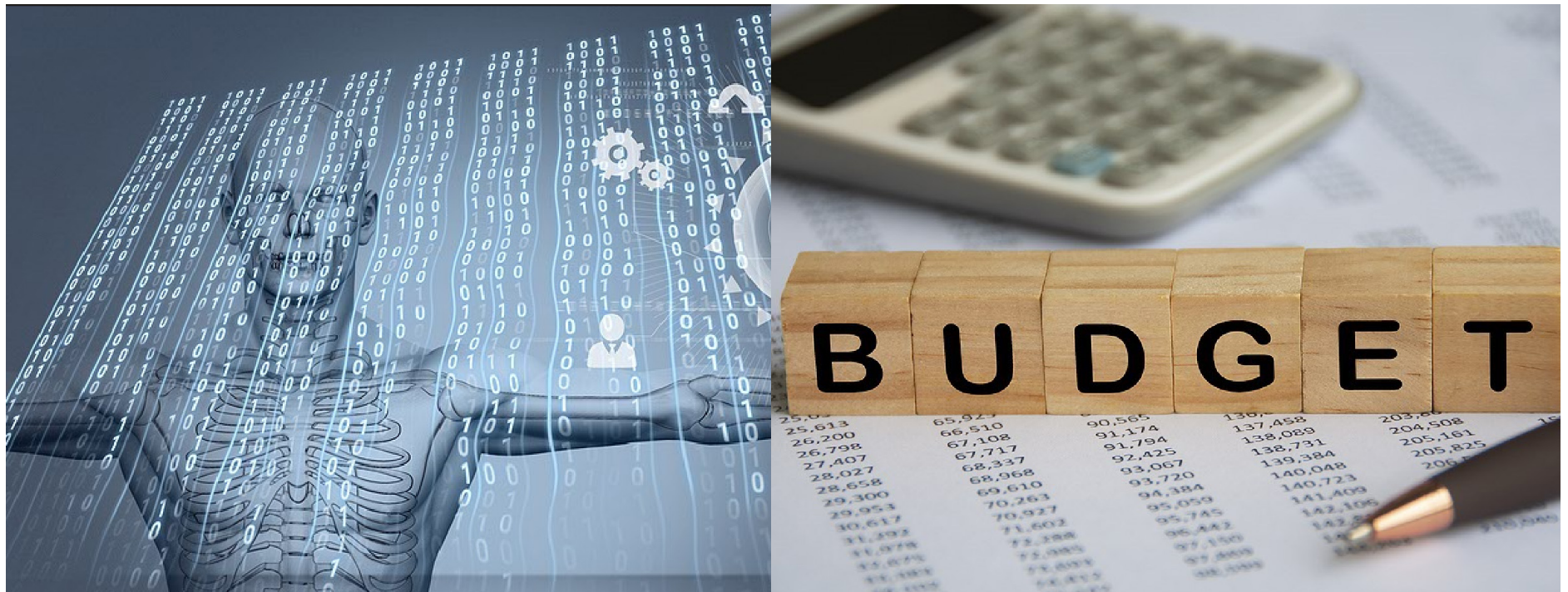


TRANSVERSAL BUDGET IMPACT ANALYSIS



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CÉCILE CAMBERLIN, CAROLINE OBYN, MATTIAS NEYT



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LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
ADH – HJA	Hospital Day-care Anonymous Hospital Stays (Anonieme Dag Hospitalisaties – Hospitalisations de Jour Anonymes)
ATMP	Advanced therapy medicinal products
AIDS	Acquired immunodeficiency syndrome
APR-DRG	All Patient Refined-Diagnosis Related Group
ATC	Anatomical Therapeutic Chemical (ATC) classification system
AZV – SHA	Hospital Inpatient Anonymous Hospital Stays (Anonieme ZiekenhuisVerblijven – Séjours Hospitaliers Anonymes)
BCR	Belgian Cancer Registry
BFM – BMF	Budget of Financial Means (Budget Financiële Middelen – Budget des Moyens Financiers)
BIA	Budget impact analysis
BS – MB	Belgische Staatsblad – Moniteur Belge
CE label	Conformity with Europe label
COPD	Chronic obstructive pulmonary disease
COVID-19	Coronavirus disease 2019
CTFPV – CRPPP	Reimbursement Commission for pharmaceutical products and deliveries (Commissie voor Terugbetaling van Farmaceutische Producten en Verstrekkingen – Commission de remboursement des produits et des prestations pharmaceutiques)
CTG – CRM	Reimbursement Commission for Drugs (Commissie Tegemoetkoming Geneesmiddelen – Commission de Remboursement des Médicaments)
CTIIMH – CRIDMI	Reimbursement Commission for Implants and Invasive Medical Devices (Commissie Tegemoetkoming voor Implantaten en Invasieve Medische Hulpmiddelen- Commission de remboursement des implants et des dispositifs médicaux invasifs)



CVA	Cerebrovascular accident
DGEC – SECM	Service for Medical Evaluation and Control (Dienst voor Geneeskundige Evaluatie en Controle – Service d'Evaluation et de Contrôle Médicaux)
EMDN	European Medical Device Nomenclature
EPS	Permanent Sample – Echantillon Permanent
EU	European Union
FAGG – AFMSP	Federal Agency for Medicines and Health Products (Federaal Agentschap voor Geneesmiddelen en Gezondheidsproducten – Agence Fédérale des Médicaments et des Produits de Santé)
FDA	Food and Drug Administration
FPS	Federal Public Service (Federale Overheidsdienst – Service Public Fédéral, FOD – SPF)
FPS Public Health	Federal Public Service Health, Food Chain Safety and Environment (Federale overheidsdienst Volksgezondheid, Veiligheid van de Voedselketen en Leefmilieu – Service public fédéral Santé publique, Sécurité de la Chaîne Alimentaire et Environnement)
FRZV – FNEH	Federal Council for Hospital Facilities (Federale Raad voor ZiekenhuisVoorzieningen – Conseil Fédéral des Etablissements Hospitaliers)
GBO	Global budgetary objective
GDPR	General Data Protection Regulation
HTA	Health technology assessment
HIV	Human immunodeficiency virus
ICD-10-BE	International Classification of Diseases-10th Revision-Belgium
ICD-10-CM	International Classification of Diseases-10th Revision-Clinical Modifications
ICU	Intensive care unit
IMA – AMI	InterMutualistisch Agentschap – Agence InterMutualiste



IVDR	In Vitro Medical Devices Regulation
IVT	Intravenous Thrombolysis
JCA	Joint clinical assessment
JSC	Joint scientific consultation
MEA	Managed entry agreements
MD	Medical device
MDR	Medical Device Regulation
MT	Mechanical Thrombectomy
MZG – RHM	Minimale Ziekenhuis Gegevens – Résumé Hospitalier Minimum
NRKP – CNPQ	National Council for Quality Promotion (Nationale Raad voor KwaliteitsPromotie – Conseil national de Promotion de la Qualité)
NRZV – CNEH	National Council for Hospital Facilities (Nationale Raad voor ZiekenhuisVoorzieningen – Conseil national des Etablissements Hospitaliers)
OJ	Official Journal of the European Union
PICO	Patient Intervention Comparison Outcome
RCT	Randomised controlled trial
RD	Royal Decree
RIZIV – INAMI	National Institute for Health and Disability Insurance (Rijksinstituut voor Ziekte- en Invaliditeitsverzekering – Institut National d'Assurance Maladie-Invalidité)
RWD	Real-world data
SAVR	Surgical Aortic Valve Replacement
SOI	Severity of illness
TAVI	Transcatheter Aortic Valve Implantation
TCT	Technical Cell (Technische Cell – Cellule Technique)



TMR – CTM	Technical Medical Council (Technisch-Medische Raad – Conseil Technique Médical)
UDI	Unique Device Identifier
UDI-DI	Unique Device Identifier – Device Identifier
UDI-PI	Unique Device Identifier – Production Identifier
US(A)	United States (of America)
UZA	Universitair Ziekenhuis Antwerp



■ SCIENTIFIC REPORT

1 INTRODUCTION

1.1 Context

Within RIZIV – INAMI (Rijksinstituut voor Ziekte- en Invaliditeitsverzekering – Institut National d'Assurance Maladie-Invalidité), the commission for reimbursement of implants and invasive medical devices (Commissie tegemoetkoming implantaten en invasieve medische hulpmiddelen – Commission de remboursement des implants et des dispositifs médicaux invasifs, CTIIMH – CRIDMI) evaluates reimbursement requests for implants or invasive medical devices according to the criteria described in the RD of 25 June 2014^a, which include besides therapeutic value, price, and importance of the device in medical practice also the cost-effectiveness and the budgetary impact of the medical device or implant. The budget impact analysis (BIA) in that context is used to estimate the financial consequences of reimbursing the implant or medical device.

Previously, the Belgian Health Care Knowledge Centre (KCE) has drafted guidelines for BIA to enhance consistency in the analyses submitted to CTIIMH – CRIDMI and RIZIV – INAMI at large.¹ According to these guidelines, the reference case analysis in BIA should include all direct health care costs from the perspective of the health care payers (see Table 1). Direct health care costs means health care costs directly related to the disease or the intervention; they include hospitalisation costs as well as costs made in ambulatory setting. Costs and savings outside the health care sector, e.g. due to (shortened) absence from work, should not be included in the reference case analysis. Nevertheless, analyses from a broader societal perspective (and including costs and savings outside the health care sector) are allowed but should be distinguished from the reference case.

^a Koninklijk besluit tot vaststelling van de procedures, termijnen en voorwaarden inzake de tegemoetkoming van de verplichte verzekering voor geneeskundige verzorging en uitkeringen in de kosten van implantaten en

invasieve medische hulpmiddelen, B. S. 1 juli 2014 - Arrêté royal fixant les procédures, délais et conditions en matière d'intervention de l'assurance obligatoire soins de santé et indemnités dans le coût des implants et des dispositifs médicaux invasifs, M. B. 1 juillet 2014.



The focus of the BIA is on incremental elements, i.e. elements that are different when comparing the intervention-under-evaluation and its comparator(s).

Table 1 – Included and excluded costs in the reference case of a BIA

	Health care costs	Non-health care costs
Direct costs	Included • Hospitalisation costs • Ambulatory costs: medications, outpatient consultations, home medical visits, ...	Not included* • Travel expenses to and from the hospital • Informal care • Invalidity/incapacity allowances • ...
Indirect costs	Not included* e.g. health care costs in life years gained (unrelated health care costs)	Not included* • Lost productivity of patients during treatment and rehabilitation • Lost productivity due to premature mortality

** These elements are not included in the reference case but can be included in an extra analysis from a broader perspective.*

The perspective of the submitted BIA should be that of the health care payers, including costs borne by both government and patients. In Belgium, there are several health care payers: besides the RIZIV – INAMI, which is the reimbursement institute at the federal level intervening in most health care domains, there are instances at the federated level which intervene in some particular domains of health care, such as prevention and rehabilitation. Also, within the RIZIV – INAMI, several organs manage different sub-budgets: technical councils or commissions are each responsible for their own partial budget, like medicines, medical acts, implants and invasive medical devices, etc.

There is also financing through the Budget of Financial Means (Budget Financiële Middelen – Budget des Moyens Financiers, BFM – BMF) for admissions and stays in hospital and surgical day care. The Belgian guidelines recommend to calculate both the impact on the global budget on one hand and on the budgets of the different health care payers separately on the other hand.¹ This means that financial consequences of a reimbursement decision on a federal level should also be evaluated at the level of the federated entities' budgets. This is for example the case for a surgical intervention (financed at the federal level) which leads to a reduction in rehabilitation expenditures outside the general hospitals (financed at the federated level). The guideline also states that results should be presented in a disaggregated way in which the contribution of different components to the budget impact should be reported separately from the general budget impact. For example, the budget impact of the initial intervention can be separated from further replacement costs, re-hospitalisations or re-interventions, adverse events, follow-up costs, etc..

The fragmentation of budgets, with budgets split between the federal and federated level, between RIZIV – INAMI and BFM – BMF, and within the RIZIV – INAMI, poses some particular challenges to the CTIIMH – CRIDMI (also called 'commission' hereafter). Sometimes reimbursement of an implant or invasive medical device can lead to savings or additional expenditures in other sectors. The commission therefore considers it important to move away from 'silo' mentality to a more 'transversal' approach where consequences at large for all health care payers are considered. For example, it may occur that there is not sufficient budget for reimbursement of a new device or implant (in the according budget line), whilst it is expected that its reimbursement would lead to savings in other budgets and to savings overall for the health care payer. In such cases, it would be a missed opportunity not to reimburse the device or implant. The commission is often confronted to cases where the new implant or medical device has a transversal impact and requested KCE to analyse how they can objectify the expected savings in other budgets by using real-world data (RWD).



According to the current RIZIV – INAMI administration contract^b, the reimbursement procedures for medical devices are being gradually reformed in order to ameliorate and harmonize the procedures applied by the different sub-sectors. The present topic coincides with the will expressed by the RIZIV – INAMI in its recent Perennial budgetary Trajectory for the health care budget 2020-2024 to develop a “concrete transversal approach fostering de-compartmentalization”.²

The conduct of BIA on the other hand also poses particular challenges to the distributors, as they have low access possibilities to the national databases and cannot always access to the best information available. Consequently their reimbursement file cannot always contain the most precise analyses. Distributors are therefore also demanding wider access to the real-world data.

1.2 Aim of the study

1.2.1 Research questions

Considering the challenges encountered by the commission in the evaluation of BIA for implants and invasive medical devices, as well as the challenges encountered by distributors for the submission of BIA, we formulated the aim of the study as follows. The aim of this study is to identify opportunities to improve the accuracy of data inputs used for BIA for implants/invasive medical devices, both conducted by the distributors and by RIZIV – INAMI, by using real-world data.

Note that in this report we focus on ‘transversal’ budget impact analyses. Transversal in the sense that the analysis encompasses different health sectors, possibly covered by different sub-budgets. Both the BIA conducted by distributors and by RIZIV – INAMI will require a transversal approach.

Besides the BIA done at the time of the evaluation, RIZIV – INAMI is also interested to evaluate what has been the effective budget impact of the decision, several years after the reimbursement decision was taken. This is especially the case for, but not restricted to, reimbursement under a ‘Restricted Clinical Application’, where the commission decides to temporarily reimburse the medical product for which there is still uncertainty on the added value compared to existing therapeutic alternatives, under the condition that research is undertaken during this period.

In this study KCE first of all examines whether, on the basis of national data sources, more precise input data exists than the data currently used by distributors and RIZIV – INAMI in the submission and evaluation of reimbursement requests, **at the time of the evaluation (ex ante; before reimbursement)**. Secondly, KCE examines whether precise input data exists for an evaluation of BIA which is conducted a number of years **after the reimbursement decision was taken (ex post; after reimbursement)**, to verify whether the forecasted budget impact was a reliable estimate and approaches reality.

For those data sources where opportunities for better data inputs exist, it will be examined which are the possibilities to enhance the access to those data, both for distributors and RIZIV – INAMI, both for ex ante and ex post evaluations.

The research questions of this study are thus as follows:

- What are possible national data sources to extract relevant data for BIA ex ante, for distributors and RIZIV – INAMI? Is it possible and feasible to have a detailed split up of the impact on all sub-budgets (partial budgets within RIZIV – INAMI/BFM – BMF /federated budgets)?

^b Art. 29, part 2 of 2nd Amendment 2021 to the 5th Administration Contract 2016-2018
(<https://www.inami.fgov.be/SiteCollectionDocuments/bestuursovereenkomst-2016-2018-wijzigingsclausule-2021.pdf>)



- What are possible national data sources to extract relevant data for BIA ex post for RIZIV – INAMI? – Is it possible and feasible also to have a detailed split up of the impact on all sub-budgets (partial budgets within RIZIV – INAMI/BFM – BMF/federated budgets)?
- How can access to the relevant data be improved?

We will try to respond to these research questions, both with a view on the short-term possibilities, considering the situation as it is currently, and with a view on the longer-term possibilities, considering potential future developments in data sources.

1.3 Methods

1.3.1 Two case studies

For this study we reviewed the BIA for two reimbursement files for implants/invasive medical devices that were submitted to RIZIV – INAMI in the past. We explored the availability of data in national databases both ex ante (at the time of submission/evaluation of the reimbursement file) and ex post (a number of years after the reimbursement decision).

The reimbursement files submitted by the distributors to RIZIV – INAMI are not publicly available. Neither are the evaluation reports (the proposals) drafted by RIZIV – INAMI. Therefore RIZIV – INAMI made a selection of files in which the distributors claimed that reimbursement would lead to savings in other sectors than implants/invasive medical devices. This led to the selection of the following two cases:

- Mechanical thrombectomy in case of ischemic stroke: de novo request for reimbursement
- Transcatheter Aortic Valve Implantation (TAVI): expansion of reimbursement volume

For these two reimbursement files, KCE made a formal request to RIZIV – INAMI to have access to the files in the context of publicity of the administration and accessibility of administrative documents. For each of the files, KCE received both the reimbursement requests, submitted by the

distributor(s), and the evaluation report (proposal) drafted by the commission. We ensured that no elements with confidential character are presented in the present report.

It is important to note that for this report we focussed merely on the different variables in the BIA. We did not recalculate and evaluate the total budget impact. Our aim notably was to check whether it was possible to have better data for each of the variables separately. Furthermore we did not critically assess the claimed benefits in the reimbursement requests in terms of safety or effectiveness, not based on a critical literature review, nor based on the performed data analysis. Instead we focus on the possible data sources for the budget impact analysis. This report should be seen as a methodological report, not as a report on mechanical thrombectomy and TAVI.

This report uses two cases to illustrate the actual data situation and to identify how additional information might be obtained using other data sources. We are aware that two cases are not sufficient to illustrate all possible data analyses, as the possibilities of the national databases are very wide. Instead we aim to generalize the approach that can be used to conduct BIA by referring to the different elements needed to perform such an analysis. We give an overview of the content of the national databases that can be used for providing information on these elements.

1.3.2 Data sources analyzed

For the data analysis for the two case studies in Chapter 3, we used the following databases:

- the Permanent Sample (“Échantillon Permanent(e) Steekproef” – EPS)
- the “Technische Cel – Cellule Technique” (TCT) database (MZG – RHM linked to AZV – SHA, ADH – HJA), and
- the RIZIV – INAMI Doc. N database



These databases are described in Chapter 4 (section 4). In Chapter 4, we will also discuss the potential use of other national databases, most noticeably:

- IMA – AIM^c database
- Financial feedback data by APR-DRG^d
- The future MZG – RHM/EPS.

1.3.3 Methods for the data analysis

The analyses were performed using SAS software™ version 9.4 M5 for Microsoft Windows³, using R version 4.2.2 (2022-10-31 ucrt), with aside from the standard included packages, ggdist and the tidyverse packages, ggplot2 and haven, and Microsoft® Excel® for Microsoft 365 MSO.

1.3.3.1 The case of mechanical thrombectomy

Data were extracted from the EPS for the years 2013-2015 (situation before reimbursement) and 2017-2019 (actual cases) to analyze the thrombectomy case. RIZIV – INAMI codes that were used during the extraction and analysis can be found in Table 18 and Table 19 of Appendix 1. Stays of patients undergoing a thrombectomy between 2017 and 2019 were identified, as well as stays of patients receiving thrombolysis (see ATC codes in appendix) during the same period or between 2013 and 2015.

Note on the analysis of EPS data in the present study: When analysing the EPS data, the sampling design (stratification by age and sex) must be taken into account to generalize results. This is done by weighting each observation when calculating parameter estimates (e.g. mean, median, frequencies) and calculating a precision of these estimates (sampling error). The weight is the inverse of the sampling probability of each individual in his/her stratum (40 for people younger than 65 years and 20 for people aged 65 years or older). As the present study aims at identifying hurdles and not giving strictly accurate figures, we only weighted individuals to get

extrapolated number of patients with no interval confidence. In reality, sampling methods should be used to quantify the uncertainty faced when using EPS data. More information on sampling methods can be found in KCE report 208 “Linking of the Permanent Sample with the Hospital Data: Feasibility and data representativeness study”.⁴

Given the obstacles encountered in defining the target population in the EPS, only the **actual volume case** was calculated.

1.3.3.2 The case of TAVI

The transcatheter aortic valve implantation (TAVI) is a percutaneous technique to replace the aortic valve less invasively than the surgical aortic valve replacement (SAVR). Data were extracted from the TCT data 2016-2020 to analyze the TAVI case. Stays discharged between 2016 and 2020 were selected if they were billed with a RIZIV – INAMI implant or medical fee TAVI or SAVR code, or if there was an ICD-10-BE procedure code for TAVI or SAVR. RIZIV – INAMI codes and ICD-10-BE codes that were used during the extraction and analysis can be found in Appendix 1 (Table 20 till Table 24. Only stays validly linked for which the TCT cross control tests (a.o. consistency checks of the information contained in both data sources) were successful were retained.

The number of stays selected is used to estimate the **actual case volume**.

For the calculation of the **adverse events**, i.e. pacemaker implantations and subsequent strokes), the five registration years selection allowed a 2 years follow-up period after a TAVI or SAVR performed in 2018 as well as a 2 years buffer period before (to cast aside patients whose TAVI or SAVR was not a primo-intervention).

Calculation of time spent in ICU after a TAVI procedure was done on stays during which no SAVR was performed. The time of unit admission (date, hour, minute) is registered in the STAYUNIT file of the TCT data. The identifiers of the ICU and operating theatres chosen by the hospital must

^c InterMutualistisch Agentschap – Agence InterMutualiste

^d All Patient Refined-Diagnosis Related Group



begin respectively by “INT” and “OPR”, which allows to identify them. It was therefore possible to calculate the time spent by patients in such units. Some irregularities were noted in the data: some stays had some time recorded in “OPR” unit (sometimes for 1 or 2 days) but not in any “INT” unit, and vice-versa. Possibly, the catheterization laboratory was considered or not as an “OPR” unit by hospitals. It seemed less probable that ‘OPR’ and ‘INT’ can be mistaken/registered for each other. Nevertheless, ICU time was calculated according to two methods, the first one being more strict and the second one more maximalist in order to estimate a range rather than a point estimate. First, the ICU time was computed on TAVI stays with the ‘INT’ unit registered, considering the time spent in (consecutive) ‘INT’ unit(s) starting on the TAVI day. Second, the ICU time was computed on TAVI stays with the ‘INT’ and/or ‘OPR’ unit(s) registered, considering the time spent in (consecutive) ‘OPR’ and/or ‘INT’ unit(s) starting on the TAVI day. This second method was also chosen to solve the issue of stays during which there was an ‘OPR’ readmission (‘OPR’-‘INT’-‘OPR’-‘INT’ sequence).

Hospitalisation costs for the both procedure were calculated on stays during which only SAVR and no TAVI were performed, and conversely only TAVI but no SAVR. Stays with irregular invoices were discarded from the calculation, i.e. stays with no record of hospitalisation lump sums, medical imaging lump sums, clinical biology lump sums and stays with no medical fees or no valve invoiced. The financing of the hospitals, called budget of financial means (Budget Financiële Middelen – Budget des Moyens Financiers; BFM – BMF) and which covers o.a. nursing and accommodation, is composed of two parts: a fixed one and a variable one. The fixed part (more or less 80%) is paid to the hospitals by the sickness funds in the form of monthly ‘provisional twelfths’. The remaining variable part consists of per diem and per admission lump sums, which are invoiced for each stay. Every 6 months, the amounts of these lump sums are set per hospital and depend on the type of bed where the patient stays. The fixed part of the BFM – BMF, i.e. provisional twelfths, is not registered in the TCT

data, while the variable part, i.e. admission and per diem lump sums are registered for each stay. To reconstruct the actual hospitalisation cost (BFM – BMF at 100%), the per admission and per diem lump sums registered are ignored and replaced by their 100% equivalent amount multiplied by the number of days (length of stay). The 100% equivalent amounts are published on the [RIZIV – INAMI website](#). Some hospital stays are financed outside the dual system and are subject to true lump sum funding (e.g. with ‘maxi lump sum’, non-surgical day care, etc.). In these cases, actual lump sum costs should simply be added. Note that this does not apply to the stays with TAVI or SAVR found in the TCT data that were all inpatient stays financed by the dual system. Besides the 100% hospital per diem price, the other reimbursed amounts were added up: medical fees including clinical biology and medical imaging^e but excluding the TAVI or SAVR medical fees, implant and medical devices other than the TAVI or SAVR valve implant itself (e.g. catheter, electrodes, thoracic drainage system, ...), pharmaceuticals and other possible materials (blood, plasma, radio-isotopes). The TAVI or SAVR medical fees and the replacement valve were presented separately. Besides the reimbursements, the **patient share** was calculated by adding up the amounts paid by the patient for the pharmaceuticals and materials. To complete the patient share, two amounts of €6.20 and €7.44 were added for each stay respectively for the medical imaging and the clinical biology admissions lump sums paid by the patient and not registered^f in the TCT data. Similarly, the number of days multiplied by €0.62 was added for each stay, accounting for the pharmaceutical per diem lump sum supported by the patient.

Similarly as for the hospitalisation costs, stays with both procedures were not taken into account for the **identification of specific (adverse) events**. Only patients undergoing one TAVI or SAVR procedure in 2018, who did not have any such procedure in 2016, 2017, 2019 or 2020, were analysed. Adverse events were looked for during index admission, starting from the day of TAVI or SAVR (intra-, postoperative or later stroke and pacemaker

^e Clinical biology and medical imaging were not corrected (no 100% reconstruction).

^f Contrary to the medical imaging and clinical biology admission and per diem lump sums reimbursed by the RIZIV – INAMI that are registered in the TCT data.



primo-implantation) as well as after discharge in the two years following the day of TAVI or SAVR (readmission for stroke as principal diagnosis or pacemaker primo-implantation). During index admission, strokes occurring before the TAVI or SAVR procedure were excluded using the Present-on-Admission variable in the file DIAGNOSE and, in the case an ICD-10-BE code was recorded for the procedure, the order of medical speciality (order_spec) registered both in DIAGNOSE and PROCEDUR. Pacemaker replacements were excluded (note that in such case, 2 ICD-10-BE codes are recorded: one for the removal and one for the new implantation). See Appendix 1 (Table 22, Table 23 and Table 24) for codes used to identify strokes and pacemaker implantations.

1.4 Report outline

In Chapter 2, we make an introduction to the fragmentation of budgets for health care in Belgium, focusing first on the partial budgets within RIZIV-INAMI and secondly on the split between the responsibilities of the federal and the federated levels.

In Chapter 3, we analyse the case studies. We start with the case of thrombectomy and then continue with the case of TAVI. For each of the cases, we start with summarising the PICO (Patients-Intervention-Comparator-Outcome) as presented in the reimbursement file, to give the reader an introduction to the topic. Consequently, we give an overview of the elements used in the BIA (volume of interventions, cost of the intervention, follow-up costs, ...) and then discuss element by element. Which data were used by the distributor(s)? Which data were used by RIZIV – INAMI? Which data can KCE retrieve for each of these elements?

In Chapter 4, we give an overview of national databases that can potentially be used for BIA and their access possibilities.

In Chapter 5, we generalise our findings based on the two cases to any type of BIA submitted to the CTIIMH – CRIDMI and further discuss the possibilities and the limitations of the real-world data (RWD).

2 BACKGROUND

The present chapter first addresses the subdivision of the federal RIZIV – INAMI health insurance budget in partial budgets and presents the different organs responsible for those. After that, it briefly addresses the responsibilities of the federated levels.

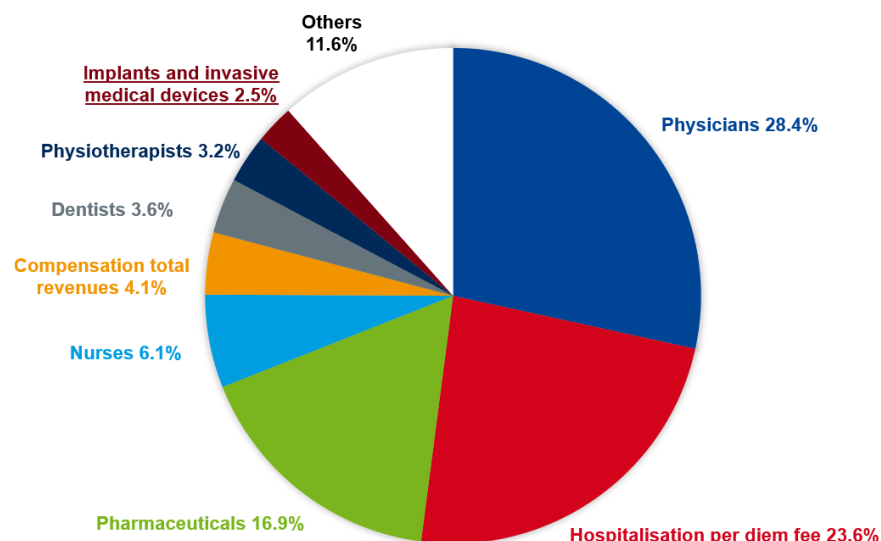
2.1 The global and partial budgets of the federal RIZIV-INAMI health insurance budget

The health insurance budget is estimated at €40 387 million for 2023 ([Decision CGSS, RIZIV — INAMI, 17 October 2022](#)). This amount includes mostly the reimbursements and payments to health care providers, the hospitalisation per diem fees and the overhead of the sickness funds and the RIZIV – INAMI. The reimbursements and payments to health care providers and the hospitalisation fees constitute the so-called global budgetary objective (GBO), which is broken down into different partial budgetary objectives, each related to a health care sector represented by a different convention or agreement commission. The 2023 GBO amounts to €35 285 million, or 87.4% of the total health insurance budget.

The repartition between the largest sectors is presented in Figure 1. The largest share (almost 70%) is represented by physicians fees, (non-psychiatric) hospitalisation fees and drugs.



Figure 1 – Composition of the 2023 global budgetary objective



Source: [Decision CGSS, RIZIV — INAMI, 17 October 2022](#). The Hospitalisation partial budgetary objective (€8 339 million, budget item 12 of the global budgetary objective) pertains to general hospitals excluding the military hospital and the psychiatric ones, which are included in the 'Others' category of the pie (resp. €11.1 million and €6.5 million). The pharmaceuticals budgetary objective is obtained after deducting the amounts paid by pharmaceutical companies as budgetary compensation for the conclusion of agreements on temporary reimbursement of innovative pharmaceuticals ("art.111", former art.81"). In other words, the gross reimbursements paid for pharmaceuticals amounted to 21%, including 4.1% which were refunded by the companies.

How are the global and partial budgetary objectives determined?

Based on the technical estimations of the RIZIV – INAMI actuarial services (Directie actuariaat & budget – Direction actuariat & budget), the **Insurance Committee** (Verzekeringscomité – Comité de l'assurance) prepares a yearly GBO proposal to the General council in accordance with the legal growth norm of 1.5% and the health index. According to the government agreement, a legal growth norm of 2.5% applies in 2023 and 2% in 2024 allowing to absorb the volume effect of the demand but also new care initiatives. Once set, the GBO is divided into partial objectives for the different health care sectors and health care providers.

The **General Council** of the health care insurance (Algemene raad – Conseil général) approves at the latest on the third Monday of October the GBO of the next year proposed by the Insurance Committee as well as the partial budgetary objectives of the conventions and agreements commissions. It watches over the financial balance of the health care insurance, takes the necessary budgetary correction measures, establishes the budget and closes the accounts of the health care insurance.⁹ The federal government plays also a role in the GBO as five of its representatives sit with a right of veto on the General Council.

The **Budgetary Control Commission** (Commissie voor Begrotingscontrole – Commission de contrôle budgétaire) puts up reports on the health insurance budget management, the revenues and expenditures, and the financial evolution and forecasts. This Commission proposes economy measures in certain sectors to respect both the legal norm growth and the health index increase.

⁹ The next paragraphs are adapted from <https://www.riziv.fgov.be/fr/inami/organes/Pages/soins-sante-organes.aspx>



These **three organs**, all concerned by the GBO determination, are represented in Figure 2, which describes the RIZIV – INAMI organs involved with the health insurance budgetary aspects.^h The other organs located in the bottom half of the figure are only involved with a partial budgetary objective, each representing a different sector of the health care expenditures. There are a lot of organs less occupied with budgetary matters that are not depicted on the figure such as the Scientific council, the licensing councils (conseils d'agrément des paramédicaux – Erkeningsraden voor paramedici), the National council for quality promotion (Nationale raad voor kwaliteitspromotie – Conseil national de Promotion de la Qualité (NRKP – CNPQ)), the Profiles commissions (commissions de profils – profielencommissies), the Physicians colleges (Collèges de médecins – Colleges van geneesheren) and so on.

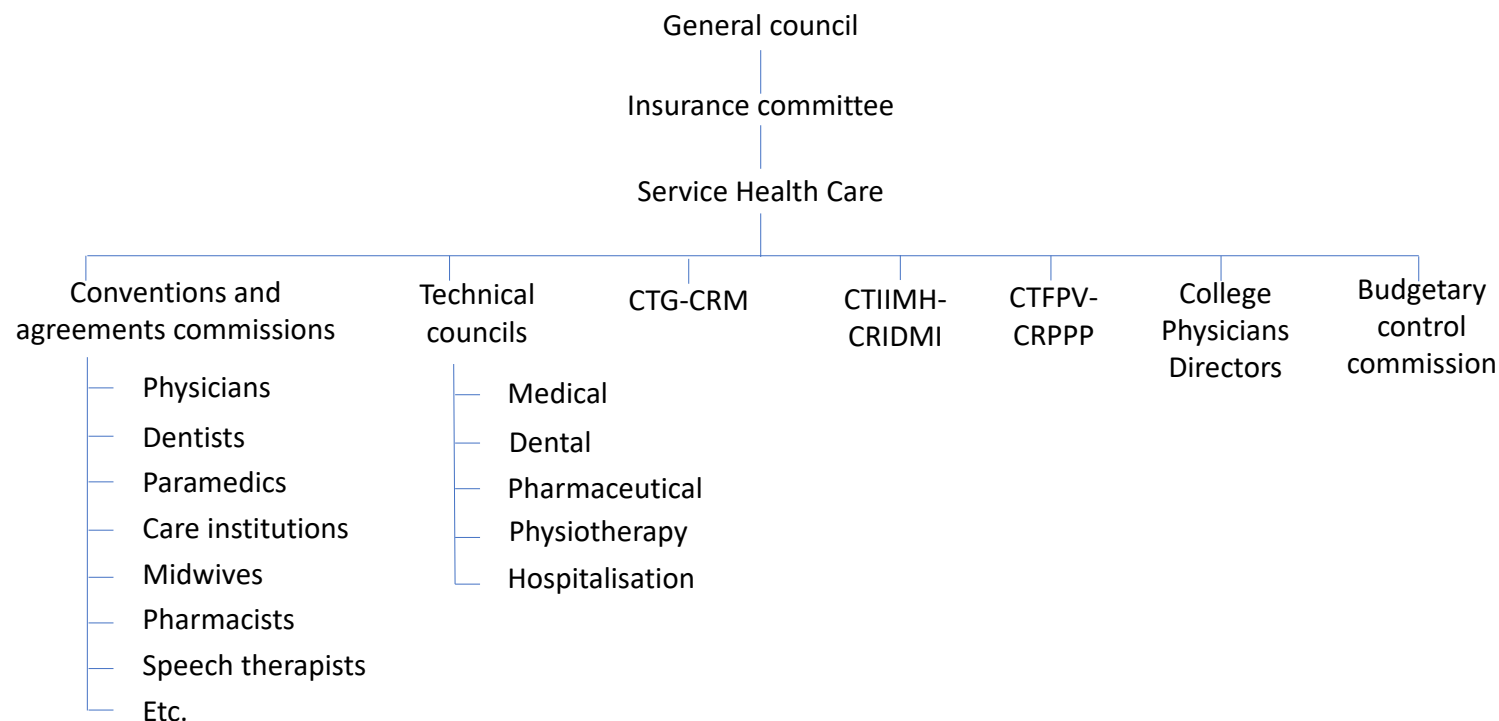
The organs working on the partial budgets

The following organs are all qualified in one sector or another to modify the reimbursement fees, each in a particular health care sector:

- The **Conventions and Agreements Commissions** negotiate fees between sickness funds and the different health care provider groups (physicians, dental practitioners, paramedics, care institutions, midwives, pharmacists, logopaedists, audicians etc.).
- The **Technical councils** (the Technical Medical, Dental and Pharmaceutical Councils, the Technical Council for Physiotherapy, the Technical Council of Hospitalisation) make among others proposals to modify the health interventions 'nomenclature'.

- The **Reimbursement Commission for Drugs** (Commissie tegemoetkoming geneesmiddelen – Commission de remboursement des médicaments (CTG – CRM)) elaborates proposals to extend the list of reimbursable pharmaceuticals, delivers recommendations on pharmaceutical reimbursement conditions and draws up proposals of interpretative rules on this reimbursement.
- The **Reimbursement Commission for Implants and Invasive Medical Devices** (Commissie tegemoetkoming implantaten en invasieve medische hulpmiddelen – Commission de remboursement des implants et des dispositifs médicaux invasifs (CTIIMH – CRIDMI)) elaborates proposals to extend the list of reimbursable implants and invasive medical devices, delivers recommendations on their reimbursement conditions and draws up proposals of interpretative rules on this reimbursement.
- The **Reimbursement Commission for pharmaceutical products and deliveries** (Commissie voor Terugbetaling van Farmaceutische Producten en Verstrekkingen – Commission de remboursement des produits et des prestations pharmaceutiques (CTFPV – CRPPP)) makes proposals to modify the reimbursement requisites, modalities and list of of medical nutrition, raw materials for magistral preparations and diagnostic devices and non-invasive medical devices
- The missions of the **College of Physicians-Directors** cover a.o. the rehabilitation nomenclature and rehabilitation conventions, the multidisciplinary teams for palliative care conventions and the Special Solidarity Fund. In particular, the College can intervene at the request of the CTIIMH – CRIDMI to assess reimbursement modalities of implants or invasive medical device on a case by case basis (see 1.1).

^h Other Services beside the 'Service Health Care' are not depicted in the figure: the Allowances Service, the Medical Assessment and Control Service, the Administrative Control Service, the Medical Accident Fund and the General Support Services.

**Figure 2 – RIZIV – INAMI organs working on the different partial budgets**

Source: Adapted from: <https://www.riziv.fgov.be/fr/inami/organes/Pages/soins-sante-organes.aspx>. CTG – CRM: Commissie tegemoetkoming geneesmiddelen – Commission de remboursement des médicaments, CTIIMH – CRIDMI: Commissie Tegemoetkoming voor Implantaten en Invasieve Medische Hulpmiddelen – Commission de remboursement des implants et des dispositifs médicaux invasifs, CTFPV – CRPPP : Commissie voor Terugbetaling van Farmaceutische Producten en Verstrekkingen – Commission de remboursement des produits et des prestations pharmaceutiques.



2.2 The CTIIMH – CRIDMI and the reimbursement decision procedure for implants and invasive medical devices

The present section describes the reimbursement decision procedure in Belgium for implants and invasive medical devices. The section is mostly based on the report published by the KCE in 2018 on the Responsible use of high-risk medical devices: the example of 3D printed medical devices⁵ and on the section “Implants suppliers” of the RIZIV – INAMI website.ⁱ

2.2.1 Definitions

The terms used in the present report are those described by the European Regulation (see Box 1).

Box 1 – Definitions

The following terms are described in the Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017 on medical devices, *OJ. L* of 5 May 2017, iss.117, 1.^j

- **Medical device:** any instrument, apparatus, appliance, software, implant, reagent, material or other article intended by the distributor to be used, alone or in combination, for human beings for one or more of the following specific medical purposes
 - diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease,
 - diagnosis, monitoring, treatment, alleviation of, or compensation for, an injury or disability,
 - investigation, replacement or modification of the anatomy or of a physiological or pathological process or state,

- providing information by means of in vitro examination of specimens derived from the human body, including organ, blood and tissue donations,

and which does not achieve its principal intended action by pharmacological, immunological or metabolic means, in or on the human body, but which may be assisted in its function by such means. [...]

- **Active device:** any device, the operation of which depends on a source of energy other than that generated by the human body for that purpose, or by gravity, and which acts by changing the density of or converting that energy. Devices intended to transmit energy, substances or other elements between an active device and the patient, without any significant change, shall not be deemed to be active devices.[...]
- **Implantable device:** any device, including those that are partially or wholly absorbed, which is intended to be totally introduced into the human body, or to replace an epithelial surface or the surface of the eye, by clinical intervention and which is intended to remain in place after the procedure. Any device intended to be partially introduced into the human body by clinical intervention and intended to remain in place after the procedure for at least 30 days shall also be deemed to be an implantable device. In the present report both terms ‘implant’ and ‘implantable device’ are used indifferently.
- **Invasive device:** any device which, in whole or in part, penetrates inside the body, either through a body orifice or through the surface of the body.

ⁱ <https://www.riziv.fgov.be/nl/professionals/individuelezorgverleners/verstrekkers-van-implantaten/Paginas/default.aspx>
<https://www.inami.fgov.be/fr/professionnels/sante/fournisseurs-implants/Pages/default.aspx>

^j <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0745&from=DE>



2.2.2 The CTIIMH – CRIDMI

The devices covered in the present section are implants and invasive medical devices for which reimbursement requests are evaluated by the CTIIMH – CRIDMI. Some invasive devices (e.g. internal sutures) and non-invasive medical devices are excluded such as solutions for bladder irrigations, care materials (pumps for medicines, plaster material, etc), diagnostic devices (e.g. blood pressure monitors), insulin syringes, probes for “autosondage” at home. The reimbursement of these devices is settled by the Royal Decree (RD) of 23 November 2021 setting the procedures, terms and conditions for reimbursement by the health insurance of the provisions referred to in art. 34, 1st section, 5° a), 19°, 20° and 20bis of the health insurance act, coordinated on 14 July 1994.^k The RIZIV – INAMI organ qualified to evaluate requests for reimbursement for these devices is the CTFPV – CRPPP (see Figure 2).

The reimbursement procedure for implants and invasive medical devices is settled by the RD of 25 June 2014^l establishing the procedures, terms and conditions of health and disabilities insurance in the costs of implants and invasive medical devices. This RD was recently adapted in 2019 (RD of 17

May 2019 modifying the RD of 25 June 2014). The patient co-payment is regulated by the RD of 29 June 2014^m.

Once an implantⁿ or long-term invasive medical device has received the CE label and has been notified to the Federal Agency for Medicines and Health Products (Federaal Agentschap voor Geneesmiddelen en Gezondheidsproducten – Agence Fédérale des Médicaments et des Produits de Santé, FAGG – AFMPS), a distributor can introduce a request for reimbursement to the CTIIMH – CRIDMI. The same procedure applies for an amendment or a removal from the list of reimbursed devices. The Minister of Social Affairs can as well make a request for reimbursement, amendment or removal from reimbursement. Since 1st August 2019, requests can also be made by scientific or professional associations.

The CTIIMH – CRIDMI is composed of voting members (experts from Belgian universities, sickness funds, hospital pharmacists and physicians) and nonvoting members (hospital administrators, representatives of the industry (beMedTech)), representatives of the Federal Agency for Medicines and Health products (FAGG – AFMPS) and the three FPS (Federal Public Services) Social Affairs, Budget and Health, Food Chain Safety and

^k Koninklijk besluit van 23.11.2021 tot vaststelling van de procedures, termijnen en voorwaarden waaronder de verplichte verzekering voor geneeskundige verzorging en uitkeringen tegemoetkomt in de kosten van de verstrekkingen bedoeld in artikel 34, eerste lid, 5° a), 19°, 20° en 20bis van de wet betreffende de verplichte verzekering voor geneeskundige verzorging en uitkeringen, gecoördineerd op 14 juli 1994, *B. S. 15 december 2021* - Arrêté royal du 23.11.2021 fixant les procédures, délais et conditions dans lesquelles l'assurance obligatoire soins de santé et indemnités intervient dans le coût des fournitures visées à l'article 34, alinéa 1er, 5° a), 19°, 20° et 20bis de la loi relative à l'assurance obligatoire soins de santé et indemnités, coordonnée le 14 juillet 1994, *M. B. 15 décembre 2021*.

^l Koninklijk besluit van 25.06.2014 tot vaststelling van de procedures, termijnen en voorwaarden inzake de tegemoetkoming van de verplichte verzekering voor geneeskundige verzorging en uitkeringen in de kosten van implantaten en invasieve medische hulpmiddelen, *B.S. 1 Juli 2014* – Arrêté

royal. du 25.06.2014 fixant les procédures, délais et conditions en matière d'intervention de l'assurance soins de santé invalidité dans le coût des implants et des dispositifs médicaux invasifs, *M. B. 1 juillet 2014*.

^m Koninklijk besluit van 29.06.2014 tot vaststelling van het persoonlijk aandeel van de rechthebbenden in de kosten van de in het raam van de verplichte verzekering voor geneeskundige verzorging en uitkeringen vergoedbare implantaten en invasieve medische hulpmiddelen, *B.S. 2 Juli 2014* – Arrêté royal. du 29.06.2014 fixant l'intervention personnelle des bénéficiaires dans les coûts des implants et des dispositifs médicaux invasifs remboursables dans le cadre de l'assurance obligatoire soins de santé et indemnités, *M. B. 2 juillet 2014*

ⁿ Invasive medical devices for short-term use (remaining less than 30 days in the body) do not have to be notified



Environment and a representative from the RIZIV – INAMI Service for Medical Evaluation and Control (DGEC – SECM).

The CTIIMH – CRIDMI evaluates requests for reimbursement according to the criteria described in the RD of 25 June 2014 (Box 2). All of the criteria or some of them are taken into account according to the class of the device defined by the therapeutic (added) value (see Box 3). To allow the Commission to assess how the criteria are met, the request must include, among others, the notification code, the CE certificate, a scientific justification for the reimbursement request, epidemiological data, clinical, and also cost-effectiveness studies in case of a claimed added value compared to existing alternatives. In particular, the patient target group must be quantified and motivated, based on epidemiological data if available. **The annual budgetary impact has to be detailed and motivated, and must include the budgetary impact on drug consumption, hospitalisation length and possible avoided hospitalisations or interventions.** The transversality of budgetary impact is explicitly mentioned in the manual of the web application IRREQ allowing to introduce a reimbursement request for a medical device.^o

Box 2 – Criteria applied by the CTIIMH – CRIDMI to take a reimbursement decision

1. The therapeutic value of the implant or invasive medical device
2. The proposed individual price and reimbursement basis
3. The value in the medical practice according to the therapeutic and social needs
4. The budgetary impact
5. The cost-effectiveness.

Box 3 – Classes of implants and invasive medical devices according to the therapeutic value and possible therapeutic and health economic added value

The RD of 25 June 2014 defines four categories of implants and invasive medical devices:

- Class 1: device with a proven added value compared to existing therapeutic alternatives (all criteria of Box 2 are taken into account in the decision).
 - Subclass 1a: the list contains no intervention giving an appropriate description for the device yet.
 - Subclass 1b: the list already contains an appropriate description of the intervention but the device offers an added-value compared to all the other devices falling under this description.
- Class 2: device equivalent to existing therapeutic alternatives, without added value.
 - Subclass 2a: the list contains no intervention giving an appropriate description for the device yet (criteria 1 to 4 in Box 2 apply).
 - Subclass 2b: the list already contains an appropriate description of the intervention but the device must be listed on a nominative list (criteria 1 and 2 in Box 2 apply).

^o <https://www.inami.fgov.be/nl/toepassingen/Paginas/irreq.aspx>
<https://www.inami.fgov.be/fr/programmes-web/Pages/irreq.aspx>



2.2.3 The list and the nominative lists

The reimbursement is organized based on two types of lists: the '**list**' and the **nominative lists**, which are the Annex I and II to the RD of 25 June 2014. The '**list**' consists of services ("verstrekkingsen – prestations") of reimbursed implants and invasive medical devices. The '**list**' is organized in 13 chapters, themselves subdivided into subchapters (A: ophthalmology, B: neurosurgery, C: otorhinolaryngology, D: urology and nephrology, E: abdominal surgery and digestive pathology, F: thoracic and cardiac surgery, G: vascular surgery, H: gynaecology, I: pulmonology and respiratory system, J: plastic and reconstructive surgery K: surgery in general, L: orthopaedics and traumatology, and M: others). For each intervention (e.g. A.3.1. Interventions on crystalline lens, 150135 – 150146 intra-ocular lens in polymethylmethacrylate), the '**list**' gives the reimbursement basis, the specific reimbursement conditions, the reimbursement category (as explained below and in Box 4), the related medical billing codes, if applicable the ceiling or the maximum price, the patient co-payment expressed as a percentage of the reimbursement basis, the safety margin expressed as a percentage of the reimbursement basis that can be charged as a supplement to the patient, the amount reimbursed and, if applicable, the reference of the **nominative list**. The '**list**' does not indicate the delivery margin borne by the patient covering the storage, sterilisation and delivery of devices by the hospital pharmacy (=10% of the price with a maximum of €148.74)

The **nominative lists** contain the list of individual reimbursed implants and invasive medical devices, coupled with an intervention of the '**list**'. They were 88 at the time of writing, May 2023 (e.g. neurostimulators, disc prostheses, cardiac valves, hip prostheses, Parkinson devices, etc.).

These lists are applicable in the three following cases:

1. Active implants (requiring a source of energy such as e.g. defibrillators, pacemakers, cochlear implants)
2. When there is a need for additional evidence on the quality of the medical device (clinical trial, lifetime of the device, ...).
3. When there is a need to control for the invoicing (in particular for complex and expensive devices).

When a nominative list has been added to the service in the list, an application for reimbursement must be made individually. Each list gives for each device the individual price, the reimbursement amount, the patient supplement (safety margin x reimbursement basis) and the delivery margin borne by the patient.

Implants and invasive medical devices may be reimbursed under 8 categories listed in Box 4, depending a.o. on the inscription on a nominative list or not. Each category is subdivided into subcategories identified by a small letter at the third position, defining the patient's co-payment as a percentage of the reimbursement basis: a=0%, b=25%, c=45%, d=55%, e=88%, f=5%, g=10%, h=15%, i=20% and j=30%.

Implants and invasive medical devices of category A are reimbursed up to the ceiling price indicated in 'the '**list**' or up to the price as listed in the nominative list when inferior to the ceiling price. They are excluded from reimbursement if their price exceeds the ceiling price. For categories B and C, a maximum price is set in the '**list**'. In accordance with article 102 of the Hospitals Law^p, these implants or invasive medical devices can be neither reimbursed nor charged to the patient at all by the hospital when purchased at prices exceeding their maximum prices (see Figure 3). For the lump sum reimbursement (categories D & E), the hospital is free to negotiate the price with the distributor in order to purchase it at a lower price than the lump sum

^p Gecoördineerde wet op de ziekenhuizen en andere verzorgingsinrichtingen, B.S. 7 november 2008 - Loi coordonnée sur les hôpitaux et autres établissements de soins du 10 juillet 2008, M.B. 7 novembre 2008.



that will be reimbursed to the hospital. If the price exceeds the lump sum, the difference is borne by the hospital, not the patient. In case of a limitative list (Category E), no individual price is listed as the lump sum is reimbursed whatever the selling price. Devices reimbursed based on their price with no limitative list fall under category F. An implant or medical device may also be reimbursed temporarily under category G, allowing for evidence to be collected in order to clear up the uncertainty on its added value. Finally, category H covers the devices that are reimbursed under a contract, which is the last reimbursement option when the Restricted Clinical Application procedure did not end up in a final proposal.

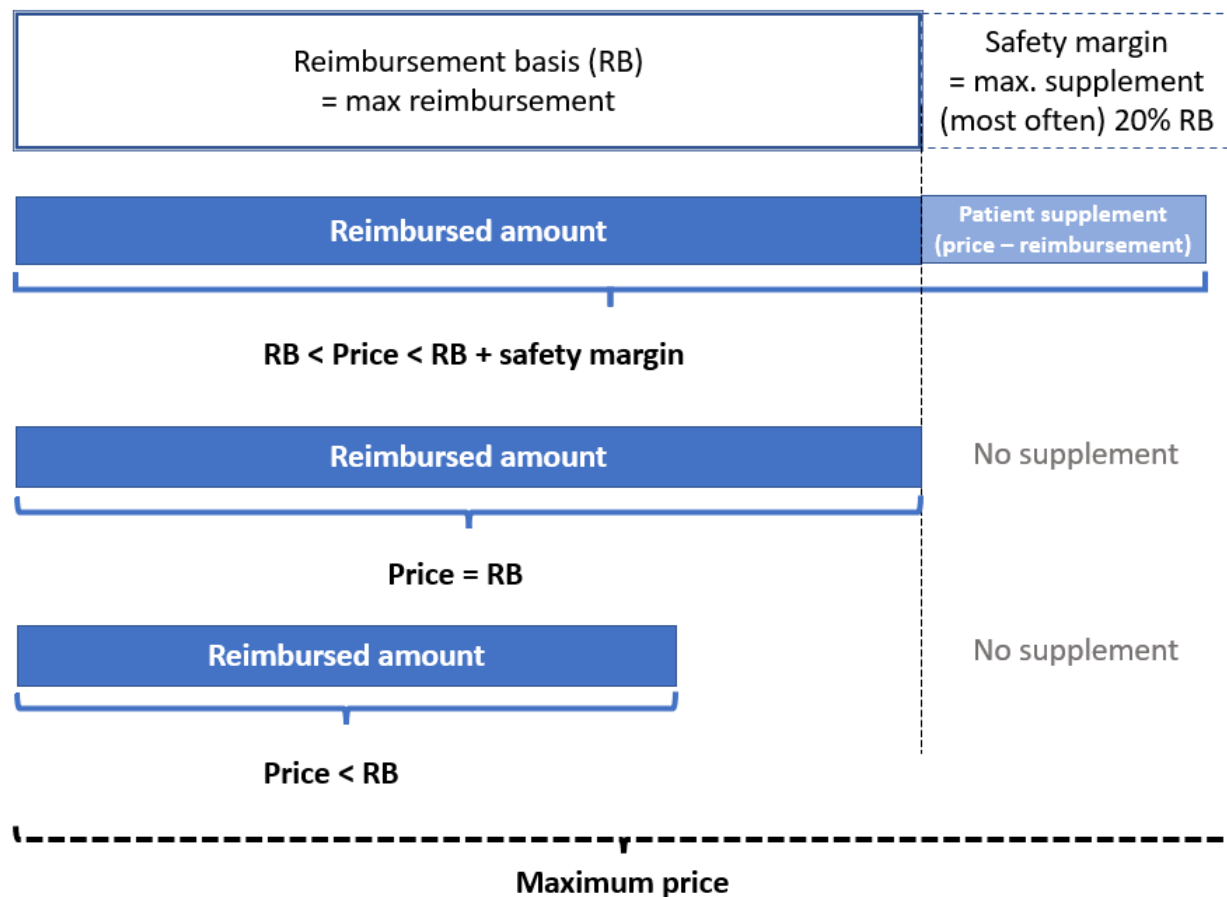
Box 4 – Reimbursement categories on ‘the list’

Categories I and II correspond to the implants (I) and the invasive medical devices (II). They are both subdivided into the following subcategories:

- A: reimbursement based on an individual price when included in the nominative list.
- B: NO lump sum reimbursement, NOT in the nominative list.
- C: NO lump sum reimbursement, in the nominative list
- D: lump sum reimbursement, NOT in the nominative list.
- E: lump sum reimbursement, in the nominative list.
- F: reimbursement based on sale price, VAT included (no nominative list).
- G: reimbursement in a Restricted Clinical Application when the CTIIMH – CRIDMI proposes to temporarily reimburse under specific research conditions a medical device coming within a technological innovation for which there is still uncertainty on the added value compared to existing therapeutic alternatives.
- H: reimbursement under contract between applicant and the RIZIV – INAMI when the CTIIMH – CRIDMI has not been able to formulate a final reimbursement proposal for a Restricted Clinical Application.



Figure 3 – Reimbursement based on a maximum price and a safety margin (category B & C)



No reimbursement
(and no supplement)
if $\text{Price} > RB + \text{safety margin}$



Example: Thrombectomy material (category II.D)

The material used during a mechanical thrombectomy consists of a kit used to extract the thrombus and in some cases, depending on the technique used, one or more optional thrombus stent retrievers to capture the thrombus before extraction. The kit (depending on the technique, e.g. pump, catheters, retrieval bag) is billed under codes 182136 – 182140 and the possible stent retrievers under codes 182151 – 182162.

In case of a proximal lesion (not distal) additional material can be billed under 182173 – 182184.

The thrombectomy material is listed under chapter G.2. (G=vascular surgery, 2=Thrombectomy or embolectomy material) of the **list** of interventions. The devices are reimbursed under category II.D.a, which means that they are invasive medical devices (not implantable), reimbursed a lump sum and are not listed on any nominative list. The subcategory 'a' indicates that there is no patient co-payment.

Codes (day care – overnight stay)	Label	Reimbursement basis	Safety margin	Maximum price	Reimbursement	Patient co-payment	Patient supplement
182151 – 182162	All material necessary for the endovascular extraction of a thrombus by aspiration, or necessary for the use of a thrombus retriever in an endovascular intracranial mechanical intracranial thrombectomy procedure, in case of ischaemic stroke	€2971.5	n.a.	n.a.	€2971	€0	n.a.
182173 – 182184	All dilatation material and any stent used in endovascular treatment of a proximal arterial constriction to provide access for endovascular extraction of an intracranial thrombus, in case of ischemic stroke	€891.45	n.a.	n.a.	€891.45	€0	n.a.
182136 – 182140	One or more thrombus retrievers used in an endovascular intracranial mechanical thrombectomy procedure for ischaemic stroke	€4457.25	n.a.	n.a.	€4457.25	€0	n.a.

Amounts valid as of 16 March 2023. N.a. non applicable. Codes 182136-182140, 182151-182162 and 182173-182184 can only be billed once per hospitalisation.

Note that a necessary reimbursement condition is that the hospital where the thrombectomy is performed must be licensed as a centre specialized in invasive acute stroke care.

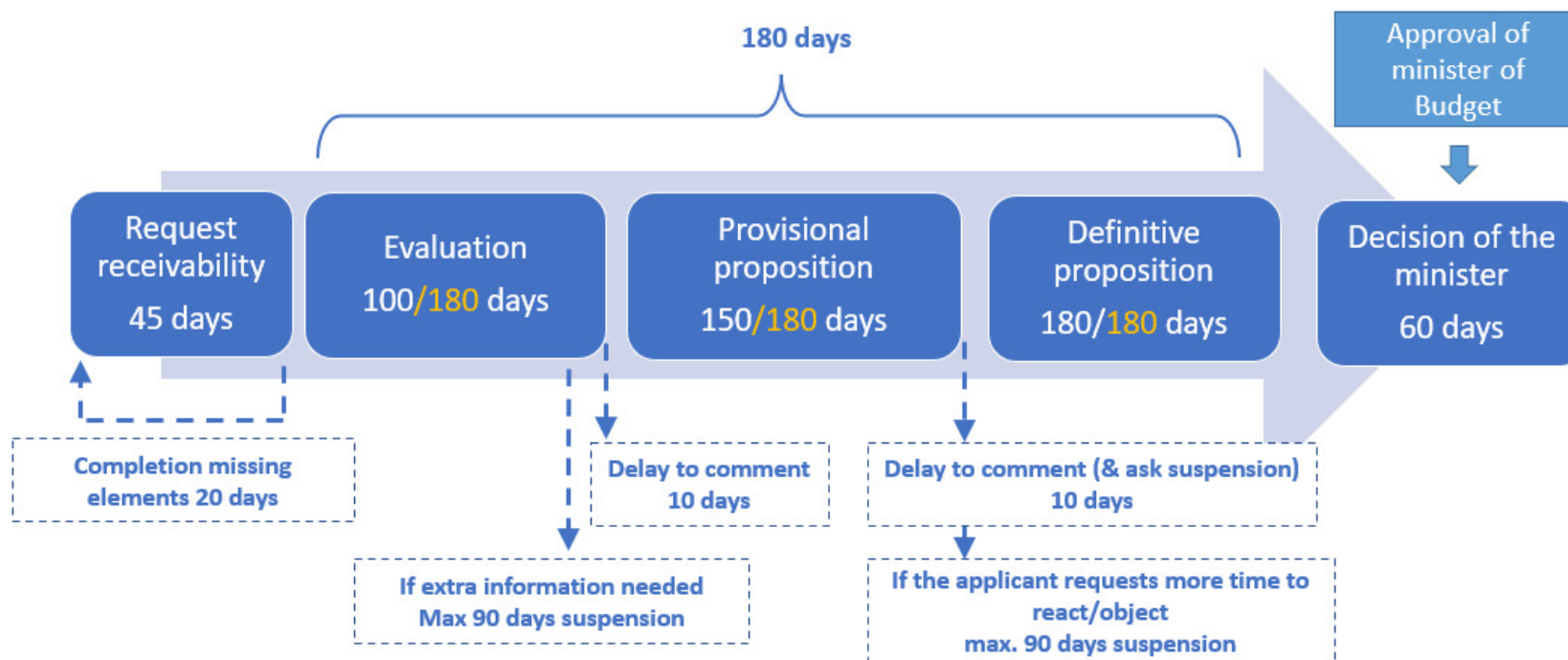


2.2.4 *The procedure*

Figure 4 presents the procedure to modify the list of interventions of reimbursed implants and invasive medical devices. When a reimbursement request is introduced (by a distributor or a professional or scientific association) for a new intervention on the **list** (e.g. in case of a new technology or a new indication) or a suppression from 'the list' (by a distributor), the request admissibility is evaluated by the CTIIMH – CRIDMI secretariat and notified within 45 days. In case of missing information, the request must be completed within 20 days, after which the 45 days evaluation period is reinitialized. If the request is admitted, the CTIIMH – CRIDMI has 100 days to write an evaluation report and transmit it to the applicant. The Commission appoints one or more internal or, if judged necessary, external experts to do the evaluation. The applicant has ten days to send potential remarks or objections on the evaluation report. The CTIIMH – CRIDMI makes then a motivated reimbursement proposal. The term to communicate the proposal is 180 days if the proposal meets the request and 150 days if it differs from the request. In that last case, the distributor has ten days to react and the possibility to obtain maximum 90 days to submit comments and objections (that must be discussed in the CTIIMH – CRIDMI plenary session within 25 days after submission). Otherwise, the proposal becomes definitive. The last step is the approval by the Minister of Social Affairs. The Minister of Social Affairs has 60 days to take a decision, given that he/she receives the Minister of Budget's approval of the budgetary impact within 30 days. The final decision may diverge from the CTIIMH – CRIDMI proposal for social or budgetary reasons. Note that if the CTIIMH – CRIDMI does not draw up a proposal and the Minister does not take a final decision in the legal time limits, the distributor's or association's request is accepted as such.



Figure 4 – Modification procedure for ‘the list’



Source: Adapted from: <https://www.inami.fgov.be/fr/professionnels/sante/fournisseurs-implants/Pages/remboursement-implants-dispositifs.aspx> Evaluation, provisional proposition if need be and definitive proposition must all be made in the 180 days after the communication of request receivability: Evaluation at the 100th day (100/180), provisional proposition at the 150th day (150/180) and definitive proposition at the 180th at the latest (180/180).



The timing described above applies only for implants and invasive medical devices for long-term use (staying in the body for at least 30 days)^a of class 1 or 2a (see Box 3). In other cases, and when the initiator is the Minister of Social Affairs or the CTIIMH – CRIDMI, no legal terms are imposed.

After the request evaluation, the CTIIMH – CRIDMI may also propose a temporary reimbursement in a **Restricted Clinical Application** (category G in 'the list', see Box 4) for scientific reasons (not budgetary) when some uncertainty exists around the added-value of a technological innovation. The proposal sets the term of the reimbursement and evaluation period and can list conditions in terms of qualification criteria for the centres where the device will be used and reimbursed, qualification criteria for the health care providers, reimbursable indications, total or annual maximum number of reimbursed devices, specific criteria to be enlisted on a nominative list, data to collect and description of the evaluation.

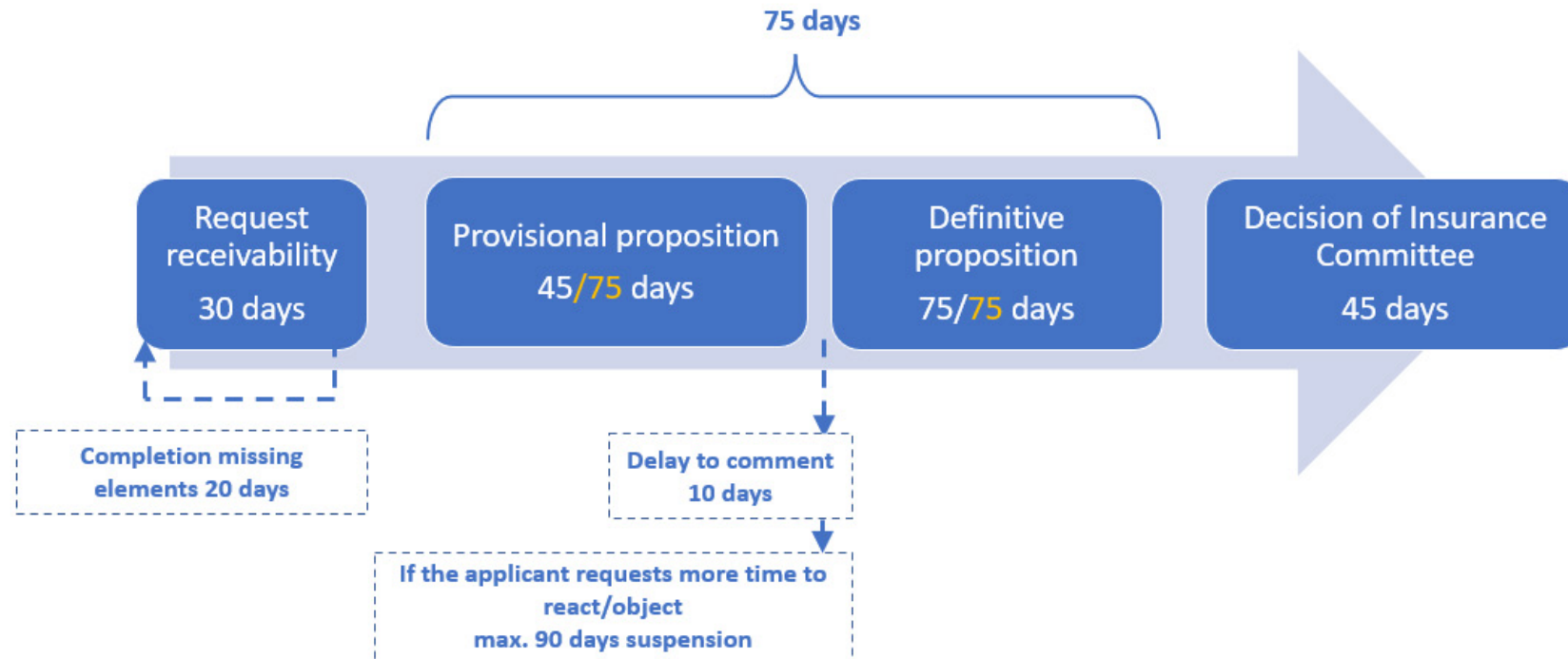
Finally, if the CTIIMH – CRIDMI did not formulate any definitive motivated proposal in the legal time limit and if the CTIIMH – CRIDMI proposed a Restricted Clinical Application, a company can ask to sign a 1- to 5-year **contract** with the RIZIV – INAMI (category H, see Box 4) (remark: this is not applicable for a request from a scientific or professional association). The request must be sent within seven days to the Minister of Social Affairs, who has seven days to approve the request. If the request is approved, the RIZIV – INAMI sets up a working group with members representing the Ministers (Social Affairs and Budget), the sickness funds, the distributor, the industry and a member designated by the CTIIMH – CRIDMI. The Inspector of Finances may attend the meetings of the working group in order to give an opinion to the Minister of Budget. A contract can be signed if both

Ministers and the company come to an agreement. The Minister may decide to modify the 'list' either in absence of a contract or according to the terms of the contract. The contract sets the price, the reimbursement basis, the methodology for the scientific report and evaluation by the distributor during the contract, the possible compensation for the budgetary risks when the reimbursement basis is not proportional to the criteria listed in Box 2.

To introduce an implant or invasive medical device on a **nominative list** or remove it from the list, the company is notified within 30 days of the admissibility of the request. In case of missing information, the request must be completed within 20 days. Once the request is admitted, the CTIIMH – CRIDMI has 45 days to evaluate the request and make a provisional motivated reimbursement proposal, different from the request or 75 days for a definitive one, corresponding to the request. If the proposal differs from the request, the company has ten days to react and the possibility to obtain maximum 90 days to submit comments and objections (that must be discussed in the CTIIMH – CRIDMI plenary session within 25 days after submission). Otherwise, the proposal becomes definitive. Since 1st August 2019, the 75 days is restricted to 45 days when the request concerns a distributor name modification, or when the device distribution is taken over or co-distributed by another distributor. The definitive motivated proposal is transmitted to the Insurance Committee (not the Minister contrary to request of adaptation to 'the list'), including the nominative list as well as the device name, identification, distributor and price. The Insurance Committee must take a motivated decision within 45 days, otherwise, the definitive motivated proposal is automatically accepted.

^a NB: Invasive medical devices for long-term use are deemed to be 'implantable devices' by the European Medical Device Regulation.

Figure 5 – Modification procedure for the nominative lists



Source: Adapted from: <https://www.inami.fgov.be/fr/professionnels/sante/fournisseurs-implants/Pages/remboursement-implants-dispositifs.aspx> Evaluation and definitive proposition must all be made in the 75 days after the communication of request receivability: Evaluation at the 45th day (45/75) and provisional proposition at the 75th day at the latest (75/75).

Specific procedures were introduced by the RD of 17 May 2019 to suspend a device from a nominative list following a withdrawal from the Belgian market, and to lift such a suspension. Nevertheless, these specific procedures were considered out of scope and therefore not described in the present report.



2.3 The health care responsibilities of and data transmission by the federated instances

In Belgium, responsibilities for health policy are shared between the federal level and the federated entities (regions and communities).

Since the 1980 state reform, health promotion and disease prevention were explicitly assigned to the communities. Since the sixth state reform of 2011-12, the communities and regions have also become responsible for financing facilities that provide rehabilitation (except when the rehabilitation take place in a general hospital), psychiatric care homes, nursing homes, sheltered housing initiatives, multidisciplinary support teams and mobility aids.

The initial RIZIV – INAMI pseudo-nomenclature of the transferred sectors has been gradually replaced by regions and communities own nomenclatures. Registration of billing in these transferred sectors now takes place through regional pseudo-codes and correspondence tables between the regional pseudo-codes and the former RIZIV – INAMI pseudo-codes exist. The regional nomenclatures of the transferred sectors that were administered previously by the RIZIV – INAMI are now administered by the [Agentschap Zorg en Gezondheid](#) in Flanders, Agence pour une vie de Qualité ([AVIQ](#), web-interface nomenclature: [Nomenwal](#)) in Wallonia and [Iriscare](#) in Brussels (web-interface: [Nomiris](#)) The German-speaking community manages agreements and conventions but has not developed a nomenclature as such.

RIZIV – INAMI pseudo-codes were still in use for the aforementioned health care at the beginning of the transition period on 1st January 2015. They were progressively replaced by the regional pseudo-codes with which they co-existed for a few years. The transition period ended on 31st December 2021 and since then, only the regional pseudo-codes can be used by health care providers. Nevertheless, agreements were concluded between the federal government and the federated entities to maintain, during the transition period, the registration of RIZIV – INAMI pseudo-codes in the data transmitted by the sickness funds to the RIZIV – INAMI and the IMA – AIM, next to new registration of pseudo-codes for the federated entities. The 'old' RIZIV – INAMI pseudo-codes that are still available, e.g. in the Doc. N; for 2015-2021 were reimbursed by the federated entities but still allow to

characterize and analyze the Belgian health care consumption on a centralized level, at least for this period until 2021. After this period, the regional reimbursements will be available in the IMA – AIM database but not anymore in the RIZIV – INAMI data. Note that the reimbursements of the German-speaking community are an exception as these are not transmitted to the IMA – AIM.

Since 2019, the specialized hospitals (8 in Flanders) are not legally obliged anymore to transmit their MZG data to the FPS Public Health. Some of these hospitals are specialized, a.o. in cardio-pulmonary (former 710499 revalidatieziekenhuis Inkendaal, Vlezenbeek and 710676 Koningin Elisabeth Ziekenhuis, Oostduinkerke), locomotor (the two aforementioned hospitals as well as 710679 Bundeling Zorginitiatieven Oostende) or neurologic rehabilitation (the two first aforementioned hospitals as well as 710116 Revalidatie & MS Centrum, Overpelt and 710693 Nationale MS Centrum vzw, Melsbroek). They could potentially admit patients for aftercare of medical device implantation or adverse event treatment (e.g. acute stroke).



3 RETROSPECTIVE ANALYSIS OF TWO CASES

3.1 The case of mechanical thrombectomy

3.1.1 Background information

In the period 2015-2017 the commission received five files from an equal number of distributors for the reimbursement of the material used for mechanical thrombectomy (MT) in case of ischemic stroke. The files comprised each a medico-technical part, an economic part with price, estimated volume and budget impact, a scientific part and a proposal for tariffs setting. In response to these files, the commission drafted a proposal for reimbursement, comprising an adjusted budget impact estimate, to the Minister of Social Affairs. The Minister approved the reimbursement and subsequently the material for mechanical thrombectomy was reimbursed since 1 July 2017.

3.1.2 PICO of the reimbursement request

In this section, we will briefly describe the reimbursement request, in terms of patient population (P), the intervention-under-evaluation (I) and its comparator (C), as well as which outcomes (O) the intervention claims to improve. We refer to Table 2 for the PICO. This PICO is constructed on the basis of the reimbursement requests and evaluation files; the adequacy of the PICO was not critically assessed.

According to the reimbursement files, mechanical thrombectomy is intended for the treatment of patients with acute ischemic cerebral infarction (acute ischemic stroke) caused by intracranial occluded blood vessels, or in patients who are not eligible for intravenous thrombolysis (IVT) or who do not react on treatment with IVT. In the reimbursement files, the population of patients eligible for mechanical thrombectomy corresponds to the patients who are eligible for IVT, in which a blood vessel of large size is occluded. There should be no significant ischaemic injury. IVT alone is the comparator used in the reimbursement files.

The outcome used is the modified Rankin Scale (mRS). This scale is frequently used as measure for the functional outcome for stroke (including ischemic stroke). mRS is measured by a structured interview. The mRS score goes from 0 (no symptoms at all) to 5 (severe disability) and 6 (death).

Table 2 – The PICO for the case of mechanical thrombectomy

PICO element	Description
Population	• Patients with acute ischemic cerebral infarction (stroke) • With an occlusion of an intracranial vessel with a medium or high clinical NIHSS-score (National Institute of Health Stroke Scale) • With an occlusion of specific arteries, like intracranial carotid artery, middle cerebral artery (M1 or M2), or anterior cerebral artery (A1 or A2) • Treatment within 6 hours of onset of stroke
Intervention	Mechanical thrombectomy (MT), in combination with IVT
Comparator	The comparator treatment is Intravenous thrombolysis (IVT) alone
Outcome	Modified Rankin Scale (mRS), measuring the degree of dependency after stroke: 0 No symptoms 1 No significant disability. Able to carry out all usual activities, despite some symptoms. 2 Slight disability. Able to look after own affairs without assistance, but unable to carry out all previous activities; 3 Moderate disability. Requires some help, but able to walk unassisted. 4 Moderate severe disability. Unable to attend to own bodily needs without assistance, and unable to walk unassisted. 5 Severe disability. Requires constant nursing care and attention, bedridden, incontinent. 6 Dead In studies, the outcome is usually mRS at 90 days. The scores can be grouped, e.g. $mRS \leq 2$ or $mRS \leq 1$.



3.1.3 Overview of inputs from the budget impact analyses

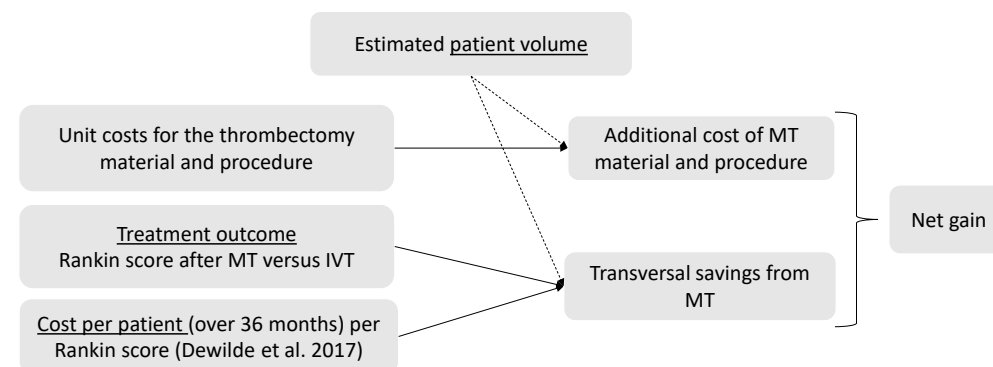
In all of the distributors' submitted files, as well as the commission's proposal, the budget impact is calculated in a similar way (see Figure 6). First of all, an extra cost on the budget for implants and invasive medical devices (MDs) is calculated for the MT material. Secondly, the impact on other budgets which cover follow-up and rehabilitation is estimated. As there are no randomised clinical trials (RCTs) calculating the impact of MT on follow-up and rehabilitation costs directly, the cost impact is estimated in an indirect way, combining the results from clinical studies with the results from a cost study. Savings from MT on these 'transversal' budgets are calculated based on evidence (presented in the submission files) that treatment with MT gives better results in terms of patient autonomy (measured by mRS score), on one hand, and data from a Belgian study on cost per patient by Rankin score, for the first and consecutive years after stroke, on the other hand. Combining both types of studies, MT is expected to reduce rehabilitation costs. Finally, according to the calculations in the reimbursement requests, subtracting the expected savings on follow-up and rehabilitation from the extra cost for the thrombectomy material, and in some cases a procedure tariff, results in an expected net saving.

It frequently occurs that cost parameters are not included in the clinical studies, and even when they are included, they are not necessarily representative for the Belgian health care organization, as many of the existing studies have been performed abroad. Therefore, the distributors and RIZIV – INAMI have to make indirect calculations, combining results from clinical studies with cost data for the Belgian situation. Such detailed cost data are however also often not directly available, neither in studies, neither from real-world data as often too limited data is available on patient characteristics in the real-world data. This case of mechanical thrombectomy was rather an exception as there was a detailed Belgian cost study available, measuring the follow-up and rehabilitation costs for patients after stroke according to mRS score. This study used data collected through two case report forms, one for patients or their caregivers and one for neurologists. The data collected through these case report forms also comprised data that are not available in the national databases, notably mRS score of each patient. So, should this cost study not have been

available, it would not have been possible to replicate the resulting data on the basis of national databases.

Both distributors and RIZIV – INAMI relied on this cost study to estimate the budget impact. The main question RIZIV – INAMI posed in the context of this report is whether, currently, several years after the reimbursement approval, the real budget impact can be verified on the basis of real-world data.

Figure 6 – Budget impact calculation method in the submitted files



The main input variables included in the BIAs are the following: patient volume, cost of the implant materials, cost of the medical procedure, and other costs related to hospitalisation, follow-up and rehabilitation. These input variables are stepwisely discussed in the following parts.



3.1.3.1 Patient volume

Distributors

The distributors based their estimates on volume of patients on the incidence of ischemic CVA in Belgium, to which they applied an estimated percentage for those patients potentially eligible for IVT and a further percentage applied to that for those patients eligible for MT. Some distributors take into account a gradual growth in patients treated with MT over the years, others consider a fixed number of patients and make no projections for the years afterwards. Overall, the number of treated patients is estimated between 900 and 1575 three years after reimbursement.

RIZIV – INAMI

In the RIZIV – INAMI proposal the commission assumed 1000 to 1600 cases treated with MT with 1300 as most likely estimate, considering an estimate from the National Council for Hospital Facilities (Nationale Raad voor ZiekenhuisVoorzieningen – Conseil National des Etablissements Hospitaliers, NRZV – CNEH^r), consensus between contacted neuroradiologists and further analyses and information in the files.

KCE Comment

Data available for patient volume estimation at the time of submission/evaluation of reimbursement files

The identification of the thrombectomy target group could not be done based on the national administrative databases (EPS, IMA – AIM or TCT data) because no administrative database contains information on eligibility for thrombectomy (or thrombolysis).

There are diagnostic codes characterizing the different cerebral infarctions and an APR-DRG code for acute stroke (ICD-10-CM I63 “Cerebral infarction” and APR-DRG “045 CVA & Precerebral Occlusion with Infarct” in TCT data), but not every hospitalised patient for acute stroke is a candidate for a thrombectomy. Applying a percentage from the literature would approximately quantify a theoretic target group for whom no cost calculation would be possible (see further). In the MZG – RHM data, mechanical thrombectomy is coded under ICD-10-BE procedure depending on the localization (03C**ZZ). Nevertheless, selecting the mechanical thrombectomies in the MZG – RHM data (or in the TCT data) would not have solved the volume question as pre-reimbursement likely only a limited number of patients were treated with mechanical thrombectomy (less than the volume of patients eligible for MT) and furthermore it is not sure whether the patients already treated with MT pre-reimbursement also meet the indication criteria defined for this reimbursement request. Note also that the MZG – RHM diagnoses and procedures data for 2015 are unexploitable as this registration year is the transition year between the ICD-9-CM to the ICD-10-BE coding system; 2015 records were considered as a first exercise for the hospitals but are not valid enough to be used.

Furthermore, thrombolysis products can be identified as they are reimbursed (EPS, IMA – AIM database or TCT data), but thrombectomy may be administered in combination or not with thrombolysis and thrombectomy may be used in other indications. Not every patient receiving thrombolysis is a proper candidate for thrombectomy. Conversely, we verified on the EPS 2017-2019 that some patients received a thrombectomy without thrombolysis, which is not unexpected as thrombectomy is also indicated in patients who are not eligible for IVT. Therefore no ex-ante target delineation could be possible based on the EPS.

^r Former name of the Federal Council for Hospital Facilities (Federal Council for Hospital Facilities (Federale Raad voor ZiekenhuisVoorzieningen – Conseil Fédéral des Etablissements Hospitaliers, FRZV – FNEH)

**Actual case volume (EPS 2017-2019) (currently available data, after start of reimbursement)**

In the case of thrombectomy, the number of cases who benefited from the reimbursed medical device is available in aggregated reimbursement databases such as the Doc. N. Indeed, the code 182151 – 182162 for catheterisation material for either thrombus aspiration or thrombus retrieval is recorded for every patient undergoing MT, possibly in combination with other billing codes (stent retriever, dilatation for proximal arterial constriction). Nevertheless, additional data at the individual patient level are required to be able to identify the cost of the hospitalisation and subsequent treatments. An EPS extraction is possible, provided that the population concerned is sufficient, or an IMA – AIM extraction. TCT data can also be exploited if the material is limited to the hospital setting but will not give access to costs incurred after discharge.

In total, 113 patients were found having undergone a thrombectomy between 2017 and 2019 in the EPS. There were 23 patients younger than 65 years and 90 patients older. Considering the oversampling of older patients, they correspond to 2720 patients over the whole period (66.2% aged 65 or more, n=1800): 440 in 2017, 1140 in 2018 and 1140 in 2019. This total extrapolated number of patients falls in line with the estimation retained by the CTIIMH – CRIDMI and the distributors, i.e. between 1000 and 1600 patients a year, with 1300 as the most probable number. This is confirmed by the number of thrombectomy material codes 182151 – 182162 reimbursed in the Doc N: 376 performed in 2017, 1009 in 2018, 1156 in 2019 and 1187 in 2020.

- For the ex ante analysis, we do not see an easy way to improve the patient volume estimate in the case of mechanical thrombectomy. The identification of the thrombectomy target group could not be done based on the national administrative databases (EPS, IMA – AIM or TCT data) because no administrative database contains information on eligibility for thrombectomy (or thrombolysis). The target patient population cannot be identified on the basis of an existing procedure code (RIZIV – INAMI code) or a clinical ICD-10-BE (diagnostic or procedural) code.
- Even when the reimbursement request could have been anticipated by RIZIV – INAMI, it would have been difficult to create a specific procedure code to detect patients eligible for thrombectomy:
- Who is eligible for MT?
 1. patients who are not eligible for IVT: these patients cannot be flagged even when a specific procedure code would have been created by RIZIV – INAMI;
 2. patients in which IVT was not successful: neither could these patients be flagged with a specific procedure code created by RIZIV – INAMI (whether IVT was successful or not is only known after IVT has been performed; this would also imply that the success of IVT must be judged to choose a procedure code);
 3. as adjacent treatment in patients who received IVT: neither could these patients be flagged with a specific code created by RIZIV – INAMI for IVT.
- For the ex post analysis, the actual patient volume can be identified in the national databases.



3.1.3.2 Cost of the invasive medical device (cost per patient)

Distributors

For the initial **cost of the material** of MT, the estimated costs per case in the submitted files and RIZIV – INAMI proposal are in the range of €6500 to €11 000, based on 1.2 to 1.5 stent-retrievers.

RIZIV – INAMI

In the RIZIV – INAMI proposal, three scenarios are presented: (1) based on consensus by neuroradiologists, (2) results from 3 hospitals and (3) a compromise between scenarios 1 and 2 as estimated by the commission.

- According to a consensus amongst radiologists, 40% of cases would be treated with aspiration, without use of a thrombus retriever (code 182151 – 182162) and the remaining 60% would be treated with aspiration with use of a thrombus retriever (code 182151 – 182162 plus code 182136 – 182140).
- From detailed data from three hospitals, it appeared that in only 15% of cases no thrombus retriever was used, so in 85% of cases a thrombus retriever was used.
- In the compromise scenario from the commission, it is assumed that 25% of cases are treated without use of a thrombus retriever (see Table 3).

For the material 182173 – 182184, the commission assumed a rate of 15% based on consensus amongst neurologists.

Furthermore, the catheter(s) billed in connection with nomenclature code 589175 – 589186 would no longer be reimbursed once the material codes 182151 – 182162 would be admitted to reimbursement. Therefore its cost is subtracted from the other material costs.

The resulting total cost of the materials used, each weighted by their frequency per intervention, amounts to €6148 on average (see Table 3: $75\% \times €4500 + €3000 + 15\% \times €900 - €362$).

Table 3 – Cost of materials used for mechanical thrombectomy

Description and code	Tariff *	Percentage
182136 – 182140: One or more thrombus retrievers used during mechanical thrombectomy in case of ischemic stroke	€4500	75%
182151 – 182162: All other material used during mechanical thrombectomy in case of ischemic stroke	€3000	100%
182173 – 182184: All dilatation and stent material potentially used in endovascular treatment of a proximal arterial occlusion in case of ischemic stroke	€900	15%
161534 – 161545: Use of one or more catheters in connection with nomenclature code 589175 – 589186	€362	- 100%

* Tariffs at the time of the submission/evaluation of the reimbursement file

KCE Comment

Available data on the medical device costs at the time of evaluation of reimbursement files

No real-world reimbursement data was available to estimate the material costs that were going to be billed to RIZIV – INAMI on average per patient at the time of **the reimbursement decision, as it was not reimbursed yet. There was also no data available from billings to the patient in pre-reimbursement phase as it does not concern an implant (if it is not reimbursed, it comes at charge of the BFM – BMF of the hospital).**

Actual medical device costs (currently available data, after start of reimbursement)



The Doc. N database indicates that 2541 all-material codes and 2200 stent retrievers codes were actually billed and recorded between their introduction to reimbursement and 2019, complemented by 248 codes for the dilatation material. The proportion of stent retriever technique is in reality 87% (2200/2541), **leading to a higher budget impact than planned**. About 10% of the thrombectomies required the additional dilatation material. Total average cost of materials used per intervention amount to €6880 for the thrombectomy material plus €21 for the catheters (161534 – 161545) that are used in 6% of the cases.

- **For the ex ante analysis, we do not see a possibility to improve the data on the medical device cost. Even in the future, with the introduction of the UDI, the cost of the (short term) invasive medical device, when used pre-reimbursement, will likely not be available in the real-world data, as only implants and long term invasive medical devices can be charged to patients (when not yet reimbursed). (We will see further however that other costs associated to the implant/invasive medical device (hospitalisation costs, follow-up costs, ...) will be traceable through the UDI.)**
- **For the ex post analysis, the actual medical device reimbursement can be retrieved from the national databases.**

3.1.3.3 *Cost of the physician input (medical procedure) (cost per patient)*

Distributors

At the time of the reimbursement request, there was no specific procedure code for mechanical thrombectomy. Some distributors included the tariff of an existing code, which is however not specific to MT (589175 – 589186^s: €305 at the time of request), others did not include any procedure cost.

RIZIV – INAMI

In the RIZIV – INAMI proposal, no procedure cost is included as there was no concrete proposal yet by TMR – CTM for the new procedure.

KCE Comment

Available data on the medical procedure costs (at the time of evaluation of reimbursement files, before reimbursement)

As there was no proposal for a specific medical procedure code, the fee of an existing medical procedure code could have been used.

Actual medical procedure costs (currently available data, after start of reimbursement)

To date, no specific procedure code for MT has been created yet. From the data, we see that the codes 589175 – 589186 were billed. At the time of writing this report, the fee amounted to €327.82.

^s 589175 – 589186 Percutaan inbrengen onder controle door medische beeldvorming van endovasculaire catheters met het oog op de rekanalisatie van een gedocumenteerde vasculaire occlusie, door fibrinolyse, door mechanische rekanalisatie, door aanwending van energie (thermische, laser, radiofrequentie) en door aspiratie inclusief de manipulaties en controles tijdens de behandeling en het gebruikte materiaal, exclusief de angioplastiekcatheters, de farmaca en contrastmiddelen. Voor de andere

bloedvaten dan de coronaire – Introduction percutanée sous contrôle d'imagerie médicale de cathéters endovasculaires visant à la recanalisation d'une occlusion vasculaire documentée, par fibrinolyse, par recanalisation mécanique, par utilisation d'énergie (thermique, laser, radiofréquence) et par aspiration, y compris les manipulations et contrôles pendant le traitement ainsi que le matériel utilisé, à l'exclusion des cathéters d'angioplastie, des produits pharmaceutiques et de contraste. Pour les vaisseaux autres que les vaisseaux coronaires.



- **From hindsight, it appears that for the ex ante analysis, the most precise input for the procedure cost was the tariff of an already existing code. However, it was not known at the time that this code was also going to be used for mechanical thrombectomy. For the ex post analysis, the actual procedure costs can be retrieved from the national databases.**

3.1.3.4 Other costs (hospitalisation, follow-up and rehabilitation) (cost per patient)

Introducing MT also has an impact on other sectors than only the implant/invasive medical devices sector. As treatment with MT has a positive impact on the functional status of patients, MT is expected to lead to net cost savings, in terms of **hospitalisation, follow-up and rehabilitation costs** after stroke. It has to be noted that treatment with MT is also expected to reduce deaths (because of stroke or in the months after stroke), and thereby may lead to higher costs for those saved lives; however, it was expected that overall (for the whole patient group) MT would lead to savings.

There was no comparative study which examines the impact of treatment with MT on costs directly. Therefore the impact of treatment with MT on costs was estimated in an indirect way, by combining the impact of treatment with MT on the mRS score, on one hand, with data on costs measured per mRS score, on the other hand. The study of Dewilde et al. (2017) showed that a better functional status (mRS score) was associated with lower hospitalisation and rehabilitation costs in the year of the procedure as well as in consecutive years. All of the submitted files used data from Dewilde et al. (2017) on the cost per patient per Rankin score in the first and consecutive years after stroke.

This study of Dewilde et al. (2017) collected data on resource use using two case report forms, one for patients or their caregivers and one for recruiting neurologists. Outpatient resource use from patients and caregivers was self-reported, whereas inpatient resource use was derived from medical records. The inpatient data collected during the initial stroke hospitalisation related to days spent in an acute bed, in a general or stroke ward and in a rehabilitation bed.

Outpatient data concerned the number of visits to the emergency ward, neurologist, cardiologist, geriatrician, rehabilitation doctor, general practitioner (GP), nurse, physiotherapist, occupational therapist, speech therapist, and neuropsychologist; all differentiated whether the visit took place at the doctor's office or at the patient's home. In addition, hospital readmission, residency in rehabilitation facilities and nursing homes, as well as days spent in a day care center and ad hoc rehabilitation therapy were registered.

Resource use for outpatient care was valued using the National Tariff unit costs (Nomenclatuur – Nomensoft). The cost of all hospital admissions was based on a national average per-diem cost multiplied by the length of stay (LOS), plus the cost of medication, laboratory tests, and imaging. The medication, laboratory tests and imaging data were obtained from ischemic stroke hospitalisation claims data in 4 out of the 10 participating hospitals.

Note that there was also additional imagery in case of MT. This cost was included in the hospitalisation cost.

As already mentioned, this was rather an exceptional case for the RIZIV – INAMI as this detailed cost study on cost per patient by mRS score in a Belgian setting was available. In other reimbursement files, often such detailed cost study in a Belgian setting is not available. Should this study not have been available, then it would not have been possible to replicate the results on the basis of national databases, as in the latter, no information is available on the mRS score of the patient.

**Description of the study Dewilde et al. (2017) “Modified Rankin scale as a determinant of direct medical costs after stroke”****Methods**

Multicentre study: 10 academic and nonacademic centers

Data collection: acute and chronic in- and outpatient resource use in survivors of ischemic stroke, stratified by levels of disability according to the modified Rankin Scale. The following costs are covered:

- Hospitalisation costs of the initial stroke hospitalisation: acute bed, in a general or stroke ward, and rehabilitation bed
- Outpatient costs: visits to emergency ward, neurologist, cardiologist, geriatrician, rehabilitation doctor, general practitioner, nurse, physiotherapist, occupational therapist, speech therapist, and neuropsychologist
- Hospital readmission
- Residency in rehabilitation facilities and nursing homes, days spent in a day care center and ad hoc rehabilitation therapy.

Statistical inference on costs at each level of the modified Rankin Scale was estimated using a general linear model for the first three months, the first year, and any subsequent year after ischemic stroke.

Results

A total of 569 survivors of ischemic stroke were enrolled.

Costs varied substantially over time and with each modified Rankin Scale level:

- The total average costs in the first year were estimated \$33 147 per patient, ranging from \$9114 for modified Rankin Scale 0 to \$83 236 for modified Rankin Scale 5. In the second year, medical costs were on average \$14 039, varying from \$2921 to \$39 723 for patients with modified Rankin Scale 0–5. The level of disability based on the modified Rankin Scale was a major determinant of resource use, irrespective of age, gender, atrial fibrillation, and vascular risk factors.

Conclusion

Long-term resource use after stroke is high and is mainly driven by the degree of disability as measured by the modified Rankin scale

Distributors

Follow-up and rehabilitation costs from MT compared to IVT were calculated in the files by combining data on the Rankin score after MT and after IVT with data on the cost per patient per Rankin score. Different randomized studies were used to estimate the Rankin score after MT versus IVT:

There is a meta analysis of Goyal et al. (2016) which analysed 5 randomized studies (MR CLEAN, EXTEND IA, ESCAPE, SWIFT PRIME and REVASCAT). Some distributors used this meta analysis, some used a single study from this meta analysis, some combined both.

RIZIV-INAMI

The RIZIV – INAMI proposal used the results from the meta-analysis of Goyal et al. (2016), which classifies patients into Rankin score 0 to 6. Of note is that these results were used in turn in combination with survival data from a study of Slot et al. (2008) which analysed survival per Rankin score in different cohorts. Data from the Lothian cohort were used. Indeed, survival appeared to differ between patients depending on Rankin score: the lower the Rankin score, the longer the survival. This implied that, as MT improved the Rankin score after stroke, MT also lead to longer survival, which again had an impact on costs.



KCE Comment

Available data on hospitalisation, follow-up and rehabilitation costs at the time of evaluation of reimbursement files

As the patient group eligible for MT, but treated with the comparator, could not be identified in the databases, it was not possible to derive the 'other costs' for this population at the time of evaluation of the reimbursement files.

Only when a patient target group has been defined in the databases, it becomes possible to calculate the costs of the index hospitalisation (TCT data, EPS-IMA – AIM database or EPS) as well as the subsequent real costs related to readmissions (idem) or outpatient follow-up (only EPS or IMA – AIM data).

Actual other costs (currently available data, after start of reimbursement)

Actual other costs for the patient population undergoing MT can now be derived from the databases; however, no data is available on costs linked to a comparable patient group undergoing the comparator intervention. So based on the national databases it is not possible to quantify the budget impact from the new intervention.

Experts from RIZIV – INAMI pointed to an alternative option to verify whether MT has led to budget savings in 'other costs'. In this alternative option, first the actual 'other costs' would be calculated for all patients with diagnostic code ICD10-CM I63 (Cerebral Infarction) in a recent year (in which MT is frequently used), and these would then be compared to the costs for all patients with the same diagnostic code in a year where MT was not frequently used yet. If such an analysis would be performed, different types of bias should be taken into account. Even if a higher or lower cost per patient would be observed over time, then it might be difficult to reliably link this evolution to the use of MT, as also other(un)known factors might have had an influence on the outcomes of interest. A critical assessment of such pre/post analysis should be performed on a case-by-case basis (see discussion).

- For the ex ante evaluation, the impact on other costs was estimated based on an indirect estimate, combining the results from studies on the clinical outcome with the result from a study on cost. It is not possible to extract reliable costs from the real-world data since it is not possible to identify patients meeting the selection criteria for the treatment (see PICO), nor to calculate costs in function of the primary outcome of the studies (mRS, measuring the degree of dependency after stroke).
- For the ex post evaluation, it is possible to calculate the 'other costs' for the patient population having undergone MT; however, as it is not possible to identify the comparator patient group (patients who would have been eligible for MT but who received the comparator intervention) makes that it is not possible to calculate the actual budget impact from MT.

3.2 The case of TAVI

3.2.1 Background information

In 2019 a reimbursement file was submitted to RIZIV – INAMI to increase the reimbursed volume of the Transcatheter Aortic Valve Implantation (TAVI). TAVI was already reimbursed, as inscribed on the nominative lists 35601 and 35602 and notably with the following lump sums:

- a "large lump sum" (172734-172745 linked to nominative list 35601) for reimbursement under the following conditions: high operative risk or inoperable patients; limited to 500 patients per year; for the amount of €9905.
- a "small lump sum" (172756-172760 linked to nominative list 35602) for reimbursement of other patients (who can meet the conditions of the large lump sum or not); for the amount of €2971.5; unlimited in volume.

For the accessories there was a lump sum reimbursement (172771-172782) of €2971.5.



The distributor did not request to review the indications but to increase the volume for the large lump sum from 500 to 1800 patients per year, as the maximum volume at that time would not be sufficient to reimburse all Belgian patients with high or very high operative risk.

Evidence shows that TAVI has therapeutic added value in inoperable patients and is at least equivalent to the surgical aortic valve replacement in high-risk patients. Besides the indication of patients with high or very high operative risk, TAVI is additionally indicated in patients ≥ 75 years and in whom the operative risk is median (surgical risk score of $\geq 4\%$ according to the Society of Thoracic Surgeons, or an estimated mortality of $\geq 4\%$ according to the heart team). These patients are currently not reimbursed under the large lump sum, but reimbursement can be obtained under the small lump sum as no conditions in terms of indications are imposed. For this patient group (with median operative risk), however, there was no reimbursement request, as the distributor preferred to give priority to all high and very high-risk patients.

The crucial point in this reimbursement file was the estimate of the total number of Belgian patients who have high or very high operative risk. In response to the reimbursement request, the commission proposed to increase the allowed volume of the large lump sum from 500 to 1500 patients per year. The commission also proposed to split up the small lump sum in 2 codes, notably the existing code 172756-172760 and a new code 181952-181963, associated with a new nominative list 35603. The criteria on the indications for the large lump sum are now also valid for the existing code of the small lump sum, still without a limit on the volume (so for inoperable and high operative risk patients above the limit of 1500). The new code of the small lump sum (181952-181963) is for patients who do not meet the indication criteria of the large lump sum, also without a limit on the volume.

^t Ministerieel besluit van 27 maart 2023 tot wijziging van hoofdstuk "F. Heelkunde op de thorax en cardiologie" van de lijst en van de nominatieve lijsten, gevoegd als bijlagen 1 en 2 bij het koninklijk besluit van 25 juni 2014 tot vaststelling van de procedures, termijnen en voorwaarden inzake de tegemoetkoming van de verplichte verzekering voor geneeskundige verzorging en uitkeringen in de kosten van implantaten en invasieve medische hulpmiddelen, *B. S. 6 april 2023* - Arrêté ministériel du 27 mars

By creating an extra code, the commission aims to get a better view on the characteristics of the reimbursed patients.

The proposal from the commission was accepted by the Minister and the changes came into force from 1st May 2023.^t The large lump sum (172734-172745) is now limited to 1500 high operative risk or inoperable patients a year for the amount of €9549. The small lump sum (172756-172760) applies for the same type of patients once the annual limit has been reached for the amount of €2971.5. A new code exists now for all the other cases for the amount of €2971.5. The reimbursement amount of the accessories lump sum (172771-172782) is now €2269.1. Furthermore the decision was taken to create a registry for all aortic valves, SAVR or TAVI with follow-up for 30 days. The results of this data collection will be presented every two years to the CTIIMH – CRIDMI by the Belgian Working Group on Interventional Cardiology and the Belgian Association for Cardio-Thoracic Surgery report.

The process of the reimbursement conditions modification took more time than usual due to the impact of the COVID-19 pandemic on administrative procedures and the necessity to establish a legal base for a new register.

In what follows, we describe the budget impact elements considered in the application file from the distributor as well as those considered in the proposal from the RIZIV – INAMI. As at the time of writing the decision was not yet into force, we did not do an "ex post" analysis, as defined in the introduction chapter, for this case. Instead, we explored the most recent data available to see where they can be useful for budget impact analysis.

2023 modifiant le chapitre " F. Chirurgie thoracique et cardiologie " de la liste et les listes nominatives jointes comme annexes 1 et 2 à l'arrêté royal du 25 juin 2014 fixant les procédures, délais et conditions en matière d'intervention de l'assurance obligatoire soins de santé et indemnités dans le coût des implants et des dispositifs médicaux invasifs, *M. B. 6 avril 2023*.



The increase in volume of reimbursement with the large lump sum would have an impact, on the budget of implants and invasive medical devices and possibly on other budget silos as well, if the total number of patients treated with TAVI increases.

3.2.2 PICO of the reimbursement request

We refer to Table 4 for the PICO, as based on the budget impact analyses of the distributor and RIZIV – INAMI.

The aim of the reimbursement request is to increase the allowed number of TAVI in patients with high and very high operative risk. The considered comparator is surgical aortic valve replacement (SAVR). Literature does not show a significant difference in survival in the high-risk population between percutaneous and SAVR, but the percutaneous intervention is less invasive. Furthermore, the percutaneous intervention does no longer always take place under general anaesthesia, but also under local anaesthesia. Note that the alternatives for inoperable patients, notably medication or balloon valvuloplasty, have not been considered in the budget impact calculations.

Table 4 – The PICO for the TAVI case

PICO element	Description
Population	• All patients that have a native aortic valve with symptomatic stenosis or a surgical bioprosthetic valve with stenosis, insufficiency, or a combination of both with need for replacement. • Already reimbursed patients: patients with high operative risk or inoperable patients (max. 500) • Reimbursement request is made to increase the number of patients in the already reimbursed indications: for patients with high or very high risk
Intervention	TAVI (Transcatheter Aortic Valve Implantation)
Comparator	Surgical Aortic Valve Replacement (SAVR)
Outcome	Survival Adverse events: stroke and permanent pacemaker implantation

3.2.3 Overview of inputs from the budget impact analyses

Both the distributor and the RIZIV – INAMI took into account the following elements for the budget impact calculation:

- Patient volume
- Costs of the implants and invasive medical devices, per patient
- The physician honorarium, per patient (without supplement)
- The total hospitalisation cost, per patient
- The costs for adverse events, medication and follow-up, per patient

Each of these elements is discussed in the following sections.

3.2.4 Inputs

3.2.4.1 Estimated patient volume for TAVI and SAVR

The distributor

Based on data from abroad, the distributor proposed a gradually increasing volume for the large lump sum for TAVI. For SAVR the distributor assumed a slight volume decrease. For the real volumes of TAVI and SAVR in the base year (2018), the distributor used data from beMedTech. Upon request of its members, beMedTech notably collects market statistics for a limited number of products.

RIZIV – INAMI

The commission proposed to increase the allowed volume for the large lump sum for TAVI to 1500. As the actual volumes that would be reached remained unknown, estimates were made based on the average of a best-case and worst-case scenario.



In both scenarios, it was assumed that the maximum allowed volume of the large lump sum (of 1500) would be reached.

For the volume of the small lump sum, RIZIV – INAMI estimated that in 2019 minimum 443 percutaneous heart valves were placed. Of these 443 small lump sums, it was not known whether they met the indication criteria of the large lump sum or not.

In the best-case scenario (the scenario with minimal budget impact), it was assumed that 100% of the small lump sums would shift to the large lump sum, thereby assuming that all of the small lump sums met the indication criteria for the large lump sum. In this scenario, the volume of the small lump sum would remain zero.

In the worst-case scenario (the scenario with maximal budget impact), it was assumed that the maximum volume for the large lump sum (1500) would be billed, and that still 443 small lump sums would be billed.

For SAVR, RIZIV – INAMI assumed no volume decrease.

Comment

Currently available data for patient volume estimation

The identification of the number of patients undergoing TAVIs or SAVRs can be done based on the national administrative databases (EPS, IMA – AIM data). We used TCT data 2016-2020 to be able to answer further questions below, beyond volume estimations. Moreover, thanks to the clinical registration of ICD-10-BE procedure codes in the TCT linked database, we could identify patients who received an SAVR or a TAVI but were billed one of the generic cardiac valve implant codes instead of a code specific to TAVI/ or SAVR aortic valve replacement. These generic codes became only specific to aortic position in 2021 (e.g. 159202 “Biological valve: pericard

with stitch”, changed into “Biological valve: pericard with stitch, implanted in aortic position” on 1st of October, 2021).

Combining ICD-10-BE procedures and RIZIV – INAMI billing codes, the estimation of the number of patients undergoing one of these procedures is presented in Table 5 below.

The actual number of procedures in 2018 lies above the volumes of the distributor based on the beMedTech database (resp. 759 TAVIs and 2583 SAVRs in 2018).

It is noteworthy that new technologies of valve replacement emerged recently. Hence, new ICD-10 procedure codes are already in application since 2017 for the Rapid Deployment Technique of Aortic Valve Replacement with Zoological Tissue, in percutaneous approach (X2RF332), open (X2RF032) or percutaneous endoscopic approach^u (X2RF432). While a TAVI implant is billed when an X2RF332 code is registered, the two other ICD-10 codes may be used to identify more recent SAVR techniques.

Actual case volume (TCT 2016-2020) (currently available data)

A decrease in SAVRs is observed in 2019 and 2020 and in TAVIs in 2020. The COVID-19 pandemic may probably have something to do with this trend. It is not clear what is the driving factor behind the decrease in SAVRs. Note that in the case of discharge data such as TCT data, stays of patients having undergone procedures at the end of year Y but who were discharged in year Y+1 will be found in the Y+1 data. This is something to keep in mind when using discharge data. In our present case, considering the lockdown periods of end 2020 and begin 2021, a catching up of surgical procedures could be observed from the second half of 2021 registration.

When we look at the lump sums billed for the implant, excluding the old lump sums valid until 31 July 2016 (680153-680164 and 680993-681004), the percentage of large lump sums is in average 57.2% on the whole period and the small lump sums 43.0% (the addition exceeds 100% as a small number

^u The endoscopic approach of valve replacement was already used before the rapid deployment technique introduction. This approach can be considered as (minimally invasive) surgery, though less invasive than the classic open SAVR approach.



of stays had one of each (n=4)). The percentage of stays with a small lump sum increases from the introduction of both lump sums: 21.2% (2016), 29.3% (2017), 41% (2018), 51.7% (2019) and 49.2% (2020).

Table 5 – Number of procedures and stays with TAVI and/or SAVR performed between 2016-2020

Type of procedure performed during the stays	2016	2017	2018	2019	2020	TOTAL
TAVI	557	720	879	1037	981	4174
SAVR	3187	3214	3245	3207	2580	15 433
Total number of procedures (TAVI AND SAVR)	3744	3934	4124	4244	3561	19 607
Number of stays with both procedures	21	26	42	57	56	202
Total number of stays (TAVI AND/OR SAVR)	3723	3908	4082	4187	3505	19 405

Note that other analyses on real-world data are possible for estimating the volume of patients, such as examination of the patient profile for those receiving the small lump sum versus those receiving the large lump sum. This could help estimate whether the patients receiving the small lump sum would also be entitled to the large lump sum if the allowed volume of the latter would be increased. A recent report from IMA analysing the survival of patients after a TAVI implantation illustrates this possibility as they calculated the prevalence of a number of proxies for operative risk, such as arterial hypertension/heart failure, atrial fibrillation, diabetes, COPD etc., as well as an additive euroSCORE and post-procedure outcomes in both patient groups.⁶

- Estimating the total number of Belgian patients who have high or very high operative risk was a crucial point of this reimbursement file. Yet, limited data were available for this estimate. If a parallel nomenclature code would have been created in the past for patients with high or very high operative risk and that are still billed under the small lump sum, more data would have been available at the time of the reimbursement decision.
- At the time of this reimbursement decision, the commission decided to create such a parallel nomenclature code (for patients that have high or very high operative risk and that are still billed under the small lump sum) to get a better view in the future on whether the new volume limit of 1500 for the large lump sum is sufficiently high. This indeed is a way to obtain better data on volume (as well as on costs associated with the intervention) for the considered patient population. If such a code would have been created earlier, better data would have been available to help deciding on the new volume limit for the large lump sum and to improve the budget impact calculations.
- Considering that in the future a further increase of volume could be requested for patients ≥ 75 years and in whom the operative risk is median, yet another parallel code could be created to obtain data on this particular patient group: a code for these patients who are billed under the small lump sum, as well as a code for these patients who are treated by SAVR. By creating such parallel nomenclature codes, not only data on the volume of patients can be obtained but also on the costs associated with both the intervention (TAVI) and comparator intervention (SAVR) in this particular patient group.
- For estimates on the gradual take-up of the new procedure (how long it takes to reach the total volume) and on the decrease in SAVR no better data can be retrieved ex ante; these have to be based on e.g. expert estimates or experience abroad.



- In this case, nomenclature codes already existed at the time of the distributor's file introduction. In other cases, newly created ICD-10 procedure codes are registered in the TCT data (MKG – RHM) before creation of nomenclature codes. Therefore TCT data exploitation may be advantageous, particularly to identify not yet reimbursed emerging technologies.
- National databases can give a clear view on the number of TAVIs (large lump sum versus small lump sum) and the number of SAVRs performed. However, the data for 2020 appeared to be distorted by the COVID-19 pandemic.

3.2.4.2 Cost of the implant and materials (cost per patient)

Distributor

For the cost of implants and materials for TAVI, a sum is made of the relevant nomenclature code tariffs (large lump sum, accessories, temporary electrode and vascular closure device), weighted by their volume, amounting to €13 006 (=€9905 + €2971.5 + €62.42 + €66.93) in total per procedure (see Table 6 – old tariffs).

Table 6 – Cost of implants and materials for TAVI

Description and code	Old tariff *	New tariff *
Large lump sum: 172734-172745	€9905	€9549
Small lump sum: 172756-172760	€2971.5	Same as old
Newly created code for the small lump sum: xxxxx1-yyyyy1		€2971.5
Accessories: 172771-172782	€2971.5	€2269.1
Temporary electrode: 158771 – 158782	€62.42	Same as old
Vascular closure device: 161630 –161641	€66.93	Same as old

Total cost (old tariffs) per procedure (assuming large lump sum): €13 006

Total cost (new tariffs) per procedure (assuming large lump sum): €11 947

** Old tariff: at the time of the submission of the reimbursement file; New tariff: tariffs proposed by the commission at the time of the evaluation of the reimbursement file*

For the cost of implants and materials for SAVR, a sum is made of the nomenclature pseudo-codes in Table 7, weighted by their frequency as billed in 2019, amounting to €4209 in total per procedure.

**Table 7 – Cost of implants and materials for SAVR, as presented by the distributor**

Description and code	Fee	Frequency
159191-159202 Biological valve: pericard with stitch	€2755.17	Used in 75% of cases
170634-170645 Biological valve: pericard without stitch	€3053.04	Used in 25% of cases
159611-159622 Cardiotomy set	€939.43	1 per intervention
159530-159541 Catheter(s)	€153.50	1 per intervention
160370-160381 Thoracic drainage system (150%)	€56.28	1 to 3 pieces per intervention: average of 1.5
162956-162960 Auto-transfusion material	€179.08	1 per intervention
158793-158804 Electrode catheter(s)	€22.51	1 per intervention
Total average cost per procedure: €4209		

RIZIV – INAMICost of implants and materials for TAVI

For the calculation of the impact on the budget implants and invasive medical devices for TAVI the relevant codes with the new tariffs were taken into account (see Table 6 – new tariffs).

Considering that the allowed volume of reimbursements with the large lump sum was significantly increased, the commission proposed to reduce the tariff of the large lump sum from €9905 to €9549, as it wanted to give the signal to the distributor that an increase in volume should be compensated with a reduction of the price of the device.

The commission also proposed to reduce the tariff of the accessories from €2971.50 to €2269.10 following a cost analysis on the cost of the accessories. This analysis showed that the old tariff was higher than the cost of these accessories. The total cost of the implant and materials for TAVI with the new tariffs, assuming large lump sum, amounts to €11 947, compared to €13 006 with the old tariffs.

Comment**Actual implant and material costs for SAVR (TCT 2016-2020) (currently available data)**

Starting from the 15 231 patients with a SAVR and no TAVI (15 433 – 202 in Table 5), the actual costs were calculated separating the costs for the replacement valves and the rest of the material. Calculations were done on 13 788 stays (90.6%), discarding stays with no replacement valve reimbursed^v (n=1438), and no price per diem invoiced (n=18). On average, €2972 is reimbursed for the replacement valve and €2361.1 for the other materials covered by the implants and invasive medical devices partial budget. Details per year can be found in Appendix 1.2, Table 25. So the total cost is on average €5333.1 per procedure for implants and materials for SAVR, which is higher than the cost estimated by the distributor.

Note that in absence of a variable characterizing the risk profile of the patients for whom we analyzed the costs, we are not able to distinguish medium from high-risk patients.

Amongst the stays without any valve registered as implant, some receive a valve from human origin. About 2% of the SAVRs are performed with such type of valve between 2016 and 2020. The reimbursement of tissues from human origin is not covered by the implants and invasive medical devices pseudo-codes but by nomenclature codes. It amounts on average to €4043 for those who receive these valves (from €3924 in 2017 to €4128 in 2020). This more costly option – marginal though – was not considered at the time of the reimbursement request. More details on valves invoiced and the

^v These stays were selected based on ICD-10-BE procedure codes only.



number of stays concerned are presented in Table 8. Note that more than one valve (up to 3) is billed for a few stays (n=355, 2.6%). No further investigations were made within the scope of the present project, but more fine-tuning is theoretically possible (e.g. by determining if the first replacement failed or if another surgery was performed during the same hospitalisation on other valves such as the mitral or tricuspid ones).

Table 8 – Artificial/human valve used for SAVR between 2016 and 2020 (TCT data)

Number of stays	2016	2017	2018	2019	2020	Total
Implants						
159132-159143 Mechanical valve: bileaflet	303	315	237	221	169	1245
159154-159165 Mechanical valve with graft	86	71	60	57	46	320
159176-159180 Porcine valve	200	147	186	201	195	928
159191-159202 Biological valve: pericardium placed surgically with suture	1771	1820	1836	1687	1289	8403
159224 Biological valve: without stent	191	170	149	142	105	757
159261 Biological valved conduits: biological graft	9	13	9	8	4	43
170645 Valve placed surgically by aortotomy in aortic position with system for rapid placement, including placement system and all accessories	431	473	511	512	525	2452
Tissues from human origin (outside the 13 788 stays retained)						
269301 Human cardiac valve	42	53	58	91	39	283

^w Some stays had only the accessories or a generic cardiac valve reimbursed, they were nevertheless discarded to exclude any misclassification risk in the calculation.

Actual implant and material costs for TAVI (TCT 2016-2020) (currently available data)

Starting from the 3972 patients with a TAVI and no SAVR (4174 - 202 in Table 5), the actual costs were calculated separating the costs for the replacement valves (and accessories) and the rest of the material. Calculations were done on 3418 stays (86.1%), discarding stays with no TAVI valve reimbursed (n=552^w), and no price per diem invoiced (n=4). On average, €9716 is reimbursed for the valve (and accessories) and €1000 for the other materials covered by the implants and invasive medical devices partial budget. Details as means per year can be found in Appendix 1.2, Table 27 and Table 28. So there is on average a total cost of €10 716 per procedure for implants and materials for TAVI.

**Table 9 – Valves used for TAVI between 2016 and 2020 (TCT data)**

Number of stays	2016	2017	2018	2019	2020	Total
172745 Percutaneous valvular stent implantable in aortic position with placement system (large lump sum)	132	435	448	444	435	1894
172760 Percutaneous valvular stent implantable in aortic position with placement system, when conditions for service 172734-172745 are not satisfied (small lump sum)	36	181	308	469	422	1416
681004 Percutaneous valvular stent implantable in aortic position with delivery system, including accessories	87	.	.	.	.	87
680164 Percutaneous valvular stent implantable in aortic position with delivery system	25	.	.	.	.	25
172782 Accessories of a percutaneous valvular stent implantable in aortic position	156	596	759	903	829	3243

Assuming that each patient with a small lump sum would give rise to a large lump sum, we can simulate the impact of the valve (and accessories) reimbursement modification from 2019 (year of the submission file). In 2019, 444 patients are identified with a large lump sum versus 469 for the small lump sum group. The different cost items of the entire hospitalisation costs are given for both patient groups in Appendix 1.2, Table 29 and Table 30. In 2019, the average amount reimbursed in case of a large lump sum is €12 843 versus €5886 in case of a small lump sum (€12 883 versus in €5795 in 2020).

Consequently, each patient with a small lump sum who would be entitled to a large lump sum instead would cost an extra €6957 for the valve and its accessories only. Which means that raising the large lump sum ceiling of 500 to 1500 patients would result in an extra required budget of almost €70 000 per year for the valve and its accessories.

- The tariffs for the implants and materials are subject to negotiation and decision by RIZIV – INAMI. The quantity of codes billed per procedure can be retrieved from RIZIV – INAMI data or estimated by experts. More precise data (per patient) can be found by using TCT data.
- Nevertheless, the delineation of patient groups according to risk profile is not possible in the TCT data. Therefore, with the currently registered information, SAVR hospitalisation costs could not be stratified according to risk profile of the patients.
- Similarly, it is not possible to identify patients who have not received a TAVI under the current reimbursement rules but could be considered as eligible under modified reimbursement conditions.



3.2.4.3 Cost of the physician input (surgeon/interventional cardiologist) (cost per patient)

Distributor

Physician fee estimates (without supplements) for TAVI and SAVR were based on the most recent fees, but no details were given on which data they were actually based on. Note that at the time of the submission of the reimbursement file, there was no specific medical fee code for TAVI.

RIZIV – INAMI

As there was no specific medical fee code for TAVI, several data were used for physician fees for TAVI: €2933.80 (based on input Medical technical council) and €1893 (based on input from the insurance committee).

Comment

Actual physician fees for TAVI and SAVR (TCT 2016-2020) (currently available data)

The two most frequent cardiac surgery RIZIV – INAMI codes billed between 2016 and 2020 (TCT data) for the 13 788 stays retained for the costs calculation are presented in Table 10.

On average, based on the 13 241 stays (95.8%) who underwent these procedures, a physician fee of 3175€^x is billed. The remaining patients undergo other thoracic surgery with no reference to valve surgery, such as heart operation under hypothermia (229541) or a more generic operation on the heart or large intrathoracic vessels (229025), for which medical fees are included in the other hospital costs below (3.2.4.4). The investigation of the remaining 4% of the stays in order to verify if these codes are actually linked to a valve replacement was deemed out of scope of the present pilot project.

^x Note that the denominator for the global averages presented in Appendix 1.2, Table 26, is 13 788 stays. The global average for the 2 medical fees for valve replacement is thus logically lower (€6 000)

Table 10 – Physician fees billed for SAVR between 2016 and 2020 (TCT data)

Number of stays	2016	2017	2018	2019	2020	Total
229526 Surgery on the heart or large intrathoracic vessels that involves the placement of more than one artificial valve or valve homograft, or an artificial valve combined with myocardial revascularisation, with extracorporeal circulation	1506	1511	1419	1341	1104	6881
229600 Surgery on the heart or large intrathoracic vessels that involves the valvuloplasty or the placement of an artificial valve, with extracorporeal circulation	1332	1338	1389	1280	1052	6391

Note that 31 stays were billed one of each code, see remark under 0 on multiple valve replacements.

In a similar way we could find out which physician fees are billed for TAVI. The most frequent RIZIV – INAMI code billed between 2016 and 2020 (TCT data) was a percutaneous endovascular valvuloplasty (Table 11).

**Table 11 – Physician fees billed for TAVI between 2016 and 2020 (TCT data)**

Number of stays	2016	2017	2018	2019	2020	Total
589201 Percutaneous endovascular aortic valvuloplasty, congenital malformation of the aorta, pulmonary valve, mitral valve, tricuspid valve or fulguration of a valve, including handling and monitoring during treatment and catheters used, excluding dilatation catheter(s) and pharmaceutical and contrast media, maximum per operative session	272	565	695	823	748	3103

Table 29 in Appendix 1.2 learns us that the average amount reimbursed in case of a large lump sum is €1607 versus €1570 in case of a small lump sum (€1563 versus €1568 in 2020), in other words yearly amounts of surgeon fees are similar whatever the lump sum reimbursed.

- **When there is no specific procedure code for the intervention, the distributor and RIZIV – INAMI have to make an estimate of it. TCT data show the actually billed procedure codes.**

3.2.4.4 Other hospitalisation costs linked to the index hospitalisation (cost per patient)

Distributor

1st method: based on KCE report 163

The distributor based its calculation for other hospitalisation costs linked to the index hospitalisation on the data from KCE report 163: €18 667 (equals €19 341 indexed to 2018 (€21 768) minus tariff of the accessories (€2971.5), electrode (€62.42) and vascular closure device (€66.93)). This is the hospitalisation cost excluding the device, physician honoraria and materials.

Similarly, for SAVR the distributor based the cost on Table 28 of KCE report 163: €19 075.

2nd method: based on a patient sample of UZA

A second method for estimating the costs of the index hospitalisation for TAVI and SAVR in the high-risk population, consisted of an analysis of anonymized patient data on 33 TAVI cases and 10 SAVR cases in the Antwerp University Hospital (Universitair Ziekenhuis Antwerpen, UZA). Note that this sample size is relatively small and that it is not clear what the characteristics were of the patient population in terms of operative risk. The transferability of the results of this cost analysis to other hospitals is also not clear.

RIZIV – INAMI

Cost of other hospitalisation costs linked to the index hospitalisation were also based on Table 26 from the KCE report 163: €18 667 (equals €19 341 indexed to 2018 (€21 768) minus tariff of the accessories (€2971.5), electrode (€62.42) and vascular closure device (€66.93)). This is the hospitalisation cost excluding the device, physician honoraria and materials.



Comment

Actual other hospitalisation costs for TAVI and SAVR (TCT 2016-2020) (currently available data)

Currently available data (ex post analysis)

The hospitalisation costs based on the UZA patient sample was deemed to be conservative according to the distributor because, a. o., the number of days in ICU (mostly 1 day) was considered high, taking into account recent evolutions. Using the TCT data, we were able to calculate the postoperative time spent in ICU after TAVI procedure in Belgium. Whatever the method applied (considering 'INT' units only or 'OPR' and/or 'INT' units, see 1.3.3.2), the average time can be estimated at 2.1 days for the whole country (Table 12). Even if this time was slightly reduced from 2016 and 2020, it still reached on average 1.9 days in 2020 (Figure 7). The particular case of UZA can thus not be generalized.

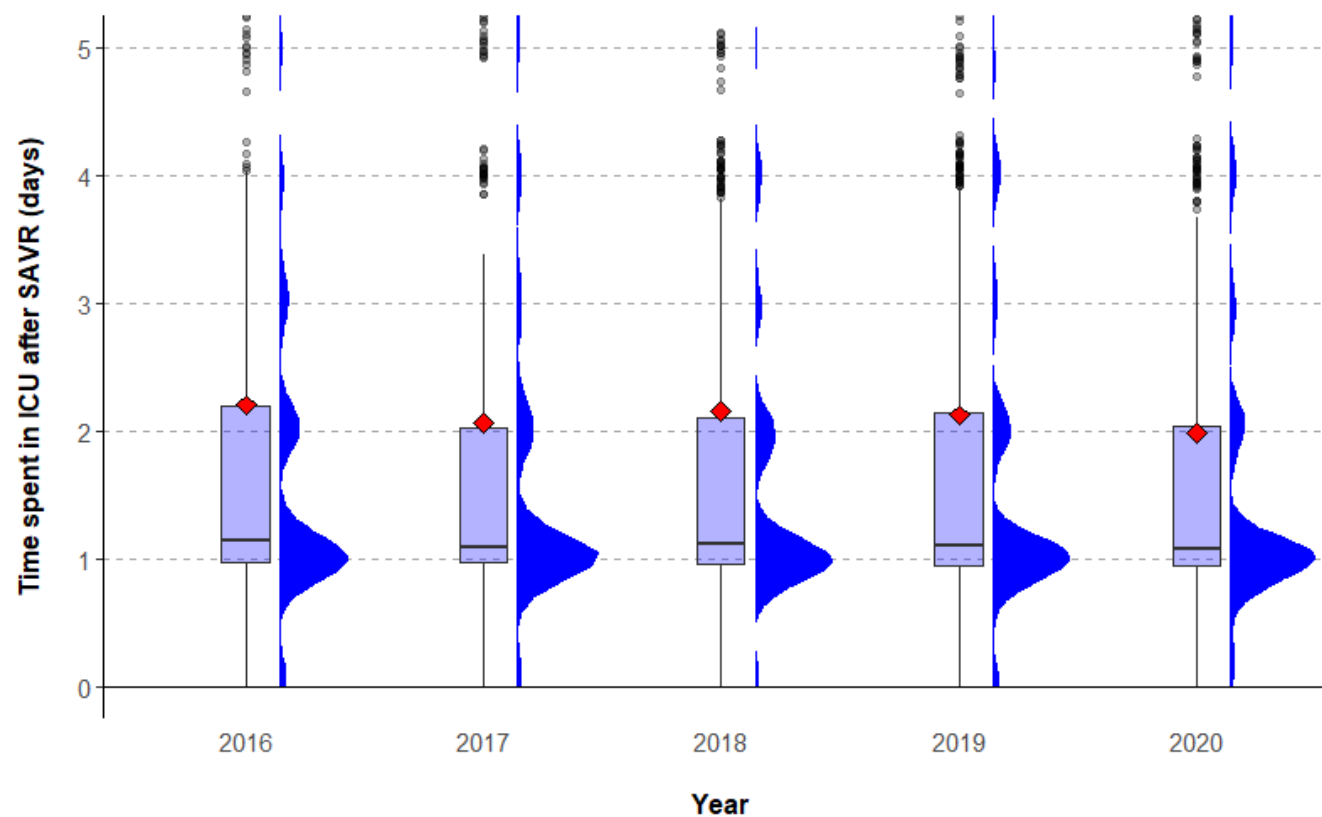
Table 12 – ICU time after TAVI procedure in days (TCT data 2016-2020)

Calculation method	N(*)	Mean	Std	Min	Q1	Median	Q75	Max
Method A: 'INT' only (N=3448)	3442	2.1	2.8	0.0	1.0	1.1	2.1	58.0
Method B: 'OPR' and/or 'INT'	3736	2.1	3.2	0.0	1.0	1.2	2.2	61.0

(*) the time of TAVI performance and/or the ICU could not be identified for respectively 6 and 4 stays in the method 1 and 2.



Figure 7 – ICU time after TAVI procedure in days per year, according to method A (TCT data 2016-2020)



Boxes are drawn from Q1 to Q3 with median as inside line, whiskers are drawn until first observation $> Q1 - 1.5 IQR$ and last observation $< Q3 + 1.5 IQR$. Means are represented by a red diamond and probability density function are pictured on the right of the boxes.



On the contrary, the UZA observation on the age of their patients was confirmed in the national TCT data: TAVI patients were older than SAVR ones. The median age of patients who had TAVI exclusively or SAVR was respectively 83 and 71 years in 2018 (highlighting the problem of non-comparability of observational data). Other parameters influencing the costs could have been compared, such as the comorbidities (e.g. using direct comparison, such as the number of patients with diabetes or using aggregated comorbidity indexes).

Actual other hospitalisation costs for SAVR (TCT 2016-2020) (currently available data)

The mean amount of per diem price recalculated at 100% was €9092 per hospitalisation, varying from €8697 in 2018 to €9249 back in 2016. This average depends on the length of stay as well as the price of each individual hospital. Other costs such as clinical biology, medical fees, pharmaceuticals, etc. reached on average €7427. Finally, the patient share, consisting of the medical imaging admission lump sum, clinical biology admission lump sum, daily pharmaceuticals lump sum and the non-reimbursed pharmaceuticals amounted to €303, with the exclusion of potential supplements. When adding up all cost items, including the patient share (without supplements), the total average amount for one hospitalisation was €25 203, varying from €24 621 in 2018 to €25 864 (2020).

Note that when the health index is applied to previous estimations, the result is higher than the actual amount. The SAVR total hospitalisation costs published in 2011 ⁷, indexed by the distributor to estimate the 2018 total hospitalisation cost, is €26 729, thus €2000 above the actual figure.

More details can be found in Appendix 1.2, Table 25 and Table 26.

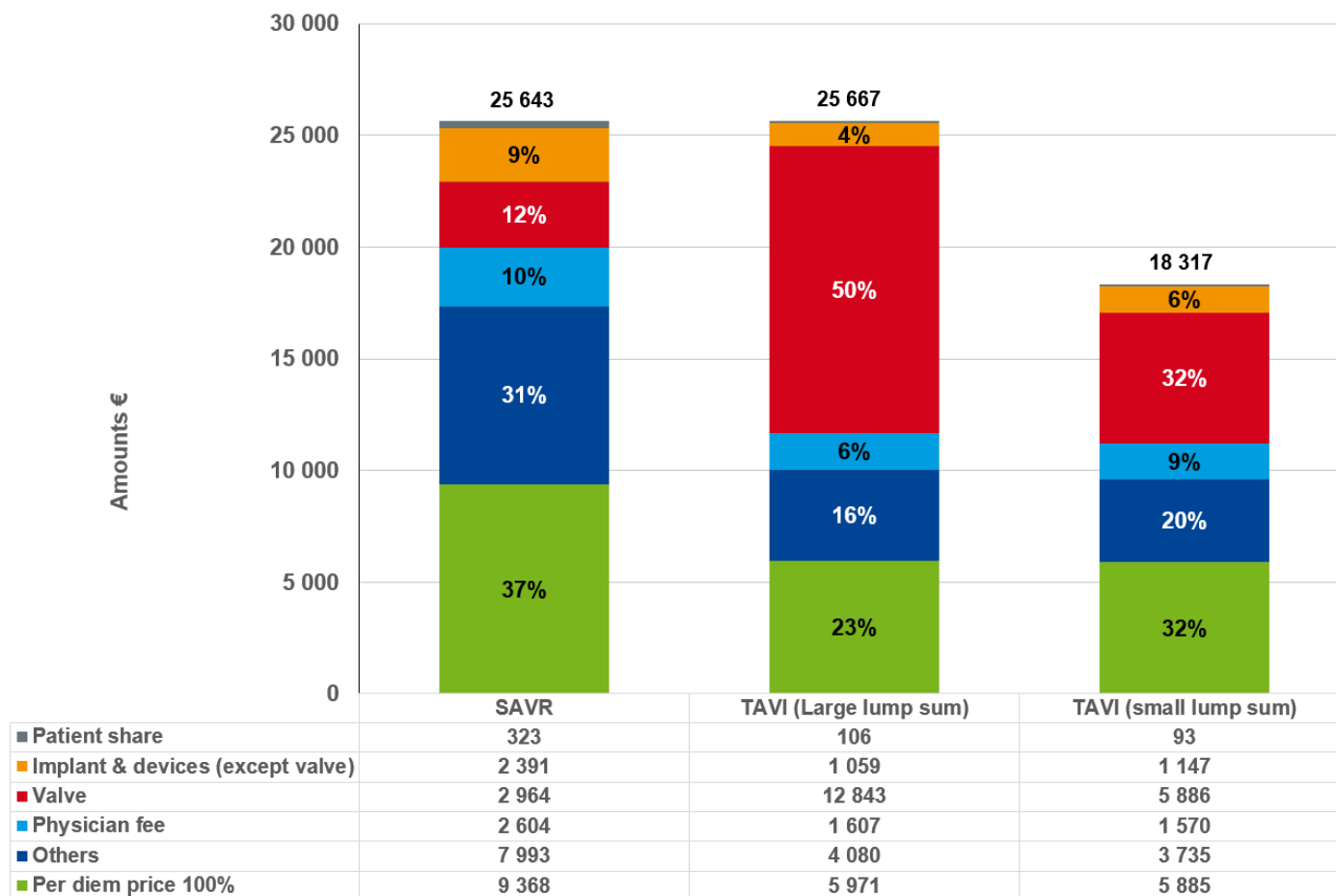
Actual other hospitalisation costs for TAVI (TCT 2016-2020) (currently available data)

On average, the per diem price recalculated at 100% was €5713 per TAVI hospitalisation, varying from €5428 in 2020 to €6165 back in 2016. If we add the cost of the valve (€9716) and other implants and invasive medical devices (€1000), the physician fee (€1597), the remaining costs covered by the RIZIV – INAMI (3822€) and the patient share (€99), the mean total cost for a TAVI hospitalisation, amounts to €21 947, ranging from €21 881 (2020) to €22 855 (2017). More details can be found in Appendix 1.2, Table 27 and Table 28.

Figure 8 presents the cost components of the total hospitalisation costs for SAVR and TAVI for the year 2019 (year of the submission file). TAVI costs are presented in function of the lump sum reimbursed. The main drivers for hospitalisation costs are the valve itself, mainly for TAVI, and the per diem price, mainly for SAVR, since the length of stay is higher than in TAVI cases. The 'Other costs' item is also influenced by the length of stay (surveillance fees, per diem medical imagery or clinical biology lump sums, etc.).



Figure 8 – Average hospitalisation cost components for SAVR and TAVI according to type of lump sum (TCT data 2019)





The index hospitalisation costs (other than implants and materials and physician input of surgeon/interventional cardiologist) depend on a number of variables, amongst which the length of stay, the length of stay on the intensive care unit (ICU), the cost of medical imaging, ... There are possibilities for better estimating these costs ex ante on the basis of national databases. There are several options:

1. By creating parallel RIZIV – INAMI codes:
 - better data could have been obtained for SAVR in high-risk patients: If a parallel code would have been created for the high-risk patients who are treated with SAVR. As such, it would have been possible to select the relevant population and have access to data on the index hospitalisation cost for SAVR (in IMA – AIM or TCT data).
 - better data could have been obtained for TAVI in high-risk patients: If a parallel code would have been created for high-risk patients who are billed under the small lump sum, then there would have been more complete data on the hospitalisation cost of TAVI in all high and very high-risk patients (hospitalisation cost of TAVI in high/very high-risk patients can differ from those in median risk patients, e.g. with regard to length of stay in ICU).
2. If a registry for SAVR/TAVI would have been available, by linking the patient characteristics (risk classification) from the registry to IMA – AIM data.

The estimation methods proposed by the KCE guideline for BIA¹ should be examined on a case-by-case basis; the TAVI case shows that applying the health indexation on previously calculated hospitalisation costs would be inappropriate.

3.2.4.5 Other costs: follow-up, adverse events (cost per patient)

Distributor

Follow-up costs included drug costs and medical follow-up based on KCE report 163, indexed to 2018: respectively €268 (drugs) and €564 (medical follow-up). Follow-up costs were assumed to be equal for TAVI and SAVR.

For adverse events, the frequency was calculated based on the two-year data of the Corevalve High Risk study.⁸ Only those adverse events were considered where there were differences in frequency between TAVI and SAVR and where costs were considerable. This resulted in the consideration of stroke events and pacemaker implantation.

Treatment costs for stroke were based on TCT data for APR-DRG 045 (CVA and precerebral occlusion with infarctus): €8853.

For pacemaker implant costs, a distinction was made between:

- when the pacemaker implant is done during the index hospitalisation; in this case only the cost of the device is included €4127 (sum of codes 172395 – 172406 (€3578.68) and 158675 – 158686 (€548.30));
- when the pacemaker implant is done after the index hospitalisation; in this case TCT data for APR-DRG 171 (Implantation of permanent pacemaker without AMI, heart decompensation or shock) were used: €9026.

Table 13 – Frequency and cost of stroke and pacemaker implantation for TAVI and SAVR

Adverse event	TAVI frequenc y	SAVR frequenc y	Cost per event
Stroke	10.2%	14.5%	€8853
Pacemaker during index procedure (first 30 days)	20.0%	7.0%	€4127
Pacemaker after index procedure (until 24 months)	5.4%	1.9%	€9026



So for TAVI, the cost per procedure for adverse events, weighted by their frequency, resulted in €2215.81 (see Table 13: $10.2\% \times €8853 + 20.0\% \times €4127 + 5.4\% \times €9026$).

RIZIV – INAMI

RIZIV-INAMI followed the calculation from the distributor: the cost of adverse events (€2215.81) + the cost of drugs (€268) + the cost of medical follow-up (€564).

Comment

Actual data on adverse events (TCT 2016-2020) (currently available data)

Based on the TCT data for 2016-2020, rates of adverse events are calculated not only during the index admission but also in the subsequent hospitalisations of the same patient, as seen in

Table 14. Only stays registered in 2018 were retained, discarding patients who had another procedure between 2016 and 2020 to ensure that the calculations were not biased in case of multiple procedures. Registration years 2019 and 2020 allowed for a two years follow-up.

About 2% of the patients were readmitted for stroke in the two years after index discharge. Naturally, we cannot exclude the possibility of patients who died of stroke before having the chance to be admitted. Moreover, the extent of loss to follow-up, i.e. patients who died of any cause before the two years period, cannot be measured. The only information is the percentage of patients who died in the hospital, whether during index admission ($37/821=4.51\%$ TAVI patients; $153/3099=4.94\%$ SAVR patients) or during posterior admissions (additional $2/821=0.24\%$ TAVI patients; $1/3099=0.03\%$ SAVR patients). The calculation of stroke occurring in the two years is also conservative due to the fact that stroke was only considered as principal and not secondary diagnosis. Note that the stays when a pacemaker was removed were excluded from the pacemaker insertion percentages. We did not calculate the percentage of patients who already wore a pacemaker. It is feasible though to trace pacemaker implantations (or adjustments) before

the date of TAVI or SAVR intervention from 2016. Identifying patients wearing a pacemaker implanted before 2016 is also possible using ICD-10-CM code Z95.0 presence of cardiac pacemaker, provided of course that such information (probably well documented in the medical file) was actually registered in the MZG – RHM.

Table 14 may not be used to compare the risk of adverse events between TAVI and SAVR as patients groups are not similar. As seen above, patients receiving TAVI were older than patients receiving SAVR. As such, the SAVR risk could be used as estimate for the baseline risk, while the TAVI risk can be used to corroborate the risk observed in trials and validate their transferability.

Table 14 – Percentages of strokes and pacemaker implantations after TAVI or SAVR performed in 2018

Procedure	N patients	Stroke		Pacemaker implantation	
		Index Admission ⁽¹⁾	Readmission for stroke ⁽²⁾	Index Admission ⁽³⁾	Readmission ⁽⁴⁾
TAVI	821	2.7%	2.1%	13.8%	4.1%
SAVR	3099	1.7%	1.9%	4.6%	2.3%

(1) Intra-, postoperative or later strokes during index admission – strokes present on admissions or occurring before the procedure day were excluded. – (2) Readmissions with stroke as the principal diagnosis in the two years after the procedure date – (3) Removals or Implantations occurring before the TAVI/SAVR procedure were excluded. – (4) Pacemakers removals were excluded.



- Better real-world data on the occurrence and the cost of adverse events could have been retrieved, if more precise data would have been available on patient characteristics (operative risk) through parallel RIZIV – INAMI codes or through linked registry data.
- This information from RWD on the risk of adverse events should not be used for comparative reasons if there are problems with the comparability of the underlying populations (see discussion). Information from RWD can be used e.g. to identify the baseline risk on adverse events in the comparator group, to validate the original trial-based estimates for the intervention group, to estimate the costs to treat the adverse event, etc. A case-by-case critical assessment should be performed to determine if the RWD provides reliable information for the specific target population and specific input parameter (intervention cost, probability/cost adverse event, etc.).

4 OVERVIEW OF NATIONAL DATABASES THAT CAN POTENTIALLY BE USED FOR BIA AND ACCESS POSSIBILITIES

4.1 Overview

Table 15 gives an overview of the national databases that can be used for BIA calculations and the extent to which KCE, RIZIV – INAMI and distributors have access to those data. Access for the different stakeholders is also depicted in Figure 9, in blue for direct^y access, red for direct but conditional access (e.g. EPS technical commission authorization) and dotted red for indirect access under contract. Speech bubbles represent (aggregated) data request possibilities.

^y 'Direct' does not mean totally free; it implies compliance with the General Data Protection Regulation and potentially a prior declaration of confidentiality signed by the data analysts.


Table 15 – Overview of national databases that can be used for budget impact calculations for implants/invasive MDs and access to these databases

Database	Description (owner)	Input parameters that can be obtained from the database	Access by KCE	Access by RIZIV – INAMI	Access by distributors	Access by universities
Doc. N	Health care interventions and lump sums reimbursement (RIZIV – INAMI)	Volume and amounts reimbursed for health care interventions (by age, sex and district)	Yes, regular RIZIV – INAMI transmission (aggregated by code ^z)	Yes	Yes, upon request	Yes, upon request
Doc. P	Health care interventions and lump sums reimbursement by providers (RIZIV – INAMI)	Volume and amounts reimbursed for health care interventions, patient ambulatory follow-up possible for RIZIV – INAMI	Yes, aggregated (not at patient level)	Yes (at patient level)	Yes, upon request, with limitations	Yes, upon request
Doc. PH	Pharmaceuticals reimbursement delivered in hospital pharmacies (RIZIV – INAMI)	Volume and amounts reimbursed of pharmaceuticals delivered in hospitals	Yes, upon request	Yes	Yes, upon request, with limitations	Yes, upon request
Farmanet – Pharmanet	Pharmaceuticals reimbursement delivered in public pharmacies (RIZIV – INAMI)	Volume and amounts of pharmaceuticals reimbursed delivered in the community	Yes, upon request	Yes	Yes, upon request, with limitations	Yes, upon request
SHA – AZV / ADH – HJA	Hospital billing data (RIZIV – INAMI)	Volume and amounts reimbursed of health care provisions in hospitals	See TCT	Yes	No	Yes, upon request
MZG – RHM	Hospital discharge data (FPS Public Health)	When specific ICD code(s) available: volume, co-morbidities, risk of adverse events (readmissions), patient characteristics, length of stay	Yes, upon request	Yes, upon request	Yes, upon request	Yes, upon request
TCT Data	Linked and validated individual data of the Hospital clinical data (MZG – RHM) of the FPS Public Health and on the billing data of the RIZIV – INAMI.	When specific ICD or billing code(s) available: volume, cost of hospitalisation and follow-up (readmissions), and risk and cost of adverse events (readmissions)	Yes, under conditions	Yes, under conditions	Yes, upon request	Yes, upon request

^z Detailed by age and sex upon request.

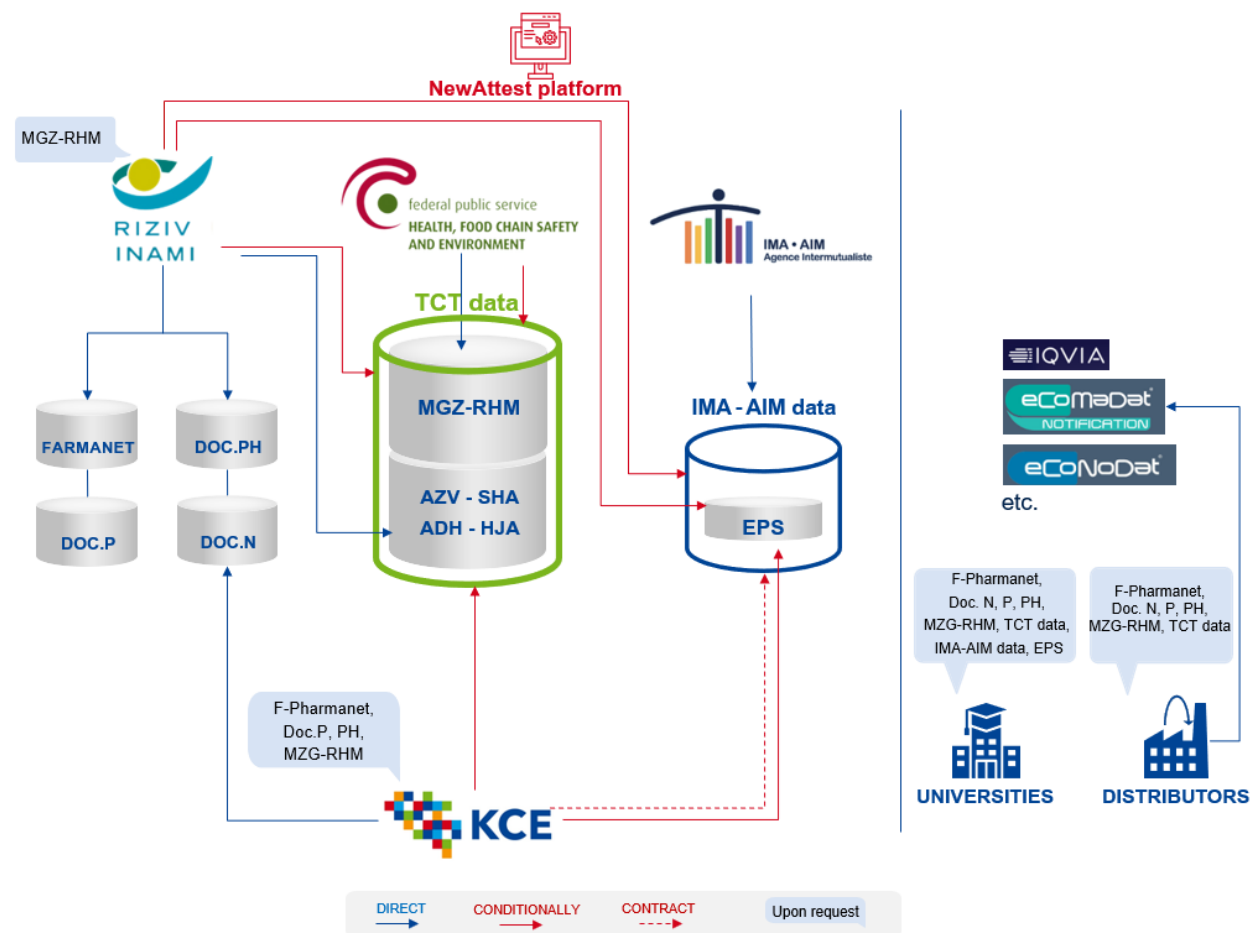


(MZG – RHM + SHA – AZV / ADH – HJA)						
Financial Feedback per pathology	Feedback of hospital reimbursements and length of stay, aggregated by MDC, APR-DRG and SOI, based on the TCT data (TCT).	When specific APR-DRG(s) available: volume and cost of hospitalisation (broken down by drugs, medical fees, etc.)	Yes	Yes	Yes	Yes
IMA–AIM Database	Individual data on health care reimbursements and patients' share for all insured patients, ambulatory and hospital settings (IMA – AIM)	When specific billing code(s) available: volume, cost of hospitalisation and follow-up (hospital or ambulatory), and risk and cost of adverse events	Yes, Through a cooperation model	Yes, under conditions	No	Yes, upon request
EPS	Stratified sample of the IMA – AIM Database (IMA – AIM)	When specific billing code(s) available: volume, cost of hospitalisation and follow-up (hospital or ambulatory), and risk and cost of adverse events	Yes, under conditions	Yes, under conditions	No	Yes, upon request
MZG – RHM/ EPS	Linkage MZG – RHM/ EPS: legal implementation ongoing	When specific ICD or billing code(s) available: volume, cost of hospitalisation and follow-up (hospital or ambulatory), and risk and cost of adverse events	Yes, under conditions?(*)	Yes, under conditions?(*)	No	Yes, under conditions?(*)

(*) Not published yet at the time of writing (April 2023)



Figure 9 – Access to national administrative databases for RIZIV – INAMI, distributors, universities and KCE



AZV – SHA: Anonieme Ziekenhuisverblijven – Séjours Hospitaliers Anonymes; ADH –HJA: Anonieme daghospitalisaties – Hospitalisations de jour anonymes; EPS: Permanent sample; IMA – AIM: InterMutualistisch Agentschap – Agence InterMutualiste; MGZ –RHM: Minimale Ziekenhuis Gegevens – Résumé Hospitalier Minimum; RIZIV – INAMI: National Institute for Health and Disability Insurance (Rijksinstituut voor Ziekte- en Invaliditeitsverzekering – Institut National d'Assurance Maladie-Invalidité) TCT: Technical Cell. Contract: the KCE writes a programme, tests it on the EPS, the IMA then runs it on the IMA data and shares the results with the KCE.



RIZIV – INAMI doc. N

The N documents (or Doc. N) are monthly aggregated data of the reimbursed amounts, numbers and days per ‘realization’ year (date of intervention), accounting year (date of reimbursed amount payment) and RIZIV – INAMI (pseudo-)^{aa} codes. Days are registered in case of hospitalisation/nursing homes lump sums or some specific intervention (ex. Huntington or multiple sclerosis intervention art. 10bis). They don’t include any information neither on the prescriber nor on the health care provider. Data are available by patient social category, district, age and sex but not at the individual patient level. Note that interventions covered by international conventions^{bb} are not included.

There are two versions of Doc. N: at 18 months and at 24 months. As health care attestations (receipts) must legally be sent to the sickness funds within a period of 2 years after the date of care delivery in order to get reimbursed, the Doc. N are exhaustive “at 24 months”^{cc} Nevertheless, the completeness of the Doc. N at 18 months, which is more rapidly available, lies above 95%. The Doc. N “at 18 months” are transmitted monthly by the sickness funds to the RIZIV – INAMI within 3 or 4 months of delay, which communicates them on a quarterly basis to subscribers such as the KCE.

Every six months, the sickness funds complete the data, adding age, sex, social category and patient district. As their granularity is higher than the patient level, they **cannot be linked to another database to follow a patient**; nor can they be used to estimate a volume in terms of number of patients (except in case of yearly conventions when a patient is counted once a year).

^{aa} Nomenclature codes are listed in the appendix of the RD of 14 september 1984 (Koninklijk besluit tot vaststelling van de nomenclatuur van de geneeskundige verstrekkingen inzake verplichte verzekering voor geneeskundige verzorging en uitkeringen, B. S. 29 september 1984. Arrêté royal établissant la nomenclature des prestations de santé en matière d'assurance obligatoire soins de santé et indemnités, M. B. 29 septembre 1984). Pseudonomenclature codes are published via RIZIV – INAMI circulars and administrative decrees.

RIZIV – INAMI Documents N *reimbursement data*, which are used in the reimbursement files for estimating the **volume** of invasive medical devices/implants, are available to both RIZIV – INAMI and distributors (upon request) (as well as KCE). The Belgian federation of medical technologies industry (including Implants and invasive medical devices), beMedTech, representing 80% of the Belgian market, also manages their own databases based on their members’ sales.

More information can be found on the [FAIR.healthdata.be](https://fair.healthdata.be) website.

RIZIV – INAMI doc. P

RIZIV – INAMI documents P are semestrial statistical tables per (pseudo-)code, health care provider, prescribing physician, place of intervention and residence, sent within a delay of 4 months by the sickness funds. Pseudo-codes that are not linked to a health care provider (a hospital for example) are not included. They allow the RIZIV – INAMI to follow the reimbursements in ambulatory setting of the same patient, but only within the framework of the RIZIV – INAMI statutory missions; this detailed level of information is **not available for third parties**. For this purpose, this database **can technically be linked to other databases** thanks to the pseudonymised national register number. International conventions have been included since 2015, contrary to the Doc. N. More details are available on the [FAIR.healthdata.be](https://fair.healthdata.be) website.

Distributors may request aggregations from the Doc. P (some variables are not communicated for the protection of patient privacy and attention is paid to small cells risks).

^{bb} By international conventions we mean agreements between Belgium and foreign countries ensuring the possibility for patients who decide to receive healthcare in a State other than the State of affiliation to receive cross-border healthcare

^{cc} Except extremely rare exceptions (e.g. a delay of 25 months was observed in the case of neurostimulators in the past).



RIZIV – INAMI doc. PH

RIZIV – INAMI documents PH include *pharmaceutical reimbursements delivered by the hospital pharmacies* to hospitalised or ambulatory patients, broken down by hospital, reimbursement category or pseudo-codes^{dd} and CNK product code (unique national code). Doc. PH is available on an aggregated form from 2002 until 2017 (accessed on 16 March 2023) on the FAIR.healthdata.be website and more recent years should follow. The **information is not available at the patient level** and thus cannot be linked to other databases at this level.

The same limitations apply to data transmitted to distributors as for Doc. P.

Farmanet – Pharmanet

This database includes the *reimbursements of pharmaceuticals delivered in public pharmacies* by prescriber, delivery date, CNK code. The detailed information is available at the patient level for the three most recent years but **is not linkable to any other database because the patient identifier is specific** to Farmanet – Pharmanet. The patient identifier is pseudonymized once by the sickness funds that transmit the data to a trusted third party that runs a second pseudonymisation before delivering the data to the RIZIV – INAMI. There is no possible correspondence with any other pseudonymised national register number.

The same limitations apply to data transmitted to distributors as for Doc. P and PH.

AZV – SHA / ADH – HJA

The Hospital Billing Data contains all reimbursements by the RIZIV – INAMI related to general hospital stays: fees charged by physicians and other health care providers, pharmaceuticals and implants/invasive medical devices, per admission and per diem lump sum payments, etc. They are composed of Anonymous Hospital Stays (AZV – SHA “Anonieme ziekenhuisverblijven – Séjours hospitaliers anonymes”) for inpatient stays and Anonymous Day-care Stays (ADH – HJA “Anonieme dag Hospitalisaties – Hospitalisations de jour anonymes”) for day-care stays. In practice, hospitals bill the patient’s sickness fund for the provided services for the part covered by the health insurance on the basis of the RIZIV – INAMI nomenclature. Data for year Y include stays from 1/7/Y-1 to 30/6/Y+1. They are sent to the RIZIV-INAMI by the sickness funds during January Y+2.

They are available at patient level and allow patients follow-up in hospital setting (readmissions and adverse events).

More details on the [AZV – SHA](#) and [ADH – HJA](#) can be found on the FAIR.healthdata.be website.

From registration year 2019, non-reimbursed implants and long-term invasive medical devices are identifiable per patient by their notification code in the AZV – SHA – / ADH – HJA, as well as the amounts paid by the patient. See mode details in 5.6.1.

Since registration year 2017, patient supplements are included in the AZV – SHA / ADH – HJA.

KCE has a conditional access via the TCT data (see below) but thirds like distributors or universities must submit a data request.

^{dd} For radio-isotopes and antibioprophyllaxy.



RHM – MZG database

All general (not psychiatric) hospitals are required to submit twice a year a large set of data on all inpatient and day-care hospital stays and emergency room contacts: the Minimal Hospital Data (“Minimale Ziekenhuis Gegevens – Résumé Hospitalier Minimum” or MZG – RHM defined in the Royal Decree of 27 April 2007^{ee}). These data are transferred to the FPS Public Health. Available variables pertain, a.o. to demographics, clinical information such as diagnoses, comorbidities, treatments and complications, length of stay, nursing units involved and discharge status. The clinical data also contain the All Patient Refined-Diagnosis Related Group (APR-DRG), severity of illness and risk of mortality output by the 3M™ APR-DRG Grouper software for each hospital stay, based on the principal diagnosis, secondary diagnoses and procedures, age and sex of the patient and, for some APR-DRGs (for neonates) birth weight. There is also a variable indicating whether a hospital stay is a readmission but only in the same hospital, so follow-up is very limited.

More details on the MZG – RHM variables can be found on the [FPS Public Health website](#).

A future Royal Decree is in preparation at the FPS to transmit to the RIZIV – INAMI a yearly copy of the MZG – RHM database, which can currently be accessed upon request for the RIZIV – INAMI and KCE.

Distributors may fill a data request for aggregated data extracted from the database. Otherwise, some publications are made available on the website of the FPS.

For example, the numbers of stays per 3-digits ICD-10-BE principal diagnosis (and district) are available per registration year until 2020, in classic hospitalisation as well as one-day hospitalisation (non-empty small cells are indicated by “<5” though for privacy reasons).^{ff} Universities may request aggregated or pseudonymised individual data.

TCT data

The “Technical Cell – Cellule Technique” (TCT) created in the Law of 29 April 1996^{gg} on social provisions, is a common service of the RIZIV– INAMI and FPS Public Health, Safety of the Food Chain and Environment. Its mission is to collect, link, validate, and anonymize data relating to hospitals. Figure 10 presents the different types of data available in the TCT linked database. Each year, the TCT links the MZG – RHM to the Hospital Billing data (or AZV – SHA / ADH – HJA) for the analysis of links between the expenditures of the health care insurance and the treated condition and for the elaboration of financing rules, accreditation standards and quality conditions in the context of an effective health policy.

Not all the variables from MZG – RHM and AZV – SHA / ADH – HJA are linked. More details on the MZG – RHM variables that are linked to AZV – SHA / ADH – HJA can be found on the [FPS Public Health website](#): Domains Administration (A) and Medical (M). The implant notification code and the patients supplements included in the AZV – SHA / ADH – HJA are not available in the TCT data available at KCE, as they are not listed in the convention of TCT data delivery to KCE.

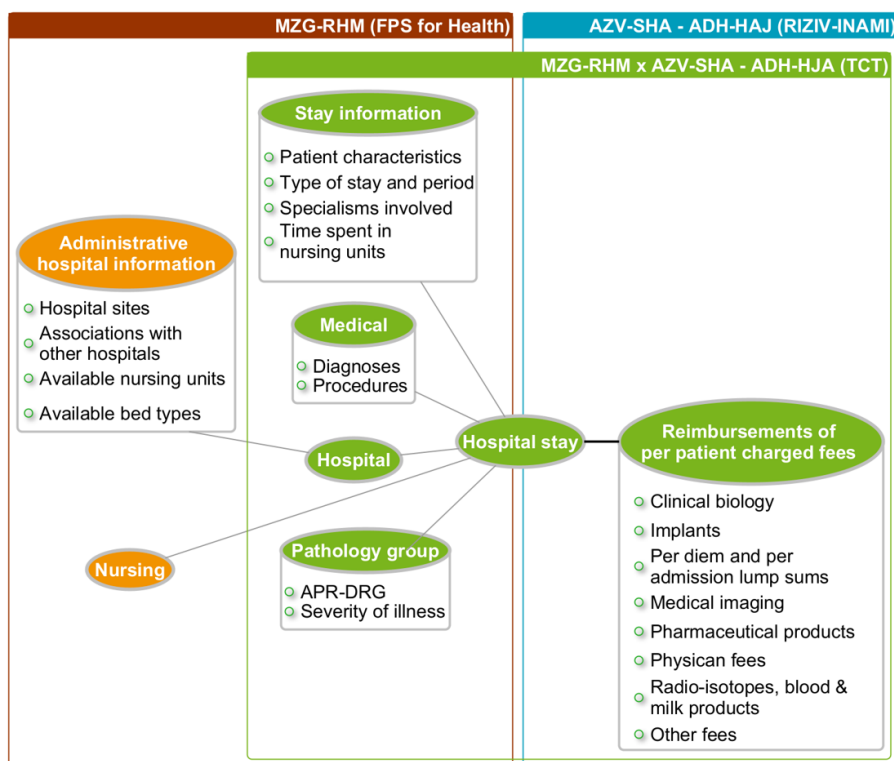
^{ee} Koninklijk besluit van 27 april 2007 houdende bepaling van de regels volgens welke bepaalde ziekenhuisgegevens moeten worden medegedeeld aan de Minister die de Volksgezondheid onder zijn bevoegdheid heeft, *B. S. 10 juli 2007* - Arrêté royal du 27 avril 2007 déterminant les règles suivant lesquelles certaines données hospitalières doivent être communiquées au Ministre qui a la Santé publique dans ses attributions, *M. B. 10 juillet 2007*.

^{ff} <https://www.health.belgium.be/nl/mzg-publicaties-het-voorkomen-van-ziekte-beelden-een-ziekenhuis>

^{gg} Wet van 29 april 1996 houdende sociale bepalingen, *B. S. 1996 april 30* - Loi du 29 avril 1996 portant des dispositions sociales, *M. B. 30 avril 1996*.

The linking process involves a double encryption of the patient national register number so that each patient has a unique pseudonymised identifier. Therefore reconstructing episodes of care, including readmissions across different hospitals, is possible and follow-up and adverse events identification (when requiring hospitalisation) as well.

Figure 10 – Structure of the information available in the TCT data



TCT (Technical Cell) database available in accordance to convention contracted with RIZIV-INAMI and KCE is presented in green. AZV – SHA: Anonieme Ziekenhuisverblijven – Séjours Hospitaliers Anonymes; ADH – HJA: Anonieme daghospitalisaties – Hospitalisations de jour anonymes; APR-DRG: All Patient Refined Diagnosis Group; FPS: Federal Public Service for Health, Food Chain Safety and Environment; MZG – RHM: Minimale Ziekenhuis Gegevens – Résumé Hospitalier Minimum.



TCT data include inpatient stays but no outpatient data, so they are particularly useful when outpatient costs can be neglected. If, however, also outpatient costs have to be considered, then IMA – AIM database will be required. Access for the KCE, RIZIV – INAMI and FPS Public Health to the pseudonymised TCT data is regulated in the same law as the Technical Cell. According to this law and in particular the Royal Decree of 18 October 2001^{hh} implementing its article 156, §3, **distributors, as third parties, can address a data request to the Technical Cell** that will examine it in the light of the principles of purpose, proportionality and relevance.

It is important to note that the AZV – SHA / ADH – HJA (billing part of the TCT data managed by the RIZIV – INAMI) represent a situation “at 18 months”. They include the same information as the Doc. N at 18 months explained above. Whereas the Doc. N can be updated by posteriori accounting adjustments/regularisations, the AZV – SHA / ADH – HJA are not corrected once linked to the MZG – RHM to constitute the TCT data. In other words, they represent a snapshot of the information available 18 months after the care delivery. Nevertheless, their exhaustivity is close to 100%.

TCT Financial feedback per pathology

The [national financial feedback per pathology](#) is a publicly accessible on-line presentation of the aggregated hospitalisation costs, number of stays and length of stay in Belgian general hospitals, **excluding one-day stays**. It is made available by the Technical Cell based on the TCT data. Beside the open-access national figures, each general hospital has an individual secure access to its own data.

The feedback includes the amounts reimbursed, excluding patient share or fee supplements, which are not available in the data. Nevertheless, the hospital 100% per diem price being recalculated, the patient share for this cost item is included. Similarly, the amounts presented for pharmaceuticals are also recalculated at 100%, and include therefore the patient share.

Total and average amounts, number of stays and length of stay are broken down per MDC, APR-DRG and level of severity. The different cost items available at this finest detail are the 100% per diem price, the pharmaceuticals, the clinical biology (25% reimbursed per fee-for-service), the medical fee-for-services, the lump sums, the implants and invasive medical devices, and the varia. Additional details are given for pharmaceuticals in general and for antibiotics in particular (reimbursements distribution parameters).

IMA – AMI database

The Intermutualistic Agency (“InterMutualistisch Agentschap – Agence InterMutualiste” – IMA–AIM) is a non-profit organisation that manages and analyses information on all reimbursements related to the compulsory health insurance, collected by the Belgian sickness funds on all insured citizens. The IMA – AMI database is the **most complete reimbursement database**, comprising inpatient as well as outpatient follow-up costs for each individual patient.

These data cover all reimbursed services (consultations, pharmaceuticals, diagnostic and therapeutic procedures, implants and invasive medical devices) and some patient demographic characteristics as well as social security related data to the extent they influence reimbursement (e.g. chronic illness reimbursement status, invalidity, increased reimbursement category, unemployment).

^{hh} Koninklijk besluit van 18 oktober 2001 tot uitvoering van artikel 156, § 3, van de wet van 29 april 1996 houdende sociale bepalingen, *B. S. 4 december 2021* - Arrêté royal du 18 octobre 2001 portant exécution de l'article 156, § 3, de la loi du 29 avril 1996 portant des dispositions sociales, *M. B. 4 décembre 2001*.



The database is composed of three original files or datasets: Population, Health care and Farmanet – Pharmanet, as well as several datasets derived from the original data thanks to algorithms developed by the Agency: General practitioners patients, Hospitalisations and Patient characteristics.

Note that contrary to the Farmanet – Pharmanet at RIZIV – INAMI's disposal, the patient pharmaceutical data are linked to the two other datasets at the patient level. Some calculated variables ('flags') are added to the original information. For example, the IMA – IMA database does not include clinical information as such; nevertheless, pseudo-comorbidities ("Farmacie Kosten groepen" – "Groupes de coûts pharmaceutiques") are derived from the pharmaceuticals reimbursements and added to the Population variables.

A unique patient identifier allows to study patient follow-up, readmissions and adverse events when requiring reimbursed health care services (including ambulatory health care). The date of death is also available in the Population variable, which allows accurate survival analyses of each patient.

The updating regularity and availability depend on the type of datasets composing the IMA – AIM database, as presented in Table 16.

Table 16 – Updating regularity and availability delay of the IMA datasets

IMA dataset	Description	Updating regularity	Availability (approximative completeness)
Population	Patient demographics, health and socio-demographic data	Yearly and half-year	Situation 31/12/Y (or 30/6/Y if missing): August Year + 1 (incomplete) November Year+2 (full)
Health Care	Health care reimbursements	Monthly	Accounting month available after 6 months
		Yearly	For accounting Year Y: 1 year (full at 86%) 18 months (full at 99%) 2 years (full at 99.6%) Corrections may be introduced after 2 years
Farmanet – Pharmanet	Pharmaceuticals reimbursements	Quarterly	Accounting quarter available after 4 months
		Yearly	For accounting year Y: April Y + 1 (91%) 18 months (99.95%) April Y + 2 (99.98%) Corrections may be introduced after 2 years

**Datasets derived from the three datasets above:**

General practitioners patients	Consultations and visits of patients with min. 1 contact or global medical file rights in a year Y based on the Health Care and Population datasets	Yearly	June Year+2
Hospitalisations	Information on (day-care or 'classic') hospitalisations based on the Health Care dataset	Yearly	Accounting Year Y (admissions, per diem prices): June Year + 1 (at 77.8%) December Year + 1 (at 99.7%) June Year+2 (99.9%) December Year + 2 (full)
Patient characteristics	Information on health care consumption based on all three original datasets.	Yearly	December Year + 1 (6 accounting quarters: 99%) December Year + 2 (10 accounting quarters: 99.9%) December Year + 3 (14 accounting quarters)

The KCE has an indirect access to the IMA – AIM database through a cooperation model concluded with the IMA – AIM. In a first step, the KCE develops a SAS analysis programme to be run on the full IMA – AIM database. Then the IMA – AIM extracts a subset of data and variables from the full database. Finally, the KCE analysis programme is run by the IMA – AIM on the subset and the produced outputs are transmitted to the KCE.

Since 2017ⁱⁱ, the following RIZIV– INAMI services have each a different access through the New Attest platform to some IMA – AIM data, depending on their specific legal missions:

- The Service for Medical Evaluation and Control (DGEC – SECM) has access to the health care services with identification of health care providers, prescribers and beneficiaries,
- The Service of Administrative Control has access to the health care services with identification of beneficiaries and their sickness funds,

- The Service Health Care (that includes the CTIIMH – CRIDMI) has access to the social data of personal character, including health-related data. Contrary to the two services above, these data are encrypted twice (once by the sickness fund and once by a third party before delivery to the IMA – AIM).

Distributors do not have access to the IMA – AIM data

The statutory mission of IMA – AIM is to analyze the data collected by sickness funds in the context of their missions and to provide information about them. This can be done on its own initiative or at the request of its legal partners: the RIZIV – INAMI, the Federal Public Service (FPS) Public Health, the FPS Social Security and the KCE. IMA – AIM also conducts scientific research projects in collaboration with and/or commissioned by other federal government agencies, Regions and Communities as well as in collaboration with universities. (<https://www.ima-aim.be/-Wie-zijn-we-?lang=nl>; https://aim-ima.be/IMG/pdf/ima_-_privacy_disclaimer_online_nl_-_v1_3.pdf) The data thus cannot be requested to be used for commercial

ⁱⁱ Article 9quater of the health insurance act, coordinated on 14 July 1994, introduced by the Law holding social dispositions of 11 Augustus 2017, published on 28 Augustus 2017. (Wet houdende diverse bepalingen inzake

gezondheid of 11 augustus 2017, B. S. 28 augustus 2017 - Loi portant des dispositions diverses en matière de Santé du 11 août 2017, M.B. 28 août 2017)



purposes, such as in the context of the submission of a reimbursement file by distributors, nor for commercial research performed before or after market entry. If we would plead for the use of IMA – AIM database in BIA in reimbursement files, we would plead for a trajectory where the distributor asks RIZIV – INAMI to obtain the data from IMA – AIM as the distributor itself had no (direct) access to the data. Preferably such data demand would take place before the submission of the file given the tight deadline of 180 days once the file is submitted.

EPS

IMA–AIM composes and maintains a substantive sample called the Permanent Sample (EPS). The purpose of the EPS is to provide permanent access to a representative sample of the IMA–AIM database to Belgian federal and federated institutions, conditional on their missions (see also art. 278 of the Program Law (I) of 24 December 2002). The EPS is composed of randomly drawn members of the Sickness Funds, stratified by age and gender, approximately 1 in 40 for members younger than 65, and 1 in 20 for members aged 65 and older. The purpose of the larger sample in the latter age category is to increase the precision for this group, which has relatively more health expenditures, and in whom the older age groups would otherwise become too small. The sample is longitudinal and contains data since 2002. Every year, an additional sampling similar to the original sampling compensates for members lost to follow-up due to decease or other reasons.

The management of the EPS is legally exercised by the EPS Technical Commission (TCPS) (see the abovementioned art.278 of the Program Law (I) of 24 December 2002 and its implementing Royal Decree of 9 May 2007 modified by the Royal Decree of 21 March 2013). Further details on the EPS can be found on <https://metadata.ima-aim.be/nl/app/bdds/Ps> and on <http://www.riziv.fgov.be/nl/publicaties/Paginas/permanente-steekproef.aspx>

The EPS is directly (though conditionally) accessible by both the KCE and RIZIV – INAMI, but **not accessible to distributors**. As for IMA data universities can request EPS data.

EPS data are particularly interesting to use as access to these data is **less labour- and time-intensive** than for the IMA – AIM database. Nevertheless, the EPS data are only sufficient when the pathologies of interest are highly prevalent, i.e. when large population groups are concerned. So, EPS data are particularly interesting for an initial evaluation in case of a high prevalence of the underlying pathology, otherwise, IMA – AIM database or TCT data will be better suited.

MZG – RHM/EPS

In 2013, the KCE published the report “Linking of the Permanent Sample with the Hospital Data: Feasibility and data representativeness study” in collaboration with the IMA – AIM, the Technical Cell and the eHealth platform, recommending the creation of the MZG – RHM/EPS linked database.⁴ At the time of writing, the Royal Decree required to implement this linkage is not published yet.

These linked data will allow the **most accurate patient selection**, allowing for (pseudo-)nomenclature and clinical criteria as well. Obviously, the same restriction applies for the EPS, i.e. the group of interest must have a sufficient size in the Belgian population. The perennial character of the linkage would allow to avoid long and complex linkage authorization procedures which represents **time and money savings**. Moreover, the **longitudinality** of the database would be very useful to study the follow-up of patients benefiting from an implant or an invasive medical device.

At the time of writing, accessibility conditions are still unknown, for the KCE, the RIZIV or any third party such as distributors or universities.



Table 17 – Technical overview of national databases that can be used for transversal budget impact calculations

Database	Patient level and demographics	Exhaustivity	Regularity /availability (delay)	Implants/ invasive MD	Medical honoraria	Drugs	Hospitalisation costs	Other subsector	Varia (non exhaustive)
Doc. N	N	Y	Monthly /3-4 months	Y	Y	N	Y	Y	
Doc. P	Y (Ambulatory: RIZIV – INAMI use only)	Y	Half-year/ 4-5 months	Y	Y	N	Y	Y	
Doc. PH	N	Y (hospital pharmacies)	Half-year/ 4 months	N	N	Y	N	N	
Farmanet – Pharmanet	Y	Y (public pharmacies)	Quarterly / quarter	N	N	Y	N	N	
SHA – AZV	Y	Y Hospital setting	Yearly / 2 years	Y	Y	Y	Y	Blood, radio-isotopes, milk, ...	- length of stay - hospital services - patient insurance status - health care provider qualification
ADH – HJA	Y	Y (Hospital setting)	Yearly / 2 years	Y	Y	Y	Y	Blood, radio-isotopes, milk, ...	- hospital services - patient insurance status - health care provider qualification
MZG – RHM	Y	Y (Hospital setting incl. uninsured)	Half-year (yearly for transmission) / 2 years	N	N	N	N	N	- length of stay - time spent in hospital services, units and specialisms



									- APR-DRG, SOI, diagnoses, procedures in ICD-10-BE - patient insurance status
TCT Data	Y	Y (Hospital setting only)	Yearly / 2,5 years	Y	Y	Y	Y	Blood, radio-isotopes, milk, ...	- See MZG –RHM, SHA – AZV and ADH – HJA
Financial Feedback pathology	per N	Y (Hospital setting only)	Yearly / 2,5 years	Y	Y	Y	Y	Blood, radio-isotopes, milk, ...	- length of stay
IMA – AIM Database	Y	Y	Depending on the data: see Table 17	Y	Y	Y	Y (reconstructed by IMA–AIM)	Blood, radio-isotopes, milk, ...	- length of stay, - time spent in hospital services, - health care provider qualification, - patient vital status (date of death) - patient insurance status - socio-economic parameters, - employment status, incapacity benefits
EPS	Y	N - sample	Yearly / February Y + 2	See IMA – AIM database					
RHM – MZG /EPS	Y	N - sample	Yearly/ Yet unknown	Y	Y	Y	Y	Yet unknown	

ADH – HJA: Anonieme Dag Jospitalisations de Jour Anonymes; APR-DRG: All Patient Refined Diagnosis Group; AZV – SHA: Anonieme Ziekenhuisverblijven – Séjours Hospitaliers Anonymes; EPS: Permanent Sample; FPS: Federal Public Service; IMA – AIM: InterMutualistisch Agentschap – Agence InterMutualiste; MZG – RHM: Minimale Ziekenhuis Gegevens – Résumé Hospitalier Minimum. SOI; Severity of illness; TCT: Technical Cell.



Distributors may also purchase data from private companies. One example is IQVIA, an international company that gathers and maintains information on health care consumption, health care technologies, etc. They offer a.o. trend analyses of the pharmaceuticals market, hospital data aggregations, etc. Another example is the Belgian Besco that develops a web-based portal to access different modules, such as eCoNoDat for the nomenclature (quantities and amounts reimbursed by nomenclature code, accompanied by legal references and application conditions), eCoMaDat that gives the same type of information for the implants and invasive medical devices and eCoFaDat, a reference table of pharmaceuticals (no quantity nor amount though are available in this table).

4.2 Limitations of the national databases

The national databases can provide valuable extra information on top of data from RCTs. National routinely collected data are relatively inexpensive, comprehensive sources of information with a stable longitudinal structure. However, national databases also have their limitations:

- The first concern is the quality of the information, especially concerning some dimensions of data quality such as validity, completeness and accuracy, as well as timeliness.
 - The clinical information coded in the MZG – RHM may be subject to coding differences across hospitals. Biases can also be triggered by the fact that these data are used in the hospital financing system, making “upcoding” enticing (i.e. optimizing the choice of clinical codes translated from patients medical files in order to aggravate the hospital case-mix to increase financing). On the contrary, when not playing any role in the level of severity assigned by the APR-DRG classification system, relevant information may be underreported, e.g. hypertension. Incompleteness can be due to many reasons. Patients dying shortly after admission may have their chronic illnesses undocumented compared to patients staying for a long time. Typically, patient history and lifestyle information are often underreported (e.g. body mass index, smoker status). Although controls and audits are performed by the FPS Public Health, they do not have sufficient human and financial resources

to carry out frequent and comprehensive audits of the data registered and transmitted by general hospitals. Moreover, there is currently no legal ground for the FPS Public Health to apply any sanction in case of shortcomings or even fraud. The use of the TCT data could help to detect coding issues by comparing clinical information with billing data. Previous initiatives have explored such comparisons.⁹

- Billing instructions and billing codes to be used may also be interpreted differently by different invoicing systems or health care providers. Nevertheless, contrary to the MZG – RHM registration, penalties are possible in case of fraud detected by the DGEC – SECM. Also, it is not known if and when reimbursed pharmaceuticals delivered, mostly in ambulatory setting, are actually taken by a patient. The information is accurate enough for the original purpose of the administrative database (reimbursement management) but can be inaccurate in patient selection.

Recent data are often lacking as most databases are not available for years (see Table 17). The waiting times are even longer in case of database linkage (e.g. TCT data). As for ad hoc linkages, when personal data protection is at stake and legal authorization of the Information Security Committee of the Crossroad Bank is required, the delays amount to several years. In a (yet undetermined) future, the Health Data Authority should facilitate such linking procedures.

- The national databases (TCT data as well as IMA – AIM database or EPS) comprise limited patient characteristics (in terms of scores, operative risk, examination and laboratory results...). This can make it difficult to identify with sufficient precision the relevant eligible patient population in the data.
 - In some cases, comorbidities are available in the data: registration of chronic diseases such as diabetes, heart failure, and kidney diseases for instance in the MZG – RHM part of the TCT data. Composite comorbidities indexes can also be computed to summarize the clinical information registered in these data, such as the Charlson score, the Elixhauser index, etc.. Note that in Belgium, the number of secondary diagnoses that can be recorded



is fortunately not restricted as it is the case in other countries using the ICD classification since a long time (such as USA or Canada). In other databases, proxies are computed based on the health care consumption: in the IMA data and EPS, 'pharmaceutical cost groups' based on the consumption of reimbursed pharmaceuticals give an indication of chronic conditions (e.g. COPD/asthma, chronic anticoagulation, diabetes, HIV/AIDS, etc.). Other clinical proxies based on health care consumption are also available in these data (people having undergone a treatment in the preceding year such as, among others, cancer radiotherapy, bariatric surgery or having benefited from a diabetes convention).

- In the absence of clinical information, especially in the ambulatory setting, some comorbidities can be inferred from health care consumption: algorithms for comorbidities such as diabetes or cardiovascular morbidities have been developed based on drug consumption in the IMA – AMI data. In 2016, the Belgian Cancer Registry (BCR), in collaboration with the KCE, ran a validation study of pharmaceutical consumption based algorithms to identify comorbidities in the IMA – AIM data (linked to the BCR database) compared to patient medical files. The validation was established for diabetes, cardiovascular diseases and chronic respiratory diseases but not renal insufficiency.^{10, 11}
- As only limited patient characteristics are available in the national databases, a number of options can be considered to enhance the data.
 - If a future reimbursement request is expected by RIZIV – INAMI for a certain subpopulation of patients, which cannot be identified in the national databases, then RIZIV – INAMI can in some cases proactively create a parallel code (for the medical device, implant, or physician procedure) for patients with the characteristics matching those of the possible future reimbursement extension. In this way,

the volume and associated costs of those patients can be tracked in the national databases.

- Another option is – if a registry is available – to link the patient characteristics from the registry to the national databases. Unfortunately, the feasibility of such an option is jeopardized by the strict procedure deadlines imposed to the CTIIMH – CRIDMI considering the complexity of the linking processes, the involvement of trusted third party like the e-Health platform, the necessity to run small cell analyses and the need to obtain the authorization of Information Security Committee of the Crossroad Bank in order to guarantee the respect of the General Data Protection Regulation (GDPR). As written above, the creation of the Health Data Authority should facilitate such linking procedures in the future.
- Not every national database consists of longitudinal data. RIZIV – INAMI documents do not allow to follow the patient over time^{jj}. MZG – RHM can be used to follow a same patient in the same hospital only. AZV – SHA / ADH – HJA and TCT data allow to follow patients in hospital setting but not in ambulatory setting. IMA – AIM data and EPS are the only longitudinal national database allowing to trace patient history of health services consumption before benefiting from an implant/invasive MD and her/his consumption afterwards, including the postoperative care and adverse events treatments.

Furthermore, each particular database has its own characteristics and limitations. Depending on the implant or invasive medical device submitted by a distributor, some sources can be useful or not. For example, no data are available on ambulatory costs in the TCT data, so follow-up data cannot include ambulatory costs. In case of a population with a high mortality risk during the follow-up period, TCT data imply an unmeasurable actual loss to follow-up since mortality information is not included in this database. An absence of readmissions may be explained by an absence of adverse events requiring hospitalisation but may also be due to deaths in the

^{jj} Doc. P longitudinality in ambulatory setting cannot be used for BIA, only for a limited number of RIZIV missions.



community setting. So, when ambulatory costs are at stake, or when the patient survival must be analysed or adverse events requiring hospital admission must be measured in a population at high risk of dying, the IMA – AIM database must be used as the data source instead since the patients' vital status is included.

The TCT Financial feedback per pathology is sometimes used in cost estimations. This gives rather rough estimations as APR-DRG can often not be used as a satisfactory proxy for a population targeted by a specific procedure or pathology. Moreover, we must remember that, since its origins back at the end of the last century, this feedback excludes the day-care setting even though surgery is since then more and more performed in day care.

On the other hand, IMA – AIM data have no clinical information as such and “pseudocomorbidities” measured on reimbursed pharmaceuticals consumption may be insufficient to define patient populations.

Differences between discharge data and accounting data must also be taken into account. One registration year of discharge data such as the MZG – RHM and the TCT data comprise the hospital stays discharged during that year, which means that some patients were admitted and, for example received an implant the year before. It also means that patients admitted at the end of the year are absent from that registration year. Hence discrepancies exist between such databases and the billing data. The Doc. N include the intervention year and the reimbursement (accounting) year. None of these corresponds exactly with a discharge data registration year. Discrepancies may be explained by other reasons; for example, once the AZV – SHA / ADH – HJA are linked to the MZG – RHM, the resulting TCT data cannot be modified afterwards contrary to the original AZV – SHA / ADH – HJA.

4.3 Overview of elements in a BIA and which national databases can be used for them

For estimating the **volume**, national administrative databases can give relevant input (see Table 15).

- Pre-reimbursement volume of the intervention-under evaluation:
 - If there is one or more ICD-10 procedure code specific enough for the intervention-under-evaluation, then the TCT data or MZG – RHM can give data on the potential volume of this intervention, even in the situation where it is not yet reimbursed. However, as the volume likely will increase in a context where the intervention is reimbursed, these pre-reimbursement volume data are likely not fully informative. If the code is not specific enough, the volume will be overestimated.
 - The same holds for an ICD-10 diagnostic code: if there is a diagnostic code (or a combination of procedure and diagnostic codes) specific enough for the intervention-under-evaluation, then data on the pre-reimbursement volume can be obtained. These data will need to be completed, e.g. with estimates about the future impact of reimbursement on the volume.
 - Now that the AZV – SHA / ADH – HJA include the implant notification code – even when the implant is not reimbursed – a more accurate identification before reimbursement becomes possible based on the implant itself (not only on the implant type but also on the model specifically proposed by the distributor).
- Reimbursed volume of the comparator:
 - When the intervention-under-evaluation replaces an already reimbursed intervention (**substitution**), or is being used in addition to an already reimbursed intervention (**combination**), then the administrative data including reimbursements (such as TCT data, IMA – AIM database or EPS) can give input on the volume of the total treated population. However, if it concerns only a partial substitution or a partial combination (for only a subpart of patients), then it remains to be seen whether this subpopulation can be



identified in one way or another. If the intervention-under-evaluation concerns a situation where there is **no existing care**, then it may also be difficult to identify this patient population in the data.

- In some cases, like for TAVI, a future reimbursement request might be foreseen, in which case RIZIV – INAMI can introduce a parallel intervention code for the comparator, for those patients who would meet the future eligibility criteria for the new intervention. On the basis of this parallel intervention code, a better estimate can be made of the future volume of the new intervention. However, it has to be acknowledged that cases where a reimbursement request can be anticipated from several years beforehand, are rather scarce and that the case of TAVI forms rather an exception than the rule.
- If the comparator involves an implant, the notification code also allows the determination of this volume in the data more accurately than based on the pseudo-code (AZV – SHA / ADH – HJA, IMA and EPS if reimbursed).
- Most often estimates have to be made on the future volume of the intervention and on the gradual uptake of it; these estimates can be based on (inter)national incidence or prevalence data or expert estimates.

For the **cost (pseudo-nomenclature tariff) of the implant/invasive medical device**, it is clear that, if the tariff has not yet been agreed upon, estimates have to be made. The same holds for the cost (nomenclature tariff) of the **physician's input**. Administrative data, however, can give a clear picture of which physician codes are billed in reality in case there are no clear guidelines on which code must be billed.

Depending on the implant or invasive medical device analyzed and considering the information available at the level of the (pseudo-)nomenclature codes in many administrative databases, cost items may be defined differently as in the two cases studied. For example, it may be interesting to identify the volume and cost of blood and blood-derivates

required by a procedure, the medical imaging techniques involved or a specific pharmaceutical product.

Also for the cost of the **associated hospitalisation and follow-up, as well as the cost of adverse events**, national administrative databases (TCTdata, IMA – AIM data or EPS data) can sometimes be used as input (depending on the quality of the data), especially if there is a comparator/intervention which is already reimbursed. Furthermore, through the use of administrative databases, data on the incidence of adverse events with the comparator/intervention can in some cases be retrieved (depending on the possible identification of the target population, the relevant adverse event, etc.). However, due to the limitations of the national databases (limited data on clinical patient characteristics), often, the relevant population cannot be identified in the data.

MZG – RHM data (and thus also TCT data) can be helpful to verify some clinical assumptions. In the TAVI case, we checked whether the observations made by the distributor on patient age and on ICU time in one hospital were generalizable to the whole country. Similarly, other observations can be verified, such as the burden of comorbidities varying from one group of patients to another. This is helpful when assumptions are made about patients presenting more co-morbidities than other patients. Note that the severity of illness making part of the APR-DRG system can also be used to compare patient groups, providing that the comparison is made in the same APR-DRG (the logic behind the four levels of severity of illness are determined for each APR-DRG individually and levels cannot be compared across APR-DRGs). If there is an ICD-10 procedure code specific enough for the intervention-under-evaluation (not yet reimbursed), then the TCT data can also give data on the intervention-under evaluation, its associated costs in terms of hospitalisation and follow-up costs, as well as the cost and incidence of adverse events treated in a hospital setting.

In general, data are available in the national databases on the comparator treatment (outcome of the treatment (baseline outcome); risk of adverse events (baseline risks)). Since RCTs are not necessarily representative for the whole patient population, it can be checked on the basis of national databases whether the baseline outcomes and risks from the real-world data (RWD) match the data from the RCTs. If this is not the case, then the absolute treatment effect (outcomes/risks) from the RCTs cannot be simply



extrapolated to the whole patient population. It will have to be explored what could be the reason behind this deviation and assumptions will have to be made on what would be the resulting treatment effect for the whole patient population (one possibility is to apply the relative treatment effect instead of the absolute treatment effect to the baseline outcomes/results from the RWD) (see 5.2).¹²

The current report illustrates an analysis of a few study possibilities using the national administrative databases. Other types of analyses can be done, depending on the case. For example, the representativeness of the data collected by the distributors from a few hospitals can be verified. Or the learning curve effect can be studied; the results of real-world data registered from a few experienced early adopters may indeed change once reimbursement opens the way to inexperienced newcomers. Conversely, the results obtained from the health providers may get better as the position of the health providers moves up along the learning curve. As another example, in cases where the impact on the RIZIV – INAMI expenditures on the ‘maximum bill’ is considered large, it will be interesting for RIZIV – INAMI to also calculate this impact. The system of the maximum bill does not change the total budget impact considering the perspective of all healthcare payers (which includes patients as well), but it does have an impact on the expenditures for RIZIV – INAMI. A household is entitled to the maximum bill when its total yearly amount of co-payments exceeds a threshold, after which the household gets reimbursement for the co-payments as well.

5 DISCUSSION

5.1 Caution when using national databases for demonstrating effectiveness

In the above discussed cases, we tried to use national databases to obtain relevant RWD for inputs of a BIA. For as long as the relevant patient population (eligible for the new treatment) can be identified in it, useful data can be obtained – ex ante – about the volume of these patients and the cost of treating them with the standard/comparator treatment, as well as on the follow-up costs and the risk and costs of adverse events with the standard/comparator treatment. In some cases, these data can also be retrieved for the new treatment. Still the above discussed cases illustrated that often it is not possible to precisely identify the relevant patient population, as only limited clinical characteristics of patients are available in the databases.

Nevertheless, even when the relevant patient population can be identified, RWD has its limitations and caution should be taken when they are used to demonstrate effectiveness, as it is very difficult to imitate the pure measurement of effectiveness as obtained through randomization in RCTs. Even if known confounding factors would be controlled for in the real-world data analysis, there may be other unknown confounding factors (on which doctors consciously or unconsciously select their patients) missing in the analysis. The strength of RCTs is that confounding factors are controlled for even when they are unknown. Therefore RCTs remain the gold standard to demonstrate effectiveness.¹²

Data from RCTs also have their limitations. The population included in RCTs is often not representative for the population eventually getting the intervention once reimbursed. Combining the strengths of both RCTs (to identify the relative treatment effect) and RWD (to identify the baseline risk for outcomes of interest) might offer a solution (see 5.2). Another possibility is pragmatic registry-based RCTs. This might provide a solution to meet both criteria: providing reliable evidence on a treatment’s effectiveness (internal validity) in the relevant population (external validity).¹³ Despite its limitations,



RWD remain an important and valuable source to complement data from RCTs or being included as part of pragmatic registry-based RCTs.

The focus of this report is not on the data to be used for demonstrating the effectiveness, but on data to be used in the BIA. Nevertheless, because reliable information on efficacy/effectiveness is needed to make reliable budget impact calculations, we cover this in the following part of this discussion.

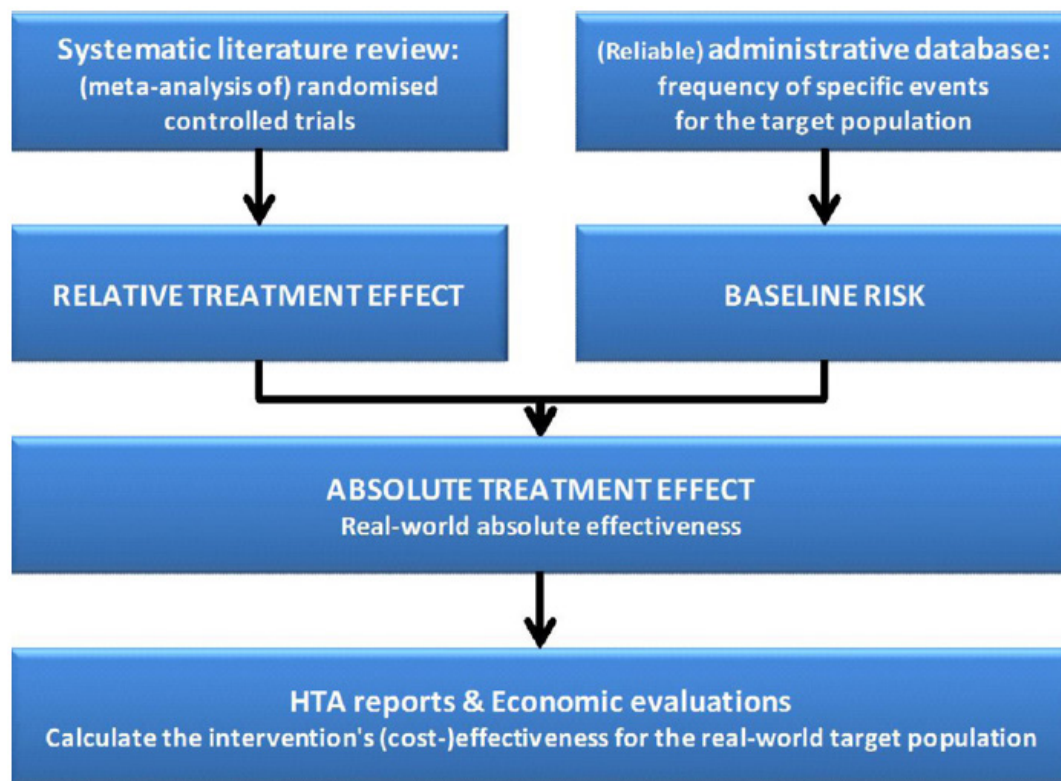
5.2 (Transversal) budget impact – information needed for different elements

When making calculations for a (transversal) budget impact analysis, researchers need information for several variables. For example, if it is indicated that an intervention will result in fewer rehospitalisations by avoiding an adverse event, it concerns, for example, 1) the risk of rehospitalisations for the comparator group (baseline risk), 2) the cost of such rehospitalisations (and, for transversal budget impact analysis, the impact on different sub-budgets such as bed days, pharmaceuticals, honoraria, etc.), and 3) the relative treatment effect. Applying the relative treatment effect to the baseline risk can be used to calculate the absolute effect on rehospitalisations. Applying the cost results in a monetary valuation of this impact.

The necessary critical analysis is of course necessary when interpreting reliability. This applies to all three elements listed as an example in the previous paragraph: 1) for baseline risk: e.g. can the relevant population and rehospitalisation linked to the adverse event be correctly identified? 2) do we have reliable (real-world) data reflecting the costs linked to this rehospitalisation? 3) is reliable evidence available on the treatment effect for the relevant population? The first two elements can potentially be extracted from RWD. To obtain reliable information on the treatment effect, the gold standard is the RCT. Again, critical analysis is always needed. For example, a pragmatic trial may directly provide information on baseline risk and relative/absolute treatment effect if the selection criteria and the treatment/follow-up reflect the population and treatment targeted in real life. In that case, there is both internal and external validity of the results. In an RCT with strict inclusion criteria and intensive follow-up, there may be internal validity but no external validity. In that case, it may be useful/necessary to make an adjustment for the baseline risk. Figure 11 outlines this approach.



Figure 11 – A possibility to combine the strengths of both RCTs and observational data for economic evaluations and budget impact analyses



Source: Neyt et al. (2012) ¹²

Remark 1: This approach is not only relevant for (cost-)effectiveness analyses, but also for BIA.

Remark 2: In a pragmatic RCT that includes the target population, a good estimate of the relative and absolute treatment effect is provided directly. In this case, larger scale RWD may be useful to e.g. validate the baseline risk information collected.



We explain the above approach with two examples from two previous KCE Health technology assessment (HTA) reports, one for devices¹⁴ and another for drugs¹⁵:

- Drug-eluting stents: “Cost-effectiveness/utility analyses most often use results from RCTs to model effectiveness. Results may however not always be generalisable to the population for which policy makers want to take a decision. For example, in the case of drug-eluting stents (DES), some RCTs comparing DES with bare-metal stents (BMS) show a decrease, in absolute (not relative) terms, of about 17% in the number of re-interventions due to the lower risk of restenosis [...]. Should the economic modeller then apply this absolute reduction of 17% to the real-world population of patients that received BMS to estimate the benefit of DES? Belgian registry data on about 11 500 patients with BMS showed that the number of repeat hospitalisations was on average almost 15% after one year of which less than half (43%) of them were due to restenosis^{12, 14}. This implies a real-world baseline risk for this population of about 6% for repeat hospitalisations due to restenosis with BMS. The contrast with the 17% absolute benefit in the trial with DES is intriguing. It is due to the specific eligibility criteria for inclusion in the RCT as well as to protocol-driven angiographic follow-up, which led to an overestimated baseline risk for restenosis. This example illustrates the irrationality and non-generalisability of this absolute benefit. If about two repeat hospitalisations on three can be avoided, then applying this relative benefit on the 6% baseline risk results in an estimated real-world absolute benefit of about 4% [...].” In this example, the relative treatment effect was based on RCT data and the baseline risk for repeat hospitalisations in the standard-of-care group could be identified based on large-scale RWD.
- Tiotropium: “Another example is the cost-effectiveness of tiotropium for the treatment of chronic obstructive pulmonary disease (COPD). The UPLIFT¹⁶ (understanding potential long-term impacts on function with tiotropium) trial, comparing tiotropium with placebo in COPD patients who were permitted to use all respiratory medications except inhaled anticholinergic drugs, showed a significant reduction in exacerbations and a non-significant reduction in exacerbation-related hospitalisations. Due to the relatively high cost of such hospitalisations, this variable was

considered of major importance for the economic analysis. However, in Belgium, administrative data of more than 56 000 COPD patients showed that during the course of one year the number of hospitalisations with COPD as primary diagnosis was on average 0.14. Before tiotropium was used, about 90% was not hospitalised and only 2.2% had more than one hospitalisation related to COPD. As a result, the cost-effectiveness of tiotropium was hampered by the good performance of the (cheaper) treatment alternatives.”¹⁵ In this example, the RWD could be used to provide information about the baseline risk for hospitalisations in the target population.

The above examples are based on economic evaluations to estimate the cost-effectiveness of interventions. The same reflections are also applicable for (transversal) BIA.

As a solution to the problem of obtaining realistic estimates for the absolute treatment effect, needed in reliable economic evaluations and BIA, there is no one-size fits all. Do you go straight for a pragmatic RCT or combine information from an RCT in the ideal setting with RWD about the baseline risk for specific events in the comparator group under real-world conditions? Each approach has both its advantages and disadvantages. For example, in the case of combining RCT data with baseline risk data, you make the assumption that the relative treatment effect is constant. This idea is summarized by Collins et al.¹⁷ as follows: “*In generalizing the results of a randomized trial, the assumption is not that the patient population studied is representative of all patients but rather that the proportional effects of the treatment studied on each specific health outcome should be similar in different circumstances, unless there is good reason to expect otherwise.*”¹⁸ Consequently, valid estimates of the absolute benefits and harms of a treatment can be obtained by applying reliable randomized evidence for its separate proportional effects on each outcome of interest to the absolute incidence of these outcomes in observational studies conducted within a particular population.”¹⁷ This approach may be feasible and acceptable in some cases, but not in others, which requires a case-by-case assessment.



5.3 (Problem of) identifying the relative treatment effect

During the discussion about one of the examples in this report (thrombectomy), the question was raised whether the potential impact of the intervention on different partial budgets such as drugs, medical acts, hospitalisations, rehabilitation, home nursing care, etc. could be assessed based on real-world data. The suggestion was made to consider e.g. before/after analyses. We did not address this because this would only produce unreliable results. Can we identify a comparable population in the before/after analysis? Can we identify the relevant costs for variables such as rehabilitation and home nursing care? And if we could, what is the impact of the intervention on these costs and can we isolate the impact of other known and unknown comorbidities or events on these elements? Such an analysis based on non-randomised RWD is very susceptible to various forms of bias which is problematic for the interpretation of the results. We, therefore, chose not to apply for such an unreliable method and point out the problem of trying to estimate a treatment effect via non-randomised observational RWD.

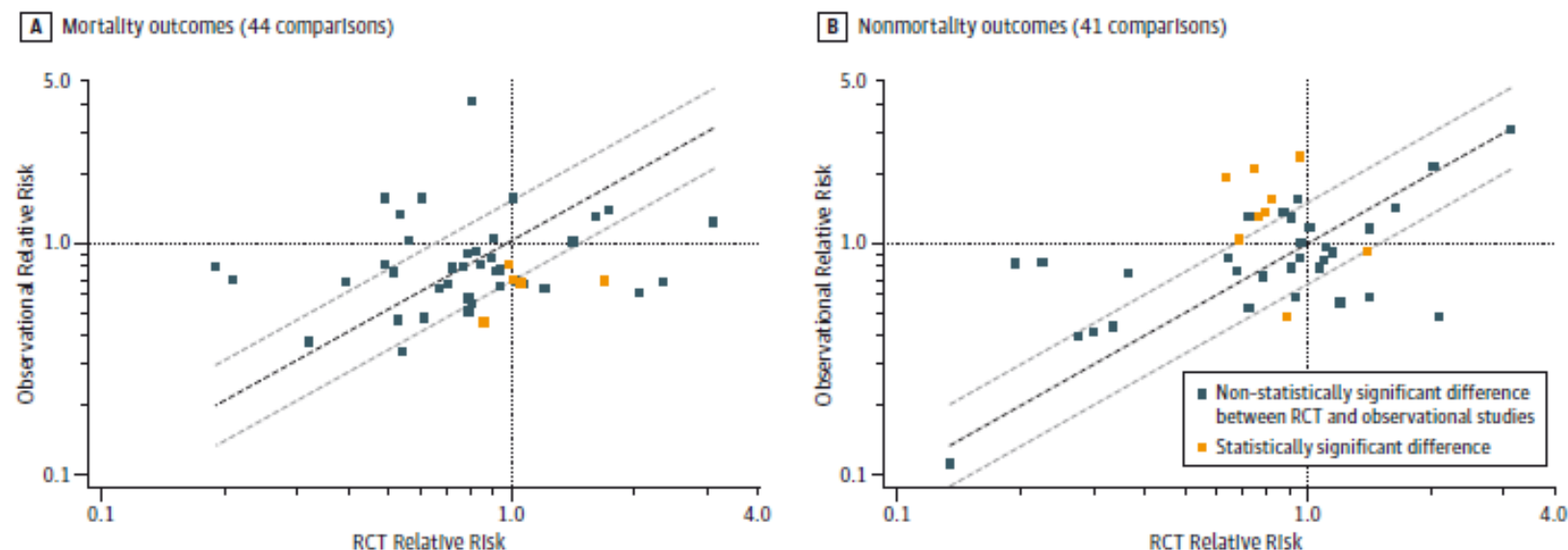
5.3.1 RCTs versus observational data: large-scale evidence

With the exception of very large treatment effects (often cited as the example of the parachute whose effect was also not investigated with an RCT¹⁹), estimating the treatment effect purely via observational data is problematic, even if sophisticated statistical techniques are applied to it, such as propensity-score adjustments. This was demonstrated in the analysis of Dahabreh et al.²⁰ and Kumar et al.²¹

Dahabreh and Kent²⁰ mention that despite continued advances in epidemiological and statistical methods and the advent of “big data,”²² there is concern that inferences from observational data can lead to poor health care decisions by misrepresenting association for causation. They discuss propensity score methods since these techniques are considered one of the most advanced methods in order to try to extract causal inferences from observational data.

In an empirical evaluation, they combine the results of three studies²³⁻²⁵ contrasting results of propensity score analyses and RCTs in which the effect of an intervention in similar populations are compared. Dahabreh et al. observed a lack of agreement across designs and mention most disagreements among RCTs and observational studies have been ascribed to incomplete control of confounding in the latter.²⁰ The authors were concerned about the absence of a clear pattern that could be used to predict the level of agreement for both mortality and non-mortality outcomes (see Figure 12).²⁰ According to the authors, *“this is crucial: some disagreement between studies of different designs should be expected, but it is the unpredictability of the disagreement that most undermines the credibility and limits the application of observational results.”*²⁰

Figure 12 – Comparison of propensity score analyses and RCT Results
(Dahabreh et al.)



Scatter plots of results from empirical comparisons of propensity score analyses (y-axis) and corresponding randomized clinical trial (RCT) results (x-axis). Markers denote comparisons between observational and randomized study estimates for the same research question (similar populations, interventions, and outcomes); statistically significant differences ($P < .05$) are shown in orange. The dotted lines indicate lack of effect in RCTs (vertical lines) and observational studies (horizontal lines). Values lower than 1 indicate that the new treatment evaluated in the trial was more effective than the more established treatment; observational study results are expressed in the same way as the corresponding trial results. Markers in the

top-right and bottom-left quadrants in each panel indicate agreement between randomized and observational results with respect to the direction of effects. Markers in the top-left and bottom-right quadrants indicate discordant direction of effects between designs. Black dashed diagonal lines indicate the line of identity (perfect agreement) between RCT and observational study results; gray dashed lines demarcate observational study relative risks that are between 0.67 and 1.5 times those produced by the corresponding RCT results. The term "relative risk" is used to denote risk, odds, or hazard ratio estimates, as reported in the 3 empirical analyses contributing data to this figure.

Source: Dahabreh et al. (2014)²⁰

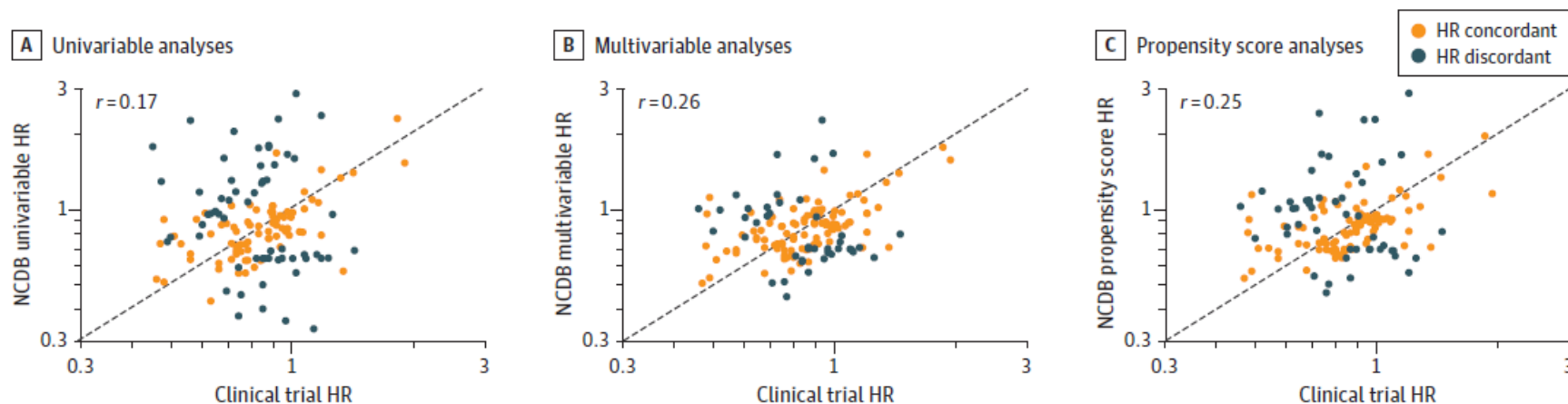


Dahabreh et al.²⁰ already pointed out that no clear improvement in agreement relative to previous comparisons of RCTs vs observational studies analyzed with conventional adjustment methods²⁶ was observed. This is also confirmed in a more recent very large-scale study of Kumar et al. in the area of cancer.²¹ Kumar et al. examined the extent to which comparative effectiveness analyses using observational cancer registry data produce results concordant with those of RCTs. A total of 141 RCTs including 85 118 patients were identified. Data on participants within the National Cancer Database (NCDB) diagnosed between 2004 and 2014, matching the eligibility criteria of the RCT, were obtained including 1 344 536 patients. Three Cox proportional hazards regression models were used to determine hazard ratios (HRs) for overall survival, including univariable, multivariable, and propensity score-adjusted models.²¹

In their analysis, the main outcome was concordance between the results of RCTs and observational cancer registry data. "Hazard ratios with an NCDB analysis were considered concordant if the NCDB HR fell within the 95%CI of the randomized clinical trial HR. An NCDB analysis was considered concordant if both the NCDB and clinical trial P values for survival were nonsignificant ($P \geq 0.05$) or if they were both significant ($P < 0.05$) with survival favoring the same treatment arm in the NCDB and in the randomized clinical trial."²¹ The results (Figure 13) were summarized as follows: "analyses using the NCDB-produced HRs for survival were concordant with those of 141 randomized clinical trials in 79 univariable analyses (56%), 98 multivariable analyses (70%), and 90 propensity score models (64%). The NCDB analyses produced P values concordant with randomized clinical trials in 58 univariable analyses (41%), 65 multivariable analyses (46%), and 63 propensity score models (45%). No clinical trial characteristics were associated with concordance between NCDB analyses and randomized clinical trials, including disease site, type of clinical intervention, or severity of cancer."²¹



Figure 13 – Comparison of hazard ratios from RCTs and analyses with data from the National Cancer Database (NCDB) (Kumar et al.)



Hazard ratios shown for univariable analyses (A), multivariable analyses (B), and propensity score analyses (C). Each point on the scatter plot represents the HR for overall survival from 1 of the 141 randomized clinical trials in this study and the corresponding analysis within the NCDB. Yellow dots represent NCDB analyses in which

the NCDB HR falls within the 95% CI of the HR in the clinical trial (concordant), and blue dots represent HRs from the NCDB analyses that fall outside the 95% CI of the HR in the clinical trial (discordant). The gray dashed line shows where clinical trial HRs equal NCDB HRs. The intersection of the axes represents an HR equal to 1.

Source: Kumar et al. (2020) ²¹

As stated by Banerjee and Prasad,²⁷ “these findings are discouraging. Propensity-matched hazard ratios for overall survival from CER [comparative effectiveness research]-based analyses fell outside the 95% CIs of their RCT counterparts 36% of the time (with 64% falling within). Furthermore, observational studies led to a different inference regarding therapeutic efficacy 55% of the time (i.e., point estimates that were either in a different direction, nonsignificant in CER vs significant in RCT or significant in CER but nonsignificant in RCT).”²⁷ They refer to problematic elements of observational studies being unmeasured confounders, problems defining time 0, and selection bias (confounding by indication).

Nevertheless, they clearly state there is a role for observational studies, however, for the right research question: “observational studies may clarify issues of prognosis, patterns of real-world usage, rare adverse events, and glaring disparities in cancer care delivery. However, when it comes to establishing the fundamental efficacy of therapeutic interventions, caution is warranted, and propensity score matching is not a panacea.”²⁷



5.3.2 (Lack of) comparative evidence for implants and invasive medical devices

For medical devices, access to the European market is provided through the CE marking system, controlled by Notified bodies, which are mainly for-profit entities designated by the local governments.²⁸ Even for high-risk devices, the clinical trial data supporting the CE mark may be limited. In the European Union (EU), under the new medical device regulations Regulation (EU) 2017/745 (MDR)^{kk} which entered into force in May 2017 and became applicable on 26 May 2021, only safety and device performance need to be demonstrated, together with an acceptable benefit-risk ratio.²⁸

Clinical performance means the ability of a device, resulting from any direct or indirect medical effects which stem from its technical or functional characteristics, including diagnostic characteristics, to achieve its intended purpose as claimed by the manufacturer, thereby leading to a clinical benefit for patients, when used as intended by the manufacturer.²⁸ The MDR specifies that *clinical benefit* means the positive impact of a device on the health of an individual, expressed in terms of a meaningful, measurable, patient-relevant clinical outcome(s), including outcome(s) related to diagnosis, or a positive impact on patient management or public health.²⁸ Unfortunately, none of these definitions include a requirement to compare the intervention with the current standard of care or best alternatives. To demonstrate that safety and performance criteria are met, manufacturers of all classes of medical devices are required to perform a clinical evaluation. A clinical evaluation should consider currently available alternative treatment options. However, a clinical evaluation does not mean a clinical trial but constitutes a broad collection and analysis of all kinds of clinical data.²⁸

According to article 62 of the MDR, the *purpose of clinical investigations* under the Regulation are:

- “to establish and verify that, under normal conditions of use, a device is designed, manufactured and packaged in such a way that it is suitable for one or more of the specific purposes listed in point (1) of article 2, and achieves the performance intended as specified by its manufacturer;
- to establish and verify the clinical benefits of a device as specified by its manufacturer;
- to establish and verify the clinical safety of the device and to determine any undesirable side-effects, under normal conditions of use of the device, and assess whether they constitute acceptable risks when weighed against the benefits to be achieved by the device.”

In the context of clinical investigations with medical devices, the MDR expressly states that the clinical investigation plan must include a description of “*the current state of the art in clinical care in the relevant field of application and the proposed benefits of the new device.*” However, again, this does not mean a comparative trial should demonstrate the added value of the medical device in comparison with current standard of care. As a result, medical devices can be CE-labelled without having demonstrated their added value to the patient on certain outcomes compared to the current standard of care or other existing alternatives.

In contrast, health technology assessment is always comparative in nature, focusing on comparing the evidence for a new treatment with current or best practice (comparative evidence).²⁸ Patients, health care providers and governments want to know how an intervention performs on patient-relevant outcomes compared to existing alternatives.

^{kk} Regulation (Eu) 2017/745 of the European Parliament and of the Council of 5 April 2017 on medical devices, amending Directive 2001/83/EC, Regulation (EC) No 178/2002 and Regulation (EC) No 1223/2009 and repealing Council Directives 90/385/EEC and 93/42/EEC.



In contrast with the evidence required by the regulators, national reimbursement rules for medical devices may need additional evidence regarding the (comparative) effectiveness and added therapeutic benefit, cost-effectiveness and budget impact.^{28, 29} In Belgium, reimbursement decisions of medical devices claiming an added value, for which a higher price might be requested, include the five following reimbursement criteria: (i) the therapeutic value of the medical device; (ii) the price and proposed reimbursement basis; (iii) the importance of the medical device for medical practice in relation to the therapeutic and social needs; (iv) the impact on healthcare expenditures; (v) and the relation between the healthcare cost and the therapeutic value of the medical devices (Box 2) (Article 16 of 25 June 2014^{II}).

The lack of the necessary comparative evidence also creates problems in correctly estimating the budget impact. If this comparative evidence is lacking for relevant endpoints, it is difficult to critically assess assumptions about savings resulting from the use of medical devices. Without reliable evidence, it is difficult to estimate whether savings linked to (re-)hospitalisations, adverse events, rehabilitation, home nursing, productivity, etc. are realistic. As indicated above, analysing real-world observational data will also not be able to reliably answer a question linked to the relative or absolute treatment effect.

5.4 Opportunities under the new HTA regulation: joint scientific consultations and joint clinical assessments

The lack of comparative evidence might hinder properly making a reliable (transversal) budget impact analyses. Towards the future, the new HTA regulations provides opportunities. This [regulation](#) was adopted in December 2021.^{mm} Concerning medical devices, medical devices classified as class IIb or III and in vitro diagnostic medical devices classified as class D shall be subject to joint clinical assessments (JCA). (Article 7 §1) There is a progressive implementation of the regulation. While this starts in January 2025 for cancer drugs and advanced therapy medicinal products-(ATMPs), and in January 2028 for orphan drugs, this is only in January 2030 for the above medical devices. (Article 7 §2) The JCAs will be limited to a description of the scientific analysis of (a) the relative effects of the health technology as assessed on the health outcomes against the chosen parameters which are based on the assessment scope, and (b) the degree of certainty of the relative effects, taking into account the strengths and limitations of the available evidence. (Article 9 §1)

There will also be "*joint scientific consultations [JSC] in order to exchange information with health technology developers on their development plans for a given health technology. Those consultations shall facilitate the generation of evidence that meets the likely evidence requirements of a subsequent joint clinical assessment on that health technology. The joint scientific consultation shall include a meeting with the health technology developer and result in an outcome document that outlines the scientific recommendation made. Joint scientific consultations shall in particular concern all relevant clinical study design aspects, or clinical investigation design aspects, including comparators, interventions, health outcomes and patient populations.*" (Article 16 §1) These JSCs are only advice and do not have any legal implications for the health technology developer. (Article

^{II} Koninklijk besluit van 25.06.2014 tot vaststelling van de procedures, termijnen en voorwaarden inzake de tegemoetkoming van de verplichte verzekering voor geneeskundige verzorging en uitkeringen in de kosten van implantaten en invasieve medische hulpmiddelen, *B.S. 1 Juli 2014 – Arrêté royal. du 25.06.2014 fixant les procédures, délais et conditions en matière*

d'intervention de l'assurance soins de santé invalidité dans le coût des implants et des dispositifs médicaux invasifs, *M. B. 1 juillet 2014.*

^{mm} Regulation (EU) 2021/2282 of the European Parliament and of the Council of 15 December 2021 on health technology assessment and amending Directive 2011/24/EU



16 §3) However, in the JCA, “if a health technology has been subject to a joint scientific consultation, an explanation from the health technology developer on any deviation from the recommended evidence” should be included.(Annex II §1g) This provides an opportunity to be transparent in the pre-market phase to the health technology developer about what evidence is needed. In anticipation of the application of this HTA regulation, countries can already make their preparations to work out this early dialogue process.

5.5 Learning from managed entry agreements

If important evidence is missing and policy makers demand further information to solve this uncertainty, it is important to establish a correct link between the missing information and the intended research design. It should be avoided to choose, for instance, to set up a register to collect data if it is already clear in advance that the open research question cannot be answered via a register. In this regard, we refer to KCE report 288 on the evaluation of managed entry agreements (MEAs) where specific recommendations were made related to evidence generation: the responsibility of providing good evidence should be kept in the first place with the companies, industry should explicitly mention how they will respond to the identified uncertainties and the proposal could be reviewed by NIHD experts with the support of independent experts, not to rely purely on observational data for estimates of effectiveness, including the possibility to change/stop a convention if data collection requirements are not fulfilled, etc.³⁰ Although this report on MEAs is about drugs, the recommendations also apply for uncertainties policy makers are confronted with in the reimbursement request of medical devices.

5.6 Future opportunities for data enhancements

5.6.1 European UDI to replace notification code

When not (yet) reimbursed, implants and invasive medical devices are difficult to trace in administrative databases because these are primarily based on health care reimbursements. ICD-10-BE codes registered in the MZG – RHM can be useful but are often not detailed enough to identify accurately some devices. A unique identifier, whatever the reimbursement status, represents the solution. The European Unique Device Identifier (UDI) could be the answer, replacing the notification code (that was so far not completely exploitable in the AZH – ADH). The new system will be applied to all medical devices and in-vitro diagnostic medical devices placed on the EU market except custom-made devices.

The European Medical Device Regulation [2017/745](#) (EU-MDR) and In Vitro Medical Devices Regulation [2017/146](#) (IVDR) define the conditions for the European Unique Device Identifier (UDI) and the creation of EUDAMED, the European Database on Medical Devices. The aim is to uniquely identify each medical device and centralize the registration of medical devices available on the European market, providing better access to information for the public and health care professionals. EUDAMED is a registration system but also offers a tool to exchange information and a reporting tool. It also aims at facilitating the traceability of medical devices on the European market during their lifetime cycle. It is composed of six interconnected modules:

1. Actors registration (authorities, notified bodies, distributors, importers,...)
2. UDI Database and device registration: registration of UDI information categorized following the European Medical Device Nomenclature (EMDN) according to the function of the device and/or body system involved.
3. Certificates and Notified Bodies (communication between notified bodies)
4. Clinical Investigation and Performance Studies



5. Vigilance and Post-market Surveillance

6. Market Surveillance

The first modules have been launched progressively first on a voluntary basis and are operational since December 2020 (1) and October 2021 (2 and 3). The complete system should be fully operational mid-2024. UDI registration should become mandatory two years after EUDAMED is fully functional. Most information from the first three modules is publicly available (see [EUDAMED database - EUDAMED \(europa.eu\)](#)), while access to the others is restricted.

The UDI is composed of a readable barcode (1 or 2 dimension(s)) as well as a numeric and alphanumeric character code and consists of a static part and a dynamic part: the static UDI Device Identifier (UDI-DI) for the model itself and the dynamic UDI Production Identifier (UDI-PI) that changes with each production piece and identifies the production unit and serial number, lot number, software identification, manufacturing and/or expiry date. The UDI-DI is the unique key used to identify a device in EUDAMED. Note that the European UDI and US UDI for a same unique device have the same structure but the European UDI registered in EUDAMED must differ from the US one registered with the Food and Drug Administration (FDA), the GUDID database.

Since 2014, implants or long-term invasive medical devicesⁿⁿ must be notified by the health professionals to the FAGG – AFMPS to be centralized in the Central Register for traceability. The aim is to trace distributed, prescribed, delivered, implanted and explanted devices. The traceability should allow the authority to react in case of safety issues. The second aim is the patient information as each patient has access to its own devices registrations. The registration suffered from underreporting since it was not compulsory (personal communication).

Nevertheless, the notification became compulsory from 1st May 2021 for the following implants (listed in the appendix of the Royal Decree of 27 september 2000^{oo} on the Central Traceability Register):

- stents;
- neurostimulators;
- cochlear implants;
- hydrocephalic shunts;
- orthopaedic implants;
- implants for cosmetic or reconstructive purposes falling within the scope of the European Medical Devices Regulation [2017/745](#);
- electrodes and biosensors;
- mechanical heart implants;
- electronic and electrical heart implants;
- ophthalmic implants.

This Royal Decree indicates that the implant identifier device is the UDI. Until the UDI implementation, the notification code remains in use.

Reimbursed implants and invasive medical devices are identified in the Doc. N and P, the IMA data, the EPS, the AZV – SHA / ADH – HJA (and thus also in the TCT data) by the RIZIV – INAMI pseudo-nomenclature code. In the IMA data and EPS moreover, the notification code is also recorded, which give more information on the specific model and brand of the product. In the MZG – RHM, no implant or invasive medical device is recorded as such.

ⁿⁿ Invasive medical devices for short-term use (remaining less than 30 days in the body) do not have to be notified

^{oo} Koninklijk besluit van 27 september 2020 houdende het centraal traceerbaarheidsregister en tot uitvoering van artikel 51 van de wet van 15

december 2013 met betrekking tot medische hulpmiddelen, B. S. 2 oktober 2020. - Arrêté royal du 27 septembre 2020 relatif au Registre central de traçabilité et portant exécution de l'article 51 de la loi du 15 décembre 2013 en matière de dispositifs médicaux, M. B. 2 octobre 2020.



Their use can only be deduced by the related surgical procedures coded in ICD-10-BE. This is true whether the implant or invasive medical device is reimbursed or not.

Until recently, non-reimbursed implants and long-term use invasive medical devices were absent from the RIZIV – INAMI databases although hospitals must transmit their notification codes and the amounts paid by the patients covered by the national Health Insurance to the sickness funds (since 2009). It is only since registration year 2019 that these data are included into the AZV – SHA / ADH – HJA transmitted to the RIZIV – INAMI by the sickness funds. The RIZIV – INAMI has recently begun to analyze the range of the patient out-of-pocket expenses for these non-reimbursed implants and long-term use invasive medical devices. This information is not listed in the convention settling the TCT data delivery to KCE.

In the future, the European UDI is to replace the notification code. The registration of the placement of a number of implants is now compulsory in the Central Traceability Register, whether they are reimbursed or not. The use of non-reimbursed implants becomes thus more traceable than in the past. Theoretically, input parameters influencing the costs, such as physician fees, length of stay, resort to ICU, and so on will technically be linkable to the use of non-reimbursed implants. Adverse events and their costs could also be identifiable. Moreover, the UDI will allow an implant/MD to be identified with the same identifier across all the European databases. Hence, use of (inter)national studies will be facilitated as well as the follow-up of patients beyond the trial time window.

5.6.2 Health Data Agency

When writing a report about health(care) data, it is important to refer to the Belgian Health (Care) Data Agency. This agency was recently created by law.^{PP}

According to the law, the Health (Care) Data Agency, is charged with the following missions:

- Developing a cross-organisational policy for federal health and health care data and support its implementation;
- Establishing a metadata catalogue, with for each database a description of its content, who is responsible for the data, how frequently the data are updated, how one can access the data, ...;
- Giving directions on the exchange and re-use of data and advising on the regulation: standardising requests, standardizing contracts and data transfer protocols, ...
- Giving guidance to organisations (both governmental and other) with a need for health and health care data; giving technical, procedural and methodological support for data requests; providing training, ...
- Creating and ensuring trust among the citizens about correct use of their data.

Considering the missions of the Health (Care) Data Agency, it is expected and desired that it will play a role in optimising access for RIZIV – INAMI and other stakeholders to data relevant for budget impact analyses (but also for other studies e.g. on safety), wherever possible. The contributions of the Agency could be beneficial in many domains such as the information of the metadata catalogue on data availability and the linking possibilities between databases. Also, the Agency can offer guidance to enhance data quality, help to set priorities on where to use the data given the limited (human)

^{PP} Wet van 14 maart 2023 houdende oprichting en organisatie van het Gezondheids(zorg)data-agentschap, *B. S. 3 april 2023* - Loi du 14 mars 2023 relative à l'institution et à l'organisation de l'Agence des données de (soins de) santé, *M. B. 3 avril 2023*.



resources (e.g. give priority to data use in the context of RCTs and reimbursement requests and no priority for generation of numerous hypotheses for basic research), set the rules for data transfers or communication of results of performed analyses (e.g. to both RIZIV and distributors), etc.. Furthermore, trainings on the data use can be beneficial for different stakeholders, as well as the support for data requests.

Concerned data holders are RIZIV – INAMI, FPS Public Health, FPS Social Security, Statbel, KCE, FAGG – AFMPS; Sciensano; the eHealth Platform; the Crossroads Bank for Social Security, the Cancer Registry; and the members of the Insurance Committee of the Medical Care of RIZIV – INAMI referred to in Article 21, § 1, first paragraph, b) to e), of the law concerning the obligatory insurance for medical care and benefits, coordinated on 14 July 1994.⁹⁹

6 CONCLUSION AND RECOMMENDATIONS

For a summary of our findings we refer the reader to the Synthesis which is available in Dutch and French. This Synthesis also includes the recommendations.

⁹⁹ Wet betreffende de verplichte verzekering voor geneeskundige verzorging en uitkeringen gecoördineerd op 14 juli 1994, *B. S. 27 augustus 1994* - Loi

relative à l'assurance obligatoire soins de santé et indemnités coordonnée le 14 juillet 1994, *M. B. 27 août 1994*.



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■ APPENDICES

APPENDIX 1. CODES USED IN THE CASES ANALYSIS

Appendix 1.1. Thrombectomy case

Table 18 – RIZIV – INAMI codes used to select mechanical thrombectomies in the EPS 2016-2020

Code	Label	Valid from	Valid until
182151 – 182162	Geheel van katheterisatiemateriaal nodig voor een endovasculaire verwijdering van een intracraniele trombus via aspiratie, of nodig voor het gebruik van een trombus retriever bij een endovasculaire intracraniele mechanische trombectomie procedure, bij een ischemisch cerebrovasculair accident / Ensemble du matériel nécessaire à l'extraction endovasculaire d'un thrombus par aspiration, ou nécessaire à l'utilisation d'un thrombus retriever lors d'une procédure de thrombectomie mécanique intracrânienne endovasculaire, en cas d'accident vasculaire cérébral ischémique	01-07-2017	-
182173 – 182184	Ensemble du matériel de dilatation et tuteur éventuel utilisé lors d'un traitement endovasculaire d'une constriction artérielle proximale, afin d'avoir un accès pour une extraction endovasculaire d'un thrombus intracrânien, en cas d'accident vasculaire cérébral ischémique / Ensemble du matériel de dilatation et tuteur éventuel utilisé lors d'un traitement endovasculaire d'une constriction artérielle proximale, afin d'avoir un accès pour une extraction endovasculaire d'un thrombus intracrânien, en cas d'accident vasculaire cérébral ischémique	01-07-2017	-
182136 – 182140	Un ou plusieurs thrombus retrievers utilisés lors d'une procédure de thrombectomie mécanique intracrânienne endovasculaire en cas d'accident vasculaire cérébral ischémique	01-07-2017	-

Table 19 – ATC codes used to select Intravenous Thrombolysis in the EPS 2016-2020

ATC code	Label
B01AD02	Alteplase
B01AD04	Urokinase
B01AD11	Tenecteplase



Appendix 1.2. TAVI case

Table 20 – ICD-10-BE procedure codes used to select TAVI and SAVR in the TCT data 2016-2020

Procedure	Code	Label
SAVR	02RF07Z	Replacement of Aortic Valve with Autologous Tissue Substitute, Open Approach
SAVR	02RF08Z	Replacement of Aortic Valve with Zooplasic Tissue, Open Approach
SAVR	02RF0JZ	Replacement of Aortic Valve with Synthetic Substitute, Open Approach
SAVR	02RF0KZ	Replacement of Aortic Valve with Nonautologous Tissue Substitute, Open Approach
SAVR	02RF47Z	Replacement of Aortic Valve with Autologous Tissue Substitute, Percutaneous Endoscopic Approach
SAVR	02RF48Z	Replacement of Aortic Valve with Zooplasic Tissue, Percutaneous Endoscopic Approach
SAVR	02RF4JZ	Replacement of Aortic Valve with Synthetic Substitute, Percutaneous Endoscopic Approach
SAVR	02RF4KZ	Replacement of Aortic Valve with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach
SAVR	X2RF032	Replacement of Aortic Valve using Zooplasic Tissue, <i>Rapid Deployment Technique</i> , Open Approach, New Technology Group 2
SAVR	X2RF432	Replacement of Aortic Valve using Zooplasic Tissue, <i>Rapid Deployment Technique</i> , Percutaneous Endoscopic Approach, New Technology Gr. 2
TAVI	02RF37Z	Replacement of Aortic Valve with Autologous Tissue Substitute, Percutaneous Approach
TAVI	02RF38Z	Replacement of Aortic Valve with Zooplasic Tissue, Percutaneous Approach
TAVI	02RF3JZ	Replacement of Aortic Valve with Synthetic Substitute, Percutaneous Approach
TAVI	02RF3KZ	Replacement of Aortic Valve with Nonautologous Tissue Substitute, Percutaneous Approach
TAVI	02RF3JH	Replacement of Aortic Valve with Synthetic Substitute, <i>Transapical</i> , Percutaneous Approach
TAVI	02RF37H	Replacement of Aortic Valve with Autologous Tissue Substitute, <i>Transapical</i> , Percutaneous Approach
TAVI	02RF38H	Replacement of Aortic Valve with Zooplasic Tissue, <i>Transapical</i> , Percutaneous Approach
TAVI	02RF3KH	Replacement of Aortic Valve with Nonautologous Tissue Substitute, <i>Transapical</i> , Percutaneous Approach
TAVI	X2RF332	Replacement of Aortic Valve using Zooplasic Tissue, <i>Rapid Deployment Technique</i> , Percutaneous Approach, New Technology Group 2

**Table 21 – RIZIV – INAMI codes used to select TAVI and SAVR in the TCT data 2016-2020**

Procedure	Code ⁽¹⁾	Label	Valid from	Valid until
SAVR	170634 – 170645	Heelkundig via aortotomie geplaatste klep in aortapositie met systeem voor snelle plaatsing, inclusief het plaatsingssysteem en alle toebehoren / Valve placée chirurgicalement par aortotomie en position aortique avec système pour placement rapide, y compris le système de placement et tous les accessoires	01-07-2014	-
TAVI	680153 – 680164	Percutaan implanteerbare klepstent met plaatsingssysteem in aortapositie / Stent valvulaire percutané implantable en position aortique avec système de placement	01-08-2014	31-07-2016
TAVI	680993 – 681004	Percutaan implanteerbare klepstent met plaatsingssysteem in aortapositie inclusief toebehoren / Stent valvulaire percutané implantable avec delivery system en position aortique, y compris les accessoires	01-08-2014	31-07-2016
TAVI	172734 – 172745	Percutaan implanteerbare klepstent in aortapositie inclusief het plaatsingssysteem / Stent valvulaire percutané implantable en position aortique avec système de placement	01-08-2016	-
TAVI	172756 – 172760	Percutaan implanteerbare klepstent in aortapositie inclusief het plaatsingssysteem, indien niet is voldaan aan de voorwaarden voor de verstrekking 172734-172745 / Stent valvulaire percutané implantable en position aortique avec système de placement, lorsqu'il n'est pas satisfait aux conditions pour la prestation 172734-172745	01-08-2016	-

(1) No ambulatory codes was billed between 2016 and 2020.

Table 22 – ICD-10-BE diagnosis codes used to identify strokes in the TCT data 2016-2020

Code	Label
I63.***	Cerebral infarction
I97.810	Intraoperative cerebrovascular infarction during cardiac surgery
I97.820	Postprocedural cerebrovascular infarction following cardiac surgery

Table 23 – ICD-10-BE procedure codes used to identify pacemaker implantations in the TCT data 2016-2020

Procedure	Label
02H40NZ	Insertion of Intracardiac Pacemaker into Coronary Vein, Open Approach
02H43NZ	Insertion of intracardiac pacemaker into Coronary Vein, percutaneous approach
02H44NZ	Insertion of Intracardiac Pacemaker into Coronary Vein, Percutaneous Endoscopic Approach
02H60NZ	Insertion of Intracardiac Pacemaker into Right Atrium, Open Approach
02H63NZ	Insertion of intracardiac pacemaker into Right Atrium, percutaneous approach
02H64NZ	Insertion of Intracardiac Pacemaker into Right Atrium, Percutaneous Endoscopic Approach



02H70NZ	Insertion of Intracardiac Pacemaker into Left Atrium, Open Approach
02H73NZ	Insertion of intracardiac pacemaker into Left Atrium, percutaneous approach
02H74NZ	Insertion of Intracardiac Pacemaker into Left Atrium, Percutaneous Endoscopic Approach
02HK0NZ	Insertion of Intracardiac Pacemaker into Right Ventricle, Open Approach
02HK3NZ	Insertion of intracardiac pacemaker into Right Ventricle, percutaneous approach
02HK4NZ	Insertion of Intracardiac Pacemaker into Right Ventricle, Percutaneous Endoscopic Approach
02HL0NZ	Insertion of Intracardiac Pacemaker into Left Ventricle, Open Approach
02HL3NZ	Insertion of Intracardiac Pacemaker into Left Ventricle, Percutaneous Approach
02HL4NZ	Insertion of Intracardiac Pacemaker into Left Ventricle, Percutaneous Endoscopic Approach
0JH604Z	Insertion of Pacemaker, Single Chamber into Chest Subcutaneous Tissue and Fascia, Open Approach
0JH605Z	Insertion of Pacemaker, Single Chamber Rate Responsive into Chest Subcutaneous Tissue and Fascia, Open Approach
0JH606Z	Insertion of Pacemaker, Dual Chamber into Chest Subcutaneous Tissue and Fascia, Open Approach
0JH607Z	Insertion of Cardiac Resynchronization Pacemaker Pulse Generator into Chest Subcutaneous Tissue and Fascia, Open Approach
0JH634Z	Insertion of Pacemaker, Single Chamber into Chest Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH635Z	Insertion of Pacemaker, Single Chamber Rate Responsive into Chest Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH636Z	Insertion of Pacemaker, Dual Chamber into Chest Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH637Z	Insertion of Cardiac Resynchronization Pacemaker Pulse Generator into Chest Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH804Z	Insertion of Pacemaker, Single Chamber into Abdomen Subcutaneous Tissue and Fascia, Open Approach
0JH805Z	Insertion of Pacemaker, Single Chamber Rate Responsive into Abdomen Subcutaneous Tissue and Fascia, Open Approach
0JH806Z	Insertion of Pacemaker, Dual Chamber into Abdomen Subcutaneous Tissue and Fascia, Open Approach
0JH807Z	Insertion of Cardiac Resynchronization Pacemaker Pulse Generator into Abdomen Subcutaneous Tissue and Fascia, Open Approach
0JH834Z	Insertion of Pacemaker, Single Chamber into Abdomen Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH835Z	Insertion of Pacemaker, Single Chamber Rate Responsive into Abdomen Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH836Z	Insertion of Pacemaker, Dual Chamber into Abdomen Subcutaneous Tissue and Fascia, Percutaneous Approach
0JH837Z	Insertion of Cardiac Resynchronization Pacemaker Pulse Generator into Abdomen Subcutaneous Tissue and Fascia, Percutaneous Approach
02PA0NZ	<i>Removal of Intracardiac Pacemaker from Heart, Open Approach</i>
02PA3NZ	<i>Removal of Intracardiac Pacemaker from Heart, Percutaneous Approach</i>
02PA4NZ	<i>Removal of Intracardiac Pacemaker from Heart, Percutaneous Endoscopic Approach</i>



0JPT0PZ	<i>Removal of Cardiac Rhythm Related Device from Trunk Subcutaneous Tissue and Fascia, Open Approach</i>
0JPT3PZ	<i>Removal of Cardiac Rhythm Related Device from Trunk Subcutaneous Tissue and Fascia, Percutaneous Approach</i>

Replacement codes were used to exclude stays with pacemaker replacement in the adverse events calculation.

Table 24 – RIZIV – INAMI implant codes used to identify pacemaker implantations in the TCT data 2016-2020

Procedure	Label	Valid from	Valid until
172395 – 172406	Eerste implanteerbare hartstimulator, inclusief adaptor / Premier stimulateur cardiaque implantable, y compris l'adaptateur	01-10-2015	-
158594 – 158605	Eerste resynchronisatie-hartstimulator, inclusief adaptor / Premier stimulateur de resynchronisation cardiaque, y compris l'adaptateur	01-07-2014	-
172410 – 172421	Vervangingshartstimulator, inclusief adaptor / Stimulateur cardiaque de remplacement, y compris l'adaptateur	01-10-2015	-
158616 – 158620	Vervangingsresynchronisatie-hartstimulator, inclusief adaptor / Stimulateur de resynchronisation cardiaque de remplacement, y compris l'adaptateur	01-07-2014	-
158631 – 168642	Vervangingsresynchronisatie-hartstimulator, inclusief adaptor, in geval van voortijdige vervanging om patiëntgebonden redenen / Stimulateur de resynchronisation cardiaque de remplacement, y compris l'adaptateur, en cas de remplacement anticipé pour des raisons liées au patient	01-07-2014	-
172432 – 172443	Vervangingshartstimulator, inclusief adaptor, in geval van voortijdige vervanging om patiëntgebonden redenen / Stimulateur cardiaque de remplacement, y compris l'adaptateur, en cas de remplacement anticipé pour des raisons liées au patient	01-10-2015	-
172454 – 172465	Vervangingshartstimulator, inclusief adaptor, in geval van voortijdige vervanging omwille van end-of-life / Stimulateur cardiaque de remplacement, y compris l'adaptateur, en cas de remplacement anticipé en cas d'une end-of-life	01-10-2015	-
172612 – 170623	Vervangingshartstimulator, inclusief adaptor, in geval van voortijdige vervanging om patiëntgebonden redenen / Stimulateur de resynchronisation cardiaque de remplacement, y compris l'adaptateur, en cas de remplacement anticipé en cas de end-of-life	01-07-2014	-

Replacement codes were used to exclude stays with pacemaker replacement in the adverse events calculation.



Table 25 – Distribution of the hospital costs components for SAVR (TCT data 2016-2020), in euros.

year	Variable	Label	N	Mean	Std Dev	Minimum	Maximum	Sum
2016	amount_reimbd_100p	100% per diem price	2936	9249.4	9533.4	365.5	146189.3	27156275.1
	valve_reimbd	Valve (implant)	2936	2963.4	672.2	0.0	10638.4	8700538.4
	implant_reimbd	Other implants and invasive medical devices	2936	2297.5	2229.6	0.0	69717.3	6745540.9
	fee_reimbd	Surgeon medical fee	2936	3263.2	808.4	0.0	8801.2	9580864.8
	Other_reimbd	Other hospital costs	2936	7114.6	6190.1	488.7	85266.8	20888403.4
	Pat_share	Share of the patient (no supplement)	2936	293.8	338.7	17.4	5560.0	862655.0
2017	amount_reimbd_100p	100% per diem price	2935	8956.0	9319.4	376.7	122706.1	26285763.1
	valve_reimbd	Valve (implant)	2935	2988.6	700.9	2616.8	11126.4	8771619.2
	implant_reimbd	Other implants and invasive medical devices	2935	2217.4	1504.6	0.0	17069.3	6508156.5
	fee_reimbd	Surgeon medical fee	2935	3306.4	763.4	0.0	7606.5	9704201.9
	Other_reimbd	Other hospital costs	2935	7134.6	6846.7	2417.1	97638.3	20939934.5
	Pat_share	Share of the patient (no supplement)	2935	283.6	310.1	18.6	5523.1	832231.1
2018	amount_reimbd_100p	100% per diem price	2915	8696.9	8954.5	398.7	187661.0	25351438.9
	valve_reimbd	Valve (implant)	2915	2946.3	657.8	2417.0	11616.4	8588548.6
	implant_reimbd	Other implants and invasive medical devices	2915	2385.8	2724.1	0.0	70372.5	6954629.8
	fee_reimbd	Surgeon medical fee	2915	3293.2	820.3	0.0	7720.6	9599788.3
	Other_reimbd	Other hospital costs	2915	7012.4	6861.3	901.3	105927.8	20441220.7
	Pat_share	Share of the patient (no supplement)	2915	286.7	343.6	18.0	8188.2	835651.7
2019	amount_reimbd_100p	100% per diem price	2750	9367.7	10093.1	441.8	127385.6	25761269.6
	valve_reimbd	Valve (implant)	2750	2963.9	693.2	2592.0	11020.7	8150597.9
	implant_reimbd	Other implants and invasive medical devices	2750	2390.7	1769.9	0.0	21387.8	6574383.9
	fee_reimbd	Surgeon medical fee	2750	2604.0	1659.8	0.0	11580.9	7160960.5
	Other_reimbd	Other hospital costs	2750	7992.8	6868.4	566.3	102020.1	21980147.7
	Pat_share	Share of the patient (no supplement)	2750	323.4	376.0	19.8	7304.2	889227.8
2020	amount_reimbd_100p	100% per diem price	2252	9239.7	11235.4	403.8	173754.8	20807849.3
	valve_reimbd	Valve (implant)	2252	3002.8	717.6	2592.0	8237.0	6762277.7
	implant_reimbd	Other implants and invasive medical devices	2252	2563.2	2241.0	0.0	70133.0	5772300.5
	fee_reimbd	Surgeon medical fee	2252	2662.8	1659.6	0.0	9007.4	5996517.3
	Other_reimbd	Other hospital costs	2252	8061.1	7138.2	2311.6	109253.6	18153546.1
	Pat_share	Share of the patient (no supplement)	2252	335.3	475.7	14.3	15105.6	755122.3
ALL	amount_reimbd_100p	100% per diem price	13788	9092.2	9785.8	365.5	187661.0	125362596.1
	valve_reimbd	Valve (implant)	13788	2971.7	687.4	0.0	11616.4	40973581.9
	implant_reimbd	Other implants and invasive medical devices	13788	2361.1	2136.6	0.0	70372.5	32555011.7
	fee_reimbd	Surgeon medical fee	13788	3049.2	1226.7	0.0	11580.9	42042332.7
	Other_reimbd	Other hospital costs	13788	7427.0	6783.3	488.7	109253.6	102403252.5
	Pat_share	Share of the patient (no supplement)	13788	302.8	367.9	14.3	15105.6	4174887.9



Table 26 – Distribution of the total hospitalisation costs for SAVR (TCT data 2016-2020), in euros.

year	Variable	Label	N	Mean	Std Dev	Minimum	Maximum	Sum
2016	total_reimbursed	Total reimbursed	2936	24888.2	15768.9	5137.3	209419.4	73071622.6
	Pat_share	Share of the patient (no supplement)	2936	293.8	338.7	17.4	5560.0	862655.0
	TOTAL		2936	25182.0	15976.2	5175.9	213837.1	73934277.6
2017	total_reimbursed	Total reimbursed	2935	24603.0	15694.0	11368.6	212608.5	72209675.2
	Pat_share	Share of the patient (no supplement)	2935	283.6	310.1	18.6	5523.1	832231.1
	TOTAL		2935	24886.5	15890.0	11456.9	214886.7	73041906.3
2018	total_reimbursed	Total reimbursed	2915	24334.7	15482.1	4742.0	229963.8	70935626.3
	Pat_share	Share of the patient (no supplement)	2915	286.7	343.6	18.0	8188.2	835651.7
	TOTAL		2915	24621.4	15685.8	4842.4	231138.5	71771278.0
2019	total_reimbursed	Total reimbursed	2750	25319.0	17018.7	9308.1	225150.2	69627359.6
	Pat_share	Share of the patient (no supplement)	2750	323.4	376.0	19.8	7304.2	889227.8
	TOTAL		2750	25642.4	17251.2	9610.5	228913.2	70516587.4
2020	total_reimbursed	Total reimbursed	2252	25529.5	18081.3	8178.4	258538.3	57492491.1
	Pat_share	Share of the patient (no supplement)	2252	335.3	475.7	14.3	15105.6	755122.3
	TOTAL		2252	25864.8	18390.2	8406.8	273644.0	58247613.4
ALL	total_reimbursed	Total reimbursed	13788	24901.1	16350.2	4742.0	258538.3	343336774.8
	Pat_share	Share of the patient (no supplement)	13788	302.8	367.9	14.3	15105.6	4174887.9
	TOTAL		13788	25203.9	16578.1	4842.4	273644.0	347511662.7



Table 27 – Distribution of the hospital costs components for TAVI (TCT data 2016-2020), in euros.

year	Variable	Label	N	Mean	Std Dev	Minimum	Maximum	Sum
2016	amount_reimbd_100p	100% per diem price	284	6164.9	5088.7	485.2	46248.5	1750843.2
	valve_reimbd	Valve (implant)	284	8718.9	4658.4	3000.0	24000.0	2476161.0
	implant_reimbd	Other implants and invasive medical devices	284	1314.7	2067.8	0.0	15752.4	373363.2
	fee_reimbd	Surgeon medical fee	284	1666.2	346.2	0.0	3435.1	473190.6
	Other_reimbd	Other hospital costs	284	4106.5	2105.6	1646.5	18560.0	1166239.5
	Pat_share	Share of the patient (no supplement)	284	127.1	181.9	19.6	2544.1	36090.8
2017	amount_reimbd_100p	100% per diem price	618	5719.7	5721.2	371.3	58163.0	3534786.8
	valve_reimbd	Valve (implant)	618	10815.5	3362.2	3000.0	16000.0	6684000.0
	implant_reimbd	Other implants and invasive medical devices	618	767.1	1467.2	0.0	6752.6	474069.0
	fee_reimbd	Surgeon medical fee	618	1586.1	493.6	0.0	3463.7	980187.3
	Other_reimbd	Other hospital costs	618	3867.3	2726.3	997.7	35165.8	2389965.9
	Pat_share	Share of the patient (no supplement)	618	99.0	78.0	18.6	784.5	61174.5
2018	amount_reimbd_100p	100% per diem price	765	5607.3	7938.5	433.1	165698.0	4289572.7
	valve_reimbd	Valve (implant)	765	9976.3	3520.4	2971.5	13000.0	7631885.0
	implant_reimbd	Other implants and invasive medical devices	765	924.7	1654.6	0.0	8965.4	707406.3
	fee_reimbd	Surgeon medical fee	765	1623.1	499.5	0.0	3515.6	1241685.0
	Other_reimbd	Other hospital costs	765	3847.8	2746.5	951.1	38093.3	2943569.7
	Pat_share	Share of the patient (no supplement)	765	95.2	84.7	15.5	916.1	72835.9
2019	amount_reimbd_100p	100% per diem price	917	5934.7	7646.1	407.4	89697.5	5442115.2
	valve_reimbd	Valve (implant)	917	9241.8	3515.2	2971.5	12876.5	8474718.0
	implant_reimbd	Other implants and invasive medical devices	917	1101.5	1952.9	0.0	15751.2	1010090.7
	fee_reimbd	Surgeon medical fee	917	1590.1	544.5	0.0	3515.6	1458103.4
	Other_reimbd	Other hospital costs	917	3913.8	3329.4	691.9	50663.0	3588979.9
	Pat_share	Share of the patient (no supplement)	917	99.2	182.3	17.4	4751.8	90972.5
2020	amount_reimbd_100p	100% per diem price	863	5428.4	6122.0	507.0	89024.4	4684732.2
	valve_reimbd	Valve (implant)	863	9303.6	3671.8	2971.5	15848.0	8028993.0
	implant_reimbd	Other implants and invasive medical devices	863	1021.5	1956.3	0.0	16936.1	881582.4
	fee_reimbd	Surgeon medical fee	863	1567.1	602.2	0.0	3559.6	1352413.1
	Other_reimbd	Other hospital costs	863	3583.5	3524.7	754.4	81407.3	3092532.0
	Pat_share	Share of the patient (no supplement)	863	91.4	89.4	19.2	1150.9	78887.1
ALL	amount_reimbd_100p	100% per diem price	3418	5712.8	6863.4	371.3	165698.0	19526314.2
	valve_reimbd	Valve (implant)	3418	9716.0	3654.8	2971.5	24000.0	33209327.0
	implant_reimbd	Other implants and invasive medical devices	3418	1000.3	1826.6	0.0	16936.1	3418981.6
	fee_reimbd	Surgeon medical fee	3418	1596.6	528.7	0.0	3559.6	5457214.5
	Other_reimbd	Other hospital costs	3418	3822.2	3078.9	691.9	81407.3	13064423.3
	Pat_share	Share of the patient (no supplement)	3418	98.7	128.0	15.5	4751.8	337292.3

**Table 28 – Distribution of the total hospitalisation costs for TAVI (TCT data 2016-2020), in euros.**

year	Variable	Label	N	Mean	Std Dev	Minimum	Maximum	Sum
2016	total_reimbursed	Total reimbursed	284	21971.1	8450.6	8297.4	77401.6	6239797.5
	Pat_share	Share of the patient (no supplement)	284	127.1	181.9	19.6	2544.1	36090.8
	TOTAL		284	22098.2	8500.4	8323.2	77717.2	6275888.3
2017	total_reimbursed	Total reimbursed	618	22755.7	9066.1	8008.4	87450.0	14063009.0
	Pat_share	Share of the patient (no supplement)	618	99.0	78.0	18.6	784.5	61174.5
	TOTAL		618	22854.7	9116.6	8042.1	87878.9	14124183.5
2018	total_reimbursed	Total reimbursed	765	21979.2	11220.1	8887.1	223306.6	16814118.6
	Pat_share	Share of the patient (no supplement)	765	95.2	84.7	15.5	916.1	72835.9
	TOTAL		765	22074.5	11271.7	8934.1	224171.8	16886954.5
2019	total_reimbursed	Total reimbursed	917	21781.9	11621.6	8374.1	148603.8	19974007.2
	Pat_share	Share of the patient (no supplement)	917	99.2	182.3	17.4	4751.8	90972.5
	TOTAL		917	21881.1	11741.6	8423.6	153355.6	20064979.7
2020	total_reimbursed	Total reimbursed	863	20904.1	10458.6	8508.9	183065.4	18040252.7
	Pat_share	Share of the patient (no supplement)	863	91.4	89.4	19.2	1150.9	78887.1
	TOTAL		863	20995.5	10518.0	8543.8	183881.5	18119139.8
ALL	total_reimbursed	Total reimbursed	3418	21847.9	10595.1	8008.4	223306.6	74676260.5
	Pat_share	Share of the patient (no supplement)	3418	98.7	128.0	15.5	4751.8	337292.3
	TOTAL		3418	21946.6	10668.4	8042.1	224171.8	75013552.7



Table 29 – Distribution of the hospital costs components for TAVI according to the TAVI lump sum (TCT data 2019-2020), in euros.

year	TAVI Lump sum patient group	Variable	N	Mean	Std Dev	Minimum	Maximum	Sum
2019	Large	amount_reimbd_100p	444	5970.9	7995.0	451.6	89697.5	2651066.6
		valve_reimbd	444	12843.0	313.9	9905.0	12876.5	5702308.5
		implant_reimbd	444	1059.3	1743.2	0.0	7005.3	470320.6
		fee_reimbd	444	1607.4	529.8	0.0	3515.6	713670.9
		Other_reimbd	444	4079.8	3642.1	691.9	50663.0	1811449.6
		Pat_share	444	106.3	247.2	17.4	4751.8	47215.9
	Small	amount_reimbd_100p	469	5884.9	7318.2	407.4	86324.4	2760018.6
		valve_reimbd	469	5886.0	408.1	2971.5	5943.0	2760523.5
		implant_reimbd	469	1147.2	2139.8	0.0	15751.2	538029.8
		fee_reimbd	469	1570.4	558.1	0.0	3515.6	736522.4
		Other_reimbd	469	3735.3	2987.3	730.2	42000.2	1751875.7
		Pat_share	469	92.7	84.4	17.4	848.9	43467.0
2020	Large	amount_reimbd_100p	435	5084.8	4452.6	757.8	43556.1	2211876.5
		valve_reimbd	435	12883.3	318.9	9905.0	15848.0	5604249.0
		implant_reimbd	435	984.4	1755.9	0.0	12300.3	428196.1
		fee_reimbd	435	1562.9	595.2	0.0	3559.6	679854.0
		Other_reimbd	435	3572.4	2093.4	754.4	20052.9	1553996.5
		Pat_share	435	89.0	62.0	19.2	683.4	38695.7
	Small	amount_reimbd_100p	422	5686.5	7419.8	507.0	89024.4	2399696.6
		valve_reimbd	422	5795.1	1170.2	2971.5	15848.0	2445544.5
		implant_reimbd	422	1032.1	2120.8	0.0	16936.1	435563.5
		fee_reimbd	422	1568.4	613.7	0.0	3559.6	661880.4
		Other_reimbd	422	3565.3	4561.2	777.2	81407.3	1504547.5
		Pat_share	422	92.4	109.0	21.1	1150.9	39007.1



Table 30 – Distribution of the total hospitalisation costs for TAVI according to the TAVI lump sum (TCT data 2019-2020), in euros.

year	TAVI Lump sum patient group	Variable	N	Mean	Std Dev	Minimum	Maximum	Sum
2019	Large	total_reimbursed	444	25560.4	11583.0	15549.6	148603.8	11348816.2
		Pat_share	444	106.3	247.2	17.4	4751.8	47215.9
		TOTAL	444	25666.7	11762.6	15574.2	153355.6	11396032.1
	Small	total_reimbursed	469	18223.8	10510.6	8374.1	109589.0	8546969.9
		Pat_share	469	92.7	84.4	17.4	848.9	43467.0
		TOTAL	469	18316.5	10577.7	8423.6	110223.1	8590436.9
2020	Large	total_reimbursed	435	24087.8	6830.2	15286.4	76941.4	10478172.0
		Pat_share	435	89.0	62.0	19.2	683.4	38695.7
		TOTAL	435	24176.7	6873.4	15353.7	77624.8	10516867.8
	Small	total_reimbursed	422	17647.5	12363.5	8508.9	183065.4	7447232.5
		Pat_share	422	92.4	109.0	21.1	1150.9	39007.1
		TOTAL	422	17739.9	12442.2	8543.8	183881.5	7486239.6