Haalbaarheidsstudie voor de invoering van een "all-in" pathologiefinanciering voor Belgische ziekenhuizen

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Federaal Kenniscentrum voor de Gezondheidszorg
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Contact

Federaal Kenniscentrum voor de Gezondheidszorg (KCE)
Administratief Centrum Kruidtuin, Doorbuilding (10e verdieping)
Kruidtuinlaan 55
B-1000 Brussel
Belgium

Tel: +32 [0]2 287 33 88
Fax: +32 [0]2 287 33 85

Email: info@kce.fgov.be
Web: http://www.kce.fgov.be

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STEFAAN VAN DE SANDE, DORIEN DE RYCK, KRISTEL DE GAUQUIER, REBECCA HILDERSON,
MATTIAS NEYT, GERT PEETERS, NATHALIE SWARTENBROEKX, WIM TAMBEUR,
GUY VANDEN BOER, CARINE VAN DE VOORDE

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Auteurs:	Stefaan Van De Sande (KCE), Dorien De Ryck (UZ Leuven), Kristel De Gauquier (KCE), Rebecca Hilderson (UZ Leuven), Mattias Neyt (KCE), Gert Peeters (UZ Leuven, voorheen KCE), Nathalie Swartenbroekx (voorheen KCE), Wim Tambeur (UZ Leuven), Guy Vanden Boer (UZ Leuven), Carine Van de Voorde (KCE)
Reviewers:	Jean-Pierre Closon (KCE)
Externe experten:	Edith Azoury (UCL Saint-Luc), Jan Beeckmans (UZ Brussel), Benoît Collin (RIZIV), Dirk Corens (UZ Brussel), Guy Durant (UCL Saint-Luc), Mickaël Daubie (RIZIV), Peter Fontaine (Stedelijk Ziekenhuis Roeselare), Paul Gemmel (UGent), Bruno Holthof (ZNA), Ingrid Mertens (FOD Volksgezondheid), Samira Ouraghi (FOD Volksgezondheid), Annick Poncé (FOD Volksgezondheid), Walter Sermeus (K.U.Leuven), Raf Stevens (Studiecentrum Gezondheidszorg vzw), Maurice Tuerlinckx (Zorgnet Vlaanderen), Luc Van Aken (Partezis), Rob Van den Oever (AMC), Patrick Waterbley (H. Hart-Ziekenhuis Roeselare-Menen)
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Externe validatoren:	Kenneth Bonheure (McKinsey), (Daniel Ransart (CHR Citadelle Liège), Siok Swan Tan (iMTA, Erasmus Universiteit Rotterdam)
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VOORWOORD

In de meeste buurlanden ontvangen ziekenhuizen voornamelijk een globale financiering op basis van de pathologie van de patiënten. In België hangt een belangrijk deel van de ziekenhuismiddelen nog steeds af van het aantal verrichte prestaties, met de bekende inflatoire gevolgen van dien. De rest van de middelen wordt berekend op basis van regels die constant evolueren en die soms wel en soms niet verbonden zijn met de behandelde pathologie. Over het algemeen is iedereen het erover eens dat de financieringsregels voor de ziekenhuizen zeer complex en weinig transparant zijn.

Vele landen hebben gekozen voor een globaal financieringssysteem omdat ze de voordelen ervan inzien. Maar is dat voldoende reden om ook het Belgische systeem te veranderen? Uiteindelijk lijken wij niet minder goed verzorgd te worden dan elders. Lopen we dan niet het risico om het kind met het badwater weg te gooien? Zijn wij in staat om het systeem te veranderen en beschikken wij meer bepaald over betrouwbare gegevens om de globale budgetten op een billijke manier te berekenen? Welke vragen moeten voorafgaand beantwoord worden indien een principebeslissing genomen is om over te gaan tot een meer globale financiering?

Het huidige rapport wil zo volledig en goed mogelijk alle aspecten belichten die bij een wijziging in de aanpak van de Belgische ziekenhuisfinanciering aan de orde zijn. Het technische karakter van de behandelde kwesties zal het rapport misschien alleen toegankelijk maken voor enkele specialisten. Toch verdient de efficiëntie en duurzaamheid van ons ziekenhuissysteem een bijzondere inspanning. Wij bedanken de onderzoeksequipe van UZ Leuven die ons heeft geholpen bij dit omvangrijke project. Wij hopen dat dit rapport een nuttig hulpmiddel zal zijn voor de beleidsmakers om een aantal hervormingen, die al meer dan 20 jaar geleden op de sporen werden gezet, te doen samensmelten tot een coherente, transparante financieringsvorm die door alle betrokken partijen wordt ondersteund.

Jean-Pierre CLOSON
Adjunct Algemeen Directeur

Raf MERTENS
Algemeen Directeur

Samenvatting

CONTEXT

Wereldwijd zijn er verscheidene financieringssystemen van ziekenhuizen in gebruik, elk met hun eigen sterkten en zwakten. Hoewel er geen consensus is, noch in theorie, noch in praktijk, over welk ziekenhuisfinancieringssysteem het best beantwoordt aan de doelstellingen van een performant, billijk en kwaliteitsvol gezondheidszorgsysteem, hebben talrijke landen gekozen voor een systeem op basis van het aantal en de aard van de behandelde aandoeningen, ook wel de "case-mix" van het ziekenhuis genoemd. De drijfredenen om voor dergelijke financiering op basis van de case-mix te kiezen, zijn het aanmoedigen van doeltreffendheid en het inperken van de kosten. Dit moet gerealiseerd worden door a priori te bepalen welke financiering het ziekenhuis zal ontvangen voor elk behandeld geval, dit wil zeggen vóór de daadwerkelijke zorgepisode en bijgevolg onafhankelijk van de reële kosten voor de geleverde diensten.

In de meeste landen die voor een financieringssysteem in functie van de behandelde pathologie hebben geopteerd, wordt een variant van de DRG methode ("Diagnosis Related Group") gebruikt om de case-mix van het ziekenhuis te meten. De DRG methode is een patiëntenclassificatiesysteem waarbij gevallen die zowel klinisch als op vlak van hun kostprijs homogeen zijn, gegroepeerd worden. De ziekenhuizen ontvangen een forfaitaire vergoeding per opname behorende tot dezelfde DRG. Landen verschillen zeer sterk in de wijze waarop de forfaits en de groepen worden gedefinieerd, in het aantal groepen en in de exclusie van specifieke patiënten en diensten uit de case-mix financiering. In het merendeel van de landen werd dergelijk pathologiefinancieringssysteem geleidelijk over meerdere jaren ingevoerd.

In de loop van de twee laatste decennia werden ook in het Belgische ziekenhuisfinancieringssysteem geleidelijk aan elementen van een case-mix systeem geïntroduceerd. Maar, tot op vandaag blijft het Belgische systeem partieel en fragmentarisch. Eén van de conclusies van het KCE rapport vol. 8, waarin de financiering van ziekenhuisgeneesmiddelen in een aantal Europese landen en Canada beschreven werd, was dan ook dat "België momenteel het enige land is waar de financiering per pathologie op zo'n gefragmenteerde manier gebeurt". Maar, alvorens het "all-inclusive" (afgekort "all-in") financieringssysteem op basis van de case-mix verder kan ontwikkeld en geïmplementeerd worden, zijn er nog vele voorzichtige en belangrijke voorbereidingen nodig.

OBJECTIEVEN

De belangrijkste doelstelling van deze studie is de haalbaarheid te evalueren van de introductie van een all-in prospectief financieringssysteem voor de Belgische ziekenhuizen, alsook de consequenties en limieten hiervan te begrijpen. Die haalbaarheid wordt voornamelijk vertaald in termen van beschikbaarheid van gegevens, zowel afkomstig uit de verplichte registraties als uit andere bronnen.

Volgende vragen werden bestudeerd:

1. Welke zijn de karakteristieken van de financieringssystemen op basis van de case-mix van het ziekenhuis in een aantal geselecteerde landen? Wat zijn de consequenties en limieten van een all-in pathologiefinancieringssysteem?
2. Is een all-in financieringssysteem op basis van de case-mix van het ziekenhuis uitvoerbaar in België?
3. Welke financiële impact zou een all-in financieringssysteem hebben voor de ziekenhuizen?

METHODEN

INTERNATIONALE VERGELIJKING

Door middel van een literatuurstudie werden de kenmerken van pathologiefinanciering in vijf landen bestudeerd: Engeland, Duitsland, Frankrijk, Denemarken en Australië (Victoria). Volgende onderwerpen werden in kaart gebracht: het DRG classificatiesysteem (naam en oorsprong, redenen van invoering, reikwijdte, transitiefase en groeperingsproces), de methode van kostenallocatie (met inbegrip van de omvang van de gegevenssteekproeven en de kwaliteit van deze), de definitie van outliers, de berekening van de tarieven (hoe worden de kosten omgezet in prijzen; hoe wordt het tarief berekend; welke bijzondere aanpassingen van tarieven bestaan er; hoe wordt het ziekenhuis terugbetaald) en een overzicht van welke ziekenhuisactiviteiten inbegrepen zijn in de pathologiefinanciering en welke niet. Het onderzoek is vooral gebaseerd op de grijze literatuur en de raadpleging van deskundigen.

ANALYSE VAN BELGISCHE ZIEKENHUISGEGEVENS

Om de haalbaarheid van een all-in financieringssysteem op basis van de case-mix van het ziekenhuis in België te evalueren, werden twee databanken aangemaakt. De eerste bevat alle gegevens met betrekking tot de klinische case-mix en de facturatie van alle Belgische ziekenhuizen in 2005. Deze exhaustieve databank van de Belgische ziekenhuissector laat toe om de "grouper" die momenteel beschikbaar is te evalueren op basis van terugbetalingstarieven (het prijsmodel). De tweede databank bevat gedetailleerde gegevens met betrekking tot de boekhouding, de klinische case-mix en de facturatie van 9 Belgische ziekenhuizen voor het jaar 2002. Deze databank laat een oefening in analytische boekhouding toe waarbij de kosten toegewezen worden aan patiënten die gehergroepeerd zijn in een variant van de DRG (het kostmodel). In beide databanken wordt de case-mix weergegeven door middel van de APR-DRG grouper (All Patient Refined DRG; versie 15.0) die rekening houdt met de ernst van de aandoeningen.

SIMULATIE OEFENING

In een budgetneutrale simulatieoefening werden de herverdelingseffecten op de Belgische ziekenhuizen geschat van de implementatie van een all-in pathologiefinanciering.

RESULTATEN

INTERNATIONALE VERGELIJKING

Pathologiefinanciering wordt voornamelijk ingevoerd in een poging de kosten te beheersen en incentieven te creëren die de efficiëntie doen toenemen. Sommige systemen mikken ook op een afname van wachttijden en de promotie van bepaalde ziekenhuisactiviteiten, zoals bijvoorbeeld dagheelkunde.

Het financieringssysteem op basis van de case-mix van het ziekenhuis wordt toegepast op alle patiënten en alle diensten. Uitzonderingen zijn de diensten waarvoor geen afdoend classificatiesysteem bestaat (vb. geestelijke gezondheidszorg en revalidatie), de financiering van activiteiten die niet patiëntgebonden zijn (vb. onderzoek en onderwijs) en de betaling van kosten die het gevolg zijn van de lokalisatie (vb. ziekenhuizen in rurale gebieden) of van organisatorische redenen (bv. schaalgrootte).

In alle landen werd een dergelijk systeem geleidelijk, over meerdere jaren, ingevoerd. Tijdens de transitieperiode, kregen de ziekenhuizen de mogelijkheid om vrijwillig deel te nemen aan het nieuwe systeem, werden het budget van elk ziekenhuis of het totaal budget constant gehouden, of werden de oude tarieven slechts geleidelijk vervangen door nieuwe.

Omdat de kenmerken van deze vijf pathologiefinancieringssystemen te uiteenlopend zijn om kort en duidelijk samen te vatten, wordt de geïnteresseerde lezer voor een gedetailleerd overzicht verwezen naar de samenvattende tabel in Hoofdstuk 4 van de scientific summary (Tabel 10).

ORGANISATIE EN FINANCIERING VAN DE BELGISCHE ZIEKENHUISSECTOR IN 2009

De Belgische ziekenhuisfinanciering is momenteel (2009) een duaal systeem naargelang de aard van de geleverde diensten. De consultaties en medisch-technische diensten worden vergoed via de honoraria per prestatie en bepaalde forfaits per opname en/of per dag, waarvan het onderhandelde bedrag is weergegeven in de nomenclatuur. De artsen staan een deel van hun honoraria af om bij te dragen tot de financiering van de kosten van hun activiteiten in deze diensten. De bijdrage van de artsen wordt geregeld door een algemeen akkoord tussen de ziekenhuisbeheerder en de ziekenhuisartsen. Voor de ziekenhuisactiviteiten ontvangen de ziekenhuizen het "Budget van Financiële Middelen" (BFM). Tot in 1986 was dit budget volledig gebaseerd op historische kosten en activiteiten. Tussen 1986 en 1994 werden prospectieve elementen geïntroduceerd maar de case-mix van het ziekenhuis werd nog niet in acht genomen. Vanaf 1995 werd het concept van de "pathologie gewogen verblijfsduur" ingevoerd, dat echter nog altijd verbonden was met de (individuele) ziekenhuiskosten. Sinds 1 juli 2002 werd geleidelijk overgeschakeld naar het begrip "verantwoorde activiteit" waarbij de case-mix van elk ziekenhuis vermenigvuldigd wordt met de gemiddelde verblijfsduur op nationaal niveau per groep van aandoeningen (met correctie voor de outliers) om op die manier het aantal verantwoorde ligdagen per ziekenhuis te bepalen. Wanneer een ziekenhuis zijn prospectief toegewezen aantal verantwoorde ligdagen overschrijdt, worden de dagelijkse kosten van de overtollige dagen slechts gedeeltelijk terugbetaald. De kosten die daardoor bespaard worden, worden herverdeeld onder de ziekenhuizen die zich onder hun toegewezen aantal verantwoorde ligdagen bevinden.

Zoals in andere landen werden in de loop van de voorbije twee decennia verscheidene hervormingen en financiële incentieven geïntroduceerd om de efficiëntie te verbeteren. De programmatieregels, die maxima vastlegden wat betreft het aantal en het type bedden, waren immers uitgewerkt omdat in een systeem waar de vergoeding per prestatie een belangrijke bewegingsvrijheid biedt aan patiënten en zorgverstrekkers, beperkingen op niveau van het aanbod slechts een beperkte impact hebben op de inperking van de gezondheidszorguitgaven. Om de ziekenhuizen meer financieel verantwoordelijk te maken werden hervormingen onder de vorm van prospectieve financiering op basis van case-mix doorgevoerd. Maar, in tegenstelling tot andere landen, werd het prospectief systeem in België slechts gefragmenteerd en soms weinig transparant toegepast.

GEGEVENS EN METHODOLOGISCHE VRAGEN: TOEPASBAARHEID VAN DE APR-DRG GROUPER OP DE BELGISCHE ZIEKENHUISACTIVITEIT

In een pathologiefinancieringssysteem ontvangen de ziekenhuizen een vast bedrag voor elk behandeld geval dat tot één van de gedefinieerde categorieën behoort met gelijkaardige klinische karakteristieken en gebruik van middelen. Een kostenberekening moet alle ziekenhuiskosten toewijzen aan individuele verblijven om de kost per geval te bepalen. Vervolgens moet voor elke pathologiegroep een gewicht en een tarief berekend worden. Problemen met de gegevens en methodologische kwesties komen aan bod in Hoofdstuk 5.

Ondanks het feit dat de APR-DRG grouper reeds meer dan een decennium wordt gebruikt voor de ziekenhuisfinanciering, werd dit classificatiesysteem nog nooit getest met Belgische ziekenhuisgegevens. Onze studie evalueert voor de eerste keer in welke mate de APR-DRG grouper (versie 15.0) erin slaagt om de Belgische ziekenhuisactiviteit, met name de coherentie en homogeniteit van de pathologiegroepen in termen van kosten en gebruik van middelen, te omschrijven. Deze verificatie is belangrijk aangezien deze grouper in het huidige systeem als basis wordt gebruikt voor de financiering van de ziekenhuisactiviteiten.

De homogeniteitanalyse bestaat uit het bepalen van outliers op basis van verscheidene afkappunten, een analyse van cellen met een klein aantal observaties en een analyse van subgroepen om zodoende exclusies te definiëren. De berekeningen van gewichten en tarieven werden op twee manieren aangepakt. In het eerste model zijn gewichten en tarieven gebaseerd op terugbetalingtarieven. Deze "prijzen" weerspiegelen de manier waarop de ziekenhuizen momenteel gefinancierd worden (met gegevens van 2005). Het prijsmodel kan trouwens ook gebruikt worden om te identificeren waar wijzigingen aan het APR-DRG classificatiesysteem moeten aangebracht worden vóór het toegepast wordt op Belgische ziekenhuizen. Idealiter zouden de prijzen moeten overeenkomen met de reële kosten, maar in werkelijkheid zijn ze eerder een weerspiegeling van de historische onderhandelingsmacht van zorgverleners of zijn ze het resultaat van politieke onderhandelingen en kunnen dus een over- of onderschatting zijn van de werkelijke kosten. In het tweede model werd een eerste poging ondernomen om gewichten en tarieven te baseren op een 'top-down' kostencalculatie. Bij gebrek aan een exhaustieve databank met kostengegevens voor de Belgische ziekenhuissector, werd het herverdelingsmodel gebaseerd op de kostengegevens van 9 ziekenhuizen en toegepast op alle Belgische ziekenhuizen.

De evaluatie van de beschikbare data en van methodologische aspecten toonde aan dat de APR-DRG grouper (versie 15.0) zou kunnen dienen als basis om een all-in pathologiefinanciering uit te werken. Niettemin zijn aanpassingen aan het APR-DRG classificatiesysteem, zoals geïdentificeerd en geïllustreerd in Hoofdstuk 5, noodzakelijk vóór het toegepast wordt op Belgische ziekenhuizen. In alle landen worden vóór en na invoering van het nieuwe financieringssysteem verfijningen aangebracht in het classificatiesysteem om het op maat te maken van het land in kwestie.

De Belgische publieke overheden beschikken over een gedetailleerd registratiesysteem van de ziekenhuisactiviteiten. De huidige factureringgegevens, boekhoudkundige gegevens en klinische data laten de betalende overheden toe om toezicht te houden op de ziekenhuisactiviteiten. Maar, een adequaat financieringssysteem op basis van activiteiten heeft gedetailleerde kostengegevens nodig. Momenteel beschikken we niet over een verplichte nationale registratie van ziekenhuiskosten per patiënt voor de geleverde diensten.

BUDGETTAIRE GEVOLGEN

De herverdelingseffecten tussen ziekenhuizen ten gevolge van het invoeren van een all-in pathologiefinanciering werden berekend met zowel het prijs- als kostenmodel. In beide modellen is de budgetafwijking ten opzichte van de huidige situatie substantieel en gekenmerkt door een grote spreiding, met zowel positieve en negatieve outliers op ziekenhuisniveau. Deze belangrijke herverdeling van middelen tussen ziekenhuizen geeft duidelijk aan dat een nieuw pathologiefinancieringssysteem voor ziekenhuizen progressief ingevoerd zou moeten worden, zoals dit het geval was in andere landen.

Een analyse van de budgettaire gevolgen van het nieuwe systeem per ziekenhuis of per groep van ziekenhuizen is ongetwijfeld interessant maar prematuur. Verschillen die zowel in het prijs- als het kostenmodel vastgesteld worden, zijn met name afhankelijk van de veronderstellingen die bij de berekeningen aangenomen worden. Meerdere problemen duiken hierbij op: de veronderstellingen zijn niet geruggensteund door politieke keuzen, de gegevens zijn niet representatief, enz. Daarom werd beslist om deze verschuivingen niet te gaan interpreteren en om ons te beperken tot een pure haalbaarheidsstudie.

CONCLUSIES EN DISCUSSIE

Een evaluatie van de «technische» haalbaarheid van de introductie van een all-in prospectief financieringssysteem op basis van de case-mix van het ziekenhuis in België vormt een eerste belangrijke en tevens noodzakelijke stap op de weg naar een hervorming van het systeem van de ziekenhuisfinanciering. Nochtans volstaan de conclusies van een haalbaarheidstudie op zichzelf niet om tot een fundamentele wijziging van de ziekenhuisfinanciering te komen. Beleidsmakers, ziekenfondsen, ziekenhuisbeheerders en zorgverstrekkers moeten hierbij betrokken worden, wil men dergelijke hervorming tot stand brengen. De positie van de "stakeholders ", met name de betrokkenheid en het engagement van alle belanghebbende partijen is cruciaal voor de verwezenlijking van een hervorming van de ziekenhuisfinanciering in de gegeven Belgische politieke en economische context.

Impact van de hervorming van de ziekenhuisfinanciering op de inkomstenstructuur van de ziekenhuizen en de relaties tussen ziekenhuisbeheerders en zorgverstrekkers

De werkingskosten van de ziekenhuizen worden voornamelijk gefinancierd via het Budget van Financiële Middelen (BFM) en (een deel van de) medische honoraria. In een systeem van all-in financiering zal het aandeel van de medische honoraria verminderen ten voordele van het bedrag rechtstreeks gestort aan het ziekenhuis. Zelfs indien een nieuw systeem van ziekenhuisfinanciering ingevoerd wordt met de verzekering van een zero operatie op budgettair vlak, zal de resulterende wijziging in samenstelling van de ziekenhuisinkomsten met grote waarschijnlijkheid ook de bestaande machtsverhoudingen in de onderhandelingen tussen ziekenhuisbeheerders en ziekenhuisgeneesheren fundamenteel veranderen. Inderdaad, indien de ziekenhuisbeheerders als het ware alleen kunnen beslissen over de verdeling van de inkomsten verkregen uit het BFM, zullen zij desondanks, in het kader van de bestaande ziekenhuiswet, tot een akkoord moeten komen met de Medische Raad over de verdeling van de inkomsten m.b.t. de medische honoraria. Terugschroeven of zelfs opheffen van het aandeel honoraria in de ziekenhuisinkomsten komt dan neer op het gedeeltelijk respectievelijk volledig uitschakelen van de macht van de Medische Raad, zoals actueel uitgebouwd in de ziekenhuiswet. Versterking van de macht van de ziekenhuisbeheerders ten koste van de geneesheren mag in geen geval gezien worden als een automatisch recept voor de realisatie van de objectieven van een all-in financiering. Wel integendeel, een goede verstandhouding tussen medisch korps en de inrichtende macht van het ziekenhuis vormt dikwijls de basis tot succes en draagt bij tot het bereiken van de doelstellingen van het gezondheidszorgsysteem.

Hoe kan nu vermeden worden dat een gewijzigde inkomstenstructuur, als gevolg van een "all-in" pathologiefinanciering, het bestaande machtsevenwicht tussen ziekenhuisbeheerders en zorgverstrekkers verstoort? Op het eerste zicht kunnen twee oplossingen overwogen worden. De eerste zou erin bestaan de APR-DRG gewichten en tarieven apart te berekenen voor het BFM en voor de medische honoraria. Deze optie behoudt het bestaande systeem van duale financiering met twee gescheiden inkomstenstromen. De eerste geldstroom, die van het BFM, zou zich dan niet meer baseren op de 'verantwoorde' beddenaantallen, maar wel op APR-DRG tarieven. In de tweede geldstroom, die van de medische honoraria, zouden de vergoedingen per verstrekking vervangen worden door forfaitaire bedragen per APR-DRG. Het voordeel van dergelijke benadering is het behoud van het actuele machtsevenwicht tussen ziekenhuisbeheerders en Medische Raad. Anderzijds dreigen dan wel conflicten te ontstaan tussen onderscheiden specialismen binnen de schoot van de Medische Raad m.b.t. de verdeling van een globale honorariapool. Deze verdeling zou dan moeten geregeld worden zonder te kunnen teruggrijpen naar facturatiegegevens per individuele prestatie. Een ander belangrijk nadeel is het bemoeilijken van substitutiemogelijkheden tussen medische en andere activiteiten.

Een andere optie zou erin bestaan de APR-DRG gewichten en tarieven toe te passen op én BFM budgetten én medische honoraria, maar dan met een wijziging van de Ziekenhuiswet, betreffende de netelige kwestie van het ziekenhuisbeheer versus het statuut van de ziekenhuisgeneesheer.

In het licht van de vele jaren van laveren die het de wetgever gekost heeft om tot de huidige wettekst te komen, mogen de slaagkansen voor een compromis tussen alle betrokken partijen over de redactie van een nieuwe tekst niet overschat worden. Daartegenover staat dan wel dat een fundamentele hervorming van de ziekenhuisfinanciering ook kan gezien worden als een opportuniteitsvenster voor politici, ziekenhuisbeheerders en zorgverstrekkers om nieuwe modaliteiten van partnership binnen het ziekenhuis te exploreren. Zo bijvoorbeeld duwen de bestaande wettelijke beschikkingen de ziekenhuisgeneesheren in een grotendeels defensieve rol gericht op de verdediging van hun inkomsten; nieuwe modaliteiten van partnership zouden hen een meer proactieve rol kunnen toebedelen m.b.t. alle oplossingen die het ziekenhuis in staat moeten stellen beter bij te dragen tot het geheel van objectieven in de gezondheidszorg.

Of men nu de eerste, dan wel de tweede oplossing voorstaat, er zal in ieder geval aan ziekenhuisbeheerders en aan het medisch korps de tijd moeten gegeven worden om zich gedurende een vooraf voldoende ruim bepaalde periode aan te passen aan de nieuwe financieringsmethoden.

Impact van de hervorming van de ziekenhuisfinanciering op de kwaliteit en toegankelijkheid van de zorg

Een "all-in" financiering stimuleert de ziekenhuisactoren om de kosten te beperken. Indien deze kostenbeperking niet goed gerealiseerd wordt, kan de zorg ook aan kwantiteit en/of kwaliteit inboeten. Bovendien zou een "afroming" van de minst dure patiënten kunnen resulteren in een verminderde toegankelijkheid van de zorg. Bijgevolg moet naast de invoering van een nieuw financieringssysteem, een kwaliteitscontrole uitgevoerd worden. Er moet ook op toegezien worden dat de forfaits rekening houden met de zwaarte van de aandoeningen.

Impact van de hervorming van de ziekenhuisfinanciering op het macro niveau van de ziekenhuissector

Ondanks het feit dat een toenemend aantal elementen van een prospectief pathologiefinancieringssysteem gedurende de laatste decennia werd ingevoerd, gebeurde dit toch slechts op een beperkte schaal. De betaling per prestatie, met prijzen die onderhandeld worden binnen de Technisch Medische Raad en de Commissie Geneesheren – Ziekenfondsen, blijft het belangrijkste betalingssysteem voor de vergoeding van de geneesheer-specialisten. Voor heel wat procedures weerspiegelen de honoraria echter niet meer de reële kosten omdat er onvoldoende aanpassingen en herzieningen gebeuren volgens de evolutie van de wetenschap en de medische praktijk.

In een systeem van ziekenhuisfinanciering volgens case-mix ontvangen ziekenhuizen die patiënten met dezelfde case-mix verzorgen ook hetzelfde budget. De overgang van een financiering per prestatie naar een pathologiefinanciering kan leiden tot belangrijke budgetverschuivingen tussen de ziekenhuizen. Ziekenhuizen die nu een hoge consumptie hebben binnen het systeem van betaling per prestatie zullen na introductie van een pathologiefinanciering waarschijnlijk geconfronteerd worden met een daling van hun inkomsten. Op dezelfde manier zullen er veranderingen optreden in de inkomsten tussen en binnen ziekenhuizen naarmate de prijzen geleidelijk aan vervangen zullen worden door de reële kosten om de APR-DRG gewichten en tarieven te berekenen. Ziekenhuizen en departementen die overmatig veel diensten leveren waarvoor de huidige vergoeding veel hoger is dan de reële kost zullen als gevolg van deze aanpassing inkomsten verliezen.

Zonder uit het oog te verliezen dat kostenbeheersing en verbetering van de efficiëntie de grote drijfveren zijn om een pathologiefinanciering in te voeren, moet er tot slot natuurlijk over gewaakt worden dat dit niet leidt tot het faillissement van bepaalde ziekenhuizen. Om te grote budgetverschuivingen bij de invoering van dit systeem te vermijden, wordt een geleidelijke overgang voorgesteld. Hierbij kan het budget van elk ziekenhuis de eerste jaren constant gehouden worden, zoals men in Duitsland deed.

AANBEVELINGEN

Het antwoord op de vraag of de invoering van een « all-inclusive » financieringssysteem op basis van de case-mix van het ziekenhuis haalbaar is in België lijkt eerder positief te zijn. Daarom beveelt het KCE aan om op deze denkpiste verder door te gaan eerder dan het blijven introduceren van partiële en gefragmenteerde hervormingen die het geheel uiteindelijk erg ondoorzichtig maken en moeilijk te beheren.

Indien voor een all-in ziekenhuisfinanciering gekozen wordt, moeten meerdere voorbereidingen getroffen worden om een succesvolle start mogelijk te maken:

- Om rekening te kunnen houden met de nieuwe financieringsstromen zal er moeten gezocht worden naar een zo groot mogelijke consensus tussen alle betrokkenen over de manier waarop de verhoudingen tussen de ziekenhuisbeheerders en het medisch korps zullen veranderen.
- Om een correcte weging van de verschillende medische activiteiten mogelijk te maken, moet een systeem van kostenregistratie opgesteld en verplicht worden.
- De kwaliteit van de registratie van de aandoeningen in de Minimale Klinische Gegevens moet beter gecontroleerd worden.
- De problemen gerelateerd aan de verschillende technische keuzes die mogelijk zijn bij invoering van een all-in ziekenhuisfinanciering (definitie van outliers, inclusie of exclusie van bepaalde activiteiten, enz.) moeten duidelijk in kaart gebracht worden en de beleidsmakers zullen duidelijke keuzes moeten maken tussen deze alternatieven.
- Meer nog dan in het huidige systeem, moet gezorgd worden voor een systeem dat de zorgkwaliteit controleert of stimuleert.

De implementatie van dit nieuwe ziekenhuisfinancieringssysteem brengt een revolutie met zich mee op het niveau van ziekenhuisbudget, cultuur en management. Deze introductie dient dan ook gefaseerd te worden ingevoerd teneinde het systeem van de ziekenhuiszorg niet in gevaar te brengen. In de eerste fase zou het ziekenhuisbudget dan ook slechts een minimale impact hiervan mogen ondervinden.

Scientific summary

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LIST OF ABBREVIATIONS

A&E	Accident and Emergency
ABC	Activity-Based Costing
AC	Activity Centres
AC-CP	Activity Centre-Care Programme
ADH	Anonieme DagHospitalisatie
ALOS	Average Length Of Stay
AP-DRG	All Patient DRG
APR-DRG	All Patient Refined DRG
AR-DRG	Australian Refined DRG
AZV	Anonymous Hospital Stays (Anonieme ZiekenhuisVerblijven)
BFM (BFM/BMF)	Budget of Financial Means
BFM/BMF	Budget Financiële Middelen
BMF/BFM	Budget des Moyens Financiers
BOS/BOA	"Bill Of Services" or "Bill Of Activities"
CBI	Clinical Biology Index
CIV	Centre for Information Processing (Centrum voor InformatieVerwerking)
CMI	Case-Mix Index
CMS	Centres for Medicare and Medicaid Services
CPAS/OCMW	Centres Publics d'Action Sociale
CRAFT	Case mix Rehabilitation and Funding Tree
CT	Computed Tomography
CV	Coefficient of Variation
DAGS	Danish Ambulatory Grouping System
DBCs	Diagnose Behandeling Combinaties
DBD	Day care Billing Data
Dk-DRG	Danish DRG system
DRG	Diagnosis Related Group
ED	Emergency Department
FFS	Fee-For-Service
FOD	Federal Public Service (Federale OverheidsDienst)
FPS	Federal Public Service
FTE	Full time Equivalent
G-DRG	German DRG system
GHS	Groupes Homogènes de Séjour
GP	General Practitioner
HBD	Hospital billing Data
HCFA	Health Care Financing Administration
HIV	Human Immunodeficiency Virus
HRG	Healthcare Resource Groups
IBF	Interdepartmental Budgetary Fund (Interdepartementeel Begrotingsfonds)
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
INAMI/RIZIV	Institut National d'Assurance Maladie-Invalidité

IQR	InterQuartile Range
KCE	Belgian Health Care Knowledge Centre
LOS	Length Of Stay
LTP	Lower Trim Point
MARZ	Minimum accounting system for hospitals (Minimum Algemeen Rekeningstelsel voor de Ziekenhuizen)
MCD	Minimal Clinical Data
MDC	Major Diagnostic Categories
MFD	Minimal Financial Data
MIC	Maternal Intensive Care
MND	Minimal Nursing Data
MRI	Magnetic Resonance Imaging
NHS	National Health System
NIC	Neonatal Intensive Care
NIHDI (RIZIV/INAMI)	National Institute for Health and Disability Insurance
NLM	National Library of Medicine
NYDH	New York State Department of Health
OCMW/CPAS	Openbare Centra voor Maatschappelijk Welzijn
OMC	Open Method of Coordination
P4P	Pay for Performance
PAL – NAL	Positive/negative number of inpatient days (Positief Aantal Ligdagen - Negatief Aantal Ligdagen)
PET	Positron Emission Tomography
PPS	Prospective Payment Systems
RDRG	Refined DRG
RIZIV/INAMI	RijksInstituut voor Ziekte- en InvaliditeitsVerzekering
ROM	Risk Of Mortality
SHA	Anonymous Hospital Stays (Séjours hospitaliers anonymes)
SHI	Statutory Health Insurance
SID	Supplier Induced Demand
SOI	Severity Of Illness
TCT	Technical Cell
THP	Total Hip Prosthesis
TKP	Total Knee Prosthesis
UTP	Upper Trim Point
VASC	Victorian Ambulatory Classification and Funding System
VFSIPH	Flemish Fund for the Social Integration of Disabled Persons (Vlaams Fonds voor Sociale Integratie van Personen met een Handicap)
VIC-DRG	Victoria (Australia) DRG system
VIPA	Flemish Infrastructure Fund for Personal Affairs (Vlaams Infrastructuurfonds voor Persoonsgebonden Aangelegenheden)
WIES	Weighted Inlier Equivalent Separation

1 INTRODUCTION

1.1 GENERAL BACKGROUND OF THE STUDY

One of the major reforms in the hospital sector since the beginning of the 1990s is the world wide implementation of prospective payment systems (PPS). Until the eighties the main form of hospital payment in many countries was retrospective cost-based reimbursement. The rationale for a PPS for hospital payment is to encourage efficiency and contain costs by fixing the payment per unit of output a priori, i.e. before the period for which care is given. This way, hospitals have to bear certain financial risk. Prospective payment systems vary widely in design; one option is the case-based payment method where hospitals are paid a fixed amount per case, regardless of the actual costs of the provided services. The case-based payment method can be grounded on one flat rate for each patient treated, without taking clinical or other differences into account. However, to limit the risk of hospitals attracting less ill patients, different patient classification systems have been developed with the aim of measuring a hospital's case-mix and adjust the flat rate payment. The term 'case-mix' refers to the composition of patients treated in a hospital. In most countries some variant of the Diagnosis Related Group (DRG) method is used as a measure of the inpatient case-mix. Inpatient admission cases are divided into categories which are relatively homogeneous in terms of hospital resource use and hospitals are paid a flat rate (tariff or case value) per case belonging to the same DRG. The DRGs "bundle" goods and services that are needed in diagnosis, treatment and care of a patient of a particular clinical type. However, a large variability between countries is observed in the way groups and tariffs are defined (including the rules for outlier payment), in the number of groups, and in the inclusion or exclusion of specific patients and services. In most countries the introduction of the diagnosis-based payment system has been gradually phased in over several years.

Prospective payment elements were also introduced in the Belgian hospital financing system during the last two decades. Examples are the (partly) case-mix system for non-medical hospital costs, laboratory testing and medical imaging. Since July 2006, prospective payment is also applied to a subset of hospital drugs. However, this partial case-mix system has been criticized. One of the conclusions of KCE report vol.8, in which the financing of hospital drugs in some European countries and in Canada is described, was that "Belgium is the only country with such a fragmentary case-mix hospital financing.[1] However, before moving further towards the development and implementation of an "all-inclusive" case-based hospital payment system, several steps need to be taken in a careful way.

There is a large amount of theoretical and (to a lesser extent) empirical literature on the effects of different hospital reimbursement systems and of prospective methods based on (variants of) DRGs on inpatient hospital utilization, costs and outcomes. Since the patient classification system and the available data are tied to a particular country and its health care system, they are important determinants of the results of a *within* country comparison of different hospital payment systems. However, this severely limits a comparison *between* countries. Hence a review of the international literature including the practice in other countries alone will not suffice to formulate well-founded recommendations concerning the introduction of an all-inclusive case-based payment system for Belgian hospitals. Therefore, it was considered necessary to explore the feasibility of using routinely collected data and data from a selection of hospitals to reimburse Belgian hospitals based on a classification of the case-mix of their patients. In this, the review of the practice in a selection of countries serves as background for a thorough analysis and assessment of Belgian data.

1.2 AIMS, SCOPE AND METHODS

The overall objective of the study is to assess the feasibility and understand the consequences and limitations of introducing an "all-inclusive" prospective case-based payment system for Belgian hospitals. Feasibility is defined in terms of constraints of data availability both from compulsory registration and other sources.

The following research questions were defined:

1. What are the characteristics of the case-based payment system in a selection of countries? What are the consequences and limitations of an all-inclusive case-based payment system?
2. Is an all-inclusive case-mix payment system for hospitals feasible in Belgium?
3. What could be the financial impact of an all-inclusive payment system for hospitals?

To answer these questions, different methods were applied.

First, a survey of the literature was undertaken to review the characteristics of the case-mix hospital payment system in a selection of five countries[a] (England, Germany, France, Denmark and Australia (Victoria)). In this review the main topics of interest were the patient classification system or grouper, the costing methodology, the definition of outliers, the determination of the tariff for the grouper and the inclusion or exclusion of specific services and/or patients. The review is mainly based on (grey) literature and consultation of experts. The terms "case-based" and "activity-based funding" using case-mix are used as synonyms.

Second, to assess the feasibility of an all-inclusive case-based payment system in Belgium, two databases were constructed. In the first database clinical case-mix and billing data for all Belgian hospitals for the year 2005 are included. These data were acquired through compulsory registrations. This exhaustive database for the Belgian hospital sector allows an evaluation of the currently available grouper, on the basis of reimbursements (price model). The second database contains detailed accountancy, clinical case-mix and billing data for the year 2002 for a group of Belgian hospitals and allows the application of a cost model in which costs are allocated to patients grouped in a (variant of the) DRG (cost model). In both databases the measure of the case-mix is the APR-DRG grouper (All Patient Refined DRG; version 15.0), which is a severity of illness-adjusted grouper.

Third, in a budget-neutral simulation exercise redistribution effects of the implementation of an all-inclusive cased-based payment model on Belgian hospitals were estimated with the price and the cost model.

1.3 STRUCTURE OF THE REPORT

The report is structured in 7 chapters and illustrated with numerous tables and figures in Appendix. The main chapters address the following topics:

- Introduction to provider reimbursement systems and costing methodologies (Chapter 2);
- Detailed overview of the Belgian hospital sector (Chapter 3);
- A review of case-based hospital financing in five countries (Chapter 4);
- Data and methodological issues related to Belgian hospital data (Chapter 5);
- Model building and simulations (Chapter 6).

Discussion of the feasibility assessment and of the results is provided in Chapter 7.

[a] The review reflects the situation up to 2008.

2 A BRIEF INTRODUCTION TO HOSPITAL REIMBURSEMENT SYSTEMS AND COSTING METHODOLOGIES

Reforms in the way hospitals are reimbursed can have important implications for broader health policy goals such as the quality and cost of health care. Each reimbursement system has different inherent incentives that can considerably influence hospital behaviour and these broader policy goals. To evaluate hospital responses to incentives in different reimbursement systems, we confront the possible responses with the general objectives of a health care system. The main purpose of this general overview of hospital reimbursement systems and their theoretical incentives is to introduce a basic terminology and to provide a framework for certain choices in the empirical analyses.

As mentioned in the introduction, the objective of this study is to assess the feasibility of the introduction of an "all-inclusive" case-mix reimbursement system for Belgian hospitals. It is beyond the scope of the study to provide a systematic review of the theoretical and empirical literature on the effects of different hospital reimbursement systems in general and of prospective methods based on DRGs in specific. Hence reference to the literature is limited to some overview studies or international projects.

Since the review of the practice of hospital reimbursement in a selection of countries (Chapter 4) and the empirical analyses (Chapters 5 and 6) focus on case-based prospective payment systems, this chapter also provides a brief introduction to "the building blocks" in calculating DRG tariffs.

2.1 HOSPITAL REIMBURSEMENT SYSTEMS

In this section we provide a classification of reimbursement systems and the way they may affect the general objectives of a health care system, i.e. quality, efficiency and equity and accessibility. In the first part (2.1.1), these objectives are clarified. In the second part (2.1.2), characteristics of the reimbursement system that may influence provider behaviour are discussed.

The conceptual framework for classifying provider reimbursement systems is mainly based on one article[2] and report (in Dutch)[3] which we refer to for further details. As mentioned in these references, in order to avoid misunderstanding, the scope is limited to the (public) 'reimbursement system' and not the broader concept of 'financing system', which e.g. also contains the private health care financing systems. In this document, depending on the context and perspective, the terms 'payment', 'reimbursement' and 'financing' are however often used interchangeably.

2.1.1 Principal objectives of a health care system

Although a health care system can be evaluated along many dimensions, the general objectives of a health care system are often described as a triptych: quality of care, efficiency, and equity.[3] At a European level, one of the Open Method of Coordination (OMC)[b] objectives is accessible, high-quality and sustainable health care and long-term care by ensuring:[4]

- "**access** for all to adequate health and long-term care and that the need for care does not lead to poverty and financial dependency; and that inequities in access to care and in health outcomes are addressed;

[b] See http://ec.europa.eu/invest-in-research/coordination/coordination01_en.htm for more information on the OMC.

- **quality** in health and long-term care and by adapting care, including developing preventive care, to the changing needs and preferences of society and individuals, notably by developing quality standards reflecting best international practice and by strengthening the responsibility of health professionals and of patients and care recipients;
- that adequate and high-quality health and long-term care remains **affordable** and financially **sustainable** by promoting a rational use of resources, notably through appropriate incentives for users and providers, good governance and coordination between care systems and public and private institutions. Long-term sustainability and quality require the promotion of healthy and active life styles and good human resources for the care sector."

In the following paragraphs, a short description of these objectives is provided. There exists no agreed-upon definition for these concepts.

2.1.1.1 Effectiveness and quality of care

According to the National Library of Medicine (NLM), effectiveness is "the benefit (e.g., to health outcomes) of using a technology for a particular problem under general or routine conditions." Quality of care is "the degree to which health care is expected to increase the likelihood of desired health outcomes and is consistent with standards of health care."[5] Quality is seen as a broader concept than effectiveness. It does not only take into account the medical effects of health care (which is related to evidence-based medicine)[c], but also looks at other aspects, such as appropriateness of care and patient satisfaction.[3]

2.1.1.2 Efficiency and sustainability

Economic resources are limited, but human needs and potential use of those resources are infinite. Due to scarcity of resources, choices have to be made and providing health care to one group of patients might have the opportunity cost of failing to treat another group. Efficient behaviour in general means minimising the costs of producing a particular level of output or, alternatively, maximising the output (e.g. a nation's health) for a particular budget.[7] Technical efficiency is the production of the greatest amount or quality of patient outcomes for each unit of expenditure, while allocative efficiency (Pareto optimality/efficiency) is the allocation of resources such that no change in spending priorities could improve the welfare of one person without reducing the welfare of another.[8] In contrast to effectiveness, efficiency measurements incorporate both the inputs or costs and the outcomes. In health economics, it is often assumed that it is not possible for health services to be efficient unless they are effective.[7]

Sustainability is a trade-off between levels of service and the availability of funds. There are limits to taxation, limits to spending and therefore, limits to the quantity and quality of health services in a publicly funded health care system. Sustainability can be defined in terms of whether the system can provide the financial means to pay the costs associated with present and future demands for health services and whether the means to this end are politically and economically acceptable. It ultimately depends on whether public budgets can continue to absorb the costs of the health care system.[9]

2.1.1.3 Equity and accessibility

The concept of equity is an ethical concept which can be seen as synonymous with notions of social justice and fairness. Since social justice and fairness imply a moral judgement, these concepts can be interpreted differently by different people. It is beyond the scope of this study to review the extensive literature on defining or measuring equity. Instead issues discussed in this literature are briefly addressed.[10]

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[c] i.e. "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."[6]

Equity has widely been defined as equality in the distribution of 'something'. However, equality per se is not necessarily the same as equity. There is usually some qualification in the equality statement (e.g. 'for equal need'). Some principles to achieve equity proposed in the literature are: equal health outcomes, equal expenditure per capita, equal resources per capita, equal resources for equal need, equal use for equal need or equal access for equal need. The principle of equity most commonly used is equal access.

In order to analyze the effects of policy reforms on equity, one must first identify the different categories of equity goals (e.g. equality in health care access or equality in resource allocation), the barriers affecting them and interventions that can be implemented to address those barriers.[11]

2.1.2 Typology of hospital reimbursement systems

Provider reimbursement systems can be defined through a number of attributes or dimensions. The following paragraphs describe two basic dimensions of a typology for provider reimbursement systems, i.e. fixed versus variable (2.1.2.1) and retrospective versus prospective (2.1.2.2) systems, and the relation between these two dimensions (2.1.2.3). In the literature there is a lack of unanimity in defining these dimensions. Often different meanings are given to the same terms. For example, Morris et al.[7] categorize 'fee-for-service' as a retrospective reimbursement system, while in the following typology this is regarded as a variable prospective reimbursement system. A classification of provider reimbursement systems from an incentive point of view is not about right or wrong, but about providing a framework which allows one to analyse how different systems can influence provider behaviour and contribute to attain the general objectives of a health care system.

The unit of reimbursement, which is a third dimension of a provider reimbursement system, is discussed in more detail in section 2.1.2.4. Related to the unit of reimbursement is the degree of financial risk. A provider is at financial risk when he bears the consequences of costs being higher (or lower) than expected. This dimension will be discussed together with the unit of reimbursement (2.1.2.4).

Providers can of course pursue different types of objectives and are affected by more than just financial incentives, which can even be overruled by other factors. However, to illustrate the theoretical incentives created by the typology of provider reimbursement systems, Jegers and colleagues assume that providers aim at maximising profits.[2] Although the typology applies to health care professionals (e.g. specialists) and health care institutions (e.g. hospitals), when summarizing possible units of reimbursement the emphasis will be on hospitals.

Throughout section 2.1.2 only theoretical incentives are considered. Two points should be kept in mind. The theoretical predictions regarding the behaviour of providers under different reimbursement schemes should be interpreted with caution as they give the possible isolated impact of a single reimbursement system. In a health system different payment mechanisms to reimburse providers can coexist. In these blended systems the incentives of the individual systems are mixed. In addition, there is also some literature which empirically evaluates these theoretical incentives.[12] Although one can learn from experiences in other countries, we do not enter into this literature since it offers relatively little guidance for concrete choices which have to be made in a different context (and which is the focus of this study). As was mentioned by Moreno-Serra and Wagstaff, the empirical literature on the impacts of payment model changes suffers from at least four limitations. First, this literature focuses largely on the United States and the shift in hospital payment by Medicare in 1983 (see section 2.2.1). Second, the impact assessment is largely limited to the hospitals that underwent the payment reform. A more general evaluation of a possible impact on other health care actors or on the health care system is mostly lacking. Third, most studies are limited in scope. Studies analyse a small number of geographic areas within a country or a limited number of hospitals, sometimes participating in a pilot program. Fourth, as for the methodological approach, confounding factors are not always taken care of appropriately.[12]

2.1.2.1 *Fixed and variable systems*

The first dimension in the typology of provider reimbursement systems indicates whether there is a link between the provider's income and his activity. In variable systems, the provider has an ability to influence his earnings by increasing or decreasing his activities. In contrast, in fixed systems, variations in activities do not induce changes in remuneration.[2]

In variable systems, it is expected that providers have an incentive to increase production, in theory, until marginal income equals marginal cost. This entails that systems with generous fees may cause overproduction. However, more is not always better and may even do more harm than good to patients (e.g. overconsumption of antibiotics or over-screening). Furthermore, this may not always be regarded as efficient use of resources. The 'spoiled' resources might have been spent more wisely in order to obtain more health benefits.

A fixed system gives a 'lump sum' to providers, irrespective of their production. This lump sum is determined ex ante. From an efficiency point of view, this creates incentives to reduce the marginal costs. However, quality of care may be reduced if patients receive less care than appropriate. It may also endanger the accessibility of care if the most costly patients (which need more intensive and/or costly care) are excluded. The type of activity parameter of course also plays a role in the created incentives.

At the macro-level the distinction between fixed and variable boils down to the distinction between closed-end and open-end systems. In a closed-end system policymakers decide on the global budget to be spent during a certain period. Since closed-end budgeting establishes a fixed level of spending, it can be a useful instrument for cost-containment. In an open-end system there are no budget limits. This may be done with a global budget, which allows shifts among sectors, or partial budgets according to the type of health care. A 'hard or soft cap' may be applied which refers to whether or not there is a correction (e.g. individual penalisation or linear price reductions) if the budget is overrun.[2]

The combination of fixed and variables elements at the micro and macro level can reinforce or weaken certain incentives. For example, a variable micro system that is open-ended at the macro level could boost overproduction further in contrast to a variable micro system in combination with a closed-end macro system.

2.1.2.2 *Retrospective and prospective systems*

The second dimension indicates whether the provider's payments are related to his actual costs or not.[2]

In a retrospective payment system, the provider's own costs are the basis for reimbursement ex post, which may provide an incentive to increase costs and hence his income. This system does not stimulate efficiency, e.g. providers may perform too many diagnostic tests or hospitals keep patients too long in hospital.

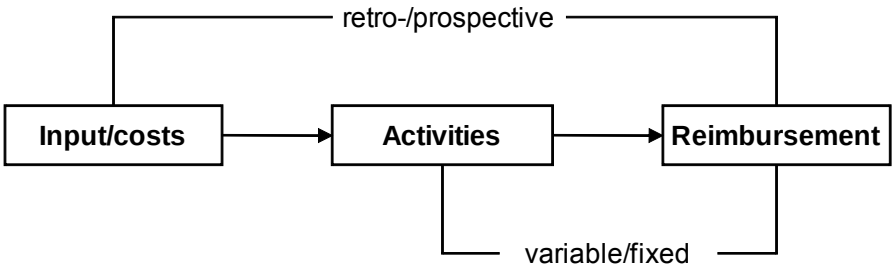
In a prospective payment system, the provider's payment rates or budgets are determined ex ante, without any link to the real costs of the individual provider.[2] Since the size in payments (not the payment itself) is determined in advance, this creates an incentive to reduce costs. Although such a system might improve efficiency, this may endanger quality of care and accessibility. Jegers et al. refer to the 'quicker but sicker' phenomenon, which occurs when patients are discharged too early and have an increased risk to be readmitted.

Shifting costs is another possible side effect in which certain (expensive) patients may be referred to other providers, which, if less appropriate, may lead to increased overall costs. Patients with a predicted unfavourable relationship between costs and revenue may also experience accessibility problems.[2]

2.1.2.3 *The fixed/variable retrospective/prospective mix*

The terms retrospective and variable, as well as the terms prospective and fixed, are often confused with each other. Figure 1 by Jegers et al. brings clarity in this. They phrase the difference as follows: "The dimension retrospective/prospective refers to the presence/absence of a link between reimbursement for the provider and his costs. The dimension variable/fixed describes the presence/absence of a link between reimbursement for the provider and his activities."[2] Although there is a link between costs and activities, the two are not the same.

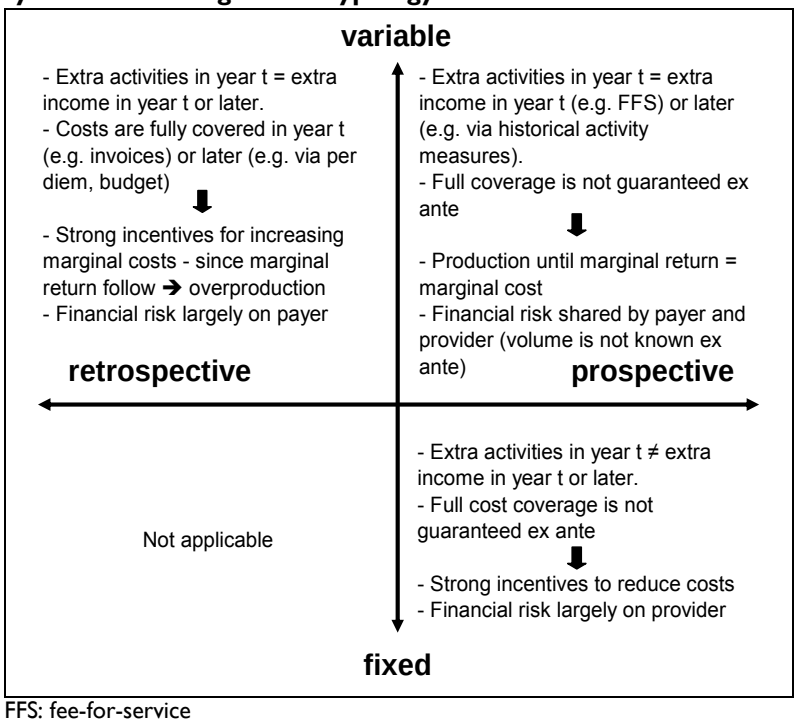
Figure 1: Retrospective/prospective dimension versus fixed/variable dimension of a typology for hospital reimbursement systems



Source: Figure adapted from Jegers et al.[2]

Figure 2 shows the characteristics of systems in the mix of fixed/variable and retro/prospective dimensions, together with their incentives (assuming profit maximisation) and the indication of who bears the financial risk. A fixed retrospective system is the only combination that is not possible since, by definition, retrospective systems are variable. While in a variable and prospective system, the financial risk is shared by both the payer and provider, the risk is largely for the payer in a variable retrospective system and for the provider in a fixed prospective system.

Figure 2: A summary of characteristics and incentives in reimbursement systems according to two typology dimensions



FFS: fee-for-service
Source: Adapted from Jegers et al.[2]

2.1.2.4 *Provider payment systems according to the unit of reimbursement*

The incentive effects of fixed versus variable reimbursement systems are also determined by the type of activity parameter used.[2] The aggregation level determines whether a system is more or less fixed or variable and hence determines the risk-sharing between provider and payer. Jegers et al. define five units of reimbursement i.e. item-of-service (fee-for-service), patient-day (per diem), case, patient (capitation) and period. For the reimbursement of physician care, the most common units are item-of-service, capitation system and period or salary system. For hospitals these are patient-day systems, the case and the period systems.

Per item-of-service

In this system, also called fee-for-service system, the price of each item is known ex ante. It is a variable system since (individual) providers can increase their returns by providing more listed services (unless there is a correction or 'hard cap' at the macro level). The advantages are that accessibility is guaranteed and that the best care available may be provided. However, the latter is only true from an economic point of view if the marginal payments compensate the marginal cost of care. The major adverse effect is that there may be an overproduction of care if the payment for providing the services exceeds the costs.[2] This phenomenon is also known as 'supplier induced demand' (SID), i.e. "the amount of demand, induced by doctors, which exists beyond what would have occurred in a market in which consumers are fully informed".[13]

Per patient-day

This system to finance the operational costs of hospitals is a largely variable system. It is retrospective if the real costs of the hospital determine the reimbursement. It is prospective if the price does not depend on the real costs. The latter creates more incentives in a profit-maximisation environment to reduce costs per patient-day.[2]

Per case

A case-based payment system pays hospitals according to the type of case treated. The most known per case system is the Diagnosis Related Group (DRG) system.[d] In general, DRG payments are an example of prospectively determined payments based on the average costs per case in each diagnostic group derived from a sample of hospitals.[e] Several case-based payments systems exist, such as the classification according to diagnosis, according to treatment and procedures or a combination.[2] One of the risks in this system is that costs and/or patients may be shifted (i.e. shifting patients or services to parts out of the DRG system). Furthermore, this system may also cause DRG creep which means that patients are classified into DRGs with a higher payment.[7]

Per patient

Providers may also receive a periodical lump sum per patient under their supervision for a certain period. This fixed prospective system creates the incentive to reduce costs. Furthermore, this system has few administrative needs and expenditures are approximately known in advance.[2] On the other hand, it creates negative incentives to undertreat patients and may create risk selection. In the latter, access of care for vulnerable patients may be endangered if providers select low cost patients to the prejudice of expected high cost patients. This may be mitigated by differentiating capitation payments according to risk or by prohibiting refusal of enrolment.[2]

Per period

The payment of a lump sum may also be linked to a given period for the treatment of patients, irrespective of their number. This is a fixed system, both at micro- and macro level since both provider's income and payer's expenditures are known in advance. The system can exist both at the level of the physician and the hospital. For the physician it entails that his salary is not linked to the costs and quantity of his activities. The advantage of this prospective fixed system is that there are few administrative costs. In contrast, it may lead to under-utilisation and patient shifting.[f] At the level of the hospital, two main types of measurement can be distinguished to determine the periodical reimbursement: input-related and volume-related measures. An example of the first is the capacity of the hospital, measured by e.g. the number and types of beds and/or specialists. The volume-related measurement can be linked to e.g. the number of admissions, DRG cases, patient days, etc.[2] The incentives of this system can be very different, depending on the degree to which providers can influence future income. If budgets take into account the production in the previous year(s), the providers may be incentivized to increase production, which is not the case if the system is more fixed.[2]

The relation between the unit of reimbursement and the dimensions fixed/variable and prospective/retrospective

In their typology, Jegers et al. include two dimensions, i.e. variable/fixed and retrospective/prospective, and five units of reimbursement, i.e. item-of-service, patient-day, case, patient and period. With respect to the providers of health care, the micro level refers to individual caregivers or providers (GPs, specialists, physical therapists, dentists, home nurses…), whereas the macro level refers to (all or some) providers as a group or the institutional providers (hospitals, nursing homes, home care agencies…), which is the relevant level for the payer.[2] Table 1 shows the relationship between both dimensions and units of health care systems at the micro level and the link with the macro level.

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[d] Section 2.2 goes further into details about DRG reimbursement systems.

[e] In the empirical analyses of Chapter 5 'average costs' for 'a sample of hospitals' are described in more detail.

[f] Geographic capitation is another variety of 'fixed periodical payments' that Jegers et al. classify in this category of periodical payments. In contrast to 'list patient capitation', they consider it as more fixed since providers have no tools to increase their income by having more patients on their list.[2]

Table 1: Relation between micro dimensions and unit of reimbursement and the macro level

macro	closed-end		open-end
micro	**fixed** Criteria: input* output* combination other	**variable** Unit of activities: item-of-service patient-day case patient period	
	prospective		**retrospective**

* see input- and volume-related measures in per period payment
Source: Adapted from Jegers et al.[2]

In summary, Table 1 shows that a macro closed-end system can be fixed or variable at the micro level, whereas open-end systems are variable at the micro-level. As shown in Figure 2, retrospective systems are by definition variable and thus open-end on the macro level. Prospective systems in combination with certain criteria or units of activities can be fixed or variable and closed- or open-end. What makes it even more complex is that a variety of units and systems can be used simultaneously in a certain treatment setting (i.e. hybrid or blended systems).[2]

2.1.2.5 Pay for performance

Under pay for performance providers are rewarded for meeting pre-established targets for delivery of health care services. This payment model rewards health care providers for meeting certain performance measures for quality and efficiency and was studied in KCE report vol.118.[14]

2.1.2.6 Conclusion

There are many different approaches to reimbursing hospitals. The advantages and disadvantages of these different approaches can be evaluated in terms of general objectives of a health care system, i.e. quality, efficiency and equity and accessibility. Although very often the main goal of reforms in the reimbursement of providers is cost containment, they may have intended or unintended impacts on other objectives. Payments can be seen as a price that can be used to adjust incentives and realize a balance between multiple competing objectives. Hence policymakers should identify the complete set of incentives provided by payment schemes and decide on the trade-offs between the various objectives. Furthermore, there may be conflicts between the micro and macro level or the short and long-term. More efficient use of resources in one sector (e.g. earlier discharge of a patient from hospital) may lead to more expenses in another sector (e.g. more homecare). Or less investments in research, education or prevention may seem efficient in the short term, while this may not be true from a dynamic perspective.[3] The type of provider payment system may have an influence on the balance between the health care objectives. Whereas a fixed system creates the incentives to reduce the cost and to be more efficient, it may lead to underproduction and reduced access to care. In contrast, more variable systems can lead to an overproduction of care and inefficient use of resources. Similar, retrospective systems may not use resources efficiently, whereas prospective systems may endanger accessibility and quality of care. As concluded by Kesteloot et al.[3], provider payment systems should try to combine the best qualities of the two dimensions and aim to improve efficiency without endangering quality and equity.

Key points

- **The primary objectives of a health care system are quality, efficiency and equity.**
- **Health care payment systems can be categorised as fixed or variable, and retrospective or prospective systems.**
- **Being categorized as variable or fixed depends on whether or not there is a link between the provider's income and his activity.**
- **A fixed system creates more incentives to minimise costs, whereas a variable system creates more incentives to maximise earnings.**
- **Being more or less fixed or variable is also determined by the level of aggregation of activity parameters. The most common units are per fee-for-service, per patient-day, per case, per patient and per period.**
- **Being categorized as retrospective or prospective depends on whether or not the provider's payments are related to his actual costs.**
- **A retrospective system creates more incentives for a provider to increase costs, while a prospective system creates incentives to reduce costs.**
- **In a variable retrospective system, the financial risk is largely for the payer, whereas in a fixed prospective system, the provider largely bears this risk. In a variable prospective system, the financial risk is shared by both the payer and provider.**
- **Provider payment systems should try to combine the best qualities of fixed/variable and prospective/retrospective systems and aim to improve efficiency without endangering quality and equity.**

2.2 DEVELOPING AND RATING DRGs FOR PROSPECTIVE HOSPITAL PAYMENTS

An increasing number of hospital payment methods adjust for clinical and other characteristics of patients. Information from the patient's medical record is used to place patients into groups. The Diagnosis Related Groups (DRGs) classification is the best-known case-mix system for prospective payments. In section 2.2.1 the different steps in developing and rating DRGs are briefly summarized. In section 2.2.2 a brief introduction is given on costing methodologies for estimating the cost of care. The description is limited to the core process of calculating the DRG tariff. In Chapter 4 more details for the selected countries are provided.

2.2.1 DRGs: definition, types and weights[g]

Diagnosis Related Groups (DRGs) are a patient classification scheme which relates the types of patients treated in a hospital (the case-mix) to the costs incurred by the hospital to treat these patients. The DRG definitions were originally developed in the late sixties at Yale University by Fetter and colleagues.[16] The original objective of DRGs was the development of an instrument to monitor quality of care and the use of services in an acute care hospital by grouping together clinically similar cases with a similar pattern of resource use. All age categories were included: newborns, pediatric and general adult populations including the Medicare population (people who are aged 65 and over, or who meet other special criteria). The development of the DRGs provided the first operational means of defining and measuring a hospital's case mix complexity.

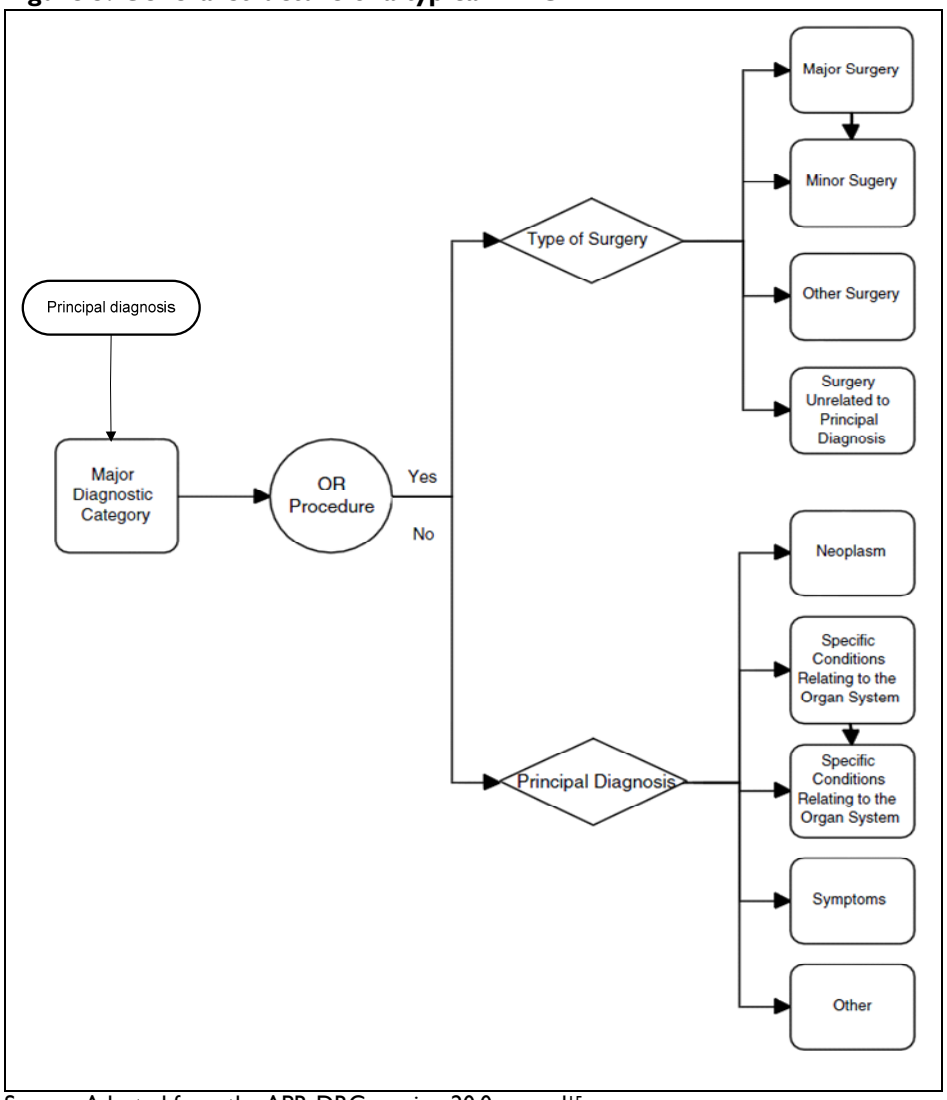
g The content of this section is largely based on the APR-DRGs version 20.0 manual produced by the Clinical Research and Documentation Departments of 3M Health Information Systems.[15] The manual gives an overview of methodology, history and bibliography of DRG-classifications.

The building of the original DRGs started with the classification of all possible principal diagnoses (International Classification of Diseases, 9th Revision, Clinical Modification; ICD-9-CM) into 23 mutually exclusive principal diagnosis categories called Major Diagnostic Categories (MDC). To guarantee clinical coherence, this step was performed by physician panels. Each MDC bundles all diagnoses that correspond to a single organ system or etiology. In general, they are associated with a particular medical specialty. However, not all diseases or disorders could be assigned to an organ system-based MDC and residual MDCs were created (e.g., systemic infectious diseases, myeloproliferative diseases, and poorly differentiated neoplasms).

Next, most MDCs were divided into medical and surgical groups because of the different consumption of hospital resources: a surgical procedure significantly affects the type of hospital resources (e.g., operating room, recovery room, anesthesia). Surgical patients were identified based on the procedures that were carried out. As soon as a patient had a procedure code for which it was expected that the operating room was required, that patient was classified as a surgical patient. Patients with multiple procedures were assigned to the surgical group highest in the hierarchy. The medical groups in each MDC included a group for neoplasms, symptoms and specific conditions relating to the organ system involved. The general structure of a typical MDC is shown by the tree diagram in Figure 3. Each MDC usually includes a group "other medical diseases" and a group "other surgical procedures". These groups include diagnoses or procedures which were infrequently encountered or not well-defined clinically. There are also patients who receive surgical procedures which are completely unrelated to the MDC to which they were assigned. These are called "unrelated operating room procedures".

Next, each MDC group was evaluated by physician panels to determine if complications, co-morbidities or the age of the patient would consistently affect the consumption of hospital resources. A diagnosis code, when present as a secondary condition, was considered a substantial complication or co-morbidity if the code caused an increase in length of stay by at least one day for at least 75 percent of the patients. This process resulted in a basic list of complications and co-morbidities that would apply to most DRGs. The patient's age was used in the definition of pediatric DRGs. Pediatric patients (age 17 years or less) were often assigned to separate DRGs. For more details, we refer to the APR-DRGs version 20.0 manual.[15]

Figure 3: General structure of a typical MDC



Source: Adapted from the APR-DRG version 20.0 manual[15]

2.2.1.1 *Evolution of DRGs and the APR-DRG algorithm*

The term "DRG" is often used to refer to any kind of DRG-based system. There are however many different DRG algorithms[h], with major differences among them. We limit the description to algorithms relevant to the Belgian situation.

Following a large-scale application of the DRGs in the late seventies in the State of New Jersey, a U.S. national DRG-based hospital prospective payment system for all Medicare patients was introduced in 1983. DRGs were adapted to the Medicare population by an algorithm called CMS-DRGs[i]. It was used by Medicare from 1983 to 2007.[18]

In 1988, the state of New York instituted a DRG-based prospective payment system for all non-Medicare patients. The applicability of the DRGs to a non-Medicare population, in particular neonates and patients with Human Immunodeficiency Virus (HIV) infections, was evaluated by the New York State Department of Health (NYDH) in cooperation with 3M HIS.[j] As a result, the number of 'base' DRGs was substantially reduced by eliminating all age related complications (CC) and major CC distinctions.

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h In addition, other case-mix grouping algorithms not based on DRGs exist.[17]

i CMS is the Centres for Medicare and Medicaid Services, formerly known as the Health Care Financing Administration (HCFA).

j 3M Health Information Systems

The DRG definitions developed by NYDH and 3M HIS are referred to as the All Patient DRGs (AP-DRGs). Since the initial release in 1988, the AP-DRGs have been updated every one or two years.

In 1989 a project at Yale resulted in the development of the refined DRG (RDRG) system, which looked at severity of illness in the Medicare population. 3M developed All Patient Refined DRGs (APR-DRGs) in 1990 to address both severity of illness and risk of mortality over all patient populations. APR-DRGs extend the basic DRG structure with its focus on resource intensity by adding two sets of subclasses to each base APR-DRG, namely severity of illness (SOI) and risk of mortality (ROM). Resource intensity is the relative volume and types of diagnostic, therapeutic and bed services used in the management of a particular disease. Patients are allocated to an APR-DRG-SOI group on the basis of principal diagnosis, secondary diagnoses and procedures (all coded in ICD-9-CM), age and sex of the patient and, for some APR-DRG (e.g. burns) type of discharge. Severity of illness is defined as the extent of physiologic decompensation or organ system loss of function and introduces 4 'grades' for SOI: 1 = minor, 2 = moderate, 3 = major, 4 = extreme. The SOI takes into account the main diagnosis, age, the existence of certain non-operative procedures and the consequences of secondary diagnoses that are not connected with the main diagnosis and which are not mutually linked with other secondary diagnoses.[19] Risk of mortality is defined as the likelihood of dying. Hence, each patient is assigned three distinct descriptors in the APR-DRG system: the base APR-DRG, the SOI-subclass and the risk of mortality subclass. Allocation to a SOI-subclass is based on clinical judgment and resource consumption (costs or length of stay). In July 2005 the state of Maryland implemented new payment regulations using the APR-DRG method for rate setting.

Outside the U.S., many (European) countries have introduced DRGs or similar grouping systems. It is beyond the scope of this study to describe and compare all existing DRG-based or similar algorithms. We refer to Schreyögg and colleagues[20] for a nice overview. They compare methods used to determine tariffs for inpatient care within DRGs or similar grouping systems employed in nine EU member states (i.e., Denmark, France, Germany, Hungary, Italy, the Netherlands, Poland, Spain and England; survey up to 2006). Some countries used existing classifications while others modified these to take into account local clinical standards and practice. The Netherlands have developed their own classification system based on so-called diagnosis treatment combinations (Diagnose Behandeling Combinaties or DBCs in Dutch). Chapter 4 describes more in detail than in the overview of Schreyögg et al. the grouper in five countries. As will become clear in Chapter 3, Belgium did not develop its own "local version" of DRGs but has fully adopted the APR-DRG classification system. In the early nineties Belgium shifted from the AP-DRG system to the APR-DRG (version 15.0) classification system.

In this APR-DRG version, the number of DRGs is reduced to 355 base DRGs, each with 4 SOI-classes, and two 'residual' APR-DRGs grouping hospital stays whose medical record abstracts contain clinically atypical or invalid information, thus rendering SOI classification irrelevant (APR-DRG 955 – Invalid principal diagnosis and 956 – Ungroupable stay). Overall, the number of distinct groups amounts to 1 422.

APR-DRG version 15.0 was released by 3M HIS in 1998, but a more recent version 20.0 was introduced in 2003 reducing the number of base APR-DRGs to 314. Versions 24.0, 25.0 and 26.1 followed.

2.2.1.2 DRG adjusted payments

DRGs can be described as a way of classifying the outputs of a hospital into a manageable number of treatment diagnoses. Without such an output classification system, it would be impossible to move from a fee-for-service system to a system with standard prices based on patients' pathology. In a DRG payment system the unit of payment is redefined to be a hospital stay, with higher payments for sicker patients where sickness depends on diagnoses and major procedures. Since payments do not depend on individual hospital costs, a hospital has incentives to improve efficiency and to treat patients of all case-mix groups since it receives a higher payment for sicker patients. Introducing a reimbursement model based on DRG related costs, shifts financial risk from payers to hospitals.

Once each stay has been allocated to an APR-DRG-SOI subclass, the DRG-system[k] can be used for hospital payment purposes. In a case-based prospective payment system, hospitals receive a fixed predetermined amount for each stay, regardless of their actual costs. Therefore a tariff has to be assigned to each DRG. Two elements are crucial here: the DRG relative weight or DRG relativity and the base payment rate. Different costing methodologies for assigning the DRG weights and for the estimation of the base payment rate (e.g. the average costs per DRG) are described in section 2.2.2.

The DRG weight is a relative measure and reflects the average level of hospital resources consumed by a patient belonging to that specific DRG. Stated differently, the weight is a ratio comparing the average resources required by all hospitals to treat a patient in that DRG with the resources needed to treat patients in all DRGs. It compares the costliness of the DRG to the average case. The weight applies equally to all hospitals. Weights can be standardized to a theoretical average weight of 1.0 which is the relative weight of the national average hospital resources consumed per stay. Hence patients in a DRG with a weight larger than one consume more resources than the average patient, for patients in DRG with a weight less than one the opposite holds. The average DRG weight in an individual hospital is called the case-mix index (CMI) of the hospital.

Instead of using DRG weights, DRG tariffs can also be determined directly.[20] The advantage of standardized DRG weights is that only the tariff of the DRG weight of 1.0 has to be set since tariffs for all other DRGs are calculated by multiplying their weight with this base rate. In the next chapters we come back to this point.

Adjustments to the principle of one tariff per case are possible. Some adjustments apply to groups of cases (e.g., outliers, transfers) while others apply to groups of hospitals (e.g., teaching hospitals, location of hospitals causing different input prices). More information can be found in the review of the practice in five countries in Chapter 4.

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k The general term "DRG" represents different DRG-based or similar algorithms.

2.2.2 Costing methodology

Whatever the unit of reimbursement used in a prospective reimbursement system, a monetary value for this unit has to be determined in advance. As described by Mogyorosy and Smith, researchers agree on the basic principles of 'costing', in which the costing exercise starts with "*(a) formation of a well-defined decision problem, including the objectives of costing, the perspective of costing, and the time horizon, as well as (b) the description of a particular service (cost object). After the service for costing has been defined in detail, the costing methodologies follow three distinctive steps: (c) the identification of resources used to deliver the service, (d) the measurement of resource utilization in natural units, and (e) attaching monetary value to resource use. In addition, there is a consensus that the robustness of the result should be addressed by (f) sensitivity analysis and statistical tests.*"[21, 22] Furthermore, "*ideally, costs should be traced directly if it is possible in an economically feasible way. Indirect costs (overheads) should be allocated to service areas based on actual utilisation or cause-and-effect bases.*" Since this study aims to assess the feasibility of the introduction of an all-inclusive case-mix reimbursement, the description of the different steps in costing is limited to methods relevant for the definition of tariffs for DRGs (or a variant of it).

a. The ultimate goal of the costing exercise is to calculate reimbursement rates for DRGs. As far as the perspective of costing is concerned, all steps are performed from the perspective of the third-party payer. This perspective does not necessarily coincide with the perspective of the provider.

b. The cost objects or health services are defined with the ultimate aim of comparing costs per treatment episode or case.

c. The identification and classification of resource items (all relevant costs) are described in Chapter 5.

d. There exist several methods for resource use measurement. Whatever the costing approach, since case-based hospital payment systems pay hospitals for each treated case, direct and indirect costs should be allocated. Methods can be categorized under top-down cost and bottom-up cost calculation methods. The two approaches based on costs as well as a mixed approach are briefly explained and discussed hereafter. The discussion is largely based on the HealthBasket review of Mogyorosy and Smith in which the main methodological issues in costing of health care services are described.[21] The aim is not to reach a consensus on which method should be preferred, but rather to give an overview of possible approaches and their (dis)advantages. As also mentioned by Mogyorosy and Smith, there is no universally accepted appropriate costing methodology. The selection of the most appropriate method depends upon the type of service, the reason for costing and the economic feasibility of cost calculation.

- Top-down cost calculation: Calculation of costs frequently relies on existing financial accounts and other databases with a retrospective nature. A top-down approach apportions pre-existing data on total or average costs in some way to the option being evaluated, without costs being decomposed into their constituent quantities and prices.[7] If information is already available in a secondary database, then the top-down method may be preferred if the data are accurate enough for the intended purpose. These secondary databases have the advantage of being already available (quickly and relatively cheap or maybe for free), having large numbers of observations collected in a standardised way, and they can have a good external validity. However, if a service provision is based on complex organisational arrangement (input mix could vary significantly), and e.g. human resource costs and overheads (that are not included in the database) are responsible for a large portion of the total costs, the inaccuracies introduced by a top-down approach may become important.[21]

- Bottom-up cost calculation: Opportunity costs may differ substantially from market prices due to market failures, third-party payment systems, government interventions, unstable or unpredictable market price, stage in the product's lifecycle, because a market price does not exist, etc.[21] As a result, the 'accounting costs' may differ from the 'economic costs' and a bottom-up approach where patient-specific data is collected, may be preferred. This approach identifies, quantifies and values resources in a disaggregated way, so that each element of cost is estimated individually. At the end they are summed up.[7] For example for labour costs, the bottom-up approach entails recording of staff time used to perform various tasks. In principle, the bottom-up approach is the preferred resource use measurement approach, in part because it is more reliable, accurate and flexible than top-down approaches. The drawback may be that some costs are overlooked. Moreover, the calculation of opportunity costs could be difficult and resource intensive, whereas accounting costs (maybe) can provide reasonable accurate estimates of opportunity costs. A bottom-up approach needs a sample that is large enough to reach internal validity and enable meaningful statistical analysis. Moreover, while the internal validity may be very high, the external validity may suffer.[21] Nevertheless, "bottom-up cost calculation is generally believed to be the gold standard methodology for the costing of hospital services".[23]
- Mixed approach: The top-down approach is (most of the times) cheaper and faster than the bottom-up approach and often may be the only feasible option. On the other hand, accuracy and reliability of this method depends on the quality of the secondary data,[21] and thus bottom-up cost calculation may be preferred in other cases. A mixed approach can try to profit of the advantages of both methods and reduce the disadvantages. Top-down cost calculation could be used "where variation in resource use is reasonably small, and/or when the level of aggregation is relatively high as well as where bottom-up cost calculation would be very expensive." A bottom-up approach could then be used "where the accuracy of resource measurement is important, and data collection is feasible in an economically sensible way."[21] The study of Tan et al.[23] suggests that "restricting the use of bottom-up costing to those cost components that have a great impact on the total costs (i.e., labour and inpatient stay) would likely result in reliable total cost estimates."

In the cost model of this study, a mixed approach with activity-based costing (ABC) was followed as a first attempt of costing methodology. Activity-based costing is a cost accounting system which is based on the paradigm that activities consume resources, and services or products are the result of activities.[21] The allocation of resource costs to the products is based on activity consumption. Hence, indirect costs are allocated to products using a large number of cost drivers. In traditional cost accounting methods the number of cost drivers is limited and cost drivers are mainly based on volume. In section 5.4.1 a detailed description is given of the cost accounting model used in this study.

e. In addition to counting the number of services patients receive, a monetary value has to be attached to the resource units. Different methods exist which, broadly speaking, can be classified into valuation methods based on costs and methods based on prices (fees, tariffs or charges). Sometimes charges and costs are used interchangeably as synonyms in the literature. However, these concepts have different meanings: "Charges are the amount expressed in monetary terms that providers ask for products sold or services provided, and these charges may or may not reflect actual resource consumption or costs. Costs can be defined as the amount of expenditure incurred on or attributable to a particular good or activity."[21] Ideally, the DRG tariff should reflect the real hospital costs for a specific case and its treatment. In theory, charges or reimbursements may accurately reflect actual resource costs, but this is rarely the case.

2.2.3 Conclusion

Although it is beyond the scope of this study to describe and compare in an extensive way existing case-mix systems for reimbursing hospitals, the basic characteristics of the APR-DRG grouper algorithm were provided since this grouper is available in Belgium. In Chapter 5 the applicability of this grouper on Belgian hospital activity is assessed. Essential in fixing the DRG payment rate or case value are the DRG weight and the base rate.

Key points

- **The Diagnosis Related Groups (DRGs) classification or grouper is the best-known case-mix system for prospective payments. The unit of payment is a hospital stay.**
- **Different classification systems based on DRGs exist. In Belgium, the All Patients Related (APR-) DRG grouper is available. Each APR-DRG consists of 4 subclasses based on severity of illness (SOI).**
- **A DRG payment rate is mainly determined by the DRG weight and the base rate.**
- **Different costing methodologies exist to calculate the DRG weight and the base rate. They can be classified into top-down, bottom-up and mixed approaches. The monetary value attached to the resource units are costs or prices (fees, tariffs or charges).**

3 STRUCTURE OF THE HOSPITAL SECTOR AND HOSPITAL REIMBURSEMENT IN BELGIUM

The Belgian hospital sector has been undergoing major reforms during the last decades. As in most European countries, Belgium has moved from a full retrospective cost reimbursement system towards one (partially) based on a prospective global budget with some case-based payments. Since these reforms in the hospital sector fit into the broader developments in the Belgian health care sector in this period, we briefly sketch some features of the overall context of the Belgian health care system, with a focus on financial flows and responsibilities of different authorities (section 3.1). Next, a detailed overview is given of the current structure of health care providers (section 3.2), regulatory framework (section 3.3) and reimbursement system (section 3.4) of hospitals in Belgium as well as a brief description of some important reforms.

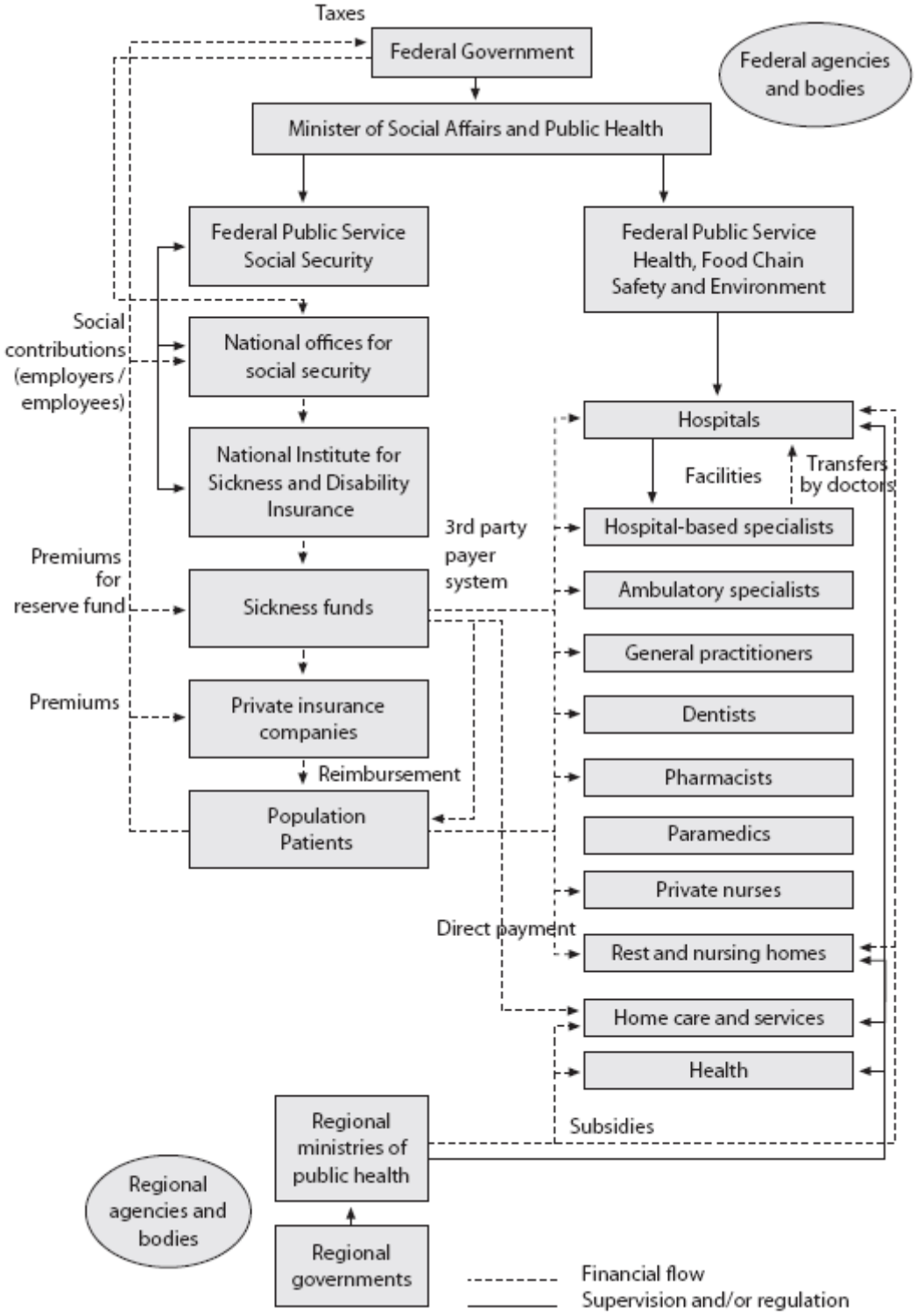
3.1 FINANCIAL FLOWS AND RESPONSIBILITIES IN THE BELGIAN HEALTH CARE SECTOR

The Belgian health system has a Bismarckian-type of compulsory national health insurance covering the entire population with a very broad benefits package.[19] Compulsory health insurance is organized through private, non-profit sickness funds. Membership of a sickness fund is compulsory but the choice of sickness fund is free. Health coverage and social contribution rates levied are the same for all funds. Compulsory health insurance is combined with independent medical practice. As far as the health care payer structure is concerned, the financing mix mainly consists of public means (i.e. taxes and social security contributions which almost have an equal share), alternative financing (e.g. indirect taxes and excise duty), private insurance and out-of-pocket payments.[1] Social security contributions are related to income (a percentage fixed by law) and worker's status (salaried or self-employed) and do not depend on the health risks of the insured.[19, 24]

Figure 4 gives an overview of the general financing structure and responsibilities in the Belgian health care system. Consistent with the financing structure, public authorities play an important role in Belgian health care policy.

[1] Different sources mention different percentages for the share of out-of-pocket payments in total financing of the system. Most of them are in the range of 20-30%.

Figure 4: The general financing structure and responsibilities in the Belgian health system



Source: Corens, 2007[19]

Responsibility for health care policy is shared between federal and regional governments. At the federal level, responsibility is exercised by the Federal Public Service of Health, Food Chain Safety and Environment (former Ministry), the Federal Public Service Social Security and the National Institute for Health and Disability Insurance (NIHDI/RIZIV/INAMI[m]). The authorities are responsible for the regulation and financing of the compulsory health insurance; the determination of recognition criteria (i.e. minimum standards for operating hospital services); the financing of hospitals and heavy medical care units; legislation covering different professional qualifications; and the registration of pharmaceuticals and their price control. At the regional level the Dutch-, French- and German-speaking community Ministries of Health are responsible for health promotion; maternity and child health services; different aspects of elderly care; the implementation of hospital accreditation standards; and the financing of hospital investment.[19]

The NIHDI plays a central role in the Belgian system. This federal institution establishes the rules for the reimbursement and determines the tariffs of the health care services (the so-called nomenclature) and pharmaceuticals. It organizes, manages and supervises the correct application of the public compulsory health insurance. The NIHDI inspects both the sickness funds and the health care providers to see whether they apply the rules of the health care and health insurance system correctly.[25] While the NIHDI manages and supervises the compulsory health insurance, the sickness funds are responsible for the reimbursement of health care costs.[26] The NIHDI falls under the responsibilities of the Minister of Social Affairs and is directed by a General Council with representatives from the government, the trade unions and employers' organizations, the providers and the largest sickness funds.[24]

Provider payment is mainly fee-for-service and patients have a free choice of physician. There are (almost) no gatekeeping arrangements. There are two main systems of provider payment. The first is a *third-party payer system*, in which the patient only pays the co-payment[n] while the sickness fund directly pays the provider for the cost of treatment. This system mainly covers inpatient care and pharmaceuticals. The second is a *reimbursement system*, in which the patient pays the full fee of services to the providers (fees) and then obtains a refund for part of the expense from the sickness fund. This is the case for ambulatory care.[19, 24] All diagnostic and therapeutic procedures that can be reimbursed by the NIHDI are described in a list, the nomenclature, which is determined by Royal Decree and updated regularly. This list gives a detailed description of the intervention, the convention tariff and the conditions for reimbursement. The type of reimbursable benefits and their amounts (total fee and reimbursement) are determined through a complex process of negotiations with the various actors involved (sickness funds, representatives of health care professionals etc.) within NIHDI, all within preset budgetary limits. The negotiated fee or convention tariff is settled in agreements (for physicians and dentists) and conventions (for other health care professionals). Health care professionals who accede to the agreements or conventions have to adhere to the fee schedule as determined in the nomenclature, except for some specific situations.[27]

Already with the introduction of the compulsory health insurance system in 1963 the nomenclature was created primarily as an instrument for distributing the health care budget correctly amongst the various providers and was based on a fee-for-service payment. When the fee value was fixed for the first time, the amount of care activity provided and the costs were taken into account by assessing and comparing the time and complexity of the procedure. This process was applied to a limited number of representative procedures of each specialty. In a next step, the fees for other diagnostic and therapeutic procedures were settled by making rough estimates and comparisons. Quality of care and the critical character of the procedure were barely taken into account in the calculation of the fee.

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m Rijksinstituut voor ziekte- en invaliditeitsverzekering; Institut national d'assurance maladie-invalidité

n We use the term "co-payment" to refer to co-payments and co-insurance. Both are cost-sharing arrangements which require the individual covered to pay part of the cost of care. A co-payment is a fixed fee (flat rate) per item or service; in case of co-insurance the patient pays a fixed proportion of the total cost.

Due to insufficient review and updates to take account of evolution in medical science and practice, fee values for a number of procedures no longer reflect the real cost.[28]

In Belgium there is no overall budget allocated to health care. However there is a fixed annual budget for the compulsory health insurance system (about 24.250 billion euro for 2010), and sectoral target budgets within it (hospitals, doctors, pharmaceuticals, etc). Budget allocation takes place at federal and regional levels after negotiations between insurers, providers and the government.[29, 30] The budget is distributed by the NIHDI to the sickness funds.[24] Based on the Law Moureaux of February 15, 1993 a '*growth norm*' was introduced that restricted the annual maximum increase in expenditure to 1.5% in real terms. This limit was raised to 2.5% in 2001 and to 4.5% in 2004. However, the government can still introduce exceptions to this rule for specific new interventions. On a quarterly basis, a special commission confronts each sub-sector with its expenditures and partial budget. In case of a significant target overrun, corrective measures – such as an adjustment in the fee schedule or an increase in co-payments – can be undertaken.[24]

Key points

- **Belgium has a compulsory health insurance system mainly financed by public means. Public authorities play an important role in the Belgian health care policy.**
- **Provider payment is mainly fee-for-service. A third-party payer system and a reimbursement system coexist.**
- **All diagnostic and therapeutic procedures that can be reimbursed by the NIHDI are described in a list, the nomenclature. This list is the result of negotiations between stakeholders.**
- **There is no overall budget allocated to health care. For the compulsory health insurance system, a global and sectoral target budgets are fixed annually.**

3.2 HEALTH CARE PROVIDERS IN BELGIUM

Health care providers in Belgium consist of predominantly private health care professionals (medical or paramedical) and private non-profit or public health care institutions. Health care institutions mainly include hospitals – general, psychiatric or mixed-, revalidation centres, day centres, polyclinics, laboratories and rest and nursing homes. Polyclinics are outpatient facilities that can be managed by physicians, sickness funds or hospitals. A day-surgery centre is a hospital-integrated facility where surgical interventions can be carried out efficiently and safely in one day and patients transit the hospital without overnight stay. Each hospital is required to operate a clinical laboratory. However, laboratory facilities are also found outside the hospital. Rest and nursing homes provide residential and nursing care for people over 60 years of age. Private for-profit clinics, e.g. for cosmetic plastic surgery, do not have to be recognised (see section 3.3.2) and are not included in this study.

In the next paragraphs the description of Belgian health care providers is limited to hospitals and health care professionals working in hospitals.

3.2.1 Typology of hospitals

Belgian hospitals can be classified along different dimensions. A first dimension is hospital ownership. About 72% of Belgian hospitals are private non-profit institutions, the other 28% are public institutions.[o] Public hospitals are mostly owned by public municipal welfare organizations (OCMW/CPAS[p] or intermunicipal organizations), while private hospitals are generally owned by religious charitable organizations or in some cases by sickness funds or universities. A second dimension is hospital (service) type. However, different classifications exist for hospital type. Hospitals can be classified into general and psychiatric hospitals. Psychiatric hospitals are exclusively designed for psychiatric care. In general, they dispose of one or more of the following departments: A (department of neuropsychiatry for acute observation and treatment), K (department of neuropsychiatry for children), Sp (specialized department for psycho-geriatric care) and T (department of neuropsychiatry for chronic treatment). Except for T-departments, the other (A, K and Sp psycho-geriatrics) can also be found in some general hospitals, along with acute care departments: C (surgery), D (internal medicine), E (paediatrics), M (obstetrics), IC (intensive care), NIC (neonatal intensive care), L (contagious diseases) and H (not otherwise specified - NOS - care). General hospitals can be further divided into acute, specialized (Sp) and geriatric[q] hospitals. Specialized hospitals provide chronic treatment and/or revalidation of patients with e.g. cardiopulmonary diseases, locomotive diseases, neurological disorders, palliative care, NOS chronic diseases and psycho-geriatric care. Typically, such hospitals have Sp-departments (specialized departments for treatment and rehabilitation) which can go together with H- (NOS care), T-(for chronic psychiatric treatment) or G-departments (geriatric). Geriatric hospitals dispose of G-departments (geriatric). Some acute hospitals can also cover acute psychiatric (A), specialized (Sp) or geriatric (G) departments. They can be considered as mixed general hospitals.

Table 2: Number of hospitals in 2005, by type

Type	Subtype	Number
General	Acute	116
	Specialized	23
	Geriatric	7
Psychiatric		69
Total		215

Source: Federal Public Service of Health, Food Chain Safety and Environment

Acute hospitals consist of university hospitals, general hospitals 'with university character' and other non-university hospitals. Belgium has seven university hospitals, one for each medical school that offers the entire medical education.[32] They have a particular status because they combine specialist treatment with research and education. Each medical school is assigned a quota of hospital beds with 'an academic label', which are spread over the university hospital itself and over other non-university hospitals. The Royal Decree of December 24[33], 1980 limits the maximum number of 'university beds' to 7 405. Also the distribution of this maximum number over the seven university hospitals is determined in the same Royal Decree. 75% of these university beds are allocated to university hospitals. Non-university hospitals who dispose of university beds are called general hospitals 'with university character'. A minimum number of beds should be allocated to hospitals in provinces without a medical school.

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o Figures for 2005, available from the website of the Federal Public Service of Health, Food Chain Safety and Environment.[31]

p Openbare Centra voor Maatschappelijk Welzijn; Centres Publics d'Action Sociale

q Geriatric hospitals could also be catalogued as specialized hospitals.

3.2.2 Typology of health care professionals

Medical health care professionals are classified into general practitioners and other specialists. General practitioners provide office consultations and home visits. Specialists can be consulted at home, at the hospital or in a polyclinic. Most health care professionals are paid on a fee-for-service basis. The practice of physicians, dentists, midwives, nurses, pharmacists and practitioners of paramedical professions (such as physiotherapists, medical laboratory technicians, medical imaging technicians, speech therapists, dietitians, etc.) is regulated by the Practice of Health Care Professions Act. In order to practice medicine every physician has to be registered on the list of the Order of Physicians.

Key points

- **Health care providers consist of predominantly independent health care professionals and private non-profit or public health care institutions.**
- **Hospitals can be classified along different dimensions: hospital ownership, type of hospital (department).**
- **In 2005 there were 215 hospitals: 69 psychiatric and 146 general (acute, specialized or geriatric) hospitals.**

3.3 REGULATORY FRAMEWORK FOR HOSPITALS

The Belgian hospital sector is subject to extensive regulation concerning the quantity of health care provision. The health care system and more specific the hospital sector underwent a number of reforms over the last years. These reforms followed more or less the same pattern as in other countries. During the 1980s regulation intensified and reforms were implemented with the intention to impact upon the supply of health care. In the following decade some microeconomic incentives were introduced to increase financial responsibility for health expenditures. Some important changes in the choice of instruments of regulation with a direct or indirect influence on the hospital sector are discussed in this section.

Entry into the market for hospital services is restricted by government regulation (sections 3.3.1 to 3.3.3).[34] In short, a hospital has to meet two general conditions. First, it has to fit into the national planning determined at the federal level. If a hospital complies with the programming criteria, it respects the national planning. Second, a hospital has to fulfil several recognition criteria before it is allowed to operate. Recognition standards and criteria are also determined at the federal level. The regional authorities are responsible for granting and controlling the recognition.

3.3.1 Planning and programming

The federal government is responsible for planning global hospital capacity. Next, this planning is translated into programming standards and criteria. The programming determines the number of hospitals, the number and type of departments and the number of beds. These numbers are based on the size, age structure, and morbidity of the population and on the geographical dispersion. The programming as outlined in the Hospital Act of December 23, 1963[35] takes the form of target figures measured e.g. by the number of beds per 100 inhabitants or the number of beds per 1 000 births for maternity services.[29] Where the programming criteria of the Hospital Act of December 23, 1963 had an indicative character, they became compulsory by the Hospital Act of July 6, 1973.[36] However, the programming system of 1973 was still inadequate for reaching the intended results. In 1982 the government decided to introduce a moratorium on the number of hospital beds (Royal Decree of July 22, 1982[37]). The threshold of the number of recognized beds was set at the number of recognized beds on July 1, 1982 for general hospitals. For psychiatric hospitals the threshold was set at the number of beds existing before July 1, 1986 (see section 3.3.2 for the meaning of recognized beds). The moratorium still applies today. Any new bed results in the closure of another bed somewhere else in the hospital system.[19]

However, exceptions are possible. Furthermore, the 1982 reform restructured the hospital sector by creating specialized geriatric departments and services in hospitals, and by setting up a plan (involving financial incentives) to convert acute and chronic hospital beds into geriatric beds and beds in community residential care centres. This allowed them to be reimbursed at a cheaper rate.[24]

Hospital mergers for general hospitals were also encouraged by demanding a minimum of 150 beds spread across at least three departments (Royal Decree of January 30, 1989[38]). Patient-day quotas were also imposed on hospitals which were not to supply more patient-days than in 1980. These quotas were gradually reduced further thereafter.[29]

These supply restrictions have resulted in a decrease in the number of beds from 8.3 per 1 000 inhabitants in 1970 to 7.2 per 1 000 inhabitants in 1998 and halving of the number of hospitals in the period 1980-1998 in combination with an increase of the average hospital capacity from 177 beds to 311 beds.[24]

While in the 1960s and 1970s programming criteria mainly targeted the number of hospital beds, during the last decades programming regulation was extended to heavy medical equipment (e.g. PET-scans), medical and medico-technical services or care programs.

3.3.2 Recognition

The federal government disposes of a second instrument to regulate the hospital sector. A hospital not only has to fit into the national planning, it also needs recognition before it can operate. The principle of compulsory recognition was also introduced by the Hospital Act of December 23, 1963. Recognition standards and criteria give the hospital the right to be subsidized and to be reimbursed by the sickness funds. Recognition is needed for a hospital service to operate a certain number of beds for each service category.[39] Recognition follows a rigorous regulated procedure and has to be renewed every couple of years. The government can withdraw an existing recognition which leads to closure of the hospital or of the services in question.

The standards and criteria for recognition are considered as a guarantee for hygiene, safety and quality of care. There are several recognition standards such as:

- Organizational standards: staff requirements and responsibilities, hygiene, ethical requirements;
- Architectural criteria concerning the number, size, comfort and hygiene of hospital rooms;
- Functional standards such as convenience and accessibility;
- Additional standards related to minimum activity.

These general norms and criteria are included in article 66 of the Hospital Act.[40] Apart from general standards, there are also specific standards and criteria (Hospital Act, article 67) for example for university hospitals. Furthermore, there are additional specific recognition norms and criteria in the Hospital Act. These are defined for several groups:[41, 42]

- Hospital departments (maternity department, rehabilitation department, etc.);
- Divisions and functions (hospital blood bank; hospital pharmacy; palliative care, intensive care, ombudsman, etc.);
- Medical and medico-technical services (centre for human genetics, computed tomography (CT) medical imaging, magnetic resonance imaging (MRI), centre for chronic kidney failure treatment, radiotherapy, service for nuclear medicine with PET scanner, transplantation centre, etc.);
- Care programs (cardiac pathology, children, geriatrics, etc.)

3.3.3 Accreditation

Apart from the concepts of planning and programming, and recognition, 'accreditation' also needs a more detailed explanation. Accreditation (dissimilar to recognition) can be defined as "initiatives to externally assess hospital against pre-defined explicit published standards in order to encourage continuous improvement of the health care quality". Until now, Belgium lacks a system that systematically reviews hospital quality.[43] Several initiatives have been taken, although these were the result of rather separate, individual projects. A global vision and approach are still missing.

Nevertheless there is a general trend towards quality improvement in health care organizations, e.g. the 'Quality Decree of 1993' of the Flemish government. This decree obliges general, specialized and university hospitals to develop an integral quality policy. Hospitals can lose their recognition if they do not respect the Quality Decree. For instance, they have to appoint a quality coordinator and develop a quality manual.[44]

3.3.4 Supply restrictions on the number of health care professionals

Since the nineties a limit on the number of doctors and dentists that can have access to accreditation for practice has been imposed (Royal Decree of August 29, 1997[45]). The federal government has computed the quotas for doctors[r] in such a way that the discrepancy in medical density between the North and the South of Belgium should gradually disappear.[46] For the number of dentists the quota was 140 for 2002 and 2003, i.e. 84 and 56 for Flanders and Wallonia, respectively. For the number of doctors this was 700 (Flanders: 420, Wallonia: 280), 650 (Flanders: 390, Wallonia: 260), and 600 (Flanders: 360, Wallonia: 240) for the period 2004 to 2006, respectively. The exact numbers were revised several times. This measure was intended to address excess supply in the health care market and as such to reduce supplier-induced demand, medical unemployment and other problems.[29] As a result, the Flemish community organizes annually entrance examinations to limit the number of first-year medical students and the French community has chosen to limit the number of medical students on the basis of exam results organized after the first year of medical education.

Key points

- **Federal and regional governments have several instruments to regulate the hospital sector: planning and programming, recognition, accreditation.**
- **Programming and planning concerns the number of hospitals, the number and type of departments and the number of beds.**
- **Recognition concerns standards and criteria to guarantee hygiene, safety and quality of care.**
- **Accreditation concerns initiatives to assess quality of care according to pre-defined standards. Until now, there is no global approach in Belgium.**

[r] Defined as medical graduates (i.e. holding a diploma in medicine) accepted for further training leading to practicing with license.

3.4 FINANCING OF HOSPITAL ACTIVITIES: PRICE REGULATION AND PROSPECTIVE PAYMENTS

A third regulatory instrument of government used in the hospital sector is price regulation. Price regulation in Belgium applies to the remuneration of health care professionals (section 3.4.1) and the reimbursement of hospitals (section 3.4.2 and 3.4.3). Major changes have been implemented in the reimbursement of hospitals characterized by a gradual move towards prospective financing. In short, at this moment (2009) the Belgian hospital financing system is (still) characterized by a dual system depending on the type of services provided. Consultations and technical procedures are remunerated through the variable reimbursement system of fee-for-service. Non-medical activities, such as the services of accommodation (nursing units), emergency admission (accident and emergency services), and nursing activities are financed via a fixed prospective budgeting system partially based on APR-DRGs. The following paragraphs provide more detailed information on the history of financing of hospital activities.

3.4.1 Remuneration of health care professionals in hospitals

Financing of medical, medico-technical and paramedical services is not determined by the Hospital Act but is chargeable to the compulsory health insurance system. Physicians are paid for their medical services separately from the hospital. Medical fees cover all costs directly or indirectly linked to the performance of medical services (Article 154 of the Hospital Act, coordinated on July 10, 2008[40]). These costs include costs of medical, nursing, paramedical, caring, technical, administrative, maintenance or other supportive staff but also the costs related to the use of rooms, costs of purchasing, renovation and maintenance of equipment and costs of materials not included in the budget of financial means (see section 3.4.2).

Article 146 of the same Hospital Act stipulates the possible remuneration schemes for hospital specialists. Most specialists in a hospital operate under a fee-for-service system. In ambulatory care patients usually pay the negotiated fee for the consultation, as determined in the nomenclature, directly to the physician and claim reimbursement with their sickness fund afterwards. In some hospitals ambulatory fees are centrally collected at the hospital level or by a Medical Board controlled collection desk or at the level of a department. Specialists receive part of this pool. Most specialists working in university hospitals are salaried.

Whatever the remuneration system, a central collection of fees is obliged for all hospitalized patients including one day care (Article 147 of the Hospital Act[40]). This central collection is not compulsory for ambulatory patients. The central collection of fees can be organized by the hospital or by the Medical Board. The choices for the organization of the central collection influence the structure of the income statement, the balance sheet and the financial ratios. Only when the central collection of fees is organized by the hospital the financial accounts reflect all fees for medical, medico-technical and paramedical services. A central collection organized by the Medical Board may bias the financial accounts of a hospital when only the balance (total amount of fees collected minus the remuneration of specialists) is taken up.[47]

The physicians cede part of their fees to help finance the costs of medical activities in the hospital (Article 154 of the Hospital Act). The physicians' contribution to the operating costs (space, equipment, staff, overhead services) of the medical activities is regulated in a general agreement between hospital management and the hospitals' physicians. Depending on the situation, the fees are partially or totally transferred to the revenues of the hospital.[48] Financial agreements between hospital and physicians about the physicians' contribution are compulsory, but are not regulated by law. The contribution of physicians can consist of:

- *Contribution in terms of a percentage*: This means that physicians cede a fixed percentage of their fees to the hospital to cover operational costs. Percentages can differ according to the medical discipline or type of service. Imbalances in nomenclature can be partly rectified by applying different percentages[s]. In this case there is no guarantee of total cost coverage and therefore the hospital may bear a great part of the financial risk. Furthermore this type of contribution does not inherently stimulate rational use of medical resources.
- *Real cost coverage*: In this more complicated type of contribution, the physician reimburses the costs of his/her activities. This implies that it is the physician who bears the financial risk. Although this gives more incentives to a rational use of medical resources, there is less solidarity in this system and it is harder to correct for nomenclature imbalances.
- *Mixed forms*: In order to avoid the disadvantages of both previously described systems, mixed forms are applied. Examples of mixed forms are: a system of real cost coverage for direct costs combined with a contribution in terms of a percentage for indirect cost coverage, a system with contribution in terms of a percentage combined with a condition of minimal cost coverage, a fixed remuneration for the physician combined with a variable remuneration depending on, for instance profit of the department or turnover growth, salaried physicians, etc.

This last example of salaried physicians is the most extreme case and is not implemented on a large scale. In general, university hospitals work with salaried physicians. In this case, physicians receive a monthly salary independent of their activity. Because salaries are not influenced by the growth of fees, it is important to stimulate medical activity and financial awareness by other measures, for instance by linking growth of medical staff to sufficient growth of fees or activity. The average contribution percentage of hospital physicians is 57%. The percentage differs between hospitals and between specialties.

3.4.2 Hospital reimbursement for non-medical activities

3.4.2.1 A brief overview of reforms

Each hospital receives a budget, the 'budget of financial means'[t], which covers the costs for a hospital admission and stay. Remuneration of physicians, costs for technical services and for pharmaceuticals are not covered by the budget of financial means.

Article 5 of the Hospital Act of December 23, 1963 was the first law to determine a per diem rate per hospital per department.[49] Furthermore Article 9 of the same Hospital Act mentioned that a higher price than the per diem rate per department could be obtained if the hospital could prove that real costs were not covered. Many hospitals appealed to Article 9 so that what was meant as an exception became the rule. As such, per diem prices were rather reflecting hospitals' accounting costs.[49] In addition to the moratorium on the number of beds, prices were also locked at the existing level (1981). Until 1986 hospitals received a per diem rate equal to the rate in 1981 which was based on real costs. In 1982 the number of invoiced days was fixed at the number of invoiced days in 1982. As such, budgeting and prospective financing was introduced in a dominantly variable and retrospective payment system. An "envelope" system per hospital replaced the a posteriori recalculation method of payment. The envelope per hospital, which was calculated a priori, and hence the budget were completely based on historical costs and activities.[49]

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s It is generally believed that due to insufficiently taking account of the evolution in medical science and practice or the quality and efficiency of providing health care, the nomenclature brings about an increasing level of income inequity between the various medical specialties.[28]

t Budget Financiële Middelen (BFM) in Dutch; Budget des Moyens Financiers (BMF) in French.

The Ministerial Decree of August 2, 1986[50] introduced new criteria for the fixing of hospital budgets, putting less emphasis on historical or accounting costs and more on the function of the hospital, its needs and its performance.[29] Since 1986 the Federal Public Service (FPS) Public Health, Food Chain Safety and Environment yearly sets a national total budget for hospitals' operating costs. This closed-end budget is paid to the hospitals by the compulsory health insurance system via the sickness funds and by the Ministry. Once the global budget is approved, the Ministry of Social Affairs, Public Health and the Environment sets a provisional budget for each hospital institution. This budget is composed of three major parts (A, B and C),[u] which are set separately and further divided into sub-parts.[19] Each part of the hospital budget is calculated according to rules set out by the Ministerial Decree of August 2, 1986. The allocation among hospitals of the budget for B1 was based on a cost comparison between 5 groups of hospitals. One group consisted of the university hospitals, for the other hospitals size was the determinant for grouping. The allocation of the budget for B2 was based on a points system. Points were determined by the structure of a hospital (e.g. number of beds) and by activity levels. Activity was measured by the number and cost of medical and surgical services, the nursing workload and the treated pathologies.[29]

For every hospital, a per diem rate was determined on the basis of the hospital budget and a quota of patient days. The day quota, i.e. the number of days a hospital should provide given its capacity and occupation norms, was calculated involving historical cost, average cost of a sample of hospitals with similar size and occupancy rate, case mix and workload.

The per diem rate was then calculated by dividing the hospital's total budget by its day quota. If more inpatient days were supplied, the hospital only received part of the per diem rate. As such, the hospital's budget was revised at the end of the year according to the comparison of the level of activity which actually took place during the year and the quota.[29]. The per diem rate is equal to the amount the hospital invoices to the sickness fund for each inpatient day.

In 1994, a correction for the budgets for B1 and B2 was introduced to stimulate a decrease in the length of stay (LOS) (Royal Decree of March 28, 1995[51]). By this system of 'length of stay performance' lengths of stay for AP-DRGs (All Patient DRGs) were set using the Minimal Clinical Data (recorded since 1989 for all hospitalized patients).[v,19] A national average length of stay is calculated per pathology group (AP-DRG), which is subsequently applied to the case-mix of each hospital. The term *standardized* or *pathology-weighted length of stay* is used because a weight variable is applied to pathologies treated in the hospital.[19] This PAL – NAL system (Positive/negative number of inpatient days), resembles a bonus-malus system and hence does not influence total budget to a large extent since 95% of the refunds are redistributed to the hospitals with a shorter LOS.[49] In this system of pathology-weighted LOS, the per diem rate, however, was still based on the structure of the hospital and therefore related to costs.[24] The mainly retrospective system was applied until July 1, 2002.

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[u] Initially, part A contained three parts: A1: investment costs, A2: costs for short-term credits, and A3: general non-indexed costs. Part B initially consisted of two parts: B1: costs for common services (general costs, maintenance, heating, administration, laundry and linen, nourishment, and boarding) and B2: costs for clinical services (personnel, standard medicine, etc.). Part C was also divided in two parts: C1: costs for construction of new buildings, C2: costs with respect to past financial years.[50]

[v] Data in the Minimal Clinical Data set are collected per patient and include: main diagnosis, secondary diagnoses, surgical interventions, special techniques, age, sex, sort of admission and discharge. [19] In section 5.2.1 more details on this data set are provided.

3.4.2.2 *Since July 1, 2002*[w]

Since July 1, 2002, there has been a gradual switch to the notion of "justified activities", whereby pathology-weighted length of stay is given a more prominent role rather than being used as a correction a posteriori.[19] The case-mix of each individual hospital is multiplied by the national average LOS per pathology group (corrected for 2×IQR[x] for outliers) to determine a hospital's justified patient days. Per department or group of departments, the number of justified patient days is divided by the normative capacity utilization of the service. In contrast to the previous system, this financing system is more focussed on the activity of the hospital expressed in terms of treated pathologies and justified beds, instead of the structure of the hospital expressed in the number of recognized beds.[42] As such, hospitals become financially responsible for excess days in comparison to a norm based on the patient's characteristics. When the hospital's number of days exceeds its prospectively attributed number of days, the daily costs for excess days are only partially reimbursed and the amounts saved are redistributed to hospitals situated below their prospectively attributed number of days.[54] As such, it was expected that a financial transfer from inefficient to efficient hospitals would occur.[55]

The Law of January 14, 2002[56] changed the articles referring to hospital financing thoroughly. The Ministerial Decree of August 2, 1986 was replaced by the Royal Decree of April 25, 2002.[57] Since July 1, 2002 the concepts of 'per diem rate' and 'day quota' have disappeared. The budget of financial means is now set by adding up the values or points of the different parts (A, B and C) and subparts. These points are calculated conformably to the Royal Decree of April 25, 2002.

Components of the hospital budget (2009)

A complete overview of the different parts and sub-parts is included in Appendix 1. Since the empirical analyses in Chapter 5 and 6 are mainly based on data for 2005, the share of each (sub-)part in the total budget is given for the year 2005.

Part A: capital and investments costs (approximately 7% of the hospital budget)

Part A is divided into three parts: A1 (circa 5% of the budget in 2005), A2 (1.5%) and A3 (0.5%). These budgets mainly cover depreciations and investment costs as well as short-term credit burdens.

Part B: operational costs (more than 90% of the hospital budget)

Part B covers the operational costs and is by far the most important part of the budget. It is divided in nine budget components:

- B1: common operational costs (administration, maintenance, laundry…) (circa 26% of the hospital budget in 2005)
- B2: clinical costs (personnel and medical equipment) (47%)
- B3: medico-technical departments (1%)
- B4: some specific (mostly) lump sum costs (12%)
- B5: pharmacy costs (2%)
- B6: costs for carrying out the social agreement for personnel not included in the budget of financial means (2%)
- B7: extra costs for teaching hospitals or university function of the hospital (3%)
- B8: specific costs for patients with a weaker socio-economic profile or social function of the hospital (0.5%)
- B9: extra-legal financial benefits (not available in 2005)

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w A detailed description of the budgeting procedure and of the financing of the budget is given in a report of the Court of Audit of Belgium.[52]

x The interquartile range is the difference between the third and first quartile. Outliers Type II are defined by the Royal Decree of June 4, 2003.[53]

Part C: other costs

This part of the hospital budget contains some additional financial costs. It is divided into four different budget components of which C2 to C4 are corrective:

- C1: advance costs for new construction or existing hospitals
- C2: readjustment (positive or negative) of budgets for past financial years
- C3: reduction of the budget of financial means with an amount equal to the room supplements charged in a single or double room (negative amount)
- C4: amount equal to the estimated surplus of receipts for the financial year for which the budget is determined (negative amount).

Calculation of the individual hospital budget

The distribution of the national hospital budget to the individual hospitals is based on a very multifaceted calculation. Each budget component has its own calculation method with its own determining parameters. Here we focus on the calculation of the budget for B2, since this is the main part of the hospital budget (47% in 2005). For more details on the calculation method for B2 and for the other (sub-parts) we refer to the Royal Decree of April 25, 2002.

The budget (B2) consists of two major parts: a basic part based on justified beds and a supplementary part based on activity and care profile. A point system is used for the calculation of both parts.[19] The starting point for the basic part is the number of justified beds and the minimal nursing staff ratios that have been set in the past for various types of nursing departments.[58] The minimal nursing staff ratios and points can be found in Table 3. This implies that the basic financing is determined by the operational bed capacity which in turn is determined by the expected length of stay per APR-DRG and severity characteristics of the hospital and is consequently called the "functional" part of the budget.[19]

Table 3: FTE formation and points by index

Nursing Ward	FTE / justified bed	Points per justified bed
Surgery and Internal Medicine	0.40	1
Paediatrics	0.43	1
Maternity	0.58	1.46
Maternal Intensive Care (MIC)	1.50	3.75
Neonatal Intensive Care (NIC)	2.50	6.25
Geriatrics (incl. paramedics)	0.56	1.36
Intensive Care	2.00	5
Psychiatry Acute Care	0.53	1.33
Child Psychiatry	0.80	2

Source: Sermeus, 2007[58]; FTE: full time equivalent

As mentioned before, a point system is used to calculate the basic financing. Every year, the global prospective budget for hospitals is approved by the government. The budget is divided by the total number of financial B2 points earned by all hospitals. This results in a financial value for a point. This allows the final budget calculation for each hospital and allows adherence to the provisional budget limits.[58] In 2005, the financial value of a B2-point was €19 607.3.

The supplementary part is developed for specific nursing departments (surgery and internal medicine, paediatrics). Each hospital gets supplementary points according to its relative position among all hospitals. All hospitals are ranked according to their nursing profile and according to their profile based on medical interventions. The hospitals are divided in deciles (groups of 10% of hospitals) in accordance with their ranking and points are allocated. The number of supplementary points per justified bed that can be allocated varies from 0 points (the lowest decile) to 0.34 points for the highest decile for surgery and internal medicine or to 0.38 points for paediatrics.

This means that for hospitals in the highest decile the budget is augmented with an amount ranging from 34% to 38%.

The number of intensive care beds for which a hospital is financed is determined as a percentage of the number of beds in surgery and internal medicine and paediatrics. Again, hospitals are ranked in deciles according to three criteria: the number of resuscitation interventions, the intensive nursing care profile of the hospital and the expected length of stay in intensive care per APR-DRG. The percentage of intensive care beds can vary from 2 to 10.25%.

Financing of the emergency department is based on the number of justified beds and can vary from 3 to 5 points per 100 justified beds depending on whether the hospital has an emergency department "first level aid" or "specialized aid". Supplementary points are allocated according to a decile system based on "urgent medical interventions".

The operating room (including the operating room of the surgical day centre) is financed based on a standardized operating time for a set of some 2 000 surgical interventions (varying from 30 minutes to 20 hours). The standardized operating time reflects the need for nursing resources and not the duration of the intervention itself. Based on these standardized operating times a number of rooms is calculated for each hospital. Per operating room 7.5 points are allocated. Some (mostly university) hospitals receive extra financing for a "permanent operating room" (maximum 2 and 20 points per room).

A budget for medical products for nursing departments, the emergency unit and operating room is assigned according to the number of points for the nursing staff budget for these three departments.

An overview of the calculation of the B2 financing can be found in Table 4.

Table 4: Calculation of B2 financing

B2 Points system	**Basic financing** = "functional" part Basis: justified beds in relation to minimal nursing staff ratios
	Supplementary financing = "activity" part Basis: activity parameters and care profile

Payment of the individual hospital budget

Before the reforms of the Hospital Act of January 14, 2002 costs of admission and stay in a hospital were reimbursed by submitting invoices to the sickness funds. A per diem rate was paid to the hospital for each patient day. Since July 1, 2002 the budget of financial means is divided into a fixed and a variable part. The fixed part is paid by the sickness funds to the hospitals on the basis of monthly advances ("provisional twelfths"). The amount paid by each sickness fund depends on its share in total expenses of the specific hospital in the most recent financial year. No invoices are submitted for this part of the hospital budget. The fixed part includes (theoretically) 80% of the subparts B1 and B2 and 100% of all other parts. The remaining variable part includes (theoretically) 20% of the subparts B1 and B2. The variable part is paid according to the number of admissions (10% of the budget) and the number of nursing days (10% of the budget) for the general hospitals and exclusively according to the number of days (20% of the budget) for the other hospitals. For the variable part hospitals submit an invoice to the sickness fund. For uninsured persons, defined as persons not enrolled into one of the sickness funds, or for stays without entitlement to reimbursement from the NIHDI hospitals have to submit their bills for parts A, B and C to the paying authorities (e.g. work accident insurance, private insurance, public municipal welfare organizations). In this case the term 100% day price is used. Table 5 gives a schematic overview of the hospital budget allocation for general hospitals.

Table 5: Hospital budget allocation for general hospitals

Insured	Fixed monthly budget: 80% B1-B2 100% other parts	Variable part: 20% of B1-B2 10% per admission 10% per nursing day
Uninsured	100% day price	

Several nomenclature codes exist for the amounts per admission and per nursing day. The amounts are hospital-specific and are adapted twice a year. They are published on the website of the NIHDI since 2008, together with the 100% day price.[59] The amounts also depend on the type of the hospital stay:

- A = acute stays
- B = care of heavy burns
- G = isolated geriatrics[y]
- P = psychiatric stays
- Pal = palliative care
- Sp = specialized chronic care

The sickness funds receive the necessary financial means from the NIHDI and from the Federal Public Service (FPS) of Health, Food Chain Safety and Environment. Subparts B7 (university function) and B8 (social function) are completely financed by the FPS. For the other subparts, about 25% of the budget is paid by the FPS and 75% by the NIHDI. Since 2004 the part financed by the Ministry stems from the 'alternative financing' and is paid by the NIHDI.

3.4.3 Prospective payments for a selection of hospital activities

Originally, the shift towards a prospective system only involved non-medical costs. Medical and medico-technical services (consultations, laboratories, medical imaging and technical procedures) and paramedical activities (physiotherapy by non-physicians) were still reimbursed via a fee-for-service system to the provider.[19] Since the patient only pays a fixed co-payment to the provider and the health insurance system pays the rest of the bill, this variable fee-for-service system may result in overproduction and -consumption, especially in an open-ended system at the macro level.

3.4.3.1 Medical services: laboratory testing and medical imaging

This problem was considered especially acute for clinical laboratory testing and medical imaging, where expenditures were booming in the 1970s and 1980s with an average annual growth of more than 10%.[24] In laboratory testing, one of the reasons was the fast growing automation decreasing the time needed to perform tests and exponentially increasing the number of tests that could be performed in a certain period of time.[49] Between 1974 and 1988 there was an almost continuous policy of tariff reductions. However, the short-term effect was countered by supply reactions, increasing proportionally the number of tests performed.

Laboratory testing

In 1988 a fixed national budget was introduced for laboratory testing with a separate envelope for the inpatient hospital and ambulatory sector (Article 27 of the Programme Act of December 30, 1988[60]). Since August 1988 a mixed financing system applies to the sector of laboratory testing. Financing partly consists of a fee-for-service system and partly of lump sum payments. Since February 1, 1989 the fee-for-service was reduced to 25% of the value for this service before the introduction of lump sums for the inpatient hospital sector and to 42.5% for the ambulatory sector (since October 1992).[61]

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y Geriatric stays in chronic hospitals (Sp). Geriatric stays in acute hospitals are considered to be acute stays.

The system of fee-for-services allows keeping track of these activities through data-analysis of the billing data. To compensate for the reduction in the fee per service, several lump sum payments were introduced in both sectors.

For hospitalized patients lump sum payments consist of a daily rate and a lump sum per admission, which both are independent of whether or not tests were performed and irrespective of the number of those tests. For ambulatory care lump sum payments are related to the type and number of executed laboratory tests.[24]

The lump sum per day is hospital-specific and partially depends on case-mix data (since November 1, 2002; Royal Decree of October 18, 2002 abolished by the Royal Decree of November 12, 2008[62]). More specific, it is calculated as follows (the share of each part in the total budget for laboratory testing is given between brackets):

- Pathology information (APR-DRG) of the hospital (40%)
- Per APR-DRG a clinical biology index (CBI) is calculated. The CBI is the average expenses of clinical biology per stay, per APR-DRG and per severity class (without outliers) divided by the national average expenses of clinical biology per stay for all APR-DRGs and all severity classes.
- Mean national expenditures per type of hospital stay (40%)
- Six type of hospital stays are distinguished (e.g. acute Sp, maternity department in a general hospital, etc). The budget part is calculated by multiplying the determined number of nursing days per type of stay by the national average expenses of clinical biology per day per service group.
- Number of intensive care beds in the hospital (10%)
- Organization of a permanent guard duty of laboratory technicians (10%)

Lump sums per admission are determined at the national level and consist of a basic lump sum and an additional lump sum (two tariffs) depending on certain characteristics of the clinical laboratory of the hospital (e.g. the number of staff, guarantee of continuity -24/24;7/7 guard duties- on the intensive care unit, emergency department (ED) and a general the guard-duty for inpatients).

Until 2000 hospitals received a separate emergency lump sum for providing urgent clinical biology care to hospitalized patients. In 2000 these emergency lump sums were abolished and the associated budget was mainly transferred to the budget for paying the lump sums per admission.

For patients in the ambulatory sector a lump sum per day of prescription and a lump sum per admission in day care were introduced. In 2002 this last lump sum was transferred to the (inpatient) hospital sector.[63]

Medical imaging

In **a**nalogy with laboratory testing, the financing system for medical imaging was also reformed by the establishment of a fixed national budget and the gradual introduction of lump sum payments. In June 1991 a lump sum per admission was introduced for the inpatient sector, the so-called consultancy fee. Its primary purpose was to cover costs linked to the assessment of the clinical situation and the choice of the most appropriate medical imaging test. The amount of the lump sum was determined at the national level. In 1992 a second lump sum fee per admission was added, which was replaced in 1999 by a lump sum determined by the hospital's case-mix and average expenditures for medical imaging per pathology. Hence the price of this lump sum is hospital-specific. The calculation of the price involves several steps (Royal Decree of April 26, 1999 overruled by the Royal Decree of June 3, 2007[64]). Since April 2009 the calculation method of the lump sum per admission has changed. The lump sum per hospital is now completely determined by the hospital's case-mix (APR-DRGs and severity level) and by the national average expenses for medical imaging per hospital stay. In 1999 three lump sum fees were introduced (for a selection of services) in the ambulatory sector (Royal Decree of April 29, 1999[65]). Finally, the reduced fee-for-service theoretically equals 75% of the former value for the service.[19, 29, 42]

Hospitals receive a lump sum per admission and a lump sum consultancy fee, whether there was an act for medical imaging or not. For day care and for ambulatory patients consultancy fee payments are related to the provision of medical imaging services.

3.4.3.2 Pharmaceutical specialties

Until 1983 hospital drugs were completely reimbursed on a fee-for-service basis. For all pharmaceutical specialties the purchasing price plus 10% profit margin was charged. There were no financial incentives for the optimization and rational use of drugs. Because of increasing expenditures for pharmaceuticals, the federal government attempted to control the budget by introducing a co-payment per person per day in 1983 (€0.62). This co-payment is charged irrespective of actual consumption. The hospital also received a reimbursement percentage from the NIHDI. Since that year all pharmaceutical specialties have been assigned to a reimbursement category. The reimbursement percentage of the compulsory health insurance depends on those categories (category A, B, C, Cs, Cx, D, E). The pharmaceutical specialties of category A, B and C are considered as 'necessary' drugs. Category D and E consist of non-reimbursable and foreign drugs.

Several efforts have been taken in order to control escalating expenditures for pharmaceuticals. A first step towards prospective pharmaceutical budgeting for hospitalized patients was made in 1997 for the prophylactic use of antibiotics in surgical interventions. Unnecessary long treatment or inadequate choice of drugs (too broad spectrum) may lead to high costs and microbial resistance. The Royal Decree of February 21, 1997 (implementation May 1, 1997)[66] describes a pathology-related lump sum reimbursement system. The calculation of these lump sums was based on clinical guidelines. Antibiotics used during the perioperative period (i.e. from the day before until the day after the surgical procedure) were reimbursed for 75% with a lump sum. The remaining 25% of the antibiotics were reimbursed per product. As such, statistical registration of consumption remained possible. The lump sum system could be abandoned in exceptional circumstances, e.g. when standard antibiotics are insufficient or when curative treatment for an infection is needed. These exceptions were supposed to occur more often in hospitals with a heavy case-mix.[19, 49] This system was applied until July 1, 2006.

Since July 1, 2006 (2 Royal Decrees of May 16, 2006)[67, 68] a prospective budget for pharmaceuticals administered to patients hospitalized in an acute hospital was introduced. Most pharmaceuticals are integrated in this budget for approximately 75% of their value. The remaining 25% is still reimbursed per product, allowing to track the consumption of these products.[19, 42] Prospective budgets are based on the hospital's case-mix and the national average cost per APR-DRG and severity of illness. As such, every hospital receives the same amount per APR-DRG, irrespective of actual consumption.[19]

The previous system is not applicable to psychiatric hospitals or chronic hospitals with isolated Sp (revalidation) or G (geriatric) services, nor for ambulatory care.[69] Furthermore, it does not include all pharmaceuticals. In general, an active compound is not included if it is very relevant to medical practice, taking into account therapeutic and social needs and its innovative character, and if the cost can strongly slow down its administration to a hospitalized patient if it would be included in the prospective budget. Other specific products are excluded by law from the prospective budget (e.g. orphan drugs, cytostatics, immunoglobulins and albumins, retroviral drugs, radioisotopes, etc.).[69] The list of excluded pharmaceuticals is updated monthly and these products remain entirely reimbursed per product.[19]

Hospital drugs for ambulatory patients are not included in the prospective budget. The patient pays a co-payment per reimbursed drug, according to the reimbursement rules applicable to drugs dispensed from community-based pharmacies. Co-payments vary from 0% to 80%.

3.4.3.3 Reference amounts

The system of reference amounts was introduced in 2002 to detect and control large variability in hospital practices (Paragraphs 1-10 of Article 56ter of the Law regarding compulsory insurance for health care and indemnities, coordinated on July 14, 1994[70]). It was intended for harmonizing and standardizing hospital practice of medical health care providers as far as homogeneous, frequent and less severe pathologies are concerned. 32 APR-DRGs (20 surgical APR-DRGs grouped into 22 diagnostic groups and 12 medical APR-DRGs) were included in the system of reference amounts. The system is limited to inpatient stays in low severity DRGs (1 and 2). Stays in day or ambulatory care were not included, but the system of reference amounts can be extended to day care by Royal Decree. The technique of 'reference amounts' is similar to a lump sum system. The reference amount is a standard by which the hospital is compared and is calculated as the national average expenditure raised with 10%. The reference amounts contain the expenditures of clinical biology (with exception of the lump sum payments), medical imaging (with exception of the lump sum payments and MRI services) and other technical services (internal medicine, physiotherapy and various medico-technical services). Outliers Type II (Q3 + 2*IQR) are excluded from the total expenditures.[71] If the expenditures of a hospital exceed the reference amount, the surplus of expenditures can be reclaimed by the NIHDI. Although the system was introduced in 2002, it was applied for the first time to stays of 2006 (Method 2006).[72] Given the delay in data collection and validation, this implies that surplus expenditures were claimed back for the first time in September 2009.[71] For stays ending after December 31, 2008 (Method 2009), improvements are applied to the calculation method of the reference amounts (Article 50 of Law of December 19, 2008 concerning Health adding paragraph 11 to Article 56ter of the of the Law regarding compulsory insurance for health care and indemnities, coordinated on July 14, 1994[73]).

Method 2006 consists of two steps. In the first step hospitals eligible for being claimed the refundable amounts are selected by calculating the difference between real expenditures and the reference expenditures (number of stays multiplied by the reference amounts) per APR-DRG, per severity level and service group (clinical biology, medical imaging or other technical services). In case of a positive difference for all APR-DRGs, severity levels and service groups taken together, the amount to be refunded is calculated in a second step. This is done by calculating the difference between real expenditures and median reference expenditures (number of stays multiplied by national median expenditures) per APR-DRG, per severity level and service group. Unlike step 1, compensation between APR-DRGs, severity levels or service group is not possible. The refundable amount is the sum of all positive differences. Only amounts larger than €1 000 are claimed.

Method 2009 is to a large extent identical to Method 2006. There are however some modifications. First, expenditures for physiotherapy are no longer included in the group 'technical services' for 5 APR-DRGs. Second, expenditures for the three service groups (clinical biology, medical imaging or other technical services) made within 30 days before the hospital admission (called "Carenztijd" in Dutch) for one of the 20 surgical APR-DRGs can be included when executing step 1 and 2 as described above. The modalities of this expansion still have to be explored. Third, provisional reference amounts are calculated and communicated to the hospitals. The purpose of these provisional calculations is twofold. It allows hospitals to adapt their behaviour to the standards and it reduces the risk of a downward spiral of the average national amounts.

3.4.4 Other sources of hospital financing

3.4.4.1 Day care

There is no legal definition of day care or of a day hospital. According to the OECD, day care comprises medical and paramedical services delivered to patients that are formally admitted for diagnosis, treatment or other types of health care with the intention of discharging the patient on the same day.[74] Since 1987 a negotiated agreement between hospitals, sickness funds and the NIHDI defines the rules for day care financing. This agreement defines a day hospital as "an organized and integrated function of day care under the supervision of a medical specialist with fixed procedures concerning selection of patients, safety, quality, continuity, reporting and cooperation with several medico-technical services."[59]

In 1988 four lump sums were introduced to finance day care (Article 4 of the national agreement between sickness funds and hospitals). There was a "mini lump sum", a "maxi lump sum", a "super lump sum" and a lump sum for the plaster room. The price of the mini, maxi and super lump sums was hospital-specific since it was determined by the B2 part of the hospital budget. The price of the mini lump sum equalled half of the B2-part, the price of the maxi lump sum was equal to the B2-part and the super lump sum was twice the B2-part. Each lump sum was linked to a number of nomenclature codes. When the hospital provided services from the list of nomenclature codes, it was entitled to one of the lump sums. Since the lump sums were hospital specific, large price variations existed between hospitals for providing the same services. To reduce the influence of inpatient hospital activity on the financing of day care, four new lump sums were introduced in 1993. These lump sums called A-B-C and D are the same for all hospitals. They are again linked to a number of services, which has expanded over the years. In April 1998 the super lump sum was abolished and was replaced by the A-lump sum.[75]

The new national agreement of July 1, 2007 introduced new lump sums for day care.[76] With the introduction of the new 'day hospital lump sum' and the 'lump sum chronic pain', a full overview of the current lump sums for day care looks as follows (amounts for 2009):

- "Mini" lump sum: hospital-specific

The following conditions have to be fulfilled to charge the mini lump sum:

  - Urgent admission
  - Intravenous therapy for therapeutic reasons

- "Maxi" lump sum: hospital-specific

The following conditions have to be fulfilled in order to charge the maxi lump sum:

  - General anaesthesia
  - Administering chemotherapeutic agents (A-medication)

- Day hospital lump sum: Seven groups of lump sums were created, which bundle a selection of nomenclature codes. The lump sum payments vary between €140 and €247.
- Lump sum "chronic pain": 3 lump sum payments with corresponding (new) nomenclature codes and payments varying between €72 and €196.
- Lump sum "plaster room": a fixed amount of €26.10
- Lump sum haemodialysis (see section 3.4.4.3)

3.4.4.2 *Day-surgery centre*

For activities performed in a day-surgery centre, several terms are used interchangeably, such as one-day surgery, day-care surgery or ambulatory surgery. Since July 1, 2002 the financing of the day-surgery centre is included in the hospital budget.[77] The general costs are included in part B1 and costs specific to the day-surgery centre and its activity in the operating room are included in part B2. Justified activities in a day-surgery centre concern two types of stays: stays in day care for which at least one surgical nomenclature code from a specified list (List A) was recorded and unjustified inpatient stays. The last category consists of stays for which at least one nomenclature code from a specified list (List B) was recorded. Nomenclature codes on List A are codes that gave entitlement (before July 1, 2002) to a maxi lump sum or to lump sums A-B-C and D and that met two additional criteria: they involve an invasive surgical intervention and at least 60% of these interventions should be performed in an inpatient, day care or policlinic stay. For the unjustified inpatient stays comparable criteria have to be met. Codes on List B are codes that gave entitlement to a maxi lump sum or to lump sums A-B-C and D and that met two additional criteria: they involve an invasive surgical intervention and the substitution level of the inpatient stays by day care stays has to be to at least 10% during the reference period (Minimal Clinical Data of the last three registration years). A stay is defined as an unjustified inpatient stay if it meets all of the following criteria at the same time:

- It involves one of 32 selected APR-DRGs
- It concerns an inpatient stay
- It concerns a scheduled admission
- The length of stay is maximum three days
- The stay has a severity of illness rate of 1 (minor)
- The patient did not die during the stay
- The stay has a risk of mortality rate of 1 (low)
- The patient is under 75 years of age

The total number of justified stays in a surgical day hospital is the sum of stays in surgical day centre and the unjustified traditional hospitalizations. Each justified stay in surgical day hospitalization receives a justified length of stay of 0.81 days. This is the basis for calculating the number of justified beds for the surgical day clinic.

The justified beds of the surgical day clinic are taken up as C-beds in the B2 calculation of the hospital budget.

3.4.4.3 *NIHDI conventions*

Haemodialysis

Haemodialysis[78], executed in a recognized centre for chronic dialysis, is reimbursed by a lump sum system and by medical fees. The financing of haemodialysis is regulated by the Royal Decree of June 23, 2003[79], adapted by the Royal Decree of March 24, 2006[80], which provides in a lump sum of €37.80[z] augmented with 20% of the per diem rate of the hospital as applicable on June 30, 2002. If the centre for chronic dialysis disposes of a program for an alternative kidney replacement treatment outside the hospital (haemodialysis at home, peritoneal dialysis at home or collective auto-dialysis at a centre for auto-dialysis), the lump sum is raised by:

- €28.20 if more than 5% and less than 10% of the total number of patients of the centre receives an alternative kidney replacement treatment
- €69.10 if more than 10% and less than 25% of the total number of patients of the centre receives an alternative kidney replacement treatment

[z] The amounts in this Royal Decree are subject to indexation.

- €90.17 if more than 25% and less than 35% of the total number of patients of the centre receives an alternative kidney replacement treatment
- €95.15 if more than 35% of the total number of patients of the centre receives an alternative kidney replacement treatment

The lump sum amounts to a total of minimum €107.09 and maximum €247.89. If the patient receiving haemodialysis is admitted to the hospital, B2-prices per admission and per nursing day are raised with 50% of the lump sum of haemodialysis.

Rehabilitation conventions[78]

The NIHDI can make arrangements with individual hospitals for specific chronic disorders. Some of these arrangements are intended to finance particular rehabilitation programs, others reimburse multidisciplinary health programs for chronic diseases. The patient population is accurately defined and hospitals comply with specified conditions. Financing is usually arranged through a lump sum system.

Examples of these rehabilitation conventions are: diabetes, locomotory rehabilitation, aids, cystic fibrosis, chronic fatigue syndrome, cardiac and respiratory rehabilitation, neuromuscular disorders, cerebral palsy, sudden infant death syndrome...

3.4.4.4 Patient contributions[aa]

The out-of pocket payments for patients consist of two parts. The difference between the convention tariff and the reimbursement by the NIHDI is the co-payment. This is an official tariff. There are different types of co-payment in the hospital setting: per nursing day, per admission, per service, etc. In addition, in some circumstances, more than this official tariff is charged by health care providers. The difference between total payments (by the NIHDI plus patients) and the convention tariff can be defined as supplements. In some cases services are not covered by the compulsory health insurance. There is no convention tariff and the patients pay the full price out-of-pocket. For inpatient care one usually makes the distinction between fee supplements, room supplements and material supplements. In addition there are payments for medicines, parapharmaceutical products and diverse items (such as a refrigerator, telephone or television in the hospital room) for which no reimbursements exist since they are not included in the nomenclature.

3.4.5 Capital financing

Financing of hospital investments is also dual: part of it is integrated in the hospital budget (sub-parts A1, A3 and C1) and part is financed by the medical fees.[81] This last part is hospital-specific since it is the result of negotiations between the hospital management and medical specialists. In general, the budget for sub-parts A1 and A3 is intended to finance the depreciation of investments. The depreciation period is fixed and cannot be determined by the individual hospital.[57]

Although it is beyond the scope of the study to provide a detailed overview of the items included in the sub-parts A1, A3 and C1, some clarification is needed with respect to the budget for sub-part A1. Sub-part A1 contains investments in real property consisting of investments that increase the patrimony and replacement investments. Although the distinction between the two categories of investments is not always clear, it is important since the first category can in principle be subsidized while this is not the case for the second category. Subsidies are provided by regional authorities.

[aa] This section heavily borrows from section 1.1.2 of KCE report vol. 50. We refer to the same source for a detailed overview of the legislation concerning supplements.[27]

Since 1989 part of the responsibility for financing hospital investments has been transferred to the regional authorities (Article 64 of the Hospital Act). The regional authorities are allowed to enact own rules concerning hospital financing. In the Flemish region these rules are summarized in the VIPA[bb]-procedure, the Brussels Region has its own rules and in the Walloon region the federal rules apply since no new rules were enacted. Regional authorities can subsidize 60% of hospitals' capital investments. The remaining part is covered by federal authorities via the hospital budget (sub-part A1). Priority capital investments can be subsidized by a particular investment percentage of 90% from federal government and 10% from the regional government, to reduce the financial impact on the limited regional budgets.

Building activities are controlled by the so called "building calendar" (Protocol Agreement of June 19, 2006 - Belgian Monitor of January 19, 2007 for the period 2006-2015)[82]. The building calendar has been laid down for three periods (1989-1995, 1996-2005 and 2006-2015). It determines the maximum budget at the federal level, the partitioning of the budget at the regional level (Flanders, Wallonia, Brussels) and the investments which will be subsidized per year and per hospital. The calculation of the maximum funding per hospital is regulated by the Ministerial Decree of May 11, 2007.[83]

As mentioned before, to summarize the rules for investments in real property in sub-part A1, the distinction between two kinds of investments is important. Hospitals receive a budget for sub-part A1 for investments that increase the patrimony only when the following two conditions are met: (1) the investment figures on the building calendar and (2) the investment is subsidized by the regional authority and the subsidy is de facto paid. In addition, sub-part A1 covers 100% of replacement investments.

3.4.6 Other financial resources

A number of services are financed through other resources. These are marginal in the global picture of hospital financing, but can be significant for an individual hospital. Other financial resources include among others: subsidies for aids reference laboratories, centres for molecular diagnostics, centres for human genetics, national register for antropogenetics or supplementary financing for human resources such as the social Maribel scheme[cc], IBF (Interdepartmental Budgetary Fund)[dd] or VFSIPH[ee] (Flemish Fund for the Social Integration of Disabled Persons).

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bb Vlaams Infrastructuurfonds voor Persoonsgebonden Aangelegenheden in Dutch; Flemish Infrastructure Fund for Personal Affairs. For more details we refer to the website of VIPA (http://wvg.vlaanderen.be/vipa/start.htm).

cc The social Maribel scheme was introduced to promote employment in the non-profit sector through a reduction of employers' social security contributions.

dd Interdepartementeel Begrotingsfonds in Dutch; IBF financing was introduced to support (part-time) employment of long-term unemployed and persons entitled to a subsistence level income in the non-profit sector.

ee Vlaams Fonds voor Sociale Integratie van Personen met een Handicap in Dutch

3.4.7 Hospital financing in numbers

3.4.7.1 The size of the hospital budget

The size of the hospital budget or the budget of financial means is yearly set as the result of negotiations between the NIHDI, health care providers, sickness funds, representatives of employees and employers and the government. Finally, the federal government adds 25% to the hospital budget.[78] In 2009, the hospital budget amounted to about 24% of total NIHDI budget.

Table 6: Evolution of hospital budget 1997-2009 (general hospitals)

Year	Hospital budget (in million EUR)	Index 97 =100
1997	3 054.56	100
1998	3 135.96	103
1999	3 373.65	110
2000	3 462.88	113
2001	3 664.11	120
2002	3 996.62	131
2003	4 400.26	144
2004	4 628.54	152
2005	4 560.17	149
2006	4 743.14	155
2007	5 099.71	167
2008	5 319.17	174
2009	5 600.43	183

Source: Sermeus (2006)[78] and yearly Royal Decree which defines the global hospital budget (e.g. Royal Decree of December 15, 2000 for the year 2001)[84]

3.4.7.2 Financing sources of hospitals

The large categories of financing sources of hospitals for 2006 are given in Table 7. The hospital budget and fees amount to about 80% of total financing.

Table 7: Financing sources of hospitals in 2006

Resource type	Share 2006
Hospital budget + outstanding amounts[ff]	39.2%
Room supplements	1.0%
Lump sums NIHDI conventions	3.8%
Pharmaceuticals	14.8%
Net fees (hospital)	40.3%
Ancillary products	0.8%

Source: Kesteloot and Van Herck, 2008[48]

3.5 DISCUSSION AND CONCLUSION

The main purpose of Chapter 3 was to give a description of the current system of hospital regulation and financing in Belgium and of its major reforms. Several reforms and financial incentives were introduced to increase efficiency. Supply restrictions with respect to the number and type of beds, and number of physicians were imposed. However, in a fee-for-service system with a large degree of freedom for both patients and providers, supply restrictions may only have a limited influence on curbing the growth of health expenditures.[19] Supply restrictions were perhaps a necessary but certainly not a sufficient measure to keep costs under control.[24] Reforms which made hospitals more financially responsible and increase efficiency were necessary. Whereas previously hospital financing was provided by retrospective payments (based on costs), there has been a gradual move towards prospective financing.

[ff] Outstanding amounts (inhaalbedragen in Dutch) are surplus or deficit receipts with regard to a budget settled for the current year of activity.

As mentioned in the introduction, the current system is largely fragmented with separate lump sum payments for laboratory testing, medical imaging, pharmaceuticals, inpatient hospital admissions (per admission and per day), day care etc. Prospective financing and a "restricted" case-mix system (see section 1.1) in particular may also induce adverse effects on efficiency, quality and equity. Without being exhaustive, we conclude this chapter with a brief discussion of a limited number of studies which analyse the impact of introducing prospective or restricted case-mix financing based on Belgian data.

A system of pathology-weighted LOS and reward for increasing day care may create incentives for hospitals to reduce the patient's LOS below the prospective number of days and to increase the rate of day care.[54] This may result in e.g. a *split of a single admission into several short ones* ('salami tactics') since there is no constraint on the number of admissions and hospitals may want to increase the number of shorter and thus more profitable admissions. In general, this practice also increases total co-payments to be paid by patients.

The difference in financing structure between non-medical (prospective) and medical (fee-for-service) activities may boost the more frequent use of the latter. Physicians may use more intensive techniques in order to achieve early discharge. Moreover, as certain medical and surgical treatments may still be reimbursed generously, the lower profits of non-medical activities may be compensated through an *increase in medical services* that are not included in the prospective financing system.[54]

For pharmaceuticals, several negative incentives could be created by the lump sum financing for an inpatient stay. There could be a *shift towards drugs outside the lump sum*, *underconsumption* of some expensive drugs, or a *shift* from use of drugs in inpatients *towards day care stays* that fall outside the lump sum.[69] The latter currently seems not to be the case.[85]

DRG upcoding, in which more profitable DRG codes are selected by the hospital to obtain higher reimbursement (DRG-creep) is another phenomenon. To get a more interesting financing, physicians/hospitals may search (actively) for the most 'appropriate' code.[49, 86]

Other possible adverse effects of prospective or "restricted" case-mix financing which have <u>not</u> been analysed with Belgian data include patients to be *discharged too early or referred to other types of health care services* that fall outside the prospective financing rules. For example, in some cases, patients risk being referred to rest homes or home care too early (even though this should of course be encouraged in appropriate cases).[49] A too early discharge may also cause the *'quicker and sicker' syndrome*. This is the premature discharge of patients which increases the possibility of the same (sicker) patient to be readmitted later on. Prospective financing may also induce *patient selection* in which certain physicians/hospitals may accept to treat 'interesting cases' and refer certain types of patients to other hospitals, e.g. older (more expensive) patients ('cream skimming' or 'cherry picking').

In general, reforms have to be carefully designed, implemented and evaluated to avoid adverse effects. In the empirical analyses of Chapter 5 and 6 we come back to possible positive and negative effects of an all-inclusive prospective financing of hospitals. However, it should be kept in mind that the main purpose of this study is to evaluate the technical feasibility of the introduction of such a system, and not an estimation of possible positive or negative effects.

Key points

- **Different schemes for the remuneration of health care professionals in hospitals coexist (fee-for-service, salary). Whatever the remuneration scheme, specialists contribute part of their income to the hospital to help finance their activities in the hospital.**
- **For non-medical activities hospitals receive a budget called the 'budget of financial means'. Until 1986, the hospital budget was completely based on historical costs and activity. From 1986 until 1994 prospective elements were included in the calculation of the budget. Hospital case-mix was not considered. From 1995 onwards the concept of "pathology-weighted length of stay" was introduced, which was still linked to (individual) hospital costs. Since July 1, 2002 pathology-weighted length of stay is given a more prominent role rather than being used as a correction a posteriori.**
- **Also the payment of the hospital budget changed in 2002: the concept of per diem rate disappeared and was replaced by a fixed and variable part. The variable part is paid by submitting an invoice to the sickness fund, the fixed part is paid on the basis of monthly advances.**
- **Prospective budgets were introduced for medical imaging, laboratory testing and pharmaceutical specialties.**
- **Other sources of hospital financing, not included in the hospital budget, are for day care, day-surgery centre, some NIHDI conventions, capital costs and patient contributions.**

4 ACTIVITY-BASED HOSPITAL FINANCING: A REVIEW OF ENGLAND, GERMANY, FRANCE, DENMARK AND AUSTRALIA (VICTORIA)

4.1 RATIONALE AND SCOPE

4.1.1 Rationale

This review was carried out to inform the researchers working on this study on the organisation of activity-based hospital funding in other countries. The term 'activity-based funding' stands for the use of diagnosis-related groups (DRGs) and is synonymous with Payment by Results (UK), Prospective Payment system (US), Case-based Payment, Patient-based Funding, "Tarification à l'Activité" (France), case mix funding (Australia) et cetera.

The mechanics of activity-based funding are described in detail: how patients are classified, how costs are calculated, how prices or tariffs per DRG are set and how other specific hospital activities are funded. Knowledge about the situation in foreign countries, gives insight into, for example, the necessity of supplementary financing for specific activities such as intensive care, or the in- or exclusion of capital costs in the all-in financing.

4.1.2 Scope

4.1.2.1 Selected countries

The comparative analysis comprehended five countries i.e. England, Germany, France, Denmark and Australia (Victoria).

The selection of these countries was based on two criteria. The first criterion is the existence of an established, preferably national activity-based hospital financing system responsible for a considerable part of hospital revenue. Second, the availability of information on this country in one of the following languages: French, Dutch, English or German. Several countries were excluded: Norway (only 40% activity-based; little information in English)[87]; Italy and Spain (too regional); Austria (too regional and limited information); United States of America (limited to patients >65 years under the Medicare programme); the Netherlands (limited generalisability and still in development phase).

4.1.2.2 Topics of interest

First, each country analysis started with a brief overview of the health care system: type of healthcare system, status or ownership of hospitals, hospital financing and employment of physicians (4.3.1).

Second, the DRG classification system was described: name and origin, reasons for introduction, scale on which it is used, transition phase, refinement and grouping process (4.3.2).

The third focus is on the method of cost allocation, size of data sample and quality of this data (4.3.3).

Fourth, the outliers are defined, as are lower and upper trim points (4.3.4).

Fifth, the determination of the DRG tariff is assessed: how are costs converted into prices; how is the DRG tariff calculated; which specific adjustments of the DRG tariff are there; how are hospital stays reimbursed (4.3.5).

Finally, an overview is given of which hospital activities are included in the activity-based financing and which are not. The following activities are assessed: capital costs, research training and medical education, intensive care, medical devices, high cost drugs, chemo- or radiotherapy, interventional radiology, diagnostic imaging, renal dialysis, mental health, rehabilitation, palliative care, transplants, accident and emergency department, outpatient services (4.3.6).

4.2 METHODOLOGY

Grey literature was searched, e.g. websites of government departments and agencies, academic and research institutes, professional groups, health insurers et cetera. Secondly, we contacted several organisations or authorities in order to retrieve additional information on the organisation of the hospital financing in the different countries. Details on the search strategy are provided in the supplement to this chapter.

The international comparison is based on a checklist of items (which is provided in the supplement) and was performed by four reviewers.

The next chapter summarizes the results of the review in a continuous text. A more structured overview of all items that were compared between the five countries is provided in Table 10 (page 58). The comprehensive text is available in the supplement to this chapter. Since Chapter 4 is already a summary of the results and all relevant information is provided in Table 10, no key points were added.

4.3 RESULTS

4.3.1 General information on healthcare system

4.3.1.1 Type of healthcare system

England, Denmark and Australia (Victoria) are (predominantly) tax-financed health systems with the majority of the healthcare facilities under public ownership. In France and Germany, the statutory health insurance system provides for compulsory insurance and entitlement to insurance.

4.3.1.2 Status or ownership of hospitals

In England and Denmark almost all hospitals are publicly owned. In France, 66% of beds are public, while in Victoria and Germany this applies to approximately 50% of beds.

4.3.1.3 Hospital financing

In all five countries, responsibility for hospital financing lies mostly with regional authorities.

In all countries except Australia, financing rules are, or will be (in case of England), identical for private and public hospitals. The DRG tariff, on the other hand, is not always identical. In Denmark, the tariff for public hospitals is regionally adapted. In France, tariffs for public and private hospitals will differ until 2012.

In Australia, activity-based funding is only used to fund public hospitals and to reimburse services commissioned from private hospitals.

4.3.1.4 Employment of physicians

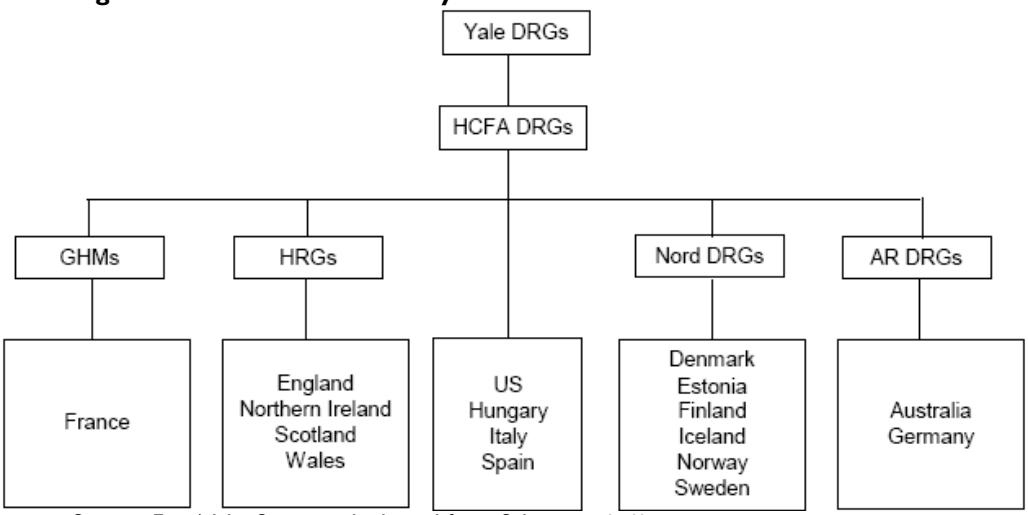
In most countries that were studied in this review, physicians working in hospitals are paid salaries. Only in Denmark, specialists are paid on a fee-for-service basis.

4.3.2 DRG classification system

4.3.2.1 Name and origin of DRG classification system

Diagnosis Related Groups (DRGs) were first developed by Fetter et al. at Yale University as a means to categorise patients into groups with similar resource requirements (see also section 2.2.1). These Yale DRGs were refined by the US Health Care Financing Administration (HCFA) for funding Medicare patients. Figure 5 illustrates how the HCFA system was subsequently adopted in countries around the world.[87]

Figure 5 : DRG classification systems used in different countries



Source: Fig. 4.1 by Street and adapted from Schreyogg [87, 88]

The five countries studied in this review adopted different DRG classification systems. In 1986, the first version of the Groupes Homogènes de Séjour (**GHS**) was published in France. In England, Healthcare Resource Groups (**HRG**) were introduced in the 1990s. The Danish DRG system (**Dk-DRG**) is a modified version of the Scandinavian Nord-DRG system and was introduced in 2002. Germany and Victoria (Australia) both based their classification system on the Australian Refined DRG system. Victoria introduced its **VIC-DRG** in 1993. Germany introduced its **G-DRG** system in 2003.

4.3.2.2 Reasons to introduce DRG classification system

The most common reason for policymakers to introduce activity-based funding is to increase the efficiency in hospitals with the aim of containing or reducing hospital costs. An increase in transparency in hospital costs and an encouragement of monitoring and benchmarking is supposed to lead to a fairer remuneration of providers. This could engender competition between hospitals, for example between public and private hospitals. In addition, DRGs are often introduced to incentivise additional capacity and reduce waiting lists (England, Denmark and Victoria) or to promote certain hospital activities such as day case surgery (France). On the other hand, activity-based funding can also help to reduce excess capacity in the hospital sector. In France, DRGs were also introduced to harmonize the public and private hospital financing system.

4.3.2.3 Scale on which DRG classification system is used

In England, Germany, France and Victoria, 100% of hospitals use the DRG classification system. In Denmark, the exact number of hospitals using Dk-DRGs is unknown.

4.3.2.4 *Transition*

Victoria has the most experience of activity-based funding and completed the transition phase several years ago. In Denmark, implementation varies between regions. England, Germany and France finished their transition phase only recently. They opted for an extended period of implementation (4 to 6 years), in combination with existing funding mechanisms. This allowed close monitoring of any impact on hospital performance and limiting of budget variations during the transition period.

4.3.2.5 *Refinement of DRG classification system*

In each country, the DRG classification systems are reviewed on an annual basis. In addition, the English HRGs are drastically reviewed every 3 or 4 years.

In England, a new HRG must encompass at least 600 cases nationally and incur over £1.5 million in expenditure. In Germany, DRG splits need to meet two requirements: the difference between mean costs must be greater than 10% of the highest mean cost or must exceed €500; the number of cases to be calculated must be greater than 30, and the number of cases from all German hospitals has to be greater than 500 in every newly created DRG.

4.3.2.6 *Grouping process*

England and Germany increased their number of DRGs to more than a thousand: there are more than 1 400 HRGs in the latest English DRG classification system (HRG4) and 1 137 G-DRGs in the 2008 German system. In France and Victoria, the number of DRGs varies around 750. Denmark has less than 600 Dk-DRGs. Detailed information on the different DRG classification systems can be retrieved from Table 10 or from the supplement.

A special feature of the English HRG system, is "unbundling" which has been introduced with HRG4. The concept of unbundling is that a case will be assigned to more than one HRG if it includes any "unbundled" elements (i.e. significant elements of cost and activity). The "unbundled component" becomes an HRG in its own right as an addition to a core HRG.[89] For example; a case could be assigned the following HRGs depending on the components within it:

Core HRG	+	Unbundled Interventional Radiology HRGs	+	Unbundled High Cost Drug HRGs	+	Unbundled Diagnostic Imaging HRGs	+	Unbundled Rehabilitation HRGs

4.3.3 Calculation of costs

4.3.3.1 *Method of costing*

Mogyorosy and Smith describe different costing methodologies: the bottom-up and top-down approaches and the mixed approach (see also section 2.2.2).[21]

At the one end, there is the **bottom-up** approach which involves very detailed, direct measurement of resource utilisation at the patient or individual service level.[21] Thanks to an early investment in hospital management information systems, hospitals in Victoria can perform a bottom-up costing.

In the **top-down** method on the other hand, the total costs of the service are first calculated at the organisational, provider or departmental level. These total costs are subsequently disaggregated to the department or the units of services.[21] French hospital costs per stay are calculated using a top-down approach.

Finally, there are mixed approaches which are based partly on bottom-up and partly on top-down approaches. The **step-down** costing method is a special form of mixed approach, which is based on the provider's cost accounting system.[21] In England, Germany and Denmark, hospitals use the step-down costing methodology.

4.3.3.2 *Cost calculation*

Detailed description of cost calculation is provided in the Supplement.

4.3.3.3 Data sample

England has mandated cost collection from all public hospitals. In Victoria (Australia), all public as well as private hospitals provide cost information for DRG calculation. Denmark obtains cost data from 80% of its public hospitals. In Germany, on the other hand, only 14% of public hospitals participate in the voluntary cost collection. Because this sample represents only a subset of the cases treated, the relative frequencies for each DRG from the participating hospitals' data are corrected by the actual number of all cases of all German hospitals. In France, the data sample is even smaller with 5% of public hospitals providing cost data. In order to ensure that the data are representative, hospitals with different characteristics and from different regions are included in the sample.

4.3.4 Outliers

Sometimes a DRG can contain patients whose costs are much lower or higher than those of other patients grouped to the same DRG. Patients at the upper and lower extreme ends of the distribution of the costs of all patients within the same DRG, are termed outliers. In the countries included in our review, outliers are always defined in terms of length of stay (LOS) rather than costs.

On the other hand, countries differ in where they set the trim points to identify outliers. As shown in Table 8 and Table 9, the statistical basis for trimming varies. England and Denmark define outliers in relation to the interquartile range which contains the middle 50% of observations. In Victoria, they adopted the simpler L3H3 method: the low trim point is a third of average length of stay (ALOS); the high trim point is three times the ALOS. France and Germany use the mean and standard deviation in setting trim points. They also select the minimum value from a choice of usually two values, one of which is set independently of the DRG-specific data.[87]

In England and Denmark there are no lower trim points as such, but there are special incentives to avoid unnecessary hospital admissions. In England, the HRG tariff is reduced for short stay (0 or 1 day) non-elective emergency admissions. In Denmark, there is a special charge for the so-called 'grey zone' patients. For more information see section 4.3.5.3.

Table 8: Lower trim points

Country	Lower LOS threshold for each DRG (j)
England	No lower trim point for elective admissions, but reduced HRG tariff for short stay non-elective emergency admissions.
Germany	Round [min (2, arithmetic mean of LOS_j / 3)]
France	If $ALOS_j < 8$ days: no lower trim point. If $ALOS_j \geq 8$ days: min [($ALOS_j$/2.5);7;(modeLOS-1)]
Denmark	No lower trim point, but a special charge for 'grey zone' patients.
Victoria - AU	$ALOS_j$/3

Table 9: Upper trim points

Country	Upper LOS threshold for each DRG (j)
England	$Q75_j+(Q75_j-Q25_j) * 1.5$
Germany	Round [min (arithmetic mean of LOS_j + 2 * SD LOS, arithmetic mean of LOS_j + 17)]
France	If $ALOS_j < 8$ days: min [15; $\exp^{\text{mean}[\log(LOS_j)]+SD[\log(LOS_j)]+Q95-\text{median}[\log(LOS_j)]}$] If $ALOS_j \geq 8$ days: min [2.5x $ALOS_j$; $\exp^{\text{mean}[\log(LOS_j)]+SD[\log(LOS_j)]+Q95-\text{median}[\log(LOS_j)]}$]
Denmark	$Q75_j+(Q75_j-Q25_j) * 1.5$
Victoria - AU	3 x $ALOS_j$

4.3.5 Determining the DRG tariff

4.3.5.1 Converting cost information into prices

There are several options for converting costs into prices or tariffs.

In England and France, the cost information is converted directly into prices in monetary units. These prices reflect the average cost per DRG.

In Denmark, Germany and Victoria (Australia), cost information is converted into a system of cost weights. Street et al. describe cost weights as "a point system, whereby a benchmark treatment is assigned a score of (say) 100 points, with more points for more costly procedures".[87] The relative cost weights represent the average costliness of a particular DRG as related to a reference. This has the advantage that only the price for the DRG cost weight of 1.0 has to be set. Prices for all the other DRGs are calculated automatically by multiplying the DRG cost weight attached to each DRG with this base rate. In Denmark, the price per cost weight is negotiated at a regional level. In Australia and Germany, the price per cost weight is fixed at the national level.

4.3.5.2 Specific adjustments of DRG tariffs

DRG tariffs can be adjusted for costs that hospitals incur because of the region in which they are located or the constraints they have on the organisational structure. These adjustments are made because it concerns costs that are considered out of the hospital's control.[87]

Although England and France operate a predominantly nationally-uniform classification and pricing system, in both countries DRG tariffs are adjusted for regional characteristics. In England, the so-called Market Force Factor compensates for the differential prices that hospitals have to pay for staff, land and buildings in more expensive regions. In France, additional geographical indices are applied for the Paris region and for overseas areas.

Germany, Denmark and Victoria (Australia), on the other hand, use national classification systems but set prices/tariffs at the state (Australian states, German Länder) or regional level (Danish regions). In addition, the Victorian standard payment rate varies in accordance with size and rural character of the hospital.

4.3.5.3 Reimbursement of hospital stays

Reimbursement of day care

In Germany, there are 5 DRGs for medical day care (geriatric treatment and renal failure). Ambulatory surgery, however, is remunerated on a fee-for-service basis and thus excluded from the G-DRG system.

In France and England, day care patients are funded with the same DRG tariff as elective inpatients. This way, a financial incentive is given to transfer services to day care.

In Denmark, there is a special charge for the so-called 'grey zone' patients. These patients may be treated as either outpatients or be hospitalized. In order to create an incentive to treat patients as outpatients, a special charge is calculated that is higher than the outpatient charge but lower than the DRG tariff if the patient is admitted.

In Victoria, day cases are included in the case mix system and are funded on the basis of the Same Day Weight. Same day patients are those who are admitted and separated on the same date.

Reimbursement of short-stay outliers

In the German, French and Victorian activity-based funding systems, short-stay outliers always receive a reduced financing in comparison with inlier hospital stays. In France, short-stay outliers are reimbursed at 50% of the GHS tariff. In Germany and Victoria, the reduced compensation is possible thanks to the use of adapted per-diem cost weights. Although the English HRG system does not use lower trim points, the HRG tariff is reduced to up to 40% for short stay (< 2 days) non-elective emergency admissions.

Reimbursement of long-stay outliers

Hospitals receive an additional payment for every day above the upper trim point.

Normally, this payment is at a reduced tariff. In France, long-stay outlier days are reimbursed at 75% of the average daily GHS tariff. In Victoria, the high outlier per-diem is set at 80% of the average daily inlier cost for medical patients and at 70% for surgical patients. In Germany, reduced payment is possible by using adapted per-diem cost weights. In Denmark, per-diem payments are based on a historical figure.

In England, the total reimbursement for elective and non-elective long-stay outliers differs because trim points are HRG specific and differ for elective and non-elective activity. Although a minimum (£100) and maximum (£500) amount are set for the per-diem long stay payment, it can be higher than the average daily inlier tariff. Costs for long-stay outliers caused by problems with the provision of residential or home care have to be reimbursed by the local authority social services.

4.3.6 Funding characteristics of specific hospital activities

4.3.6.1 Share of hospital revenue that is activity-based

Countries seldom pay hospitals solely on the basis of activity that can be classified into DRGs. Activity-based funding can be complemented by two forms of additional funding: separate budgets or grants and/or adjustments in the form of surcharges to specific DRG prices.[87, 90]

Although England, Germany and France – three recent converters to activity-based hospital funding – have stated political aim to cover total hospital costs through activity-based funding, only France has reached this target. Germany attained an 80% share of hospital revenue to be activity-based, while England should have reached 90% by 2008. In other countries, hospital income comprises a mixture of activity-related payments and other forms of payment. In Denmark, for instance, activity-based funding accounts for between 39 and 52% of the total funding of hospitals. In Victoria, this percentage attains 60%.

4.3.6.2 Payments for non-patient related hospital activities

In general, non-patient related activities that hospitals undertake are financed with non-activity-based payments. It concerns sectors and services for which it is difficult to assign costs and/or that involve costs which are not sufficiently captured through DRGs such as capital costs, teaching and research and quality of hospital care.

Capital costs

In Germany and Denmark, capital costs are excluded from activity-based funding and funded separately. In England, France and Victoria, capital costs are partly covered by activity-based funding; there are additional budgets for certain investments.

Research, training and medical education

Research, training and medical education is excluded from the DRG system and financed with specific budgets. The only exception is Denmark where medical education and internal financed research is included in the DRG pricing system.

Quality of hospital care

German and Victorian hospitals receive additional grants for quality improvement measures.

4.3.6.3 Payments for patients for whom a classification system is mostly not available (mental health, rehabilitation and outpatients)

A second reason to justify non-activity-based payments is the scope of the services.[87, 90] Activity-based funding typically covers inpatient hospital care. This mostly excludes patients for whom no satisfactory classification system is available, such as outpatients, mental health and rehabilitation. Some countries have, however, expanded their activity-based funding to include these sectors.

Mental health

In all countries, mental health is currently excluded from the DRG system because activity-based funding is esteemed inappropriate since mental health diagnoses are difficult to classify and patients' costs vary considerably. There is also the concern that activity-based funding may encourage the under-provision of mental health services.[90] In England, however, within the HRG4 system, mental health HRGs are used to register (i.e. not to finance) the treatment of patients with a mental health diagnosis by an acute provider who does not provide specialist mental health services.

Rehabilitation

In Germany and France, rehabilitation is excluded from the DRG system.

In England, rehabilitation was initially excluded from the HRG system. With the HRG4 system, however, unbundled rehabilitation HRGs are generated on a per diem basis but only where care is identified as taking place under a specialist rehabilitation consultant or within a discrete rehabilitation ward or unit. Where a patient is not admitted specifically to a rehabilitation unit or where rehabilitation treatment is undertaken without transfer to a specialist consultant, such activity will not be coded and will not generate an unbundled rehabilitation HRG. For example, if the patient receives rehabilitation care after a hip replacement as part of the routine post-operative care within the same provider (and without specialist rehabilitation consultant), the rehabilitation care is regarded as part of the hip replacement procedure.[89]

In Denmark, rehabilitation is included in the Dk-DRG system. Special charges for rehabilitation were introduced, based on local cost studies, from January 1st 2007. Activity-based payments are made under five groups for rehabilitation of hospitalised patients and three groups for outpatient rehabilitation.[87]

In Victoria, an activity-based funding system called VicRehab is used for rehabilitation units with 20 beds or more. The Case mix Rehabilitation and Funding Tree (CRAFT) is the classification model that underpins VicRehab. CRAFT categories are based on diagnosis and functional status (i.e. Barthel score) at admission.[91, 92]

Outpatient (ambulatory) services

In general, German and French outpatient services are excluded from the DRG system and separately financed on a fee-for-service basis. There is, however, an exception to this rule in the German system: pre- and after-care services associated with an inpatient stay are not financed separately but are included in the DRG of the corresponding hospital stay. Pre-care services may not exceed more than three days and have to be performed within five days before the patient is admitted. After-care services may not take more than seven days and have to take place within 14 days after the end of the hospitalization.

In the English HRG4, the same HRG can be assigned regardless of setting if a procedure can be performed across different settings. The objective is to avoid perverse incentives associated with providing the same care in different settings (primary care, outpatient, day care, inpatients). This rule only applies to intervention based HRGs.

In Denmark and Victoria, outpatient care is activity-based funded. The Danish Ambulatory Grouping System (DAGS) classifies outpatients that attend hospitals into groups with similar care requirements, analogous to DRGs for acute care. The DAGS are divided into three major types of visits: ambulatory visits, emergency room visits and telephone consultations. Among ambulatory visits, there are again different types: visits for patients with a specific diagnosis (five groups, e.g. patients with cancer or diabetes); visits with a certain specific procedure (82 groups); traditional outpatient visits.[87, 93]

In Victoria, outpatient care is financed by the Victorian Ambulatory Classification and Funding System (VASC). Hospitals are funded on the basis of patient encounters. An encounter is defined as the clinic visit, plus all ancillary services (pathology, radiology and pharmacy) provided within the 30 days either side of the clinic visit.

Outpatient visits to Accident and Emergency Department (without admission)

Countries differ greatly in the way that emergency visits without admission are financed. In France and Victoria (Australia), a global grant is awarded to cover the fixed costs of the A&E Department, on top of which there is a payment per visit to adjust for workload. In Denmark, payments are made according to the DAGS system. In England, A&E Departments will be funded according to the 80:20 fixed:variable funding model. This means that a grant covers 80% of (fixed) costs and 20% of revenue is related to (variable) activity up to a planned level. Finally, Germany finances the emergency services through grants which are not attached to specific G-DRGs.

4.3.6.4 Funding of patient stays associated with longer lengths of stay and/or higher costs

Most countries use mechanisms to adjust DRG prices where these prices cannot adequately reimburse exceptional costs associated with highly complex cases and highly specialised care. An exception seems to be Denmark, which does not make any adjustments to the activity-based funding mechanism.[gg] The same approach is seen in the Norwegian DRG system where adjustments are not made either. In Norway, the expectation is that costs related to case mix complexity will average out across DRGs, with the remainder covered by additional funding.[90] Since activity-based funding currently only accounts for maximum half of the total funding of hospitals, this could well be the rationale behind the Danish DRG system as well.

There are several ways to compensate hospitals for highly complex cases associated with longer lengths of stay and/or higher costs.

1. The first mechanism is the surcharge approach which is mostly applied in Germany, France and Victoria. Surcharges - also referred to as co-payments or supplementary fees - are allocated to specific DRGs to compensate for complex cases. These surcharges are typically attached to specific DRGs and therefore account for the volume of cases.[90]
2. A second mechanism to compensate hospitals for costs incurred by complex case mix is creating specific DRGs for complex cases (England and Germany) or taking the case mix into account as a split criterion for existing DRGs (Germany).
3. Thirdly, there is the English concept of unbundling which was introduced with HRG4. Unbundling implies that a case will be assigned to more than one HRG if it includes any unbundled elements (i.e. significant elements of cost and activity) and that the unbundled component will become an HRG in its own right as an addition to a core HRG. Unbundled HRGs have been developed for chemotherapy, radiotherapy, interventional radiology, diagnostic imaging, rehabilitation, renal dialysis, critical care, specialist palliative care and high cost drugs.

Intensive care

In France, daily surcharges on top of the DRG tariff are possible for patient stays related to neonatology, resuscitation care, intensive care and continuous care. In Victoria, co-payments can be attributed to patients in need of mechanical ventilation.

In the German DRG system, there are specific DRGs for Intensive Care stays and, in addition, intensive care is used as a split criterion for other DRGs. The same mechanism is seen in England where specific HRGs were created for adult, paediatric and neonatal critical care. These HRGs are unbundled from the rest of the patient episode and are generated per diem.

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gg Taking into account that the (English) information on Denmark was rather limited.

Expensive drugs (including chemotherapy)

In France and Germany, drugs are included in the DRG system but surcharges are possible for expensive drugs when certain criteria are met. In Victoria, hospitals can receive supplementary budgets for expensive drugs. In England, specific high cost drugs and chemotherapy will derive unbundled HRGs.

Medical devices and procedures

In Germany, surcharges are possible for expensive medical devices and some expensive and/or innovative procedures. In France, some devices listed on so-called exclusion lists are reimbursed with surcharges on top of the GHS tariff. In both countries, the same criteria apply as for expensive drugs.

In Victoria, co-payments are possible for very expensive devices and procedures. In addition, there are special budgets to fund the introduction and use of new and existing technology and clinical practice in Victorian hospitals.

In England, some medical devices are excluded from the scope of tariff because the distribution of the device within the relevant HRG is not even across providers and could cause heterogeneity. Funding in this case is locally negotiated.

Radiotherapy

In all countries except England, radiotherapy is included in the DRG system. With the HRG4 system, radiotherapy has been unbundled in England.

Interventional radiology and diagnostic imaging

Again, only in England, interventional radiology and diagnostic imaging (with the exception of plain film x-ray and obstetric scans) are unbundled.

Transplants

In Germany, France, Denmark and Victoria, transplants are included in the DRG system, although French hospitals receive additional budgets for the co-ordination of organ transplants between hospitals. In England, transplant services are excluded from the HRG system to ensure a high quality of care and equity of access for patients.

Renal dialysis

In France and Denmark, there is no additional funding for renal dialysis. In Germany, there are specific DRGs for dialysis stays and renal dialysis is used as a split criterion for other DRGs. In Victoria, renal dialysis is additionally funded through a capitation payment per patient per annum in combination with the DRG payments for each session. In England, all renal dialysis will be unbundled.

Palliative care

In France and Victoria, palliative care is excluded from the DRG system. In Denmark it is included. In Germany, palliative units with more than five beds are excluded from the DRG system. German hospitals can also receive surcharges for complex palliative treatments. In England, all Specialist Palliative care is unbundled.

Admission through Accident and Emergency Department

Only in England there is a separate, often higher HRG tariff for patients who were admitted through A&E (i.e. non-elective admission). The other countries apply the standard DRG tariff because the fact that the patient was admitted through A&E is deemed immaterial to the overall cost of their care.[87]

Table 10: International comparison of activity-based financing systems for hospitals: Summary table

England	Germany	France	Denmark	Australia (Victoria)
1. General information on healthcare system				
1.1 Type of healthcare system				
National Health System (NHS) funded by taxes.	Statutory health insurance (SHI).	Statutory health insurance (SHI).	National health service, mainly funded by taxes.	Mainly publicly funded health system financed through general taxation and a small compulsory tax-based health insurance levy.
	Power of decision shared on national and regional level (16 Länder).		Two decision levels: national and regional (5 regions).	Two decision levels: Commonwealth (national) and States. Victoria has 25% of Australian population. It was the first state to introduce case mix funding.
1.2 Status or ownership of hospitals				
Majority of hospitals are public (NHS). Trend toward greater plurality of provision.	• 53.6% of beds are public • 36.4% of beds are private not for profit • 10% of beds are private and for profit	• 66% of beds are public • 14% of beds are private not for profit • 20% of beds are for profit	• 95.9% of beds are public • 4.1% of beds are private	In Victoria, 50% of hospitals are public and 50% are private.
1.3 Hospital financing				
"Payment by Results" is the name of the activity-based financing system.		"Tarification à l'Activité" (T2A) is the name of the activity-based financing system.		
Private versus public hospitals				
In the future all providers (private and public) will be reimbursed using the tariff.	Identical financing rules for public and private hospitals.	Identical financing rules for public and private hospitals, but the tariffs per DRG will differ until 2012.	The DRG tariff used to finance the private hospital is negotiated between region and hospital.	VIC-DRGs are only used to fund public hospitals and to reimburse services commissioned from private hospitals.
Responsibility for hospital financing				
Local authorities i.e. Primary Care Trusts.	The Länder (regions).	Regional hospital agencies allocate hospital budgets.	Five different funding arrangements; most important is the one between region and public hospital.	The Australian states (of which Victoria is one).

England	Germany	France	Denmark	Australia (Victoria)
1.4 Employment of physicians				
Physicians working in NHS hospitals are salaried.	Within the SHI settings, physicians working in hospitals are paid salaries. Within private settings, payment by fee-for-service.	Physicians in public hospitals are salaried; in private hospitals they are independent.	Physicians working in hospitals are paid on a fee-for-service basis.	Specialists working in public hospitals are salaried but others are mainly private practitioners.
2. DRG classification system				
2.1 Name of DRG classification system				
HRG (Healthcare Resource Groups). Latest version = HRG4.	**G-DRG** (German DRG).	**GHS** (Groupe Homogène de Séjours).	**Dk-DRG** (Danish DRG) for inpatient stays; **DAGS** (Danish Ambulatory Grouping System) for ambulatory patients.	**VIC–DRGs** (Victorian DRGs) in use in Victoria. Consistent with the AR-DRGs; only corrections for risk adjustment capitation. Other case mix funding systems: • **CRAFT** for rehabilitation inpatients in rehabilitation units • **VACS** for outpatients in major general hospitals.
2.2 Origin of DRG classification system				
Based on the HCFA DRG system (USA, 1983).	Modelled on the Australian Refined DRG (AR-DRG).	Based on the HCFA DRG system (USA, 1983).	Modified version of the Scandinavian Nord-DRG system, which originated from the HCFA system.	AR-DRG (Australian Refined) is a revised version of the Australian National DRG, which was based on the AP DRG and APR system.
2.3 Reasons to introduce DRG classification system				
• monitor and measure hospital activity • create plurality of provision • get fairer remuneration of providers • incentivise additional capacity	• more transparency and fairer remuneration • increase the efficiency in hospitals • reduce excess capacity • encourage competition	• harmonize public and private financing system • adapt the budget to the real hospital activity • incentivise hospitals to analyse their case mix, efficiency and cost structures • promotion of certain activities (day case surgery) • stop the continuous growth of	• benchmarking of hospital performance in order to get more health value for money • increase activity and reduction of waiting lists	• increase hospital productivity and reduce costs • engender competition and economic incentives for hospitals • reward efficiency and growth in services while at the same time quality was guarded

England	Germany	France	Denmark	Australia (Victoria)
		other activities		
2.4 Scale on which DRG classification system is used				
Used nationwide; 100% of NHS hospitals.	Used nationwide; 100% of hospitals.	Used nationwide; 100% of hospitals.	All regions use Dk-DRGs; exact number of hospitals using Dk-DRGs is unknown.	In 2006, all States (except New South Wales) used the DRG system. In Victoria, used by 100% of hospitals.
2.5 Transition period in relation to introduction of DRG classification system				
Period				
Transition period started in 2004. By April 2008, 90% of hospital activity is expected to be covered by the tariff. HRG4 used for NHS costing since April 2006 and may be used for funding in 2009/2010.	In 2004-2009, tariffs per DRG are hospital specific since partly based on the historical budget (i.e. 25% in 2008). From 2009, tariffs are set by the region (Länder) and are consequently identical for all hospitals of a Land.	Private hospitals are entirely activity-based financed since 2005. For the public hospitals that were previously financed by a global budget, the transition period was shortened from 2004-2012 to 2004-2007.	Time of implementation differs among regions. Danish government decided that the overall level of activity-based financing should gradually increase from 20 to 50%, but a deadline was not determined.	VIC-DRGs were introduced in 1993. Transition phase is completed.
Limit on budget variation				
Change in income is adjusted by 25% first year, 50% in second year and so on, with a maximum movement per annum of 2% of Payment by Result income.	There is a limit on the reduction of the budget i.e. may not exceed 3% in 2009.	No limit on the variations of the budget.	No information.	No information.
2.6 Refinement of the classification system				
How often is classification system reviewed?				
Annual review; drastic review every 3 or 4 years.	Annual review.	Annual review.	Annual review.	Annual review.
Conditions for creation of a new DRG				
Minimum 600 cases and expenditure of ≥ £1.5 million (approximately €2 million).	Two requirements: 1) minimum 500 cases at national level and 30 cases in the sample 2) difference between mean costs must be greater than 10% of the highest mean cost or > €500.	No information.	No information.	No information.
Target				

England	Germany	France	Denmark	Australia (Victoria)
HRGs should ideally have less than 25% length of stay and cost variability.	No information.	No information.	No information.	No information.
2.7 Grouping process				
Total number of DRGs				
HRG4: > 1 400	G-DRG: 1 137	GHS v10: 780	Dk-DRG: 585	VIC-DRG: 760
Classification				
HRGs are organised into clinically relevant chapters (rather than specialties). With HRG4, new chapters have been introduced e.g. Diagnostic Imaging and Interventional Radiology; Multiple Trauma, Emergency and Urgent Care, Rehabilitation; Critical Care, High Cost Drugs and Devices; Unbundled.	G-DRG system is subdivided into 23 Major Disease Categories (MDC) which are associated with a specialty of medicine. In addition, pre-MDCs include long-term ventilation cases and transplantations.	GHS system is subdivided into 26 Major Disease Categories (MDC) which are associated with a specialty of medicine, and 3 Major Categories (MCs) for short stays and transplantations.	Dk-DRG is organised into 25 Major Disease Categories (MDC) which are associated with a specialty of medicine. In addition, there are pre-MDCs for radiotherapy and chemotherapy.	AR-DRG system is subdivided into 23 Major Disease Categories (MDC) which are associated with a specialty of medicine. In addition, pre-MDCs include long-term ventilation cases and transplantations.
Characteristics used to assign cases to a group				
Primary and secondary diagnoses (ICD-10), procedures (OPCS-4), sex, age, legal status, method of discharge, length of stay.	Primary and secondary diagnoses (ICD-10-GM), procedure (OPS), sex, age, weight of new born, cause of hospital discharge, length of stay.	Primary and secondary diagnoses (CIM-10), procedure (CCAM), sex, age, cause of hospital discharge, length of stay.	Primary and secondary diagnoses, surgical procedures, procedures (surgical, other, diagnostic), sex, age, discharge status.	Primary and secondary diagnoses (ICD-10-AM), procedure, sex, age, weight of new born, cause of hospital discharge, length of stay.
Levels of complication or co-morbidity				
There are three complication levels: not significant complication; intermediate complication; major complication.	There are nine degrees of severity, but majority of G-DRGs have one or two severity levels.	There are three degrees of severity: no complications, with complications, with severe complications or co-morbidities.	No information.	There are four degrees of severity.
Special features				
Introduction of the concept of *unbundling*: a case will be assigned to more than one HRG if it includes any			Within each MDC, patients are divided into a medical or a surgical group. Medical patients are further divided into patients	

England	Germany	France	Denmark	Australia (Victoria)
'unbundled' elements (i.e. significant elements of cost and activity). Example: principal HRG + HRG high cost drugs+ HRG radiology. In order to unbundle a cost element, the minimum size should be 20 % of the total cost of the HRG.			receiving a *cancer treatment* or not.	
3. Calculation of costs				
3.1 Method of costing				
Step down accounting and micro-costing.	In theory, step down accounting and micro-costing, but approximations are allowed.	Top down accounting and a full costing approach.	Step down accounting.	Bottom-up costing method is possible thanks to early investments in hospital information systems.
3.2 Cost allocation				
Cost drivers are relatively detailed. Allocation of the costs of care based on the length of stay.	Very detailed and complete cost drivers, but in reality only few hospitals have the necessary data. The costs per DRG are consequently highly correlated to the length of stay.	Very detailed cost drivers for technical acts, but less detailed for the rest. In general, 60% of the costs are assigned according to the length of stay.	Cost drivers are chosen by each individual hospital. At the national level, a set of relative service weights have been developed for technical services.	Each time resources are used by a patient, the utilisation and related costs are tagged to the patient's medical record. When the episode is completed and the DRG assigned, these costs are aggregated for analysis. Only limited technical information was found on allocation method.
Particularities of the costing system				
Precise determination of the costs of the DRGs covering at least 80% of the cost and the activity. "Standardised" determination of the cost of the rest of the DRGs		Elimination of cost outliers that are considered as deviating data (same formula as LOS outliers).	Cost data are trimmed for low and high outliers: • For DRGs with >20 observations, trim points are the 1% and 99% percentile. • For DRGs with <20 observations, trim points are the 5% and 95% percentile. • For DAGS, trim points are the	Outlier trimming: low outliers, i.e. cases with less than one-third of the State average LOS, and high outliers with a LOS more than three times the State average LOS are excluded from estimation of acute-care cost weights. Data validation: removal of

England	Germany	France	Denmark	Australia (Victoria)
			10% and 90% percentile. For cases with a cost above and below the trim points, the extreme values are replaced by the trim point.	sub-acute or non-acute care types, e.g. patients receiving long term care in an acute facility, since rehabilitation, nursing-home type care or psychiatric care is separately funded.
3.3 Data sample for classification system				
Number of hospitals providing cost data for sample				
All hospitals (100%) provide their cost data. Data provision is obligatory.	14.3% of the hospitals using DRGs in Germany provide data, representing 21.3% of all cases. Data provision is voluntary and remunerated.	Only 5% of public hospitals provide data. Since 2004, also some participation by private hospitals. Data provision is always voluntary.	Approximately 80% of Danish hospitals submit cost data to the national database. Data provision is voluntary.	All public and private hospitals (100%) provide their cost data.
Sample corrections				
Not necessary.	Correction by weighting the average costs of inlier cases for the total number of cases per DRG from claims data of all hospitals using DRGs in Germany.	Correction by standardisation of the allocated daily costs on the basis of the national average LOS.	No information.	Not necessary.
3.4 Quality of data				
Quality checks				
No information.	Quality of data is checked in a four-step plausibility checking process. In 2006, exclusion of 24% of cases. Remuneration of hospitals in accordance with the quality of the supplied data.	National quality check: some data are systematically checked in all hospitals in order to trace atypical cases.	Manual correction.	A formal data quality review process was implemented in 1993.
Audit				
No information.	Hospitals are inspected at random. In case of unintended up coding, hospitals must return revenues. In case of intentional up coding,	On site inspection of hospitals (targeted or at random). In case of unintended up coding, hospitals must return revenues. In case of intentional up coding,	No information.	Audits are performed annually by external consultancy firms.

England	Germany	France	Denmark	Australia (Victoria)
	additional penalty payment.	additional penalty payment.		
4. Outliers				
4.1 Definition of outliers				
Length of stay.	Length of stay.	Length of stay.	Length of stay.	Length of stay.
4.2 Lower trim point (LTP)				
No lower trim point for elective admissions. For short-stay (<2 days) non-elective admissions, HRG tariff is reduced.	Lower LOS-threshold is one-third of the mean value of the length of stay, or a minimum of two days.	If ALOS < 8 days: no LTP. If ALOS ≥ 8 days: LTP =min[(ALOS$_j$/2.5);7;(mode LOS-1)]	No lower trim point, but a special charge for 'grey zone' patients. These are patients that can be treated as outpatients or as inpatients.	LTP = ALOS/3.
4.3 Upper trim point (UTP)				
UTP$_j$ =Q75$_j$+(Q75$_j$-Q25$_j$)*1.5 Trim points are HRG specific and differ for elective and non-elective activity.	Upper LOS-threshold is calculated as the sum of the mean length of stay and the pre-selected maximum value (17 days).	If ALOS < 8 days: UTP = min (15; upper bound). If ALOS ≥ 8 days: UTP = min ((2.5 X ALOS); upper bound).	UTP$_j$ =Q75$_j$+(Q75$_j$-Q25$_j$)*1.5	UTP = ALOS*3.
Legend of formulas				
UTP$_j$ = trim point for HRG$_j$ Q75$_j$ = upper quartile of bed days in HRG$_j$ Q25$_j$ = lower quartile of bed days in HRG$_j$		ALOS = average length of stay upper bound = exp[mean(log(LOS)) +SD(log(LOS)) +Q95-median(log(LOS))]	UTP$_j$ = trim point for HRG$_j$ Q75$_j$ = upper quartile of bed days in HRG$_j$ Q25$_j$ = lower quartile of bed days in HRG$_j$	ALOS = average length of stay
5. Determining the DRG tariff				
5.1 Converting cost information into prices				
Cost information is converted into a national HRG **price**.	Cost information is converted into a national DRG **cost weight**.	Cost information is converted into a national DRG **price** (GHS tariff).	Cost information on inpatients is converted into a national or regional DRG **cost weight**. DAGS are not transformed into cost weights.	Cost information is converted into a national DRG **cost weight**.
5.2 Calculation of DRG tariff				
HRG price reflects an average cost per HRG. *Particularities*: • Data cleaning involves removal of outliers where	The relative cost weights represent the average costliness of a particular DRG as related to a reference value. This has the advantage that only the price for the DRG	DRG price reflects an average cost per DRG.	The relative cost weights represent the average costliness of a particular DRG as related to a reference value. *Particularity*:	The payment unit is the Weighted Inlier Equivalent Separation (WIES). A separation is a patient episode (or admission) that is both weighted according to its DRG

England	Germany	France	Denmark	Australia (Victoria)
costs are less than <1/20th or >20 times the average for that HRG. • Costs are aggregated according to type of admission: elective or non elective.	cost weight of 1.0 has to be set. Prices for all of the other DRGs are calculated automatically by multiplying the DRG cost weight attached to each DRG with this base rate.		If a cost weight is very different compared to the preceding years and if this difference can not be explained by any clinical or administrative change, the cost weight of the preceding year is used.	group and adjusted for length of stay (therefore called inlier). WIES is the final DRG weight; it is the total of all relevant cost weights. The final WIES is multiplied by the WIES payment rate in order to obtain hospital remuneration. Hospitals are allocated a designated target number of WIES each year in order to ensure that state-wide budget limits are met.
5.3 Specific adjustments of DRG tariffs				
According to region				
Application of Market Force Factor to correct for geographical variation in prices for staff, land and building.	The tariffs are set at the state or regional level (Länder).	Regional tariff adjustment for certain regions: 7% for Paris, 5% for Corsica; 25-30% for overseas regions.	The DRG tariff is adjusted according to the purchaser provider relation. In transactions between regions and public hospitals, for example, the DRG tariff is determined regionally.	The standard WIES payment rate, i.e. the amount of money provided for one WIES, is set at the state level and adjusted according to the rural (higher basis) or the metropolitan location of the hospital, in order to guarantee access to care.
According to structural characteristics of hospital				
No adjustment.	No adjustment.	No adjustment.	No adjustment.	Adjustments according to the size of the hospital in case of rural hospital.
5.4 Reimbursement of hospital stays				
Reimbursement of day care				
Since there is no lower trim point for elective admissions, the same HRG tariff is paid for an elective inpatient as a day case. This is an incentive to admit patients in day care.	There are 5 G-DRGs for medical day care (geriatric treatment and renal failure). Ambulatory surgery is remunerated on a fee-for-service basis and thus	Day care patients have the same tariff as elective inpatients, giving a financial incentive to transfer services to day care.	Day cases are grouped according to the DAGS. For the grey zone DRGs, grey zone tariffs are applied, irrespective of whether the patient has been treated as an	Same day patients are those who are admitted and separated on the same date. Day cases are included in the case mix system and are funded on the basis of the

England	Germany	France	Denmark	Australia (Victoria)
	excluded from G-DRG.		inpatient or as an ambulatory patient.	Same Day Weight.
Reimbursement of short-stay outliers				
But for emergency short-stay outliers (<2 days) the HRG tariff is reduced up to 40%.	For short-stay outliers, the amount that is reimbursed per day is lower than the normal DRG payment. This reduced compensation is obtained by using adapted per diem cost weights. • For short-stay outliers with a LOS threshold = 2 days, the per diem cost weight equals the cost weight of the DRG equivalent with a one night hospital stay. • For short-stay outliers with a LOS threshold > 2 days, only the primary costs (i.e. of standard and intensive care units, radiology, laboratory) are taken into account to calculate the deduction.	Short-stay outliers are reimbursed at 50% of the GHS tariff.	There is no lower trim point.	Short stay outliers receive a reduced payment. For each DRG, the following cost weights are defined: • One day weight. • Multi-day low outlier per diem.
Reimbursement of long-stay outliers				
Outliers are reimbursed with a HRG specific rate per day beyond the trim point. Since trim points are HRG specific and differ for elective and non-elective activity, the total reimbursement for elective and non-elective long-stay outliers differs. Although a minimum (£100) and maximum (£500) amount are set for the per-diem long	Reduced compensation for long-stay outliers by using adapted per diem cost weights. Surcharges are based on the median of the costs per day of the outliers. If first formula is not possible because of too much variation in the costs, surcharges are based on primary costs.	Days above the UTP are reimbursed at 75% of the daily average GHS tariff (which is the GHS tariff divided by the corresponding ALOS).	The outlier payment is a tariff per day, determined by the government and based on a historical figure. For some ambulatory visits (DAGS), there is a supplementary fee for certain specified expensive consumables.	Hospitals will receive an additional payment for every day over the inlier range based on the high outlier per diem. This per diem is set at 80 per cent of the average daily inlier cost for medical patients and 70 per cent of the average inlier daily cost, excluding theatre and prostheses costs, for surgical patients.

England	Germany	France	Denmark	Australia (Victoria)
stay payment, it can be higher than the average daily inlier tariff. ***Particularities*** If discharge is delayed by problems with the provision of residential or home care, the cost of the delayed discharge passes to the local authority social service who reimburses the healthcare provider.	In some cases, deductions are to be made from the cost weight of a DRG if a patient is transferred before his or her length of stay reaches the mean length of stay.			
6. Funding characteristics of specific hospital activities				
6.1 Share of hospital revenue that is activity-based				
By April 2008, 90% of public hospital activity, including non-electives, outpatients, and A&E, is expected to be covered by the HRG tariff.	Approximately 80% of hospital revenue is activity-based.	Since January 2008, 100% of public and private hospital activity is funded through the T2A system.	Activity-based funding accounts for between 39 and 52% of the total funding of hospitals.	VIC-DRGs account for approximately 60% of hospital funding.
6.2 Capital costs				
Included in HRG. Additional budget in case of major investment (> €33 million).	Excluded from G-DRG.	Included in GHS except for real estate costs.	Excluded from Dk-DRG.	Included in VIC-DRG but additional budgets for a series of investments.
6.3 Research, training and medical education				
Excluded from HRG. Specific budget.	Excluded from G-DRG. Specific budget case by case.	Excluded from GHS. Fixed budget and additional payments for a series of tasks.	Included in Dk-DRG.	Excluded from VIC-DRG. Special grants.
6.4 Intensive care				
In HRG4, introduction of adult, paediatric and neonatal critical care. These HRGs are unbundled from the rest of the patient episode and generated per diem.	Intensive care is included in G-DRG: specific DRGs for IC stays & intensive care used as a split criterion for other DRGs.	Included but financed with daily supplements in addition to the GHS-tariff. Calculation of the daily supplement is based on a comparison between daily cost with and without intensive care.	Included in Dk-DRG.	Included in VIC-DRG, but co-payments are possible for patients in need of mechanical ventilation.
6.5 Expensive drugs				
With HRG4, specific high cost drugs codes will derive	Included in G-DRG, but supplementary fees can be	Included in GHS, but some expensive drugs are billed in	Included in Dk-DRG.	Included in VIC-DRG system but supplemented with several

England	Germany	France	Denmark	Australia (Victoria)
unbundled HRGs that are additional to the core HRG for the care episode.	charged when following criteria are met: spread over several DRGs; occurring sporadically; high cost.	addition to the GHS-tariff, at their real cost. Conditions: drug is expensive and induces cost heterogeneity within a GHS.		additional budgets.
6.6 Medical devices				
Included, but some medical devices are also excluded from the HRG when the distribution of the device within the relevant HRG is not even across providers and could cause heterogeneity.	Included in G-DRG, but supplementary fees can be charged. Same conditions as in 6.6 apply to medical devices and some expensive and/or innovative procedures.	Included in GHS, but some devices listed on 'exclusion lists' are reimbursed in addition to GHS. Same conditions as in 6.6.	Included in Dk-DRG.	Included in VIC-DRG, but co-payments are possible for very expensive prostheses or procedures. In addition, special budget to fund the introduction and use of new and existing technology and clinical practice.
6.7 Transplants				
Transplant services are excluded from the HRG system to ensure a high quality of clinical care and equity of access for patients.	Included in G-DRG.	Included in the GHS system, but additional budgets for hospitals that coordinate the retrieval and/or transplantation of the organ (annual lump sum), and an extra fee per organ retrieval.	Included in Dk-DRG.	Included in VIC-DRG.
6.8 Chemotherapy				
With the HRG4 system, the chemotherapy HRGs for cancer treatment have been unbundled.	Included in G-DRG. Supplementary fees if conditions specified in 6.6 are met.	Included in GHS. Supplementary fees if conditions specified in 6.6 are met.	Included in Dk-DRG.	Included but there are additional budgets for certain patients.
6.9 Radiotherapy				
With the HRG4 system, the radiotherapy HRGs have been unbundled.	Included in G-DRG.	Included in GHS.	Included in Dk-DRG.	Included in VIC-DRGs.
6.10 Interventional radiology				
With HRG4, all interventional radiology HRGs are unbundled.	Included in G-DRG.	Included in GHS.	Included in Dk-DRG.	Included in VIC-DRG.
6.11 Diagnostic imaging				
With HRG4, all diagnostic imaging with the exception of	Included in G-DRG.	Included in GHS.	Included in Dk-DRG.	Included in VIC-DRG.

England	Germany	France	Denmark	Australia (Victoria)
plain film x-ray and obstetric scans is unbundled.				
6.12 Renal dialysis				
With HRG4, all renal dialysis will be unbundled.	Included in G-DRG: specific DRGs & renal dialysis used as a split criterion for other DRGs.	Included in GHS.	Included in Dk-DRG.	Included in VIC-DRG, but supplemented with capitation grants.
6.13 Palliative care				
With HRG4, all Specialist Palliative Care will be unbundled.	Palliative units with at least five beds are excluded from the G-DRG system. Supplementary fees for complex palliative treatments are possible.	Excluded from GSH.	Included in Dk-DRG.	Excluded from VIC-DRG.
6.14 Mental health				
Excluded but specific HRGs are being developed to reflect activity undertaken by acute NHS trusts that do not provide specialist mental health services.	Excluded from G-DRG.	Excluded from GSH.	Excluded from Dk-DRG. Financed with global budgets.	Excluded from VIC-DRG.
6.15 Rehabilitation				
With HRG4, unbundled rehabilitation HRGs are only generated where care is identified as taking place under a specialist rehabilitation consultant or within a discrete rehabilitation ward or unit.	Excluded from G-DRG.	Excluded from GSH.	Included in Dk-DRG.	VicRehab is the funding system for Rehabilitation Units with 20 beds or more. CRAFT (Case mix Rehabilitation and Funding Tree) categories are based on diagnosis and functional status (Barthel score) at admission.
6.16 Admission through Accident and Emergency Department				
The additional costs of admission through A&E have been added to the admitted patient care non-elective HRG tariff in proportion to the numbers of patients admitted through A&E.	Included in G-DRG. No specific financing.	Included in GHS. No specific financing.	Included in Dk-DRG. No specific financing.	Included in VIC-DRG. No specific financing.

England	Germany	France	Denmark	Australia (Victoria)
A short stay emergency tariff reduction is applied to certain non-elective HRGs where length of stay is less than two days.				
6.17 Visits to Accident and Emergency Department (without admission)				
Application of the 80/20 fixed/variable funding model i.e. a grant covers 80% of (fixed) costs and 20% of revenue is related to (variable) activity up to a planned level.	Emergency services are financed with specific budgets	A&E Departments are financed with specific annual lump sums. In addition, a single national tariff is applied for each patient's episode in an A&E Departments which is not followed by hospitalization.	The Danish Ambulatory Grouping System (DAGS) was introduced on January 1st 2002. DAGS are divided into three major types of visits: ambulatory visits, emergency room visits and telephone consultations. The rates for ambulatory patients also include costs for drugs and medical devices. However, expensive drugs and devices can be financed separately.	Hospitals with major 24-hour A&E services are financed with 'non-admitted patient emergency services grants'.
6.18 Outpatient (ambulatory) services				
In HRG4, the same HRG can be assigned regardless of setting if a procedure can be performed across different settings. The objective is to avoid perverse incentives associated with providing the same care in different settings (primary care, outpatient, day care, inpatients). This rule only applies to intervention based HRGs.	Outpatient services are not included in the G-DRG system, but are separately reimbursed through fee-for-service systems. *Exception to this rule*: Pre-and after-care services associated with an inpatient stay are not financed separately but are included in the DRG of the corresponding hospitalisation. • Pre-care services may not exceed more than three days and have to be performed within five days before the patient is admitted. • After-care services may not take more than seven days and have to take place within 14 days after the end of the hospitalization.	Outpatient services are not included in the GHS system, but are separately reimbursed through fee-for-service systems.		Outpatient care in Victoria is financed by the Victorian Ambulatory Classification and Funding System (VASC) that incorporates case mix funding principles. The encounter is defined as the clinic visit, plus all ancillary services (pathology, radiology and pharmacy) provided within the 30 days either side of the clinic visit.

5 BELGIAN HOSPITAL ACTIVITY AND THE APR-DRG GROUPER: DATA AND METHODOLOGICAL ISSUES

The review of case-based or activity-based hospital financing in the five selected countries (Chapter 4) resulted in a detailed overview of cost calculation methods and methods to determine the DRG tariff, of how outliers are defined and of which hospital activities are included in the case-based financing. The practice of case-based financing in the five countries served as background for the assessment of the feasibility of an all-inclusive case-based payment system for Belgian hospitals. As mentioned in section 1.2, the overall objective of the study is to evaluate the technical feasibility of introducing a case-based payment system, where 'technical' refers to possible constraints in data availability or methodological problems. Of course, a technical feasibility study is a necessary but only first step in the decision-making process of implementing a hospital financing reform. Implementation of a reform also requires wide acceptability by stakeholders. We come back to this issue in Chapter 7.

The focus of Chapter 5 is twofold. First, a detailed description is given of the available data and of the different steps that have to be undertaken to create a workable database that will permit the calculation of all-inclusive case-based tariffs. A summary of the available data and these steps is provided in the main text. More details, figures and tables are in appendix. Since the implementation of a classification system requires an analysis of its ability to describe and analyse hospital activity, the second aim of this chapter is to identify a range of methodological considerations that demand careful attention. Therefore, the applicability of the APR-DRG grouper is evaluated in its ability to describe Belgian hospital activity whereby the current system of financing hospital activities as described in Chapter 3 is taken as the starting point.

For a clear understanding of this chapter, five remarks should be kept in mind. First, as already mentioned in section 2.2.2, from a semantic point of view it is important to clearly define the perspective of the concepts "price" and "cost":

- By "price" is meant the amount paid by the third-party payer (authorities, sickness funds) for care provided in hospital (by fees, tariffs or charges). From the perspective of the third-party payer, paying prices for hospital care results in expenses. From the hospital perspective, this represents revenue.
- By "cost" is meant expenses made by hospitals and which directly or indirectly related to providing care.

This distinction is important since two approaches to calculate DRG weights and tariffs are investigated. In the first model weights and tariffs are based on NIHDI reimbursements. These "prices" reflect the way hospitals are currently financed (with data for 2005): fee-for-service payments for medical specialists, a fixed and variable part of the budget of financial means, payments for pharmaceutical specialties, for day care, etc. (see section 3.4). This model mainly serves to assess whether the APR-DRG grouper corresponds to hospital cost patterns in Belgium. More specifically, it is analysed how well the APR-DRG classification performs on Belgian data in terms of homogeneity of resource use within DRGs. The price model is also used to identify where modifications to the APR-DRG classification may seem necessary before application in Belgian hospitals. DRG weights and tariffs derived from this model are mainly shown for illustrative purposes. Ideally, both should be based on actual costs since prices or reimbursements also reflect the historical bargaining power of providers or political negotiation and may overestimate or underestimate true costs. In the second model a first step towards a costing methodology was taken. This (mainly) top-down activity-based costing (ABC) approach is applied to data from 9 hospitals since no exhaustive database with cost data for the Belgian hospital sector is available. To ease the wording in Chapter 5 and 6, the first approach will be referred to as "price model" and the second approach as "cost model".

A second remark relates to the scope of the study. As will become clear from the description of the available data, it was decided not to enlarge the scope of the study to the outpatient sector. Limiting the all-inclusive case-based reimbursement to activities performed during inpatient (and day hospital) stays could stimulate the substitution of outpatient care for hospital care since financial considerations may play an important role in the decision of where to treat patients. Since the focus of this study is the (technical) feasibility of an all-inclusive case-based reimbursement of hospitals, no attempts were made to investigate the possibilities of integrating outpatient data into the case-based reimbursement rate. A second motivation for not broadening the scope of the study is the lack of diagnostic information for outpatient treatments at a national level.

Third, to enhance the readability of this chapter, most tables and figures were transferred to the appendix. Although much care was taken in the presentation of these tables and figures, it was impossible to translate all information to English. We apologize for this inconvenience to all non-Dutch readers of this study. In addition, not all variables in all tables are labelled or sufficiently explained. This second inconvenience is largely limited to original databases with raw data.

Fourth, Chapter 5 does not provide an exhaustive list of possible data and methodological issues which may be encountered when calculating all-inclusive case-based tariffs for hospitals. Although the presented issues are not exhaustive, they allow examining the feasibility of using routinely collected data or specific hospital cost data to reimburse Belgian hospitals per case. The methodological considerations dealt with in Chapter 5 are all related to the calculation of a fixed predetermined amount per stay, based on a DRG relative weight (or DRG relativity) and a base payment rate as explained in section 2.2.1.

Fifth, throughout Chapter 5 and 6 the APR-DRG grouper (version 15.0), used for the hospital prospective global budgeting system since 2002, was applied to measure a hospital's case-mix. No other versions of the APR-DRG grouper, other variants of the DRG-grouper or classifications not based on DRGs were evaluated.

Section 5.1 describes the data samples on which the price and cost model are based. Next, a summary of the available data sources is given in section 5.2. Data and methodological issues in the price model and cost model are identified in sections 5.3 and 5.4 respectively. Section 5.5 discusses the APR-DRG based budget allocation to hospitals. Section 5.6 provides a hospital typology to better understand the effects of a case-based financing system.

5.1 DEFINING HOSPITAL SAMPLES

In determining the hospital sample size for calculating DRG weights and tariffs, the trade-off between high-quality data and obtaining a representative hospital sample is a point of particular interest. As appeared from the review of the selected countries, the sample size varies substantially across countries. While in England all hospitals are included into the data sample for calculating weights and tariffs, in France the data sample consists of only 5% of public hospitals providing cost data.

In Belgium, even in the absence of direct ownership of hospitals by the public health authorities as is the case with the NHS in England, hospitals are subject to extensive, compulsory and legally well-defined registrations of financial and structural data as well as clinical case-mix data. Case-mix data are collected at the level of patient stays and subsequently grouped in APR-DRGs using the 3M™ grouper software. Afterwards those clinical data are coupled to billing data by a designated linkage authority (TCT – Technical cell). Consequently, the Belgian "data sample" is an exhaustive 'national data sample' of which data are at the disposal of public health care authorities.

In addition to the above national database, data were available for a selection of 27 hospitals, including 4 university hospitals, 23 non-university hospitals (10 public and 13 private hospitals). Three hospitals are located in the Brussels Capital Region, 4 in the Walloon region and 20 in Flanders. For the calculation of cost weights in the cost model, the composition of the sample of hospitals and its representativeness are of great importance.[20] The hospitals of which the cost data were analysed were not randomly selected but are hospitals that agreed to provide data for the project "Analysis of financial flows of Belgian hospitals according to patient-mix" as described in section 5.4.1. Due to data availability problems, the final database on which the cost model was applied consisted of 9 hospitals.

5.2 DATA SOURCES: HOSPITAL CASE-MIX, BILLING AND ACCOUNTING DATA

In this section a summary is given of the data acquired through national compulsory registrations.

5.2.1 Minimal Clinical Data (MCD)

The registration of the Minimal Clinical Data was made compulsory for all general hospitals by the Royal Decree of December 6, 1994[hh]. The Minimal Clinical Data (MCD) set is based on the International Classification of Diseases – 9th Revision-Clinical Modification (ICD-9-CM). In psychiatric hospitals or psychiatric departments of general hospitals, the equivalent Minimum Psychiatric Data are recorded. Registration applies to inpatient and day care (since 1995) stays. Stays for newborns are registered since 2000 (Royal Decree of May 3, 1999) and emergency contacts since 2003 (Article 55, paragraph 1 of the Royal Decree of April 25, 2002 changed by the Royal Decree of January 29, 2003).

The registration consists of 10 relational records: hospital, patient in hospital, hospital stay, stay per medical specialism, stay per bed index, stay in nursing department, diagnosis, procedure ICD-9-CM, procedure NIHDI and birth data for newborns. A detailed description of all variables included in the different records is given in the Supplement of KCE-report vol. 30 by Van De Sande et al. (2006)[94] and in the brochure of the Federal Public Service of Health, Food Chain Safety and Environment with guidelines for the registration of the MCD.

The linkage between the 10 relational records of the MCD is based on two key variables: the identification number of the stay and the patient identification number. The identification number of the stay is composed of the CIV-number[ii] of the hospital, the registration semester and year, and the number of the stay. The patient identification number consists of the CIV-number of the hospital, the registration year and the anonymous patient number assigned by the hospital. This last number remains the same in different data registrations (inpatient and day care) for at least a year within the same hospital. The linkage of MCD records with other data sources is based on the CIV-number of the hospital, the registration semester and year, the patient identification number and the identification number of the stay.

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hh The first Royal Decree on the registration of MCD (1990) was nullified by the decision of the Council of State (December 10, 1993).

ii Centre for information processing (Centrum voor Informatieverwerking in Dutch).

5.2.2 Hospital billing Data (HBD)

Hospital billing data are often referred to as "Minimal Financial Data (MFD)" while the correct term should be "Anonymous Hospital Stays"[jj]. The term "minimal" does injustice to the fact that hospital billing data are available in a comprehensive way.[kk]

The Royal Decrees of July 3, 1996[95], October 11, 1997[96] and February 19, 2001[97] determine the content and delivery modalities of the HBD.

The transfer of the HBD by tapes to the sickness funds is obliged since 1999. The tapes contain billing data concerning lump sums and medical acts (nomenclature). These are registered according to the instructions of the NIHDI. The files are organized as blocks of different record types consisting of the starting date of the invoice, number of nursing days, pharmaceutical products, end of the invoice, etc.

To link the data of the stay with the billing data, the hospitals were required to complete the following conversion file: CIV-number, billing year, invoice number, MCD registration year, MCD patient identification, MCD identification of stay.

5.2.3 MCD-HBD linkage

Hospitals have to send MCD records, after stripping of direct patient-identifying information, to the federal Ministry of Health (Federal Public Service) biannually. Here all department registrations are concatenated with establishment of the primary diagnosis of the whole stay, determinant for the grouper software that adds APR-DRG, SOI and mortality index assignments to the stay records.

Since 1995 the MCD records are linked to the HBD. Linkage is performed by a legally instituted 'Technical Cell' (TCT - see https://tct.fgov.be/etct/) and therefore all validated MCD data are to be transferred by the MoH to the TCT at most 18 months after the end of each registration year. Linkage itself requires separately sent matching tables containing for each identifiable hospital stay an unique patient pseudonym created by two separately executed cryptographic hashings: the first by the hospital or sickness funds respectively and the second by an appointed security advisor of the MOH. Linkage process takes about 2 years to completion and full validation. Linkage percentages increased over the years and exceed nowadays 95% overall, if HBD stay counts are taken as denominator (see Table 11). This means that the relationship between treated pathology and the costs to the health care system can be studied, at least for 'inpatient' hospital admissions. It is important to recognize that the MCD-HBD registry is structured as a relational database encircling 10 separate datasets for the MCD registry and 7 for the HBD registry.

Table 11: Calculation of primary linkage percentages 2005

Denominator (total stays in 2005)		**Nominator** (truly linked stays)	**Linkage (%)**
all stays with MCD (linked or not)	1 869 757	**1 619 654**	86.6%
all stays with HBD	**1 690 104**	**1 619 654**	**95.8%**
all stays MCD-HBD (linked or rejected)	1 650 531	**1 619 654**	98.1%

5.2.4 Minimal Nursing Data (MND)

The registration of the Minimal Nursing Data is compulsory for all general hospitals since 1988 (Royal Decree for August 14, 1987 changed by the Royal Decree of December 11, 1987). Since 2000, the registration of inpatient stays was extended to day care stays and stays of newborns (who do not share a room with the mother). The MND set contains information on the patient, the type of stay (inpatient, day care or newborn), the daily nursing care provided to the patient and the nursing staff present at the nursing departments (number of persons and hours worked).

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jj Anonieme ziekenhuisverblijven – AZV in Dutch; Séjours hospitaliers anonymes – SHA in French.

kk See http://www.riziv.fgov.be/information/nl/studies/study07/pdf/study07.pdf for an explanation of the confusion in terminology and for a detailed description of the hospital billing data.

The registration is done in four sampling periods, namely the first 15 days of March, June, September and December. For each of these periods, the government indicates arbitrarily five days for which a data transmission is required. The MND registration contains the following records:

- hospital
- hospital stay
- human resources data
- observation data of a day
- number of beds per nursing department and bed index (annual data)

Since 2008 new MND specifications are applied. The linkage of MND with other data sources is based on the recognition number, number of stay, registration year and registration quarter.

5.2.5 Day care Billing Data (DBD)

The Day-care Billing Data (DBD) are a similar compulsory registration of all NIHDI reimbursements for 'one day' hospital stays and a number of outpatient treatments that require the use of hospital facilities covered by some lump sum remuneration.

In 2004-2005 this included lump sums for renal dialysis, plaster room use, mini, maxi, A, B, C, D lump sums and provisional lumps sums for surgical day care centres. This regulation expired on 01/07/2007 (section 3.4.4.1).

DBD registration started in 2004. The data are annually transmitted by the sickness funds to the NIHDI. It took some years to their full exploitation, due to extensive validation procedures in the first years. In 2006 for the first time DBD data were linked to day care MCD registrations.

5.2.6 Accounting data: Finhosta

Health care institutions are required to transfer their accounting data to the FPS of Health, Food Chain Safety and Environment on an annual basis (Royal Decree of December 14, 1987). To verify these data, the computer application "Finhosta" (collection of statistical and financial data) was developed. The Finhosta-registration contains the following files:

- general balance
- analytical balance
- applied indirect cost allocation drivers
- monthly report of nursing days and admissions
- quarterly report of the dismissed patients
- quarterly report of the lump sums
- days per sickness fund
- annual number of nursing days
- financial statement of registered rent
- charges of investment loans
- charges of cash credits
- depreciation
- personnel expenses
- irregular performances of staff
- employed staff
- social balance, containing the following sub tables:
  - state of the employees registered in the personnel register
  - temporary employees and persons available for the hospital
  - staff turnover during the financial year

- state of employment measures during the financial year
- information about training during the financial year
- state of preliminary flotation, intangible assets and financial assets
- state of fixed assets
- guaranteed debts
- debts concerning taxes, salaries and social charges

A detailed description of the records included in Finhosta can be found in the brochure 'FOD Health, Food Chain Safety, Environment, Application FINHOSTA: version 2.6; Collection of statistical and financial data from the hospitals: Formats of the data files'. The linkage of Finhosta with the other registration systems is based on the recognition number of the hospital and the year.

5.3 THE PRICE MODEL

5.3.1 Introduction

The APR-DRG grouper was mainly evaluated on the basis of NIHDI reimbursements. Although prices may deviate substantially from actual costs, the price model allows a thorough assessment of the applicability of the APR-DRG grouper in describing Belgian hospital activity in terms of homogeneity within groups, small cell DRGs, etc. The price model also allows a number of data adjustments (construction of new variables and adjustments to lump sum reimbursements) to go from a data base reflecting the current financing structure to a workable database that will permit the calculation of all-inclusive case-based tariffs.

Many data and methodological issues discussed in section 5.3 are also relevant for the cost model. Consequently, in section 5.4 discussing the cost model, only issues specific to this model will be treated. In section 5.3 the following data availability issues are addressed:

- Initial selection of hospital stays based on raw data (5.3.2);
- Construction of new variables (5.3.3);
- Adjustments to lump sum reimbursements (5.3.4);
- Defining the fraction of the Budget of Financial Means (BFM) to be included in the analysis and primary/secondary exclusions (5.3.5);
- Data cleaning operations (5.3.6).

In addition, methodological issues about the distribution of the BFM among individual stays and about the applicability of the APR-DRG grouper are discussed, including:

- The construction and validation of the hospital severity score (5.3.8);
- A homogeneity analysis containing outlier definition and intra-DRG resource use variability (5.3.9);
- Small cell analysis (5.3.10.2);

Finally, suggestions for sub-grouping and exclusions are expressed (5.3.11-5.3.12).

5.3.2 Initial selection of hospital stays

Hospital case-mix and billing data for stays during 2004-2005 were made available for this study. At the start of the study, the data for 2005 were the most recently available data. To calculate the APR-DRG weights and tariffs in the price model, only stays in 2005 were included. Data for stays in 2004 were used as input for the extrapolating exercises (section 5.3.4). In the next subsections the different steps in the selection process for hospital stays are described. Most tables and figures are given in Appendix 3.

The complete set of all APR-DRGs contains 355 groups and 4 severity of illness (SOI) subclasses for each base APR-DRG plus two so-called residual APR-DRGs without SOI. Hence, in total there are 1 422 mutually exclusive groups. Table 3.1 in Appendix 3 gives the number of linked stays per APR-DRG-SOI group for 2005.

5.3.2.1 *Linked case-mix and billing data (MCD-HBD) for inpatient hospital stays*

The inpatient stays in 2005 as linked and validated by the Technical Cell are used as a starting point. This amounts to 1 619 654 stays. In theory, these stays can be spread over 1 422 APR-DRG-SOI groups. However, for a limited number of APR-DRG-SOI groups there were no inpatient stays for 2005 (Table 3.2 in Appendix 3).

The (partially) psychiatric stays were excluded (Table 3.3 in Appendix 3). For a number of APR-DRG-SOI the number of linked stays was less than or equal 10. This cut-off threshold of 11 linked stays is arbitrary, but was also chosen in the system of reference amounts (see section 3.4.3.3).

Small cell size may make the estimation of weights imprecise and unstable over time. In section 5.3.10 a solution is proposed to handle small cell size. Table 3.4 in Appendix 3 gives the APR-DRG-SOI with less than 11 linked stays in 2005.

5.3.2.2 *Day care billing data (DBD)*

For stays in day care in 2005 no linkage of case-mix and billing data was available. Moreover, the new national agreement of July 1, 2007 introduced seven new lump sums for day care (section 3.4.4.1). To adapt the billing data of 2005 to the current legislation, flags were added to capture the lump sum payments actually in force. There were however some limitations:

- Stays with a lump sum payment for chronic pain could not be marked since they involve newly created nomenclature codes.
- Stays with a lump sum payment "plaster room" or "mini" lump sum were not taken into account since they can be considered as being related to outpatient services. Moreover, the regulation of these lump sum also changed substantially by the national agreement of July 1, 2007 (e.g., part of the lump sum was integrated in the seven new lump sums).
- Stays with nomenclature codes relating to the seven new lump sums and the "maxi" lump sum were marked. For the "maxi" lump sum a distinction was made between general anaesthesia (Maxi=1) and oncology (Maxi=2).

Table 3.5 in Appendix 3 gives an overview of the marked stays in day care. For each of the seven groups of stays, a number of stays is also marked for the "maxi" lump sum (for general anaesthesia or oncology). According to the new regulation of July 2007 (adapted in July 2008), hospitals have in this situation the choice between billing the "maxi" lump sum or billing one of the seven new lump sums depending on which of the two has the largest amount. Since the "maxi" lump sum is hospital-specific, the eventual choice (made in reality) will also be hospital-specific. In the final choice of lump sum attached to these stays eligible for two lump sums, hospital-specific amounts for the "maxi" lump sum applicable on July 1, 2007 were taken into account. For 13 hospitals this amount was larger than the day care lump sum (one or more of the seven groups).

Table 12: Adjusted day care stay counts per type of lump sum

Lump sum	Description	Stays
M	Maxi lump sum	780 473
G1	One day group 1	39 059
G2	One day group 2	95 369
G3	One day group 3	10 268
G4	One day group 4	15 542
G5	One day group 5	18 949
G6	One day group 6	15 694
G7	One day group 7	74 737
Total		**1 050 091**

Table 12 summarizes the number of adjusted stays per type of lump sum. Given the limited information generated by this exercise and especially a granularity (only 8 distinct groups) that proved too coarse, **it was decided not to integrate the day care stays into the feasibility study**.

However, as soon as the case-mix and billing data for day care stays are linked and validated, all previous and following steps in Chapter 5 and 6 should be repeated with inclusion of the day care stays.

5.3.3 Construction of variables

In Chapter 6 the impact of different choices for an all-inclusive case-based reimbursement of hospitals is simulated. These choices are partly based on the inclusion/exclusion of certain (groups of) nomenclature codes or lump sums, or of patient or hospital characteristics. In Appendix 3.1 a detailed description is given of the concerned variables.

5.3.4 Adjustments to lump sum reimbursements

The components and payment of the hospital budget since July 1, 2002 were explained in detail in section 3.4.2.2. The current lump sum payments for laboratory testing, medical imaging and for pharmaceutical specialties were described in section 3.4.3. Some of these lump sum payments are reimbursed whether or not there is an act. Replacing these fragmented (sometimes case-based) lump sum payments with one payment including all hospital activities necessitates adjustments to the database since the hospital billing data for 2005 do not accurately reflect realized activities. In Appendix 3.2 adjustments to lump sum reimbursements for laboratory testing and medical imaging are explained. Adjustments to the way the hospital budget is calculated are treated in section 5.3.4.1. Since the prospective budget for pharmaceuticals administered to patients hospitalized in an acute hospital was introduced only on July 1, 2006, no adjustments had to be made in the database for 2005.

5.3.4.1 Adjustments to the hospital budget

The budget of financial means (BFM) is paid per budget year which runs from July 1 to June 30 of the next year.[ll] Adjustments are possible on the 1st of January.[mm] The components and the payment of the budget were already described in section 3.4.2.2. As explained in that section, a distinction has to be made between stays reimbursed by the compulsory health insurance and other stays (e.g. reimbursed by a private health insurance, by public municipal welfare organizations, by the work accident insurance). No data are available in the hospital billing data for these other stays. Hence they are excluded from our analysis. In the case-mix data (MCD) these other stays amount to about 10% of all stays during 2004-2005.

For stays reimbursed by the compulsory health insurance, the reimbursement consists of a fixed and a variable part. The fixed part cannot be attributed to an individual stay. The variable part depends on the number of days and/or the number of admissions. The NIHDI nomenclature contains specific billing codes for these reimbursements per day or admission (grouped in N-group N87). Table 3.22 in Appendix 3 shows the codes applicable in 2004-2005.

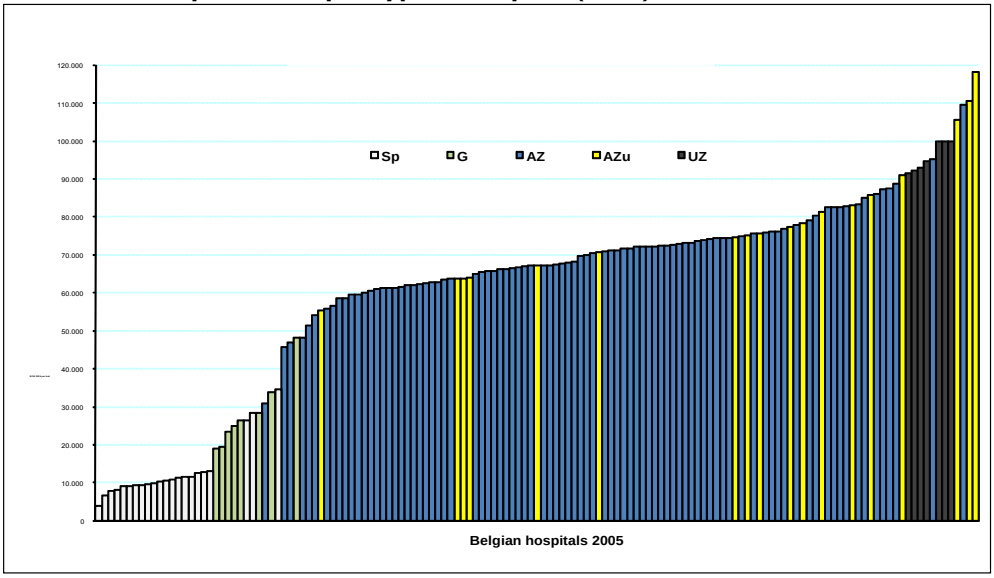
The current exercise is based on the BFM reimbursed on the 1st of July, 2005. Figure 6 shows the allocation of the total national hospital budget over the individual hospitals, according to hospital type (Sp=specialized; G=geriatric; AZ=general; AZu=general with university beds; UZ=university). The individual hospital budget is calculated per hospital bed. Chronic hospitals (Sp and G) clearly receive a lower reimbursement per bed than acute hospitals (which sometimes also cover specialized or geriatric departments). The striking difference in reimbursement per bed between the two types of hospitals may be an indication that they should be treated separately in the calculation of cased-based reimbursement rates. However, at this preliminary phase in the analysis of the data, no firm conclusion was drawn on the separate or integrated treatment of chronic hospitals since also for the acute hospitals large differences exist in the absolute amount reimbursed per bed.

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ll Art. 3 §2 of the Royal Decree of April 25, 2002..

mm Art. 4 of the Royal Decree of April 25, 2002.

Figure 6: Allocation of the national budget of financial means (BFM) to individual hospital beds; per type of hospital (2005)



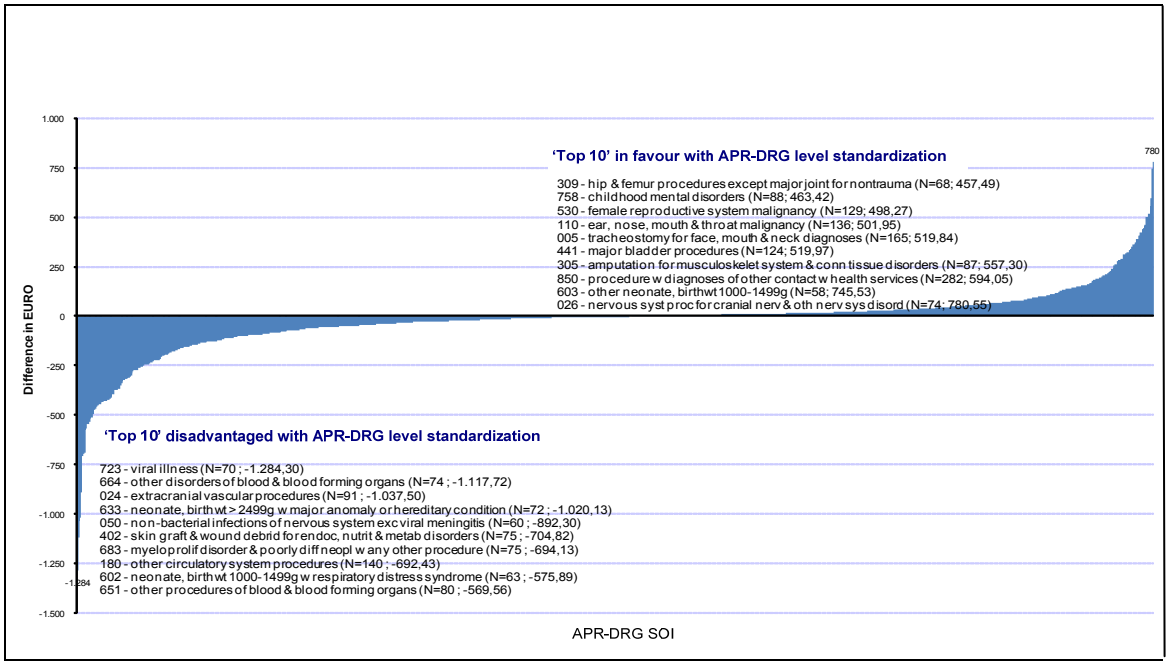
The variable part of the BFM applies exclusively to subparts B1 and B2 (theoretically 20%). Reimbursements for these 20% of B1 and B2 are recorded twice: once in the hospital billing data of the NIHDI and once in the BFM, the dataset provided by the FPS. Obviously, one of the two registrations has to be excluded when calculating case-based weights and tariffs.

As made clear in the section on costing methodology in Chapter 2 (section 2.2.2) a necessary step concerns the identification of consumed resources. Which resource items should be included in the calculation of DRG weights and tariffs? An answer to this question can be based on methodological grounds (e.g. inclusion or not of overhead costs), but also on data grounds. Given the fact that the fixed part (which includes – theoretically- 80% of the subparts B1 and B2) can not be allocated directly to individual stays (unless a sophisticated fine-grained allocation method is used as described in the revenue module of the cost model – see section 5.4.1.5), a choice has to be made on how to treat this substantial part of the hospital revenue. Should the APR-DRG weights be exclusively based on that part of the hospital budget that is in a direct way attributable to a stay? If yes, what about the calculation of the tariff? Should we include different resource items in the DRG weights as compared to the tariffs? Or should the fixed part of the BFM be distributed among the stays? And if yes, according to which criteria? To answer the above questions, many debates within the research team took place and a thorough data analysis was performed (not all results are shown in the report).

In a first instance, two tentative methods were employed. In the "exclusive" method the BFM was excluded, in the "inclusive" method it was included. To distribute the BFM among the stays in the inclusive method, hospital specific lump sums per day and/or admission were converted to a "100% day price". This day price, which is in fact an extrapolation of the current lump sums in the variable part of the BFM, was not only differentiated according to the hospital but also according to the type of bed (A, B, G, PAL or Sp), nomenclature code for the lump sum per day, year and semester of the stay. Next, these day prices were standardized over all included hospitals per type of bed and APR-DRG-SOI. These equal day prices for all hospitals per APR-DRG-SOI and per bed-type can be motivated by the concern that severe pathology APR-DRGs, which are mostly treated in large care centers, otherwise would be standardized to the level of all hospitals. Standardization per pathology (APR-DRG) and severity of illness allows more differentiation.

Figure 7 illustrates the difference in mean price per APR-DRG-SOI between standardization per APR-DRG-SOI and bed-type and no standardization.

Figure 7: Standardization per APR-DRG-SOI and bed-type versus no standardization: mean price per APR-DRG-SOI (acute hospitals, APR-DRG-SOIs with <50 stays omitted)



To calculate the mean price, extrapolated fee-for-service reimbursements were used for laboratory testing and medical imaging and lump sum reimbursements for these activities were removed from the dataset in both methods. No other adjustments to the HBD or the BFM, which are discussed in the remainder of Chapter 5, were made at this stage of the analysis.

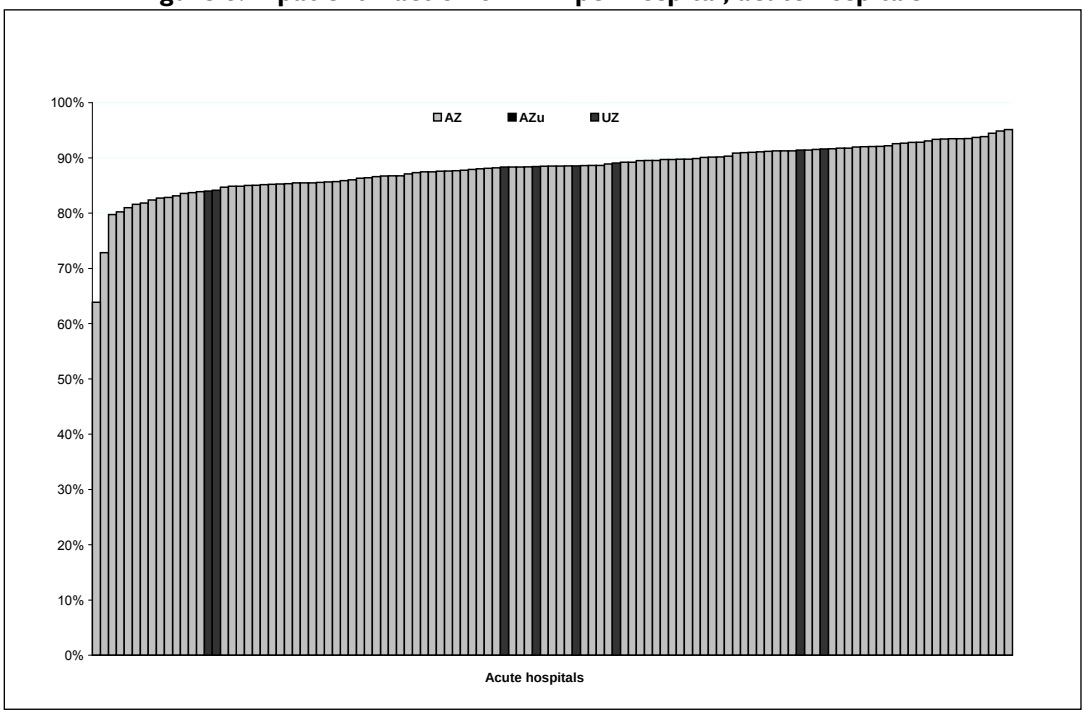
Finally, it was decided by the research team that the same resource items should be included for the APR-DRG weights and tariffs. However, instead of using a 100% day price extrapolated from the current lump sum payments, an indicator was searched for to distribute the budget of financial means among the individual stays. Otherwise, the part of the hospital budget not directly attributable to individual stays had to be distributed among hospitals irrespective of their case-mix. Section 5.3.8 provides one possibility of such an indicator, namely the 'hospital severity score'.

5.3.5 Budget of financial means (BFM): inpatient fraction and primary/secondary exclusions

The BFM includes payments for day care activities, in vitro fertilization, mobile emergency group etc. For the current study only the fraction of the BFM related to inpatient hospital activities is relevant, since linked case-mix – billing data for day care were not (yet) available in the course of the study. Different methods exist to calculate the ratio of the BFM related to inpatient hospital activities to the total BFM. The choices made will be explained and motivated, but others are possible as well.

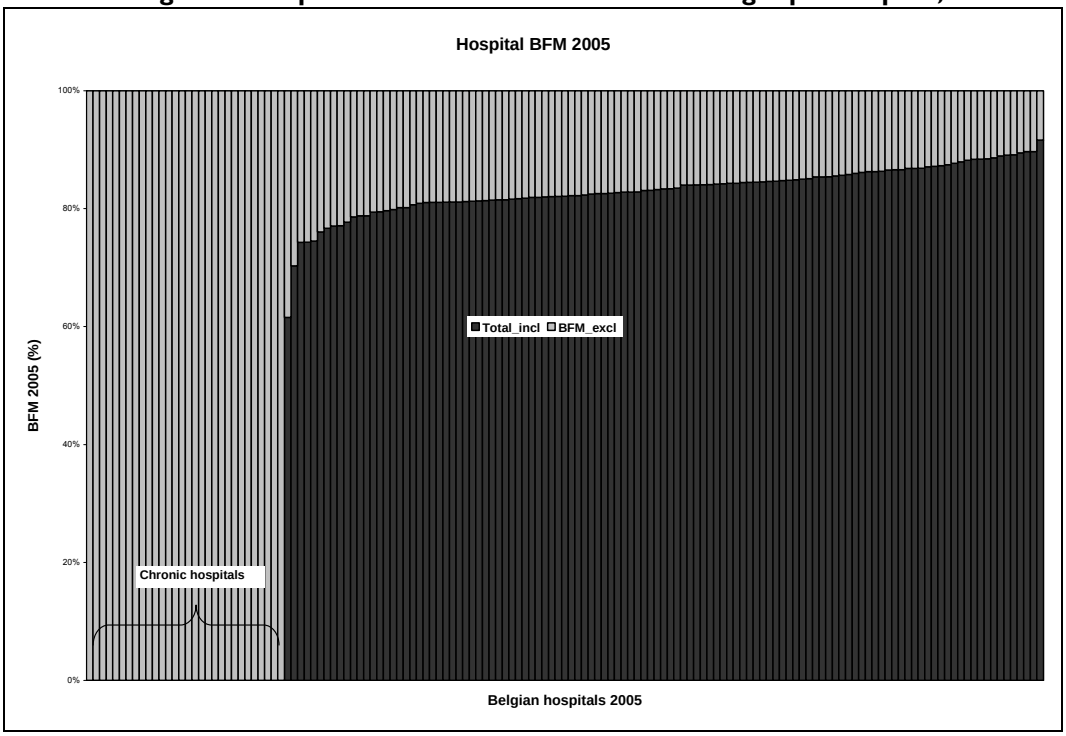
Calculation of the relevant fraction of the BFM is based on the most recent available year of comprehensive stay day remuneration data which is 2004 (activities realized in 2004 and invoiced in 2004 or 2005). The ratios applied to the BFM are calculated by dividing the variable part of the hospital budget (20% of B1 and B2 for inpatient stays) by the sum of this variable part and lump sum payments for day care (A-B-C-D and "maxi"). This ratio is calculated for each hospital individually. All data are available in the hospital billing data (HBD). The resulting fractions per hospital which are used in the current study are presented in Figure 8.

Figure 8: Inpatient fraction of BFM per hospital, acute hospitals



In addition to the calculation of the inpatient fraction of the BFM, other adjustments were explored (Table 3.23 and Table 3.24 in Appendix 3). These adjustments can be divided into 'primary' and 'secondary' exclusions. Primary exclusions concern the exclusion of that part of the BFM that reimburses hospital departments which are specific to a limited number of hospitals (specialized, palliative and burn department). Secondary exclusions concern the exclusion of subparts of the BFM (parts of A, B or C) if not all analysed hospitals benefited from corresponding BFM subpart funding in 2004. In Figure 9 the proportion included/excluded BFM budget can be seen per hospital.

Figure 9: Proportion included/excluded BFM budget per hospital, 2005



5.3.6 Data cleaning

When performing preliminary data preparation and validation work, the original and linked data showed a number of problematic stays for this study. Some examples of data cleaning operations are described in Appendix 3.3.

5.3.7 Final representativeness of the database used for the price model

Table 13 gives an overview of inclusions and exclusions and of the final number of stays included in the calculation of the DRG weights and tariffs in the price model as used in the remainder of Chapter 5.

We briefly repeat the major steps in the inclusion or exclusion of stays which have been taken until now. The starting point was the number of stays in the original MCD data set, whether they are reimbursed by the NIHDI or not. Linking the MCD to the HBD mainly excluded stays not reimbursed by the NIHDI. Next, mixed stays, stays with missing data or with a questionable LOS were excluded.

In addition, adjustments to the current lump sum reimbursements were made in order to more accurately reflect realized activities. To identify consumed resources at the level of an individual stay, a solution had to be found to distribute the budget of financial means (BFM) among the individual stays. Tentative methods were explored (exclusive and inclusive method), but it was decided to search for an indicator which allows a distribution of the BFM among hospitals taking into account their case-mix. This indicator is the 'hospital severity score' which will be discussed in section 5.3.8 and accompanying appendix.

Table 13: Rejected and accepted stays, 2005

Global stay counts 2005			
Sources	**Stays**	**Linked stays**	**Representativeness**
All MCD stays (NIHDI reimbursed or not)	1 869 757	-	All inpatient hospital stays
All HBD stays 2005	**1 690 104**	-	All NIHDI reimbursed stays 2005
Linked MCD-HBD stays	1 650 531	**1 574 411**	**93.2% NIHDI reimbursed stays 2005**
Data cleaning & rejections	**Refuted stays**	**Remaining stays**	**Remaining stays**
Mixed stays (acute + chronic) in acute hospitals*	-18 565	1 555 846	92.1% of NIHDI reimbursed stays 2005
Zero HDB total (missing data)	-177	1 555 669	92.0% of NIHDI reimbursed stays 2005
Questionable LOS: ABS(Diff LOS_MKG - tot_inv_d) > 1	-10 091	1 545 578	91.4% of NIHDI reimbursed stays 2005
Zero day care billing data	-5 130	1 541 448	91.1% of NIHDI reimbursed stays 2005
Only day prices for 'one day' (in other hospital)	-275	1 540 173	91.1% of NIHDI reimbursed stays 2005
Kept for analyses	**Stays**	**Final representativeness**	
Stays in **chronic hospitals**	**9 477**	0.8% of NIHDI reimbursed stays 2005 – 92.9% of stays of all Belgian chronic hospital stays	
Stays in **acute hospitals**	**1 530 696**	90.4% of NIHDI reimbursed stays 2005 – 99.1% of all Belgian acute hospital stays	
Acute wards	1 525 256		
Chronic (Sp) wards	2 225		
Palliative care wards	3 215		
* Not suitable for price calculations			

5.3.8 Hospital severity scoring

As mentioned in section 5.3.4.1, it was decided that the same resource items should be included for the DRG weights and the tariffs and that an indicator should be searched for to distribute the budget of financial means[nn] among the individual stays, preferably also according to the case-mix. Different possibilities were explored to classify hospitals in relation to an indicator, related to the case-mix and applicable to the budget of financial means.

It should be kept in mind that the approach which was chosen[oo] is only one of many possible ways of capturing hospital characteristics and relate them to a case-mix based indicator. The contribution of this section is not the indicator as such, but is intended to stress the necessity of allocating the BFM to the level of individual stays in a way which accounts for differences in case-mix between hospitals.

The general idea for constructing an indicator, which we called the "hospital severity score", was to give points to hospitals based on a relative weighing of inter-APR-DRG severities as opposed to the SOI-levels within the same APR-DRG (intra-APR-DRG). Two variants were explored. First, APR-DRGs were weighted with the percentage of inpatient and day care stays in SOI 3 and 4 as weights (data for 2004 and 2005). Second, APR-DRGs were weighed with mean reimbursements in SOI 3 and 4 for linked inpatient stays as weights (linked data for day care stays were not available; data for 2005). In Appendix 3.4 a detailed description is given of the construction and validation of the hospital severity score.

5.3.9 The homogeneity challenge

Patient classification systems, such as DRG systems, claim to have defined medically coherent and cost homogeneous case groups. The role of DRGs as a payment mechanism not only consists of reimbursing providers fairly for the work they do but also of encouraging efficient provision of services.[99] Hence DRGs need to be based on economically, statistically as well as clinically meaningful groups. Otherwise they would not be accepted to be used in prospective payment systems with flat case rates. Economically, patients within one group should have 'homogeneous' costs and statistically such groups should be as low-variant as possible. Clinically, cases allocated to one group should be distinguishable from other groups based on main diagnosis, severity, co-morbidity and/or treatment performed.

Although there is a general acceptance of the above design characteristics of DRGs, for a real-world application more technical questions should be addressed: What are homogenous costs? Which DRG-granularity (broadly or tightly definition of DRGs) is preferable? What is the cut-off threshold for a split of DRGs because of a lack of within-DRG homogeneity? Etc.

This section discusses a selection of possible methodological issues encountered when trying to answer the above questions. There are no "best answers" to these questions but the answers depend on the specific country-context and on the relative importance attached to the principal objectives of a health care system (section 2.1.1). For example, broad diagnosis groups (less granularity) have the advantage that they create incentives for efficiency and reduce incentives for data manipulation. However, they also give incentives for 'cream skimming' lower cost patients. Narrowly defined categories (more granularity) on the other hand have the opposite effect. Even the definition of some key variables may considerably change incentives and results (see Appendix 3.5 for a change in definition of the principal diagnosis).

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nn Only the inpatient fraction after primary and secondary exclusions, as defined in section 5.3.5.

oo And which is partly inspired by the approach used in Catalonia to reimburse hospitals.[98]

5.3.9.1 *Describing Belgian hospital activity by APR-DRGs*

As described before, the basic idea of all DRG-like systems is that patient cases are assigned to clinically relevant groups with the least possible variance in costs. In this section the performance of the APR-DRG grouper for grouping episodes of care in Belgian hospitals is examined in terms of the homogeneity of resource use within groups. An evaluation of the applicability of the APR-DRG grouper is of course not new. However, a classification system can evolve over time and the applicability can be different for different countries.[100]

As a first step in the analysis of APR-DRG homogeneity, Belgian hospital activity data are described and summarized using numerical and graphical methods. In Appendix 3.6 measures of location, dispersion and shape are briefly summarized and some empirical results are provided, all for illustrative purposes.

An assessment of the variability of resource use within a DRG is often based on the coefficient of variation (CV). The larger the CV, the larger the dispersion of the observations around the average. Although there is no internationally accepted cut-off threshold for the CV as reflecting an acceptable degree of variation, a CV of 1 is conventionally taken. A CV of greater than 1 (100%) indicates a significant level of heterogeneity. The number of DRGs with CVs greater than 100% may be represented as a criterion for evaluating the performance of a classification.

The general picture revealed by the results in Appendix 3.6 is that Belgian hospital activity data for individual stays exhibit highly skewed and heavy tailed distributions, as is typical for this kind of data.

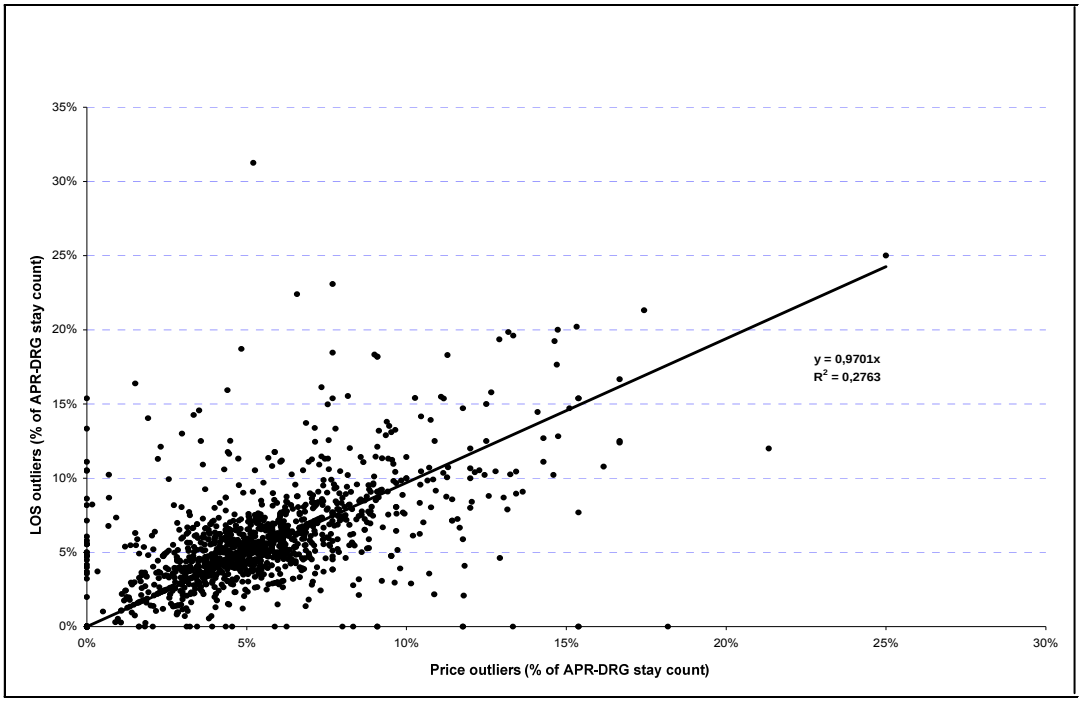
5.3.9.2 *Outliers*

Although DRGs are designed to be homogeneous in resource use, this does not mean that all patients within the same DRG have the same cost or LOS. Of course, costs are distributed within each group. But all patient classification systems are confronted with the problem that DRG-like groups include patients with resource use that is much higher or lower than the DRG reimbursement rate. The review of the five selected countries (and also the analyses in the previous section) has illustrated this for the respective DRG-like or other groupers. It is important to identify these outlier patients since they may influence the average cost and hence the DRG tariff substantially. Since high outliers occur more frequently than low outliers, the DRG tariffs tend to be overvalued if they are not corrected. Moreover, if these patients are outliers due to circumstances beyond the control of the hospital, some type of risk-sharing between the hospital and the payer and extra payments for the outlier cases may be appropriate. However, outliers may also be the consequence of an inadequate patient classification system. Table 8 and Table 9 in section 4.3.4 illustrated the divergent choices concerning the definition of trimming points and treatment of outliers. In all five selected countries outliers are defined in terms of length of stay rather than costs or prices.

Basically, two different trimming methods are used, namely parametric and nonparametric methods. The main difference between parametric and nonparametric methods is that the influence of the variance within a DRG on the trim point is significantly higher for parametric methods. However, there is no "best" trimming method in general. The choice of method should be based on an assessment of the available data and on the objectives of health-policy makers to be reached by using a DRG system.

As an illustration, Figure 10 compares percentages of LOS outliers with price outliers per APR-DRG-SOI. Some LOS outliers appear not to be price outliers at all (see points on Y axis) and inversely (see points on X axis). Furthermore, a R^2 of 0.2763 indicates small correlation. We also refer to Pirson et al. (2006) for an analysis of cost outliers based on Belgian APR-DRG data.[30]

Figure 10: Percentage LOS outliers vs. percentage price outliers per APR-DRG-SOI



Appendix 3.7 further explores different trimming methods and location parameters with Belgian hospital data.

After defining trim points for outliers, the next step consists of deciding on how to reimburse the outliers. The international review (section 4.3.5.3) revealed different reimbursement systems for short-stay and long-stay outliers. One option would be to differentiate the additional payment according to the number of outlier stay days. First, we calculate the 'excess reimbursements or billing amounts' per APR-DRG-SOI as well as the number of invoiced stay days (from day of admission) for price outliers. Excess billing amounts are obtained by subtracting the APR-DRG-SOI base price multiplied by the number of outlier stays (i.e. the 'inlier component') from the actual billed APR-DRG-SOI total for all outliers in that same APR-DRG-SOI. The difference divided by the number of billed stay days gives us the overall 'per diem' supplemental price for any outlier in that APR-DRG-SOI (see Table 3.30 in Appendix 3; Table 3.31 gives 'provisional' per diem supplement tariffs for 'no outlier' APR-DRG-SOIs).

Furthermore, in order to get more regressive tariffs, this base price can be 'scaled' as follows:

- for outliers ≤ Q3 + 3×IQR: half of per diem base price (3/6)
- for 'low' extremes ≤ Q3 + 4.5×IQR: one third of per diem base price (2/6)
- for 'high' extremes > Q3+4.5*IQR: one sixth of per diem base price (1/6)

Since LOS proved not to be an ideal parameter for price outlier predictions, those supplementary per diem payments ought to be calculated in such manner that they are chargeable as from the day of admission (in a way retrospectively). On the other hand they would be cumulative (when shifting from a lower to a higher outlier category) and consequently not 'truly' regressive.

5.3.10 Small cell size

Just as case-mix reimbursement fails when a large number of APR-DRGs have a large CV, it is even more difficult to calculate accurate and stable weights for low volume APR-DRGs. Narrowing APR-DRG groups creates more entities ('cells') and therefore inevitably decreases cell sizes resulting in 'small cells'. At the same time, statistical variability may be augmented. As a consequence, narrowly defining APR-DRGs (driven by clinical rationale) has to be balanced by decision making on the cut-off threshold for small cell size.

5.3.10.1 Threshold setting for base APR-DRG-SOIs

Threshold for price calculation

The Belgian Royal Decree setting the legal framework for the introduction of the system of the 'reference amounts' for a restricted number of common medical and surgical APR-DRGs (SOI 1 and 2 – see section 3.4.3), fixed the small cell threshold at 10 linked stays. For the sake of simplicity, we decided to use the same cut-off value for the present simulation exercises on DRG price calculations.

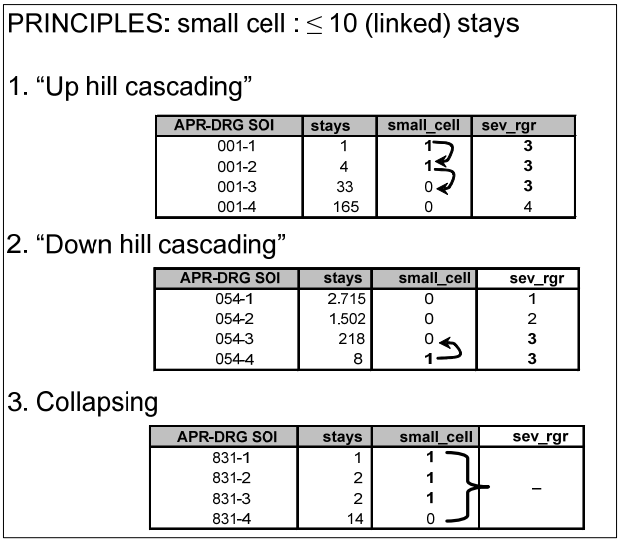
Threshold for sub-grouping

The threshold for allowing an APR-DRG split in distinct subgroups however, was set higher at a value of 50 linked stays. Although mainly inspired by purely practical reasons (reducing the amount of 'futile' recalculations on subgroups of small size and therefore with little impact), the topic in itself deserves thorough reflection. In the U.K. for instance a threshold of 250 stays was set as cut-off point for the creation of a (new) HRG.

5.3.10.2 Handling small cell APR-DRG-SOI

The Belgian database with linked stays for 2005 has 86 APR-DRG-SOIs with 10 or less stays. Furthermore, there are 29 missing APR-DRG-SOIs (no stays in 2005 – see Table 3.2 in Appendix 3). This raises the question of how to deal with those small or absent cells. For the former problem, several regrouping methods were investigated (Figure 11). More details are given in Appendix 3.

Figure 11: Small cell handling and aggregation into APR-DRGs



5.3.11 APR-DRG sub-grouping

5.3.11.1 Introduction

Whereas small cell size cut-offs deal with statistical 'sample size' problems caused by too fine granularity, too broad granularity may increase clinical heterogeneity and therefore could give strong incentives for 'cream skimming' lower cost patients. Moreover, in Belgium 3M™ grouper software is used for assigning APR-DRGs (version 15.0 definition) based on algorithms elaborated in the U.S. However, analyses on their accordance with Belgian NIHDI reimbursement data, let alone hospital cost data, are lacking, which leaves us with the question: how homogeneous are APR-DRGs in the Belgian context and is there any need for some APR-DRGs to be refined, i.e. split?

The idea of splitting existing APR-DRGs into distinct sub-groups mainly rests on two kinds of observations, one from the clinical field and the other statistical, originating from the process of APR-DRG-SOI price calculations. For instance, with the introduction of the Belgian system of the 'reference amounts' (RA) in 2002 for a selection of surgical APR-DRGs, reactions from the clinical field incited public health care authorities to differentiate RA calculations for distinct sub-groups in three of those APR-DRGs:

- For APR-DRG 302 (major joint and limb reattachment procedures of lower extremity, except for trauma) three sub-groups were defined, based on specific NIHDI-billing codes: 302a (total hip prosthesis-THP), 302b (total knee prosthesis-TKP) and a residual group containing all other orthopaedic interventions on the upper leg, which were excluded from the RA system.
- For APR-DRG 313 (knee and lower leg procedures, except the foot) only codes (313a) were subjected to the RA system, the residual group containing all other orthopaedic interventions on the lower leg being excluded.
- APR-DRG 513 (uterine and adnexa procedures for ca in situ & non-malignancy) was split into 3 sub-groups: 513a (abdominal hysterectomies), 513b (vaginal hysterectomies) and a residual group containing all other gynaecologic interventions, again being excluded.

Rest-groups in all three APR-DRGs mentioned above will be subject to a more in depth study in section 5.3.12 and the appendix to this section. In addition, the KCE study on the Belgian system of 'reference amounts' has revealed that in some cardiovascular APR-DRGs (046 - nonspecific CVA and precerebral occlusion without infarct and 190 - circulatory disorders with acute myocardial infarction, both in SOI 1 and 2) the calculated reference amount significantly differed between patient sub-groups that had or had not undergone an invasive angio-cardiographic procedure.[72] A frequency distribution analysis of the Belgian APR-DRG-SOI billing data revealed a bimodal distribution in some of them, e.g. 091 - other major head and neck procedures, SOI 1 (Figure 12) or 484 - other male reproductive system procedures, SOI 2 (Figure 13).

Figure 12: Bimodal distribution in APR-DRG 091, SOI 1

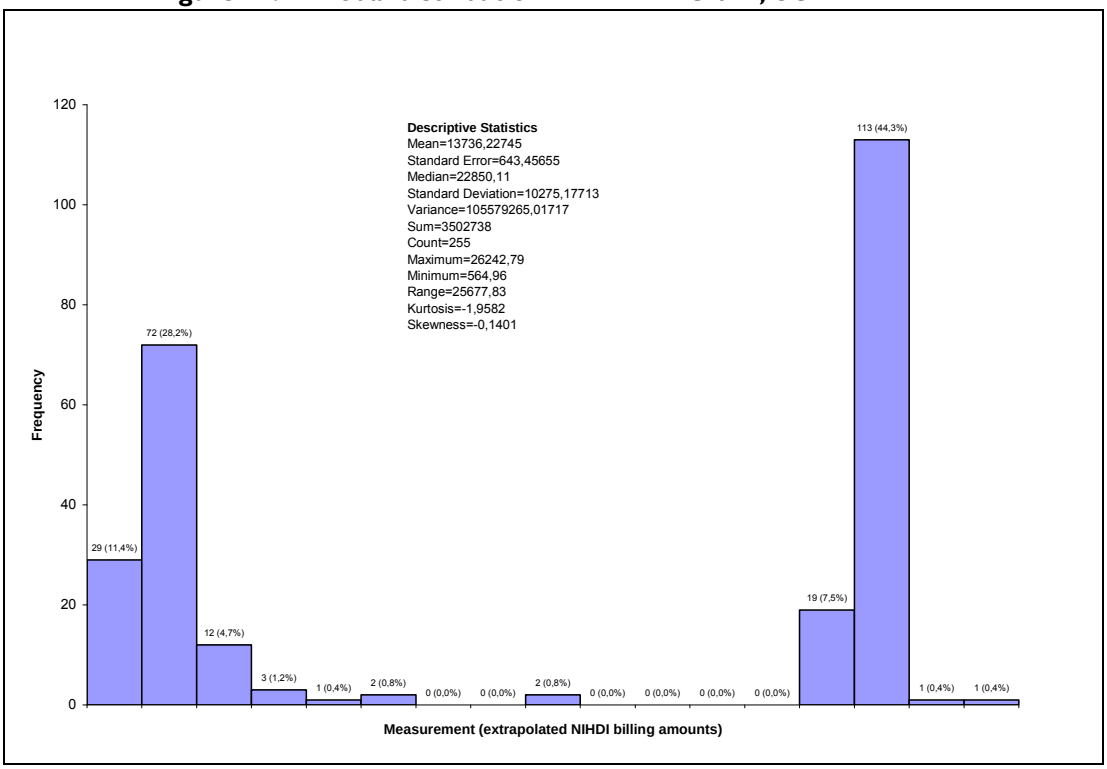
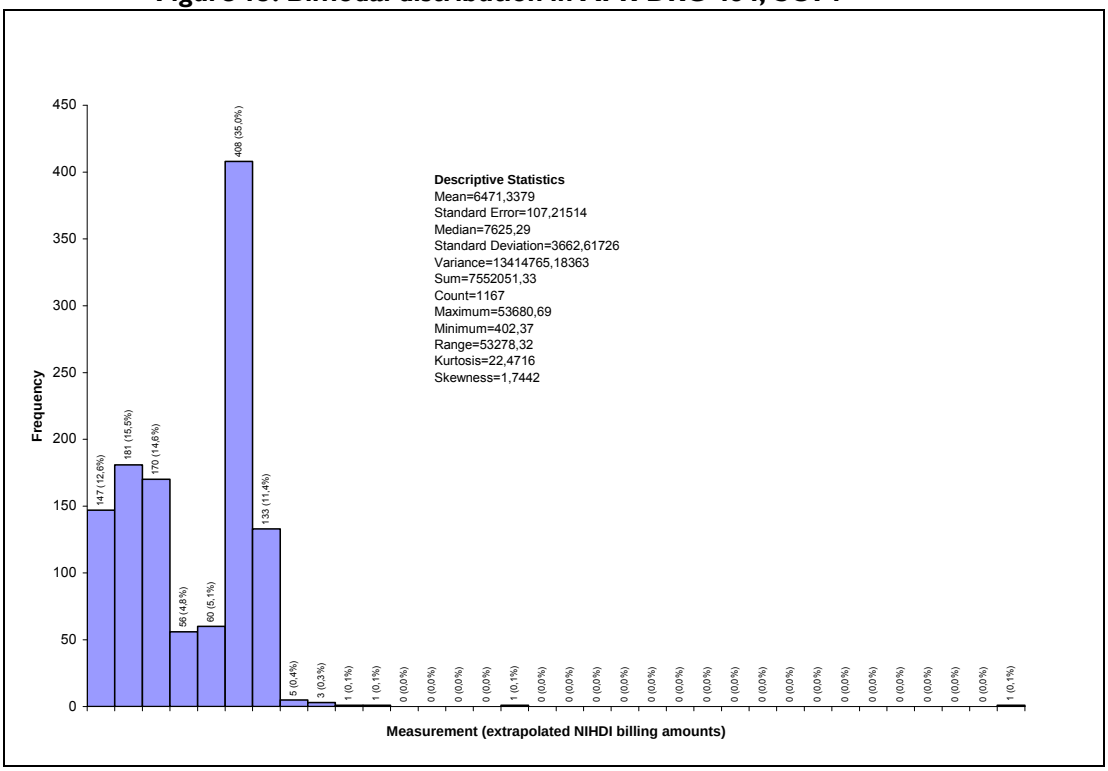


Figure 13: Bimodal distribution in APR-DRG 484, SOI 1

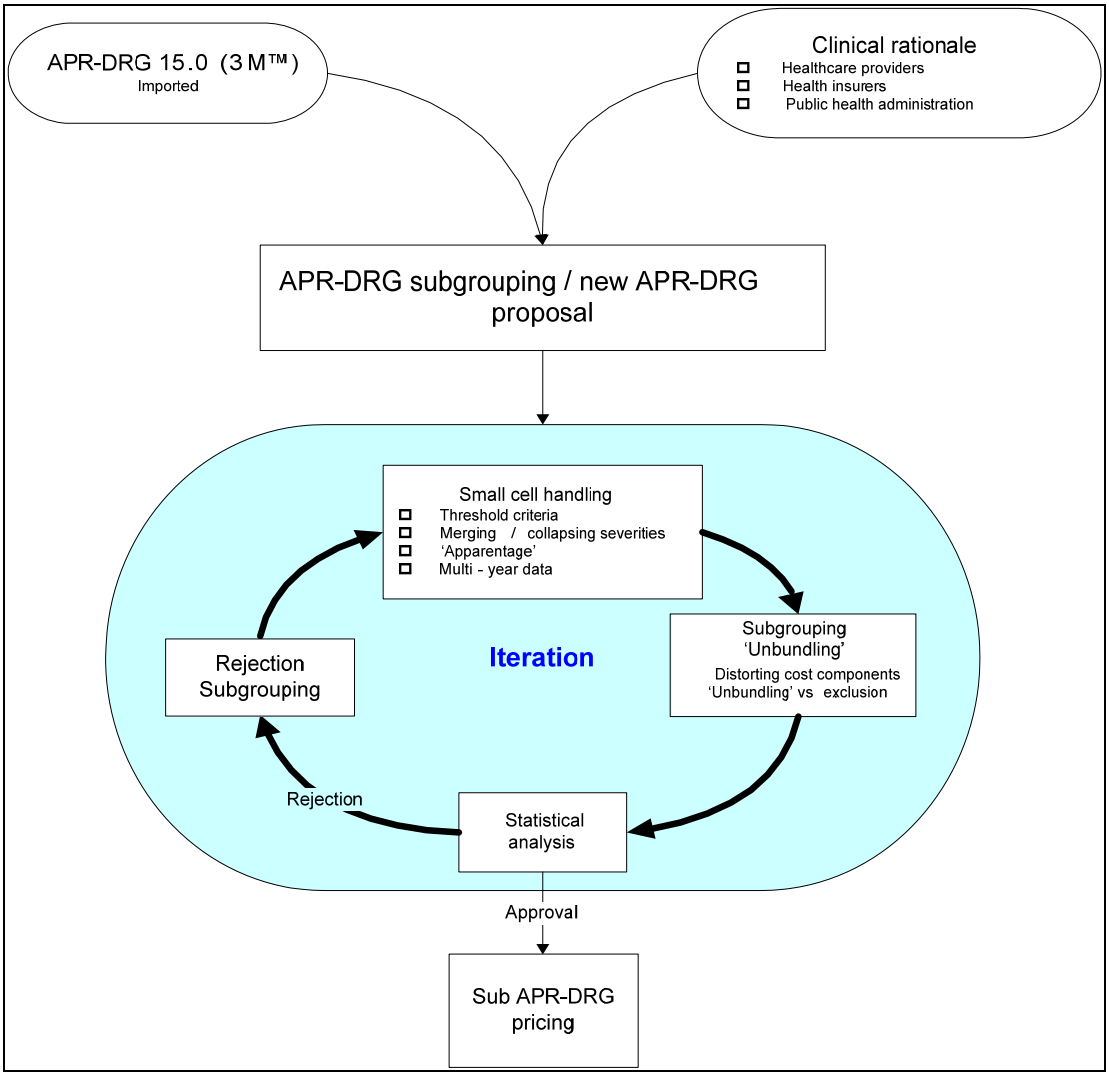


5.3.11.2 Process of sub-grouping

Sub-grouping is essentially an iterative process (Figure 14) involving different steps, starting with the 'clinical rationale' discussion on the appropriateness of splitting (or even the creation of a totally new DRG) and verification of agreed small cell thresholds. Statistical analysis for homogeneity checks should then decide on whether or not proceeding to approval or rejection of the APR-DRG split, unless strategically well understood reasons should override this.

The presence of distorting components in either price (NIHDI reimbursements) or cost data of the proposed sub-groups could be examined for 'unbundling' or 'exclusion'. A number of possible APR-DRG splits, mainly based on clinical arguments, are examined in Appendix 3.9.

Figure 14: Schematic presentation of the APR-DRG sub-grouping process



5.3.12 Separation of (excessively) distorting price components

Another way to deal with intra-APR-DRG heterogeneity is to look for price components which are excessive and hence risk distorting the measure of average resource use. Excessive price components typically are found with pharmaceuticals, radio-isotopes, blood products and derivates, implants and organ transplantations. Cut-off threshold for distortive price components was set at percentile 99. Illustrative results can be found in Appendix 3.10.

Above P99 price components raise an interesting strategic issue concerning how to handle them in a DRG-based hospital reimbursement system. There are in fact different ways to deal with such components:

- Exclusion from the prospective payment system. Although this option could be envisaged as the easiest one, the perpetuation of the existing fee-for-service system reduces incentives of cost consciousness and efficiency. Furthermore, it would need the establishment and permanent communication of well defined 'exclusion lists'. In the examples elaborated in Appendix 3.10, this proved rather simple for P99 medications and implants. It was less evident for radio-isotopes, blood products and organ transplantation related billing amounts, where we had to recur to calculation of P99 trimming points, based on amalgamated, and by definition historical billing data. In this respect, we face the same operational problem as with handling outliers. On the other hand, such exclusion would have one big advantage: it would enable timely remuneration of emerging new technologies and this simply by adding their remuneration codes, once approved and 'priced', to the exclusion lists.
- Unbundling. Another possibility could be the introduction of topic related 'add on' DRG-price modules providing specific supplementary APR-DRG reimbursements for P99 price components, above base APR-DRG-SOI reimbursement. This would however necessitate procedures of timely upgrading and communication of 'add on' tariffs. A similar strategy could also be used for outlier remunerations (see also section 4.3.2.6 about the English HRG system).
- Sub-grouping (see the example of APR-DRG-SOI 484-2).

5.3.13 Conclusions on the price model

The data and methodological issues addressed in section 5.3 clearly show that a number of important prerequisites have to be met before the APR-DRG classification system can be applied in Belgian hospitals. Without claiming to be exhaustive, we briefly repeat these prerequisites. A distinction is made between data availability and methodological points. Most points refer to choices which have to be made by policy makers.

5.3.13.1 Data availability points:

- Adjustments of 'raw' data: NIHDI billing data for laboratory testing, medical imaging and the budget of financial means.
- Data cleaning: data plausibility should be thoroughly examined and inconsistent records should be removed from the data base.
- 'Outsourced care' billing amounts were attributed to the primary hospital of admission and therefore were included for price calculations, except for day care prices which were excluded since we did not have their correspondent 100% values. As soon as linked day care data are available, this problem can be solved.

5.3.13.2 Methodological points:

- Separate treatment of acute and chronic hospital data. Acute hospitals have a totally different 'expenditure' pattern, which renders stays from both sources, though primarily classified in a same APR-DRG, totally different with regard to their respective weights and case values. For similar reasons, purely palliative care stays should be regrouped in a specific pseudo-DRG. The same applies to stays in acute versus stays in chronic wards.
- Mixed stays. The best solution would probably be to split such stays in an 'acute phase' stay (with a proper 'acute phase' APR-DRG assignment) and a chronic follow up stay. Unfortunately the latter would require a post-processing of original minimal clinical data (MCD) registration records implying:

- assigning a new principal diagnosis for the chronic stay part;
- splitting of all clinical and billing data, the latter based on their chronology and hospital department were they were delivered;
- re-assignment of a new (chronic) APR-DRG, after defining its proper principal diagnosis.

In fact such post-processing would imply the creation of 2 stays instead of one: although theoretically possible, it would however demand delicate and time consuming efforts.

- Sub-grouping. General 'rules for splitting' can be formulated:
  - There should be sufficient consensus on the clinical relevance of the splitting among health care providers, public health administration and health insurers;
  - Without, however, falling into the trap of excess granularity: a minimum threshold for sub-group stay count should be agreed on;
  - Splitting should improve homogeneity in the created sub-groups compared to that in the parent APR-DRG;
  - Room must be left for overruling some of the above principles by strategic considerations (see for example the discussion on sub-grouping in APR-DRG 302).
- Choice of price estimator. As amply discussed, this choice is never univocal:
  - For positively skewed APR-DRG-SOI the right trimmed mean seems the preferable price value;
  - For negatively skewed APR-DRG-SOI, it probably would be more prudent to use on the median as point estimator for price.
- Inclusive versus exclusive price calculations. The current dual financing of hospital costs with the BFM and medical fees causes particular concerns about whether or not to incorporate these amounts in APR-DRG-SOI price calculations. To distribute the budget of financial means among the individual stays according to an indicator which reflects hospital case-mix, the hospital severity score was developed.

Key points

- **The price model is based on NIHDI reimbursements. It allows a thorough assessment of the applicability of the APR-DRG grouper in describing Belgian hospital activity.**
- **Day care stays were not included because no linked clinical and hospital billing data were available in the course of the study. As soon as the case-mix and billing data for day care stays are linked and validated, all analyses should be repeated with inclusion of the day care stays.**
- **Current lump sum payments (medical imaging and laboratory testing) were adjusted to better reflect realized activities.**
- **Since it is advisable to include the same resource items for the APR-DRG weights and tariffs, an indicator was searched for to distribute the budget of financial means among the individual stays. The 'hospital severity score' is one possible example of such indicator.**
- **The assessment of within APR-DRG homogeneity of resource use consisted of an analysis of the coefficient of variation, outliers, small cell size, sub-grouping and separation of (excessively) distorting price components.**
- **A number of important prerequisites, related to data and methodological issues, have to be met before the APR-DRG classification system can be applied in Belgian hospitals.**

5.4 THE COST MODEL

5.4.1 Activity Centre-Care Programme model (AC-CP)

The AC-CP model is a case-mix cost accounting model developed between 2002 and 2008 as a result of the project "Analysis of financial flows of Belgian hospitals according to patient-mix" initiated by the federal government and executed by three university hospitals. The project for the federal government aimed at the development of a systematic financial model which makes the revenue and cost structure of hospitals according to patient groups transparent.

The project consisted of three stages:

- Stage 1 2002 – 2004: Development of a model to allocate costs and revenues;
- Stage 2 2005 – 2006: Thorough analysis of major hospital 'activity centers';
- Stage 3 2007 – 2008: Development of a balanced scorecard for a cost-pathology and for a hospitalisation and the implementation of cost allocation methodology in the data warehouse of the federal government.

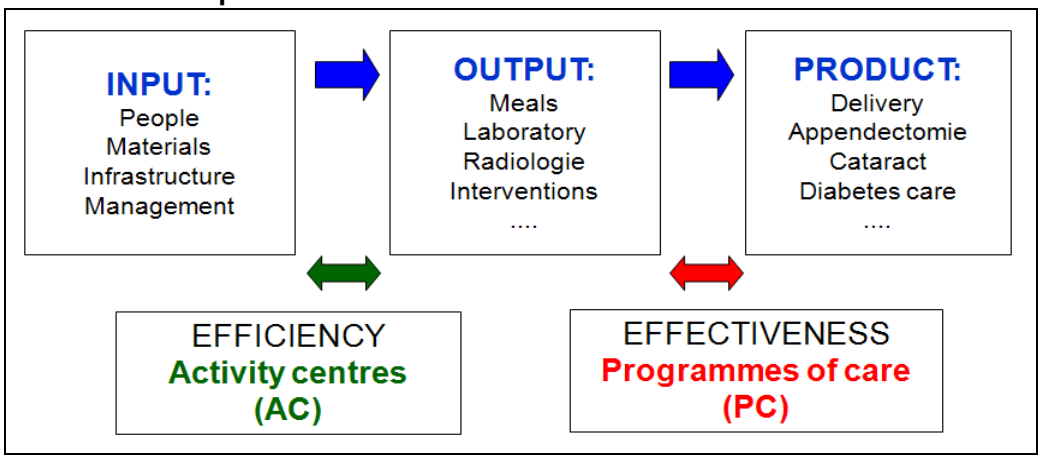
The case-mix accounting model aimed at relating both hospital costs and revenues to the case-mix of the hospital. The relationship between cost, revenue and case-mix was analysed for day care and inpatient hospital stays. It is possible to include pre-and post-hospitalisation outpatient contacts in the day care and inpatient paths. Because of limitations in the data records, the current model is limited to day care and inpatient stays and does not include outpatient and transmural care. All financial flows are included. Hospital revenues include medical and paramedical fees, the budget of financial means, lump sum payments for laboratory testing and medical imaging, pharmaceutical specialities, etc. All costs (direct or indirect) are included as well.

The remainder of section 5.4.1 describes the concepts and different parts of the AC-CP model. However, not all parts were included in the current study. Deviations between the theoretical concept of the AC-CP model and its application in the current study will be indicated.

5.4.1.1 Concepts

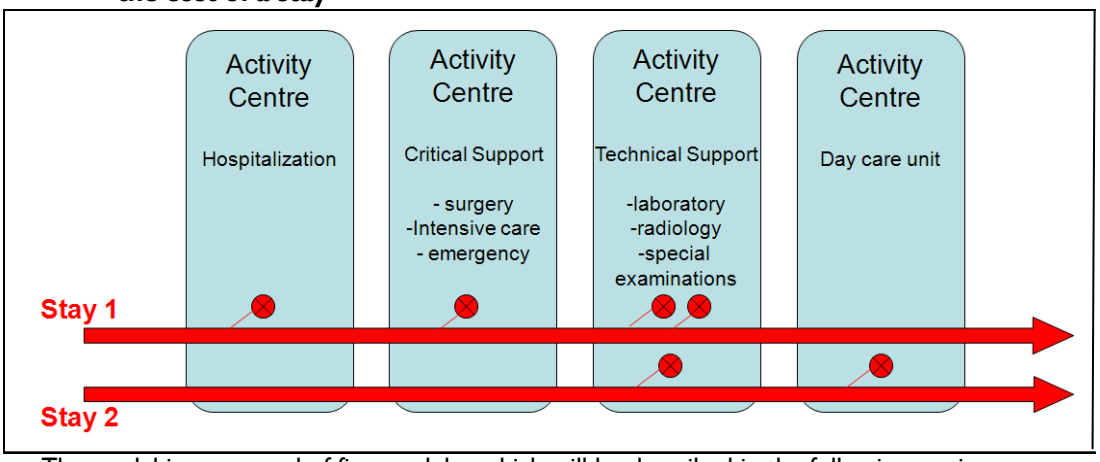
In the AC-CP model a "top-down" activity-based costing (ABC) approach is applied. The methodology is based on the principles of the "product line model" as developed by Fetter in 1980[101], in parallel with the initial development of the DRG system at Yale. Central in this model is the assignment of costs to an activity or cost object (in this case an APR-DRG). Direct costs are directly assigned whereas indirect costs are assigned to activity centers (AC), also known as cost pools or cost centers. ACs are functional units within a hospital. In short, every AC consumes resources to execute activities that lead to the set of products that characterize the AC. The AC uses a specific set of inputs that entail costs for the hospital. The AC-CP model is also the basis of the measurement of hospital output (APR-DRGs).

Figure 15: Product line model of R.B. Fetter: Relation resources use - activities – products



Each hospital stay can be seen as a series of 'visits' to the different activity centers. Each visit to an AC generates activities or services for the patient. All these visits together make the trajectory of care of the patient during his hospital stay. To determine the cost of a stay, it is necessary to identify the ACs involved and to examine to what extent the patient made use of the AC. This is given by the "bill of services" or "bill of activities" (BOS/BOA), which is a list of consumed care during the stay.

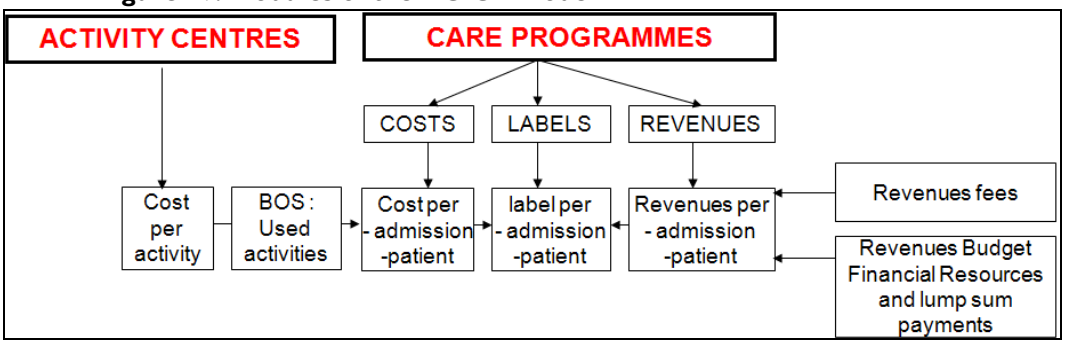
Figure 16: Product line model of R.B. Fetter: Care trajectory to determine the cost of a stay



The model is composed of five modules which will be described in the following sections:

- An **activity center structure module** in which the different functional units in a hospital setting are identified;
- A **cost module** which allocates costs to the individual stays, based on a top-down activity-based costing technique;
- A **care trajectory module** which identifies the different activity centers that the patient visited during his stay;
- An **revenue module** which allocates the hospital revenue for treatments to the individual stays;
- A **care program or pathology module** which assigns a label to similar stays to compare costs, revenue and other information of a stay with these of stays of the same label.

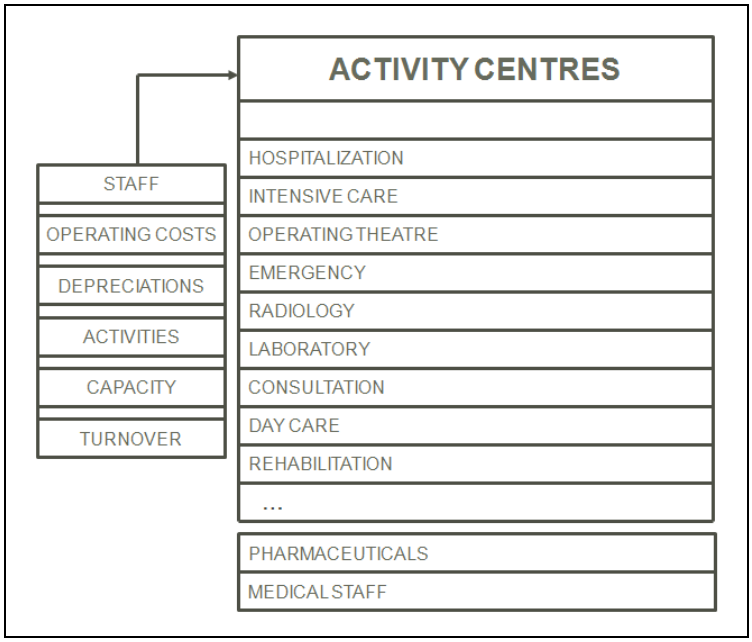
Figure 17: Modules of the AC-CP model



5.4.1.2 *Activity center structure module*

Activity analysis within ABC evaluates resource consumption through the identification of activity. As a first step in the cost allocation process, the hospital is divided first into functional units or activity centers. Each AC has a specific task (whether or not related to provision of care) and demands a particular input of resources. Examples of such activity centers are the operating theatre, radiology, day care unit, etc. ACs can be described in terms of their input of resources, activity profile and output profile.

Figure 18: Examples of activity centers



Some types of ACs that are essential for the functioning of the hospital, others are only present in certain hospitals and have a more specific and specialized task. A direct link with the patient is not achievable for every AC inside the hospital. Certain ACs deliver more supportive services, such as the human resources department. The costs related to the functioning of the human resources department can therefore be considered as indirect costs for patient treatment.

They are allocated to the different ACs by a general cost driver, e.g. according to the number of employees. These ACs with a supportive role are called "**functional non patient-related activity centers**". They are functional because they execute well defined activities and non patient-related since they do not contribute in a direct way to the patient's treatment. Other functional units are directly related to the patient's treatment. Examples of such ACs are the operating theatre, nursing units and radiology. These ACs are called "**functional patient related activity centers**". A third type of ACs are functional units with well defined activities not related to health care. While these ACs do not have a supportive role towards other ACs and form no part of the hospital, they are physically and/or legally associated with the hospital.

These ACs are called "**functional non hospital activity centers**". Examples are nursing homes and public municipal welfare organizations. Not all hospital costs can be assigned to a particular functional AC. For example, certain overhead costs are carried by all functional ACs. Therefore, in addition to the functional ACs a number of "**non functional activity centers**" are identified.

The cost centers as defined in the dataset Finhosta were used as a starting point in defining a first rough activity center structure. Each group of cost centers is linked with an activity center. Each activity center is characterized by a unique activity center id in the dataset. A list of ACs is available upon request.

5.4.1.3 Cost module

The main purpose of the cost allocation process is to estimate the cost per stay. By relating the hospital's resources consumption to the hospital's activity profile a cost per unit (weighted) activity can be determined. The cost can be calculated by assessing the activity/consumption profile of the stay and valuing it by the hospital specific cost per unit activity. The methodology of cost allocation is a top-down approach where all costs are allocated to the individual stays according to their share in the total value of the cost driver. The different steps in this process are described in more detail.

Step1: Cost per activity center and cost group

The 'activity center structure" module results in the allocation of activities into functional and non functional ACs and describes the allocation of costs. In the 'cost' module, the nature of costs is described. Cost groups were derived by applying the "MARZ" categories in Finhosta. A list of cost groups is available upon request.

As compared with the groups in the MARZ[pp], certain costs were shifted:

- Costs of medical staff not assigned to ACs "laboratory", "radiology" or "radiotherapy" nor to non-hospital ACs are shifted to AC "medical staff" (=virtual AC);
- Costs of reagents not assigned to AC "laboratory" nor to non-hospital ACs are shifted to AC "laboratory";
- Costs of pharmaceuticals are jointly assigned to AC "pharmaceuticals" (=virtual AC) if not assigned to non-hospital ACs;
- Costs of synthesis material are jointly assigned to AC "synthesis material" (=virtual AC) if not assigned to non-hospital ACs;
- Costs of plaster are shifted to AC "plaster room" if not assigned to non-hospital ACs;
- Costs of blood are shifted to AC "blood bank" if not assigned to non-hospital ACs.

Costs regarding staff are replaced by a standardized cost per hospital, per year and per function to capture differences in labour costs between hospitals for the same function.

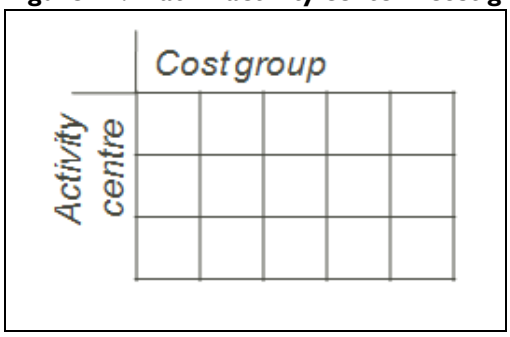
Indirect and overhead costs are assigned directly to stays according to their respective cost driver[qq].

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pp MARZ = "minimum algemeen rekeningstelsel voor de ziekenhuizen" in Dutch; Minimum accounting system for hospitals.

qq In the original project of the federal government, a stepwise allocation method was applied. Costs of supportive ACs (non functional as well as functional non patient related ACs) were first assigned to the functional ACs and in a second step to the stays according to their respective cost driver.

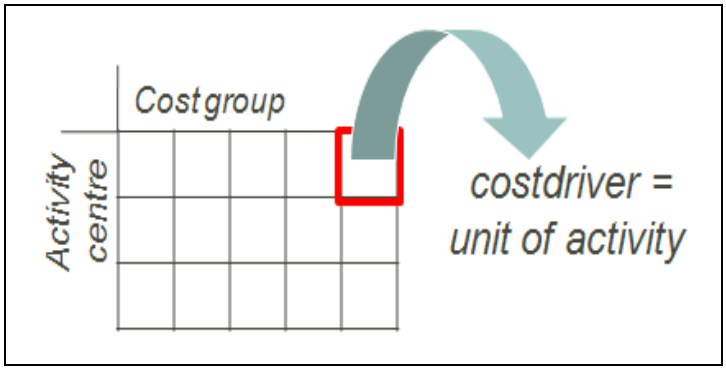
Figure 19: Matrix activity center - cost group



Step 2: Cost per unit of activity

For each cost group – activity center combination, a cost driver which reflects the provided service or activity by the activity center is chosen. The applied cost drivers per activity center and cost group are available upon request. More technical details on the cost assignment process, the choice of ACs and cost drivers is available from the authors upon request.

Figure 20: Cost driver per cost group - activity centre



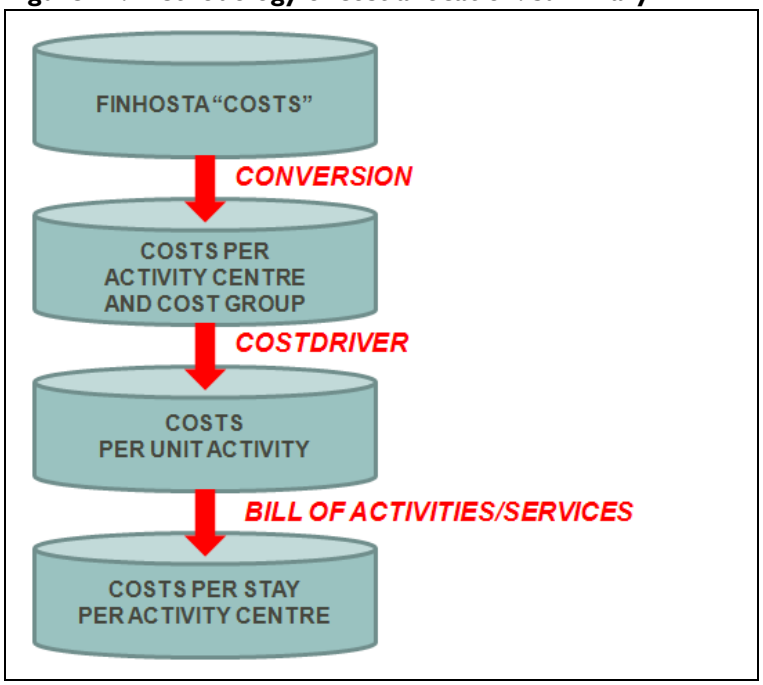
Next, the value of the driver per activity centre, cost group, hospital and year is estimated. At last, the cost per unity of activity is calculated by dividing the total cost per activity centre and cost group by total driver value.

Step 3: Cost per stay per activity centre

In a final step it is determined how many units of cost driver are consumed per stay, this is identifying the "Bill of activities" of the stay. The cost per stay per activity centre is determined by multiplying the cost per unit activity per activity centre/cost group by the number of units cost driver of the considered stay.

Figure 21 summarizes all steps of the cost allocation methodology.

Figure 21: Methodology of cost allocation: summary



As an example we identify the cost of the AC dialysis (Table 14).

Table 14: Costs on activity centre dialysis

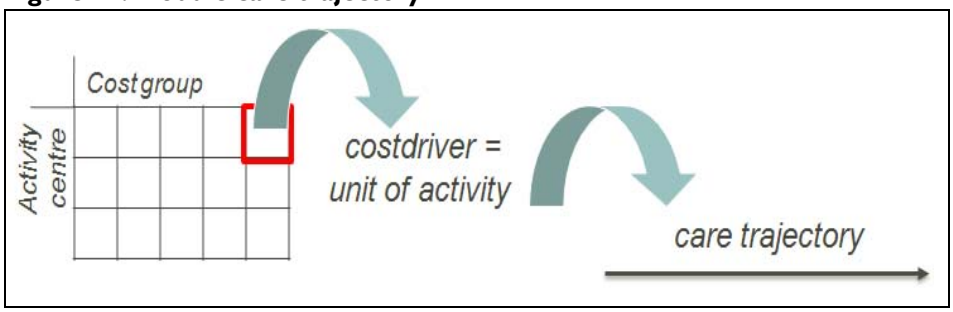
AC_ID	AC description	AC type	CG_ID	Cost Group description	Total
7300	Dialysis	Patient related AC	1	Not directly allocated pharmaceuticals and medical products	€1 563 500
			10	Medical staff	€250 000
			11	Nursing staff	€1 017 000
			13	Administration and IT	€52 500
			14	Other staff	€2 300
			15	Maintenance and cleaning	€5 000
			16	Nutrition and kitchen	€500
			17	Laundry and linen	€3 800
			18	Medical equipment	€23 000
			19	Sites, buildings, non medical equipment and utilities	€17 500
			20	Other costs	€105 500
					€3 040 600

Cost driver for the activity centre dialysis is the number of dialysis activities. The hospital had 10 000 dialysis activities during the year. The cost per unit activity equals € 3 040 600/10 000 = € 304. When patient X receives two dialyses during his stay, the cost per stay for the AC dialysis equals € 304 * 2 = € 608.

5.4.1.4 Care trajectory module

In the care trajectory module the AC per stay are identified. It concerns a description of the constituent processes of a disorder treatment. This can be seen as a care episode or a hospitalization episode. A care episode can be defined as all contacts with health care providers for the treatment of a medical disorder. This may be continuous or may consist of a series of contacts and a sequence of inpatient, outpatient and day care. A hospitalization episode on the other hand only considers the activities provided in the course of a hospital stay.

Figure 22: Module care trajectory

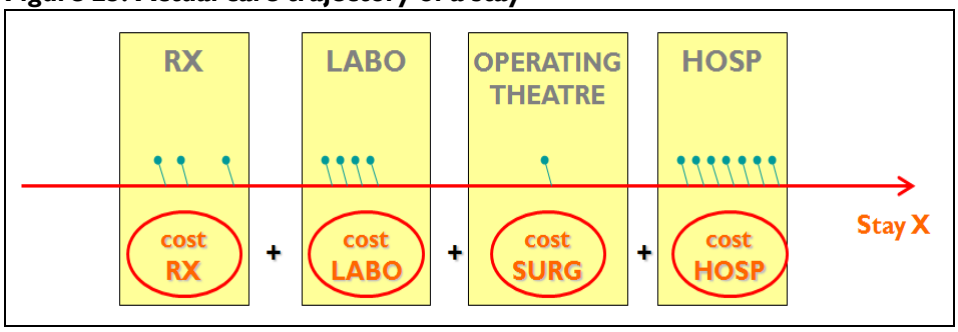


The model focuses only on hospitalization episodes, but it should be possible to link outpatient contacts to admitted patients. The care trajectory module consists of developing a methodology to identify the followed trajectory of a patient during his stay. This trajectory can comprise a visit to the emergency department, a diagnostic phase, a therapeutic phase, etc. The methodology should permit to respond to the following questions: Where did the patient go (which activity centres)? When (which date)? Which activities where executed during his visit to the different activity centres?

The deduction of the trajectory is to a large extent dependent on the structure of the identified activity centres, since this determines the usage of resources and influences the methodology of cost allocation.

Due to a lack of registration of all patient contacts in the hospital, the current exercise is based on the available information in the different registration systems, such as HBD and MCD. To determine the executed activities and their duration, information from HBD and MCD is used. In the identification of the patient's trajectory, it suffices to list the provided activities and services during the stay, i.e. identifying the visited activity centres. The cost per activity centre is determined by the "bill of activities" of the stay per activity centre. The total cost of the stay is the sum of all costs of the visited activity centres.

Figure 23: Actual care trajectory of a stay



To determine a standard trajectory per stay, we look at all patients with the same disorder and analyze which examinations, test, consultations, surgeries, etc. were executed during the stay. By comparison of actual trajectories of patients with the same pathology, it is possible to examine the variability in a care process and the possibility of the execution of a certain activity. Taking these elements into consideration, it is possible to identify a standard trajectory.

Due to lack of registration of all patient contacts inside the hospitals between the different activity centres, a visit to an activity centre is deducted in the current exercise based on algorithms on the different available information sources. Because of the limited notion of time in the available registration systems (where the most detailed level is date of relative day during a stay) the assumption had to be made that a patient can visit an activity centre only once a day during his stay.

The most important data records to identify the care trajectory are MCD and HBD. A part of the care trajectory can be derived from the HBD by tracing the acts executed (charged) at patient and stay level and identifying the activity centres based on this information.

It is essential to apply the accurate algorithm for the identification of a visit to an activity centre. For certain acts it will be necessary to take into account additional conditions such as the location of the act or the identification of the care provider.

The MCD permit determining the total length of a patient's stay and to divide it into different sub-stays per nursing department or bed index. With this information, the trajectory through the different nursing departments and MCD bed indexes can be derived for each day of the stay.

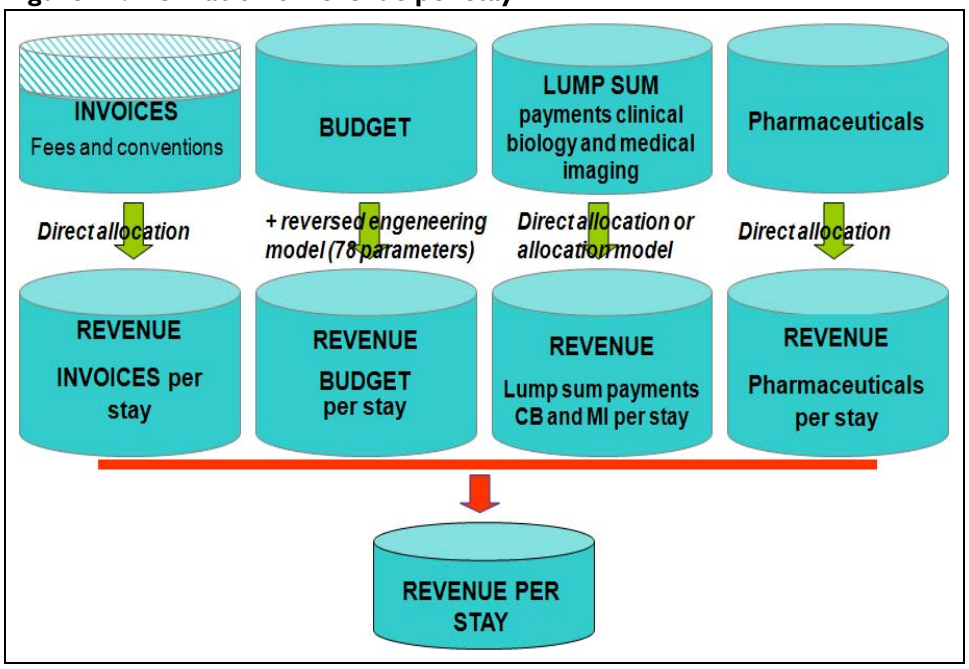
5.4.1.5 Revenue module

It is important to note that the revenue module as described here is not applied for the current study but sketches a theoretically interesting way of allocating total hospital budget to individual stays.

This module looks at the revenue types the hospital receives for the treatment of a stay. The revenue allocation is done in four sub-modules:

- Fees and convention revenues per stay (source: HBD)
- Allocation of BFM (B2, B4, B7[rr]) to the stays by a 78 parameter reversed engineering model
- Lump sum payments laboratory testing and medical imaging (directly and reversed engineering model – source: HBD)
- Pharmaceuticals per stay (source: HBD)

Figure 24: Derivation of revenue per stay



Sub modules

DERIVATION OF FEES AND CONVENTION REVENUES FROM HBD

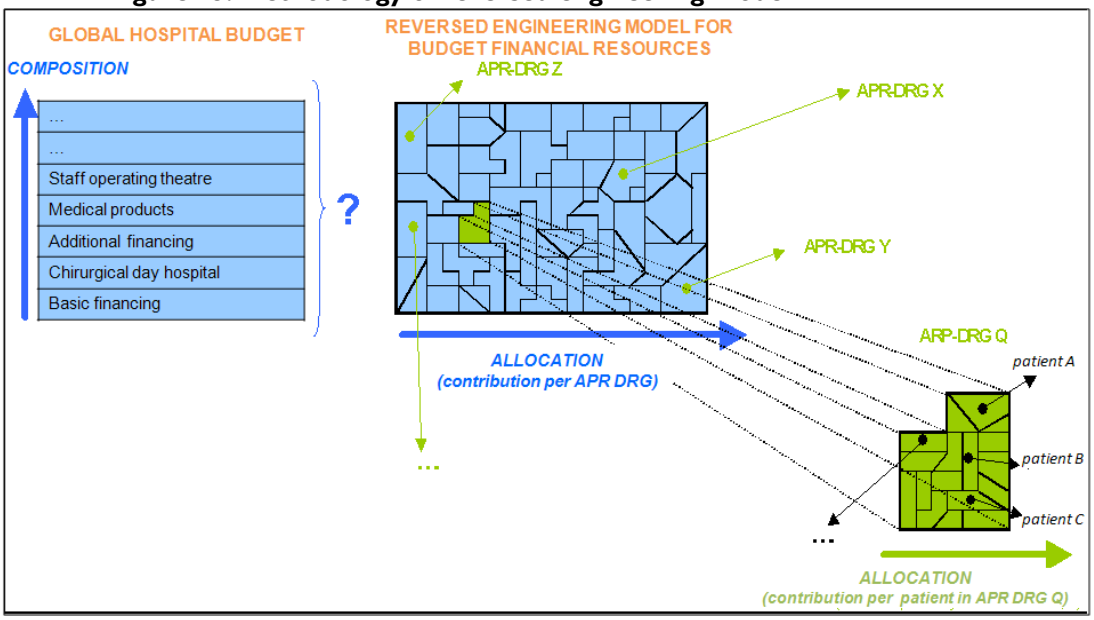
First sources of revenue are the fees which can be found in the HBD. These revenues are directly allocated to the individual stays based on the actual charged amount.

[rr] As mentioned, the revenue module as described in section 5.4.1.5 was not applied in the current study. Since B7 (part of the BFM) is not paid to all hospitals, it was excluded from the BFM as used in the price model and cost model in the simulations of Chapter 6 (see also section 5.3.5).

ALLOCATION OF THE BUDGET OF FINANCIAL MEANS (B2, B4, B7) BY A REVERSED ENGINEERING MODEL

A reversed engineering model is used to allocate the global budget (parts B2, B4, B7) to the individual stays. Based on the factors which determine the budget (see Royal Decree of April 25, 2002) an allocation to the individual stays is done. The global budget is divided into budget sections, where every stay is allocated part of the budget component according to the extent that it contributed to this budget component. This is done by means of a driver per budget section.

Figure 25: Methodology of reversed engineering model



ALLOCATION OF LUMP SUM PAYMENTS FOR MEDICAL IMAGING AND LABORATORY TESTING

Lump sum payments for medical imaging and laboratory testing can be allocated directly to the stays. This means that revenues are allocated to stays regardless of whether or not acts for medical imaging and laboratory testing were performed. A more appropriate allocation method consists of allocating these revenues by means of a reversed engineering model. Each stay receives part of the lump sum payment according to the extent that it contributed to it.

DERIVATION OF PHARMACEUTICAL REVENUES FROM HBD

Revenues received by the hospital for the compensation of the use of pharmaceuticals can be directly allocated to the individual stay using HBD.

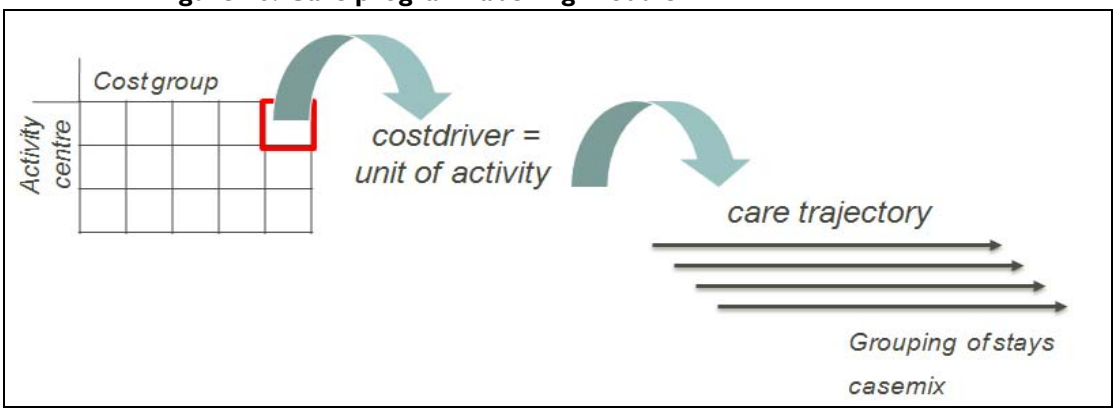
5.4.1.6 Care program labelling module

Purpose of the care program labelling module

A care program can be defined as "a homogeneous patient group according to both the type of pathology and care requirements, characterized by homogeneous care packages, multidisciplinary conceived as a unit of strategic policy organized to the cause of a specific target group of patients (e.g. elderly people) centralized around a specific pathology (e.g. hypertension) or a specific type of treatment (e.g. rehabilitation)."

The care program labelling module assigns a care program label to each stay that is taken up in the analysis in order to compare the information of the stay with similar stays. Although each patient is unique, it is obvious to group patients when analyzing costs and revenues. It is necessary that the grouping is significant and recognizable. Several classification systems can be used.

Figure 26: Care program labelling module



Possible classifications in care programs

- International Classification of Diseases
- Diagnostic related groups (DRG) and derivates
- Legal care program approach

The past years, several care programs were established by law in Belgium, among others for the cardiac pathology. This is a relative rough classification of patients based on both disorder and procedure (NIHDI nomenclature). The categorization is less refined than the APR-DRG classification.

5.4.2 Data and methodological issues in the cost model

In the price model (section 5.3) all analyses were based on (adapted) third-party reimbursements to hospitals. As was mentioned in the beginning of section 5.3, many data and methodological issues related to the price model are also relevant for the cost model. Consequently this section is limited to data and methodological issues specific to the cost model.

5.4.2.1 Initial selection of hospital stays

27 hospitals provided their data, including 1 951689 stays (all registered MCD stays) for the years 2002-2003. The year 2002 was selected for the execution of the cost allocation, including 909 177 stays.

5.4.2.2 *Construction of variables and data adjustments*

It was decided not to provide a detailed overview of the data adjustments, since all documents are based on work carried out for the original project as ordered by the federal government.

Standardization of personnel cost

At the level of the individual hospital registered personnel costs were replaced by a standardized personnel cost per staff type and function degree of the staff. The level of registered personnel costs is determined by:

- The number of applied staff
- The type of staff
- The seniority of the staff
- The financing type (Maribel, RVA trainee etc.)
- The extent of employment on irregular times (weekends, night, holidays, etc.)
- Other causes of differences in personnel cost

We wanted to eliminate certain of these effects at the level of the hospital, namely the seniority, the financing type and other causes. This is done by the calculation of a new personnel cost per cost center by multiplying the number of applied FTE (full-time equivalent) by an average cost, but taking into account the extent of employment on irregular times. All information can be found in the Finhosta data records.

Shift of cost groups to cost pools

Certain cost groups were shifted from the activity center linked with the original cost center to a cost pool or virtual activity center (see section 5.4.1.3., Step 1).

Pharmaceutical specialties

REPLACEMENT OF COST PHARMACEUTICALS BY DIRECT REVENUE PHARMACEUTICALS

All costs joined into the cost pool "pharmaceuticals" were replaced by the consumption of pharmaceuticals in the HBD. In this way the "costs" of pharmaceuticals are directly allocated to the respective stays.

PHARMACEUTICALS INCLUDED IN AND EXCLUDED FROM THE LUMP SUM

Pharmaceutical costs are divided into 2 groups: pharmaceuticals included into and excluded from the lump sum. The exclusion list is based on a list of ATC codes described in the Royal Degree of 30 may 2006. Recent updates of the exclusion list are based on article numbers of pharmaceuticals. Still, the exclusion based on ATC codes is correct, since the data for 2002 belong to the period before the introduction of the lump sum and since the excluded ATC codes correspond to the excluded article numbers.

Cost reduction

Since only inpatient stays are included in the analysis, it is necessary to distinguish the inpatient fraction of the costs from the day care fraction. A number of hospitals did not provide their outpatient billing data. Outpatient costs were in this case excluded by the application of a cost reduction percentage. This percentage was calculated based on the number of outpatient activities divided by the total number of activities of the complete billing data per activity center. This percentage was applied for the following activity centers:

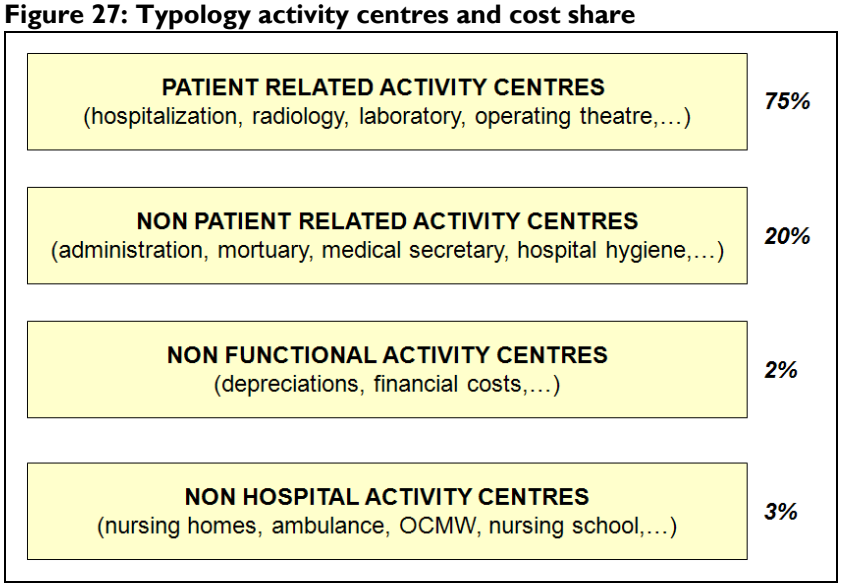
- Radiology
- Laboratory
- Dialysis
- Plaster room
- Radiotherapy
- Emergency
- Synthesis material
- Pharmacy
- Medical staff
- Non specified medico-technical services

5.4.2.3 *Data cleaning*

Data was selected based on following conditions.

- Completeness of data records
  - Required data registration for cost allocation: A number of hospitals did not provide a full data set. On the other hand, for a number of hospitals the required parameters for cost allocation were not available, e.g. no registration of MND department, no registration of date of admission in the invoicing tapes, no registration of qualification of clinician etc. These hospitals could not be included in the final data set.
  - Consistent use of cost centres and MARZ categories in Finhosta: Certain hospitals did not make use of the cost centres in Finhosta consistently. Major shifts between 2002 and 2003 were detected in both use of cost centres and MARZ categories. Other hospitals registered costs under cost centres of dialysis, radiotherapy, etc. while no activities were found. These hospital data were left out of the final data set.
- Exclusions concerning costs
  - Patient related activity centres: Only costs on patient related activity centres where included in the final data set, since they can be directly linked with the provided services during the patient's stay. Patient related activity centres correspond to 75% of the costs. Due to a lack of consistent registration of indirect cost allocation drivers in Finhosta, the distribution codes could not be used as a cost driver for indirect and overhead costs on non-patient related activity centres and on non-functional activity centres. As a result the stepwise allocation method was not implemented. Furthermore the added value of this indirect and overhead cost allocation is disputable.

Figure 27: Typology activity centres and cost share



  - "Stable" activity centres: The final data set was limited to "stable" activity centres which are activity centres with a consistent cost registration over the years and for which a suitable driver for cost allocation could be applied. Following activity centres were not included in the final data set: rehabilitation centre and NIHDI-conventions, day care, non-specified medico-technical services, psychiatry.
- Exclusions concerning stays: The focus of the analysis is on inpatient stays. They represent 52% of all registered MCD stays.

5.4.2.4 *Final representativeness of the database used for the cost model*

Table 15 displays the final dataset for APR-DRG-SOI cost calculations (2002).

Table 15: Rejected and accepted stays, 2002

Data cleaning and rejections	Effect on	Remaining number of MCD stays	Remaining costs (€)	Remaining number of hospitals
Original data		909 177	3 379 707 745	27
Required data registration for cost allocation	Stays + costs	456 715	1 814 088 810	12
Consistent use of cost centres and MARZ categories in Finhosta[ss]	Stays + costs	304 514	1 405 921 352	9
Patient related activity centres	Costs	304 514	1 033 763 630	9
Stable activity centres	Costs	304 514	907 811 610	9
Inpatient stays	Stays + costs	197 972	612 815 660	9
Final data set		197 972	612 815 660	9

It should be noted that this dataset does not represent the whole Belgian hospital sector. The exercise depended on existing data registrations and on the delivery of individual hospital data. Further data examination and adjustments are necessary when a larger sample is available. Nevertheless, this exercise does provide valuable insights for further use by the authorities. The following bottlenecks – which should be further examined – remain:

- Only part of the stays is included in the analysis. It will be possible to incorporate day stays when costs can be clearly identified. Due to a lack of outpatient registration, it is impossible to comprise the outpatient care in the exercise. This means that the cost of pre-surgery examinations is not included.
- Analysis depends on current data registration systems. Cost allocation is directly dependent on the imputation of costs on cost centres and MARZ categories. The present composition of Finhosta does not permit to outline certain important activity centres. Furthermore, accountancy differences in imputation of costs between hospitals could not always be eliminated.
- Refinement of cost drivers is necessary for a number activity centres.
  - Information about the provided activities is obtained from the billing data. However, when the nomenclature in the billing data is applied as driver, it allows at times insufficient differentiation in activities.
  - For a number of activity centres weights are based on few hospitals (e.g. radiology, operating theatre, etc.). They are not representative for the whole Belgian hospital sector.
  - For general activity centres (medical staff, non specified medico-technical services etc.) it is difficult to find a suitable driver.
- For a number of hospitals and activity centres the ambulatory fraction of the costs was identified by applying a cost reduction percentage. A more accurate identification is achievable when the complete billing data (ambulatory as well as hospitalization) is available.

[ss] A number of hospitals were excluded due to lack of required data registration for cost allocation as well as to inconsistencies in imputations of costs on cost centres and MARZ categories in Finhosta.

5.4.3 The homogeneity challenge and variability

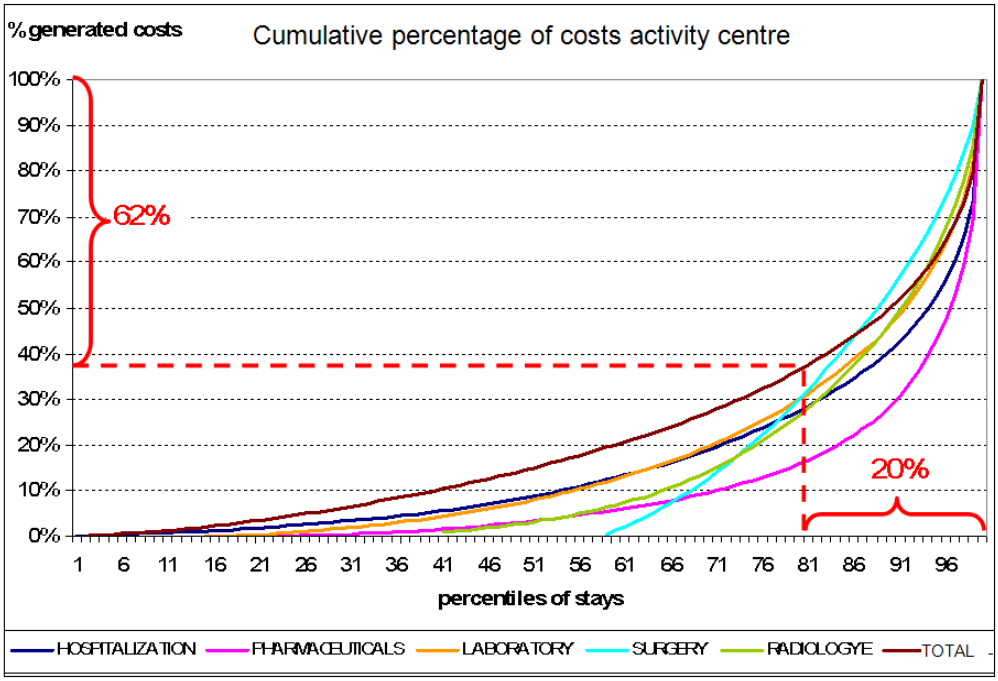
5.4.3.1 Small cell size

Since only a selection of hospitals is included in the dataset, for certain APR-DRG-SOIs a limited number of stays is available. As for the price model, the cut-off threshold for determining an APR-DRG-SOI combination as a 'small cell' is set at minimum 10 linked stays. 372 of 1 422 APR-DRG-SOIs can be considered as small cells (Table 4.1 in Appendix 4).

5.4.3.2 Variability of resource use

Figure 28 clearly indicates the variability of resource consumption between stays. All stays are classified by increasing cost and the cumulative percentage of resource consumption for the different major activity centres is calculated. The graph shows that the top 20% of stays consumes 62% of resources and that 30% of the resources are consumed by 5% of the stays. The distribution varies even more when focusing on the different activity centres. For pharmaceuticals 20% of stays consume 83% of resources.

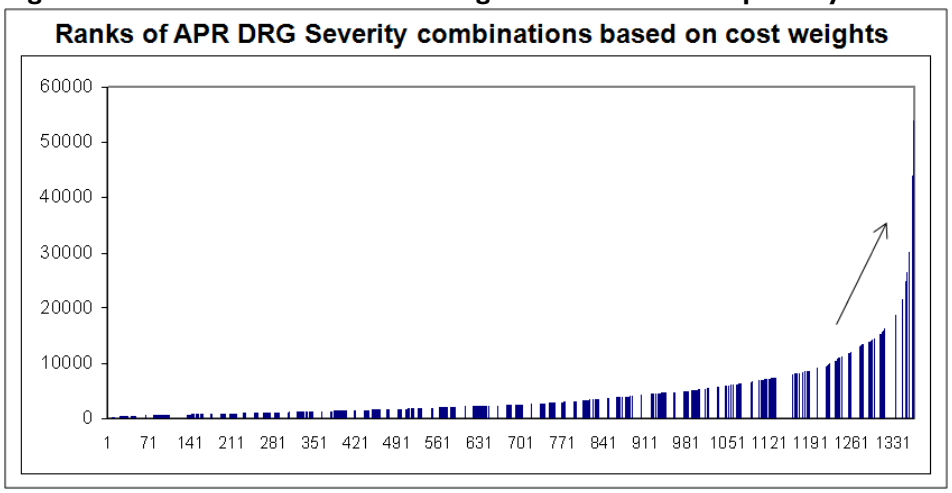
Figure 28: Percentage of cumulative costs per activity centre



5.4.3.3 Multiplication effect of cost weights

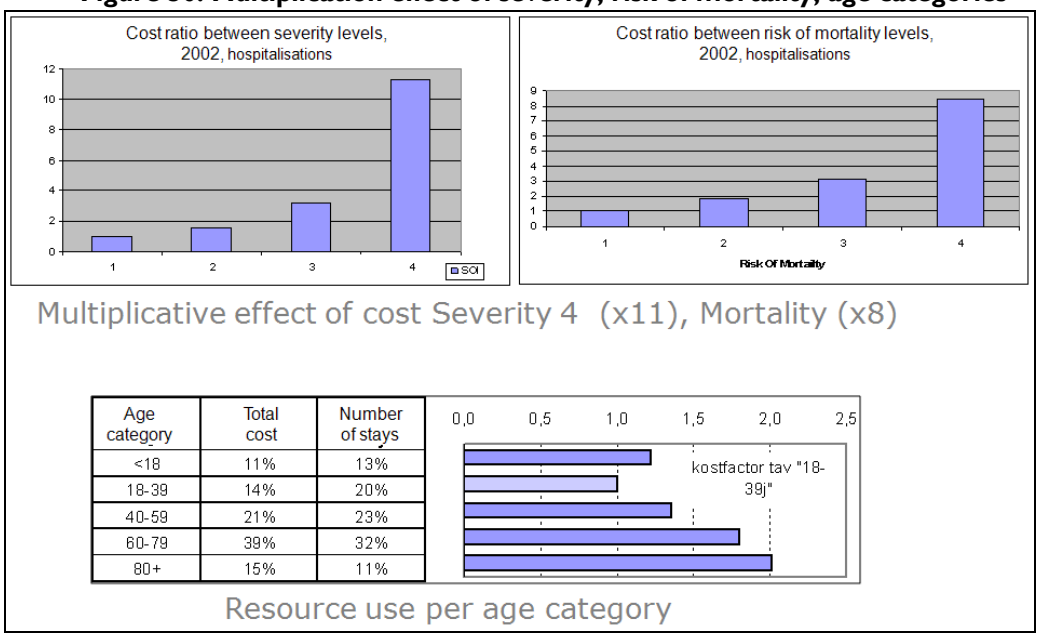
Figure 29 shows all APR-DRG-SOIs classified by mean cost per stay in ascending order. Costs of more consuming APR-DRG-SOIs are a multiple of APR-DRG-SOIs with a median cost per stay. Moreover, the graph indicates clearly that only a marginal number of APR-DRG-SOIs situated on the right side display a very high multiplication factor towards the average resource usage. It can be concluded that total resource consumption of a hospital is strongly influenced by the share of these more consuming APR-DRG-SOIs in the case-mix.

Figure 29: APR-DRG-SOIs in ascending order of mean cost per stay



A similar high multiplication of the average cost per stay can be found comparing severity levels and risk of mortality levels. Moreover, looking at the difference in resource consumption between age categories, larger resource consumption is found in older age categories. The group of young adults of 18-39 years of age consumes the least resources per stay.

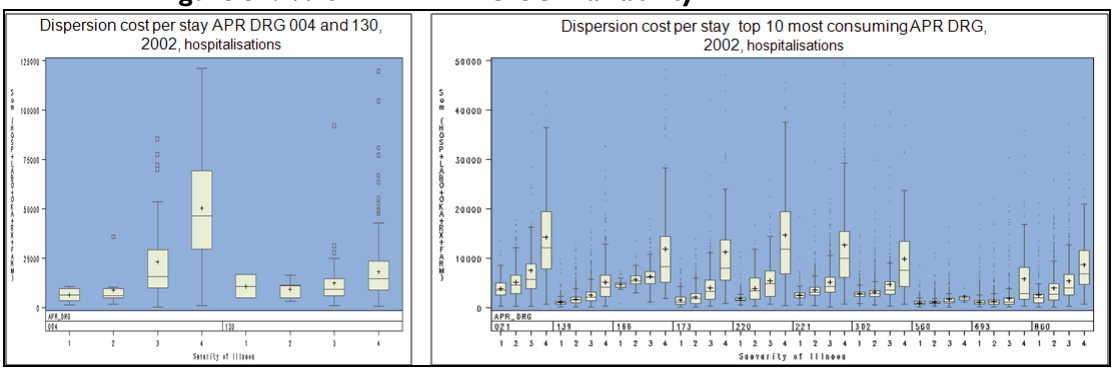
Figure 30: Multiplication effect of severity, risk of mortality, age categories



5.4.3.4 *Intra-DRG variability*

Not only between APR-DRG groups but also within certain APR-DRGs variability in resource consumption is found. Figure 31 illustrates the dispersion of costs in a boxplot for the twelve most consuming APR-DRGs .

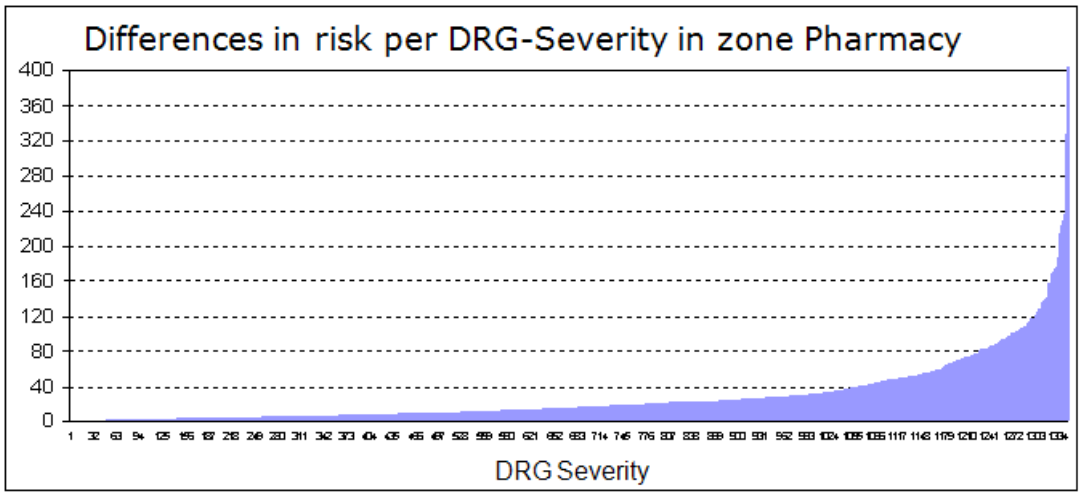
Figure 31: Within APR-DRG-SOI variability



5.4.3.5 *Measuring risk*

The differences in dispersion between APR-DRG-SOIs indicate the importance of recognizing and analyzing the variability. The variability can have serious implications on the financing of hospitals when implementing a lump sum financing. A financing system based on e.g. mean or median costs may induce a risk transfer from the health care insurer to the health care provider. Therefore it is important to analyze the causes of variability in a certain pathology group. The causes of variability in resource usage can be multiple. First, the grouper system has its own bias. The grouping system aims at clustering clinical and semantically understandable groups which are at the same time cost homogeneous. The DRG system used broadly at an international scale absorbs hence the (health) cultural differences and differences in the organization of health care. On the other hand, variability can be related to differences in health care practice during admission. These can be justified or not. Variability can also be related to the intrinsic variability of patients and their pathology. A hospital reimbursement system must try to eliminate the "exceptional" variability, this is the variability related to coding quality and non justifiable differences in health care practice. To respond to the problem of intrinsic variability, possibilities of granting a "risk premium" can be considered. Given that this intrinsic dispersion is not equally distributed between all pathology groups it is recommended to include dispersion in a risk measure. For pharmaceuticals a model of risk premium was developed. A risk class per APR-DRG-SOI was based on the ratio $\frac{(P99-P50)_{DRG_SOI}}{(P50-P1)_{poule}}$ (Figure 32).

Figure 32: APR-DRG-SOIs classified by risk measure for pharmaceuticals



Key points

- **The cost model or AC-CP model is a top-down case-mix cost accounting model relating hospital costs and revenues to the case-mix of the hospital.**
- **Comparable choices as in the price model were made, e.g. exclusion of day care stays.**
- **Variability in resource use between APR-DRGs is important: the top 20% of stays consumes 62% of resources and 30% of the resources are consumed by 5% of the stays. Within APR-DRG variability is also large. To respond to the problem of intrinsic variability, possibilities of granting a "risk premium" could be considered.**
- **Data from 9 hospitals were included in the cost model. Ideally, analyses should be repeated with a larger and representative set of hospitals.**

5.5 APR-DRG-SOI BASED HOSPITAL ALLOCATIONS

Once a decision has been taken on the data and methodological issues as described in section 5.3 and 5.4, the next step in the case-based hospital payment system is the calculation of weights and tariffs and the budget allocation to hospitals.

5.5.1 APR-DRG weighing

For each APR-DRG-SOI (x), the chosen price estimator P_x (e.g., mean, median or right trimmed mean price or cost) is multiplied by its corresponding number of stays in the reference year y (= 2005 for present study), resulting in the 'price adjusted' APR-DRG-SOI total $T_{DRGx,2005}$ in the reference year (nominator):

(A) $$T_{DRG_x,2005} = P_{DRG_x,2005} \times stays_{DRG_x,2005}$$

The sum of price totals for all APR-DRG-SOI (1⟶n) gives the overall total in the reference year (denominator):

(B) $$\sum_1^n T_{DRG,2005}$$

The ratio nominator/denominator gives the (relative) APR-DRG-SOI weight in reference year 2005:

(C) $$W_{DRG_x,2005} = \frac{T_{DRG_x,2005}}{\sum_1^n T_{DRG,2005}}$$

or substituting (A) in (C):

(D) $$W_{DRG_x,2005} = \frac{P_{DRG_x,2005} \times stays_{DRG_x,2005}}{\sum_1^n (P_{DRG,2005} \times stays_{DRG,2005})}$$

and after rearrangement of the formula:

$$W_{DRGx,2005} = \left[\frac{P_{DRG_x,2005}}{\sum_1^n P_{DRG,2005}}\right] \times \left[\frac{stays_{DRG_x,2005}}{\sum_1^n stays_{DRG,2005}}\right]$$

This means that APR-DRG-SOI weights for a given year are obtained by multiplying the APR-DRG-SOI price ratios R_{price}:

$$R_{price_{DRG_x}} = \frac{P_{DRG_x,2005}}{\sum_1^n P_{DRG,2005}}$$

by their corresponding stay count ratios R_{stays}:

$$R_{stays_{DRG_x}} = \frac{stays_{DRG_x,2005}}{\sum_1^n stays_{DRG,2005}}$$

where R_{price} is fixed (i.e. is a constant for each APR-DRG-SOI, based on price calculations on 2005 reference data[tt]) and R_{stays} is variable (depending on the year):

$$(E) \quad W_{DRG_x,2005} = R_{price_x,2005} \times R_{stays_x,2005}$$

The resulting weight is a dimensionless number (fractional: >0 and <1), representing the proportion of 'price adjusted' APR-DRG-SOI total in relation to the 'price adjusted' total of all APR-DRG-SOI. Consequently the sum of all weights should always be equal to 1:

$$(F) \quad \sum_1^n W_{DRG,2005} = 1$$

5.5.2 Nominator - denominator rule

With formula (D) comes an important logical rule: nominator and denominator are to be conform, in other words, any withdrawal (exclusion) in the nominator needs to be accompanied by withdrawal (exclusion) of its homologue in the denominator, so that correct proportionality is maintained. Consequently, the result after any nominator-denominator withdrawal is a new, different weight.

A good example of a typical withdrawal is the exclusion of outliers in price calculations (resulting in the right trimmed mean as price = $P_{inliers}$): the nominator (A) needs adaptation:

$$(A) \quad T_{DRG_x,inliers,2005} = P_{DRG_x,inliers,2005} \times stays_{DRG_x,inliers,2005}$$

and correspondingly the denominator (B) becomes :

$$(B) \quad \sum_1^n T_{DRG,inliers,2005}$$

i.e. the budgetary corrected total of all APR-DRG-SOI inlier stays with exclusion of outlier stays.

The ratio nominator / denominator gives the corresponding inliers weight for APR-DRG-SOI_x:

$$(D) \quad W_{DRG_x,inliers,2005} = \left[\frac{P_{DRG_x,inliers,2005}}{\sum_1^n P_{DRG,inliers,2005}}\right] \times \left[\frac{stays_{DRG_x,i}}{\sum_1^n stays_{DRG}}\right.$$

or, rephrased: weights are obtained by multiplying the APR-DRG-SOI price ratios by their corresponding stay count ratios, i.e. if you take the inlier price, you have to take the inlier stay counts.

5.5.3 APR-DRG level allocations

Applied to any other preset budget for another year (y'), the 2005 APR-DRG-SOI weight needs recalculation in formula (E) to get a new proportionally adjusted weight for each APR-DRG-SOI_x in the year y':

$$(G) \quad W_{DRG_x,y'} = R_{price_x,2005} \times \frac{stays_{DRG_x,y'}}{\sum_1^n all\ stays_{DRG,y'}}$$

With, again, the sum of all weights equalling 1:

tt As shown in the international review, price estimators are usually not updated annually.

$$\sum_1^n W_{DRG_x,y'} = 1$$

Calculation of the allocation $A_{(DRGx,y')}$ comes with:

(H) $$A_{DRG_x,y'} = W_{DRG_x,y'} \times Budget_{y'}$$

Since the sum of all weights equals 1, the sum of all new allocations $A_{(x,y')}$ for year y' should equal the preset budget for that year:

$$\sum_1^n A_{DRG,y'} = Budget_{y'}$$

5.5.4 Hospital level allocations

Calculating hospital allocations adds another element to the above formulas, but basic principles remain the same:

- having a to z hospitals in year y', for each APR-DRG-SOI$_x$ in hospital H_e:

(I) $$W_{DRG_x,y',H_e} = R_{price_x,2005} \times \left[\frac{stays_{DRG_x,y',H_e}}{\sum_1^n all\ stays_{DRG,y'}} \right]$$

- Summation for all APR-DRG-SOI gives us the hospital weight for H_e in year y':

(J) $$W_{H_e,y'} = \sum_1^n W_{DRG,y',H_e}$$

With:

$$\sum_a^z W_{H_e,y'} = 1$$

- Calculation of the hospital allocation $A_{(Hx,y')}$ for the year y' comes with:

(K) $$A_{H_e,y'} = W_{H_e,y'} \times Budget_{y'}$$

And:

$$\sum_a^z A_{H,y'} = Budget_{y'}$$

For good understanding, we need to emphasize that any exclusion in the year-adjusted weights can only be validly applied to the homologous exclusive budgets, which means that with each exclusion weights have to be recalculated.

5.6 HOSPITAL TYPOLOGIES

5.6.1 Objective

The main objective of this exercise is to provide a hospital typology to understand the effects of a case-based financing system (see section 6.2 for the effects of the price and cost model as employed in this study). Hospitals can be described along multiple dimensions. Traditional dimensions include size (number of beds), hospital type (e.g. general, university), average LOS, etc. However, these traditional dimensions sometimes "hide" hospital characteristics which are more connected with specific hospital activities or with the delivered "care products", such as intensive care, chronic or palliative care and pathology. Moreover, sometimes items within one dimension are interrelated with items in one or more other dimensions. This is a first attempt in finding a hospital typology which broadens traditional hospital typologies with more process and activity-related hospital characteristics or with "care products" hospitals deliver. In a more profound exercise the selected set of characteristics can be extended.

5.6.2 Selection of descriptive variables and their correlation

The definition and selection of variables to describe Belgian hospitals was mainly based on preliminary simulation exercises. Input came from the review of the practice in other countries (Chapter 4) and from the homogeneity and sub-grouping analysis in section 5.3.9 and 5.3.11. The selection of hospital characteristics and their abbreviations used in the tables and figures in the following sections can be found in Appendix 5.

The correlation matrix in Table 16 gives an overview of the interdependence between the selected hospital characteristics.

Table 16: Correlation matrix of selected hospital characteristics

correlation matrix (Pearson)	FARMEXF_REL	HOSP_SEV_POINTS_REL	VAR_POINTS_COST_REL	VAR_POINTS_PRICE_REL	PRICE_OUTL_REL	LOS_OUTL_REL	LOS_IC_REL	N12_REL	IMPL_REL	C_STAYS_REL	P_STAYS_REL	LOS_SP_REL	BFM_REL	CMI_3M	size	Pathology Diversity
N =	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116	116
FARMEXF_REL	1															
HOSP_SEV_POINTS_REL	0,31	1														
VAR_POINTS_COST_REL	0,38	0,66	1													
VAR_POINTS_PRICE_REL	0,52	0,70	0,94	1												
PRICE_OUTL_REL	0,42	ns	ns	0,25	1											
LOS_OUTL_REL	ns	ns	ns	ns	0,61	1										
LOS_IC_REL	0,39	0,21	ns	ns	ns	ns	1									
N12_REL	0,26	0,26	ns	ns	0,19	ns	0,38	1								
IMPL_REL	ns	ns	ns	0,25	ns	ns	ns	ns	1							
C_STAYS_REL	ns	ns	0,31	0,21	ns	0,33	-0,20	ns	-0,24	1						
P_STAYS_REL	ns	ns	ns	ns	0,23	0,21	ns	ns	ns	0,25	1					
LOS_SP_REL	ns	ns	0,42	0,32	ns	0,53	-0,24	ns	ns	0,74	0,38	1				
BFM_REL	ns	0,23	ns	ns	ns	0,35	ns	ns	-0,42	0,26	ns	0,23	1			
CMI_3M	0,64	0,55	0,68	0,82	0,34	ns	0,36	0,33	0,57	ns	ns	ns	ns	1		
size	0,44	0,22	0,28	0,41	0,29	0,20	0,16	0,20	0,41	ns	0,20	ns	ns	0,58	1	
PathologyDiversity	ns	0,37	0,36	0,38	ns	ns	ns	0,23	0,33	ns	ns	ns	-0,25	0,462	0,462	1
	ns= not significant		|r| > 0,55												

A relative strong correlation is noticed between:

- the variability measures (VAR_POINTS_COST, VAR_POINTS_PRICE) and hospital severity measure (HOSP_SEVERITY);
- the characteristics price- (PRICE_OUTL_REL) and LOS outliers (LOS_OUTL_REL);
- chronic hospital stays (P_STAYS_REL) and length of stay in specialized care (LOS_SP);
- the case-mix index (CMI_3M) and indices for exclusive pharmaceuticals (FARMEXF_REL), expensive implants (IMPL_REL), the variability measures and size.

Size is associated with almost all descriptive characteristics but the correlation is rather weak. PathologyDiversity correlates with the variability measures, hospital severity measure, case-mix and size, but again the correlation is weak.

5.6.3 Dimensioning hospital characteristics

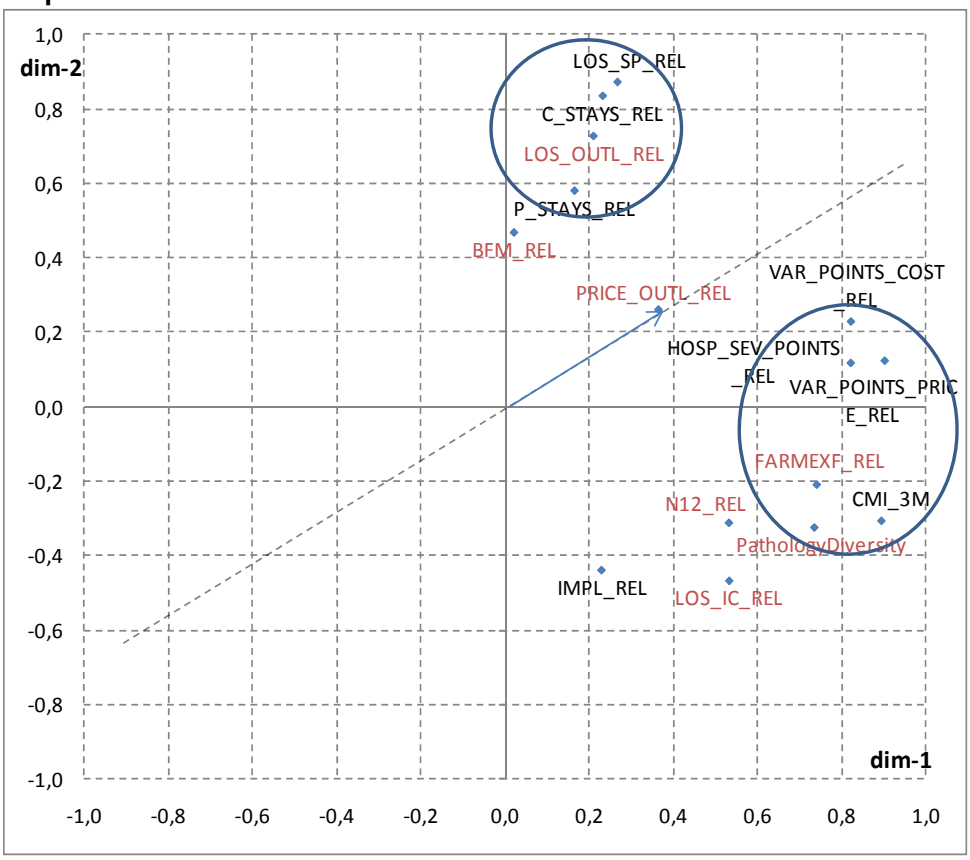
Figure 33 and Figure 34 present the (multivariate[uu]) graphical 3-dimensional summary (R^2=0.72) of the above correlations.[vv] As we initially wanted to look at process variables of the hospital, we excluded "*size*". Figure 33 displays the first dimension (x-axis) versus the second dimension (y-axis). Figure 34 shows dimension 1 (x-axis) versus dimension 3 (y-axis). On these plots the variables are positioned according to their correlation with the dimensions. For example, the (x,y) coordinates of the variable *PRICE_OUTL_REL* equal (0,36;0,26).

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uu The "Prinqual" procedure in SAS/STAT was used to transform the variables in the correlation matrix of Table 16 into a reduced number of dimensions. For this exercise, the number of dimensions was limited to three to allow for a graphical representation. Amongst others, the procedure determines principal components of qualitative data. For more information, see the online SAS-manual of this procedure available at http://www.d.umn.edu/math/docs/saspdf/stat/chap53.pdf.

vv Two hospitals were excluded from the analysis since they performed as extreme outliers in reference with the other 114 hospitals in a pre-analysis.

Figure 33: First dimension (x-axis) versus second dimension (y-axis) of hospital characteristics

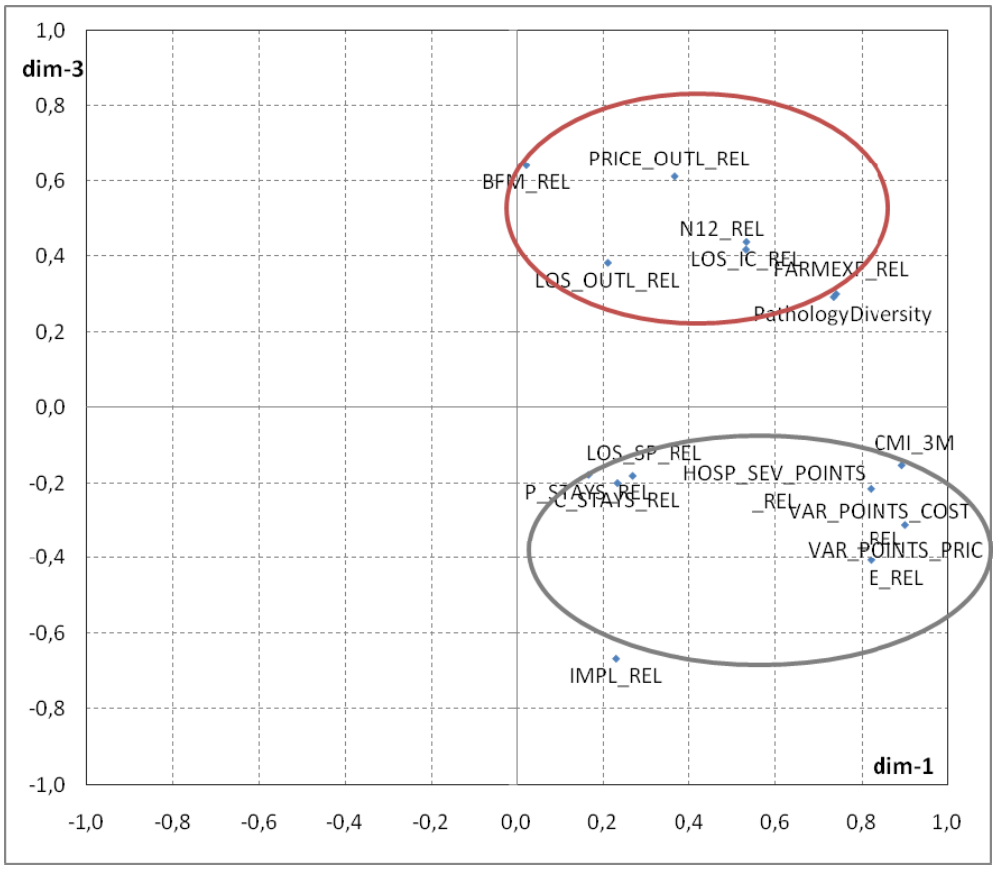


The two variability measures (VAR_POINTS_COST_REL, VAR_POINTS_PRICE_REL), the hospital severity measure (HOSP_SEV_POINTS_REL), exclusive pharmaceuticals (FARMEXF_REL), case-mix index (CMI_3M) and pathology diversity (PathologyDiversity) clearly constitute the first dimension or principal component ("dim-1"). These variables are tightly clustered and are located in the right region of the graph. This result was also found in the correlation matrix in Table 16. Moving from left to right on the horizontal axis indicates that a hospital scores higher on the descriptive characteristics positioned on the right of the graph.

Moving from the bottom to the top of the graph along the vertical axis can be interpreted accordingly. The second principal component ("dim-2") captures the variables LOS_SP_REL, LOS_OUTL_REL, C_STAYS_REL and P_STAYS_REL . Hence, a hospital which is positioned at the top of the graph has a relatively higher share of chronic and palliative hospital stays. A hospital which is positioned at the bottom (and more or less to the right) scores relatively high on LOS_IC_REL (length of stay on intensive care), N12_REL (CPR interventions) and IMPL_REL (share implants).

Figure 34 gives the first dimension on the x-axis (as in Figure 33) and the third dimension ("dim-3") on the y-axis. The third dimension is related to the variables PRICE_OUTL_REL, LOS_OUTL_REL, N12_REL and LOS_IC. These variables were situated in the back of the cube formed by dim1-dim2-dim3 (pink colour in Figure 33).

Figure 34: First dimension (x-axis) versus third dimension (z-axis) of hospital characteristics



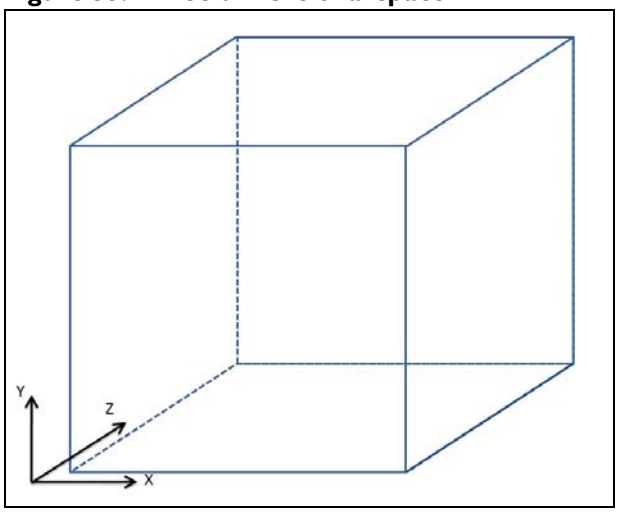
The third dimension is also related to the characteristics IMPL_REL, P_STAYS_REL, C_STAYS_REL, LOS_SP_REL and the variability measures, (HOSP_SEV_POINTS_REL, CMI_3M) which are more situated in the front of the cube formed by dim1-dim2-dim3. In other words, a hospital which scores high on "dim-3" has a relative larger proportion of patient days on intensive care, more CPR interventions, relative more LOS outliers and relatively more price outliers. On the contrary, a hospital which scores low on "dim-3" is characterized by a higher share of implants, more chronic and palliative hospital stays, and of course a higher LOS in specialized care.

Simplified, we can refer to the axes as:

- X-axis: accent on variability
- Y-axis: accent on specialized chronic and palliative care, while the counterpart is less accent on intensive care
- Z-axis: mixture of diverse variables, while main accent lays on intensive care and exceptional stays (outliers)

These dimensions or axes can be positioned in a three dimensional space.

Figure 35: Three dimensional space



5.6.4 Conclusions

Hospitals can be described along multiple characteristics, both traditional (size, type, etc.) and non-traditional characteristics (case-mix, variability, intensive care, etc.). The exercise presented above indicates that the selected non-traditional characteristics correlate with each other on three dimensions. The first, most pronounced dimension (X) is related to variability. A second dimension (Y) concerns specialized chronic and palliative care, while the counterpart is less accent on intensive care. A third, less pronounced dimension (Z) is a mixture of characteristics with the main accent on intensive care and exceptional stays (outliers). Most likely these dimensions can be refined by adding more characteristics and by including data of several years. The exercise may point towards a hospital typology which exceeds the traditional hospital classification and which is more closely related to the intrinsic choices hospitals make concerning their processes and patient populations or with the choices hospitals make regarding their "care products". Possibly, these non-traditional characteristics can contribute in gaining a clear understanding of the effects (budget deviations) that appear in a case based all-inclusive financing. A further exploration of these characteristics is therefore recommended.

6 BUILDING BLOCKS AND MACRO SIMULATION

In this chapter the redistribution effects of the application of an all-inclusive cased-based payment system are simulated on the Belgian hospital sector with the price and cost model. In section 6.1 a framework is developed which introduces the different building steps of an all-inclusive case-based financing. The framework serves as the basis for the macro simulation exercise which offers insights to guide the debate on the design of a payment system for hospitals (section 6.2). The simulation at the macro level was conducted under different scenarios of cases or activities to be funded through case-based payments and other sources. Section 6.3 concludes.

6.1 DEFINING FRAMEWORK AND DATA SET

6.1.1 Objectives and assumptions

6.1.1.1 Objectives

A framework to go from the current financing system to an all-inclusive case-based payment system is provided. The exercise results in redistribution effects between hospitals. However, it is important to note that the exact budget shifts resulting from the macro simulation exercise are not the main focus of Chapter 6. The budget shifts depend, among others, on the chosen weights and on the selection of activities to be funded through other sources. Throughout Chapter 6 all results are presented with weights based on both the price and the cost model. Both methods have their pros and cons and no attempt was made to search for the 'ideal' weight since setting appropriate tariffs per case is not merely a technical exercise. Instead, the relationship between costs, prices and tariffs per case should reflect policy choices of providing incentives that can influence hospital behaviour or broader policy goals. Hence further investigation of weights and of non-case-based payments is necessary, but was out of the scope of this study since this exceeds the technical feasibility of an all-inclusive case-based payment system. In Chapter 7 we come back to this issue when discussing further steps which should be taken before an all-inclusive case-based payment system for hospitals could be implemented in practice in Belgium.

6.1.1.2 Assumptions

The following assumptions were made in the calculation of the APR-DRG payment rate and in the macro simulation exercise:

- **APR-DRG grouper**

  As unit of reimbursement the APR-DRG grouper as developed by 3M Health Information Systems was used as a starting point and was adapted to improve the within-DRG homogeneity when applied to Belgian hospital data.

- **Budget neutral simulation**

  Budget neutrality was assumed in the simulation exercise: budget shifts between and within hospitals are possible, but total hospital resources remain equal before and after the simulation.

- **Equal hospital behaviour after all-inclusive case-based payments**

  Possible effects of the implementation of an all-inclusive case-based payment system on hospital behaviour (improved technical efficiency and productivity by e.g. decreasing length of stays, increased number of cases, providing less services or tests, etc.) can only be analysed theoretically and fall outside the scope of this study.

- **Illustrative weight application**

No attempt was made to search for the "ideal" APR-DRG weight since this implies concrete policy choices on outcomes to be attained. Weights in the price model and the cost model were calculated for illustrative purposes and served as the basis for the calculation of budget shifts in different scenarios.

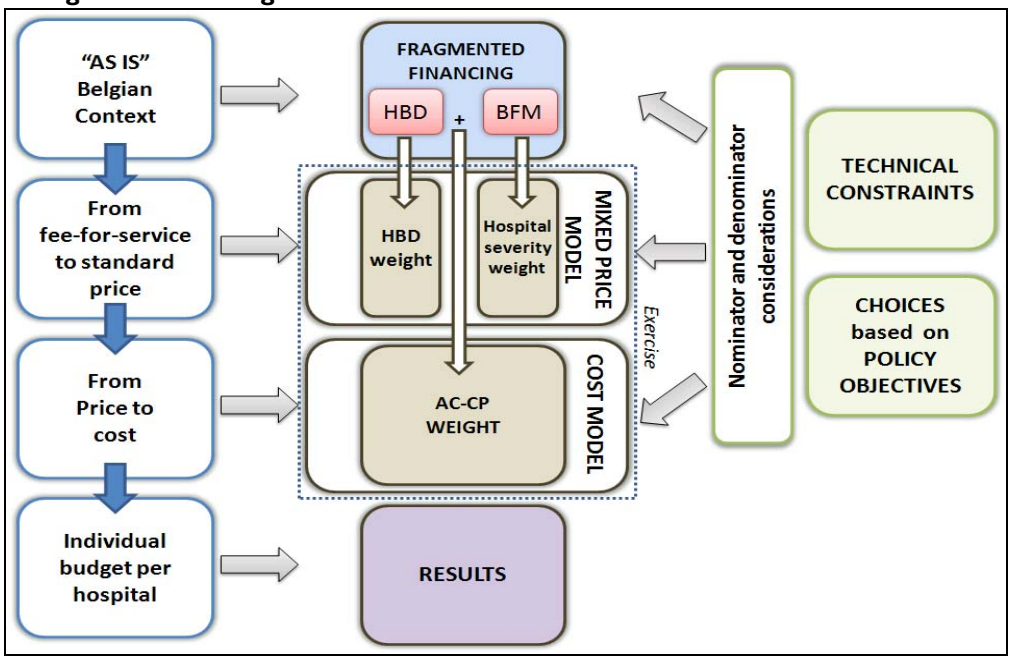
- **Illustrative scenarios**

Policy objectives may result in choices to finance certain services, pathology groups or hospitals by separate budgets or by different financing systems. The selected scenarios described below illustrate their respective effect on budget shifts but should not be interpreted as supporting specific policy choices.

6.1.2 Framework

A framework for the introduction of an all-inclusive case-based financing system was developed. The different "building steps" of the framework are shown in Figure 36.

Figure 36: Building an all-inclusive case-based model



Choices and methods used in each step of the framework are explained in the following paragraphs. In each step Figure 36 is repeated and a yellow box is drawn around the relevant part of the framework.

6.1.2.1 AS IS: Belgian context and budget components

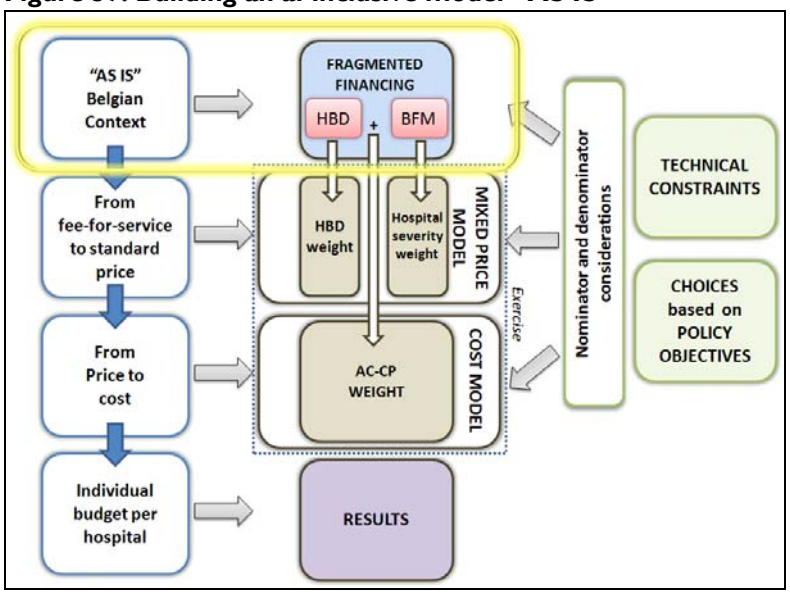
The current financing structure of hospitals was used as the starting point (Figure 37). As described in Chapter 3 Belgian hospitals operate today in a fragmented and dual financing structure. In short, non-medical activities, which mainly comprise nursing activities, hotel activities and services in accident and emergency care, are financed via a fixed prospective budgeting system based on historical data. This is the budget of financial means (BFM). Most of the medical and medico-technical services on the other hand, are remunerated through fee-for-service. We call this part of the financing structure the hospital billing data (HBD).[ww]

[ww] In section 5.3.4.1 of Chapter 5 it was explained that the HBD (or the MFG-RFM in Belgian terminology) also contain part of the BFM, namely the variable part of subparts B1 and B2. These amounts were excluded form the HBD and included in the BFM.

The HBD contain all medical fees and billing amounts for services reimbursed by the NIHDI (pharmaceuticals, blood & derivates, radio-isotopes, implants, disposables, etc.). Both reimbursements per nomenclature code on a fee-for-service base and lump sum payments for laboratory testing, medical imaging and pharmaceuticals are included.

Data are available per hospital stay. The BFM data are available per hospital and per budget component (A, B, C and subparts). Data at the level of an individual hospital stay are not available since the current monthly payment of the fixed part of the BFM to an individual hospital is not related to individual stays. Given that the nursing day price in the HBD at the level of a stay only represents a fraction of the 'full price' for the stay and moreover is an average price for all hospital pathologies, the hospital budget is taken along as a whole (at the level of the hospital) in the simulation. The global BFM of each hospital is distributed among hospitals on the basis of a global estimator. This also means that HBD prices were calculated on HBD budgets without the (fractional) stay day remunerations[xx].

Figure 37: Building an al-inclusive model - AS IS



6.1.2.2 *Determination of a standard "price" or "cost" per case*

In an APR-DRG payment system the unit of payment is a hospital stay where the payment is determined by the APR-DRG and severity level. A first step in moving from a fee-for-service system to a system with standard prices based on patients' pathology is the calculation of a weight per APR-DRG and severity level. Weights were derived from the price model (based on reimbursements) and from the cost model approach. A **price weight** was based on the HBD data and a **cost weight** was based on the cost model. It should be stressed that the calculation of both weights serves as an exercise and further weight exploration is essential when moving towards the actual implementation of an all-inclusive case-based financing system. The methodology of weight calculation can be found in section 5.5.

[xx] The option 'price calculation with 100% extrapolation of nursing day prices' was not withheld in the macro simulation.

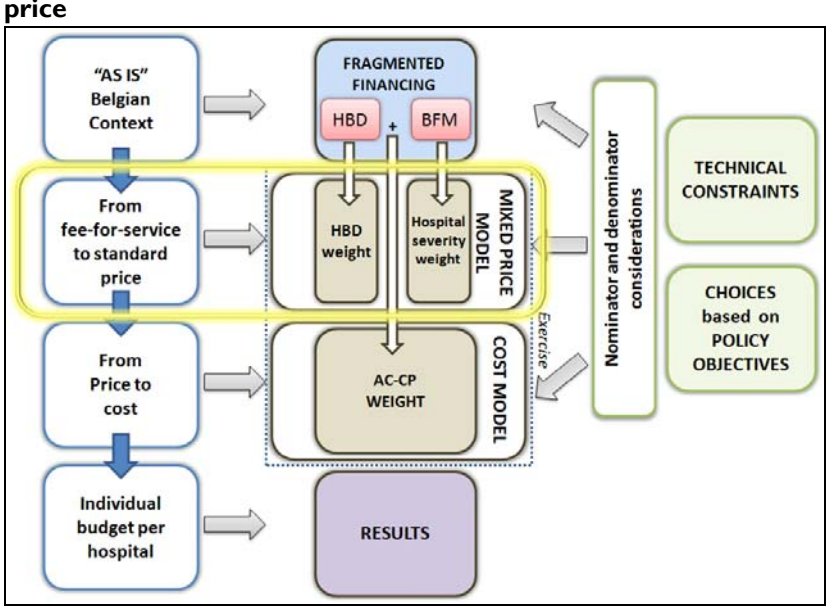
6.1.2.3 *From fee-for-service to a standard price: stretching the current financing system with a mixed price model*

In the second step both components of the current financing system (BFM and HBD) were integrated (Figure 38). In this **mixed price model** a different weight was applied to the BFM and HBD. For the HBD data a **price weight** or nomenclature weight based on reimbursed amounts of fees, lump sum payments and pharmaceuticals was calculated. As explained before, it was decided that the same resource items should be included for the calculation of the APR-DRG weights and tariff. Hence, this price weight solely based on HBD had to be complemented with a second weight to distribute the BFM among individual stays.

Therefore a **hospital severity weight**, based on the percentage of stays in SOI-levels 3 and 4 for the inpatient and day care stays, was calculated (section 5.3.8).

It was decided to calculate the weight as the median over all hospital stays, although other possibilities are possible. The "best" choice of estimator depends on the distributional characteristics of the data and on policy choices concerning the objective to be optimized. The price weight was calculated as the median price or reimbursement per APR-DRG and severity level over all stays. Current financing mechanisms and registration systems were integrally used. From the hospital point of view the price equals the revenue the hospital receives per case. This approach can be considered as a price homogenisation or standardisation. It can also be seen as a broadening of the concept of the reference amounts (section 3.4.3.3), but now including all APR-DRGs and all expenses.

Figure 38: Building an all-inclusive model – from fee-for-service to a standard price

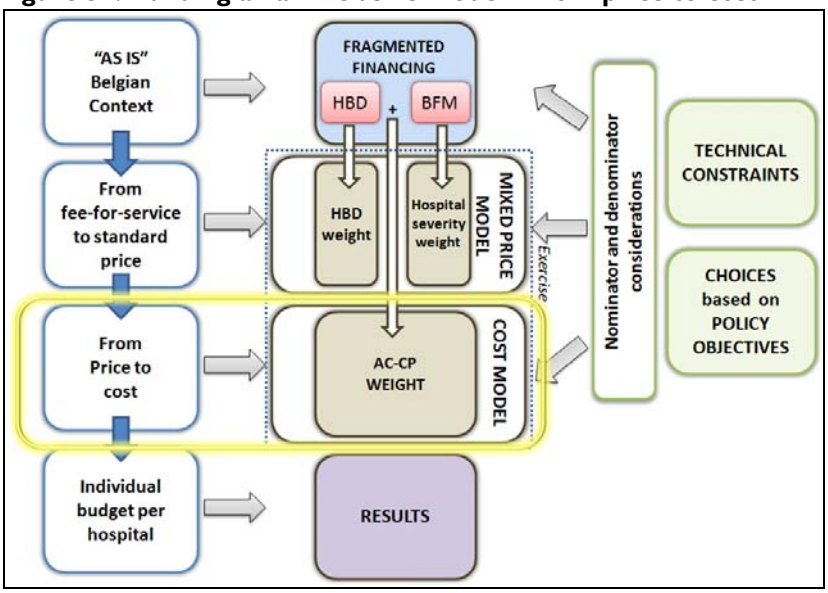


6.1.2.4 *First step towards a costing methodology with the cost model*

In the cost model a different approach was taken. The **cost weight** was calculated as the median cost per APR-DRG and severity level over all stays. From the hospital point of view the cost corresponds to the actual cost of care per case.[yy] The cost weight could be applied to both budgets (BFM and HBD) since it reflects the cost of both medical and non-medical hospital activities.

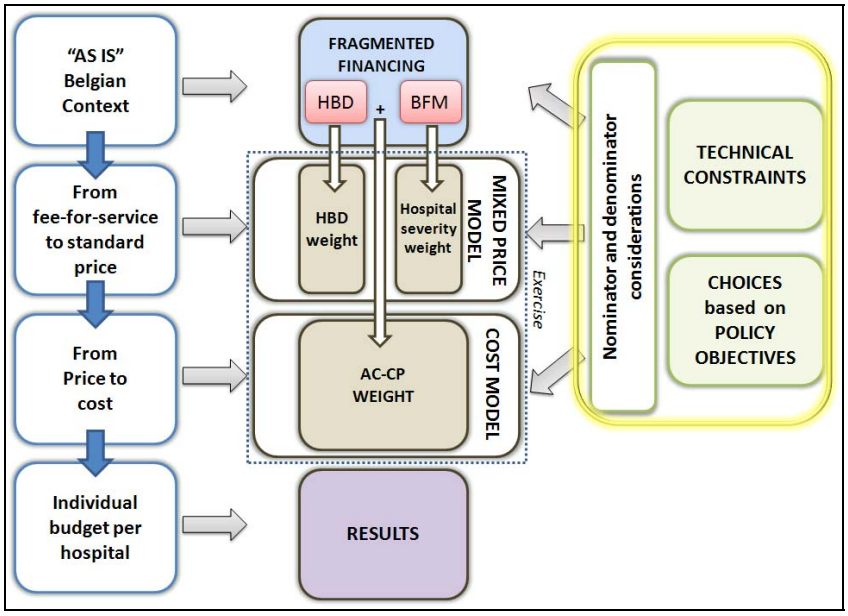
[yy] Ideally, the cost model should be based on a "bottom-up" approach in which the actual costs of individual patient episodes of care are recorded so that the weight per APR-DRG is the average (median, mean, etc.) true cost of all patients within that group.

Figure 39: Building an all-inclusive model – from price to cost



6.1.2.5 *Nominator and denominator considerations*

Figure 40: Building an all-inclusive model - nominator and denominator considerations



Although the study examines the feasibility of an "all-inclusive" case-based financing of hospitals, there may exist arguments which justify non-case-based payments for certain services, patients or pathology groups. Street et al. (2007)[87] provide three grounds for separate financing:

- payments for services provided to patients for whom no satisfactory classification system is available (e.g. mental health and rehabilitation);
- payments for non-patient related activities (e.g. teaching and research);
- payments for costs incurred by hospitals because of their location (e.g. rural) or because of constraints on the organizational structure.

The review in Chapter 4 (section 4.3.6) revealed concrete choices of non-case-based payments in the five selected countries. In the current exercise, the decision to exclude certain services, pathology groups or hospitals from an all-inclusive case-based financing and to allocate separate budgets to these items, patients or hospitals, was based on technical and policy arguments:

- Technical exclusions based on constraints of data availability;
- Choices/exclusions based on policy objectives.

Eliminating particular services or stays results in exclusions both in the cost or price weight (nominator) and in the global budget (denominator).

Technical constraints

Due to a lack of data availability or to inconsistencies in data registrations, certain elements could not be included. However, in case of full data availability, these elements could be part of the all-inclusive case-based financing.

The following elements were excluded due to technical constraints. A detailed description of these constraints was provided in Chapter 5.

- Ambulatory care/ Outpatient care: no data registration
- One day care: no linkage between HBD and clinical data available (before registration year 2006)
- Mixed stays
- Missing values due to zero HBD total (missing data), questionable LOS, zero billing amounts
- BFM for mental health: no other information (HBD, MCD) about mental health available
- Specific BFM budget components: certain BFM budget components finance specific services. Including these components in an all-inclusive financing system would result in an allocation of these components to hospitals which do not provide the specific services. A detailed list of BFM in- and exclusions in the current exercise can be found in Table 6.1 in the appendix.
- Fraction of BFM: since outpatient and day care are excluded from the simulation and only inpatient stays are included, allocating total BFM to inpatient stays would lead to an overestimation or underestimation of individual hospital budget shifts, depending on their fraction of outpatient and day care activities.

Table 17 summarizes exclusions due to technical constraints.

Table 17: Original data set and exclusions due to technical constraints (2005)

		Effect on	# MCD stays	HBD (€)	BFM (€)	# hosp
Original data set			**2 624 502**	**3 224 904 475**	**5 295 713 341**	**147**
Technical exclusions	Day care	HBD + Stays	1 050 091	571 838 936	-	147
	Mixed stays (acute + chronic) in acute hosp	HBD + Stays	18 565	91 290 222	-	147
	Missing values	HBD + Stays	15 673	42 555 004	-	147
	BFM Mental health	BFM	-	-	705 249 677	147
	Specific BFM budgets	BFM	-	-	890 869 203	147
	Fraction BFM	BFM	-	-	1 099 267 193	147
Original data set minus exclusions due to technical constraints			**1 540 173**	**2 519 220 313**	**2 600 327 268**	**147**

Choices based on policy objectives

In addition to the arguments given by Street and colleagues[87], it can be decided to finance certain services, pathology groups or hospitals by separate budgets or by different financing systems because of e.g. high inter-DRG-severity variability, to avoid disincentives for innovation, to guarantee access to health care, etc. These decisions should be made at the level of policy makers.

Hence no such choices were made in this study. Instead, inspired by the actual practice of the all-inclusive case-based financing in the countries reviewed in Chapter 4, some possibilities of such exclusions are summed up hereafter:

- Specialized (Sp) and geriatric (G) hospitals
- Outliers: price, cost, length of stay
- Intensive care
- Exclusive pharmaceuticals (pharmaceuticals on the exclusion list, not funded by lump sum payments)
- Expensive implants
- Transplants
- Chemotherapy
- Radiotherapy
- Interventional radiology and catheterization
- Diagnostic imaging
- Renal dialysis
- Emergency care
- Palliative care
- Care of burn injuries
- Capital costs

A selection of these exclusions is explored in the scenarios described in the next section.

6.2 RESULTS OF THE MACRO SIMULATIONS

In this section the redistribution effects of applying an all-inclusive case-based payment system on the Belgian hospital sector were simulated. In addition, supplementary macro simulations for different preliminary scenarios were conducted. Throughout section 6.2 the same structure was followed. For the all-inclusive model and for the selected scenarios we first define the data sample and exclusions on which the calculation of the budget shifts is based. Next, the results are given for the price and for the cost model.

6.2.1 An all-inclusive case-based financing model

The macro simulation exercise starts with the basic all-inclusive model which includes all data, with the exception of technical exclusions and some additional exclusions which were based on methodological issues addressed in Chapter 5.

6.2.1.1 Data sample and exclusions

Chapter 5 pointed out that chronic (specialized and geriatric) hospitals distinguish themselves from acute hospitals. Based on this argumentation it can be justified to make a fundamental distinction between the two types of hospitals in an all-inclusive financing. Consequently chronic hospitals are excluded from the simulation. Of course, comparable simulations could be conducted separately for chronic hospitals. In addition, the BFM for burn injuries is left out from the analysis since it concerns a specific budget which is only received by five hospitals.

Table 18 gives an overview of the number of stays and the corresponding budget amount included in the all-inclusive case-based simulation.

Table 18: Final data set in the all-inclusive model (2005)

		Effect on	# MCD stays	HBD (€)	BFM (€)	# hosp
Original data set minus exclusions due to technical constraints			**1 540 173**	**2 519 220 313**	**2 600 327 268**	**147**
Additional exclusions	BFM Burns	BFM	-	-	14 660 227	5
	Specialized and geriatric hospitals	BFM + HBD + Stays	9 477	16 080 011	152 864 939	31
Final data set	**All-inclusive model**		**1 530 696**	**2 503 140 302**	**2 432 802 102**	**116**

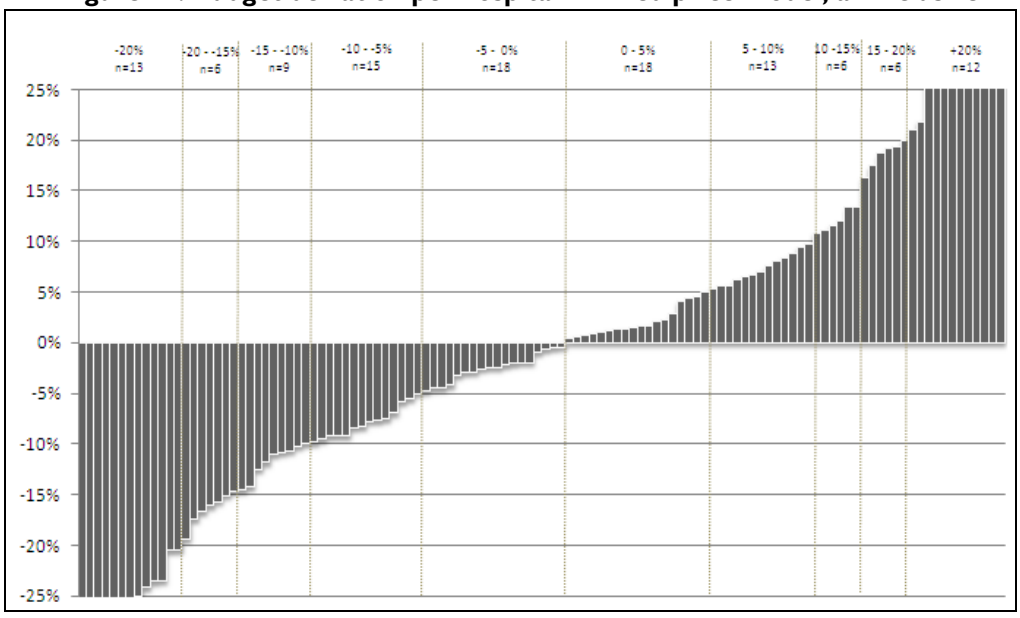
The final data set contains 87% of the original hospital budget for inpatient stays in the available data.

6.2.1.2 *From fee-for-service to a standard price: stretching the current system with a mixed price model*

In the mixed price model the price weight is applied to the HBD budget and the hospital severity weight to the BFM. The total effect is calculated as the sum of allocated budgets based on the HBD and the BFM.

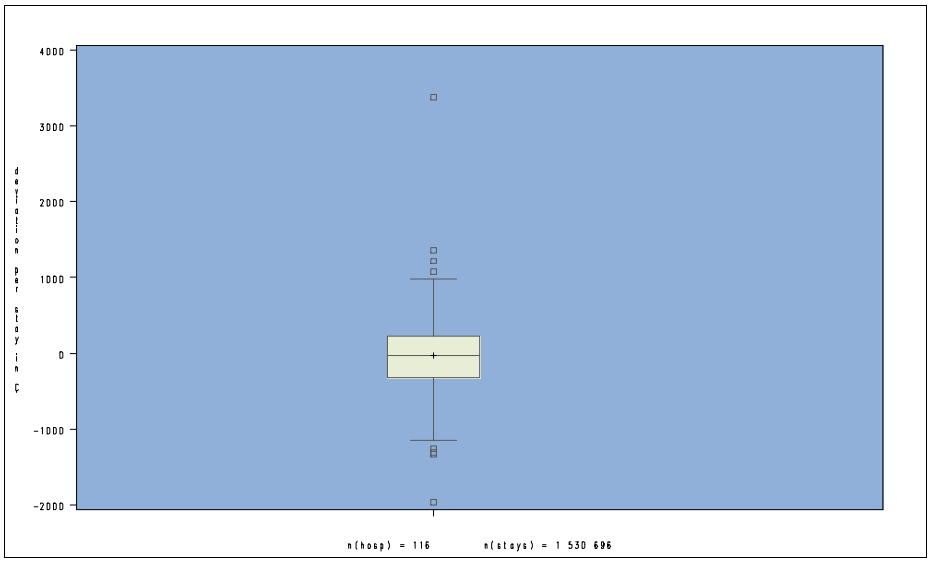
Figure 41 displays the budget deviation per hospital as compared to the current situation for the mixed price model. For 61 out of 116 hospitals the mixed price model has a negative effect on their budget, while 55 hospitals have a positive budget deviation. In global, budget shifts for a hospital can be substantial. About 10% of hospitals have an extremely positive deviation (+20%), but also for approximately 10% of hospitals negative budget shifts are large (-20%). As indicated above, 87% of the original hospital budget for inpatient stays in the available data sets was taken up in the analysis. When the excluded budget is added to both "old" (without case-based all-in) and "new" (after with case-based all-in) budgets, equal results can be observed. However, extremes are less pronounced. The result can be found in Appendix 6.1.

Figure 41: Budget deviation per hospital – mixed price model, all-inclusive



The boxplot in Figure 42 depicts the budget deviation per stay. It indicates that the budget shifts for an all-inclusive case-based model using the mixed price weight are characterized by a large dispersion, with some outlier hospitals, both in positive and negative direction. Budget shifts per stay range from +€ 3 350 to -€ 2 000 and the interquartile range (IQR - middle 50% of hospitals) is from +€ 200 to -€ 170 per stay.

Figure 42: Budget deviation per stay – mixed price model, all-inclusive

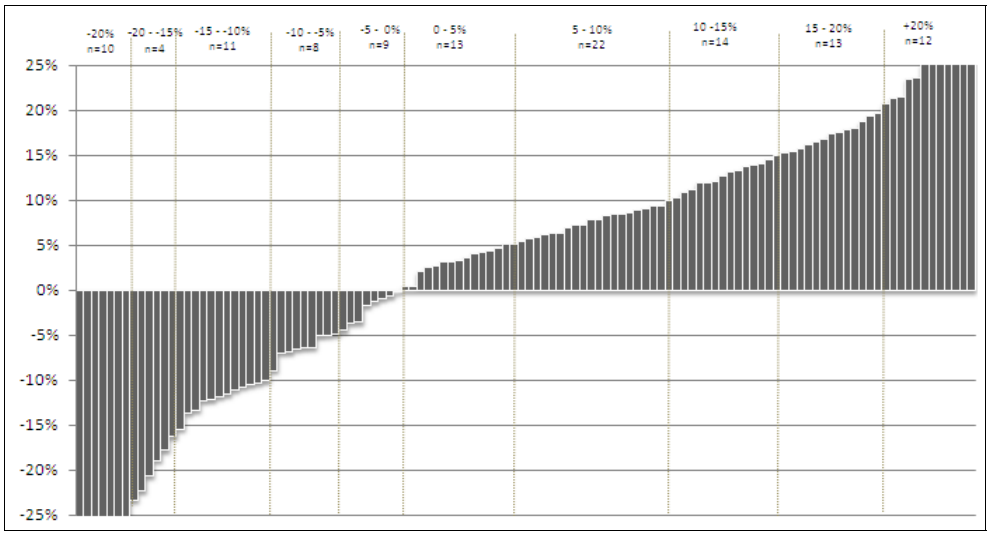


It can be concluded that the introduction of all-inclusive case-based payments as calculated with the mixed price model entails significant budget shifts between hospitals and between stays. In addition, a large dispersion in budget shifts is found.

6.2.1.3 *First step towards a more cost oriented approach with the cost model*

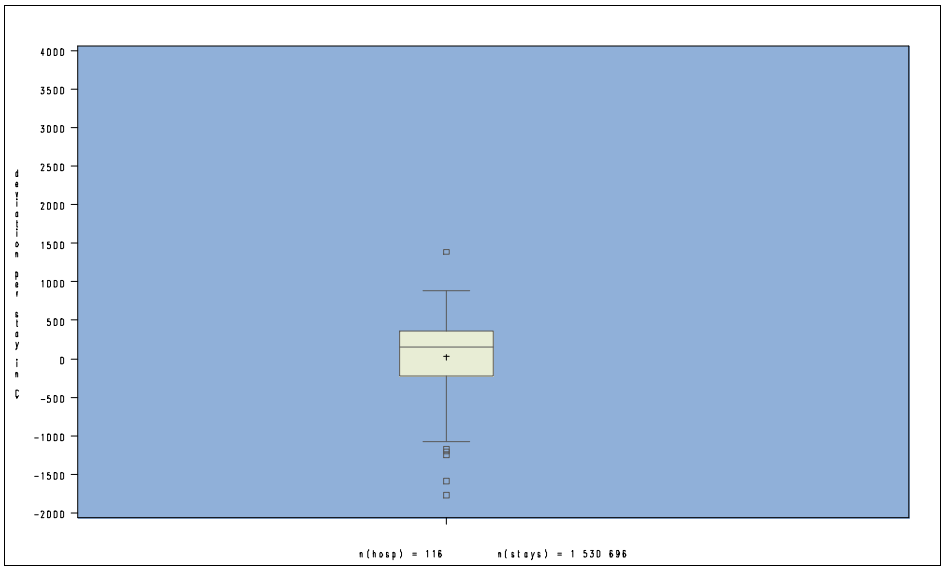
In the cost model one cost weight is applied to both budgets. Figure 43 displays the budget deviation per hospital as compared to the current situation for the cost model. Almost 65% (n=74) of hospitals enjoy a positive budget shift while 42 hospitals have negative budget deviations. The -5% to + 5% range contains less hospitals than in de mixed price model (24 compared to 36).

Figure 43: Budget deviation per hospital – cost model, all-inclusive



The boxplot in Figure 44 indicates a large dispersion in the budget shifts per stay which range from +€ 1 400 to -€ 1 760 per stay. This dispersion is lower than in the mixed price model. The interquartile range (from +€ 211 to -€ 200) is more in line with the IQR in the mixed price model.

Figure 44: Budget deviation per stay – cost model, all-inclusive



To summarize, introducing all-inclusive case-based payments as calculated with the cost model entails significant redistribution effects between hospitals and between stays, a result which was also found for the mixed price model. However, compared with the mixed price model the dispersion in budget shifts is less pronounced.

6.2.2 Scenario implementation

Two scenarios were selected. The starting point is the final data set in the all-inclusive model as given in Table 18. In the first scenario exclusive pharmaceuticals (pharmaceuticals on the exclusion list, not funded by lump sum payments), expensive implants and price outliers were excluded from the analysis. The second scenario has the same exclusions as in scenario one but focuses on acute stays (exclusion of palliative and chronic stays). In addition to these two scenarios, the redistribution effects of many other scenarios have been simulated. However, although significant budget shifts were sometimes observed at the level of a hospital or stay, at the macro level these effects were difficult to identify and to represent. Hence, these results are not presented here. The selection of the two scenarios of which the budget shifts are presented was based on a pre-examination of the data in Chapter 5 but is mainly illustrative.

6.2.2.1 Scenario 1: Exclusion of exclusive pharmaceuticals, expensive implants, price outliers

Data sample and exclusions

Table 19 gives an overview of the number of stays and budget included in the first scenario.

Table 19: Final data set in scenario 1 (2005)

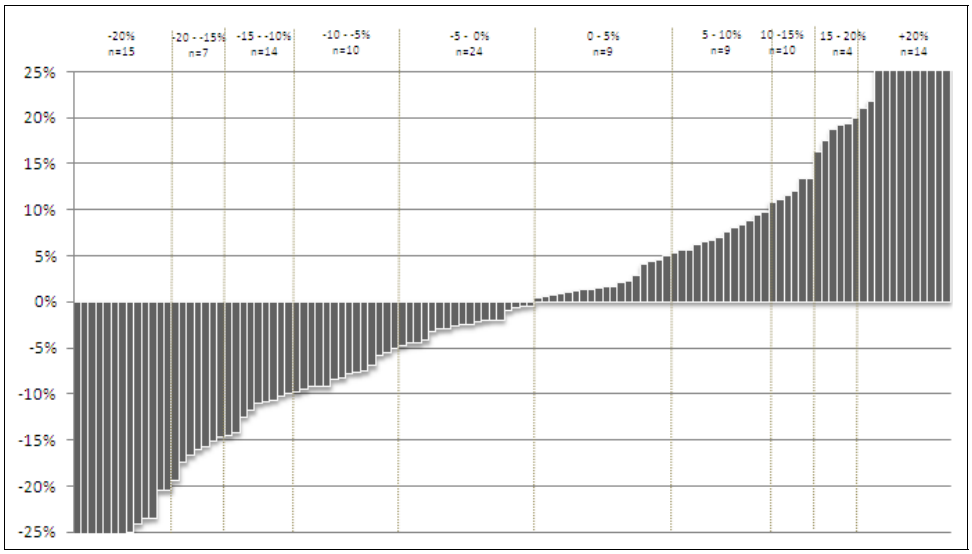
		Effect on	# MCD stays	HBD (€)	BFM (€)	# hosp
Basis	**All-inclusive model**		**1 530 696**	**2 503 140 302**	**2 432 802 102**	**116**
Exclusions	Exclusive pharmaceuticals	HBD	-	127 294 538	-	116
	Expensive implants	HBD	-	209 966 161	-	116
	Price outliers	HBD + Stays	72 018	277 455 486	-	116
Final data set	**Scenario 1**		**1 458 678**	**1 888 424 117**	**2 432 802 102**	**116**

76% of the original hospital budget for inpatient stays in the available data sets was taken up in scenario 1. Note that an overlap is possible in the effect on the hospital budget between exclusive pharmaceuticals, expensive implants and price outliers.

From fee for service to a standard price: stretching the current system with a mixed price model

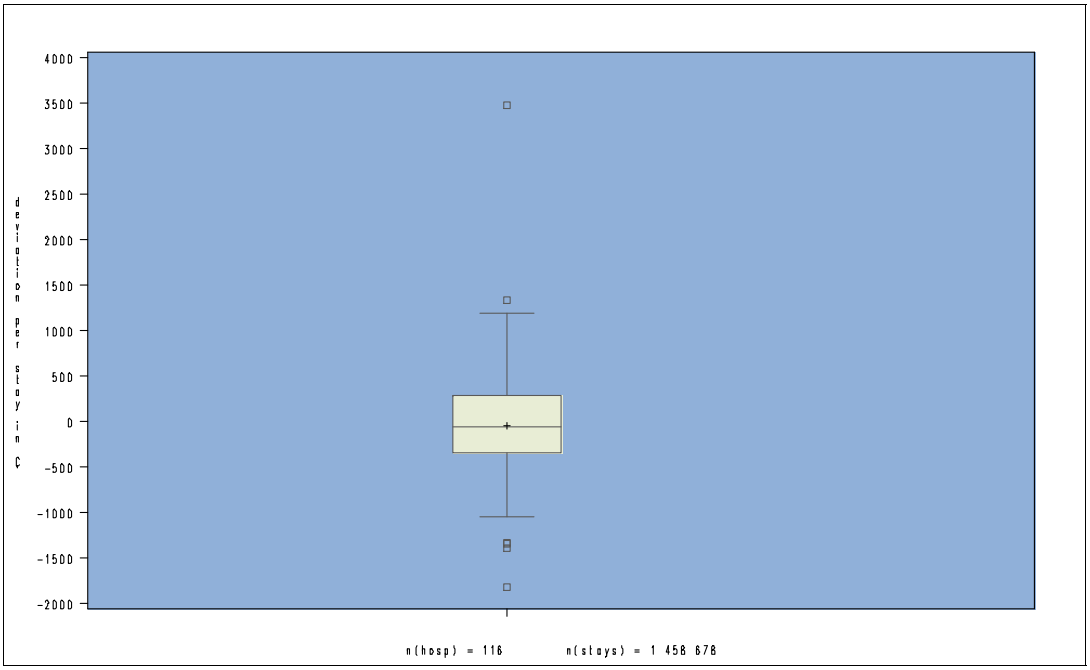
Figure 45 gives the results for the first scenario with the mixed price model. To assess the effect of excluding exclusive pharmaceuticals, expensive implants and price outliers on budget shifts at hospital level, the results should be compared with those in Figure 41. Figure 45 shows that 60% (n=70) of hospitals have a negative budget deviation, while 40% (n=46) have a positive budget deviation. The number of hospitals with a negative and positive budget shift in the all-inclusive model is equal to 61 and 55 respectively. The share of hospitals with extreme budget shifts (+ or – 20%) slightly increased from 13 to 15 for negative shifts and from 12 to 14 for positive shifts. The impact of this scenario is more visible when applying the mixed price model separately to both budget components (HBD and BFM). The results are given in Appendix 6.2.

Figure 45: Budget deviation per hospital – mixed price model, scenario 1



The boxplot in Figure 46 shows that this dispersion remains large, but the IQR gets smaller, ranging from +€ 150 to -€ 140 per stay as compared to +€ 200 to -€ 170 in the all-inclusive model.

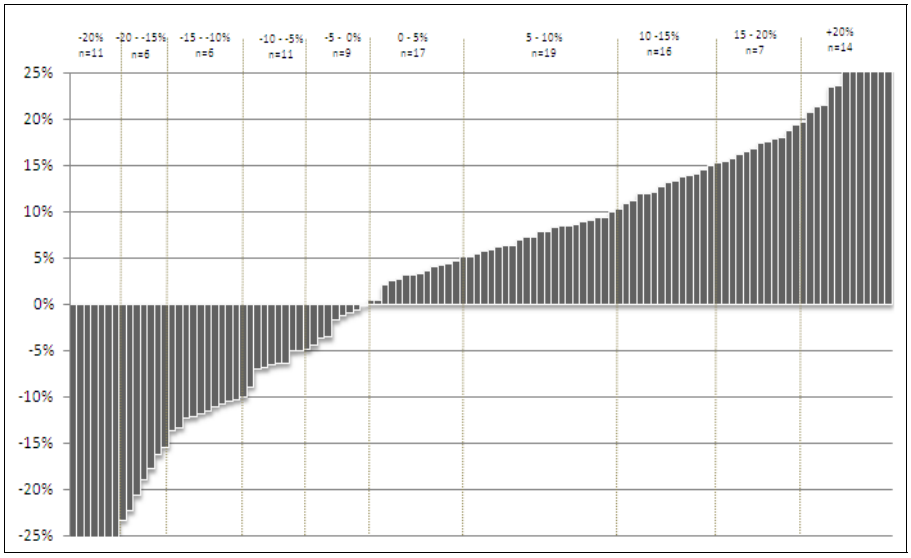
Figure 46: Budget deviation per stay – mixed price model, scenario 1



First step to move towards a more cost oriented approach with the cost model

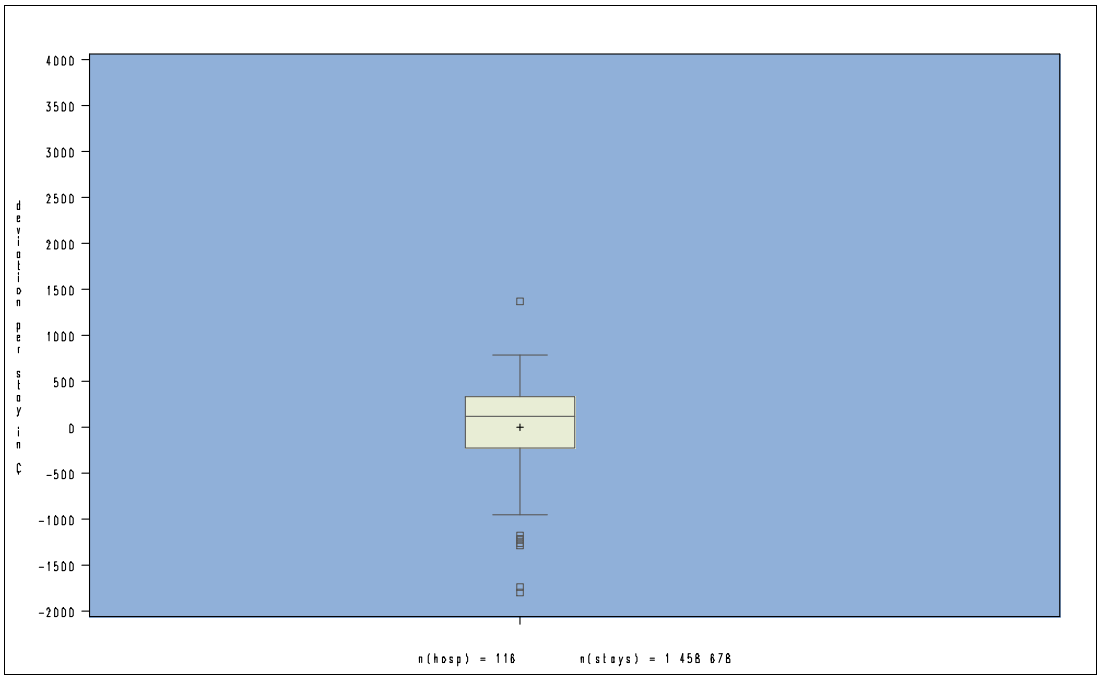
The same trend can be observed in the cost model. Deviations get smaller, but the impact is only visible looking at the individual budget components HBD/BFM (in Appendix 6.2). 73 out of 116 hospitals have a positive budget deviation while 43 hospitals have a negative budget deviation. In the all-inclusive model the respective number of hospitals equalled 74 and 42.

Figure 47: Relative budget deviation per hospital – cost model, scenario 1



Also in the cost model applied to scenario 1 the dispersion remains large, but the IQR gets smaller and ranges from +€ 160 to -€ 140 (Figure 48). In the all-inclusive model the IQR was from +€ 211 to -€ 200 (Figure 44).

Figure 48: Budget deviation per stay – cost model, scenario 1



6.2.2.2 *Scenario 2: Exclusion of exclusive pharmaceuticals, expensive implants, price outliers and selection of acute stays*

Scenario 2 starts from scenario 1 but additionally excludes chronic and palliative stays. A more accurate approach would be to add an additional perspective next to APR-DRG and severity to the weights and differentiated weights according APR-DRG, severity and stay type. However, this is technically infeasible in the study as the cost weights and hospital severity weights cannot be differentiated according type of stay.

Data sample and exclusions

Table 20 gives an overview of the number of stays and budget included in the second scenario.

Table 20: Final data set scenario 2 (2005)

		Effect on	# MCD stays	HBD (EUR)	BFM (EUR)	# hosp
Basis	**All-inclusive model**		**1 530 696**	**2 503 140 302**	**2 432 802 102**	**116**
Exclusions	Pharmaceuticals ex forfait	HBD	-	127 294 538	-	116
	Expensive implants	HBD	-	209 966 161	-	116
	Price outliers	HBD + Stays	71 572	274 487 966	-	116
	Chronic stays	HBD + Stays	3 215	5 309 504	-	116
	Palliative stays	HBD + Stays	2 225	5 507 903	-	116
	BFM chronic budget	BFM	-	-	99 117 712	116
	BFM palliative budget	BFM	-	-	25 222 364	116
Final data set	**Scenario 2**		**1 453 684**	**1 880 574 230**	**2 308 462 025**	**116**

Scenario 2 contains 74% of the original hospital budget for inpatient stays in the available data sets. The size of the additional exclusions is minor: palliative and chronic stays represent only 0.4% of stay total, 0.6% of HBD budget and 5% of BFM. Consequently, the impact in comparison with scenario 1 will be small and the effects at the macro level will be difficult to observe.

From fee for service to a standard price: stretching the current system with a mixed price model

Results only slightly differ from the results observed in the simulation of the first scenario. This is because only minor changes occur in both amount of budget and number of stays.

Figure 49 indicates that 68 hospitals have a negative budget deviation, while 48 hospitals have a positive budget deviation (2 more than in scenario 2). Further, dispersion gets a bit smaller, from +€ 3 200 to -€ 1 750 as well as the IQR from +€ 160 to -€ 121.

Figure 49: Budget deviation per hospital – mixed price model, scenario 2

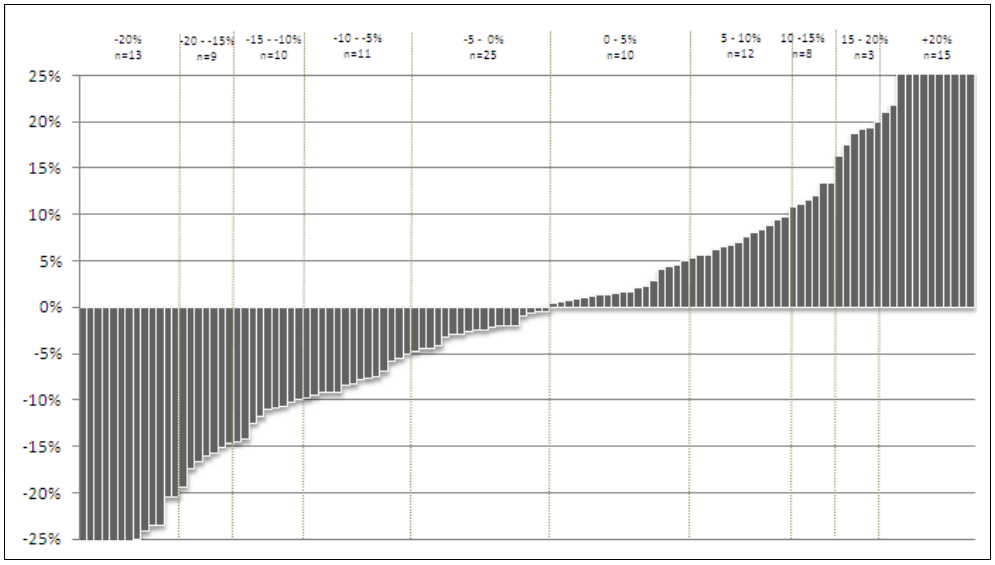
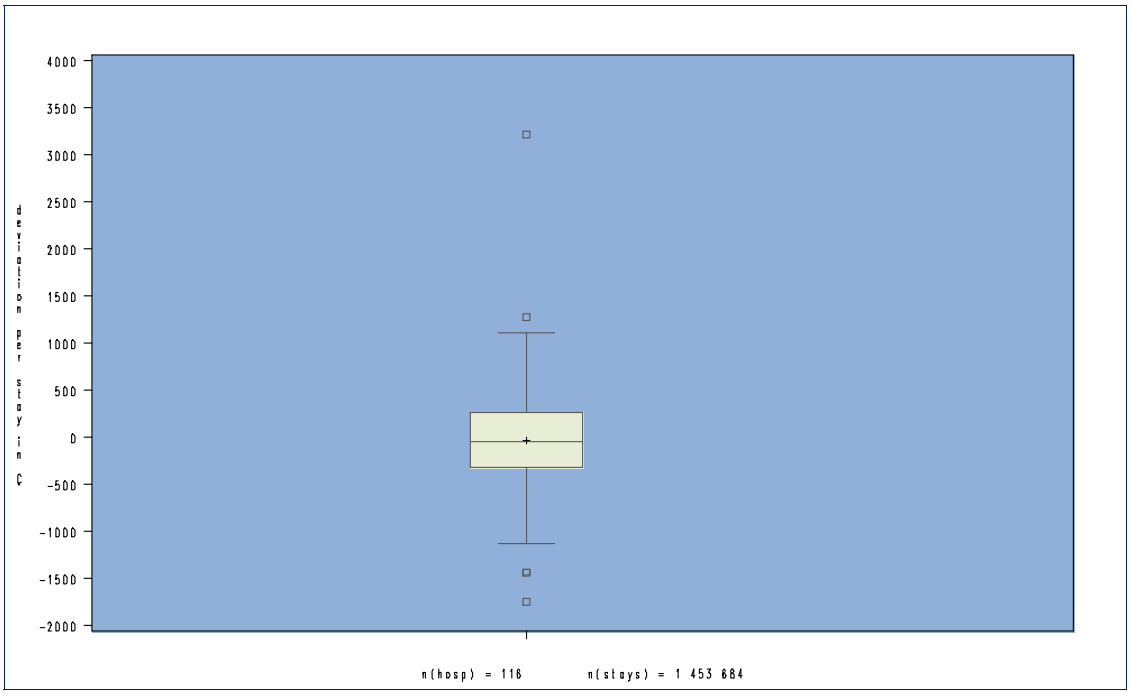


Figure 50: Boxplot - budget deviation per stay – mixed price model, scenario 2



First step to move towards a more cost oriented approach with the cost model

In the cost model, 71 of 116 hospitals have a positive budget deviation while 45 hospitals have a negative budget deviation (two more than in scenario 1). Dispersion remains more or less the same as in scenario 1, while the IQR narrows very slightly, ranging from +€ 160 to -€ 120.

Figure 51: Relative budget deviation per hospital – cost model, scenario 2

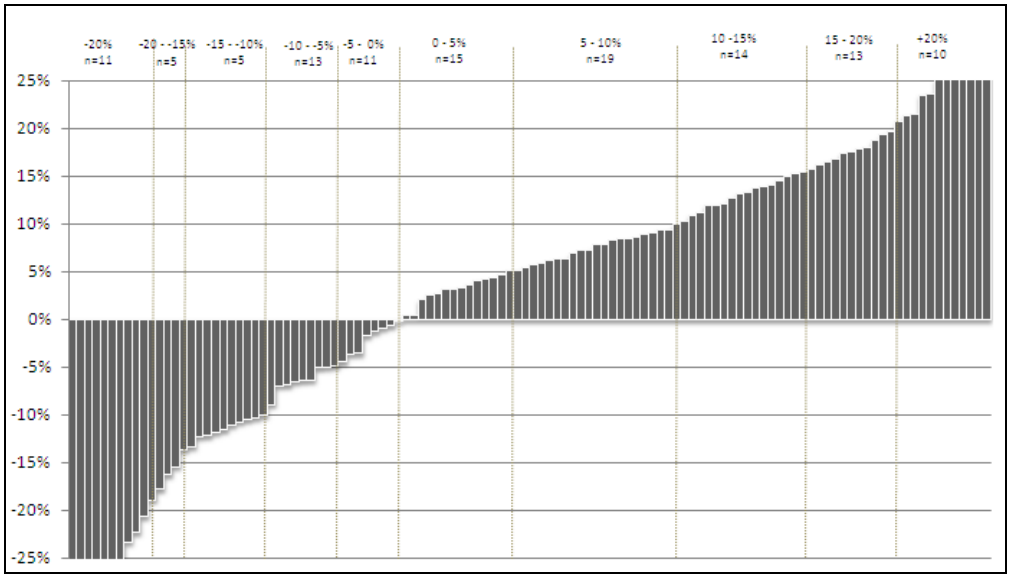
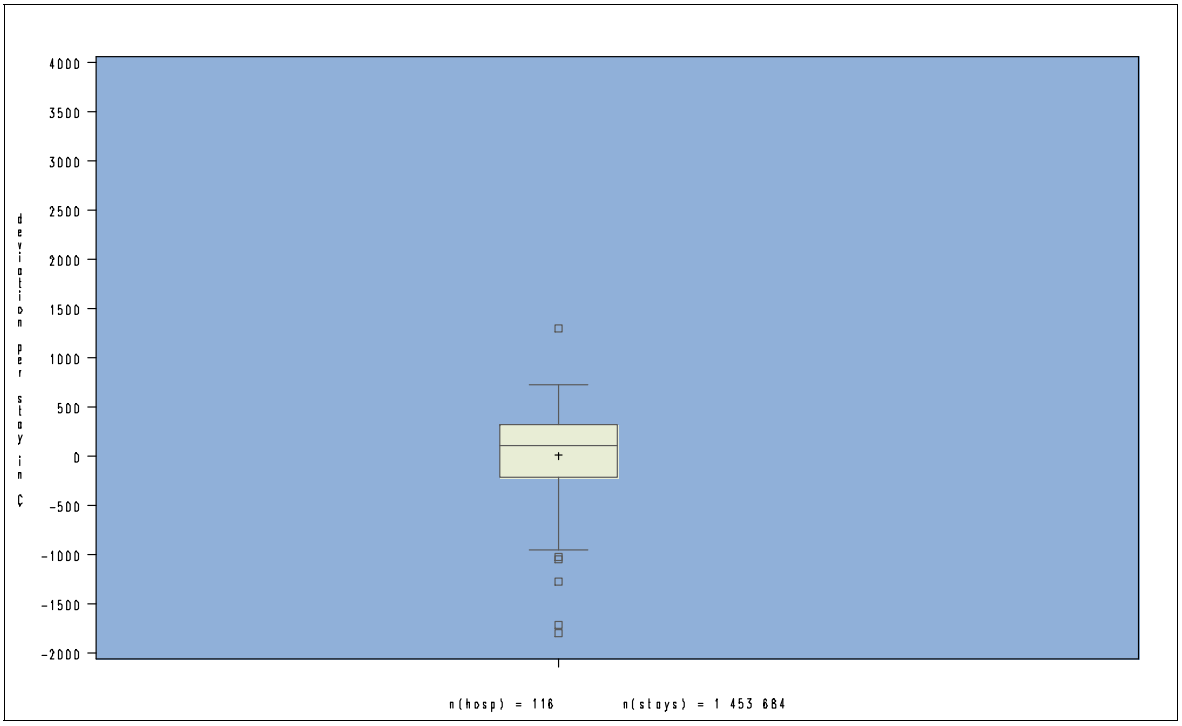


Figure 52: Boxplot - budget deviation per stay – cost model, scenario 2



6.3 CONCLUSIONS

Redistribution effects of the application of an all-inclusive cased-based payment system were simulated on the Belgian hospital sector with the price and the cost model. The simulation exercise was conducted under different scenarios of cases or activities to be funded through case-based payments and other sources. The results for an all-inclusive model and for two selected scenarios were presented. The goal of the macro simulations was not to give precise results or to search for the ideal weight, but to provide a first idea of possible budget shifts at the level of hospitals or stays as compared to the current situation.

Some results are in line with expectations: budget shifts get relatively smaller when exclusive pharmaceuticals, expensive implants and price outliers are excluded since this is more in accordance with the current financing scheme. Other results need further investigation, to clarify e.g. the differences in budget shifts between the price and the cost model, the extent of positive and negative budget shifts for some hospitals or stays and the substantial dispersion in shifts for both models and in all scenarios.

Cased-based payments clearly have a divergent effect on hospitals, whatever the model (price of cost model) or the scope of the case-based payments (all-inclusive versus 2 scenarios with exclusions). The macro simulation exercise also learned that, although significant budget shifts were observed at the level of a hospital or stay, the effects of some scenarios were difficult to identify and to represent at the macro level. All these results raise questions about the underlying driving forces of the magnitude of and dispersion in budget shifts.

Additional micro level analyses are needed to further assess the effects of an all-inclusive case-based financing and to refine the model. As a first step, cluster analysis could be used to represent the results of the macro simulations. Such a cluster analysis was explored in the course of this study. Hospitals with comparable characteristics, which emerged from the pre-analyses in Chapter 5 and from the review of the five selected countries, were grouped. A broad range of characteristics was included in the cluster analysis in order to classify hospitals in homogeneous groups. Traditional dimensions (size, hospital type, average length of stay, etc.) were complemented with specific hospital activities (variability, intensive care, chronic or palliative care, pathology, etc.) because traditional dimensions sometimes "hide" hospital characteristics which are more connected with these specific hospital activities (see section 5.6).

Although clustering hospitals on the basis of more activity and pathology-related characteristics seemed to be a valuable tool to represent results of the macro simulations in a transparent way, it was decided not to present the results of the cluster analysis in this report. The main motivation was that an interpretation, at a micro level, of budget shifts caused by the application of an all-inclusive case-based payment model was too preliminary. As was discussed in Chapter 5, both the price and cost model are restricted by data availability and by methodological issues which are still to be solved. To make a grounded proposal for a case-based payment system for activities or care segments in Belgian hospitals, further investigation of the underlying driving forces of budget shifts is indispensable. Possibly, a case-based all-inclusive financing is not feasible for all care segments.

Key points

- **The introduction of case-based payments induces different budget shifts in the price and the cost model. Positive and negative budget shifts are substantial for some hospitals or stays. Budget shifts also show a large dispersion.**
- **Cased-based payments have a divergent effect on hospitals, whatever the model (price of cost model) or the scope of the case-based payments (all-inclusive versus 2 scenarios with exclusions). Since both the price and cost model are restricted by data availability and by methodological issues which are still to be solved, the results of the budget shifts are only given for illustrative purposes and should not be taken literally.**
- **The budget shifts at the micro level of a hospital or stay are difficult to identify and to represent at the macro level.**
- **Investigation of the driving forces of the budget effects is necessary. Additional micro level analysis is needed to further assess the effects of an all-inclusive case-based financing. Cluster analysis could be an interesting first step.**

7 CONCLUSIONS AND DISCUSSION

This study explored the feasibility of introducing all-inclusive case-based or activity-based payments for Belgian hospitals. Throughout the report, emphasis was placed on data and methodological considerations related to the "mechanics" or building blocks of case-based funding: how patients are classified, how costs are calculated, how tariffs per Diagnosis Related Group (DRG) are set and how other specific hospital activities are funded. These issues were assessed by using routinely collected data based on compulsory nationwide registrations and cost data from a selection of hospitals.

An evaluation of the "technical" feasibility of all-inclusive activity-based funding provides an important and necessary first step for hospital financing reform. However, the findings of a technical feasibility study alone are not sufficient to induce a fundamental change in hospital funding. Policy makers, sickness funds, hospital managers and providers of health care must be willing to adopt it in practice. Stakeholder issues, i.e. getting involvement and commitment from all parties involved, are crucial to the realization of hospital funding reforms within a specific political and economic context. However, technical and "implementation" feasibility are often interrelated. Although the assessment of the implementation feasibility of all-inclusive activity-based funding in the Belgian hospital sector was not the topic of this study, some technical issues addressed in the course of the study are also looked at from an implementation perspective in Chapter 7.

Section 7.1 of this chapter summarizes the findings of the technical feasibility study (Chapter 2 to 5). Section 7.2 briefly addresses budget shifts of an all-inclusive case-based financing system as calculated in the macro simulation exercise (Chapter 6). Section 7.3 identifies implementation issues for policy makers, sickness funds, hospital managers and providers of health care which may be encountered in the transition from the current hospital funding-mix to all-inclusive activity-based funding. These problems and opportunities are linked to the preceding chapters but are not exclusively derived from results reported in the study.

7.1 BUILDING BLOCKS OF CASE-BASED FUNDING

7.1.1 Case-based funding: principles and objectives

Cased-based funding is a hospital reimbursement system based on the number and type of services provided to each patient for hospital care. Case-based funding has two key features. First, hospital services and patient-mix are described in a simplified way through (a variant of) Diagnosis Related Groups (DRGs). Second, if DRGs are also the basis for funding, a weight and/or tariff for each DRG is fixed in advance. Each DRG represents clinical and financial information since it groups patients with a similar clinical profile and resource use.

What are the motives underlying the introduction of case-based funding? The review of five countries (England, Germany, France, Denmark and Australia (Victoria)) revealed that the dominant motivation for adopting activity-based financing was an attempt to control costs and to introduce incentives to increase efficiency. Some systems were also targeting waiting times and the promotion of certain hospital activities such as day-care surgery.

Why should case-based hospital funding (further) be explored in the Belgian setting? The hospital financing system currently in place in Belgium is a mix of financing modalities which reflect the reforms the hospital sector has been undergoing during the last decades. As in other countries, there has been a gradual move from full retrospective cost reimbursement towards a system (partially) based on a global budget with some case-based elements. At this moment (2009) capital and operating hospital costs are covered under a dual system featuring both fee-for-service and prospective budgets, depending on the type of services provided (section 3.4).

The use of APR-DRGs for the reimbursement of hospital inpatient services is not completely new in Belgium. Elements of case-based funding were already introduced in the early nineties of the last century. However, the process of introducing prospective or case-based financing modalities differs from the reviewed countries regarding the scope and incentive structure. First, the pathology-weighted length of stay (1995) was mainly used as a correction factor for subparts B1 and B2 of the budget of financial means when the number of days a hospital should provide given its capacity and occupation norms was exceeded. The gradual switch to the notion of "justified activities" since the reform of 2002 changed the focus of the financing system from structural characteristics of the hospital expressed in the number of recognized beds to the activity of the hospital expressed in terms of treated pathologies and justified beds. In the new system, the case-mix of each individual hospital is multiplied by the national average LOS per pathology group. Hence, reduction in inpatient length of stay is still the key goal of the financing system. Second, the use of case-based funding for selected hospital services has been introduced on an ad hoc basis, mostly in response to budgetary pressures. Such a fragmentary case-mix financing can impose restrictions on substitution possibilities between different activities.

Apparently, in line with the international trend, Belgian policy makers have shown to be favourable to case-mix financing for hospitals, be it on a limited scale. Different countries are at different stages of advancement. Moreover, due to the country specific context within which hospitals operate and policy decisions are made, the case-mix approach has been implemented in many different ways. This technical feasibility study aims to clarify data availability and methodological issues underlying the building blocks of case-mix financing as the first step towards an all-inclusive case-based payment system in Belgium.

7.1.2 Data and methodological issues

The main principles underlying case-mix classifications are: (1) homogeneity of resource use within each group; (2) clinically meaningful aggregations and separations; (3) generating a practical number of classes; and (4) the group definitions are based on routinely available data. The present feasibility study explored whether the design principles (1) and (4) could be fulfilled with the APR-DRG grouper in the Belgian hospital setting.

7.1.2.1 Case-mix grouper and homogeneity of resource use

Case-mix groupers classify patients into statistically and clinically homogeneous groups based on clinical and administrative data. The currently available grouper in Belgium is the APR-DRG grouper. Although APR-DRGs have since more than a decade been used for hospital financing, the classification system has never been "tested" with Belgian hospital activity data. The 3M™ grouper software for assigning cases to APR-DRGs (version 15.0) is based on algorithms elaborated in the U.S. However, the grouping rules used in the originally developed APR-DRG system might need thorough modifications in order to accurately reflect the practice patterns and cost structures of Belgian hospitals.

The applicability of the APR-DRG system in Belgian hospitals has been evaluated in terms of homogeneity of resource use within each APR-DRG. The homogeneity analysis consisted of outlier determination by applying different trim point methods, small cell analysis and sub-group analysis to define exclusions. This analysis, which was performed mainly using price data, has demonstrated that the APR-DRG grouper (version 15.0) could serve as the basis for building an all-inclusive case-mix financing system. However, modifications to the APR-DRG classification, as identified in Chapter 5 and illustrated with numerous examples, are necessary before application in Belgian hospitals.

7.1.2.2 *APR-DRG cost weights and tariffs*

After grouping patients into APR-DRGs, additional stages must be performed in order to use the case-mix system for financing purposes. First, weights and tariffs, which are based on the corresponding patient costs, have to be set for each APR-DRG. They can be imported with the grouper or they can be developed locally. Second, a budget, as determined by the number and types of patients (case-mix of each hospital) and the tariff for each DRG has to be allocated to each individual hospital.

Belgian public authorities dispose of detailed registration systems related to hospital activity. Current hospital billing data, accounting data and clinical data allow a close monitoring of hospital activity by sickness funds, NIHDI and FPS. However, an adequate activity-based financing system crucially depends on the availability of detailed cost data. At this moment, no compulsory nationwide registration of patient-level costs incurred by hospitals for providing services is available. The international review clearly demonstrated that the calculation of actual costs is not easy and often very time-consuming since it requires extensive cost data collection across the hospital system. Moreover, hospital cost accounting systems are usually poorly developed.

In this feasibility study it was decided not to borrow cost weights form another country since this was technically infeasible due to country-specific modifications to the (APR)-DRG system. Instead, own weights were constructed. Two approaches were investigated. In the first approach APR-DRG weights and tariffs were based on 'prices' which reflect the way hospitals are currently financed. Ideally, weights and tariffs should reflect actual costs. Since prices or reimbursement rates also reflect the historical bargaining power of providers or political negotiation, a second approach was pursued. The cost accounting model based on cost data voluntarily provided by 9 hospitals is a first step towards a sound basis for determining 'Belgian' APR-DRG weights and tariffs. The cost accounting model is a mixed approach based on activity-based costing principles.

7.2 FINANCIAL IMPACT OF AN ALL-INCLUSIVE CASE-BASED FINANCING SYSTEM

Starting from a number of concrete choices concerning the "mechanics" of a case-based financing system, the financial impact at the level of an individual hospital and hospital stay was simulated. Although the choices were based on the results of the data availability and homogeneity analyses, they inevitably remain to a certain extent arbitrary. The exact redistribution effects between hospitals are therefore only given for illustrative purposes since budget shifts depend, among others, on the chosen weights and on the selection of activities to be funded through other sources. For a real-life implementation, these choices should be made by public authorities. Budget neutrality at the national level was assumed in the simulation exercise.

The impact of redistributing the current hospital budget applying an all-inclusive case-based system was identified with the price and cost model. The simulation exercise was conducted under different scenarios of cases or activities to be funded through case-based payments and other sources. In both models the budget deviation per stay as compared to the current situation was substantial and was characterized by a large dispersion, with some outlier hospitals both in positive and negative direction.

Some results are in line with expectations: budget shifts get relatively smaller when exclusive pharmaceuticals, expensive implants and price outliers are excluded since this is more in accordance with the current financing scheme. Other results need further investigation, to clarify e.g. the differences in budget shifts between the price and the cost model, the extent of positive and negative budget shifts for some hospitals or stays and the substantial dispersion in shifts for both models and in all scenarios. These results raise questions about the underlying driving forces of the magnitude of and dispersion in budget shifts. Additional micro level analyses are needed to further assess the effects of an all-inclusive case-based financing and to refine the model. As a first step, cluster analysis could be used to represent the results of the macro simulations. Possibly, a case-based all-inclusive financing is not feasible for all care segments.

The large effects on resource allocation between hospitals clearly indicate that, as was the case in other countries, a new case-based hospital payment system should be implemented incrementally.

7.3 IMPLEMENTATION ISSUES

The assessment of the feasibility of introducing an all-inclusive case-mix payment system for Belgian hospitals included an evaluation of the APR-DRG grouper in its ability to describe Belgian hospital activity and to a simulation of the financial impact of an all-inclusive financing system at the level of individual hospitals and stays. However, a reform of hospital financing may also entail a change in the revenue structure within a hospital. Therefore, an implementation strategy should be adopted to smooth the transition from the current hospital funding-mix to an all-inclusive case-based funding system. A well-planned implementation strategy requires thorough reflection on the following issues: What are the overall policy objectives of all-inclusive case-based financing for Belgian hospitals? What are the effects which are to be expected of such a system, given the country's specific policy context? Over which time period (short-term or long-term) are these effects to be expected? If results are expected in the long-term, which transition arrangements should be applied? Etc.

The following section discusses possible effects of an all-inclusive case-based funding system within hospitals (7.3.1). Next, possible effects at the macro level between hospitals are addressed (7.3.2). Finally, different issues in the implementation of a hospital financing reform are briefly outlined (7.3.3).

7.3.1 Impact of hospital financing reform on the hospital revenue structure and on the relationship between hospital management and providers of health care

Operating costs in Belgian hospitals are mainly financed by the budget of financial means (BFM) and by (part of) the medical fees. In an all-inclusive financing method, the share of the medical fees will decrease in favour of the share directly reimbursed to the hospital. Even if the new hospital payment system is implemented on a budget neutral basis, this shift in revenue structure within a hospital will very probably also fundamentally alter the current relationship and bargaining power between hospital management and physicians. Indeed, in the event that hospital management becomes the only party to decide on how to allocate the budget of financial means within the hospital, an agreement has to be found with the Medical Board on the allocation of revenue from medical fees, according to the stipulations of the Hospital Act. Hence, a reduction or abolishment of the share of medical fees in total hospital revenue may have the side-effect of disturbing the current balance of bargaining power. A shift in bargaining power away from medical specialists towards hospital management should however not be considered as an automatic recipe for attaining the targets of all-inclusive case-based funding. Instead, a good understanding and stable relationship between both parties may be critical success factors for hospital financing reforms.

How can it be avoided that a shift in revenue structure, induced by all-inclusive case-based funding, disrupts the current power balance between management and providers within a hospital? At first sight, two options are available. The first option consists of calculating APR-DRG weights and tariffs separately for the BFM and medical fees. This option maintains the current dual financing with two separate revenue streams. The first revenue stream is the BFM which is however no longer based on justified beds but on APR-DRG tariffs. The second revenue stream is coming from the medical fees but with fee-for-service payments replaced by lump sum fees per APR-DRG. An advantage of this approach is that the current power balance between management and the Medical Board would remain intact. A major disadvantage is that within the Medical Board conflicts between different disciplines could arise concerning the distribution of medical fees which would have to be defined without relying on detailed billing data. Another disadvantage is that it limits substitution possibilities among medical acts and other health production factors.

An alternative approach would be to apply APR-DRG weights and tariffs on the sum of the BFM and medical fees but with a modification of the Hospital Act, concerning the delicate issue of the management of hospitals and the statute of hospital physicians. Since it has taken many years for the legislator to achieve the current text, the chance of success for a compromise between all stakeholders on a new text should not be overestimated. However, a fundamental reform of hospital financing could also be seen as an opportunity for policy makers, hospital managers and physicians to explore new modalities of partnership.

For example, at this moment the provisions of the Hospital Act more or less stimulate physicians to play a defensive role in negotiating their income contribution to the hospital budget. Of course, policy-makers face the key challenge of ensuring that reforms are phased in gradually over a pre-defined period of time such that hospital management and providers of health care can adapt to a systematic shift to activity-related method of financing.

7.3.2 Impact of hospital financing reform at the macro level of the hospital sector

Although an increased number of prospective or case-based financing components were applied to the Belgian hospital sector during the last decades, all in all it was on a limited scale. Fee-for-service, with prices based on negotiations reflecting power relationships between medical specialties, is still the dominant payment system for medical specialists. Due to insufficient review and updates to take account of evolution in medical science and practice, fee values for a number of procedures no longer reflect the real cost. With case-mix funding, hospitals treating patients with the same case-mix characteristics receive the same budget. As a consequence, a change in hospital financing from fee-for-service to case-based funding can lead to substantial budget shifts between hospitals. Hospitals that are multiplying acts under the fee-for-service system will most probably face a reduction in their revenue after the introduction of case-based payments.

Additional revenue shifts between and within hospitals will occur when prices will be gradually replaced by actual costs to calculate APR-DRG weights and tariffs. Hospitals and hospital departments providing a large number of services of which prices are overestimated with respect to actual costs, will also loose revenue. Since the development of national cost weights based on a representative sample of hospital activities is in general not feasible at the beginning of an implementation program, a gradual transition from prices to costs to determine weights and tariffs could be envisaged. Again a delicate issue in the Belgian context of provider reimbursement is raised here, namely the discrepancy in income between medical specialties. A revision of the current nomenclature with medical fees based on actual costs, workload per medical specialty and other criteria to be defined could counter the frequently expressed concern that technical diagnoses and therapeutic activities are over-rewarded and intellectual acts are under-rewarded. Moreover, a well-defined distinction between fees for intellectual acts on the one hand and consumables and investments on the other hand could be considered to allow changes in the price of medical acts.

In conclusion, although the dominant motivation for adopting case-based financing is an attempt to control costs and to introduce incentives to increase efficiency, hospital closures should of course be avoided. Therefore, in order to avoid heavy losses or gains during the first years of implementation, individual hospital budgets could be held constant as was the case in e.g. Germany.

7.3.3 A selection of specific implementation issues

Although the implementation of a new hospital financing system was not the topic of this study, the previous chapters revealed a number of issues to bear in mind when implementing an all-inclusive case-based funding system. These issues should be addressed in a complementary study when a decision-in-principle is taken to proceed with an all-inclusive case-based funding system for Belgian hospitals. Some of these issues are briefly discussed below.

7.3.3.1 Case-based funding for day care and outpatient services

The review of the five selected countries indicated that day care or outpatient services are financed in a very diverse way, ranging from being included in the same DRG tariff as inpatient stays to being financed separately by fee-for-service. Day care stays were not included in the feasibility study because no linked clinical-billing data were available in the course of the study. Due to a lack of diagnostic information for outpatient treatments at a national level, outpatient services were not included either.

However, as soon as linked and validated data for day care stays are available, the homogeneity analysis should be performed on inpatient and day care stays. In England, the same HRG tariff (the patient classification system in England) applies to patients treated in both outpatient and inpatient settings. Weights and tariffs reflect the average costs of treatment in the two settings. However, because costs across both settings may differ substantially, this average cost pricing will very probably overpay day care settings and underpay inpatient stays. Proponents of paying one price for both settings will argue that creating incentives for increased use of day care may be an effective tool to increase efficiency and reduce costs. Opponents will emphasize a possible danger of cream-skimming the healthier patients. Whatever decision is taken by health authorities, the advantages and disadvantages of different systems should be carefully weighed against each other to incentivize providers in line with social objectives.

7.3.3.2 Complementing activity-based funding

Although the study examines the feasibility of an "all-inclusive" case-based financing of hospitals, there may be arguments which justify non-activity-based payments for certain services, patients or pathology groups. The scope of all-inclusive case-based payments differed substantially in the international review. All services or pathology groups not included in the case-based system have to be financed by other payment tools. These include payments for services provided to patients for whom no satisfactory classification system is available (e.g. mental health and rehabilitation), payments for non-patient related activities (e.g. teaching and research), payments for costs incurred by hospitals because of environmental conditions (e.g. different capital costs in rural areas), outlier payments, payments for distortive price components, etc.

7.3.3.3 Registration quality

Adequate registration of diagnoses is the basis for an effective case-based financing system.

- The quality and completeness of the diagnoses that are coded in the MCD is crucial for this type of exercise. Unfortunately, the FPS (Ministry of Health) provides no information on the timing and audit results of the MCD coding.
- It should be avoided that the transition of the current financing system to a case-based system entails a loss of the available detailed registration systems. Partly registration of (billing) data remains necessary for the sustainability and monitoring of the system but the question is which data will remain compulsory.

7.3.3.4 Quality and accessibility of care

Most countries hope that the introduction of a case-based hospital financing will increase hospitals' productivity and reduce costs but there are no guarantees for the delivery of a qualitative health care. On the contrary, there is a substantial risk of loss of quality when the cost-cutting incentives go beyond eliminating unnecessary costs and affect needed care as well. Quality may, for example, decrease because services are under-used (to cut costs), patients are discharged home in an unstable condition (to shorten the LOS) or because high-risk procedures are undertaken more on an outpatient basis (excluded from the all-in financing). Policy makers should be well aware of this threat and make sure that quality is monitored when case-based financing is implemented.

A possible way of guarding quality is by combining case mix funding with the introduction of "pay for quality" that directly relates the remuneration of delivered care to the achieved result on structure, process and/or outcome indicators. More information can be found in KCE report vol.118.[14]

Cream-skimming, defined as the selective treatment of low cost patients, should also be investigated. Since hospitals receive the same tariff for all patients within the same APR-DRG, irrespective of their real costs, case-based financing could give hospitals the incentive to reduce costs by avoiding severe cases.

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