average length of stay in the intensive care unit following a particular surgery.
- c. Average length of stay in the inpatient ward following a particular surgery.
- d. Number of different personnel involved in the surgery.
- e. Number of various diagnostic tests prescribed to the patient undergoing a particular surgery
- f. List of consumables for each of the procedure

Diagnostics/Laboratory costs

Information on the quantity of various laboratory tests/ radiological investigation/procedures, reagent or film used for a particular diagnostic test conducted at the health facility during the reference year needs to be collected for each specialty (Sections A&B)

In the case of specialty wise costing, laboratory costs will include laboratory services offered within the premises of the department only. For example, in the Cardio-thoracic Vascular Surgery (CTVS) department, if ECG is provided in department and blood tests are done at central laboratory of the facility, only cost of providing ECG service should be calculated. If all laboratory services in the selected department are covered by the central laboratory of the facility, then laboratory services should not be included in the costing of the respective department

Health Benefit Package costs

To estimate the cost of a health benefit package procedure, information about the number of personnel involved in undertaking the procedure, no of tests prescribed before and after undertaking the procedure, number of visits of the patient to each cost centre are required. In addition, out of pocket expenditure of the patient, the average length of stay of the patient in each cost centre of the facility and list of consumables required for the procedure should also be collected using a similar approach to that outlined for the OT (Section B8). Data collection needs for the health benefit package information should be matched with the information provided in the data collection forms and adapted to meet the costing needs for the specific procedure.

Specific considerations for a private sector facility

In addition to the cost information that is collected from a public hospital, the following data, if any, should also be collected from the private provider.(Annexure 3)

- Data on the revenue earned/collected by the health facility from various sources e.g. issuance of birth and death certificate, procedure fee, medical tourism etc., during the reference year.
- The amount spent on IEC activities if any also should be collected.

Practical aspects to be taken care of while collecting cost data

Finally, the following practical considerations are needed when collecting cost data at the facility level.

- A complete listing of services provided / undertaken (i.e. specific reason for admission of the patient to the cost centre) should be collected for each cost centre.
- A complete list of operative procedures conducted across different levels of healthcare facilities /regions should be matched with an updated approved list used widely by government agencies/departments for uniformity in addition to cross checking or getting validated by practicing clinicians.
- A complete list of each item of equipment, drugs and consumables should be collected for each of the detailed services/procedures for each cost centre.
- Information on the time period of staff posting and days of absence from different sections (consultant, nursing, outsource etc.) of the department should be sought at the outset of data collection as this can be time consuming.
- Cost centres which share resources e.g.: capital space with one or more departments should be noted.
- At least 25% of the staff in each cadre for each specialty, including from private healthcare providers, should be interviewed regarding their time allocation.
- Soft copies of the data should be sought wherever possible at time of the administrative approvals itself
- While filling the soft copy of the cost data collection/entry tool care should be taken to enter data as instructed usually this is numerical data without any text or other non-numeric characters (e.g. in consumables 2 packets of syringes-needs to be written as "2")
- Contact information of department or section in-charge personnel should be maintained so that they could be contacted in future for any further clarifications required.

Annexures

- 1. Cost Data Collection Tool for Tertiary Centre (Overall, OPD, IPD, OT, ICU, Laboratory)
- 2. Cost Data Collection Tool for District Hospital
- 3. Cost Data Collection Tool for Private Centre (Overall, OPD, IPD, OT, ICU, Laboratory)

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Chapter 2.5 Cost Data Analysis

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Once the data collection is over, the next crucial step is to analyse this data. It is very important to understand the context and purpose of the costing study before we carry out the cost data analysis.

Overview

The broad purpose of a costing study could be to generate evidence either for health technology assessment, planning and budgeting, setting provider payment rates or to monitor the provider performance.(1) A few other potential applications of costing include development of 'cost-functions', efficiency analysis etc.(2,3) Now, there could be specific objectives within the premises of above-mentioned purposes like to estimate unit cost of a specific service, to estimate the unit cost of implementing a program, to measure the efficiency of an ongoing program/ service, to estimate the cost of expanding the health coverage, to estimate the cost of basic or essential health package, to provide a cost basis for payment of health services through provider payment mechanism, to inform contract negotiations between providers and purchasers, compare costs and performance of different departments within the health facilities, to set benchmarks for better accountability etc. The analytical plan is largely dependent upon the purpose and the specific objectives of costing study. In this chapter, we focus on demonstrating how to carry out the data analysis in a micro-costing study implemented to inform facility or departmental unit costs and the costs of health benefit packages.

Learning Objectives

By the end of costing analysis chapter, readers will be able to comprehend about:

- Classifying the costs into recurrent vs capital; fixed vs variable etc.
- Analysing the costs of recurrent nature; and capital nature using the principles of discounting and annualization
- Using time allocation data to compute apportioning statistics for analysis of shared costs
- Adjusting the cost estimates for inefficiencies
- Handling uncertainty in cost data analysis

Key terms

- Recurrent costs: Operational costs which are incurred at a particular frequency
- Capital costs: Non-operational costs which are incurred as one-time investment
- Fixed cost: Costs which do not change with increase or decrease in scale of service
- Variable cost: Costs which change in direct proportion to an increase or decrease in scale of service
- **Discounting:** Method of adjusting the costs incurred at different time points to present value.
- Annualization: Method of distributing cost of capital asset over its useful life.
- **Apportioning:** Method of allocating the value of shared resource consumed for a particular service
- Capacity utilisation: Indicator to depict the level of service utilisation in terms of beneficiaries utilising the service out of maximum beneficiaries which can be accommodated within service provisioning
- Sensitivity analysis: Method to handle the uncertainty present in cost data

Chapter outline

This chapter first describes approaches to analysing capital and recurrent costs. Shared costs then need to be apportioned to the different cost centres before a unit cost for each cost centre can be generated.(4,5) We also discuss the issue of missing information and how to address it. In addition, as data on prices, useful life of a capital resources etc. are accessed from varied sources and are subject to uncertainty, it is essential to assess the impact of uncertainty and address it to ensure the robustness and generalizability of the estimates. Lastly, point estimates lack the statistical robustness and require reporting of interval estimates. All these concepts with the help of illustrations will be discussed in the subsequent sections of this chapter.

Analysis of recurrent costs

Recurrent or operational costs include, human resource (medical and non-medical staff) involved in service delivery, drugs, consumables, diagnostic tests overheads etc. Costs for such resources are incurred at a particular frequency, for instance staff wages are often disbursed on monthly basis. Drugs are consumed within a limited timeframe and are only used once. In a costing study, the focus of data collection (and data analysis) is on consumption of such resources in the reference period of the study.

Human Resource Costs

Specific data needs for estimation of human resource costs include full cost of employment or gross salary and the employment status of the staff. Full cost of employment includes basic salary and fringe benefits, where the latter is inclusive of all benefits like allowances, pension and medical benefits etc. Under employment status, staff is classified as regular (or full timer), part timer and volunteer. The part time staff, and the voluntary time contributions are converted to full time equivalent (FTE) which converts the hours worked into a proportion of the number of working hours that represents full-time employment in a given time period. Personnel in healthcare delivery system are often involved in multitasking and thus considered as shared resources. The cost of an individual involved in a particular activity is obtained using the FTE of that individual in that activity. The issue of dealing with shared resources will be described in more detail in the subsequent section. Hence, the cost of staff time can be computed using the given formula;

$$C_{(HR)} = \sum m (S_{m(annual)} * N_m * F)$$
 (1)

Where; $C_{(HR)}$ = Total human resource (HR) cost for a service

 $S_m =$ Wage rate plus benefits

 $N_m =$ Number of employees

F = Full time equivalent

 $m = m_1, m_2, \dots, m_n$ (Category of employees)

Drugs and consumables cost

To estimate the cost of drugs and consumables, quantities of various drugs and consumables consumed usually in a year for a service (or package of services) are multiplied with their corresponding prices. Use of market prices vs procurement prices is a debatable issue and predominantly depend on perspective of study. The procurement prices often make more sense for a cost analyses from health system perspective. Mathematically, this can be represented as equation(2) below.

$$C_{(drugs)} = \sum_{i} (q_{i (annual)} * p_{i (drugs)}) \qquad (2)$$
Where;
$$C_{(drugs)} = \text{Total cost of drugs for service A}$$

$$q_{i (annual)} = \text{Quantity of i}^{th} \text{ drug consumed in a year}$$

$$p_{i (drugs)} = \text{Unit price of i}^{th} \text{ drug}$$

$$i = i_{1}, i_{2}, \dots, i_{n} (drugs)$$

In a micro costing study covering public health facilities where there are sometimes stock-out of supplies (medicines and consumables) will result in underestimation of resources consumed and associated costs. In such instances, an alternative micro costing approach of normative estimation of medicines (and consumables) is advocated. Normative costing approach utilises some norms such as the standard treatment guidelines (STGs) or clinical judgment of the experts in the absence of STGs for the estimation of cost of medicines and consumables. The normative costing approach is preferred over other micro costing approaches for generating the evidence for development of essential health service packages (EHSP). A similar approach should be taken for all consumables.

Capital costs

Healthcare infrastructure is comprised of buildings, medical and non-medical equipment; where the latter mainly include furniture, vehicles etc., needed for service delivery. These capital resources are utilised over longer time periods than one year. The complete exclusion or inclusion of these costs as followed in the principle of accounting methods could lead to flawed estimations of the opportunity costs. In economic costing, it is standard practice to account for the value of the capital resource utilised in the reference period of costing analysis by converting capital costs into an annual equivalent cost.

There are two important considerations when converting to an annual equivalent cost. First is the opportunity cost of initial investment and, second, is the depreciation of the capital item over time. (4) In the case of building structures, construction part is subject to depreciation, whereas land is not depreciable. In fact, land has a likelihood of appreciation. Other capital items such as medical and non-medical equipment are much more straightforward. To understand the opportunity cost of investment, it is important to understand the concept of time preference.(4-6) In general, people enjoy the benefits of utilizing the services in the present and to 'pay for it in future'. This is because as humans we prefer events in the near future relative to the distant future. This implies that costs incurred in present have a higher opportunity cost (or value) relative to costs incurred in the future. Since, the future is uncertain, we generally have a positive rate of time preference which is known as the discount rate.(4) The discount rate is used to discount the value of future costs to obtain their opportunity cost. The concept of discounting is illustrated in Box 1. In costing, the capital outlay is annualised throughout the useful life of the asset taking into account the opportunity cost of capital investment (discounting) and depreciation over time. This is known as annualization.

Box 1: Illustration for Discounting

As a father of a 10-year-old son, Mr A decided today to spend $\[Tilde{?}\]$ 1 lakh per year for education of his son for next 10 years. Mr A allocated $\[Tilde{?}\]$ 10 lakhs from his savings for this schedule. The simplest option to hold this amount is to put this as fixed deposit in a bank. Suppose, Mr A opened a one-year fixed deposit of $\[Tilde{?}\]$ 1 lakh which he would be needing next year. Similarly, opened a two-year fixed deposit of $\[Tilde{?}\]$ 1 lakh needed in the 3rd year and likewise planned it for next 10 years. The prevailing nominal annual rate of return on a fixed deposit varies between 6-6.5% and after adjusting for inflation in future years, he will earn on his investment with an approximate real rate of return of 3%. So, $\[Tilde{?}\]$ 1 lakh in fixed deposit for 2nd year would indeed grow to $\[Tilde{?}\]$ 1 lakh which means to incur an amount of $\[Tilde{?}\]$ 1 lakh next year, Mr A need less than $\[Tilde{?}\]$ 1 lakh (approx. $\[Tilde{?}\]$ 97 thousands) today. In other words, $\[Tilde{?}\]$ 1 lakh today has more value than $\[Tilde{?}\]$ 1 lakh in future and therefore, equal weighting of current and future investments (costs) for certain is inappropriate. Discounting is a method for adjusting the future costs to the present value.

Annualization

The annualization method enables us to derive an equivalent uniform annual cost (EUAC) by multiplying the capital outlay of the item by the annualization factor. Two key inputs are prerequisite for computing the annualization factor (also known as the discount factor or annuity factor): the annual discount rate and useful life of the asset.(4, 5) The annualization factor can be computed using the formula given below:

$$D = \frac{r * (1+r)^{L}}{(1+r)^{L} - 1}$$
(3)

Where; D= discount factor/annualization factor/annuity factor

r= discount rate

L= useful life of the capital item

An illustration for annualization method is given in the box 2.

Box 2: Annualization Method

A costing study was undertaken to ascertain the unit cost of postpartum intrauterine contraceptive device (PPIUCD) services at primary and secondary level public health facilities in India. Data on both recurrent and capital resources was collected. At one of the study hospitals, some of the medical equipment used for service were delivery table, speculum, long forceps etc. The procurement price captured from stock registers was ₹10,000, ₹1000 and ₹500, respectively, while the useful life reported by the experts for these items was 10, 5 and 3 years, respectively. Now, to compute the discount factor (or annuity factor) assuming an annual discount rate of 3% to finally derive the equivalent uniform annual cost (EUAC) can be done in following way.

	Number of	Unit Price	Useful Life	Discount	Discount	EUAC#
Medical Equipment	Units	(₹)	in years (L)	Rate (r)	Factor*	
Delivery Table	1	10,000	10	3%	0.117	1172
2011/01/9 14:010	_	20,000		3 70	0.117	
Speculum	2	1000	5	3%	0.218	437
Long Forceps	3	500	3	3%	0.354	530

^{*}Discount factor is computed using equation (3),

#EUAC (equivalent uniform annual cost) = Number of units*Unit price*Discount factor

Source: This illustration has been derived from study Bahuguna P et al, IJCM, 2019.(7)

Dealing with shared costs

One of the most challenging parts of healthcare cost data analysis is to deal with the shared or joint costs.(4) Costs can be shared across cost centres as well as across activities or different services. To ensure accurate cost estimates, it becomes crucial to identify a robust method to apportion the share attributed for a particular service. Apportioning statistics need to be identified to allocate cost of shared resources.

Apportioning statistics

Though there is no completely precise method for designing apportioning statistics, there are standard practices widely used by health economists to help with approximation. For human resources, time devoted to a particular service out of total working hours could be a correct basis to allocate the staff time. For example, a medical officer in a primary healthcare facility is responsible to attend all the patients reporting for out-patient care. If we are interested in estimating the unit cost per antenatal (ANC) visit, we need to establish the working hours spent for attending the ANC patients out of total out-patient clinic time. In the case of equipment, usage statistics can be used to allocate the cost to each activity. For example, the cost of ultrasonography equipment (and the person operating it) for ANC patients can also be apportioned based on the number of ANC patients screened as a proportion of total screens. In the majority of cases, overheads costs comprised of support services such as general administration, power supply, water and sanitation, laundry, dietetics, transport etc. are typically of shared nature. Recommended indicators used for apportioning statistics in these cases are listed in table 1. Box 3 provides an example of apportioning shared costs in practice.

Table 1: Standard Allocation Criteria used for Apportioning Statistics

Shared Resource	Allocation Criteria
Personnel	Work time
Building	Space used
Equipment	Time used
Supplies	Quantity/Volume used
Vehicles	Distance travelled/Time used
Overheads (Electricity, Water)	Space used/Patient footfall

Box 3: Illustration for Apportioning

This illustration is taken from the PPIUCD study cited in box 3. PPIUCD is a minor procedure which generally takes 2-5 minutes. The procedure takes place in the delivery room within the Obstetrics and Gynaecology (OBGYN) department. To obtain the cost of the procedure, we needed to identify share of the costs of the delivery room, the OBGYN department and administration required for PPIUCD.

The share of overall health facility costs was allocated to the OBGYN department using the patient footfall for OBGYN relative to overall patients. Then, a share of OBGYN costs was allocated to PPIUCD based on the patient footfall of PPIUCD relative to other OBGYN patients. To derive the costs of the labour room for PPIUCD, the time taken for the procedure was also taken into account. PPIUCD is a minor procedure which generally takes 2-5 minutes compared to delivery which may end up taking 0.5-3 hours and thus, a product factor of number of patients and average time taken per procedure for PPIUCD patients vs childbirths was considered to calculate the apportioning statistic. The table given below shows the apportioning statistics used to allocate the costs for PPIUCD services in this study.

	Gynae & Obs (Labour	Gynae & Obs	Health Facility
Type of Facility	room)	(Overall)	(Overall)
PHC	0.015612	0.00065	0.00001
СНС	0.012256	0.000511	0.00001
DH	0.021386	0.000891	0.00009

Note: PPIUCD= Postpartum intrauterine contraceptive device; OBGYN = Obstetrics and Gynaecology; PHC= Primary health centre; CHC= Commun health centre; DH= District hospital

Source: This illustration has been derived from study Bahuguna P et al, IJCM, 2019.(7)

Dealing with missing information

In a costing study, there is likely to be some missing information, attributable to several reasons. The missing data could be due to non-availability of the concerned person during the data collection period or poor record maintenance or busy schedule of respective staff in routine activities. More often, the missing data issue is related to data on recurrent resource consumption such as medicines, consumables etc.; prices of medicines, consumables, medical and non-medical capital items; and lastly, information on time allocation to various activities by staff engaged in multiple activities. In order to fill the missing data, proxy data (or method) are used. For example, if the data on medicine and resource consumption for a service is not available, a normative approach can be employed to calculate the standardised quantity of drugs (and consumables) utilised to treat an episode of disease. The calculation is grounded on STGs, if available, or on clinical judgment of experts. Similarly, if the data on prices are not available, prevailing market

prices can be obtained open access sources. Sometimes, for prices of medicines and other supplies, data from other facilities within the local area which are also part of study sample can also be used. Lastly, for missing data on time allocation, time distribution of staff involved in similar nature of services can be imputed.

Unit cost estimation

Once we have analysed the specific components of costs and derived the total cost, we need to compute the unit cost or average cost per beneficiary of a particular service or programme. A standard measure of output for the unit cost of hospitalisation is the bed day. The unit cost per bed day can be calculated using the mathematical equation given below.

$$UC_{(bed day)} = TC/(Number of patients*ALOS)(4)$$

Where;
$$TC = [C_{(HR)} + C_{(capital)} + C_{(supplies)} + C_{(overheads)}]$$

TC = Total cost of treatment of patients in ward 'X' for health condition 'A'

ALOS = Average length of stay in ward 'X'

Adjustment for Capacity Utilisation

Estimates generated from a micro-costing study are influenced by inefficiency. Inefficiency in a costing study could arise from under or over-utilisation of capacity of a service or program. Both supply and demand side factors play an important role in sub-optimal utilisation of capacity. Under-utilisation of capacity in the public sector could be caused either due to the abundance of private sector services or suboptimal mix of resources in public sector making the public sector less appealing; while over-utilisation could be due to shortfalls in resources like doctors, beds, equipment etc. despite adequate demand for service. Under-utilisation of capacity clearly indicates inefficiency (resulting in higher unit costs); whereas over-utilisation of capacity leads to poor quality of services and implies inefficiency (lower health outcomes for the same cost). Whether to adjust cost estimates for inefficiency is largely dependent on the purpose of analysis. If the cost analysis is done to measure the current cost, for example, understanding the current levels of efficiency or how costs might change with scale, we can use the initial cost estimates. However, if the purpose of the costing study is to carry out national level health technology assessment (HTA), set an essential health service package, or provide payment rates, then the cost figures need to be adjusted.

Adjustment for capacity utilisation is done by computing the estimates at an agreed standard level of capacity utilisation. For example,- in a costing study estimating the in-patient admission costs at secondary level health facilities, hospitals in the study sample reported bed occupancy rate in

the range of 59-116% [8]. The variation in the bed occupancy rate alone will lead to variation in the per bed day cost estimates. The cost estimates can be adjusted by standardising the bed occupancy level for all sample facilities at 80% (or 100%), see box 4.

Unit cost	Himachal Pradesh		Kerala		Odisha		Tamil Nadu		Overall	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Per antenatal care	412 (266–557)	356 (49–	523 (281–	546 (166–	245 (180–	187 (151–	125 (83–	103 (90–	366 (260–	350 (194–
visit		866)	874)	1150)	332)	219)	155)	123)	507)	560)
Per postnatal care	1073 (825–	1040 (365-	247 (241–	150 (140–	946 (461–	528 (329-	474 (123–	221 (86-	749 (540–	514 (352–
visit	1321)	2093)	252)	160)	1473)	753)	690)	432)	995)	730)
Per vaccination shot	293 (131–403)	242 (20- 536)	196 (150- 281)	149 (80- 220)	306 (144- 461)	238 (118– 367)	93 (74–123)	66 (36-84)	235 (166– 315)	183 (121– 256)
Per outpatient consultation	168 (121–201)	127 (29- 287)	90 (52– 153)	73 (48–98)	169 (137– 204)	164 (129– 210)	103 (30- 144)	65 (26–106)	134 (104– 160)	114 (80– 145)
Per tubectomy	3157 (2437–	786 (124–	128 (128–	146 (146–	1429 (1429–	2106 (2106–	1484 (1428–	658 (488–	1806 (1505–	1237 (994–
procedure	3877)	1449)	128)	146)	1429)	2106)	1540)	828)	2135)	1427)
Per IUCD	3015 (1603-	761 (194–	1383 (1131–	1030 (473–	759 (530–	429 (389-	1289 (648–	618 (292–	1516 (1206–	946 (718–
procedure	4426)	1188)	1597)	1607)	973)	479)	1771)	788)	1919)	1181)
Per bed day	595 (130–	154 (91–191)	1153 (660–	908 (418–	465 (301–	332 (297–	1496 (320-	997 (281–	866 (534-	591 (357-
inpatient care	1326)		1650)	1362)	698)	381)	3687)	2425)	1268)	888)
Per institutional delivery	10,447 (2430- 18,464)	4991 (3604- 6379)			2673 (1978– 3667)	2186 (1880– 2542)	2131 (1098- 3043)	1852 (1168– 2425)	3833 (2668- 5839)	2583 (2187–3197

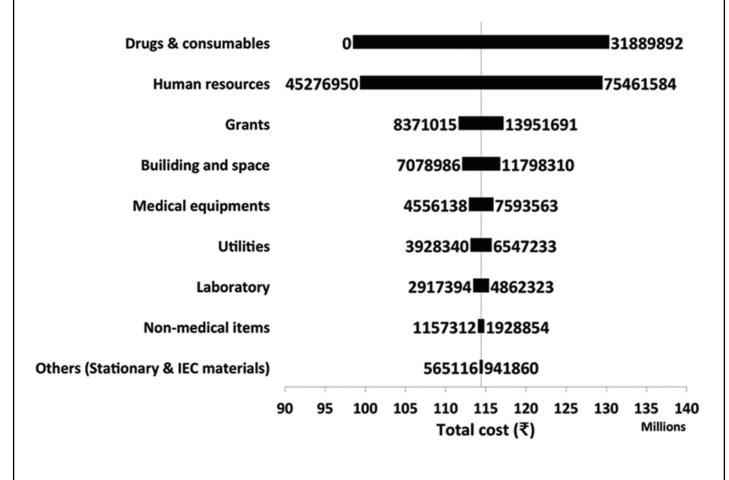
Source: This illustration has been derived from Prinja S et al, PharmacoEconomics Open, 2019. (9)

Sensitivity analysis

The input data collected in a costing study is subject to uncertainty and this can lead to uncertainty in the final cost estimates. Potential reasons for uncertainty in the cost data include that price data can be highly variable and dependent on the source (procurement prices vs market prices), estimates of the useful life of a capital item are based on expert opinion, the use of proxy data due to unavailability of actual data, the discount rate, commercial rental rates vs residential rental rates for costing building area etc.(10) Sensitivity analysis is a way to explore the impact of this uncertainty by testing the robustness of the results to these assumptions. There are two types of sensitivity analyses: deterministic sensitivity analysis (DSA) and probabilistic sensitivity analysis (PSA).(10) In DSA, the value of input parameters is varied one at a time within the plausible range keeping other parameter values constant. The results of a DSA are usually presented in a tornado diagram such as in box 5. While in a PSA a random set of values for all parameters is selected to generate the cost estimate and this process is simulated 'n' number of times. In PSA, appropriate probabilistic distributions are assigned to different parameters.(11) For example- data on prices and wages are anticipated to be positively skewed in nature and so a gamma or lognormal distribution is preferred, while a uniform distribution may be appropriate to vary the discount rate or useful life of equipment. PSA is more commonly used in full economic evaluations and underused in cost analyses.



Figure given below is a tornado diagram which depict the variation in the total cost of service provisioning at the level of a district hospital given the variation in the various input cost components.



Source: This illustration has been derived from study Prinja S et al, IJMR, 2017 (12)

Bootstrapping

Contrary to individual level healthcare surveys, the sample size in costing studies tends to be very low amounting to few health facilities or program areas, generally due to the time and resource intense nature of health system cost data collection. In addition, cost data tend to be skewed. In the presence of such limitations, it becomes difficult to estimate the interval estimates around the point estimates which lack statistical robustness. To address such issues, non-parametric methods like bootstrapping are useful for interval estimation.(9, 12, 13) The bootstrapping method utilizes the principle of central limit theorem in order to estimate the larger sampling distribution using the variability in the original distribution. Samples for the sampling distribution are drawn with replacement method. In this way, we can enhance the robustness of cost estimates by providing confidence intervals around the mean.

Box 6: Illustration for Bootstrapping

Figure given below shows the 2.5 and 97.5th percentile estimates for the unit cost of treatment in out-patient and inpatient setting in district hospitals of India. In this analysis, 1000 bootstrap iterations were done to estimate the uncertainty range for unit cost of specific services.

Unit cost	Median ₹ (USD)	2.5 th percentile ₹ (USD)	97.5 th percentile ₹ (USD)
Inpatient (per bed-day by ward)			
Obstetrics & Gynaecology	997 (18.3)	592 (10.8)	1412 (25.9)
Medical	1937 (35.6)	1212 (22.2)	2659 (48.8)
Surgery	1082 (19.9)	657 (12)	1508 (27.7)
Paediatrics	1028 (18.9)	444 (8.1)	1703 (31.3)
Otorhinolaryngology	4407 (81)	1333 (24.5)	7960 (146.3)
Neonatal Intensive Care	1438 (26.4)	960 (17.6)	1958 (36)
Emergency	210 (3.8)	87 (1.6)	334 (6.1)
Outpatient (per outpatient consultation)			
Paediatrics	137 (2.5)	102 (1.8)	182 (3.3)
Medicine	220 (4)	119 (2.1)	313 (5.7)
Ophthalmology	147 (2.7)	98 (1.8)	210 (3.8)
Otorhinolaryngology	189 (3.4)	105 (1.9)	284 (5.2)
Dermatology	122 (2.2)	80 (1.4)	164 (3)
Orthopaedics	140 (2.5)	72 (1.3)	202 (3.7)
Surgery	161 (2.9)	95 (1.7)	244 (4.4)
Dental	146 (2.6)	86 (1.5)	231 (4.2)
Obstetrics & Gynaecology	165 (3)	68 (1.2)	274 (5)
Psychiatry	166 (3)	29 (0.5)	303 (5.5)
1 USD=₹ 54.4 (2012)			

Source: This illustration has been derived from study Prinja S et al, IJMR, 2017 (12)

Challenges in Cost Analysis

There are several challenges associated with cost data analysis.(4, 14) First, it is difficult to put a monetary value on the time and other inputs of voluntary contribution by non-governmental organisations (NGOs), community etc. One of the recommended ways to address this issue is to consider the wage rates of unskilled workforce.(4) Second, when the overhead costs are shared across different services or departments, it becomes challenging to apportion these costs for specific programs and service. Third, capturing the value of the role of the district and state administration in the service delivery can be difficult. However, these administrative costs can be marginal relative to the overall cost of a specific service, once they have been apportioned across the different services.

Moreover, this challenge is primarily associated with cost data collection rather than data analysis. Fourth, use of market prices vs procurement prices for supplies; and commercial vs residential rental rates for space used for service delivery. For example, market prices more appropriately represent the opportunity cost of the resource which is crucial when healthcare costing is being conducted from an economic perspective. While procurement prices are generally preferred over market prices when costing is undertaken from financial or payer's perspective. Similarly, commercial rental rates depict the opportunity cost of space, but this data may not be available for health facilities in a rural setting with little commercialisation. Usually, health economists make a trade-off between the availability of information and the precision of cost estimates in serving a specific aim, are transparent about their assumptions and sources used for sensitivity analysis to test the robustness of the results.

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Experiences of Costing in Healthcare

Chapter 3.1 International Experiences in Costing for Healthcare Decision-making

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Overview

Health Technology Appraisal (HTA) is a core part of building a robust and expanded evidence base for healthcare decision-making. As the use of HTA has increased around the globe so has the use of economic evaluation guidelines and repositories for economic evaluation studies.(3-5) These provide easy access to the expanding evidence, just as Clinical Trials databases provide access to the efficacy and effectiveness of interventions or technologies. This pooling of knowledge has not been paralleled in the area of costs and resource use in hospitals and healthcare. Yet cost information is vital to the price setting process. Cost benchmarks can limit the cost escalation often found in health systems dependent on private providers.(1,6) Resource use and cost information is also part of ensuring value for money, monitoring and auditing stakeholders and estimating budgetary needs. More accurate estimates of cost also help policy-makers move from ad-hoc budget estimates, based on information such as historical trends, to budgets based on actual resource needs. The importance of building this part of the evidence base is being increasingly realised at the country level in India, yet the data available remains limited.(7,8) Global experience in measuring resource use and costs can provide some valuable insights for India on national efforts for resource use and cost data collection and compilation. This chapter will provide a brief overview of costing in health policy and decision-making and outline the critical sets of information needed. It will describe some of the national costing efforts from both high- and middle-income countries in order to derive some lessons and future directions for costing and resource use monitoring in India.

Learning Objectives

By the end of this chapter, the reader will be able to:

- describe the key national and international efforts for costing health services across the globe
- derive the lessons learned from these international costing schemes for India

Costing in Healthcare Decision-making

When we think of costs we often think of prices. Prices are the negotiated rate for a good or service, represented by the actual financial expenditure/ charge. However, these do not always reflect the true cost of producing a service which is the value of the inputs to a service. (table 1) In fact, charges or reimbursement rates rarely reflect the actual cost of delivery and therefore can lead to inefficiencies in resource allocation.(9) In a fragmented private system such as the USA, the reimbursement rates vary dramatically, reflecting the market power of the two parties.(10) Under a system where a central purchaser operates such as in the UK, France, Australia and Thailand, it is possible to have schedules of reimbursement rates that are uniform across sets of providers and that are based on the cost of provision. This uniform price setting by the central regulator has the greatest potential to contain growth in costs.(1) The approved capitation rate in Thailand is consistently below the proposed rate by the providers of services providing an example of how monopsony power combined with good cost information can contain costs.(11,12)

Table 1. The difference between costs, prices and reimbursement explained

Term	Definition
Cost	To providers: The value of provider resources utilised to deliver healthcare services
	incurred
	To payers: The value of all resources used to deliver healthcare services (for some
	payers this may include the costs of accessing services e.g. transport costs)
	To patients: The economic implications of accessing health care services including
	treatment costs, costs of accessing services (e.g. transport costs)
Price or charge	The amount asked by a provider of either a patient or payer in exchange for a
	healthcare good or service (the amount on a medical bill)
Reimbursement	A payment made by a third party payer to a provider of services for each service
	delivered; each day in hospital; for a DRG; or a patient under their care (capitation).

Source: Adapted from Arora V.et al, AMAJ Ethics. 2015

Investing in the accurate measurement of costs has potential to reduce inefficiency and waste. The first step in cost measurement is the identification of the inputs to the services before attaching a value to these inputs. Resource use measurement or the identification and quantifying of inputs to services therefore should underpin any national costing effort. Resource use measurement can be done at different levels e.g for a facility, for a department, for a condition or at the patient level. Patient level costing captures all the cost of all the resources utilised by a single patient in the treatment of their condition. If a health system can track resource use at this level, patient costing is the optimal way to understand resource use. However, this approach is data intensive, and few systems or facilities can capture this level of detail to produce nationally representative data.

Across the globe, common costing units (or groupings) include the cost of running a facility (block budget), the cost of a single service delivered (e.g. fee for service), the cost of a day in hospital (e.g. per diem rate for inpatient care) or for an episode of care (e.g. DRG/HRG). Diagnosis related groups (DRGs) or similar systems of coding, such as the Healthcare Resource Group (HRG) in the UK, are groupings consisting of patient events that have been judged to consume a similar level of resource within a particular specialty. DRGs are used in many countries e.g. the USA, Australia and the UK and provide good comparative estimates of costs. Defining these groups of conditions has helped streamline the charging process as charges are made against the condition rather than an assortment of services provided. DRG type systems have been able to promote cost containment compared to fee for service-based systems by providing a system for estimating benchmark costs.

One of the key problems in costing is the lack of good quality data that is reported in a transparent manner.(13,14) There has always been significant heterogeneity in methods used in costing across the globe, driven by differences in health services, organisations, data availability and lack of methodological guidance.(15) Standardisation of costing methods within a single country setting can help improve the usability of data generated. In addition, to ensure good quality estimates, particularly where capacity in health economics is limited, methodological guidance is imperative. Guidance can provide a minimum standard of quality and ensure like is compared with like when comparing costs across settings, organisations and healthcare programmes. Other quality assurance mechanisms also need to be in place, for example uniform data entry systems supported by training and guidance. Data audits will also be needed as well as independent expert review of processes and results.

To generate good quality health care cost estimates, there are a range of experiences and resources from around the globe that India can learn from and use. The following sections look at national and international level costing for healthcare decisions from around the globe. The case studies have been chosen purposively for the lessons that they can provide to India. For each initiative, the chapter describes the context and costing initiative. A final section draws some lessons for India from these initiatives.

Global Costing Initiatives to inform Healthcare Decision-making

A number of international initiatives have been put in place as a response to the ongoing issue of lack of standardisation, transparency and quality in costing and economic evaluation studies in low- and middle-income countries.(13,16) These initiatives serve to improve the quality of costing as well as generate evidence. Table 2 summarises the role of four of these global initiatives. Methodological improvements have been largely achieved through the development and

production of standardised guidance for costing such as the Global Health Costing Consortium (GHCC) principles, Immunisation Delivery Cost Catalogue (IDCC) approach to immunization costing and the Joint Learning Network's manual on costing health services.(17-19) The evidence base has also been increased through systematic reviews for GHCC, IDCC and WHO CHOICE, as well as large scale costing studies, using the new guidance.(20) WHO-CHOICE has further used their data to use statistical analysis to provide country level health system costs.(21,22)

Table 2: Overview of three significant international costing initiatives

Database	Purpose	Cost units	Source of costs	Location
GHCC	Improve unit cost estimates for TB and HIV interventions; develop database of unit costs	A specified set of outputs for HIV and TB intervention/programmes	International survey/ outreach to partners/ literature review	https://ghcosting.org/
Immuniz ation delivery cost catalogu e	Collection of primary data (EPIC) and compilation of costs for routine vaccinations based on a systematic review (ICAN) available as Excel workbook and web tool.	Specified set of outputs identified for different vaccinations (eg vaccine delivered, vaccinated child)	Systematic literature review - ICAN; Primary data collection - EPIC	http://immunizatione conomics.org/
WHO- CHOICE	Provide country level cost estimates across range of interventions for HTA	Facility level outpatient visit; Facility level inpatient day	International survey of costs combined with econometric modelling	http://www.who.int/c hoice/cost- effectiveness/en/

Such international costing initiatives have been driven and funded by international agencies working in health. They have recognised a need for information in countries where data is lacking or of poorer quality and have been able to harness the resources to collate data centrally. At the heart of these initiatives is a drive to generate information for healthcare decision-making in low- and middle-income country settings but to also inform international agencies own priority-setting and reimbursement decisions. In vertical programmes such as HIV prevention and care and vaccinations, these data can be invaluable. However, when taking a national health system approach the limitations of centrally collected data become apparent. Costs can be highly contextual and will be driven by the organisation of the health system and health services, the types of providers, the geographical nature of a particular setting, the epidemiological profile of population and the level of development. (23,24) Another drawback is the reliance on systematic

literature reviews and one-off costing studies when country contexts and healthcare procedures change over time. Regularly collated, country level costing whether through primary data collection or contextually appropriate modelling would be more appropriate to inform healthcare policy and prices.

Country Level Experiences in Healthcare Costing

Country experience in costing for health systems is diverse. As there is very little work at the national level and data systems are still under-developed in Low- and middle-income countries it is necessary to look at high and upper-middle income countries to provide lessons for national costing efforts in India. Table 3 summarises the national costing efforts in 6 purposively selected countries that hold their own national healthcare cost databases, including 1 middle income country.

The driving force behind these national costings in a country with universal healthcare tends to be the need to set uniform prices for healthcare services. In systems where uniform prices are set, national cost surveys are carried out on a regular basis. These cost surveys can involve all participating providers e.g. the UK and Australia; or a sample of representative providers e.g. France, Germany and Thailand.(1) In many LMICs, routine reporting of cost of health services at a national level is nascent or does not exist.(13,25) Implementation of national cost surveys varies from country to country as they need to meet the needs of the health system and be affordable. The technical institutions for health system costing and price-setting negotiations are established within government (e.g. England, Japan, Republic of Korea and Thailand) or as independent agencies (e.g. Australia, France, Germany and Maryland (US). These institutions have varied role but are critical in commissioning the costing work to inform commissioning of health services or national health insurance fee schedules.

Both the UK's (as of 2019/2020) and Australia's costing use patient level costing to establish the costs of the different DRGs.(26,27) Australia's Independent Health Authority also generates facility level costs to establish the level of block funding of smaller healthcare facilities.(27) In the USA, Medicare collates resource use data and healthcare charges to estimate the costs of different conditions in the Healthcare Cost Reporting Information System.(28) More recently in the USA there has been an effort to benchmark costs in the hope that this will drive charges close to the true cost of provision and limit over-charging.(6) To limit complexity and cost, Canada's patient cost estimator is derived from a smaller sample of its overall facilities from four provinces.(29) Other methods used that limit the burden of cost of data collection can be found in the Netherlands and Thailand. In the Netherlands, the reference costs are constructed using costing methods that focus on the important costs.(30,31) Unlike many other European countries, micro-costing is not applied to the less important costs. In Thailand, purposively selected facilities

that had been judged to be efficient and providing quality care were surveyed and costs were estimated by deriving relative value weights for a pre-identified set of conditions.(32) To derive the cost of each condition, the total amount chargeable for the hospital was allocated to each condition based on utilisation figures and the relative value weights.(32) Thailand's cost data have been used in negotiating capitation rates for providers as well as in economic evaluation. The government was able to use this evidence base to help negotiate lower prices with providers and suppliers.(12,33)

Table 3: Overview of selected national experiences of costing for healthcare

Costing authority	Time period	Purpose	Cost units	Source of costs	Location
HITAP (Thailand)	First reported in 2010.	HTA including price setting	Relative value units of different conditions (3091 conditions)	Sample 5 of efficient hospitals	http://www.hitap.net/co stingmenu/Only available in Thai
NHS Improvement (UK)	Annual collection since 1996/7	HTA, performance measurement, reference prices and reimbursement; measures the average unit cost to the NHS of providing defined services to NHS patients in England in a given financial year	HRGs (shift to patient level costing from 2019)	All NHS trusts	https://improvement.nh s.uk/resources/national- cost-collection/
CMS.org (USA – Medicare)	Since 1996	Reimbursement, utilisation analysis; more recently used for benchmarking costs in selected states	DRGs	All Medicare providers	https://www.cms.gov/R esearch-Statistics-Data- and- Systems/Downloadable- Public-Use-Files/Cost- Reports
Healthcare Cost and Utilisation Project (USA – national)	Since 1988	Nationally representative sample of inpatient care for research (healthcare resources and charges)	Patient resource	Facilities of 48 participating states	https://www.hcup- us.ahrq.gov/ Access for a fee.
Canadian Institutes for Health		Performance measurement, HTA and other research, Reimbursement rates, Inform decisions in other provinces	Case mix groups (based on patient level costing)	60 health service organisations in 3 provinces	https://www.cihi.ca/en/patient-cost-estimator
Dutch Costing Tool (The Netherlands)	First assessed in 2000; updated in 2010 and 2016	Reference pricing; reimbursement rates and HTA	DRGs	Sample of Netherlands health facilities	https://www.imta.nl/cos tingtool/
Independent Hospital Pricing Authority (Australia)	2012/13 to present	HTA, performance measurement, reference prices and reimbursement	DRGs (patient level costing)	453 hospitals, (96% of all admitted acute care episodes)	https://www.ihpa.gov.a u/

In all cases presented here, the specification of the full range of treated health conditions or treatment coding (e.g. DRGs) form the basis of the costing exercise. Total hospital expenditure or costs are then allocated among each of the conditions or DRGs provided in a single year. Carrying out this allocation involves measuring the resources used for each condition alongside information on the cost of those resources. To enable this approach to costing therefore requires clear and nationally accepted definition of the DRGs/conditions, hospital cost surveys that should be representative for the country(34) and reliable hospital information systems that can generate resource use data at the patient level. Raulinajtys-Grzybek M (2014) carried out an analysis of the methodologies used in cost accounting systems in 13 countries.(35) and provided an in-depth review of cost accounting methods used in different countries to inform price-setting. It found significant methodological variations in the costing approaches adopted across countries. The costing accounting methods were scored on the methods used for the allocation of support centres and the calculation of intermediate and final products(9). Step down methods of allocation were considered better than direct methods. In the case of intermediate and final product calculations bottom micro costing was considered the optimal approach and gross costing scored the lowest. Table 4 reports on the results of their analysis which show a range in the quality of methodologies across the countries. Australia ranks first with the overall score of 7 and the United States (Medicare) at the bottom with 4 points.

Table 4: Assessment of Cost Accounting Methodology

Country	Allocation of support cost centres	Calculation of intermediate products	Calculation of final products	Total
Australia	1	3	3	7
Austria	0.5	2	1	3.5
Denmark	1	2	3	6
England (mandatory)	0.5	2	2	4.5
England (PLICS)	0.5	3	3	6.5
Estonia	0.5	2	2	4.5
Finland	0.5	2	3	5.5
France	1	2	3	6
Germany	1	3	3	7
Hungary	0.5	2	2	4.5
Italy	N/A	1	2	3
Netherlands	0.5	2	2	4.5
Sweden	0.5	3	3	6.5
United States (Medicare)	1	1	2	4

Source: Raulinajtys-Grzybek M. Health Policy. 2014.

Using cost data to inform policy in practice - What next for India?

International experiences have shown a move from compilation of one-off costing studies to the systematic collection of facility level data to generate condition specific costs to, now, comprehensive collection of patient level resource use and cost data. Methods have evolved and improved as has methodological guidance. National costing efforts have provided valuable benchmarks for improving efficiency, reducing costs and even ensuring quality services.

As public sector insurance schemes in India grow, the dearth of costing evidence still remains. However, to address this gap, the Department of Health Research (DHR) have supported the development of National Health System Costing Database and now funded a large-scale national costing study-Costing Health Services in India (CHSI). The data base can be found at https://www.healtheconomics.pgisph.in/costing_web/index.php, hosting currently available health care cost data as well as methodological support and data collection tools. The CHSI study will generate costs for almost all of the healthcare packages that fall under AB-PMJAY, as delivered in the private and public sectors. (36) Data compiled for this study is a commendable first step towards filling the information gap and provides a national perspective on the healthcare costs for the first time. But there are further needs. India's health insurance schemes are multiple, and each scheme reimburses against different packages of services. Under AB-PMJAY there are close to 1400 different service packages against which patients can claim creating a complex picture of costing and price negotiation. The CHSI study is a start in meeting the costing needs of these schemes but is still small relative to the range of facilities involved. International experience suggests that, patient level costing at all empanelled providers would allow state and the central governments to provide the most accurate and useful costing benchmarks from which to set prices. One route for this to happen is the adoption of a DRG-type classification system and the establishing, as standard practice, of data systems that track patient level resource use at the facility level. Providers would need to be supported to create systems that generate this information and compelled to supply these and audited cost data to governments.

Understanding the resource use and costs associated with health service provision will facilitate consensus on the costs of different services in India, help the delivery quality, safe care and limit cost escalation. India has started to implement a national costing effort, but further work is needed to establish a standardised framework for costing, develop data systems to track resource use and to compel all healthcare providers to submit healthcare cost reports.

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Indian Experience in Costing: Costing of Health Services in India (CHSI) Study

Chapter 3.2.1 Costing of Healthcare Services in India: Study Methodology

Dr Maninder Pal Singh

Overview

In 2018, Ayushman Bharat Pradhan Mantri-Jan Aarogya Yojana (AB PM-JAY) – a tax-funded national health insurance scheme - was launched in India. With this initiative, government takes on the role of a strategic purchaser. Cost information is a critical component of health technology assessment (HTA) studies and strategic purchasing activities. This chapter explains the methodology of the first national costing study being undertaken in India. This chapter has been adapted from a published article titled "Establishing reference costs for the health benefit packages under universal health coverage in India: cost of health services in India (CHSI) protocol." Available from: doi: 10.1136/bmjopen-2019-035170.

Learning Objectives

By the end of this chapter, the reader will have:

- Explored the process of designing a national costing study in a low- and middle-income country (India).
- Examined the key considerations for selection of appropriate costing methodology.
- Understood the potential solutions for apportioning of joint resources due to lack ofdisag gregated data.

Key Definitions

- Ayushman Bharat Pradhan Mantri Jan-Aarogya Yojana (AB PM-JAY): It is a tax funded health insurance scheme aims at providing a health cover of INR 5 lacs per family per year for secondary and tertiary care hospitalization to over 50 crore beneficiaries covering the bottom 40% of income earners in the Indian population. This hospitalization care is provided through a network of empaneled public and private hospitals.
- Health Benefit Package (HBP): Designated list of health care services for treatment of conditions covered under the AB PM-JAY selected on the basis of disease burden and out-of-pocket (OOP) burden.

Introduction

The Government of India (GoI) has launched the Ayushman Bharat Pradhan Mantri-Jan Aarogya Yojana (AB PM-JAY) – a tax-funded health insurance scheme to provide accessible and affordable healthcare to its citizens. It is a scheme designed to provide financial protection to beneficiaries seeking care at secondary and tertiary levels in public and private healthcare facilities.(1) In parallel, the GoI has directed its health technology agency – Health Technology Assessment India (HTAIn) to generate evidence to inform the costing of health benefit packages (HBPs) under AB PM-JAY.(2) So, a national costing study entitled Costing of Healthcare Services in India (CHSI) was initiated. The CHSI cost information was used as a base cost in the process of revision of reimbursement prices of AB PM-JAY in the year 2019. The detailed process adopted for price setting is described in chapter 3.2.2 of the manual. This chapter will describe the costing methodology of CHSI study considering study design, costing approach, sampling strategy, data collection and data analysis.

Methodlogy

Study Design

The CHSI study follows standard principles for healthcare costing (3-5) and builds on experience from previous work on health system costing by PGIMER and its partners.(6-8) At the time of the study (2018) AB PM-JAYcovered 1573packages/procedures for hospitalisation care. The CHSI study estimated the average unit cost of the individual healthcare services which constitute these HBPs. The study took a healthcare sector perspective and included all the costs required to deliver the HBPs, in both public and private healthcare facilities. This meant that any out of pocket expenditure on drugs and consumables by the patient in the case of public healthcare facilities were also included.

Costing Approach

The available literature recommends several approaches for costing, with each serving a different purpose.(9,10) There are two general concepts: 1) a normative costing takes an approach of costing the provision of services as per a standard protocol, 2) a micro-costing approaches estimate the cost of services as per actual practices of provision. There are two ways in which micro-costing is carried out, top-down and bottom-up costing. A top-down approach uses retrospective data of healthcare expenditures and divides the total expenditure by the services provided in the given period. It does not have distinct steps for measurement and valuation of resource utilisation. A bottom-up costing approach allows much greater disaggregation of the cost data, tends to be more accurate but is more time consuming.(11) Previously in India, cost

studies have used mixed approaches.(12) Disaggregated data are useful for price-setting as it generates information on the cost of each input and allows for the estimation of different combinations of average cost, so that a decision regarding what should be included in the price may be taken.(13) Combining the simplicity of top-down and bottom-up costing approaches is also a common method applied in cost studies.(5,10) This mixed micro-costing approach was adopted in the CHSI study.

The speciality-specific costs related to outpatient, inpatient and intensive care services were estimated by top-down micro-costing approach. In Indian settings, only this approach was feasible as data on use of input resources (drugs, consumables etc) as per morbidity profile of the patients are not maintained. However, in calculating the unit cost of various surgical interventions in the operation theatre, a mixed approach was used: wherein data on utility of input resources (equipment, drugs and consumables) for each surgical intervention were captured separately using a bottom-up approach. The costs of human resources, infrastructure, furniture and overheads were estimated using top-down approach. (Table 1) The average time to conduct a procedure obtained through opinion (surgeons, consultants was expert etc.)

Table 1: Costing approach for each cost centre

Cost Centre	Input Resources	Costing Approach	
	Human resource		
	Capital		
	Furniture		
Outpatient/ Inpatient/	Equipment	Ton down micro costing	
Intensive Care Unit	Drugs	Top-down micro-costing	
	Consumables		
	Utility (Laundry)		
	Overheads		
	Human resource	Bottom-up micro-costing	
	Capital	Ton down micro costing	
	Furniture	Top-down micro-costing	
Operation theatre	Equipment		
Operation theatre	Drugs	Bottom-up micro-costing	
	Consumables		
	Utility (Laundry)	Top down micro costing	
	Overheads	Top-down micro-costing	

The next step was to calculate the unit cost of each cost centre. The average unit cost per outpatient consultation was calculated by apportioning the total input costs incurred on the basis of total number of out-patient consultations. For per bed-day cost of inpatient and intensive care services input costs were apportioned by a factor of total number of patients and average length of stay. The same unit cost was allocated for all the services delivered within the speciality. Data on resources utilised and prices were collected for one year. The cost data collection tools were adapted and developed from previous Indian costing studies.(6-8)

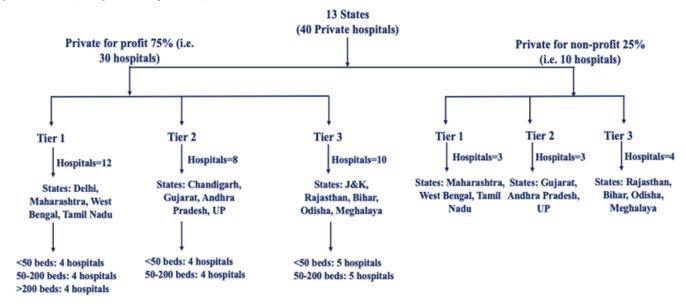
Sampling of facilities

Healthcare delivery costs vary across states and facilities due to variation in service delivery patterns, local prices, rents and wage rates. (7,8) Costs were also influenced by health workforce density and determinants of healthcare seeking behaviour. (11,13,14) Therefore, to obtain costs of items in the AB PM-JAY HBP we sought a representative sample of national level, secondary and tertiary hospitals in both the public and private sectors. A multi-stage stratified sampling method was used. The states were selected to enable representation across factors such as geography, health indicators, gross state domestic product (GSDP) and health workforce density. The states included in the study were Jammu & Kashmir, Chandigarh, New Delhi, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu and Meghalaya. Within each state, a tertiary level medical institution was chosen. The choice of the tertiary level health care facility was guided by the availability of specialities in order to maximise the number of services costed across the sample. At the secondary care level, costing was done at 3 district hospitals in each state. The districts were randomly selected from each of the 3 tertiles of the district composite development score ranking.(16) This development index was based on an aggregation of socioeconomic, demographic and health service utilisation indicators. Overall, a total of 52 public health facilities were selected including 13 public tertiary care hospitals and 39 district hospitals providing secondary care.

For sampling of the private hospitals, we used the list of empanelled hospitals as part of the national level Rashtriya Swasthya Bima Yojana (RSBY) and state-specific publicly financed health insurance schemes (PFHIs); in the absence of any formal accreditation mechanism or implementation of clinical establishment act. For each hospital, the data on location, ownership and number of beds of the hospitals were obtained. From this list, a sample of 40 private hospitals from 13 states considering type of ownership, location and size of the hospital was selected. A stratified sampling was used for selection of private hospitals. First, nearly 75% of the total private sector hospitals were reported to be for-profit,(17) a corresponding probability proportion to size approach was chosen to select hospitals by type of ownership. Second, hospitals were chosen

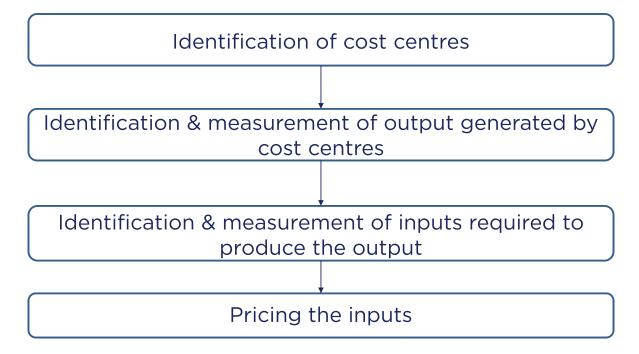
from different tiers of cities in each of the chosen 13 states. Last, the hospitals were stratified by the size in terms of hospital beds. (Figure 1) The choice of sampling methods for the private sector was complicated for multiple reasons. First, there was no single comprehensive updated line list of all medical facilities or hospitals in the private sector. Second, the heterogeneity of the private sector in terms of its resources and cost of care further complicates the methodology of sampling. Third, it was not possible to survey facilities to establish the different levels of quality of care across providers.

Figure 1: Sampling technique for private sector



Data collection

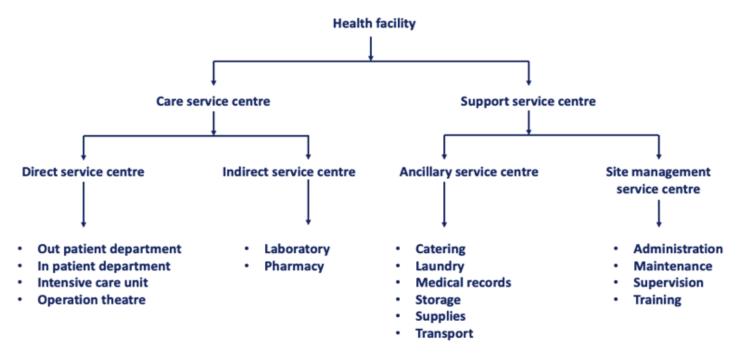
The process of data collection followed a step wise approach as shown in figure 2. Figure 2: Process of data collection



Identifying input resources

The first step was preparation of an inventory of cost centres for each facility as outlined in Figure 3. This includes care service centres (providing direct patient care) and support service centres. The care service centres were further classified into direct and indirect service centres.

Figure 3: Type of service centres to be costed at different level of facilities (all heads may not be applicable at both tertiary and secondary level health facilities)



Each service centre that produced a product or output towards care services was first identified and its output was defined. For instance, the output of an inpatient ward was number of hospitalisations; while the output of an operation theatre was number of surgical procedures performed. It was followed by measuring the quantity of output produced in one year at the service centre from the routine physical or Management Information system (MIS) records at the institution. For the support centres, a unit of output was also be defined like for catering it was number of diets prepared. Once service centres and the type of output were determined, the inputs used to produce the output for each service centre were identified and their quantity is measured. (Table 2)

Table 2: Cost centre inputs

Unit Inputs		Data collection units (how data were collected)	Data collection on salary/prices	
COSL		(now data were conected)	salary/prices	
OPD	Human	Time allocation interview and	Accounts department	
	resource	observation		
	Capital	Area in sq. feet	Rental price (Key informant interviews)	
	Furniture	Quantity in numbers from Indent registers and physical verification	Central Procurement store Online sources	
	Equipment	Quantity in numbers from Indent registers and physical verification	Central Procurement store Online sources	
	Drugs	Quantity in numbers from Indent registers	Central Procurement store Online sources	
	Consumables	Quantity in numbers from Indent registers	Central Procurement store Online sources	
	Utility (Laundry)	Quantity from speciality records	Outsourced: Expenditure data In-house: Costing as a single cost centre	
	Overheads	Expenditure in INR from accounts department	Expenditure data in INR	
IPD/ ICU	Human resource	Time allocation interview and observation	Accounts department	
100	Capital	Area sq. feet	Rental price (Key informant interviews)	
	Furniture	Indent registers and physical verification	Central Procurement store Online sources	
	Equipment	Indent registers and physical verification	Central Procurement store Online sources	
	Drugs	Indent registers	Central Procurement store Online sources	
	Consumables	Indent registers	Central Procurement store Online sources	
	Utility (Kitchen & Laundry)	Quantity from speciality records	Outsourced: Expenditure data In-house: Costing as a single cost centre	
	Overheads	Expenditure in INR from accounts department	Expenditure data in INR	
ОТ	Human resource	Time allocation interview and observation	Accounts department	
	Capital Furniture	Area in sq. feet Indent registers and physical	Rental price (Key informant interviews) Central Procurement store	
	ramiture	verification	Online sources	

Equipment	Indent registers and physical	Central Procurement store
	verification	Online sources
Drugs	Indent registers	Central Procurement store
		Online sources
Consumables	Indent registers	Central Procurement store
		Online sources
Utility	Quantity from speciality records	Outsourced: Expenditure data
(Laundry)		In-house: Costing as a single
		cost centre
Overheads	Expenditure in INR from accounts	Expenditure data in INR
	department	

OP: outpatient, IP: inpatient, ICU: intensive care unit, OT: operation theatre, INR: Indian Rupees

The inputs were divided into fixed and variable using a standard classification system across all facilities. The variable resources were subdivided into: drugs, consumables, utility and overheads such as electricity, water, maintenance etc. Fixed resources were subdivided into: human resources, capital space, equipment, furniture etc. Staff time for each service centre was determined through staff interviews using a pre-tested semi-structured interview schedule, used in earlier costing studies.(11,12,17) For each service centre, a minimum of 25% of staff from each cadre of staff was interviewed to ascertain the time spent by each cadre in individual activities. All resources used for a given surgery or procedure for treating a specific condition which were not provided by the public healthcare facility, a list was obtained based on the expert opinion and included in cost estimation. This includes out-of-pocket expenditure incurred by the patients on resources such as medicines, consumables, or diagnostics. This information was important for deriving cost estimates for setting the provider payments for HBPs.

Valuing resources used

The monetary value for each item was determined based on the current market price. Since the purpose of the CHSI study was to inform price setting under the AB PM-JAY scheme, the current procurement prices of the hospitals for procurement of medicines, consumables, equipment and other items were used. Gross salaries of individual human resources were obtained using the pay slips from the accounts department. The rental value of government land when leased to private vendors was used to estimate the opportunity cost of the space utilised in each cost centre. In addition, this was supplemented with a key-informant survey to obtain rental prices in the neighbourhood of the hospital. For estimating the cost of building and space, the floor area was multiplied with rental value. The capital costs such as equipment, furniture etc., was annualised using a standard discount rate of 3% as recommended in international and Indian HTA guidelines.(3,17) All costs were calculated in current INR.

Costing Handbook 1

Data analysis

Total and unit costs for each service centre and speciality

The annual cost of each type of recurrent input was calculated by multiplying the unit price by the number of consumed inputs for a given time period within the service or support centre. All input costs for the care or support centre were then be summed to obtain the total cost. At each facility, total cost and unit cost was generated for each cost centre. The cost of joint resources was allocated based on appropriate apportioning statistics. (Figure 4) (Table 3)

Figure 4: Apportioning of overhead costs

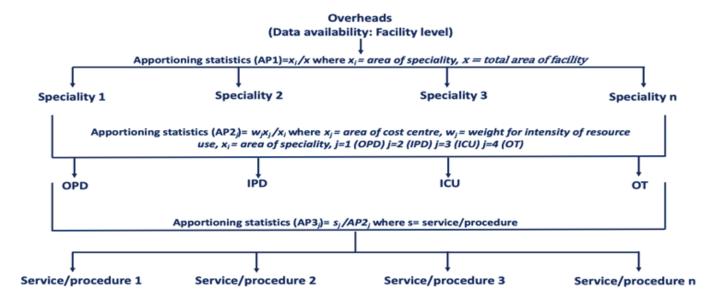


Table 3: Apportining statistics for joint resources

Input resources	Level of data	Allocation Apportioning statistics		
	collection	level		
Human Resource	Speciality	1. Cost centre (OPD/ IPD/ICU/ OT) 2. Output	Based on time allocation & observation, salary was apportioned to each cost centre For shared human resources like ward boys, salary was allocated to the respective departments based on the number of patients of each department OPD: Number of patients ICU/IPD: Number of patients * average length of stay OT: Weighted average of number of procedures * time per procedure	
Capital	Speciality	1. Speciality 2. Cost centre (OPD/ IPD/ ICU/ OT) 3. Output	Total space of speciality in the facility based on area sq. feet Total space of cost centre in the speciality based on area sq. feet Common areas like waiting areas, corridors etc were allocated based on number of patients of each department OPD: Number of patients ICU/IPD: Number of patients * average length of stay OT: Weighted average of number of procedures * time per procedure	
Furniture	Speciality	1. Cost centre (OPD/ IPD/ ICU/ OT) 2. Output	Furniture used in each cost centre Furniture in common areas like waiting areas, corridors etc were allocated based on number of patients of each department OPD: Number of patients ICU/IPD: Number of patients * average length of stay OT: Weighted average of number of procedures * time per procedure	

Equipment	Speciality	1. Cost centre 2. Output	Equipment used in each cost centre Equipment in common areas like waiting areas, corridors etc were allocated based on number of patients of each department OPD: Number of patients ICU/IPD: Number of patients * average length of stay OT: Equipment use for each procedure was estimated; then allocation based on weighted average of number of procedures * time per procedure
Drugs & Consumables	Speciality	1. Cost centre 2. Output	Drugs & consumables used in each cost centre OPD: Number of patients ICU/IPD: Number of patients * average length of stay OT: Drugs & consumables used for each procedure were estimated followed by apportioning on number of procedures
Utility (Kitchen & Laundry)	Speciality	1. Cost centre 2. Output	Expenditure on each cost centre OPD: Number of patients ICU/IPD: Number of patients * average length of stay OT: Number of procedures
Overheads a. Electricity	Facility	 Speciality Cost centre 	Cost was allocated based on proportion of area Cost was allocated to each cost centre by using an electricity consumption factor

		3.	Output	OPD: Number of patients
				ICU/IPD: Number of patients * average length of stay
				OT: Weighted average of number
				of procedures * time per procedure
h \\\-\-\/\C/				
b. Water/Gas/ Kerosene	Facility	1.	Speciality	Cost was allocated based on
				proportion of area
		2.	Cost	Cost was allocated to each cost
			centre	centre by proportion of area
		3.	Output	OPD: Number of patients
				ICU/IPD: Number of patients *
				average length of stay
				OT: Weighted average of number
				of procedures * time per procedure
c. Telephone/	Facility	1.	Speciality	Cost was allocated based on
Internet/				proportion of area
Security		2.	Cost	Cost was allocated to each cost
			centre	centre by proportion of area
		3.	Output	OPD: Number of patients
			·	ICU/IPD: Number of patients *
				average length of stay
				OT: Number of procedures
d. Biomedical	Facility	1.	Speciality	Per bed day expenditure
waste				multiplied by number of beds in the
				speciality
		2.	Cost	Based on number of bins in each
			centre	cost centre
		3.	Output	OPD: Number of patients
				ICU/IPD: Number of patients * average length of stay
				OT: Weighted average of number
				of procedures * time per procedure

OP: outpatient, IP: inpatient, ICU: intensive care unit, OT: operation theatre

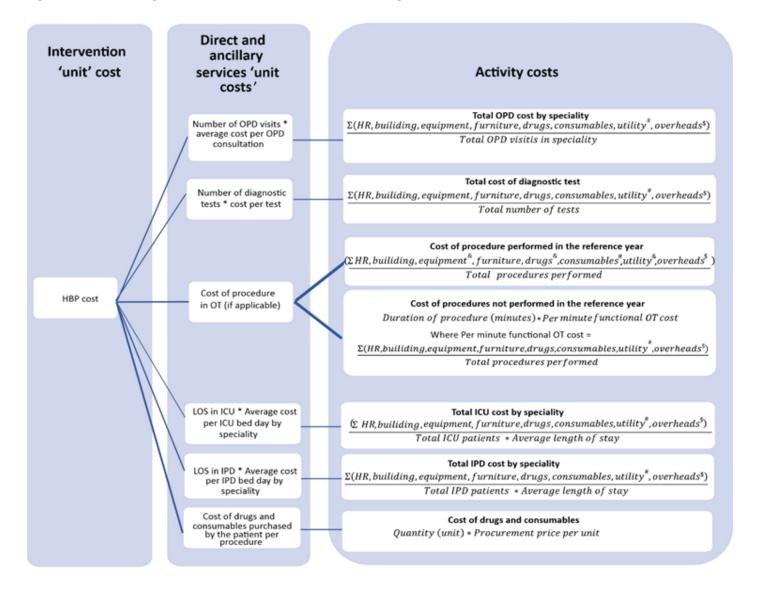
Costing Handbook

Finally, the allocated cost of the support and indirect service centres such as laundry, kitchen etc., was added to the costs of the respective care centre to obtain a total annual cost of providing each service (care and speciality). These costs were allocated to each of the care centres on the basis of utility and number of patients. The CHSI study estimated the following unit costs for individual specialties at public and private sector hospitals, for both secondary and tertiary level of health care – the cost per outpatient consultation, per inpatient bed-day, per individual surgery, per diagnostic test, per ancillary service etc. The speciality specific unit cost of outpatient care was estimated as a ratio of total annual costs for outpatient care and total number of out-patient visits for respective specialties in reference year period. Similarly, the unit cost for inpatient care was calculated as the ratio of total inpatient costs and total bed-days of admission for each speciality. The unit cost per procedure for the operation theatre was calculated as the ratio of the total cost of inputs like HR, equipment, drugs, capital etc. utilised for specific procedures to the number of each specific procedure.

Disease-specific or HBP Cost: Using Cost data for Pricing

The estimates derived from the CHSI cost data includes unit cost per out-patient consultation, per diagnostic test, per procedure, per bed day cost (intensive care unit or in-patient ward) and per follow-up consultation. These estimates were calculated for each speciality and same unit cost was used for all the above-mentioned services delivered in a particular speciality. These estimates were used to derive unit cost of HBPs within the AB PM-JAY. (Figure 5) The HBPs under a speciality were of two types, procedures performed in the facility during the reference year and those not performed. For the estimation of the cost of these items, data on average OP visits, diagnostics, procedure time and average length of stay in ICU/IP was collected based on the expert opinion. For the estimation of cost of procedures performed during the reference year, primary data were collected. However, the cost of procedures which would not have been conducted during the reference period, was estimated by using unit cost per functional operation theatre hour. All other unit costs such as (OP, IP, diagnostics) remain the same as in the case of procedures conducted in the reference year. This individual service specific costs were added up to about 32,500 end points. For each disease, thetreatment pathway was described and cost data from the CHSI study is applied to estimate the average cost of the hospital component of treatment. The input costs in the HBPs are divided into fixed and variable costs, so as to derive package rates at different levels of reimbursement of fixed cost at 100%, 75%, 50% and 33%, along with 100% variable cost.

Figure 5: Calculating Unit Cost of a Health Benefit Package (HBP)



OP: outpatient, IP: inpatient, ICU: intensive care unit, OT: operation theatre, LOS: length of stay

The CHSI study provided the first nationally representative comprehensive costing data – in terms of geographic coverage, condition coverage, levels of care and type of health care providers. It used standard costing methods to determine the cost of 1573 HBPs under the AB PM-JAY and incorporate diverse public and private healthcare facilities. The CHSI study proposed a range of different pricing scenarios for setting of reimbursement prices by presenting disaggregated analysis of unit costs for each HBP. Each scenario consisted of full variable cost and different shares of fixed cost (100%, 75%, 50% and 33%).

In the Indian healthcare system, the availability of segregated data at identified cost centres was limited or lacking. As such only the mixed micro-costing approach, a combination of top-down and bottom-up was possible. However, apportioning of shared resources was done recognising that there was a degree of arbitrariness to such allocations and needs to be clearly explained in the data analysis section. Moreover, there was absence of electronic health records (EHR) in Indian healthcare system, hence it was not feasible to capture disease specific data. Therefore, speciality specific inputs were apportioned to individual services provided by a cost centre based on suitable apportioning statistics as provided in table 3. So, for all the HBPs delivered in a speciality the same cost per outpatient visit or cost per bed-day was used. This may have reduced the accuracy of the cost calculation. Furthermore, in absence of standard treatment guidelines (STGs) for most of disease conditions or HBPs, to define treatment protocol expert opinion by healthcare providers was considered.

The CHSI study will help in deriving a cost function to predict the cost of various health care services at different levels of India healthcare system and thus reducing the need for recurrent primary data collection. In addition, the cost data can be used for health technology assessment (HTA) studies in India for which health system cost data are required but primary costing studies have been necessary due to the absence of national level or disease specific data. This was not only resource and time consuming but may also lack generalisability due to the small sample of hospitals covered. The study estimates will also help to broaden the existing health system cost database.(19) Finally, it will help policy makers understand the present costs of delivering various services in the public healthcare system and support the better management of financial resources. These cost data can help in developing transparent and evidence-based decision and policy making to facilitate re-allocation of resources more appropriately, effectively and efficiently.

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3.2.2 Use of Cost Information for Policy and Research

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Overview

Health system cost information is the building block for determining efficient use of resources. This chapter will provide an overview of various cost accounting methods and the use of cost data in research and policy making.

Learning Objectives

By the end this chapter the reader will understand the following in relation to the health sector in India:

- · Selection of appropriate cost information for research and policy making
- · Uses of cost information in policy
- Use of cost evidence for evidence-based price setting

The adoption of health system costing and cost accounting systems in the health sector gained momentum in the late 1980s as an important step in health financing reforms.(1) Globally, health system cost information provides a basis for the resource allocation for providers, purchasers and regulators at the system and organizational level.(2) However, the development of health system costings which are valid, reliable, feasible and comparable has proved to be challenging.(3) In this chapter, we focus on the use of cost information to improve health care financing and for undertaking economic evaluations. This chapter is divided into three subsections. Section one focuses on the important aspects to be put into consideration before selecting or using cost information for research and policy making. In the second section, different uses of cost information in the health system and policy making are discussed. The last section addresses a critical question on the use of cost information for evidence-based price setting. Last, the recent experience from India pertaining to the revision of reimbursement prices of a large national tax-funded insurance scheme is discussed.

Section 1: Important points for selection of appropriate cost information

There are many concerns over the variability and quality of the cost information.(4) Therefore, in selecting cost evidence for use in HTA studies the following points must be considered:

1.1 Costing Methodology

There are different costing methodologies available. The cost evidence and the granularity of the results will vary based on the selection of the costing methodology (top-down or bottom-up, macro or micro), study perspective (health system or societal or patient to name a few), availability of data on resource utilisation and, the degree of data disaggregation. The definitions of costing methods and perspective are provided in the chapter 2.1 and 2.2 of this manual. Further, the availability of resources and the time period to undertake the costing study are also important considerations.

In many countries, due to the absence of electronic health records (EHR) availability of disaggregated data by condition is rarely available. So, under these circumstances undertaking a costing study from a pure bottom-up approach is not possible. Therefore, in low-and-middle-income countries (LMICs) combining a top-down approach with bottom-up costing is a common method applied in cost studies.(5)

The underlying policy or investment decision will influence the choice of the costing study; to plan for the budget of a health care facility financial cost data are required, whereas for an economic evaluation full economic cost is essential. Financial cost is the actual expenditure paid on the inputs for producing goods and services, reflecting how much money has been spent. Whereas, economic costs are defined as the full cost borne by society, and are based on the concept of opportunity cost, and generally reflected in market prices. On the other hand, to estimate out of pocket expenditure (OOPE) and financial risk protection (catastrophic health expenditure and impoverishment) a study using the cost of illness (COI) approach is useful. "The aim of COI studies is descriptive: to itemize, value, and sum the costs of a particular problem with the aim of giving an idea of its economic burden." (Jefferson et al. 2000) Therefore, to select a costing methodology it is important to identify the appropriate type of cost information needed to inform the research or policy question.

1.2 Addressing variation in cost across hospitals

There is likely to be significant variation in the cost-of-service delivery at country, state and different levels of health care provisioning (primary, secondary and tertiary level). Even within a single hospital, cost of per patient outpatient (OP) visit or per bed-day stay in an inpatient (IP) for different departments or specialities may vary significantly. Hence, sample selection will influence the cost results. Therefore, before using cost evidence from a study the cost information, as assessment to see if the data are robust or relevant and fulfil the needs of policy making or

research. For example, for a hospital manager who wishes to calculate the cost of running a department or speciality, a study within the similar level of the hospital or with a small sample may be sufficient; however, for the revision of reimbursement prices for a health insurance scheme at the state or national level, cost evidence from a study with a large representative sample is required.

1.3 Perspective of the costing

The study perspective is an important aspect and influences the cost evidence generated from the study. The perspective can be societal, health system, patient, healthcare sector or payee etc. These are discussed in detail in chapter 2.1 of this manual. For example, for the economic evaluation of a new drug/technology, societal cost is required whereas for provider payment rates the cost-of-service delivery from a payee's perspective is used.

1.4 Adjusting cost information for inflation

The healthcare costs will increase due to inflation and thus cost information from different years needs to be adjusted. So, it is important to use an appropriate inflation index so that results should be adjusted for inflation to the present year.

1.5 Discounting

By using a discount rate, costs and outcomes at different time periods can be compared. This is separate to inflation and reflects the preferences that society has for deferring costs to a later time, whilst having benefits now earlier rather than later. This phenomenon is known as time preference and has been posed as a rationale for discounting. The detailed explanation is given in chapter 2.5 of this manual.

Section 2: Uses of cost information

Cost information has multiple uses and forms the basis in the field of health care research and policy making. The cost evidence is used in different ways for budgeting and planning, efficiency analysis, estimating the economic burden of disease and illness, economic evaluations of health care interventions or programs and evidence-based price setting.(3) The details of each aspect are discussed as follows:

2.1 Budgeting and Planning

Budgeting is related to the process of defining the allocation of resources to produce the best outputs given the level of revenues. Financial cost information provides the basis for planning and designing services. It helps to project the cost of an intervention or a program in the present and future budget. Further, economic costs and economic evaluations provide a basis for comparing different health care interventions and choosing the most efficient intervention as priority setting.

2.2 Efficiency Analysis

At the level of health financing, cost information provides a basis for resource allocation. Using resource use and cost information can help facilitate more efficient use of scarce resources. Cost data can help in cost management by highlighting on specific inputs, activities or interventions which cause excessive costs. It helps inform robust decisions for restructuring and improvement of services for better management of limited monetary resources.

2.3 Estimating the economic burden of disease and illness

This calculates the cost implications of specific diseases, health behaviours, health conditions etc. For estimating disease cost, two approaches are used: prevalence (also known as average) and incidence (also known as incremental) cost.(3) Both cost estimates have different uses so should be chosen correctly depending upon the research question. Prevalence/average cost estimates include the cost of care for all the individuals including newly diagnosed, long-term survivors as well as the end of life for some diseases like cancer. Average cost estimates can be used by policy makers for budgeting future costs of a program or intervention, setting reimbursement prices for the health insurance etc.

However, for economic evaluations like cost effectiveness analysis (CEA) incidence or incremental cost data is useful. The incidence/incremental cost only includes newly diagnosed cases which are followed longitudinally to assess the costs following diagnosis of a disease. These are helpful in policy decisions for a disease specific treatment or coverage of interventions for prevention and treatment of a disease.

2.4 Economic evaluations of health care interventions or programs

Economic evaluation assesses the specific health care interventions or technologies or drugs for their economic impact and benefits. This also measures the budget impact to assess the financial impact and feasibility of the interventions.

For economic evaluations like cost-effectiveness analysis (CEA) incidence or incremental cost data are useful. In addition, direct and indirect costs are included in an economic evaluation. The direct costs are the costs borne out by the health system to provide an intervention whereas the indirect costs are the costs to the patients for availing the same intervention. The former cost information is derived from the costing studies with the health system and the latter from patient

patient perspective studies.

2.5 Use of cost information for evidence-based price setting

Another important use of cost information is providing a base for price-setting negotiations. Price setting is a complex process having wide financial implications. Provider payment rates are influenced by four factors: policy objectives, available resources, the cost of delivering services and negotiation with providers.(6) In systems where uniform prices are set, cost surveys are carried out regularly. These cost surveys can involve all participating providers e.g. the United Kingdom (UK), United States (US) (Medicare) and Australia; or a sample of representative providers e.g. France, Germany and Thailand (see Chapter 3.1).(7) In many LMICs, routine reporting of the cost of health services does not happen.(8) Price setting mechanisms should cover the cost of health care services and provide financial incentives to the providers to achieve broader health system goals of efficiency and equity. Therefore, there is a need to generate robust estimates of the healthcare service costs, there is a need to invest in the formal mechanisms of cost data collection. Many high-income countries require healthcare providers funded by the state to submit cost data for this purpose, according to a pre-defined cost accounting system. These systems vary in the identification of cost components (gross or micro-costing) and their valuation (top-down, bottom-up and mixed) data availability, data disaggregation, allocation of joint resources, time and resources according to the needs and data systems available in country (see Chapter 3.1).

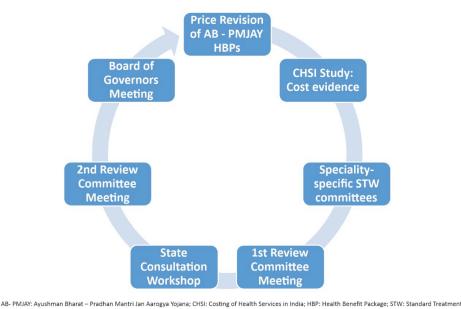
Section 3: Use of cost information for price-setting: An Indian Experience

In 2018, the Government of India launched Ayushman Bharat Pradhan Mantri-Jan Aarogya Yojana (AB PM-JAY) – a tax-funded national health insurance scheme, to cover 100 million families with an annual household coverage of INR 500,000 for provision of inpatient services provided through a network of public and private hospitals. Under PMJAY, providers of health services are reimbursed by the national insurance agency for treatment of 1573 qualifying conditions in the form of health benefit packages (HBPs). The reimbursement rates for each HBP comprises a combination of hotel costs of care plus specific treatment costs defined by guidelines or expert consensus. At the launch of PMJAY, in 2018, the provider payment rates for the AB PM-JAY HBPs were first determined through a consultative process with experts and a review of existing national and state-level health insurance schemes. This was in part because there was limited evidence on the cost of providing health services. Cost studies were limited, and cost accounting mechanisms are partial in public facilities where block grants are received from the state or, in the private sector, have not been adapted to meet the needs of costing HBPs under PMJAY.

Numerous media reports highlighted the limitations of the fee-setting process and there were complaints that the costs were either too high or too low. As a result, the 'Costing of Healthcare Services in India' (CHSI) study was commissioned by DHR to generate evidence on the cost of HBPs, which could be used for price-setting. The CHSI study methodology is published in an international peer-review journal and also discussed in chapter 3.2.1 of this manual.(11)

In 2019, as the scheme expanded, it was decided to revise the reimbursement rates. The CHSI study was used in this second round of price-setting. The revised prices were set following negotiations with the associations of private providers and using the CHSI cost as the evidence base. The first step was a review of CHSI cost for AB PM-JAY HBPs by the Standard Treatment Workflow (STW) committees constituted by the Indian Council of Medical Research (ICMR) for each speciality. Each STW meeting consisted of members of STW group (clinical experts), representatives from NHA, Department of Health Research (DHR), and provider associations such as Indian Medical Association (IMA), Association of Healthcare Providers India (AHPI), and the Federation of Indian Chambers of Commerce & Industry (FICCI). Based on the CHSI cost, experts' inputs and prevailing reimbursement prices, a set of HBP prices were recommended. Next, a state-level consultation workshop was organised for building consensus. Subsequently, another review committee met to incorporate the feedback from different stakeholders. Once feedback from the state level stakeholders' hand been incorporated, the prices were presented to the Board of Governors of NHA. Finally, the Board approved the revision in the AB PM-JAY HBP prices (Figure 1)

Figure 1: Process for Price Setting: for AB PM-JAY HBPs



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Source: Prinja S et al. Applied Health Economics and Health Policy. 2021

Conclusion

Good quality cost data informs evidence-based decision making and enhances the efficiency of the health system. Cost information is fundamental for the management of the health system and research. This chapter serves as a reference for policy makers and researchers in choosing the appropriate cost information for decision making and economic evaluations. In the future work should continue in the field of health system costing to improve the scientific rigour and usefulness of the health system cost in India as well as other low- and middle-income countries (LMICs).

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3.2.3 Costing - The Indian Experience

Ms. Sehr Brar

The Costing of Health Services (CHSI) study was a landmark study, spanning 13 states of India, collecting cost data for over 1500 medical packages. The scope and extent of the study make it a treasure trove for researchers and managers who want to learn about cost data collection in India. The learnings from the CHSI study were captured through a process evaluation of the study, which is presented in this chapter. This chapter describes the experiences of CHSI study including the problems encountered during the data collection process and the innovative ideas employed to obtain the required data. This chapter has been adapted from a published article titled "Process evaluation of health system costing – Experience from CHSI study in India". Available from: https://doi.org/10.1371/journal.pone.0232873

Learning objectives

By the end of this chapter the reader will:

- Understand the specific challenges faced in conducting a nationwide costing study in the Indian setting.
- Understand the processes and bottlenecks in cost data collection
- Be able to make recommendations to address these challenges in the process of the planning future costing studies.

Introduction

Cost data collection for economic costing of health services involves a number of sequential steps including identification of input resources, estimation of resource use, valuation resources in monetary terms and determining the service outputs.(1) The number of steps and complexities of cost data collection make it a daunting task. Challenges in data collection have been reported by previous costing studies both in India and elsewhere.(1,2)These include wide variations in health care delivery infrastructure in India, non-availability of disaggregated data and hospital management information systems (HMIS). Other challenges include obtaining stock-related data, price information and in particular the continued record keeping in physical forms. Documenting these issues is critical for shaping cost data collection and improving data quality in future studies. The Costing of Health Services in India (CHSI) study aimed to generate cost estimates to informprice setting of AB-PMJAY packages and Health Technology Assessment (HTA). The scope and extent of the study make it a treasure trove for researchers and managers who want to learn about

cost data collection in India. A process evaluation of data collection at 11 public tertiary care hospitals under the study was undertaken.(3) The evaluation was exploratory in nature and used three approaches including an online survey using a semi-structured questionnaire, group discussion and a review of monitoring data. Data were collected with the aim of understanding the process of cost data collection including time taken, resources used, challenges and possible solutions. This chapter presents its findings.

Key Findings

The key findings of the process evaluation related to staff profiles and training for the data collection team; the time taken for data collection; logistical challenges in data collection; and the implementation of quality assurance.

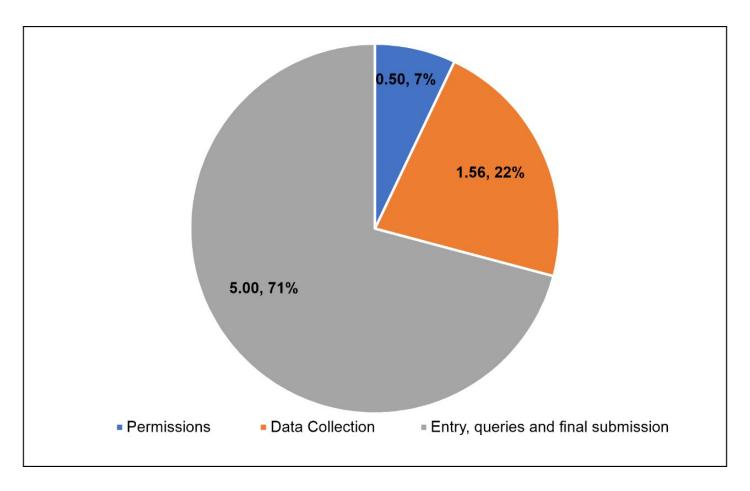
I. Data collection team and training

The profile and skill mix of the data collectors impacts upon the efficiency and robustness of cost data collection. In the CHSI study, with 11 states included in the data collection, there were a total of 65 staff working on the costing study across the different sites. On an average each team comprised of 3 field officers, 1 administrative assistant guided by 1 co-principal investigator. At some sites regular hospital staff (residents and professors) aided the data collection. Appropriate use of the skill mix of data collectors was essential. Data that generally required less expertise were collected by non-technical staff (items such as overheads, biomedical waste, leave records, consumable indent, and building area measurements). In contrast, technical staff were used to collect data on time allocations required for apportioning resources across different services. Theoretical training, practical exposure to data collection and the model of 'training of trainers' was found to be useful. Amongst the CHSI staff (N=65), 49% were centrally trained of whom 53% were the principal investigators, professors and residents and 47% were field data collection staff. The remaining staff (51%), primarily field investigators and administrative assistants, were trained locally.

II. Time period for cost data collection

The data collection process comprised of 3 main activities; obtaining permissions, data collection and entry, queries & final submission. Figure 1 depicts the median time of data collection in months. On average, data collection in one department of one facility covering all its services required 355 person-days.

Figure 1: Median time spent in data collection (months)



Source: Prinja S et al. PlosOne. 2020

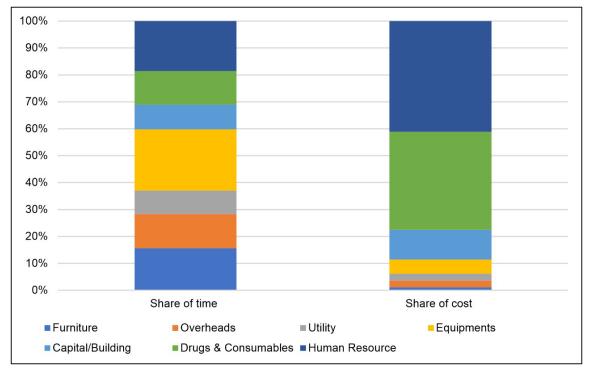
The duration of data collection was disaggregated to various input resources. (Table 1) Across all input resources, the time spent on negotiation and waiting was more than the actual time spent on data collection.

Table 1: Time required for data collection (days) per input resource					
		Time required for collection			
		Negotiation& waiting	Actual Collection		
Input resource	Data type	(Days)	(Person-days)		
		(Median, Interquartile	(Median, Interquartile		
		Range)	Range)		
Human	HR Salary & Incentives	13 (8 – 30)	12 (5 – 18)		
resource	Leave	10 (5 – 29)	8 (5 – 11)		
	Time allocation	7 (5 – 10)	12 (9 – 26)		
Physical area/	Building area measurement	15 (3 – 28)	17 (5 – 30)		
building	Determination of rental price	2 (1 – 7)	3 (1 - 6)		
Consumables	Consumables used	14 (4 – 23)	15 (6 – 27)		
Consumation	Prices of consumables	13 (6 – 26)	15 (5 – 25)		
Francis	Furniture items used	7 (3 – 15)	28 (10 – 30)		
Furniture / Non-	Prices of non-consumable items	8 (5 – 19)	15 (6 – 25)		
consumables	Information on average life of	4 (2 – 7)	12 (4 – 16)		
	furniture items				
	Equipment used	7 (6 – 12)	16 (9 – 26)		
	Equipment procurement prices	9 (4 – 23)	15 (8 – 25)		
Equipment	Average life of equipment	5 (2 – 7)	12 (5 – 16)		
	Usage of equipment in different procedures	6 (4 – 9)	15 (9 – 18)		
	Electricity	3 (2 – 9)	6 (3 – 14)		
	Building Maintenance	3 (3 – 7)	4 (2 – 8)		
Overheads	Equipment Maintenance	3 (2 – 7)	4 (2 – 10)		
	Laundry	6 (2 – 21)	8 (5 – 10)		
	Dietetics	7 (4 – 20)	8 (6 – 9)		

	Biomedical waste management	5 (3 – 11)	4 (2 – 10)
	Annual patient load data (OPD/IPD/ Surgeries)	7 (6 – 14)	20 (12 – 25)
	Average time of each procedure	6 (2 – 13)	4 (3 – 13)
Service provision data	Average length of stay in ICU and IPD	5 (2 – 14)	4 (2 – 11)
	Diagnostics used in each procedure	4 (2 – 7)	6 (4 – 15)
	Average OPD visits (pre- and post- procedure)	2 (2 – 7)	6 (3 – 11)
	List of drugs and consumables purchased by patient before procedure	2 (1 – 7)	4 (2 – 6)

The proportion of time taken to collect data on each input resource was compared with its share in the total cost, as depicted by Figure 2. While human resources and drugs & consumables contributed to 78% of the total cost and consumed only 31% of data collection time; furniture, overheads and equipment consumed 51% of the total time contributing to only 9% of the total cost.

Figure 2: Share of input resources in data collection time and cost



Source: Prinja S et al. PlosOne. 2020

Some steps which led to loss of time included multiple levels of permissions required, gaining full participation of facilities and logistical delays. The permission requirements varied across the settings, however having an official consent letter from the head of the institution, holding stakeholder meetings and assuring confidentiality helped to gain confidence and smoothen the data collection process, ultimately reducing delays. At most study sites, the key person to be contacted for data collection permission was the Dean/Administrator of the institution. Additionally, some sites required permission from the head of the departments (HODs) and cost centre (ICU/OT/OPD/IPD) in-charge.

II. Specific challenges in collecting different cost data

Human resources

Collecting data on human resource time allocation involved personnel interviews. Obtaining consent to these interviews proved challenging. Within the interviews, participants tended to over-report the time devoted to a particular activity. This was evident when the total hours of their reported activities added to more than their total working hours. This was found in 4 sites and corrections had to be made by re-interviewing the person concerned.

Building area & valuation

A wide variation in the estimates of building rental prices from different sources was observed. Different sites followed different approaches. The most common sources were market survey and housing rentals in the same area. The final estimate was derived from multiple sources (in 9 of 11 sites), with a preference for commercial rates.

Equipment & furniture

Determining the average useful life of equipment & furniture items was difficult due to the absence of records. All sites relied on expert opinion for this estimate. Secondly, cross checking of equipment & furniture lists with physical observation was found to be essential to determine the functional status of the items.

Price data sources

The price data of consumables, furniture items and equipment were often scattered and multiple sources were required to obtain complete information (Figure 3 - Sources of data for price of consumables, equipment and furniture items).

Figure 3: Sources of data for price of consumables, equipment and furniture items

NOTE: Total percentages may not be equal to 100% as price data was obtained from multiple sources

■ Departmental store ■ Central store/ Procurement office ■ Chemist ■ Online sources ■ Others

Prices of equipment

Prices of furniture

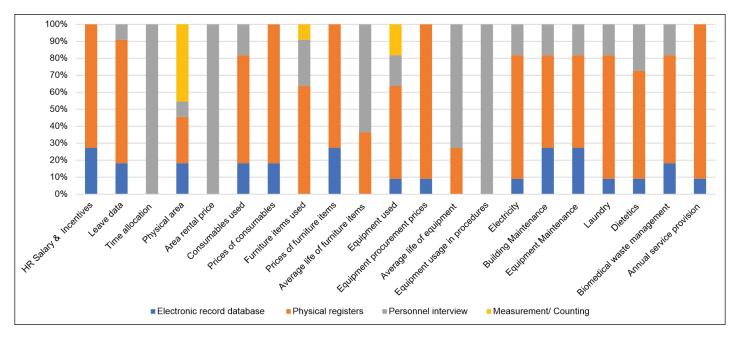
Source: Prinja S et al. PlosOne. 2020

Prices of consumables

Type of data source

Figure 4 depicts the form of available data. Electronic databases were not available for data collection at most sites. The most common source of data was physical records maintained in the respective departments of the hospital. In other cases, where the required data were not available, expert opinions were sought. A barrier common to data collection of all resources was having to do data extraction This using physical records and registers. was cumbersome and time-consuming. Sites with insufficient information management systems are known to be difficult to cost.(6) Reliable electronic health records would facilitate data collection and prevent time delays and would likely have beneficial effects in other areas such as patient care and facility management.

Figure 4: Types of sources of different input resources

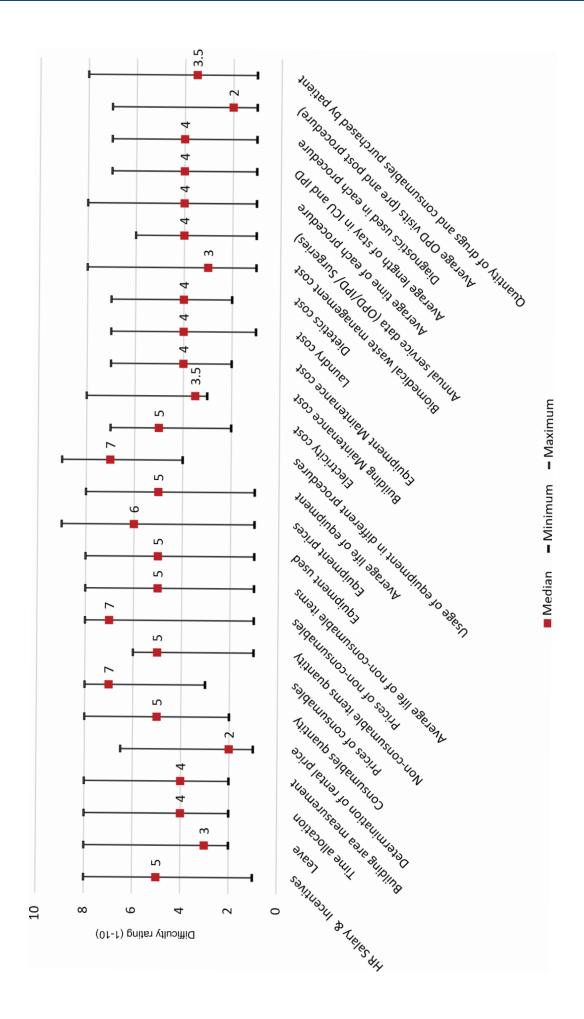


Shared costs

Shared resources require additional data collection for apportioning of costs. The additional data included: the duration of procedures conducted in the same premises, collected through staff interview; the number of patients sharing common resources, collated from hospital records; and, operation theatre schedules, collected from the hospital administration.

Level of difficulty of data collection

The levels of difficulty in cost data collection for each item of data were rated (on a scale of 1-10) by the data collection teams from each site and are shown in Figure 5. Input resources with a high difficulty rating included measuring the relative utilisation of equipment in different procedures (6.59 0.52), prices of consumables (6.09 0.58), equipment procurement price (6.05 0.72) and prices of furniture items (5.64 0.68).



Detailed information about the process of cost data collection has been summarised highlighting the key issues faced by the different sites in collecting data on input resources in Table 2.

Table 2 : Overview of cost data collection for different input resources

Data type	Common challenges across sites	Potential suggestions from field teams
Human resource data	Common chancinges across sites	- Steman Juggestions from field teams
HR Salary & Incentives	Salary information tends to be sensitive Information on	Written permission from the head of the institution
This daily differences	allowances and incentives may be difficult to obtain.	expedited data collection.
	anowances and incentives may be unificult to obtain.	'
		Central authority instead of individuals maybe easier to
		approach for this information.
Leave	Personnel are usually hesitant to share this	Written permission from the head of the institution
	information.	expedited data collection.
	Records are difficult to obtain.	Individual letter and micro-meetings to apprise the staff facilitate access.
Time allocation	Physical records are lacking	Explaining the purpose of this information in costing
	Interviews resulted in over-estimates of working hours	can improve participation.
		Schedule appointments/interviews
		Sum up time taken for all activities in a day and cross
		check with total working hours and duty roasters.
Physical area/ building		
Building area measurement	Records of area may not be available	Take advantage of tiled flooring
	physical measurement of area is resource and time	Use laser measuring devices.
	intensive.	ose laser measuring devices.
Determination of rental price	Vast variation in different approaches across sites for	Minimum and maximum rates could be reported.
Determination of Tental price	determination of rental price.	ivillimum and maximum rates could be reported.
Consumables	determination of rental price.	
Consumables used	Data is often disaggregated, in physical registers	With permission registers can be
Consumables used		
	serving multiple services	photocopied/photographed
	Discrepancies in electronic records and actual	
	consumables stock.	
Prices of consumables	Piecemeal from different sources	Use multiple sources
	Not be available for all items.	Develop a central cost data base for Indian settings.
	Physical form of data only	
Equipment and non-consumables		
Items used	Records only available at institutional or departmental	Correlate information in records with physical
	level.	observation
	Discrepancies in records and actual furniture being	
	used.	
Prices of items	Prices of old or donated items not available or in form	Develop a central data base for costing studies in Indian
	of physical records.	settings.
Information on average life of items	Information not available.	Use expert opinion or condemn policy if institute has
		one.
		Develop a central data base for costing studies in Indian
		settings.
Usage of equipment in different procedures	These data are not readily available.	Interview personnel - prepare a list of procedures and
S - 141 h - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	ask personnel to put a tick against the ones in which
		the equipment is used.
		the equipment is used.

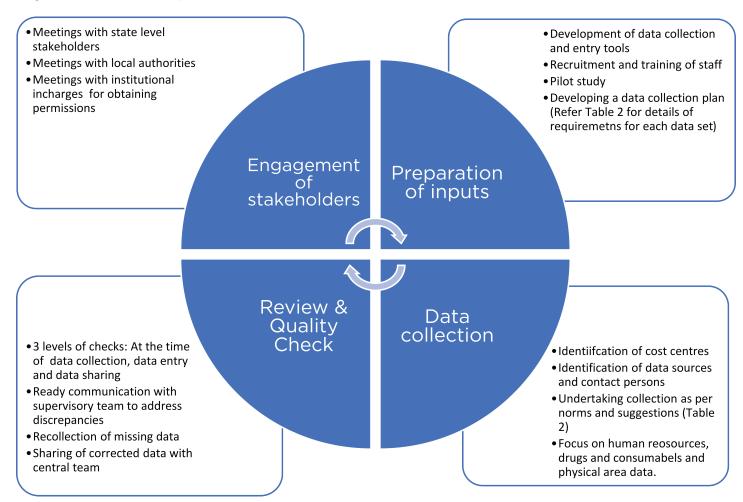
Overhead costs for the service/department	Problems may be faced in identification and availability	It may be useful to take prior appointment.
	of the right person to obtain information	Apportion cost to various departments being serviced
	Hesitation in sharing financial information of the	by the respective utility
	institution.	Use total institutional expenditure and total number of
	Institution level data	beds to calculate per bed expense .
Service provision data		
OPV/IPD/ Surgeries	Records may not be disaggregated by procedure.	Use main surgical records
LOS	Availability of right person there for the interview.	
	Physical records may be tedious to extract data out of.	
Average time of each procedure	Contingent upon identifying the right person and their	
Diagnostics for each procedure	availability for the interview.	
OPD visits (pre- and post-procedure)		
List of drugs and consumables purchased		

III. Quality assurance

Four levels of quality checks were highlighted in stakeholder interviews. First, during data collection, correctness and appropriateness of data were checked. Second, correctness of data entry was checked. Third the data were verified by the field supervisor before sharing with the central team. Fourth, the central team that carried out the analysis identified data gaps and discrepancies which were then communicated to the field teams. Finally, the teams then addressed those gaps by clarifying doubts, recollecting and re-entering the required data. Implications for planning a cost data collection

Costing requires information on numerous input resources, each of which have distinct data collection methods, making such activities time consuming. Additionally, factors such as the nature of costing (prospective or retrospective), the costing methodology (top down or bottom up), the form of data, the number of people involved and willingness to share data, define the kind of challenges and time delays faced during data collection.(4) Operational and methodological issues in cost data collection are further exacerbated in due to limited data availability and lack of digitization in lower resource settings like India. This leads to the need for multiple sources and increased time taken to collate, input and assure data quality.(1,2)

Figure 6: Framework to plan cost data collection



Source: Prinja S et al. PlosOne. 2020

To minimise the impact of these challenges, planning a cost data collection entails four important sets of considerations as depicted by Figure 6. At the outset of cost data collection, decisions need to be made regarding key input resources to be prioritised, key data sources, time and human resources required for each set of data. As many of the same assumptions can be made across sites in multi-centre costing studies, a reference data base for input prices and average useful life of equipment and furniture items would save time. A national health system cost database which has been developed for India has made this first step by providing representative data on prices and salaries.(5) This type of streamlining would be a cost-effective solution and is particularly justifiable in the case of equipment which only contributed 5% of the total cost. Certain areas of data collection were more challenging than others (see figure 3) and are a more significant share of total cost. Table 3 lists the areas of data collection that were reported to have a difficulty of 5 or above and also, identifies their contribution to overall cost to help identify items that require additional inputs or careful advance planning (e.g. consumables use) or other potential solutions (e.g. a central database for HR salaries and incentives).

Table 3: Summary findings and implications for cost data collection

Cost head	Percentage share of total cost	Data type	Median rating of Difficulty of collection (Scale of 1-10)	Implications for data collection
Human resource	41%	HR Salary & Incentives	5	Central database
Consumable items	36%	Prices of consumables	7	Central database
		Consumables used	5	Site specific Technical person needed
Equipment	5%	Equipment used	5	Technical person needed
		Equipment prices	6	Site specific Technical person needed
		Average life of equipment	5	Central database
		Usage of equipment in different procedures	7	Site specific Technical person needed
Overheads	2%	Electricity	5	Site specific
Furniture / Non	1%	Furniture items used	5	Site specific
consumable items _		Prices of non consumable items	7	Central database
		Average life of furniture items	5	Central database

Conclusion

The Government of India is committed to health technology assessment. Improving methodologies and the practical implementation of costing studies will improve the quality of estimates being generated and ultimately aid national priority setting. For the implementation of costing studies, having clearly outlined outputs, conducting a pilot test, having a quick communication between the data collectors and central team, specific quality checks and assumptions, are key considerations. In addition to practical aspects, it is essential to strengthen the health system to facilitate costing studies. Developing electronic health records, having nationally representative cost data databases for reference in the case of unavailability of on-site data and developing guidelines on costing in Indian settings are key recommendations. CHSI is a landmark study which is a source for invaluable information on the practical aspects of implementing a multi-centric costing study in India. In Phase 2 of the study, cost data collection is also being undertaken at district hospitals, diagnostic departments and private hospitals. An insight into cost data collection at each of these locations further inform future processes, and a process evaluation component was incorporated into the regular monitoring tools of the project. The component would capture processes involved, challenges faced, and solutions developed, during the course of cost data collection at various sites under the project.

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3.2.4 First-hand Experience of Data Collection for Costing

Dr Prakash Patel, Prof Gajanan D Velhal & Dr Amit Bhondve

Overview

Collection of data plays a vital role in cost studies. In the data collection for the CHSI study, many processes are new and being implemented for the first time. This makes sharing of experiences important to help others working in the same field and to improve data collection processes. To supplement the process evaluation presented in the previous chapter, this chapter presents two case studies, from the Maharashtra and Gujarat sites, describing the data collection process for the CHSI study.

Learning objectives

By the end of this chapter, the reader will understand the practical reality in:

- The identification of cost centres in a hospital,
- The process of identifying resource use i.e. which cost centres and which human resources to focus on,
- How to sample the staff for time allocation interviews
- Overcoming challenges faced in data collection.

Case Study 1: Costing of a clinical department in Surat Municipal Institute of Medical Education & Research (SMIMER)

ICMR MRU,SMIMER, Surat was assigned four department (ENT, Ophthalmology, Orthopaedic and Obstetrics & Gynaecology) for costing of health care services in SMIMER medical college hospital which is situated in southern part of the Gujarat state. Initially, we have been trained by the central teams at Postgraduate Institute for Medical Education Research (PGIMER) and DHR team on the methodology of data collection for the costing study.

We decided to start with one department and move to the second department only after completion of the first. We decided to start with ENT department because it is smaller than the other departments. This case study describes our experiences of costing the ENT department, focussing on key lessons learned.

Administrative approvals

We initiated data collection with a circular from the dean's office to all the heads of the department, with the understanding that this circular would suffice for all permissions. We then contacted the head of the department of ENT who immediately agreed to help us in the data collection as he already received the circular. However, when we started data collection, we found that staff were reluctant to share data, especially the type of data we required. For example, when we asked about dead stock and consumables, the sister-in-charge of the ward refused as these documents are not meant to be shared with everybody. Later, we learned that the staff were not aware of the study and this was one of the reasons for poor cooperation. During data collection in the first department, we also learned that poor cooperation was also due to the poor understanding of the study methodology. This was true for all staff, from head of the department to class IV workers. We had to explain the study methods and type of data we needed repeatedly to different staff members e.g. in-charge nurse of OT, in-charge nurse of ward, in-charge nurse of OPD and many faculties. We also had to repeatedly to call the HOD for staff to release data to us. The whole process became very challenging for the fieldwork team and made data collection very difficult.

To avoid this issue in the remaining departments, we decided to begin data collection with an orientation for the department. We called a meeting for all staff and made a presentation of the objective and methods of the data collection. We also prepared a list of registers that we would need. This orientation meeting was very fruitful. It was very interactive, with lots of questions asked, especially by medical faculties. The process also helped us to understand the working of the department which later helped to better identify the cost and service centres.

Identification of data sources in each costing centre

We began with the ENT department and based on our understanding of the department we first prepared a list of the probable expenditure heads. The data collection tool prepared by PGI was very useful in this process. Initially we thought that we had to collect data from five different points for the ENT department: OPD, IPD, Operation theatre, Hospital HR dept. and finance department for indirect expenditure. However, as we moved forward, gradually our understanding on various sources of information improved. We also learned that there was no uniform pattern of staff who maintain the data that we need. Based on our experience we derived the following list of sources of information:

- a) In-charge of ward/OT/OPD: He/she basically maintains a lot of data related to his/her unit. Data like the number and type of instruments, drugs, furniture, equipment, consumables, linen, stationery, duty list, etc. were available from his/her.
- b) HR clerk of the college: He/she provided HR detail related to faculties and PG residents like Salary, leaves, LTC benefit, etc.
- c) HR clerk of the hospital: He/she provided HR detail related to nursing staff, clerical staff, class 4 worker (Ward boy and aaya) like Salary, leaves, LTC benefit, etc.
- d) Sanitary Office: This office provided details about sanitary staff like number of staff assigned to specific ward or OT or OPD, actual working hours, salary, leaves, other benefits, etc.
- e) Central Medical Purchase Office: This office has provided purchase price of drugs, consumables and medical/surgical instruments. For instruments, purchase year was available from this office.
- f) Central store: This office has provided purchase price of all non-medical materials like furniture, linen, stationery, etc. For furniture and linen, purchase year was available from this office.
- g) Housing & Engineering dept. It provided detailed map and area of various premises
- h) Account office: This office provided detail on common expenses of hospital like electricity bill, Bio-medical waste management cost, maintenance cost of medical equipment, maintenance of furniture, property tax, food expenses for patient, etc.
- i) Medical faculties: As such very little costing data is available with medical faculties because their main role is to provide services. However, their expert opinion was required to collect data on duration of life of each instrument.

Apart from these routinely collected data, the team also had to collect certain items ourselves. For example, the physical area of common utility, toilets, sitting area in OPD, etc. as well as physically verifying many items, such as furniture. Initially we took the list of items from the register and then verified them physically whether they were there in the ward or OPD. However, we found that many items were missing or had been shifted to other ward and vice a versa. To save time we created the list ourselves directly by identifying the items in the ward or room.

Identification of service provision data

Initially we thought that obtaining and organizing service data would be a tough task, especially looking at the wide variety of services provided and huge number of cases. However, we found very well-maintained service data in the hospital. This is because of regular ongoing Medical

Council of India (MCI) inspections. Each department must provide all service data during MCI inspection, so we found very well organized OPD, IPD and OT data. Although this was not available by broken down by illness. There are basically three service centres:

- 1) OPD: Number of patient availed OPD services was available with the OPD in-charge nurse who maintained daily OPD data separately for various room and OPD based procedures. Illness wise number of OPD patients was not available. This was obtained by expert opinion of senior faculties.
- 2) IPD: Number of patients, duration of stay, prescribed lab investigation, etc. details was obtained from ward in-charge nurse. Illness wise number of IPD patients was not available. This was obtained by expert opinion of senior faculties.
- 3) Operation theatre: Number of surgeries and type of surgeries were available from OT register maintained by OT in-charge.

Staff time allocation

There are many people present in one department, but it was not necessary to record the time allocation for all staff. In most of the departments of the hospital similar types of duty are assigned to the same cadre staff. Keeping this fact in mind, we did not do time allocation of all the staff. First, we tried to understand the various duties assigned to various staff. For instance, there were eight staff nurses given the same duties in the ward. The number of working hours were the same and duties rotate over day, evening and night. In such cases we recorded the time allocation of only one staff nurse. She acted as a proxy for time allocation of other nurses. This method was adopted for all similar types of duty staff. Based on our experience of time allocation, we can say that time allocation of medical faculties is more difficult because of their involvement in various kinds of services including OPD, IPD, Operation Theatre, academic, administrative etc. Time allocation to each service centre for the staff which has fixed assigned duty is relatively easy.

Additional details for surgical procedures

To calculate the costs of individual surgical procedures, a lot of additional data were required. This included duration of the procedure, HR involved in the procedure, instruments and consumables used in the procedure and many more details. Most of these data were not available anywhere. As a result, for most procedures we had to rely on expert opinion, and this varied from person to person.

To obtain the best estimates, first we tried to identify the best person to provide this information. We listed them as follows:

- 1) No. of OPD visits associated with a procedure: Expert opinion from associate professor and professor
- 2) No of inpatient days before and after surgery: Expert opinion from associate professor and professor
- 3) Duration of surgery (hours): OT register
- 4) Staff involved in the surgery: OT register
- 5) Instrument, drug and consumables involved in a specific surgery: OT staff nurse who was responsible for preparation of OT based on the OT list
- 6) Pre- and post-surgery laboratory investigations: Expert opinion from associate professor and professor
- 7) Medication prescribed for surgery and during the inpatient stay: Prescription available with patients and in-charge nurse

In the data collection for individual procedures, while collecting HR detail for individual surgery, we came across anaesthesia staff involved in the surgery. Various cadre of anaesthesia staff were involved in various types of surgery. The time duration of involvement was obtained from the OT register. However, to calculate costing of anaesthesia staff to estimate the unit time, we had to information was also used for other surgical departments.

Summary - key challenges and recommendations

- 1. Before the beginning of data collection, it is crucial to explain objectives and methodology of the study to the staff of the concern department, including senior faculties to lowest cadre of the staff. An orientation meeting with all staff of the department is very helpful.
- 2. Understanding of working of the department, patient flow, service outputs and data flow is very important, before the beginning of the data collection. Ask the department to make presentation about their department.
- 3. During the orientation meeting with staff, try to identify key persons which can provide various data. Find out availability of these key persons and plan data collection time accordingly.
- 4. The anaesthesia department has a major role in operation theatre so don't forget to collect details of anaesthetic department.
- 5. Thorough understanding of the data entry tool is very important factor before the outset of data collection.
- 6. Before submitting the data, show it to the senior faculty in the department.

Case study 2: Costing of services at different levels of health care delivery infrastructure in Maharashtra: Sharing the experiences

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Nodal Department - Community Medicine

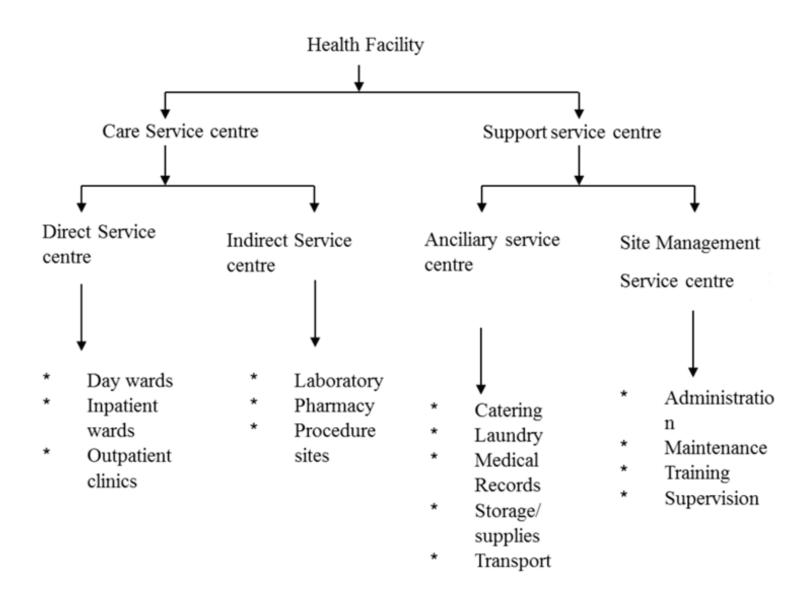
In this case study of costing hospital services in Maharashtra, from the CHSI project, we will discuss various scenarios which helped us in identifying cost centres within a hospital, the process of identifying resource use i.e. which cost centres to focus on, which staff to focus on and how to sample the staff for time allocation interviews. It will also include the challenges faced and the means adopted to overcome difficulties in data collection. At Seth GMC and KEMH we undertook costing of 11 (4 in 1st phase and 7 in 2nd Phase) specialities. We also surveyed 3 district hospitals (Thane, Pune and Beed) and 5 private hospitals (2 from Mumbai, 2 from Pune and 1 from Beed). In the case study we first look at defining the cost centres, then the defining and measuring of outputs and inputs. Next, we discuss the sources used for obtaining data on inputs and time allocation. Finally, we discuss the challenges faced during data collection.

Definition, types and Identification of Cost Centre

The first step in data collection was to identify the cost centres in each of the facilities survey. This required a clear understanding of the services provided and how the facility operated. A cost centre in health care refers to the unit of the organisation – department of a hospital, health centre, etc. – for which one wants to identify and analyse the costs. From a functional point of view, a cost centre may be relatively easy to establish, because a cost centre is any unit of the organization to which costs can be separately attributed. For example, in any surgical department, an operation theatre can be considered a cost centre, whereas in any diagnostic department laboratory can be considered as a cost centre. Any part of an enterprise to which costs can be charged can be called a 'cost centre'.

In reference to the study, we have two types of cost centres in a facility.

- · Care cost centre
- Support cost centre



A. Care cost centre

It can be defined as a cost centre where the core services are delivered. These cost centres vary according to their departments. In surgical departments cost centres can be IPD, operation theatres and trauma care centres. Whereas in diagnostic departments these can be laboratories, blood Banks, CT scan and MRI centres etc. Service cost centres can further be classified as direct and indirect service cost centres. Direct service cost centres are identified as OPD, IPD, ICU, operation theatres etc. Indirect cost centres can be identified as the sites for laboratory, pharmacy and surgical and diagnostic procedures.

B. Support service cost centre

Support service cost centres do not provide the core services pertaining to the department, nevertheless, they are an inevitable part of the department services. Support service departments or cost centres are further classified into ancillary services and site management services. Examples of ancillary services are catering, laundry, medical records, stationery and sanitation. Site management services include transport, maintenance, training and supervision.

Costing Handbook 19

To identify the cost centres an inventory of service/cost centres was prepared. At our institute during the first phase of the study we were allotted four surgical departments. This meant that identification of cost centres mainly focused on the operation theatre for major, minor and emergency procedures.

As the focus was on operation theatres, we also had to collect data from the anaesthesia department. The anaesthesia department was a different cost centre on its own. The anaesthetics team and supplies used during the surgery were not provided by the surgical department but by the anaesthesia department. The consumables utilised during the surgery were also designed or procured by anaesthesia department. In some cases, the associated drugs and consumables were purchased by the patient as an out-of-pocket expenditure.

Some of the support service centres can be large and complex in terms of inputs and outputs which makes costing difficult within the time and budget constraints of a study such as the CHSI study. Hence at our institute we decided to take estimated support service cost. The cost was estimated by the accounts department of the hospital. The support service departments for which we obtained estimated unit costs were diet and laundry.

At the district and private sector hospitals, data collection was focussed on the cost centres with the highest number of procedures for the respective facilities. At the selected district hospitals of Thane, Pune, and Beed, the identification of cost centres (both care and support service cost centres) was done with the help of the civil surgeon of the district hospital. The important cost centres, where data collection was focussed, at these hospitals were then identified. For example, at Pune District Hospital, the focus of data collection was on ophthalmology operation theatre as there were many ophthalmology procedures performed.

To identify cost centres at private hospitals with more than 200 beds i.e. Bharati University Medical College Hospital, the CHSI study team had allotted 4 departments i.e. ENT, Orthopaedics, CVTS and Urology. To identify the important cost centres at private hospitals of the strength of less than 200 beds the director of the hospital was consulted and the hospitals assisted us with the number of each procedure performed at the hospital. The cost centres to be focused were finalised accordingly. For example, at H.J. Doshi Hindu Sabha hospital cardiac procedures were the type of procedure that was most frequently carried out. Hence, cardiac OT and Cardiac Catherization lab Interventional Cardiac Catheterization Operation theatre were selected as the focus cost centres.

Define and measure outputs by service centre

Each service centre produces a product or output towards the number of visits, duration of stay, no. of procedures performed, diets served, linen washed etc. These services were identified as

outputs of the cost centre. For example, the number of OPD visits for an OPD, inpatient days for inpatient ward, or surgeries performed in an operation theatre. Once definition of a service output was decided, quantity of output produced in a year was assessed.

At the institute, the quantity of the output produced was noted down on inpatient registers or OT registers. The field officers (RMOs) counted individual disease entities as well as the procedures where possible. Some departments had these recorded and segregated in excel format. Where the procedure names did not match the PMJAY format, the nomenclature was adapted to match with the help of experts (Assistant Professor) from the department. The number of diets served was calculated manually for each patient by multiplying the inpatient days by the number of diets served in an entire day. The number of linens washed was available with sister in-charge in a register format on a biweekly basis. At our institute linen is washed in house as well as outsourced. The number of linen outsourced was taken from the register maintained by the linen department for the entire institute.

MIS records of the centre are in the phase of development. Therefore, the records relating to the reference year were not found in MIS. The data regarding number of OPD visits, average number of inpatient days, average number of ICU stay was taken approximately from the experts of individual departments. In Depth interviews were conducted for all these experts. Assistant Professor, IIIrd Year Resident Medical officers, Sister in-charge and Senior Staff Nurse managing the cost centres were considered as experts.

Define and measure inputs by service centre

Alongside the direct costs involved in providing health services, the data on resources spent to support the health service delivery, which includes costs of administration, logistics, monitoring and evaluation (M &E) costs etc. was also captured. Before collection of data on inputs, common inputs which are being utilised were identified and classified according to the schema laid out in figure 2.

Figure 2: Identification of Inputs

Capital • Space/building • Equipment (medical and non-medical) • Furniture • Vehicles

Recurrent • Salaries of human resource • Drugs • Consumables (Sanitary, Surgical, Stationary) • Overheads (water, electricity, telephone, diesel, etc.) • Maintenance

Others Funds and grants Cash benefits Revenue generated IEC materials

Capital items

One of the key challenges in collecting capital cost data was that some the buildings at our centre are more than 90 years old. To obtain data on the area of these buildings manual measurement techniques were followed: a. Calculation by counting no. of tiles b. Manual calculation by using measuring tape. c. Using Laser based device. For newly constructed buildings the blueprints and overall dimensions were available with the civil department. These data were supplemented with manual measurements when, in some departments, partitions had been constructed.

Rental expenses were approximated by using three techniques:

- a. We visited Registrar, Excise department, Mumbai and obtained copy of ready reckoner from them. The copy is also available online.
- b. We conducted key informant interviews from locally based 10 real estate agents and confirmed the rates.
- c. Every week Times of India (Properties Supplement) newspaper publishes rental rate for different areas in Mumbai. We followed those rates (C) and for 1 month and took maximum of all these rates and mentioned final rate in the prescribed tool.

Seth GS Medical College and KEM Hospital is a Municipal Corporation of Greater Mumbai (MCGM) run medical college and Hospital. MCGM runs three more of such Medical colleges and Hospitals. Central Purchase Department (CPD), MCGM (Municipal Corporation of Greater Mumbai) is responsible for purchasing furniture, equipment, drugs, consumables, miscellaneous etc. for all four medical colleges. Central purchase department fixes the prices of all these items and invites the tenders accordingly. The lowest and best tenders get the approval —to supply the items. The number of furniture items was listed at the cost centre by observation and from the dead stock register which was maintained manually. Very few furniture items were procured from CPD. The prices of these items were marked from CPD circulars. When the item was old (e.g. purchased more than 15 years ago), replacement prices were obtained online.

Recurrent items

For most of the cost centres list of the recurrent input items was available in written format. Recurrent input items like Salaries, Drugs, Consumables (Sanitary, Surgical, and Stationary), Overheads (water, electricity, telephone, diesel, etc.) and maintenance were available in recorded formats and were obtained from individual departments. The prices of drugs and consumables were available as circulars distributed by CPD MCGM. Overheads data were not available for individual cost centres hence data was reported for the overall facility and allocated to the respective cost centre.

Challenges in sourcing data on inputs (resources) including time allocation

After identifying the various resources i.e. capital resources, recurrent resources and other types of resources (Joint resources), identifying the sources of the data for these inputs was a vital prerequisite of the overall exercise.

Identifying the source was challenging as this changed according to the cost centre and could involve different departments and cost centres. For example, in an operating theatre, each of the quantities of drugs, consumables, medical equipment had to be taken from different sources i.e. the medical store, consumable store, purchase department respectively. In another example the data on human resources (faculty, RMOs, Nursing staff, servants, ward boys, sweepers) i.e. salary, leave and other data at individual department had to be taken from four different sources hence we had to acquire permissions at 4 different establishments.

The other major challenge was in interviewing staff to obtain HR time allocations. Due to busy clinical schedules and their presence on various committees and organizations at institute and state level finding some of the faculties, doctors, and RMOs was challenging - even after their working hours. Hence, we adopted certain strategies to interview them for their time allocation:

a. Questionnaire:

We designed a questionnaire and mailed it to the concerned faculty. The questionnaire was filled and sent back to us by faculty. After checking through adequacy of the information delivered and thorough check with the time allocation data collection format the process was complete. However, if the questionnaire was incomplete, we would mail it back to the faculty and get it completed at satisfactory level.

b. Telephonic Conversation (Interview Schedule)

Based on the time allocation data collection format we designed a telephone-based interview schedule. A field officer (RMO) would collect the information according to the interview schedule.

c. Proxy Interview Method:

If the concerned person was unavailable for providing the information, we would ask the person to assign any other person to give time allocation details and get the task completed

Institute and Department wise specific issues

Many of the issues faced were particular to the department or institution. These included matching the names of procedures to PM-JAY definitions as well as some site-specific challenges:

Matching names of procedures to AB PM-JAY definitions

The most important issue which was to be managed at all the departments was matching of names of procedures of PM-JAY and Institute. This exercise was to be done after we had collected the data from the tertiary hospitals. At the beginning of the study, it was unclear whether the procedure names are to be matched according to the PM-JAY names.

This time-consuming exercise was only possible with the help of junior faculty. Even resident doctors did not have exact idea of matching the names. Hence to get the time of junior faculty specifically in the super speciality departments was challenging. Nevertheless, on repetitive follow ups and making use of some of the personal relations with the Junior Faculty we could match all the procedure names according to PM-JAY names.

District Hospitals

At the level of district hospital, it was difficult to obtain the data on levels of the employees. The service record registers were incomplete. Hence our field officer offered them the help to get the service record registers completed on manual basis referring to the musters they had maintained of that year. One more issue which was faced by field officer was obtaining the data of locally purchased drugs, consumables and equipment. The data was stored in three different registers and their invoices were stored in various files. The process of this matching was tedious and time consuming.

Private Hospitals

All the private hospitals were reluctant to share the remuneration data of the consultants working at the hospitals. Similarly, the consultants' remuneration varies with the procedures performed. The remuneration paid for the same procedure varies from consultant to consultant. Nevertheless, we repeatedly followed up the issue. The directors of the hospitals had meetings with trustees and the hospitals shared the data.

The smaller private hospitals had OPD drugs issued from medical store which was not owned by the hospital. Hence obtaining data from the medical store was also difficult. The owner did not share the purchase cost of the drugs. Hence for the private hospital all the drugs and consumables data is obtained on MRP basis.

Logistical challenges during data collection

1. Staff recruitment

Recruitment of staff under the project took more than 3 months. Hence, we took assistance from resident medical officers at KEMH who collected the data of all four departments. As the administrative assistant also joined late this work was initially handled by the state investigator. The knowledge accrued by the state investigator as administrator and data collector facilitated the data collection process.

2. Permissions and Access

Obtaining permission for data collection began with Institutional ethics committee. The majority of the work to be done regarding sharing data was novel to all the HODs and hospital heads specifically at Public sector. In contrast, in the private sector this exercise was not novel, but they did not want to reveal the data. In both the sectors all data were maintained at the cost centre level by nursing in-charges. Despite the permissions from the HODs and Heads of the hospitals the permissions had to be sought additionally from nursing in charges. This issue was addressed in the following ways:

- Repeated follow up at IEC
- Repeated meeting with HODs both common for all and individual level were conducted to motivate and convince them the importance of such exercise.
- Many corporate hospitals, despite frequent follow ups of e mail as well as by personal communication, refused to participate in the study. Hence, we took help form MPJAY and tried to reach small singly owned hospital, as well as approaching multiple hospitals. We also selected two cities to collect the data from so that we could approach more private hospitals
- Repeated follow up with the Nursing I/C (Sister-in-Charge) was done and counselling them regarding the importance of the data and study. Personal visits by State and Principal investigator to facilitate the process was also necessary.
- Principal Investigators advocacy with the Directors of the Hospitals was very effective. As a result of the persistent persuasion with the director and trustees of the hospitals by the Principal Investigator we convinced them to share the data on salary and other incentives in private sector hospitals.

3 Unavailability of electronic records

There were very few electronic records available from which to draw the data. It takes time to read register records and process the same as per the requirement of our data collection tool. This means that while records of procedures of purchase are maintained well, however it is not so when it comes to utilization.

To facilitate data collection, pictures were taken of the registers and converted into a pdf for better clarity with due permission from sister in Charge. These pdfs were processed as per the requirement of our data collection tool. The utilization of purchase data was not available for old equipment which have been in use for more than 15 years. Hence, we had to approximate the prices data. We also had to fetch the data from the internet.

Opportunities Identified

In spite of the challenges faced in the data collection, certain opportunities were also developed through undergoing the process. These can be summarised as follows:

- 1. Facilities have a greater understanding of the importance of adequacy, appropriateness, consistency and reliability of data.
- 2. Grass root level problems of utilization of resources becomes clear. This knowledge highlights importance of HMIS. HMIS should be strongly built and implemented.
- 3. The entire exercise highlights importance and principles of health economics which have to be observed in day-to-day practice. There is scope to enhance the importance of the topic in PG studies amongst different categories of health care workers.
- 4. There is scope to identify predictors of costs of each unit of services hospital and patient related factors e.g. Health seeking behaviour of patients, seasonal variations etc.

Recommendations at the facility level

To facilitate future health economics analysis and promote efficiency on site, the following is recommended:

- 1. Devise standard input output indicators for clinical, para clinical and supportive services departments, which can be routinely monitored.
- 2. Devise institution-based set of indicators to understand gross scenario of utilization of human resources, money and material resources.
- 3. Guidance for routine record keeping conducive to operationalize easy calculation of each unit of services of various departments,
- 4. Involvement of Indian Medical Association and Association of Medical consultants and other organizations for better participation of private sector hospitals in developing health economics capacity and informing cost analyses.

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Other Costing Resources

4.1 The Healthcare Cost Database of India

Dr Akashdeep Singh Chauhan

Overview

Cost information plays an important role in various strategic decisions related to health policy and planning. However, the cost data in India is scarce and limited in accessibility. The present chapter focuses on the need of cost information and presents salient features of the costing database being developed by Post Graduate Institute of Medical Education and Research (PGIMER), along with instructions on how to use the database.

Learning objectives

After going through this chapter, one would be able to:

- 1. Recognize the need for cost information and a cost database
- 2. Understand the salient features of the cost database being developed for India
- 3. Be able to access the cost data from the database

Key Definitions

- Universal health coverage: Universal health coverage is defined as ensuring that all people have access to needed health services (including prevention, promotion, treatment, rehabilitation and palliation) of sufficient quality to be effective while also ensuring that the use of these services does not impose any financial hardship.(1)
- **Reimbursement:** The payment made by a payer such as the government/health insurance company to the health provider that covers the total or a proportion of the cost of the treatment provided by the health provider or hospital.
- **Health technology assessment:** It is a multidisciplinary process that uses explicit methods to determine the value of a health technology at different points in its lifecycle. The purpose is to inform decision making in order to promote an equitable, efficient, and high-quality health system.(2).
- Government sponsored health insurance (GHIS): It is a demand side financing mechanism that mobilizes and channels additional public finances to health and provides fully subsidized coverage for a limited package of health care services through an organized hospital networks consisting of public and private facilities.

• Strategic purchasing: It is a 3-pronged process that involves identifying evidence-based service-mix and volume to be purchased; selecting the appropriate provider-mix based on the aspects of quality, equity and efficiency; and determining how services will be purchased considering contractual arrangements and provider payment mechanisms.

Background

The past decade has seen an increasing commitment by the Government of India in achieving Universal Health Coverage (UHC).(3) While political commitment is essential for mobilizing financial and human capital towards such efforts, the realization of UHC requires a strong and robust evidence base, depending on which rational policy decisions can be made. Accurate cost data on the delivery of health services is one such area of vital information. The cost information is required for many purposes such as budget estimations, health technology assessments and the setting of reimbursement or provider payments rates.

There have been few major recent developments in the Indian health system signaling a promising shift towards UHC based on evidence-informed policy. First, Government of India under the aegis of Department of Health Research has established Health Technology Assessment India (HTAIn), an official body for conducting Health Technology Assessment (HTA) in India.(4) Second, India's largest ever government sponsored health insurance scheme by the name of 'Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY)' has been launched.(5) Third, an initiative has been taken to upgrade the existing sub-centers and primary health centers into health and wellness centers, which in addition to maternal and child health services, would provide comprehensive primary health care services including diagnosis and management of non-communicable diseases.(6)

To facilitate HTAIn's role in providing the evidence base for priority-setting, a strong information system that could provide good quality and locally derived cost estimates needs to be in place. Similarly, for setting reimbursement rates of services covered by AB-PMJAY, accurate and transparent cost information gains significant importance. While the initial payment rates, that were developed based on expert opinion came under significant criticism, stakeholders of this insurance scheme such as government officials and private providers (empanelled hospitals under AB-PMJAY) have agreed on the need for scientifically derived cost estimates of procedures covered under the insurance scheme.(7-9) Lastly, in case of scale-up of health care facilities like that of health and wellness centers, readily available cost data can also facilitate health care managers in accurately assessing the additional budgetary requirements. Despite the increasing demand for the information on the health system cost of facility-based healthcare delivery, available data is meagre and is also not readily available.(10)

The strategic purchasing landscape in the Indian health system is complex. While the different states interact with the federal government for the financing and provisioning of public healthcare services, there are many different types of providers and facilities. The public sector delivers care through different levels: sub-health centers, primary health care centers, community health care centers, district hospitals and referral tertiary centers, alongside a diverse and large private-for-profit and not-for-profit sectors ranging from single practitioner clinics or specialist clinics to tertiary hospital care. Documenting the production and costs of health services in such a complex setting is a significant task. Currently, no single repository on cost data or on cost studies exists for India. Further, the data are not available consistently across states and levels of the health system.(11-15)

The situation in other low-and-middle-income countries (LMICs) is also the same, where the requirement and availability of cost information is increasing but it is still limited and mixed in quality.(16-18) For HTA, most LMICs depend on one off costing exercises or internationally generated data such as from the WHO CHOICE or Global Health Costing Consortium's unit cost data repository for their specific programme areas such as immunization, HIV and TB.(19-21) However, in recognition of the demand for good quality cost information in health care decision-making, Thailand has developed an open access national cost reference database.(22) Further, other developing nations such as Indonesia, Philippines and Vietnam have also developed a similar form of National Health Insurance Database that provide data on the medical costs of various reimbursed medical conditions.(23) However, the cost estimates in these insurances claims-based database may not reflect the actual cost of production of health services due to issues of monopoly and profit margin in the private sector. On the other hand, high income countries like Japan, United Kingdom(UK), Australia, Netherlands, etc., have already very welldeveloped cost data repositories. (24-27) Recognizing the increasing need of cost data, there has been a concerted effort in creating a 'National Health System Cost Database' for India with the aim of collating and documenting data on the cost of health care from different level of health care across the states in a single repository.

The National Health System Cost Database

The main aim of the database is to provide a comprehensive repository of cost data on health care delivery in India. The present database was developed when HTAIn was initially institutionalized. At that time, cost estimates from previously undertaken costing studies on primary and secondary level of health care conducted across 6 states in India were used as the starting point of the database. Further, it was decided to regularly update the database as and when new cost data become available. It is hoped that the cost estimates from the ongoing 'Cost

Cost of Healthcare Services in India (CHSI)' study will soon be added and made available on the database to provide evidence on cost at tertiary level of health care facilities.

As mentioned, currently the database is based on health system cost data collected from 200 public health sector facilities across 6 states of Punjab, Haryana, Tamil Nadu, Odisha, Himachal Pradesh and Kerala. (28-30) This cost data is based on a standard bottom-up methodology, the details of which have been published elsewhere. (28, 30) The cost data within the database consists of annual and average health care facility costs for sub-centers, primary health centers, community health centers and district hospitals (Box 1). The annual cost (or referred to as total cost) is also segregated into various inputs (salaries, capital, drugs, consumables, other supplies, etc.), level of services (preventive, promotive, curative and indirect administrative activities) and type of specific activities (like outpatient care, inpatient care, laboratory services, immunization, ante-natal/post-natal care, immunization, etc.). Further, the average costs (also referred to as unit cost or cost per unit of output) of specific activities (like cost per outpatient visit or ANC/PNC visit, cost per inpatient stay, etc.) are presented at current level of health care utilization as well as for 100% and 80% of capacity utilization for each level of health facility. The breakdown of unit cost into various inputs is also presented. All these cost estimates are presented as the mean value along with 95% confidence intervals. The cost estimates exclude any payment made for services outside the public facility, or financed through out-of-pocket expenditure, and therefore allows for comparable facility cost estimates.

In addition to the total and average cost, the database also provides important information on state level salaries of human resources, and prices of capital and recurrent items used for delivery of health services as an additional resource for researchers. This complementary information on the prices was generated during the process of cost data collection and contains data that are invaluable resource for economists working on health sector issues (Box 1). In addition to this, the database hosts a supporting manual. This includes instructions on how to use the database, the costing methodology and the data collection tools.

The database also hosts access to other pieces of analytical work that build on the currently available cost data. A cost function model also referred to as 'Unit cost estimator' has been developed to predict costs for other states in India.(31) The unit cost estimator uses statistical methods to generate an average or unit costs in the form of cost per outpatient visit or inpatient admission across states in India based on a set of key variables known to influence unit cost.

In addition, the facility cost data is also being used to carry out a technical efficiency analysis to enable the identification of factors that drive efficiency and another analysis on the resource gap in health services in India. The database is also expected to be updated on a regular basis as and when the cost data from the newer costing studies (with a similar methodology) becomes

Box 1: Contents of the cost database

1. Cost estimates

- a. Annual cost
 - i. Input wise distribution
 - ii. Level of services
 - iii. Type of specific health services
- b. Average or unit cost and its input wise distribution
 - i. At current level of utilization
 - ii. At 100% capacity utilization
 - iii. At 80% capacity utilization

2. Health system service inputs

- a. Salaries of human resource
- b. Unit price of capital items
- c. Unit price of drugs and consumables

3. Data collection tools

- a. Sub-centre
- b. Primary health centre
- c. Community health centre
- d. District hospital

4. Costing methodology document

- a. Cost data collection
- b. Cost analysis

5. Other analytical work

- a. Unit cost estimator
- b. Technical efficiency analysis (work in progress)
- c. CHSI estimates (work in progress)

6. Supporting manual other training material

How to use the database?

The database is developed and hosted by the Department of Community Medicine and School of Public Health, PGIMER with technical support from the International Decision Support Initiative (a global network of health, policy and economic expertise, working to achieve Universal Health Coverage), and overall stewardship of the HTAIn in the Department of Health Research. The database is freely available to registered users at https://www.healtheconomics.pgisph.in/costing_web/. The front end of the database is programmed to extract and present the data in a user-friendly format. The user can request the data using a set of front-end pull-down menus. Summary tables are then generated using code built into the platform. It is possible to extract data for individual states, levels of health system or individual variables. Figure 1 shows the overall design of the website and initial user interface.

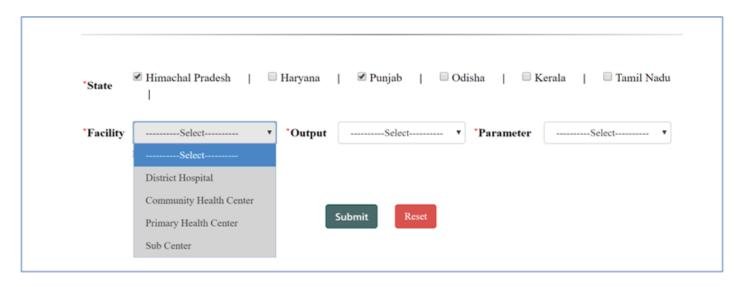
Figure. 1: Overall design of the website



Once the user clicks on the data base, he/she will be presented with a set of pull down menus so that they can select the desired data as per the need. For each state and level of facility, estimates on the mean annual cost (referred to as total cost) and cost per unit of output (referred to as unit cost) can be extracted based on the following steps:

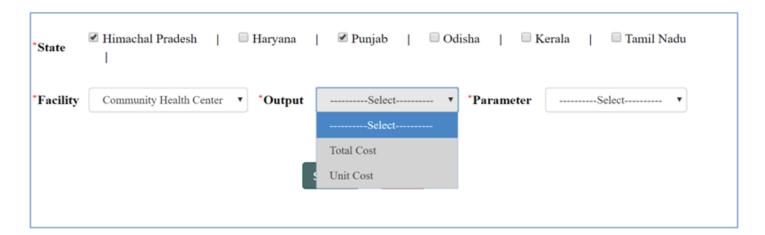
Step 1: First choose the state and level of the health system

After registration, select the state (or states) by clicking on the box next to the state of interest. Either one or all the states can be selected. In the screenshot below, Himachal Pradesh and Punjab have been selected. Once the states are selected, use the pull-down menu to select the level of health facility.



Step 2: Choose the type of cost data

The next step is to choose between the type of cost data i.e., total cost or unit cost. This can be selected from the 'Output' pull down menu as shown in the screen shot below.

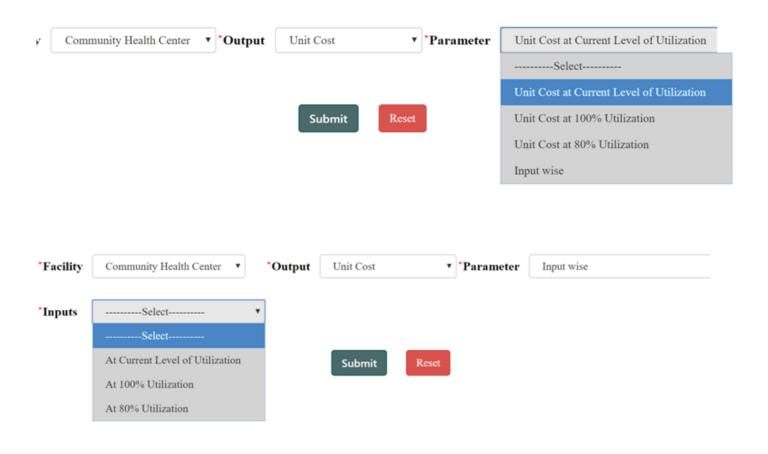


Step 3: Extracting Data

If 'Total cost' is selected, the next step requires choosing between the type of segregation in the "Parameter" menu. This option include breakdown of total cost by level or type of specific service and by the type of inputs. The different options are shown in the screenshots below. Once the required parameter is selected, click on 'Submit' to generate the cost tables.



If 'Unit cost' is selected, it needs to be decided that whether only an overall unit cost estimate is needed or it is also required in term of breakdown by inputs. The screenshots below show that if input wise breakdown is selected, another 'Input' box appears along with the option to choose between the different levels of capacity. If input wise breakdown is not needed, one can only select the level of capacity utilization for unit cost without the breakdown by inputs, by clicking on the desired option in the 'Parameter' box itself. Once the 'Parameter' and 'Inputs' (if needed) have been selected, click on submit to extract the unit cost data tables.



Step 4: Downloading Output Tables

Screenshots shown below presents the distribution of mean annual health system cost incurred at the level of community health centers of Himachal Pradesh and Odisha by specific services, type of inputs and by level of services. All these tables can also be downloaded as MS Excel tables.

Specific Services	services at the level of community health center across different states in India Mean annual cost in Indian rupees (95% CI)		
.,	Himachal Pradesh (2014-15)*	Odisha (2014-15)*	
Antenatal and postnatal care	285,175 (37,253-424,225)	736,634 (468,039-1,210,990)	
nstitutional deliveries and new borne care corner	285,909 (13,840-629,104)	1,993,881 (1,104,361-3,020,506)	
mmunization	266,940 (130,562-502,853)	398,455 (212,548-610,814)	
Outpatient department	3,026,718 (1,212,441-5,612,495)	5,581,465 (4,362,013-7,082,494)	
Family Planning activities	386,641 (64,867-925,966)	653,520 (374,012-919,622)	
npatient ward & special day care	2,031,908 (557,033-4,756,065)	2,529,381 (1,441,889-3,921,109)	
Operation theatre	38,029 (3,749-99,482)	102,618 (54,240-160,310)	
Dental	457,663 (0-738,971)	5,701 (357-11,711)	
mergency	456,876 (77,063-1,013,504)	125,391 (62,213-912,142)	
Outreach activities	368,817 (110,774-744,685)	638,987 (384,269-2,268,658)	
Leetings	549,757 (76,459-903,656)	853,039 (575,137-1,086,145)	
Routine administrative work	1,218,637 (5,274-1,968,313)	1,605,879 (1,164,205-2,046,036)	
Monitoring and supervision	536,989 (0-895,662)	137,917 (85,309-189,660)	
Support activities	793,428 (330,605-1,663,477)	1,496,678 (1,015,060-1,987,344)	
Diagnostics	1,349,206 (1,003,888-1,922,902)	882,725 (497,677-1,678,157)	
Ambulatory	554,744 (0-1,084,040)	288,018 (112,872-466,352)	
Frainings	163,101 (225-245,399)	32,975 (15,447-53,604)	
[otal	12,770,537 (4,937,681-22,187,626)	18,063,266 (14,083,160-22,804,305)	

Inputs	Mean annual cost in Indian rupees (95% CI)		
	Himachal Pradesh (2014-15)* Odisha (2014-15)*		
Human resource	7,061,353 (2,283,195-12,681,267)	8,500,109 (7,363,819-9,650,411)	
Space & building	1,646,846 (780,595-2,686,957)	172,719 (139,573-214,770)	
Equipment & furniture	1,790,394 (1,368,566-2,469,911)	760,779 (339,498-1,285,824)	
Drugs	720,521 (66,491-1,319,485)	3,809,129 (2,386,340-5,594,787)	
Consumables	659,846 (24,254-1,716,759)	1,420,646 (467,565-3,055,101)	
Other recurrent costs	404,257 (92,047-815,782)	512,357 (147,472-1,091,714)	
Fund & cash benefits	487,320 (158,394-806,100)	2,887,527 (1,744,824-4,117,026)	
Total cost	12,770,537 (4,937,681-22,187,626)	18,063,266 (14,083,160-22,804,305)	

Distribution of annual cost by level of services at the level of community health center across different states in India			
Level of Services	Mean annual cost in Indian rupees (95% CI)		
	Himachal Pradesh (2014-15)*	Odisha (2014-15)*-	
Preventive	598,787 (495,547-679,016)	1,015,177 (582,880-1,597,552)	
Curative	6,603,735 (1,924,966-13,174,284)	10,812,350 (7,495,476-14,508,931)	
Promotive	380,905 (111,011-566,776)	937,201 (732,212-1,174,676)	
Indirect services	5,187,110 (2,052,241-8,223,315)	5,298,538 (4,577,829-5,953,310)	
Total cost	12,770,537 (4,937,681-22,187,626)	18,063,266 (14,083,160-22,804,305)	

Next steps for the database

The present database in its current form does have some limitations. One concern is that it provides only public sector costs that are often partial in settings like India where out-of-pocket(OOP) expenditures are 63% of all health expenditures (32) In the absence of facility records that document full production costs, national level surveys on consumption provide some

Costing Handbook 17

of the additional detail on patient level out of pocket expenditures. These patient incurred costs can be accessed in the National sample survey (NSS) survey and a link to this resource is provided on the national cost database website.(33) The other concern is that the database does not provide any cost estimates on the delivery of health care in public tertiary level and private sector in India. To address this, facility level cost estimates, as being assessed in the nationwide CHSI study, of various services delivered by tertiary level facilities and private hospitals of India are expected to be made available on the database.(34)

It is also hoped that other institutions will also use the PGIMER methodology and also permit their data to be added to the database. Finally, it is anticipated that this initiative will develop into a national reference cost database that achieves a level of transparency in line with those in countries such as the UK, Australia and the Netherlands.(24-26) In these countries, government contracting requires that all providers (whether public or private) submit cost reports which facilitate the estimation of case or condition specific costs and prices. To accommodate the long-term goals, this first cost database and web-based resource, will be flexible enough to incorporate new data as and when it is entered into the system.

By publishing these different sets of cost data online and demonstrating their utility through the analytical work, two important shifts in research on costs of health services in India are envisaged. First, it is hoped that as the utility of these data are demonstrated, there will be an increase in the demand from policymakers for further, more substantive, better quality and more granular data. Second, this demand will begin to put pressure on the private sector to become more transparent, to keep costs constrained and to contribute to the database with their own cost data. With these shifts, the government of India will be better able to make more informed decisions around health care provision and financing.

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4.2 Useful Resources and References for Costing of Healthcare Service

Dr. Aamir Sohail, Dr. Akshay Chauhan & Dr Maninder Pal Singh

Overview

This chapter provides references to some additional resources and websites for researchers/ practitioners who are interested in carrying out healthcare costing exercise. These resources provide important costing data and methodologies useful in carrying out costing exercise. The resources provided here include disease specific, such as those from UNAIDS, and country specific (such as HTAIn) materials as well as tools and guidelines that can be used across all health services in any country-setting. Finally, we include two globally recognised check lists for checking the quality of costing studies.

Resources

1 Global Health Cost Consortium (GHCC)

GHCC is free for public access website providing cost data adapted to specific settings, as well as resources to improve cost data over time. There are two main resources to support practitioners in cost analysis:

• The GHCC Reference Case

This provides methodological principles of costing defining perspectives, type of costs, definition of "units", time horizons with examples of application of study design principles The Reference Case provides a practical framework for analysts to ensure that they consider how methods may influence estimates and thereby improve the interpretation and use of cost data. Link: https://ghcosting.org/pages/standards/reference_case

A Unit Cost Study Repository for HIV and TB services

Users can filter data by key characteristics of the intervention (e.g. country, delivery platform, cost perspective) to display relevant data using various data visualizations. The underlying data can then be exported in different formats depending on user preference. The data consists of 2898 unit cost estimates for 57 countries from 387 studies

Link: https://ghcosting.org/pages/data/ucsr/app/

2 Joint United Nations Programme on HIV/AIDS (UNAIDS)

Established under united nations economic and social council (ECOSOC) UNAIDS aims to help and support an expanded response to HIV/AIDS. UNAIDS has taken a lead in disseminating important and up-to-date guidelines and models and promoting their use in strategic planning. Important resources on costing methodologies, available from the UNAIDS website are:

Costing Guidelines for HIV/AIDS Intervention Strategies

Link: https://data.unaids.org/publications/irc-pub06/jc997-costing-guidelines_en.pdf

Manual for costing HIV facilities and services

Link:https://www.unaids.org/en/media/unaids/contentasets\doc-uments/document/2011/20110523_manual_costing_HIV_facilities_en.pdf

Costing Guidelines for HIV Prevention Strategies

Link:https://www.google.com/url?sa=t&rct=j&q=&esrc=s source=web&cd=&cad=r-ja&uact=8&ved=2ahUKEwjCtKysif_qAhVc4jgG-HZAHDPkQFjACegQIAhAB&url=http%3A%2F%2Fdata.unaids.org%2publications%2Firc-pub05%2Fjc412-costguidel_en.pdf&usg=AOvVaw3SwAYMmsYjX8Mjck4dSD93

3 Joint Learning Network (JLN) Manual on Costing of Health Services

The Joint Learning Network for Universal Health Coverage (JLN) is an innovative, country-driven network of practitioners and policymakers from around the globe with a focus on the implementation of universal health coverage(6). JLN has developed a Practical Costing Handbook on Costing of Health Services for Provider Payment that provides guidance to address multiple challenges related to costing for provider payment in low and middle-income countries (LMICs). The guidance consists of:

A practical manual

Link: https://www.jointlearningnetwork.org/resources costing-of-health-services-for-provider-payment-a-practical-manual/

Costing Handbook Toolkit

Link: https://www.jointlearningnetwork.org/resources/costing-manual-tool-kit/

Online course:

Link: https://www.jointlearningnetwork.org/resources/costing-emodule/

4 Health Technology Assessment in India (HTAIn)

The Department of Health Research had set up a health technology assessment body named as "Health Technology Assessment in India (HTAIn)". HTAIn has produced a manual on how to conduct HTA studies in the Indian context. The manual contains chapter on costing of healthcare services to familiarize readers with the concepts and methodologies of costing, and to increase their knowledge base and build capacity. The key resources relevant to costing are:

HTAIn Manual

Link: https://htain.icmr.org.in/index.php/documents/publications/htain-manual.

HTAIn Compendium

Link: https://htain.icmr.org.in/index.php/documents/publications/htain-compendium.

National Health System Cost Database for India

This is being developed in collaboration with the Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh. The database contains cost information for healthcare services in India. It provides Data Collection Tools, Health Service Input Prices and Training modules. It also provides further data resources and publications that could be useful in understandings of healthcare costing in India.

Link: https://www.healtheconomics.pgisph.in/costing_web/

5 WHO-CHOICE

The CHOICE (Choosing Interventions that are Cost-Effective) project is a WHO initiative developed in 1998 with the objective of providing policy makers with economic evidence for deciding on interventions and programmes which maximize health for the available resources. It provides internationally relevant details on costing methodology, estimates of health service unit costs at the country level and standardise data on prices and other relevant information for cost analysis.

WHO CHOICE inputs and unit prices

This page provides access all the relevant data, estimates and guidance.

Link: https://www.who.int/choice/cost-effectiveness/inputs/en/

6 ONE HEALTH Tool, World Health Organisation

One Health Tool is another tool available from WHO. This is a software tool designed for low- and middle-income countries. The tool attempts to link strategic objectives and targets of disease

control and prevention programmes to the required investments in health systems. The tool provides planners with a single framework for scenario analysis, costing, health impact analysis, budgeting and financing of strategies for all major diseases and health system components. The The tool is intended to inform sector wide national strategic health plans and policies Link: https://www.who.int/choice/onehealthtool/en/

7 Other useful resources

The following Guidelines and book are also recommended to provide guidance in carrying out costing and cost analysis in data poor settings.

Costing Guidelines for Tuberculosis Interventions

Link: https://www.who.int/tb/publications/costing_guidelines/en/

Landscape Study

The Cost, Impact, and Efficiency of Above Service Delivery Activities in HIV and Other Global Health Programs

Link:ttps://r4d.org/resources/landscape-study-cost-impact-ef-

ficiency-service-delivery-activities-hiv-global-health-programs/

Checklists for Assessing the Quality of Cost Analyses

Principles and Methods reporting checklist (GHCC)

We recommend use of this table for reporting methods in costing studies which is take from the GHCC reference case (https://ghcosting.org/). For a specific costing study, the "Options" column should be completed according to how the study was conducted.

Reference Case Checklist Items	Options				
STUDY DESIGN AND SCOPE					
Principle 1 - The purpose of the study, the population, and the intervention and/or service/output					
being costed should be clearly defined.					
Purpose					
	Economic evaluation, Financial Planning,				
Purpose type:	Budget Impact Analysis, Efficiency Analysis,				
	Other				
Relevance for health practice and/or policy	Free text				
decisions:	Thee text				
Aim of the cost analysis:	Free text				
Intended user(s) of the cost estimate:	Free text				
Intervention					
Main activities/technologies involved:	Free text				
Target population:	As relevant: age, gender, geographical				
rarget population.	location, clinical indication				
Coverage level:	Percentage of target population or sites				
Delivery mechanism (e.g., health system level,	As relevant: level of health service, facility type				
facility type, ownership, etc.):	As relevant. level of fleatin service, facility type				
Epidemiological context (i.e.,	As relevant: incidence and/or prevalence				
incidence/prevalence of disease)	As relevant: incluence and/or prevalence				
	Describe production process (e.g., list main				
Intervention	activities and key technologies involved in				
	delivering the intervention)				

Principle 2 - The perspective (extent of the resource use captured) of the cost estimation should					
be stated and justified relevant to purpose.					
Study perspective (e.g., provider, health system,	(Named) provider or societal, and list				
societal, household):	specific payers. State any stopping rules.				
Principle 3 - The type of cost being estimated should be	clearly defined, in terms of economic vs				
financial, real world vs guideline, and incremental vs fu	ll cost, and whether the cost is 'net of				
future cost', should be justified relevant to purpose.					
Defining the cost					
Economic vs. financial cost	Economic vs. financial cost				
Real world' vs guideline cost	Real world' vs guideline cost				
Full vs incremental cost	Full vs incremental cost				
Net of future cost	Yes or No				
Principle 4 - The 'units' in the unit costs for strategies, services and interventions should be					
defined, relevant for the costing purpose, and generalize	zable.				
List the unit costs used	Choose from list of standardized unit costs				
Describe any adjustments made to reflect the quality	Choose from list of standardized				
of service output	adjustments				
Principle 5 - The time horizon should be of sufficient ler	ngth to capture all costs relevant to the				
purpose, and consideration should be given to disaggre	gating costs into separate time periods				
where appropriate.					
Time period					
Period type (start-up vs implementation):	Start-up, implementation or both				
Time period:	Years and months				

SERVICE AND RESOURCE USE MEASUREMENT

Principle 6 - The scope of the inputs to include in the cost estimation should be defined and justified relevant to purpose.

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Above service delivery costs included	Yes or No
Costs of supporting change included	Yes or No
Research costs included	Yes or No
Unrelated costs included	Yes or No
If incremental costs, assumptions made for existing capacity	Free text
Any exclusions other to scope	Free text

Principle 7 - The methods for estimating the quantity of inputs should be described, including data sources and criteria for allocating resources.

Describe the measurement of each input as either top-down or bottom-up	Top down or bottom-up		
Describe method to allocate human resources	Observation, time sheets, work-sampling,		
inputs	interviews, other		
Describe methods to allocate above site/overhead inputs	Method, criteria and data source for criteria		
Describe the methods for excluding research costs	Method, criteria and data source for criteria		
Describe the methods for measuring other resources	Method and data source		

Principle 8 - The sampling strategy used should be determined by the precision demanded by the costing purpose and designed to minimize bias.

Site/client selection process/criteria

Describe geographic sampling (if applicable)	Frame and method
Describe site sampling (if applicable)	Frame and method

Describe patient sampling (if applicable)	Frame and method
Describe methods to calculate sample size	Calculation
Principle 9 - The selection of the data source(s) and	methods for estimating service use should be
described, and potential biases reported in the study	y limitations.
	Case note extraction, patient interviews,
Identify the data source used to measure the units	provider interviews, routine information
	systems, claims data, other
Where relevant describe the sampling frame,	_
method and size:	Free text
Describe any method used to fill missing data	Free text
Principle 10 - Consideration should be given to the ti	ming of data collection to minimize recall bias
and, where relevant, the impact of seasonality and o	other differences over time.
The timing of data collection should be specified in t	he following ways:
Timing of data collection (resource and service use)	Date of data collection
Prospective or retrospective	Prospective or retrospective
Longitudinal vs cross-sectional data	Longitudinal vs cross-sectional data
Recall period, where relevant	Months or weeks

VALUATION AND PRICING

Principle 11 - The sources for price data should be listed by input, and clear delineation should be made					
between local and international price data sources, and tradeable, non-tradeable goods.					
Report the sources of price data by input	Ministry of Health, local market, etc.				
Report inputs where local and international prices were used	Local or international				
Principle 12 - Capital costs should be appropriately annuiti	zed or depreciated to reflect the expected life of				
capital inputs.					
Describe the depreciation approach	Straight line depreciation, amortization				
Describe any discount rate used for capital goods	Percentage				
Report the expected life years of capital goods, and data sources	Years and free text				
Principle 13 - Where relevant an appropriate discount rate	, inflation and exchange rates should be used,				
and clearly stated.					
Describe any discount rate used for future costs	Percentage				
Describe the reported currency year	Currency and Year				
Describe any conversions made	Exchange rate, Source and Year				
Report the inflation type and rate used	Percentage, GDP deflator/ CPI, Source				
Principle 14 - The use and source of shadow prices for goods and for the opportunity cost of time should be					
reported.					
Methods for valuing the following should be reported:					
Report methods for valuing volunteer time	Free text				
Report adjustments for input prices (donated or subsidized goods)	Free text				

ANALYZING AND PRESENTING RESULTS

Principle 15 Variation in the cost of the intervention by site size/ organization, sub populations, or by other drivers of heterogeneity should be explored and reported.				
Describe any sub-groups or populations analyzed	Free text			
Describe any statistical methods used to establish	Free tout			
differences in unit costs by sub-group	Free text			
Describe any determinants of cost (model specification)	Free text			
Describe any multivariate statistical methods used to	Free text			
analyze cost functions	Tree text			
Principle 16 - The uncertainty associated with cost estimates should be appropriately characterized.				
Describe sensitivity analyses conducted	Free text			
List possible sources of bias	Free text			
Principle 17 - Cost estimates should be communicated clearly and transparently to enable decision-maker(s)				
to interpret and use the results.				
Limitations				
Limitations in the design, analysis, and results	Free text			
Aspects of the cost estimates that would limit	Free text			
generalizability of results to other constituencies	riee text			
Conflicts of Interest				
All pecuniary and non-pecuniary interests of the study	Free text			
contributors	Tree text			
All sources of funding that supported conduct of the	Free text			
costing	Tree text			
Non-monetary sources of support for conduct of the	Free text			
costing	Tree text			
Open access				

Drummond Checklist

The "Drummond Checklist" is a standard tool used for assessing the quality of economic evaluations. (Drummond et al 2015)While it is not designed for cost studies and is not as detailed, it can be used to assess the reporting standards in a cost analysis.

Item	Yes	No	Not	Not
			Clear	Appropriate
Study Design				
1. The research question is stated.				
2. The economic importance of the research question is stated.				
3. The viewpoint(s) of the analysis are clearly stated and justified.				
4. The rationale for choosing alternative programmes or				
interventions compared is stated.				
5. The alternatives being compared are clearly described.				
6. The form of economic evaluation used is stated.				
7. The choice of form of economic evaluation is justified in				
relation to the questions addressed				
Data collection				
8. The source(s) of effectiveness estimates used are stated.				
9. Details of the design and results of effectiveness study are				
given (if based on a single study).				
10. Details of the methods of synthesis or meta-analysis of				
estimates are given (if based on a synthesis of a number of				
effectiveness studies).				
11. The primary outcome measure(s) for the economic				
evaluation are clearly stated.				
12. Methods to value benefits are stated.				
13. Details of the subjects from whom valuations were obtained				
were given.				
14. Productivity changes (if included) are reported separately.				
15. The relevance of productivity changes to the study question is				
discussed.				

16. Quantities of resource use are reported separately from their
unit costs.
17. Methods for the estimation of quantities and unit costs are
described.
18. Currency and price data are recorded.
19. Details of currency of price adjustments for inflation or
currency conversion are given.
20. Details of any model used are given.
21. The choice of model used and the key parameters on which it
is based are justified.
Analysis and interpretation of results
22. Time horizon of costs and benefits is stated.
23. The discount rate(s) is stated.
24. The choice of discount rate(s) is justified.
25. An explanation is given if costs and benefits are not
discounted.
26. Details of statistical tests and confidence intervals are given
for stochastic data.
27. The approach to sensitivity analysis is given.
28. The choice of variables for sensitivity analysis is justified.
29. The ranges over which the variables are varied are justified.
30. Relevant alternatives are compared.
31. Incremental analysis is reported.
32. Major outcomes are presented in a disaggregated as well as
aggregated form.
33. The answer to the study question is given.
34. Conclusions follow from the data reported.
35. Conclusions are accompanied by the appropriate caveats.

Annexures

1. Cost Data Collection Tool for Tertiary Centre (Overall, OPD, IPD, OT, ICU, Laboratory)

Cost data collection tool: Human resource
Facility type: Tertiary Care (overall)

Int	erview Date:	State Name:	
Ins	titute Name:	Department Name:	
C		litu ay mayaan la ahayaa	
se	ction 1: Interview with the head of the faci	iity or person in-charge	
Α.	Please tell me how many days per week t	his facility is closed?:	(Days per week)
В.	Please tell me how many hours per day th	nis facility is open? :	(Hours per day)
C.	If the facility remains closed on Public hol	idays then mention total publi	c holidays in last year:
	(Days in year)		

Section 2: Human Resource-Salary and fringe benefits details (Details for each person separately using codes given below)

It includes all the staff involved in OPD/IPD/ICU/OT i.e., doctor (Specialist), senior resident, junior resident, staff nurse, technician, data entry operator, pharmacist, helper, etc.

Serial	Job title	Specialit	Utility (OPD	Monthly gross salary	Annual Incentive	Period/days of	Days of absence
No.	(Doctor/Resident/St aff	y	/IPD/ICU/Op eration	(inclusive of all allowances or	received for trainings	posting in the reference year	from this health facility in the
	Nurse/Technician,		theatre)	deductions)	(TA/DA received	reference year	period of posting
	etc.)				for trainings)		in the reference vear

Section 3: Details of annual allowances received (Interviews and record review)

Staff No. Code	Government residence			Transport	facility	Uniform pr	ovided/ allowa	nce	
	Square feet of the house building or rooms provided i.e. covered area (Do mention the unit of data collection	Square feet of the open area in the accommodation provided (Do mention the unit of data collection)	Amount paid in a year or How much would you pay if you would rent this house i.e. monthly rental price*12?	Amount paid in a year	Vehicle name and year of make, if provided free	Times per year (a)	Unit cost of uniform (b)	Amount incurred on uniform (a*b) or If unit cost not available ask, "For how much it will be available from market, if bought on its own?"	Any other allowance or Special allowance

Section 4: Physical infrastructure (Interview based)

Table 1: Particulars	Specify
Area of the building (Total area in Sq. ft.) (Covered + open space)	
What is the rental price of 100 sq. ft place where this Public Health centre is located?	
Was there any expense on construction of building or renovation during the period of data collection	

Section 5: Details of stationary/sanitary items (considering whole of the department)

Item	Quantity	Expenditure

Section 6: Utilities (Overall for whole of the department)

	Expenditure (Annual)
1. Building	• • • • • • • • • • • • • • • • • • • •
Electricity	
Water	
Maintenance	
Telephone	
Kerosene	
Other	
Total (If available)	
2. Equipment	
Maintenance	
Repairs	
Other	
Total (If available)	
Others	

Section 7: Utilisation of funds and grants

Amount spent in the reference year	List services for which it is used. Write serial number codes from Tables on time sheet allocation

Section 8: Sources of Revenue

		Amount collected during the reference year
1	Procedure fee	
2	Others (specify)	
3	Total user fee from the reference year	

Section 9: Time allocation sheet

Staff Member Code (Enter Code as entered in Section 1):

Service	Activity name	Type of activ	ity	Fixed schedule	activity		Routine activity			
code no		Fixed schedule	Routine schedule	Frequency (once in a week/once in month/twice a week etc.) *	Hours per day of activity	Days for which the activity was done during the reference year	Time per person (in minutes) (a)	Number of beneficiaries on a routine day (b)	If not (a) and (b) then how much time to do the activity	
1.	OPD									
2.	IPD									
3.	Operation Theatre									
4.	General Administration									
5.	Teaching/Training									
6.	Workshop/Conference									
7.	Outreach									
8.	Meetings									
9.	Research									
10.	Others (Specify)									

^{*&#}x27;1' for once a year participation, '2' for twice a year, 3 for thrice a year participation, 4 for quarterly participation, 5 for once every two months, 6 for monthly participation, 7 for fortnightly participation, 8 for weekly participation, 9 for twice a week participation, 10 for thrice a week participation.

Cost data collection tool: Outpatient department: OPD

Facility type: Tertiary Care

Interview Date	o:	State Name:	
Institute Name	e:	Department Na	ame:
Cost centre: O	PD		
Section 1: Servi	ces delivered in different room	ns in facility	
S. No.	Speciality (if any)	Number of outpat	tient consultations delivered during the reference year
1			
Section 2: Roor	n wise dimensions in outpatier Room Name	nt department	Dimension (in sq. feet)
			rd review) (Do ask for any items that are
there in stock r	egister and are stored due to r	ion-utilisation of nor	i- runctionality)

Name of the equipment or furniture		Quantity of functioning items in each room													
	OPD	OPD	OPD	OPD	OPD	OPD	OPD	OPD	OPD	OPD	OPD	OPD	Couri	Couni	Com
	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Corri	Corri	Corr idor
	no. 1	no. 2	no. 3	no. 4	no. 5	no. 6	no. 7	no. 8	no. 9	no. 10	no. 11	no. 12	dor	dor	luoi

Section 4: Details of Equipment (Observation cum record review of stock registers)

Room No.	Equipment	Quantity	Date of the purchase of the equipment	Unit price	Expected/useful life of the equipment

Section 5: Details of drugs consumed in the outpatient department of the institute (Consumption data to be taken and not the supply data) (Review the stock- register and list the quantity of drugs in drug list sheets)

S. No.	Name of Drug	Quantity consumed	Quantity expired	Unit price

Section 6: Details of Consumables consumed in the outpatient department during the reference period. Material and Supplies consumed.

S. No.	Consumables	Quantity	Unit price

Cost data collection tool: IPD/ICU

Facility type: Tertiary Care

Interview Date:	State Name:	
Institute Name:	Department Name:	_
Cost centre: IPD/ICU		

Section 1: Human resource (List the number of consultants/residents from other departments visiting the inpatient ward of the selected department)

S. No.	Designation	Speciality	Monthly gross salary	Average visits per week in the inpatient ward of the selected department	Average time per visit (in minutes)
1					

Section 2: Room wise dimensions in outpatient department

S. No.	Number of patients admitted in the inpatient ward/ICU of the department	Specific reason of admission (if any)
1		

Section 3: Room wise dimensions: Inpatient ward/ICU

S. No.	Room Name	Dimension (in sq. feet)				

Section 4: Details about non-medical items (Observation` and record review) (Do ask for any items that are there in stock register and are stored due to non-utilisation or non-functionality)

Name of the		Quantity of functioning items in each room													
equipment or furniture	IPD Ward no. 1	IPD Ward no. 2	IPD Ward no. 3	IPD Ward no. 4	IPD Ward no. 5	IPD Ward no. 6	IPD Ward no. 7	IPD Ward no. 8	IPD Ward no. 9	IPD Ward no. 10	IPD Ward no. 11	IPD Ward no. 12	Corri dor	Corri dor	Corri dor

Section 5: Details of Equipment (Observation cum record review of stock registers)

Room No.	Equipment	Quantity	Year of purchase	Unit price	Expected/useful life of the equipment
IPD/ICU room					

Section 6: Details of drugs consumed in the inpatient ward of the respective department (Consumption data to be taken and not the supply data (Review the stock- register and list the quantity of drugs in drug list sheets

S. No.	Name of Drug	Quantity consumed	Quantity expired	Unit price

Section 7: Details of Consumable consumed in the inpatient ward during the reference period. Material and Supplies consumed in the facility

S. No.	Consumables	Quantity	Price	

Section 8: Utility (Diet & Laundry)

	Quantity or expenditure (Annual)
Different types of laundry items washed	
Total	
Different types of diets served	
Total	

Cost data collection tool: Labortary

Facility type: Tertiary Care

Interv	view Date:		State	Name:				
Institu	ute Name:		_ Departme	nt Name:				
Cost	centre: Laboratory							
Section	on 1: Human resource	(List the number	of staff in La	aboratory				
	tment)	(• · · · · · · · · · · · · · · · · ·				
асраг	cirient,							
S. No	Designation	Monthly gross salary	(TA/DA	entive received frainings A received for rainings)	Period/days of p		this hea	absence from lth facility in od of posting reference year
					1			
Section	on 2: Number of vario	ous lab tests						
S. No		Name of test	No. of tests			ts		
Section	on 3: Room wise dime	ensions: Laborato	rv					
					p:	•	e ()	
	S. No	Lab Nam	e		Dim	ension (in	sq feet)	
Sectio	on 4: Details about no	on-medical items	(Observation	and recor	d review) (Do a	sk for a	ny item	s that are
there	in stock register and	are stored due to	o non-utilisat	ion or non-	-			
functi	onality)							
			Qu	antity of function	oning items in each roo	m		
Name of the furniture		Room No. 1	Room No. 2	Room no. 3	Room no. 4			Corridor
Section	on 5: Details of Equip	ment (Observatio	on cum recor	d review o	f stock registers	s)		
S.No.	Equipment	Quantity	Year of pur	chase Unit 1	price Expected/usef			ne test in which

Section 6: Details of Reagents consumed in the Laboratory during the reference period. Material and Supplies consumed in the facility

S. No.	Reagents	Quantity	Price	Name of the test in which reagents are used

Section 7: Time allocation sheet

Staff Member Code (Enter Code as entered in Section 1):

Service	Activity name	Type of activity		Fixed schedule activity			Routine activity		
code no		Fixed schedule	Routine	Frequency (once in a week/once in month/twice a week etc.)*	Hours per day of activity	Days for which the activity was done during the reference year	Time per test (in minutes) (a)	Number of tests on a routine day (b)	If not (a) and (b) then how much time to do the activity
	_								

^{*&#}x27;1' for once a year participation, '2' for twice a year, 3 for thrice a year participation, 4 for quarterly participation, 5 for once every two months, 6 for monthly participation, 7 for fortnightly participation, 8 for weekly participation, 9 for twice a week participation, 10 for thrice a week participation.

Cost data collection tool: Operation theatre

Facility type: Tertiary Care

Interview	Date:	State Name:
Institute I	Name:	
Departme	ent Name:	Cost centre: Operation theatre
Section 1:	Number of various surgeries perform	ned in the operation theatre of the department.
S. No.	Name of surgery	Annual number of surgeries done in the reference year

Section 2: Room wise dimensions in the operation theatre (10) complex

If the OT complex is common for whole of the institute, then ask about the:

• Number of operation theatres reserved for the respective specific speciality

OR

If number of OTs are limited and specific days of a week are fixed for each of the
 department within the institute; then ask about the number of fixed days/ week for which

S. No.	Room Name	Dimension (in sq. feet)

Section 3: Details about furniture and non-medical items (Observation` and record review) (Do ask for any items that are there in stock register and are stored due to non- utilisation or non- functionality)

Name of the man		Quantity of functioning items in each room									
Name of the non- medical equipment or furniture	Operatio n theatre No. 1	Operatio n theatre No. 2	Operation theatre No. 3	Operatio n theatre No. 4	Operatio n theatre No. 5	Operatio n theatre No. 6	Operatio n theatre No. 7	Operatio n theatre No. 8	Corridor	Corridor	Corridor

Section 4: Details of Equipment (Observation cum record review of stock registers)

Room No.	Equipment	Quantity	Price	Expected/useful life of the equipment	Name the type of specific surgery for which it is used

Section 5: Details of Consumables consumed in the Operation theatre during the reference period. Material and Supplies consumed

S. No.	Consumables	Quantity	Unit price	Name the type of specific surgery for which it is used

Section 6: Details of Drugs consumed in the Operation theatre during the reference period. Material and Supplies consumed

S. No.	Drugs	Quantity	Unit price	Name the type of specific surgery for which it is used

Section 7: Key personnel interview

Ask the following information from a key personnel for each of the surgery to be costed in a particular department:

S.	Name of the surgery	Average time taken	Average	Average	Number of specific	Number of various	List of
No.		for performing the procedure in the operation theatre	length of stay in the intensive care unit (if any)	length of stay in the inpatient ward	personnel involved in the surgery (Consultant, Senior resident, Junior resident, Anaesthetist, Residents of anaesthesia, OT technicians, etc.)	diagnostic tests performed on a patient undergoing the procedure	consumables for each of the procedure (list of consumables purchased by the patient before undergoing surgery)

2. Cost Data Collection Tool for District Hospital

Cost data collection tool

Facility type: District Hospital

Interv	view Date: State Name:
Distri	ict Name: Facility Name:
Section	on 1: Interview with the head of the facility or person In-charge
D.	Please tell me how many days per week this facility is closed? : (Days per
	week)
E.	Please tell me how many hours per day this facility is open? : (Hours per day)
F.	If the facility remains closed on Public holidays then mention total public holidays in last
	year:(Days in year)
Section	on 2: Salary details: Details for each person separately
	How many days

Section 3: Details of annual allowances received (Interviews and record review)

Annual Incentive

received for trainings

(TA/DA received for

trainings)

Staff No. Code	Government res	idence		Transport	facility	Uniform pr	ovided/ allowa	nce	
Sr no.	Square feet of the house building or rooms provided i.e. covered area (Do mention the unit of data collection	Square feet of the open area in the accommodation provided (Do mention the unit of data collection)	Amount paid in a year or How much would you pay if you would rent this house i.e. monthly rental price*12?	Amount paid in a year	Vehicle name and year of make, if provided free	Times per year (a)	Unit cost of uniform (b)	Amount incurred on uniform (a*b) or If unit cost not available ask, "For how much it will be available from market, if bought on its own?"	Any other allowance or Special allowance

Monthly gross

salary

(inclusive of all

allowances or

deductions)

Sr no.

he/she did not work

in reference year

Section 4a: Annual services delivered (Record based)

Services delivered	Specialities	Actual services delivered in OPD during the reference year	Actual services delivered in IPD during reference year	Auxiliary service
	Paediatrics			
Number of patients given OPD consultations in each of the	Medicine			
specialities	Chest			
	Eye			
	ENT			
	Surgery			
	Orthopaedics			
	Skin			
	Gynaecology			
	Dental			
	Psychiatry			
	Ayurveda- OPD			
	Homeopathy- OPD			
	Yoga- OPD			
	Geriatric services			
	Cardiology			
	Gastro-enterology			
OPD consultations in super				
specialities (if any)	Urology			
	Oncology			
	Neurology/Nephrology			
	Paediatrics			
	Medicine			
	Chest			
	Eye			
Number of patients admitted for	ENT			
inpatient care	Surgery			
inputient care	Orthopaedics			
	Skin			
	Gynaecology			
	Geriatric services			
	Others (like physiotherapy)			
Number of patients treated	Emergency (Accident and other			
	emergencies)			
	Critical care/Intensive care unit			
	Labour room			
	Neonatal intensive care unit			
	Dialysis unit			
	General operations			
Number of patients treated in	Surgery/orthopaedics OT			
Operation theatre (10)	Eye OT			
	Emergency OT			
	Other operations			
	Integrated Counselling and Testing			
Number of patients given	Centre De addiction contro			
consultations/treated	De-addiction centre			
	Rehabilitation services			
Family planning services	IUCD procedure			
	Tubectomy procedure			_
ietetics: Number of diet served aundry: Number of clothes washed				

Section 5: Sources of Revenue

S. No.		Amount collected during the period during the reference year
1.	Procedure fee (Medical dental combined)	
2.	Referral Charges	
3.	Medical certificate for driving license	
4.	Birth –death registration	
5.	Record checking for Birth –death	
6.	Issuing the card Birth –death	
7.	Any other (specify)	
	Total user fee from 2017-18	

Section 6: Details regarding population covered at the facility

S. No.		Amount collected during the period during the reference year
1.	Procedure fee (Medical dental combined)	
2.	Referral Charges	
3.	Medical certificate for driving license	
4.	Birth –death registration	
5.	Record checking for Birth -death	
6.	Issuing the card Birth –death	
7.	Any other (specify)	
	Total user fee from 2017-18	

Section 7 and 8: Physical infrastructure (Interview based)

S. No.		Amount collected during the period 2017-18
1.	Procedure fee (Medical dental combined)	
2.	Referral Charges	
3.	Medical certificate for driving license	
4.	Birth –death registration	
5.	Record checking for Birth –death	
6.	Issuing the card Birth –death	
7.	Any other (specify)	
	Total user fee from 2017-18	

Section 8: Services delivered in different rooms in facility

*Instruction: If the activity is a routine activity, then fill the code 11 (for routine activity) in column b(as shown in the frequency codes below) and hours per day in column (c). Similarly, if the given activity is a fixed activity (fill the respective code in column B, as per codes mentioned) and write the total hours in column 'c' for which the activity was done. Frequency: *'1' for once a year participation, '2' for twice a year, 3 for thrice a year participation, 4 for quarterly participation, 5 for once every two months, 6 for monthly participation, 7 for fortnightly participation, 8 for weekly participation, 9 for twice a week participation, 10 for thrice a week participation, 11 for routine activity.

Room Name_	Room				Room Name			Room Name			Room Name			
Area (Sq. feet)		Area (Sq. feet)			Area (Sq. feet)			Area (Sq. feet)			Area (Sq. feet)			
Activity name (a)	Freq* (b)	Hours (c)	Activity name (a)	Freq* (b)			Activity name (a)	Freq* (b)	Hours (c)	Activity name (a)	Freq* (b)	Hours (c)		

Section 9: Items in facility rooms (Observation and record review)

Do ask for any items that are there in stock register and are stored due to non-utilisation or nonfunctionality

Name of the		Quantity of functioning items in each room															
non-medical																	
items or																	
furniture																	
	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room	Room
	no. 1	no. 2	no. 3	no. 4	no. 5	no. 6	no. 7	no. 8	no. 9	no. 10	no. 11	no. 12	no. 13	no. 14	no. 15	no. 16	no. 17

Section 10a: Medical Equipments (Observation cum record review of stock registers)

Room	Equipment name	Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes from Annexure 1

Section 10b: Special equipment for new born care corner

Equipment	Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes Annexure 1

Section 10c. Dental equipment's

Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes Annexure 1

Section 10d: Laboratory Equipment

Equipment	Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes Annexure 1

Section 10e: Radiology Equipment

Equipment	Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes from Annexure 1
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Section 10f: Dialysis unit Equipment (if any)

	Equipment	Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes from Annexure 1
ſ						

Section 10g: Blood bank Equipment (if any)

Equipment	Quantity	Price	Date of Purchase of Equipment	Expected life of equipment	List services for which it is used. Write serial number codes from Annexure 1
					·

Section 11: Drug list (Review the stock- register and list the quantity and price of drugs in drug list sheets provided at the end of tool by using the sheets to photocopy index of drugs register and write quantity, price and utility against each drug as given below

Get the consumables & drug list	Quantity Consumed	Quantity Expired	Price Per Unit	List services for which it is used. Write serial number codes from Annexure 1
·				

Section 12: Consumables. Material and Supplies

Get the Consumable list	Quantity Price Per Unit		List services for which it is used. Write serial number codes from Annexure 1
Section 12b. Dental consumables	Quantity	Price Per Unit	List services for which it is used. Write serial number codes from Annexure 1

Section 13: Signage/IEC material on display in the unit (Observation cum record review in stock register)

Type of IEC material (Specify size)	Quantity	Evnanditura	List services for which it is used. Write
Type of IEC material (Specify size)	Quantity	Expenditure	serial number codes from Annexure 1

Section 14: Stationary and other miscellaneous items: (Record review for billed amounts of purchased stationary)

Item	Quantity	Expenditure

Section 15: Vehicles Details

	Type of Vehicle	Quantity	Date of Purchase of Vehicle	Price	Average Life
ſ					

Section 16: Utilities/ Overhead (Annual)

	Expenditure (Annual)
1.Means of transport	• • • • • • • • • • • • • • • • • • • •
Maintenance	
Repairs	
Insurance	
Others	
Total (If available)	
2. Building	
Electricity	
Water	
Facility rent (if relevant)	
Maintenance	
Telephone	
Kerosene	
Other	
Total (If available)	
3. Equipment	
Maintenance	
Repairs	
Other	
Total (If available)	
Expenditure on laundry	
Expenditure on Dietetics	
Expenditure on sterilization and disinfection	
Others (specify)	

Section 17: Laboratory/ Radiological investigation/Procedure fees

Type of tests	Quantity

Section 18: Details of referral transport

Total number of patients referred from facility using referral transport	No. of Under-Fives	No. of Over-Fives	List services for which it is used. Write serial number codes from Annexure 1	

Section 19: Cash benefits paid to patients

Name of Scheme	Amount paid during the period 2017-18

Section 20: Utilisation of funds and grants

Amount spent in the 2017-18	List services for which it is used. Write serial number codes from Annexure 1

Section 21. Ti	ime allocation sheet	Staff Member Co	de (Enter Code as	entered in Table 2	١٠
3 0 01101121. 11	iiile aliocation sileet	Stall Melliber Co	de (Enter Code as	entered in rable 2	<i>)</i>

Service	Activity name	Type of activity		Fixed schedule activity			Routine activity		
code no		Fixed	Routine	Frequency	Hours	Days for	Time per	Number of	If not (a)
		schedule		(once in a	per day	which	person	beneficiaries	and (b)
				week/once in	of	the	(in	on a routine	then how
				month/twice	activity	activity	minutes)	day (b)	much
				a week etc.)*		was done	(a)		time to do
						during			the
						the year			activity
						2017-18			

*'1' for once a year participation, '2' for twice a year, 3 for thrice a year participation, 4 for quarterly participation, 5 for once every two months, 6 for monthly participation, 7 for fortnightly participation, 8 for weekly participation, 9 for twice a week participation, 10 for thrice a week participation.

Section 22	2: Mention	the number	r of days o	f stay of 10) patients p	er month	(120) of fac	cility of fina	ancıal year
2017-18*									
Paediatric	s Departm	ent:							
			ı	ı	I	I		I	
Medicine	Departmen	t:	1	1	T	T		T	T
Chest Dep	partment:								
Eye Depa	rtment:								
ENT Depa	irtment:								
Surgery D	epartment:	:							
Orthopae	dics Depart	ment:							
Skin Depa	rtment:								
Gynaecolo	ogy Depart	ment:							
-									

- Exclude the following:
- Patients who died in the hospital
- Patients who were transferred to another hospital
- Patients for whom length of stay is not available
- Patients who left against medical advice or discontinued care

Annexure 1

code		code		code		code	
no.	Activity name	no.	Activity name	no.	Activity name	no.	Activity name
1	OPD: Paediatrics	18	ENT	35	Outreach activities	53	Accounts
2	OPD: Medical	19	NICU	36	Meetings	54	Store Keeping
3	OPD: Chest	20	ICU	37	Family planning camp	55	Registration
4	OPD: Eye	21	Emergency	38	Pulse polio immunisation	56	Others (Specify)
5	OPD: ENT	22	Dialysis unit	39	School health service		
6	OPD: Psychiatry	23	IPD: Paediatrics	40	IEC Activities related to National Health programmes		
7	OPD: Skin	24	IPD: Medical	41	Integrated Counselling and Testing Centre		
8	OPD: Orthopaedics	25	IPD: Chest	42	De- addiction centre		
9	OPD: Surgery	26	IPD: Eye	43	Rehabilitation services		
10	OPD: Dental	27	IPD: ENT	44	Central sterilized department: Number of items sterilized		
11	OPD: Gynaecology	28	IPD: Psychiatry	45	Blood Bank		
	OPD: Cardiology / Enterology / Urology / Oncology/	29	IPD: Skin	46	Laboratory		
12	Neurology/Nephrology	30	IPD: Orthopaedics	47	Radiology		
13	Ayurveda- OPD	31	IPD: Surgery	48	Food service/dietician		
14	Homeopathy- OPD	32	IPD: Dental	49	Transport		
15	Yoga- OPD	33	IPD: Gynaecology	50	Security		
16	Operation theatre		IPD: Cardiology / Enterology / Urology / Oncology/	51	Housekeeping		
17	Labour Room	34		52	Medical Records		

3. Cost Data Collection Tool for Private Centre (Overall, OPD, IPD, OT, ICU, Laboratory)

Cost data collection tool: Human resource

			Facility t	ype: Private	Hospital		
Interv	view Date:			State Na	me:		_
Hosp	ital Name:			Departm	ent Name:		
Section	on 1: Interview v	vith the hea	nd of the facilit	y or person l	n-charge		
G.	Please tell me	how many	days per we	ek this facili	ty is closed? :	([Days per
week	·)						
Н.	Please tell me	how many	/ hours per da	y this facilit	y is open? :	(H	ours per da
I. I	f the facility re	mains clos	sed on Public	holidays the	n mention total	public holidays	in last year
	(Days in	year)					
It incl	nurse, techniciar		y operator, pha	macist, help	er, etc.	Period/days of posting	Days of absence
No.	(Doctor/Resident/St aff Nurse/Technician, etc.)		/IPD/Operation theatre/ICU/Othe r(specify)]	salary (inclusive of all allowances or deductions)	received for trainings (TA/DA received for trainings)	in the year 2017-18	from this health facility in the period of posting in the year 2017-18
Section	on 3: Physical in	frastructur	e (Interview ba	sed)			
	1: Particulars f the building (Total area	in Sq. ft.) (Cove	red + open space)			Specify	
	s the rental price of 100 sere any expense on cons				collection		
Section	on 4: Details of	stationary/	sanitary items	(considering	whole of the de	epartment) (Reco	ord review fo

billed amounts of purchased stationary)

Item	Quantity	Expenditure

Section 5: Utilities (Overall for whole of the department)

	Expenditure (Annual)
1. Building	
Electricity	
Water	
Maintenance	
Telephone	
Kerosene	
Other	
Total (If available)	
2. Equipment	
Maintenance	
Repairs	
Other	
Total (If available)	
Others	

Section 6: Time allocation sheet

Staff Member Code (Enter Code as entered in Section 1):

Service	Activity name	Type of ac	ctivity	Fixed schedule	e activity		Routine activity		
code no		Fixed schedule	Routine	Frequency (once in a week/once in month/twice a week etc.)*	Hours per day of activity	Days for which the activity was done during the year 2017-18	Time per person (in minutes) (a)	Number of beneficiaries on a routine day (b)	If not (a) and (b) then how much time to do the activity
1.	OPD								
2.	IPD								
3.	Operation Theatre								
4.	ICU								
5.	General Administration								
6.	Teaching/Training								
7.	Workshop/Conference								
8.	Outreach								
9.	Meetings								
10.	Research								
11.	Others (specify)								

^{*&#}x27;1' for once a year participation, '2' for twice a year, 3 for thrice a year participation, 4 for quarterly participation, 5 for once every two months, 6 for monthly participation, 7 for fortnightly participation, 8 for weekly participation, 9 for twice a week participation, 10 for thrice a week participation.

Cost data collection tool: : Outpatient department

Facility type: Private Hospital

Interviev	w Date:	State Name:
Hospital	Name:	Department Name:
Cost cer	ntre: Outpatient department	
Section 1	: Services delivered in different rooms i	n facility
S. No	Speciality (if any)	Number of outpatient consultations delivered during the reference year

Section 2: Human Resource-Salary and fringe benefits details (Details for each person separately using codes given below)

It includes all the staff involved in OPD i.e., doctor (Specialist), staff nurse, technician, data entry operator, pharmacist, helper, etc.

Serial No.	Job title (Doctor/Resident/St aff Nurse/Technician, etc.)	Speciality	Utility [OPD /IPD/Operation theatre/ICU/Othe r(specify)]	Monthly gross salary (inclusive of all allowances or deductions)	Annual Incentive received for trainings (TA/DA received for trainings)	Period/days of posting in the year 2017-18	Days of absence from this health facility in the period of posting in the year 2017-18

Section 3: Room wise dimensions in outpatient department

S.No	Room Name	Dimension (in sq feet)

Section 4: Details about non-medical items (Observation` and record review) (Do ask for any items that are there in stock register and are stored due to non-utilisation or non-functionality)

Name of the Quantity of functioning items in each r							ch room								
non-medical	OPD	OPD	OPD	OPD	OPD	OPD	Corri	Couni	Corr						
item or	Room	Room	Room	Room	Room	Room		Corri	idor						
furniture	no. 1	no. 2	no. 3	no. 4	no. 5	no. 6	no. 7	no. 8	no. 9	no. 10	no. 11	no. 12	dor	dor	laor

Section 5: Details of Equipment (Observation cum record review of stock registers) (Equipment procured in year 2018 should not be captured, but condemn equipment in year 2018 should be captured)

Room No.	Equipment	Quantity	Date of the purchase of the equipment	Unit price	Expected/useful life of the equipment

Section 6: Details of drugs consumed in the outpatient department of the institute (Consumption data to be taken and not the supply data) (Review the stock- register and list the quantity of drugs in drug list sheets)

S. No.	Name of Drug	Quantity consumed	Quantity expired	Unit price

Section 7: Details of Consumables consumed in the outpatient department. Material and Supplies consumed.

S. No.	Consumables	Quantity	Unit price

Cost data collection tool

Facility type: Private Hospital

Interview Date:	State Name:
Hospital Name:	Department Name:
Cost centre: Inpatient ward/ICU	

Section 1: Human resource (List the number of consultants from other departments visiting the inpatient ward of the selected department)

S. No	Designation	Speciality	Monthly gross salary	Average visits per week in the inpatient ward of the selected department	Average time per visit (in minutes)

Section 2: Human Resource-Salary and fringe benefits details (Details for each person separately using codes given below)

It includes all the staff involved in IPD i.e., doctor (Specialist), staff nurse, technician, data entry operator, pharmacist, helper, etc.

Serial	Job title	Speciality	Utility [OPD	Monthly gross	Annual Incentive	Period/days of posting	Days of absence
No.	(Doctor/Resident/St		/IPD/Operation	salary		in the year 2017-18	from this health facility in the
	aff		theatre/ICU/OTo	(inclusive of all	trainings		period of
	Nurse/Technician,		ther(specify)]	allowances or deductions)	(TA/DA received for		posting in the
	etc.)			deductions)	trainings)		year 2017-18

Section 3: Annual service detail

S. No	Number of patients admitted in the inpatient ward/ICU of the department	Specific reason of admission (if any)

Section 4: Room wise dimensions: Inpatient ward/ICU

S. No	Room Name	Dimension (in sq feet)

Section 5: Details about non-medical items (Observation` and record review) (Do ask for any items that are there in stock register and are stored due to non-utilisation or non- functionality)

Name of the						Quanti	ity of fund	ctioning it	tems in ea	ch room					
non-medical	IPD	IPD	IPD	IPD	IPD	IPD	IPD	IPD	IPD	IPD	IPD	IPD	Corri	Corri	Corr
item or	Ward	Ward	Ward	Ward	Ward	Ward	Ward	Ward	Ward	Ward	Ward	Ward	dor	dor	idor
furniture	no. 1	no. 2	no. 3	no. 4	no. 5	no. 6	no. 7	no. 8	no. 9	no. 10	no. 11	no. 12	uoi	uoi	luui

Section 6: Details of Equipment (Observation cum record review of stock registers) (Equipment procured in year 2018 should not be captured, but condemn equipment in year 2018 should be captured)

Room No.	Equipment	Quantity	Year of purchase	Unit price	Expected/useful life of the equipment

Section 7: Details of drugs consumed in the inpatient ward of the respective department (Consumption data to be taken and not the supply data) (Review the stock- register and list the quantity of drugs in drug list sheets

S. No.	Name of Drug	Quantity consumed	Quantity expired	Unit price

Section 8: Details of Consumable consumed in the inpatient ward during the reference period. Material and Supplies consumed in the facility

S. No.	Consumables	Quantity	Price

Section 9: Utilities Diet & Laundry

	Quantity or expenditure (Annual)
Different types of laundry items washed	
Total	
Different types of diets served	
Total	

Cost data collection tool: Operation theatre

Facility type: Private Hospital

Interview Date:	State Name:
Hospital Name:	Department Name:
Cost centre: Operation theatre	

Section 1: Number of various surgeries performed in the operation theatre of the department.

S. No	Name of surgery	Annual number of surgeries done in the reference year

Section 2: Human Resource-Salary and fringe benefits details (Details for each person separately using codes given below)

It includes all the staff involved in OT i.e., doctor (Specialist), staff nurse, technician, data entry operator, pharmacist, helper, etc.

Serial No.	Job title (Doctor/Resident/St aff Nurse/Technician, etc.)	Speciality	Utility [OPD /IPD/Operation theatre/ICU/Othe r(specify)]	Monthly gross salary (inclusive of all allowances or deductions)	Annual Incentive received for trainings (TA/DA received for trainings)	Period/days of posting in the year 2017-18	Days of absence from this health facility in the period of posting in the year 2017- 18

Section 3: Room wise dimensions in the operation theatre (10) complex

*If the OT complex is common for whole of the institute, then ask about the:

Number of operation theatres reserved for the respective specific speciality

OR

• If number of OTs are limited and specific days of a week are fixed for each of the department within the institute; then ask about the number of fixed days/ week for which the certain number of operation theatres are booked for the department under study

S.no Room Name		Dimension (in sq. feet)			

Section 4: Details about furniture and non-medical items(Observation` and record review) (Do ask for any items that are there in stock register and are stored due

Name of the non-	Quantity of functioning items in each room										
medical item or furniture	Operatio n theatre No. 1	Operatio n theatre No. 2	Operatio n theatre No. 3	Operatio n theatre No. 4	Operatio n theatre No. 5	Operatio n theatre No. 6	Operatio n theatre No. 7	Operatio n theatre No. 8	Corridor	Corridor	Corridor

Section 5: Details of Equipment (Observation cum record review of stock registers) (Equipment procured in year 2018 should not be captured, but condemn equipment in year 2018 should be captured)

Room No.	Equipment	Quantity	Price	Expected/useful life of the equipment	Name the type of specific surgery for which it is used (use S.No. as per section 1)

Section 6: Details of Consumables / Drugs consumed in the Operation theatre. Material and Supplies consumed.

S. No.	Consumables / Drugs	Quantity	Unit price	Name the type of specific surgery for which it is used (use S.No. as per section 1)

Section 7: Key personnel interview

Ask the following information from key personnel for each of the surgery to be costed in a particular department:

S.No	Name of the	Average time	Average length	Average	Number of specific personnel	Number of various	List of consumables for
	surgery	taken for	of stay in the	length of	involved in the surgery	diagnostic tests	each of the procedure
		performing the	intensive care	stay in the	(Consultant, Senior resident,	performed on a patient	(list of consumables /
		procedure in the	unit - ICU (if	inpatient	Junior resident, Anaesthetist,	undergoing the	drugs purchased by the
		operation theatre	any)	ward -IPD	Residents of anaesthesia, OT	procedure	patient before
					technicians, etc.)		undergoing surgery)

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