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SYSTEMATIC REVIEW

Economic Studies on Non-Communicable Diseases and Injuries in India: A Systematic Review

Indrani Gupta[1] · **Arjun Roy**[1]

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Abstract

Background The burden from non-communicable diseases and injuries (NCDI) in India is increasing rapidly. With low public sector investment in the health sector generally, and a high financial burden on households for treatment, it is important that economic evidence is used to set priorities in the context of NCDI.

Objective Our objective was to understand the extent to which economic analysis has been used in India to (1) analyze the impact of NCDI and (2) evaluate prevention and treatment interventions. Specifically, this analysis focused on the type of economic analysis used, disease categories, funding patterns, authorship, and author characteristics.

Methods We conducted a systematic review based on economic keywords to identify studies on NCDI in India published in English between January 2006 and November 2016. In all, 96 studies were included in the review. The analysis used descriptive statistics, including frequencies and percentages.

Results A majority of the studies were economic impact studies, followed by economic evaluation studies, especially cost-effectiveness analysis. In the costing/partial economic evaluation category, most were cost-description and cost-analysis studies. Under the economic impact/economic burden category, most studies investigated out-of-pocket spending. The studies were mostly on cardiovascular disease, diabetes, and neoplasms. Slightly over half of the studies were funded, with funding coming mainly from outside of India. Half of the studies were led by domestic authors. In most of the studies, the lead author was a clinician or a public health professional; however, most of the economist-led studies were by authors from outside India.

Conclusions The results indicate the lack of engagement of economists generally and health economists in particular in research on NCDI in India. Demand from health policy makers for evidence-based decision making appears to be lacking, which in turn solidifies the divergence between economics and health policy, and highlights the need to prioritize scarce resources based on evidence regarding what works. Capacity building in health economics needs focus, and the government's support in this is recommended.

Key Points for Decision Makers

Policies to address non-communicable diseases and injuries in India require greater use of economic analysis.

Greater involvement of economists would be useful in decision making and setting priorities in a resource-constrained setting.

India needs to strengthen domestic capacity in health economics.

More funding is necessary for non-clinical health research in India generally, and particularly for non-communicable diseases and injuries.

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✉ Indrani Gupta
ig.indrani@gmail.com

Arjun Roy
arjunroy100@yahoo.com

[1] Institute of Economic Growth, University of Delhi Enclave, Delhi 110007, India

1 Introduction

In 2012, a total of 72% of all deaths in India were due to non-communicable diseases and injuries (NCDI), including cardiovascular diseases (CVD; 26%), chronic respiratory diseases (CRD; 13%), cancer (7%), diabetes (2%), "other" NCDs (12%), and injuries (12%) [1, 2]. This represents an aggregate change of 8 percentage points from 2005, when NCDIs were estimated to account for 64% of all deaths, leading to rapid health transition [3]. Furthermore, the prevalence of NCDIs is expected to increase in the coming years as a result of increasing urbanization and industrialization, changing patterns of living, and greater life expectancy [3].

India faces enormous challenges in providing a basic standard of affordable healthcare, and the private sector is the major player in both the financing and the delivery of healthcare [4]. General government funding accounted for 33% of total healthcare expenditure, which is significantly lower than the average of 52% for the South-East Asia region [5]. A more recent report put the estimated total government healthcare expenditure at 1.1% of national gross domestic product (GDP) for 2014–15 [6]. This leaves India among a group of countries with the lowest levels of public investment in healthcare. Thus, a large chunk of the financial burden of healthcare is left for individuals to bear, with out-of-pocket (OOP) payments amounting to about 64% of total health expenditure in 2013–2014 [6]. With NCDI incurring high treatment costs, this burden is likely to impose a severe strain on households, with current expenditure by households (including prepayments for insurance premiums) estimated at 68% of total health expenditure [6].

The health financing situation poses resource allocation and prioritization challenges to policy makers, not only within the group of diverse diseases that comprise NCDI but also across the whole gamut of disease, including communicable and re-emerging diseases. In this context, the need to use economic evidence in heath policy planning becomes critical and has been reiterated by many, including the World Health Organisation (WHO) [7]. Health technology assessment (HTA) has become an important part of evidence-based policy making in many countries: the UK HTA program is now almost 25 years old and has been deemed valuable in providing the necessary support for other relevant organizations, such as the National Institute for Health and Care Excellence (NICE), which supplies evidence-based guidance to the UK national health service [8].

Given India's low level of investment in health generally, generation of evidence becomes even more critical. While multiple disciplines are required for generating such evidence, priority-setting exercises that ultimately lead to resource-allocation decisions generally fall in the domain of economics.

The Government of India has recently taken various steps to incorporate such evidence in policy decisions: The Department of Health Research (DHR), under the Ministry of Health and Family Welfare, set up the Medical Technology Assessment Board (MTAB) to evaluate different kinds of health technologies in India [9]. The objective of the MTAB is to enable the country to develop cost-effective interventions that will reduce costs of and variations in patient care, reduce patient OOP expenditure, and streamline medical reimbursement procedures. While we elaborate on such initiatives in Sect. 4, suffice it to say here that it is even more imperative to establish a baseline on the extent to which economic analysis has been used by researchers to study the various dimensions of NCDI in the country so far. This will help ascertain the remaining gaps—in terms of both research and researchers—in all subsequent assessments of the various new initiatives that have been taken to help India achieve evidence-based policy making in the health sector.

HTA is important for health sector projects and would be critically relevant in the context of investment in NCDIs in a resource-constrained setting. Thus, cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA) would be important tools for economic analysis of health sector projects. However, there is more to economic analysis than CEA and CBA. For example, health economists at the US Centre for Disease Control have been involved in cost analysis, decision and transmission modelling, regulatory impact analysis, budget income analysis and Health Impact Assessment [10]. In any case, basic microeconomics and macroeconomics tools can be used to analyze a wide range of issues pertaining to the objectives of the health sector, such as equity and efficiency.

This paper is an attempt to understand the extent to which economic analysis has been used in India to analyze the impact of NCDI and inform policies on prevention and treatment. The study looked at the type of economic analysis used, the disease focus, the background of researchers engaged in the studies, the types and sources of funding, and the settings in which these have been carried out. The analysis intentionally left out analysis pertaining to distribution of disease burden, which often uses several statistical techniques to understand the socioeconomic and demographic profiles and determinants of those affected by a disease. Thus, articles that used socioeconomic variables as a determinant of NCDI occurrence were excluded from the analysis.

2 Methods

2.1 Search Strategy

We conducted a comprehensive keyword search in the PubMed database in November 2016 using medical subject heading (MeSH) terms to identify economic studies on NCDI in India between January 2006 and November 2016. The search strategy, including the keywords, is described in Table 6 in the electronic supplementary material (ESM). We limited studies to those that were published between 2006 and 2016 because the increase in NCDI in the country is relatively recent and because of a series of policy changes, such as decentralized planning under the National Rural Health Mission in 2005.

The review was limited to peer-reviewed articles published in English and excluded systematic reviews, narrative reviews, study protocols, reports, opinions, editorials, letters to the editor, and commentaries. We checked the list of journals included in PubMed to ensure articles in all leading Indian journals on health economics published in English were included.

We excluded research papers that used socioeconomic variables as a determinant of occurrence of NCDI and that focused on post-occurrence interventions and impact.

2.2 Study Selection and Inclusion Criteria

We used a two-stage review process to select economic studies. The first involved screening the titles and abstracts of all articles found in the initial keyword search run in PubMed. The second involved screening articles for duplicates and against exclusion criteria (not published in English language, not conducted within the study period of interest, or not based on human subjects), after which potentially relevant articles were selected for in-depth review of the full text. Only original research in individuals residing within the geographical boundaries of India and published in national and international journals with a peer-review process were included if they qualified as economic studies on either a specific NCDI or a combination of NCDIs. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) diagram in Fig. 1 shows the screening and identification methodology.

2.3 Data Extraction

We developed a standardized electronic form in Microsoft® Excel with which to collect general study characteristics, methodological information, and quality parameters from the selected studies based on the PRISMA and STROBE (an international collaborative initiative for Strengthening the Reporting of Observational studies in Epidemiology) guidelines (Table 1).

The general information section of the data extraction form consisted of the following items: year of publication, lead author's profession, lead author's institutional affiliation, journal country, funding source, disease classification (as per the Global Burden of Disease Study 2015—Cause List [11], with an additional category for NCDI risk factors), and study objective. The methodological section collected information on the following categories: type of analysis, study design, time period, and type of population studied. For the quality parameters, a response in the form of "yes," "no," "not applicable," or "not clear" was collected. The principal and co-investigator independently judged the quality of the studies based on the PRISMA and STROBE guidelines and reconciled any discrepancies via discussion. Studies were grouped into the following broad categories: economic evaluation, partial economic evaluation, studies on economic burden and impact, studies on public financing, healthcare insurance including universal health coverage, and, lastly, a miscellaneous category of studies that captured standard economic analysis involving pricing, access, affordability, willingness to pay, socioeconomic correlates, and so on. Economic evaluation—full or partial—was classified as per a checklist adapted from Drummond et al. [12], with full evaluation being studies that analyzed both costs and consequences for the interventions.

Studies with a chiefly epidemiological design were classified as observational or interventional; studies that used a model (typically microsimulation/Markov models) to generate a prediction were classified as model-simulation studies, and studies that most closely resembled standard economic costing analyses were classified as such.

2.4 Data Analysis

The characteristics of the studies included in the review were explored using descriptive statistics, including frequencies and percentages. While there are many ways of analyzing the data, we specifically wanted to find answers to the following questions:

- What kind of economic analysis has been mostly attempted?
- Which diseases or disease categories are emphasized in the research?
- What are the patterns of funding? Who and what kind of economic analyses received the most funding?
- What share of studies is led by domestic versus international authors? What kind of background do these authors have (clinician, economist, etc.)?
- Which category has received the most funding?

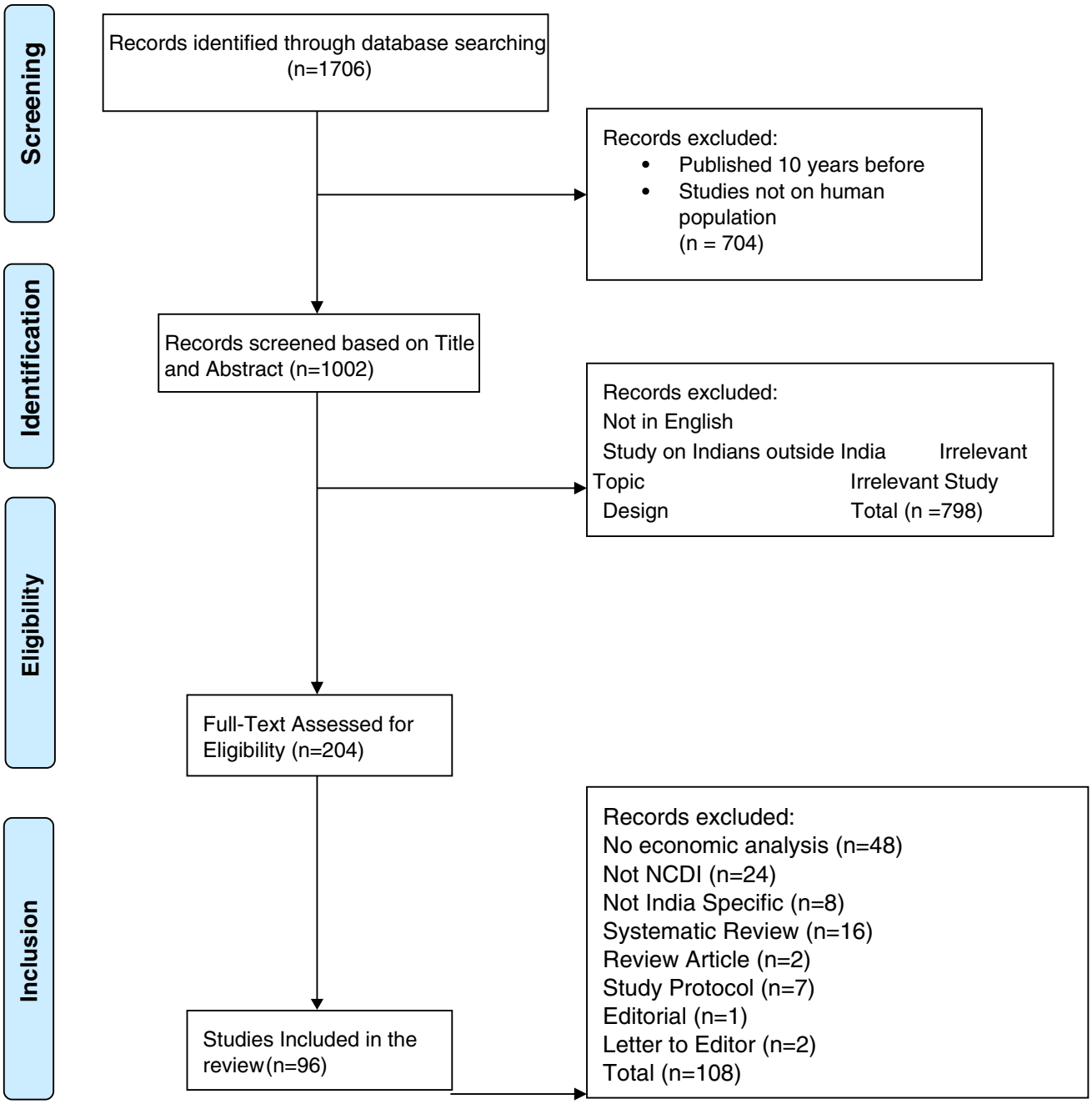

Fig. 1 PRISMA diagram. *NCDI* non-communicable disease or injury

While these were deemed the most relevant questions, we also looked at the results based on the other parameters used in the study.

3 Findings

We identified 1706 articles in the PubMed database. Applying filters to restrict selection to those published between January 2006 and November 2016 and studies in human subjects retained 1002 articles. These were screened by applying the inclusion criteria to titles and abstracts, leaving 204 articles for in-depth full-text review. We then excluded studies that were not based on Indian populations, did not study NCDIs, presented no economic analysis, or were systematic reviews, protocols, reviews, editorials, reports, etc. In total, 96 articles [13–108] were eligible for inclusion in the systematic review.

Table 1 Parameters selected for the systematic review

Parameter	Description
General	
Type of analysis	The type of economic analysis or tool used
Disease classification	Disease category as per the Global Burden of Disease Study 2015—Cause List [11]
Study design	Type of design used: cohort, cross-sectional, case–control, randomized controlled trial, quasi-experiment, pre-post, descriptive costing study, model-simulation-based study, etc.
Data source	Describes the source of data: primary, secondary, or a combination of both
Main objective	States specific objectives, including any specified hypotheses
Study period	Length of time over which data collection for the study was carried out
Sample size	Number of participants in the study on whom data were collected
Geographical location	Geographical area(s) where the study data was collected
Type of population	Whether the study was carried out in a rural or urban setting?
Participant profile	The age, sex, health conditions, occupation, and socioeconomic characteristics of the study participants
Study setting	The setting in which the study was carried out: facility, community-based, single- or multi-center
Lead author's institutional affiliation	The name and address of the main institution with which the lead author is affiliated
Lead author's profession	Indicates whether the lead author is a clinician, health economist or a public health researcher
Funding source	Funding source or donor supporting the study
Location of journal	Whether published in a national or international journal
Quality indicators	
Variables and outcomes	The study has clearly defined variables, indicators, and outcomes
Statistical methods	Main statistical techniques used in the analysis
Limitations and bias	Yes/no variable indicating whether a study acknowledges its limitations by accounting for sources of potential bias or imprecision
Results	Yes/no variable indicating whether results match objectives
Generalizability	The results of the study are generalizable to the region or India

3.1 General Characteristics of Studies

3.1.1 Type of Economic Analysis

The 96 articles selected for review were classified into six non-mutually exclusive categories based on the type of analysis presented (Fig. 2). Studies could fall under multiple classifications, so the total across all the studies exceeds 96.

Overall, economic evaluation studies were easier to find using standard keyword searches than studies that used other kinds of economic analysis such as economic impact and public finance.

Most of the studies were economic impact studies (45%), followed by economic evaluation studies (33%), and costing/partial economic evaluation studies (23%). Overall, very few studies fell under the public financing, Universal Health Coverage (UHC), or miscellaneous category "economic analysis—other" (25%). In fact, these categories include studies that fall in the domain of standard economics disciplines and use a more varied range of economic tools of analysis.

Table 2 presents further classification under each of these six categories. Most economic evaluation studies were cost-effectiveness analyses (88%). In the costing/partial economic evaluation category, the majority were cost-description studies (55%) followed by cost-analysis studies. Most of the studies in the economic impact/economic burden category were on OOP spending (91%).

Analysis of study designs (Table 3) revealed that most studies were observational, specifically cross-sectional. The remaining studies were mostly based on model simulations, followed by interventional studies, and the remainder comprised descriptive costing studies. Most of the interventional/experimental studies involved randomized controlled trials (RCTs).

Within the full economic evaluation category (Table 4), the studies mostly used a model-simulation-based design (56%), followed by an RCT-based design (25%).

Most studies classed as partial economic evaluations were observational (64%), with cross-sectional studies (71%) dominating this category (Table 7 in the ESM).

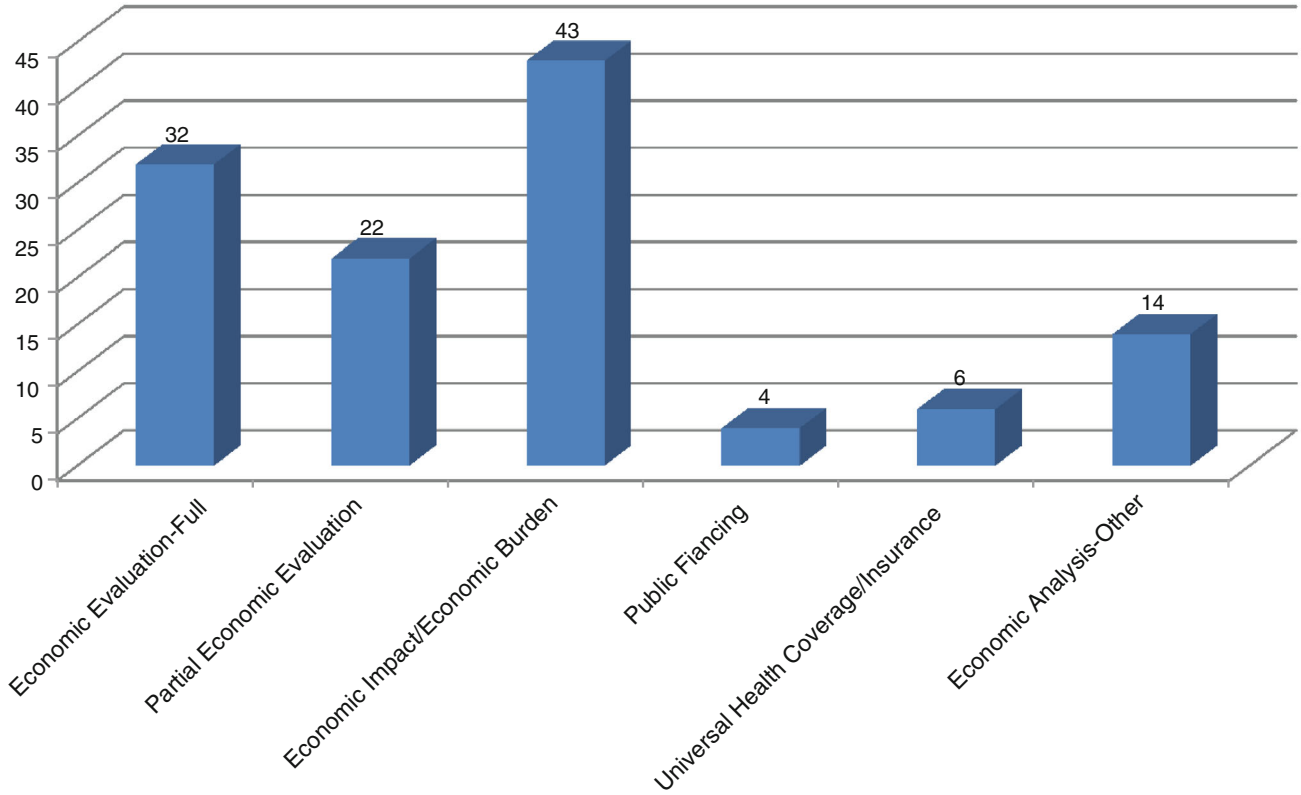

Fig. 2 Volume of studies across type of economic analysis

Additionally, studies that investigated the economic impact of NCDIs were mostly observational (84%) and involved cross-sectional study designs (92%), which primarily considered OOP spending (Table 8 in the ESM). Data in these cases were collected via surveys or from inpatient data registries to determine direct and indirect costs and other treatment information.

3.1.2 Disease Focus

The studies primarily focused on a few NCDIs (Table 5) classified as per the groupings in the Global Burden of Disease Study 2015–Cause List [11]: CVD; diabetes, urogenital, blood, and endocrine diseases (DUBE); neoplasms; CRD; cirrhosis; digestive diseases; neurological disorders; mental and substance use disorders (MSUD); musculoskeletal disorders; and other NCD (ONCD). An additional category of risk factors (RF) for NCDI was created to accommodate the few papers in which the analysis did not focus on a disease per se but were still relevant to our review.

CVD, diabetes, and neoplasms constituted more than 68% of all disease categories studied. The miscellaneous category, ONCD, was next in order of importance, with various other disease categories contributing less than 10% each.

Within economic evaluation studies, the diseases most commonly studied using CEA were CVD and DUBE. Partial economic evaluation studies that used cost-description analysis focused on neoplasms, CRD, and ONCD. Cost-analysis studies mostly investigated CVD, DUBE, and ONCD.

Studies on OOP spending, within economic impact studies, mainly focused on CVD, DUBE, CRD, and neoplasms, closely followed by neurological disorders and injuries. Macroeconomic impact studies focused on CVD, DUBE, and CRD; whereas cost-of-illness studies mostly investigated DUBE.

Universal health coverage/insurance studies mostly investigated CVD. Furthermore, studies in a miscellaneous category comprising other types of economic analysis less commonly used focused on pricing and socioeconomic correlates within a regression framework. Pricing studies mostly investigated neurological disorders and neoplasms, whereas those on socioeconomic correlates studied CVD.

In sum, most of the studies that used economic analyses focused on CVD and diabetes.

3.1.3 Funding

Close to 36% of the studies did not list a funding source, and another 15% reported that no funding was used.

Table 2 Classification of studies according to type of economic analysis

Type of analysis	Count	Total
Economic evaluation—full		32
Cost effectiveness analysis	28	
Cost benefit analysis	1	
Cost utility analysis	4	
Costing/partial economic evaluation		22
Outcome description	0	
Cost description	12	
Cost analysis	7	
Cost–outcome description	3	
Economic impact/economic burden		43
Cost of illness	8	
Cost of treatment	4	
Macroeconomic impact	9	
Sectoral impact	4	
Out-of-pocket spending—individual/household impact	39	
Public financing		4
Government spending	2	
Taxation	2	
Universal health coverage/insurance		6
Economic analysis—other		14
Pricing	6	
Access	4	
Affordability	1	
Willingness to pay	1	
Socioeconomic correlates	8	

Since there are multiple classifications possible for a given study, the numbers in the Count column will not add up to the totals given in the Total column

Table 3 Details of study design

Types of design	Sub-count	Count
Observational		54
Cross-sectional	46	
Cohort	3	
Case–control	5	
Interventional		12
Randomized controlled trial	8	
Quasi-experiment	3	
Pre-post study	1	
Descriptive costing study		9
Model-simulation-based		22
Total		97

One study is cross-classified as observational and descriptive costing

Table 4 Type of study designs used in full economic evaluations

Type of design	Sub-count	Count
Observational		3
Cross-sectional	2	
Cohort	1	
Case–control	0	
Interventional		10
Randomized controlled trial	8	
Quasi-experiment	1	
Pre-post study	1	
Descriptive costing study		1
Model-simulation-based		18
Total		32

Generally, if a research study is funded, the funding agencies require publications to acknowledge the financial contribution; thus, it is probably safe to assume that about half the studies were not funded. Only 9.4% of the studies were funded by Indian sources (government or trust), whereas 41% were funded by an international donor or United Nations/bilateral aid agency, with the Wellcome Trust funding the most studies (Table 9 in the ESM).

Of studies that received funding (Table 10 in the ESM), internationally led studies received the most funding

Table 5 Disease focus of research studies

Diseases	Percentage
Cardiovascular diseases	26.04
Diabetes, urogenital, blood, and endocrine diseases	23.96
Neoplasms	18.75
Other non-communicable disease	16.67
Chronic respiratory diseases	9.38
Neurological disorders	8.33
Mental and substance use disorders	8.33
Injuries	7.29
Risk factors	3.13
Cirrhosis	2.08
Musculoskeletal disorders	2.08
Digestive diseases	2.08

(75%), compared with their Indian counterparts (29%), even though a larger proportion of studies (54%) was led by domestic authors.

Economic evaluation studies received the most funding, with 63% of all evaluation studies being funded (Table 11 in the ESM) and 69% being led by foreign authors. A majority of the full economic evaluations were model-based simulation studies, mostly led by foreign authors with funding. There were eight RCTs, mostly led by domestic authors but without funding. In contrast, when looking into partial economic evaluations, we see that 64% were observational studies and 32% involved descriptive costing analysis, with only 36% being funded.

Slightly less than half of the economic impact studies had funding, and 61% of these were led by a domestic author. However, 76% of foreign author-led studies in such cases had funding, compared with 26% of their domestic counterparts. An overwhelming proportion (91%) of such economic impact studies were on OOP spending and had mostly cross-sectional designs. Only one-third of cross-sectional OOP spending studies conducted to gauge economic impact were funded, with 75% led by a domestic author. Once again, the bulk of the cross-sectional OOP spending studies led by foreign authors had funding, unlike those led by domestic authors.

3.1.4 Authorship and Background of Lead Authors

In total, 54% of all studies were led by domestic authors. In most of the included studies, the lead author was chiefly a clinician or a public health professional (81%), with health economists authoring the rest of the studies. However, most (74%) of the economist-led studies were by authors from outside India.

Studies on cost effectiveness were mostly conducted by international authors (71%). A majority of model and simulation-based studies were carried out by international clinicians and not health economists. We found only four public finance-related studies, and all were written by authors from outside India.

Table 12 (ESM), clearly shows that domestic lead authors have a clear preference towards conducting studies in a clinical setting. We also found that 88% of domestic authors who had carried out studies in a clinical setting used data from the facility within which they worked.

3.1.5 Study Setting and Geographical Distribution

Among other results, the setting of the study (Table 13 in the ESM) indicated that most of the studies were carried out at a single center (40%), whereas 34% were multi-centric and about 15% included inadequate information on this. Furthermore, the setting was facility based (clinic or hospital) in 50% of studies and community based in 34%.

Most of the studies (Table 14 in the ESM) were conducted in an urban setting (45%), with only 10% representing rural areas. Several studies were international, in that they used secondary data for a number of countries, including India (19%), to present a comparative analysis, whereas other studies used national or all-India data (15%).

Further, most studies were carried out in the north and the south of India (n = 48), with a few conducted in the east and west (n = 17), and almost none in central India (n = 2). In the north of India, we found the focus to be on neoplasms, injuries, MSUD, ONCD, and DUBE, whereas attention in the south was focused on DUBE, CVD, and ONCD.

3.1.6 Miscellaneous Results

Studies were almost evenly divided as to data source—primary or secondary.

Less than two-thirds of the studies reported a sample size. More than half of the studies that reported sample sizes had more than 300 subjects, which is generally considered robust in terms of the validity of inferences/conclusions drawn from it.

More than 81% of the studies were published in international journals. Most of the papers acknowledged limitations, but 28% did not mention any. One-third of domestic author-led studies and only 2.3% of foreign author-led studies were published in Indian journals, indicating that domestic authors were both targeting and succeeding in publishing in international journals.

Most of the studies were found to have very limited external validity or generalizability (Table 15 in the ESM). The studies often focused on a narrow geographical area or were limited to a single state, city, or facility. Only one-quarter of the studies had external validity, as they either used national-level data, or at least data from several states, that were geographically well dispersed.

4 Discussion

This review was undertaken to aid in understanding the extent to which economic methods have been used to analyze the economic impact of NCDIs in India and to generate evidence to guide superior resource allocation for prevention and treatment of NCDIs.

Our findings indicated that studies that did use economic techniques generally focused on the more commonly researched areas of costing, economic evaluation, and OOP expenditures. The first two fall in the domain of economic analyses of interventions and the second pertains to household impacts of health costs. CEA is most commonly used in economic evaluations, which is similar to reports on studies from South Africa, Thailand, and Vietnam [109–111]. Some cost-utility studies did not use parameters from an Indian setting within economic evaluations, instead borrowed disability and quality-of-life weights from non-Indian settings. Overall, there are relatively fewer studies on other areas of health economics such as health financing, pricing, and taxation.

The most frequently studied diseases were CVD, diabetes and cancer, indicating a clustering of research around a few NCDIs. Among domestic clinician-led studies, it was not unusual for research methodology to be imprecisely described. For instance, data collected as part of the general functioning of the hospital were labeled primary data, whereas others described studies as having followed a cohort of patients, when in fact patient information was retrospectively collected from hospital registries.

This is linked to the finding that most studies were led by clinicians or other public health professionals and carried out in the principal investigators' work setting, most often health facilities. Since access is easier for a clinician, it is not surprising that mostly facility-level data were used, limiting the scope and generalizability of the studies. This was the case even for economic impact/burden studies as data collection is relatively much easier.

Overall, the relative paucity of trained economists in research on NCDI indicates their lack of engagement with issues pertaining to the health sector generally, a finding corroborated by other such research in India [112, 113]. While simple microeconomics and macroeconomics tools can be applied to address many questions pertaining to the health sector, we found very few such studies compared with economic evaluations. Use of evidence in policy making is now closely associated with economic evaluation studies that may not necessarily require researchers to have an economics background. This could explain why these are often conducted by clinicians and public health experts, instead of—or in addition to—economists. This could also explain the lower volume of studies using economic analyses that possibly require the expertise of trained economists: thus, for instance, we did not find many macroeconomic impact studies using general equilibrium models or sectoral impact studies. Even the studies on OOP spending were not necessarily linked to poverty analysis. Analyses on taxation, health financing for NCDI, market analysis of products pertaining to NCDI, etc. are conspicuous by their absence in India.

The interest in evaluation studies could also partly be because they are relatively more publishable internationally, with wider target journals, whereas health economics journals are comparatively fewer in number and almost non-existent in India [113].

Lack of funding could also be a possible reason behind the modest designs of the evaluation studies including, the lack of cohort studies within observational study designs.

While these reasons are important, together they indicate a lack of demand from health policy makers for evidence-based decision making, which in turn solidifies the disconnect between economics and health policy. Health sector policies in India do not have a tradition of being based on the principle of resource scarcity, a need for prioritizing, and evidence regarding what works. This lack of demand might also explain why Master's degree programmes in economics mostly do not offer a health economics module in India.

As mentioned in the introduction, the DHR established the MTAB to be the central agency for undertaking HTA in India. The DHR is supported by leading national technical and academic institutes and the International Decision Support Initiative, which is a collaboration led by priority-setting institutions from the UK's Imperial College, London, and Thailand's Health Intervention Technology Assessment Program. The DHR has already signed a memorandum of understanding with the UK NICE to facilitate the exchange of institutional expertise on clinical practice guidelines, quality standards, and application of HTA [9]. The Government of India has also created an expert group on costing to drive evidence-based reimbursement for the Rashtriya Swasthya BimaYojana—the largest publicly financed health insurance scheme in India [114]. These policy initiatives are encouraging and might change the mode of engagement of technical experts, including economists, in the health sector.

However, a few more initiatives may be necessary. The DHR could actively collaborate with economics research institutes and "think tanks" to bring both young and established economists into its initiative on HTA. Similarly, the main Ministry of Health and Family Welfare could reach out to economists—either through DHR or independently—to build a network of institutes and researchers it can call upon for its various operational research needs. This will help slowly but steadily

increase health economics capacity in the country and open more avenues of collaboration and independent research. Capacity building in health economics needs focus, and governmental support in the early stages might go a long way to bringing economics into health sector analysis.

4.1 Limitations

The study only included peer-reviewed articles from PubMed and excluded grey literature such as government reports, pharmaceutical company reports, academic theses, and local conference proceedings. This was largely because no central electronic repository is available where one can search for academic theses from different universities across India. Some significant work using economic analysis for NCDI in India were excluded because they were not published in journals or were working papers or reports [115–118].

Searching across all NCDIs for various kinds of economic analysis presented a problem in terms of the keywords used, as a lot of non-standard vocabulary may have been used. The inclusion of only published literature might have introduced some publication bias, since studies with positive results are more likely to be reported than those with negative findings. It is also difficult to rule out selection bias or differences between reviewers over study criteria.

Lastly, certain economic studies that did include India in their analyses were excluded from the study because they did not include disaggregated results.

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Data availability statement The data that support the findings of this review were generated after examining full-text articles obtained through PubMed. In a few cases, PubMed did not provide full text articles but only a title and an abstract. In such cases, the articles were located using Sciencedirect, Google Scholar, Karolinska Institute Library (https://kib.ki.se/en), and individual requests to authors. These data are available from the corresponding author, Indrani Gupta, upon reasonable request. Copyright restrictions mean we are unable to provide the full text of any of the articles included in the review.

Author contributions IG identified research questions, defined exclusion and inclusion criteria, and selected studies based on the criteria. AR searched for and selected studies based on selection criteria, extracted data from the studies, and drew up relevant tables. Both authors analyzed the data and wrote the manuscript.

Compliance with Ethical Standards

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Conflicts of interest The authors Indrani Gupta and Arjun Roy have no conflicts of interest to declare.

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