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and the Environment
Ministry of Health, Welfare and Sport

Cost of **Illness study methodology** in the Netherlands

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Colophon

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Synopsis

Cost of Illness study methodology in the Netherlands

Every four years, the National Institute for Public Health and the Environment (RIVM) analyses healthcare expenditure in the Netherlands across different diseases, age groups and sex. This is known as the Dutch Cost of Illness (COI) study. RIVM has now described the methodology used to conduct the COI study to ensure that all relevant information is easy to find in one place. The methodology uses healthcare utilisation data from various registries and administrative records.

The COI study improves healthcare expenditure transparency and provides insight into expenditure by disease and age group, as well as input for such things as cost-benefit analyses. This supports evidence-based and financially sustainable future health policy development. RIVM carries out the study together with Statistics Netherlands (CBS), on behalf of the Ministry of Health, Welfare and Sport.

The COI study only considers the direct medical costs and does not include expenditure on informal care, productivity losses and welfare costs. Nor does the study examine cost-effectiveness, the impact of interventions or policy efficiency.

The study's alignment with the Organisation for Economic Co-operation and Development's (OECD) System of Health Accounts (SHA 2011) ensures that COI study data are comparable at international level.

Keywords: COI, healthcare costs, healthcare, healthcare expenditure, direct medical costs, age groups, sex, diseases, cost allocation, healthcare sectors, health policy

Publiekssamenvatting

Methodiek Kosten van Ziekte studie in Nederland

Het RIVM splitst elke vier jaar de kosten van de gezondheidszorg in Nederland uit naar verschillende ziekten, leeftijdsgroepen en geslacht. Dat heet de Nederlandse Kosten van Ziekte (KvZ) studie. Het RIVM heeft nu de methode beschreven waarmee de KvZ-studie wordt gemaakt, zodat alle informatie daarover makkelijk op één plek is te vinden. De methode gebruikt gegevens over het gebruik van zorg uit verschillende registers en administraties.

De KvZ-studie maakt de zorguitgaven transparanter, geeft inzicht in uitgaven voor ziekten en leeftijdsgroepen en geeft input voor bijvoorbeeld kosten-batenanalyses. Dit helpt om onderbouwd gezondheidsbeleid voor de toekomst te maken dat financieel te beheersen blijft. Het RIVM maakt de studie samen met het Centraal Bureau voor de Statistiek (CBS), in opdracht van het ministerie van VWS.

De KvZ-studie brengt alleen de directe medische kosten in kaart. Uitgaven voor informele zorg, verlies aan productiviteit en kosten voor welzijn zijn niet meegerekend. De studie kijkt ook niet naar kosteneffectiviteit, effecten van maatregelen of efficiëntie van beleid.

De gegevens uit de KvZ-studie zijn internationaal te vergelijken. Dat komt doordat de studie aansluit bij de studie van het System of Health Accounts, SHA 2011, van de Organisatie voor Economische Samenwerking en Ontwikkeling (OESO).

Kernwoorden: KvZ, zorgkosten, gezondheidszorg, zorguitgaven, directe medische kosten, leeftijdsgroepen, geslacht, ziekten, kostenallocatie, zorgsectoren, gezondheidsbeleid

Foreword

This report documents the methodology used in the Dutch Cost of Illness (COI) study by the National Institute of Public Health and the Environment (RIVM). The Cost of Illness (COI) study is a collaborative effort by the National Institute for Public Health and the Environment (RIVM) and Statistics Netherlands (CBS). Commissioned by the Netherlands Ministry of Health, Welfare, and Sport (VWS), the study is conducted under Programme 6: Statutory Task on Public Health and Care. Oversight is provided by the Directorates for Macro-Economic Issues and Labour Market (MEVA) and Public Health (PG).

The purpose of this report is to provide a structured description of the steps taken in setting up a COI study in the Netherlands. The report is intended for researchers, policymakers, and analysts who are interested in the methodology used in the COI study conducted by RIVM. While the report aims to describe the methodology as clearly as possible, some highly detailed procedures are presented at a more general level to provide an overview of the approach. The examples provided have been carried over from the 2019 Dutch COI study.

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Summary

The Dutch Cost of Illness (COI) study provides a detailed overview of the distribution of national healthcare expenditure across diseases, age groups and sex. Conducted by the National Institute for Public Health and the Environment (RIVM) in collaboration with Statistics Netherlands (CBS) and commissioned by the Ministry of Health, Welfare and Sport (VWS), the study supports evidence-based health policy development and long-term planning.

Scope and Approach

The Dutch COI study adopts a healthcare perspective that focuses solely on direct medical costs. It does not include expenditures such as informal care, productivity losses and welfare costs. To ensure international comparability, the study aligns with the System of Health Accounts 2011 (SHA 2011) framework (OECD/Eurostat/WHO 2017).

The study uses a combination of top-down and bottom-up approaches. Total healthcare expenditure as reported in CBS National Health Accounts, is allocated to diseases, age groups, and sex. This allocation process relies on healthcare utilisation data from various registries and administrative datasets. Expenditure is first grouped into homogeneous care clusters and then distributed across disease, age and sex. Each euro is only allocated once to eliminate the risk of double counting.

Key Outputs

The COI study produces detailed expenditure tables across six dimensions: disease (specific groups plus residual categories), age, sex, healthcare sector, healthcare function and financing type.

Purpose and Limitations

The COI study is descriptive and does not evaluate cost-effectiveness, intervention impacts or policy efficiency. The magnitude of costs associated with specific diseases should, therefore, not be interpreted as an indicator of policy priority. COI studies' primary contributions in the Dutch context are to enhance healthcare spending transparency, provide input for modelling, inform foresight studies (e.g., VTV reports) and provide input for macroeconomic projections.

1 Introduction

The Cost of Illness (COI) Study in the Netherlands

The COI study conducted by RIVM provides insights into the relationships between healthcare supply, healthcare expenditure, underlying disease patterns, and changes in population composition. By linking healthcare expenditure to demographic and epidemiological patterns, the study provides detailed insight into how healthcare resources are distributed across diseases and population groups. The output is widely used in the Netherlands. At national level, the Dutch COI study provides basic information for internal cost estimates by the Ministry of Health (RIVM 2022) and supports projections of future healthcare expenditure and budgetary needs (Slobbe 2007). Within RIVM, COI outputs are used in the Public Health Foresight Study (VTV), Social Cost-Benefit Analyses (SCBA), analytical models, and other research projects (RIVM 2022). In addition, the Netherlands Bureau for Economic Policy Analysis (CPB) uses COI outputs as inputs for economic projections (RIVM 2022).

The RIVM COI study also aligns with international health accounting and reporting standards. It follows the System of Health Accounts (SHA) framework developed by the Organisation for Economic Co-operation and Development (OECD), Eurostat, and the World Health Organization (WHO). Using this internationally standardised framework enables cross-country comparisons of healthcare expenditure and contributes to global discussions on healthcare expenditure.

Development of COI in the Netherlands

COI studies have a longstanding tradition in the Netherlands and have evolved over time, both in scope and methodology. The first national COI estimates in the Netherlands were produced for the reference year 1988 by a Rotterdam-based research group (Polder 2002, Meerding 1998). This early study was notable for allocating national healthcare expenditure across diseases, age, and sex, while maintaining consistency with national healthcare expenditure totals (Polder 2001, van Roijen 1992). Since then, COI studies have become a recurring component of the Dutch health system monitoring. Studies have been conducted for the years 1988, 1994, 1999, 2003, 2005, 2007, 2011, 2015, and 2019. Analyses for the reference year 2023 are currently underway. In general, comprehensive COI studies are published every four years, with interim estimates produced at two-year intervals.

Over time, the scope and methodology of Dutch COI studies have broadened and improved, and can be described in three phases:

- Phase 1: Early studies (1988–1999)
 - The early COI studies focused primarily on allocating national healthcare expenditure across diseases, age groups, and sex. These analyses relied largely on aggregated national expenditure statistics and a limited number of healthcare utilisation datasets
- Phase 2: Expansion of data sources (1999–2011)

- o From 1999 onwards, administrative datasets, such as hospital and pharmaceutical data, were increasingly integrated.
- Phase 3: Alignment with SHA (2011–present)
 - o Since 2011, the methodology has aligned with SHA 2011. This alignment enhances consistency over time and supports international comparability.

Purpose of this report

The allocation of healthcare expenditure across diseases involves complex methodological choices, multiple data sources, and detailed allocation keys. This report describes the methodology used in the RIVM COI study. It summarises the RIVM methodological framework for conducting COI analyses, thereby providing guidance for others interested in setting up similar studies. The report draws on RIVM's experience and includes examples from the Dutch 2019 COI study. *Chapter 2* introduces the wider scope of COI research, including definitions of core components, illustrating how COI can vary on the basis of selected core components. *Chapter 3* describes the RIVM COI methodology. It presents the four-step model used for COI calculations. *Chapter 4* illustrates the results for each step of this model using examples from the Dutch 2019 COI analysis. *Chapter 5* explains how to interpret COI results.

2 Cost of illness scope and definitions

2.1 What are cost of illness studies?

COI studies respond to the growing demand for robust cost information in the context of rising healthcare expenditure. They estimate the economic costs associated with diseases within a defined population over a specified period (Heijink 2008). COI studies are descriptive analyses that quantify the monetary burden of illness but, unlike economic evaluations, do not relate costs to health outcomes or alternative uses of resources (Larg 2011). For this reason, they are considered economic analyses rather than full economic evaluations, as they do not compare alternative interventions or assess costs related to their consequences (Drummond 2015).

2.1.1 *Uses of COI studies*

COI studies are commonly used to (Rice 2000):

- quantify the economic burden of diseases;
- identify diseases associated with high costs;
- support priority setting and allocation of research funding;
- inform policy and planning for prevention and control initiatives;
- provide an economic context for programme evaluation.

2.1.2 *Limitations of COI studies*

Limitations of COI studies include their cross-sectional and descriptive nature and their focus on cost patterns rather than causal relationships. Cost allocation can be affected by the presence of comorbidities, which are often not fully accounted for. In addition, methodological heterogeneity in perspectives, data sources, and valuation methods limit comparability and generalisability across studies (Larg 2011, Schnitzler 2023).

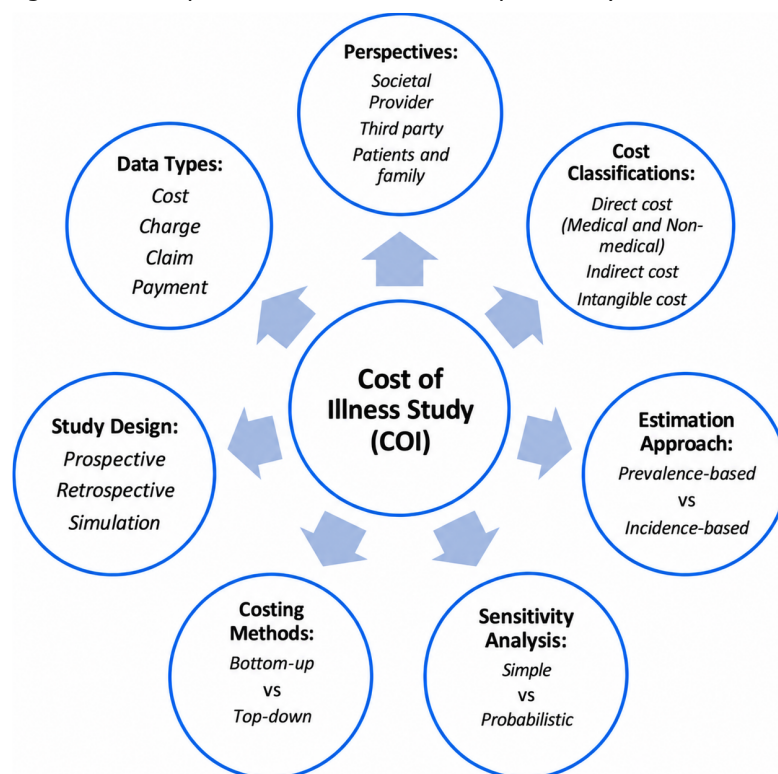
2.1.3 *Why do COI studies remain relevant?*

Despite these limitations, COI studies remain valuable for describing the scale and structure of economic burden of disease, particularly when full economic evaluations are not feasible (Larg 2011). Considering the wide scope of the entire healthcare field and the long trend of COI studies, the COI results are often used for educational purposes and provide important inputs for burden of disease modelling, economic evaluation, and strategic health planning, thereby contributing indirectly to evidence-informed policy analysis.

2.2 Components of COI studies

COI estimates depend on several methodological choices, including perspective applied, cost categories included, and data sources used. Figure 1 presents a conceptual framework that summarises these components on the basis of literature (Nakhaee 2024). The following sections describe each component, while chapter 3 explains and demonstrates how they are applied in the RIVM COI methodology.

Figure 1 Conceptual framework COI components (Nakhaee 2024)



2.2.1 Cost classifications

Costs included in COI studies can be categorised as direct, indirect, and intangible costs (Jo 2014).

- *Direct costs* include healthcare costs (e.g. treatment, diagnosis, rehabilitation) and non-healthcare costs (e.g. transport, informal care) incurred by the healthcare system, society, family, or individual patient.
- *Indirect costs* refer to productivity losses due to morbidity or mortality. They are commonly estimated using the human capital or friction cost methods.
- *Intangible costs* such as pain and suffering are rarely included in COI studies because they are difficult to measure and remain methodologically controversial.

2.2.2 Estimation approaches

COI studies can be prevalence-based or incidence-based, depending on how epidemiological data is used.

- *Prevalence-based* COI studies estimate the economic burden of a disease over a given period, usually a year. They estimate the number of deaths and hospitalisations attributable to diseases within a given year and then estimate the costs.
- *Incidence-based* COI studies estimate the lifetime costs of disease from onset until cure or death occurring in a given year. Using current incident cases, they capture both present and future costs.

The choice depends on the study purpose. Prevalence-based approaches are useful for estimating the current cost burden, whereas incidence-based approaches are more suitable for assessing prevention and long-term costs associated with new cases (Tarricone 2006).

2.2.3 *Costing methods*

COI studies can employ top-down or bottom-up approaches or combine costing approaches.

- *Top-down* approaches allocate total healthcare expenditure to diseases using aggregated data sources such as the national health accounts, or allocation measures such as population attributable fraction (PAF) (Larg 2011, OECD/Eurostat/WHO 2017). This approach is used in the SHA 2011 to allocate healthcare expenditure to diseases (OECD/Eurostat/WHO 2017).
- *Bottom-up* approaches estimate costs by measuring individual resource use and multiplying it by unit costs. These estimates rely on patient-level data and may capture a broader range of cost components.

2.2.4 *Perspectives*

Perspective determines what types of costs are included in a COI study.

- *Societal perspective* includes all relevant costs regardless of who bears them, including healthcare-related costs and productivity costs.
- *Healthcare provider perspective* captures costs incurred by a provider or a group of providers in delivering care within a healthcare system.
- *Healthcare payer perspective* includes costs incurred by a specific payer, such as an insurance programme, health agency, or control programme for services related to treatment and disease management.
- *Healthcare sector perspective* includes all direct medical costs related to healthcare services, regardless of who pays.
- *Patient or household perspective* focuses on the costs directly incurred by individuals or their families, such as out-of-pocket medical expenses or non-medical costs (e.g. transport) (Sittimart 2024).

2.2.5 *Study design*

COI studies can be performed using retrospective, prospective, or simulation designs (Jo 2014, Sussman 2020).

- Retrospective studies use existing data from past records (Jo 2014)
- Prospective studies, follow patients over time to collect data (Jo 2014).
- Simulation studies use models to simulate disease trajectory and related costs over time (Sussman 2020).

2.2.6 *Data types*

COI studies may use administrative data, registries, surveys, and epidemiological data, the choice of data depending on the study design, costing approach, and data availability (Larg 2011, Heijink 2008, Jo 2014). Mode-based estimates may be used where observed data is unavailable.

2.2.7

Sensitivity analysis

Sensitivity analysis assesses the robustness of the cost estimate.

- One-way sensitivity analysis varies individual parameters to examine their impact on results.
- Probabilistic sensitivity analysis assigns probability distributions to model parameters and varies them simultaneously to quantify uncertainty in the results (Jo 2014).

3 COI-studies at RIVM

3.1 General description of RIVM COI

This chapter describes the RIVM COI methodology. First, the COI components introduced in the previous chapter are outlined in relation to the RIVM approach. Second, the relevant dimensions are presented. Last, the four-step method used in the RIVM COI study is described.

3.2 Components RIVM COI

The COI study conducted by RIVM in the Netherlands allocates national healthcare expenditure according to disease, age, and sex of healthcare users. The study adopts a healthcare perspective and includes direct medical costs only; informal care or costs not consumed are excluded. Cost allocation is based on a combination of top-down and bottom-up approaches. Costs are assigned only once, thereby preventing double counting. In cases of multiple diseases, costs are divided across the various diagnoses, depending on the available data. In most of the healthcare registers, there is one unique diagnosis for each contact. The study is prevalence-based and is retrospective in design.

Table 1 The COI components in relation to the RIVM approach

Cost component	Description	RIVM approach
Cost classification	Type of costs	Direct healthcare costs
Estimation approaches	Epidemiological basis of costing	Prevalence-based
Costing methods	Allocation of healthcare expenditure	Combined top-down and bottom-up
Perspectives	Viewpoint determining which costs are included	Health perspective
Study design	Defines how data is collected	Retrospective design
Data sources	i.e. claims, registries, surveys	CBS Microdata, StatLine, NZR, Registrations of reimbursement claims in Zvw and Wlz, Vektis (combination of sources)
Sensitivity analysis	Assess robustness of cost estimates	Not conducted. Uncertainty analyses conducted (Koopmanschap 2024)

3.3 Dimensions of RIVM COI

The RIVM COI study distinguishes six dimensions for analysis: age, sex, disease, healthcare provider, healthcare function, and financing. The dimensions age, sex, and disease are widely used in international COI studies, which enhances the comparability of results. The provider dimension is consistent with the classification used in the SHA. The dimensions are described below.

3.3.1 Diseases

The International Classification of Diseases (ICD) is the primary system used to classify diseases in COI analyses, and its application poses some practical challenges. The ICD contains thousands of diagnostic codes, and different versions (e.g. ICD-9 and ICD-10) are used across

countries, while some healthcare providers apply alternative classifications, such as ICPC in primary care or DSM in mental healthcare. Because no universally accepted international shortlist of diseases for COI studies exists, analyses generally use the ICD chapters, e.g. infectious diseases or neoplasms. More specific disease groups are selected according to their epidemiological relevance, healthcare use, mortality, policy importance, and known costs. Furthermore, the choice depends on the level of diagnostic detail available in national health registers.

In practice, however, total healthcare expenditure is first grouped into clusters representing relatively homogeneous types of care (e.g. ambulance care or disability care). Within each cluster, expenditure is allocated across disease, age, and sex using cluster-specific allocation keys derived from utilisation and registry data. Disease groupings are periodically reviewed and, where necessary, updated to maintain comparability with previous COI editions, reflect expenditure relevance, capture changes in incidence or prevalence, and incorporate improvements in registration quality.

In the current study, diseases are coded using ICD-10, where necessary supplemented by mappings from other coding systems, such as ICPC for primary care, and ATC for pharmaceuticals. Costs are allocated across the ICD chapter levels, which act as parent groups for the 96 specific disease categories that are featured. For each main ICD chapter used, a residual, other category is included for disease groups within that chapter that are not distinguished separately. These residual categories, therefore, refer to costs that can be assigned to a main ICD chapter, but not to one of the specific disease groups within that chapter.

In addition, ICD-10 contains a separate chapter for symptoms, signs, and incompletely specified conditions. In the COI study, this includes codes such as R00-R31, R33.0-R65.0, or R65.2-R99.9. These categories should not be confused with the residual other categories within ICD chapters. Last, the COI study includes two additional categories; 1) not attributable (no. 104), for costs that cannot be assigned to a disease group, and 2) not disease-related (no. 105), for costs that are not considered disease-related. This structure allows costs to be allocated while distinguishing between specified disease groups, residual disease categories, symptom-based ICD codes, costs that cannot be attributed to a disease group, and costs that are not disease-related.

3.3.2

Age

Age is an important dimension in the COI analyses because healthcare utilisation varies across age groups. For analysis purposes, the RIVM COI study classifies age into 5-year age groups from the age of 4 (0, 1–4, ...90–94, 95+) When detailed age data is unavailable in some health registers, outcomes may need to be reported using the available classification or approximated using population age distributions. Detailed age breakdowns are particularly important for capturing the sharp rise in per capita healthcare expenditure among older age groups.

3.3.3

Sex

Sex is classified as male and female (Terpstra 2025). Among others, this classification is relevant for costs related to pregnancy and reproduction, which are typically attributed to women in COI analyses. To allow comparisons between men and women, it is important that these costs are reported separately from other healthcare expenditure. The same applies to gender-specific diseases. Distinguishing these costs in separate diagnostic groups improves the interpretation of gender differences in healthcare spending. It might also be interesting to be able to compare a non-binary category to male and female costs, but to date, there is no available data enabling this distinction.

3.3.4

Health provider

The classification of healthcare providers in COI analyses depends on the desired reporting level and the available cost data and healthcare registers. COI analyses are typically conducted using National Health Accounts (NHA) data, following which results can be mapped to the SHA provider classifications. If an NHA provider category includes both costs within and outside the SHA scope, these costs must be separated prior to analysis, often using information on healthcare functions or funding sources.

In order to attribute costs accurately to disease, age, and sex, providers that deliver multiple types of services may need to be subdivided into more homogeneous groups. This subdivision may rely on assumptions about service use and can be supported by provider surveys.

In practice, COI analyses often use many detailed provider groups, which are subsequently aggregated for reporting. For the purpose of international comparability, it is recommended to report results using the ICHA-HP provider classification of the SHA, while national classifications may also be used for domestic policy analysis.

3.4

Data Sources

For each care cluster (e.g. ambulance care, disability care), relevant data sources are selected to determine how healthcare expenditure are distributed across disease, age, and sex. Ideally, a single data source provides information on all three dimensions. In practice, however, multiple sources often need to be combined to achieve the required level of detail.

The data used to allocate healthcare costs can be categorised as follows:

1) *Individual registry data*

These are the most robust data sources because they contain information at the individual level, allowing precise allocation of healthcare costs by disease, age, and sex. Examples include hospital registries and health insurance claims data, mostly provided through Statistics Netherlands (CBS).

2) *Individual data from a (large) sample*

In cases where full registry data is unavailable, large representative samples may be used. An example is the Nivel Primary Care Database, which contains individual-level data on care provided. In 2024, data on daytime GP care was derived

from electronically recorded information from 426 Dutch general practices participating in the Nivel Primary Care Database, representing a total registered population of 1,921,614 persons (Terpstra 2025).

3) *Aggregated data*

Some organisations provide data only in aggregated form, either because individual-level data is unavailable or cannot be shared. Examples include aggregated datasets obtained from sector organisations or pharmaceutical companies.

4) *Aggregated estimates*

When registered data is unavailable, expenditure distributions may be estimated using results from previous studies or targeted research. These estimates are used to approximate the allocation of costs across disease, age, and sex.

5) *Alternative estimates*

Sometimes no suitable data sources are available to allocate costs by age, sex, and disease. For example, there is no registry or study that provides information on the distribution of self-care medication across these dimensions. In such cases, alternative approaches are used. These may include applying the distribution observed for a similar category of care (e.g. over-the-counter medication), consulting experts to identify the diseases most commonly associated with a specific product, or making reasoned assumptions on the basis of typical patterns of use (e.g. a morning-after pill is most likely to be used by women of reproductive age).

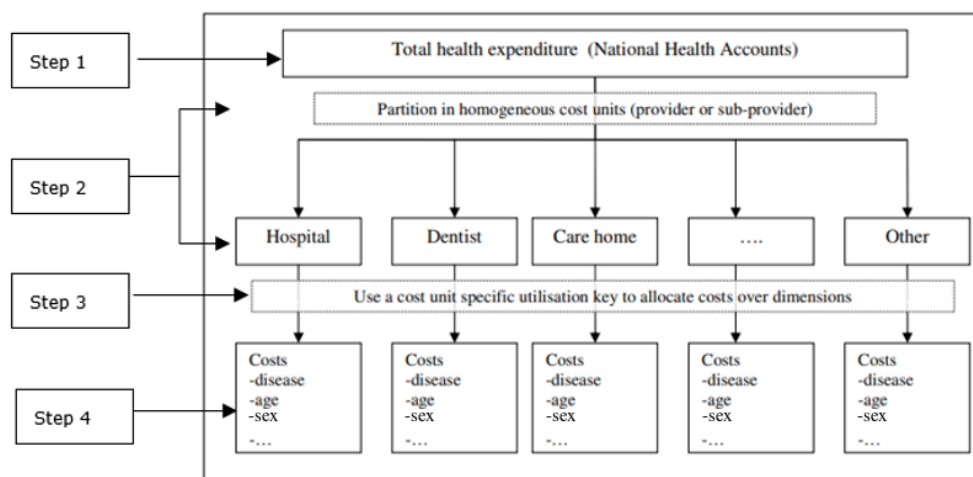
3.5 Method of RIVM COI

Every year, CBS publishes the NHA, which report total healthcare expenditure by healthcare sector, healthcare function, and type of financing (CBS 2024). Building on these data, RIVM allocates total healthcare expenditure across disease, age, and sex, using allocation keys. Below are the four main steps in the RIVM COI study. These steps are further described in the following paragraphs.

The main steps in the RIVM COI methodology are:

1. Specification of the COI study perspective (CBS);
2. Partition of national expenditure into homogenous cost units (CBS);
3. Creating allocation keys (RIVM);
4. Assignment of healthcare costs according to disease, age, and sex. (RIVM).

Figure 2 Main steps in the RIVM COI methodology



(Slobbe 2007, RIVM 2022)

3.5.1 Outputs and use of the RIVM COI study

RIVM delivers COI results as a set of data tables describing health and social care expenditure across six analytical dimensions. In the 2019 study, expenditure was classified by type of care expenditure (5 categories: cure, long-term care, mental healthcare, prevention and public health, and other healthcare-related expenditure), financing scheme (14 categories, aggregated to 5: Health Insurance Act (Zvw), Long-term Care Act (Wlz), municipal funding (Wmo and Youth Act), private payment, and other public financing), healthcare providers (88 categories, aggregated to 26), and healthcare function (30 categories, aggregated to 10). In addition, expenditure is allocated across disease (96 specific groups plus 25 residual categories), age (21 groups), and sex (2 categories) (de Weerd, 2021).

These outputs are also used as inputs for:

- analyses commissioned by VWS-Meva;
- projections of future healthcare use by RIVM Public Health Foresight Study (VTV);
- WRR and SER explorations into the sustainability of the healthcare system;
- Ageing studies (OECD, CPB, Netspar, Eurostat);
- Educational purposes at universities (VU, EUR).

3.6 Practical steps in the RIVM COI

3.6.1 Step 1: Specification of the COI study perspective

The National Health Accounts by CBS are published from a broad social perspective that covers total expenditure on healthcare and social care, reflecting the way the Dutch care system is organised. This broad scope is rooted in multiple schemes; curative care is mainly financed under the Health Insurance Act (Zorgverzekeringswet, Zvw), long-term and intensive care under the Long-term Care Act (Wet langdurige zorg, Wlz), while social support and youth care are largely organised through municipalities under the Social Support Act (Wmo) and the Youth Act

(Jeugdwet). As a result, publicly financed care extends beyond curative care and can include collective and additional healthcare (e.g. physiotherapy, dentists), and alternative healthcare (e.g. doula). Costs related to social care include senior and disability care, childcare, youth care and asylum care. In the next steps (2-4), the CBS social perspective is applied; it forms the starting point. Due to its broad perspective, other perspectives can be derived from it, such as the RIVM COI perspective, SHA, and Health expenditure ceiling (uitgavenplafond zorg, UPZ).

3.6.1.1 RIVM perspective

The RIVM COI study adopts a healthcare perspective that includes all direct collective and private healthcare expenditure. Costs related to social care, youth care, and childcare are excluded. The RIVM perspective can be summed up as follows:

RIVM COI perspective = CBS social perspective – (childcare costs + asylum care costs + youth care costs (non-health related) + other smaller costs related to social care)

3.6.1.2 Health expenditure ceiling (UPZ) perspective

In addition to the broader RIVM COI perspective, the study also considers the UPZ and SHA perspectives. For the study period, the UPZ perspective represents a policy budgetary perspective used for budgeting and financial planning. It primarily consists of expenditure under the Health Insurance Act (Zvw) and the Long-term Care Act (Wlz), supplemented by selected budget-funded healthcare expenditure. CBS defines net UPZ as the healthcare expenditure ceiling that sets the maximum healthcare expenditure permitted annually during the cabinet period, excluding the mandatory deductible and statutory co-payments.

The scope of the UPZ perspective may change over time due to changes in the insured benefits package, budgetary classifications, and the allocation of responsibilities across healthcare laws and funding schemes. CBS notes that the healthcare expenditure ceiling was abolished as of 2024 and replaced by a single expenditure ceiling for the entire central government budget (CBS StatLine).

Following the CBS definition, the net UPZ perspective can be described as UPZ-relevant healthcare expenditure, excluding the mandatory deductible and statutory co-payments:

Net UPZ perspective = Gross UPZ perspective – mandatory deductibles and statutory co-payments

3.6.1.3 SHA perspective

For international comparisons of healthcare expenditure, the RIVM COI study also considers the SHA perspective. The SHA, developed by OECD, WHO, and Eurostat, provides an internationally standardised framework for reporting health expenditure across countries with different healthcare systems. In the RIVM COI study, the SHA perspective is used to align the Dutch expenditure estimates with this international

framework. Its definition of healthcare is narrower than the RIVM perspective: it focuses mainly on activities related to curative care, treatment, and nursing, and excludes personal care. As a result, substantial parts of elderly care and long-term care fall outside the SHA perspective. The SHA perspective can, therefore, be regarded as a subset of the RIVM perspective.

SHA COI perspective = CBS social perspective – (WLZ + ...)

The various perspectives applied at RIVM, and their associated healthcare sectors are presented in Table 2 for the year 2019.

- 3.6.2 *Step 2: Partitioning national expenditure into homogenous clusters*
As a preparation for further allocation of healthcare costs, the total healthcare expenditure (CBS societal perspective) is partitioned into clusters. A cluster is defined as a group of a specific type of care, for example disability care, ambulance care, or occupational healthcare. The goal is to make the clusters as homogenous as possible, on the basis of the type of care that they provide. If this is not possible, similar clusters can be grouped together, for example a cluster for paramedical care can include a combination of speech therapy, physiotherapy, and dietetics. The clusters are formed on the basis of the availability of data. The healthcare costs within each cluster are already distributed according to healthcare sectors, healthcare functions, and types of financing by CBS.
- 3.6.3 *Step 3: Allocation of healthcare costs using distribution keys*
Allocation keys are used to distribute as accurately as possible the costs of a specific cluster across age, sex, diagnosis, health provider, financing type, or health function. Each combination of these dimensions is allocated a fraction of utilisation within the cluster. All the assigned combinations together sum up to 100% of care delivered within that cluster. Hence, an allocation key is relative because it only specifies how the total expenditure is divided and not how large the total expenditure is.
- 3.6.3.1 *Constructing allocation keys*
Methods used in constructing utilisation keys may vary across clusters because they rely on the availability and quality of data. These methods can be divided into five groups, ranked from most to least preferred.
- 1. Using a single healthcare register*
When a cluster is relatively homogeneous and a specific register exists that accurately records the delivered care, a utilisation key can be constructed directly from that register. The register should ideally include information on age, sex, and diagnosis, as well as an indicator of resource use. For example, the Dutch national GP registry records diagnoses, patient demographics, and time spent per patient, which provides a reliable measure of GP resource use. Similar registers exist for paramedical care, mental healthcare services, and disease screening programmes.

2. Combining healthcare registers

If no single register contains all required dimensions (age, sex, and disease), multiple registers may be combined. For instance, hospital outpatient care records often contain the type of medical specialist visited but not the diagnosis. By linking this data with GP referral data that includes both specialist type and diagnosis, it becomes possible to estimate the disease distribution across outpatient hospital visits. This approach has also been used to allocate pharmaceutical expenditure by combining prescription data with physician consultation data.

3. Fitting cost data to available healthcare registers

Sometimes the structure of expenditure data does not correspond directly to the structure of healthcare registers. In such cases, cost units may be reorganised to match categories for which utilisation data is available. This approach has been applied, for example, within the hospital sector, where costs are redistributed to align with existing utilisation data.

4. Using proxy keys based on utilisation keys for other cluster or COI studies

Sometimes, the structure of expenditure data does not correspond directly to the structure of healthcare registers. In such cases, cost units may be reorganised to match categories for which utilisation data is available. This approach has been applied, for example, within the hospital sector, where costs are redistributed to align with existing utilisation data.

5. Other methods

If none of the above approaches are feasible, utilisation keys may be constructed using modelling or informed assumptions. For example, healthcare costs for military medical services in the Dutch COI study were allocated based on the demographic composition of the armed forces and expected service use. In other cases, keys can be derived from programme structures, such as vaccination schedules that specify target populations by age and disease. We also assess the already available allocation keys to see which key can be applied best. In the event that no allocation key is available a generic allocation key can be applied. A generic allocation key is based on the population's age, sex and distribution in a given year. For the diagnosis group, choice is made for the most applicable residual category.

3.6.4 Step 4: Distribution of healthcare costs (aggregating across cost units)

Once utilisation keys have been constructed for all cost units and expressed as shares of the total, the COI analysis is performed by multiplying the expenditure of each cost unit by its corresponding utilisation key. This allocates actual expenditure across the study dimensions, such as disease, age, and sex. The results are compiled in a detailed output table that lists expenditure by the relevant dimension categories.

For reporting and comparing over time, the results are published in both current prices and real prices. Results in real prices are adjusted for inflation using an appropriate price index, making it possible to compare expenditure over time after removing the effect of price changes. From

the detailed output table, expenditure can also be aggregated in different ways to align with reporting frameworks, such as the National Health Accounts or the System of Health Accounts.

4 Output example cost of illness study for 2019

In this section, we illustrate the methodological steps described in Part 3 using the 2019 Cost of Illness (COI) study as a concrete example.

4.1 Step 1: Specification of the COI study perspective

Table 2 below presents the total Dutch care expenditure in 2019 from four perspectives: CBS National Health Accounts, RIVM perspective, Budget Ceiling perspective (UPZ), and System of Health Accounts (SHA). This is the starting point of the COI and shows the marginal totals to which all dimensions add up.

Under the broad societal perspective by CBS, total care expenditure in 2019 amounted to €107.2 billion. This figure encompasses healthcare as well as services related to social care, including youth care, childcare, social support, and asylum care. The RIVM perspective, which underpins the Dutch Cost of Illness (COI) studies, refines this total to €96.9 billion by excluding non-health-related social care components. This revised figure represents a healthcare-specific total, which is subsequently allocated to disease groups, age categories, and sex categories using COI methodologies.

The Budget Ceiling perspective (UPZ) only reflects collectively financed healthcare expenditure under statutory schemes, such as the Health Insurance Act (Zvw) and the Long-term Care Act (Wlz), amounting to €74.2 billion. It excludes privately financed care and serves primarily as a tool for government budgeting. By contrast, the System of Health Accounts (SHA) perspective totals €81.8 billion and aligns with OECD and Eurostat international reporting standards. This perspective excludes substantial portions of long-term personal care and specific social support services, facilitating cross-country expenditure comparisons.

This table provides the macro-level expenditure figures that form the foundation of the COI allocation process. Specifically, the RIVM healthcare perspective (€96.9 billion) serves as the cost base for distributing expenditure across disease categories, age groups, and sex categories using allocation keys derived from healthcare utilisation data.

Table 2 COI perspectives in million euros

Care Sector	CBS Health Accounts (Total costs CBS)	RIVM (Total costs RIVM)	Healthcare Expenditure Ceiling (UPZ gross) total costs	System of Health Accounts (SHA) total costs
Total	107,183.2	96,873.5	74,231.8	81,820.5
Total public health and prevention	1692.8	1692.8	114.7	1365.2
Municipal public health services	829.3	829.3	114.7	829.3
Population screening programmes	110.7	110.7	-	110.7
Other public healthcare	752.8	752.8	-	425.2
Total primary care	10,143.6	10,143.6	6072.2	9931.1
General practice (GP care)	4331.3	4331.3	3956.4	4118.8
Dental care	3558.2	3558.2	1052.3	3558.2
Midwifery practices	260.3	260.3	287.9	260.3
Physiotherapy	1614.8	1614.8	514.5	1614.8
Other primary care	379.1	379.1	261.1	379.1
Hospital and medical specialist care	29,093.9	29,093.9	25,889.6	26,518.7
Elderly care	20,563.1	20,563.1	18,268.7	17,253.3
Disability care	11,099.7	11,099.7	9220.3	5750.8
Mental healthcare	7225.4	7225.4	5391.4	5472.3
Total medicines and medical aids	8452.9	8452.9	6056.3	8452.9
Medicines	5647.6	5647.6	4593.0	5647.6
Medical aids	1505.4	1505.4	1186.9	1505.4
Glasses, lenses, hearing devices	1273.5	1273.5	252.8	1273.5
Body-related materials	26.4	26.4	23.7	26.4
Total ambulance services and transport	621.6	621.6	634.5	621.6
Ambulance care	435.1	435.1	436.2	435.1
Patient transport	186.5	186.5	198.3	186.5
Total other healthcare providers	3246.0	3246.0	1462.8	2763.3
Occupational health services and company health services	1283.6	1283.6	-	799.9
Other healthcare providers	1962.5	1962.5	1462.8	1962.5
Management organisations	4225.8	4225.8	351.6	3392.1
Total social care services	10,818.3	508.7	769.7	300.1
Childcare	4902.2	-	-	-
Other social care	1183.4	-	-	-
Facilities for persons with disabilities	508.7	508.7	-	101.7
Youth care	2189.8	-	51.7	64.8
Social shelter	2034.2	-	717.9	133.6

4.2 Step 2: Grouping expenditure into homogenous clusters

In the second step of the RIVM COI methodology, total healthcare expenditure is systematically grouped into homogeneous clusters before being allocated to specific diseases. As we did above, we will use the 2019 COI as an example, and the RIVM healthcare perspective total of €96.9 billion to illustrate this step and the following. This total is

reorganised into clusters (see Table 2) that represent distinct types of care.

Each cluster groups together a relatively homogeneous type of service delivery, based on the nature of care provided and the availability of suitable data sources for subsequent allocation. For instance, hospital and medical specialist care is grouped separately due to the detailed diagnostic data available in hospital registration systems, while pharmaceutical expenditure forms a separate cluster because allocation is based on prescription data (e.g. ATC codes). Similarly, primary care includes services such as GP care, dental care, physiotherapy, midwifery, and other first-line services, although these subcomponents may be further subdivided when constructing allocation keys.

At this stage, no costs are assigned to specific diseases. Instead, the macro-level expenditure total of €96.9 billion is reorganised into analytically meaningful clusters that reflect the structure and nature of healthcare services. This step is critical to laying the groundwork for Step 3, where distribution keys are developed to allocate expenditure across disease categories, age groups, and sex categories.

4.3 Step 3: Allocation of healthcare costs using distribution keys

This step describes how distribution keys are constructed and used to allocate expenditure across diagnosis, age, and sex. A distribution key expresses the relative share of expenditure assigned to each combination of these dimensions for a specific cost unit. For each cost unit, utilisation data is transformed into proportional shares that reflect the distribution across the relevant COI dimensions. These shares sum up to 100%, ensuring that all expenditure for the cost unit can only be allocated once and that double counting is avoided.

The resulting distribution key is then used in Step 4 to allocate the expenditure amount for each cost unit across disease group, age group, and sex category.

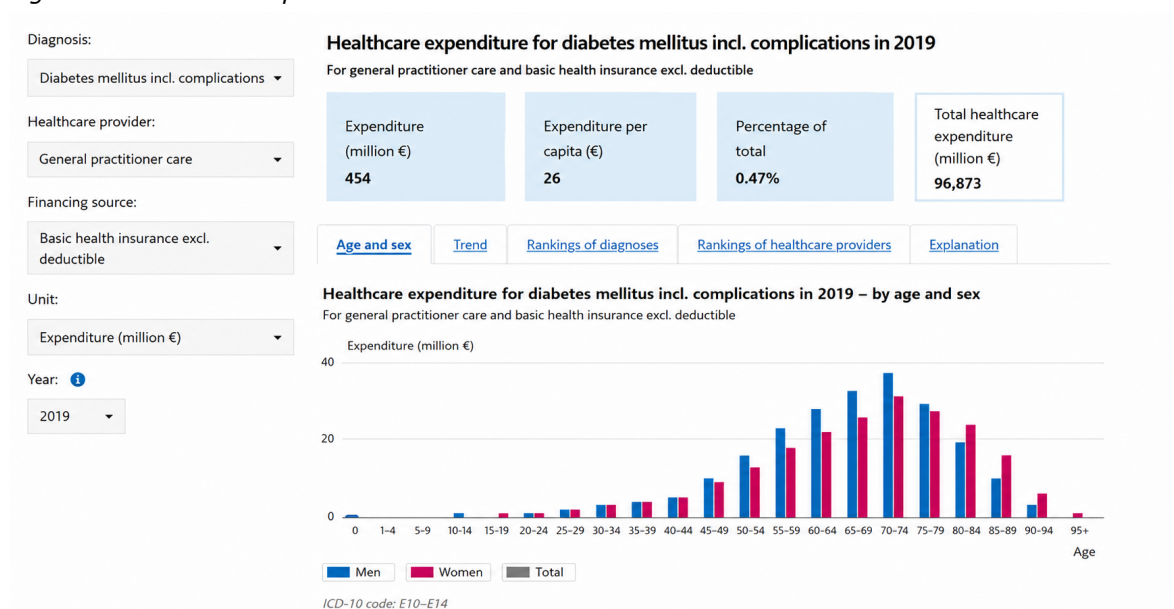
4.4 Step 4: Distribution of healthcare costs

In the final step, the distribution keys constructed in Step 3 are applied to the expenditure amounts from the CBS health accounts. These keys express the relative distribution of expenditure across diagnosis, age, and sex. For each cost unit, the relevant expenditure amount is multiplied by the corresponding distribution key. This produces healthcare expenditure estimates by diagnosis, age, and sex. Because the allocation is applied to the expenditure totals from the CBS Health Accounts, the resulting estimates remain consistent with the national expenditure totals. The distribution keys determine how expenditure is allocated across the study dimensions, but they do not change the overall expenditure totals.

As an example, Figure 3 shows the resulting distribution of general practitioner care expenditure for diabetes mellitus in 2019 by age group and sex. Expenditure is low at younger ages, increases with age, and peaks at ages 70–74 for men and 75–79 for women. Beyond these age

groups, expenditure declines. In older age groups, expenditure is generally higher for women than for men.

Figure 3 Healthcare expenditure for diabetes mellitus



Note: This example shows expenditure on general practitioner care. Comparable breakdowns by age and sex can also be produced for other healthcare sectors and for specific financing schemes.

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