



Total hip arthroplasty in Belgium : the contribution of a social health insurer to the debate

Xavier DE BETHUNE, Katte ACKAERT, Philippe GILLET, Jacques VAN DOOREN

R&D Department, Christian Sickness Fund, Brussels

This study describes current clinical practice and outcomes of Total Hip Arthroplasty in Belgian hospitals. Orthopaedic registries concentrate on implant related analyses and sometimes on patient reported outcomes. Our aim was to describe the extent and to generate hypotheses about the determinants of the variability of health care practices and of prosthesis survival in Belgium.

Only unilateral elective primary Total Hip Arthroplasties were included. Length of stay, costs, transfusion rates and other care activities were analysed over 2008 and 2009 together. Prosthesis survival was studied using Kaplan-Meier and Cox regression hazard ratio computations over the period 2000-2009.

36798 elective Total Hip Arthroplasties have been included in a study of all members of the Belgian Christian Sickness Fund. The non-standardised ten year Total Hip Arthroplasty survival rate is 93% (Kaplan-Meier). Quality has progressed notably compared with 10 years earlier. Important variations still persist though between hospitals, for all studied indicators.

Keywords : total hip arthroplasty ; benchmarking ; revision rate ; costs ; variability of care.

INTRODUCTION

Claims data from the main social health insurer in Belgium have been used to mimic and expand traditional orthopaedic registries, as the ones in

Sweden (24), Norway (25) and elsewhere (3,7). This article presents the second 10-year epidemiological analysis of such data (10). The aim was to describe the extent and to generate hypotheses about the determinants of the variability of health care practices and of prosthesis survival in Belgium.

MATERIALS AND METHODS

Data

This was a retrospective study that analysed reimbursement claims concerning all members of the Belgian Christian Sickness Fund (CSF) for elective primary Total Hip Arthroplasty (THA) admissions in Belgian hospitals between 01/01/2000 and 31/12/2009.

-
- Dr Xavier De Bethune.
 - Katte Ackaert.
R&D Department, Christian Sickness Fund, Brussels.
 - Prof Philippe Gillet, Honorary President.
Société Royale Belge d'Orthopédie et de Traumatologie, Liège.
 - Dr Jacques Van Dooren, Honorary President.
Belgische Vereniging voor Orthopedie en Traumatologie, Antwerp.
- Correspondence : Katte Ackaert, R&D-LCM, Haachtses-
teenweg 579, 1031 Schaarbeek, België.
E-mail : katelijne.ackaert@cm.be
© 2014, Acta Orthopædica Belgica.
-

*No benefits or funds were received in support of this study.
The authors report no conflict of interests.
The study was carried out by the Belgian Christian Sickness Fund.*

The CSF is a social health insurer with a membership in 2009 of 4.5 million people, about 42% of the Belgian population. Over the study period only 2.44% of CSF members switched from one sickness fund to another. Both ambulatory and institutional health care use can thus be traced over long periods of time with a minimum loss to follow up. This makes it possible to link total and partial revision interventions to the initial THA performed in the same or in another hospital.

Claims data encompass the number and the cost of each reimbursable care activity and material, as well as a number of flat fees, mainly for support activities. Data are available on length of hospital stays, costs and some care activities (blood transfusion, intensive care, physiotherapy). These indicators were calculated for 2008 and 2009 together.

To avoid issues with very small numbers, we restricted our analyses to hospitals with claims for at least 30 members of the CSF over 2008 and 2009 together. For specific activities, data have been collected for these two years. For the analysis of implant survival, we computed the results from data over the 10 years of the study. For the volume-outcome relationship, all hospitals, including those with very small numbers, are included.

The selection of cases has been done on the basis of reimbursement codes for THA surgical interventions. In the absence of a diagnosis for all patients, an algorithm based on combinations of seven care indicators¹ has been developed to exclude THA related to hip fractures. If none of the indicators or if only the evident administrative error of implanting only a stem was present, this was strongly predictive of elective THA. 11% of cases had ambiguous combinations of the 7 indicators and were excluded from further study. The rest corresponded to hip fractures. A validation of this algorithm over 226 cases in 11 hospitals yielded a correspondence between hospital and CSF data of 98%.

The prosthesis survival computations are based on the length of time between the primary elective intervention and the revision of the implant. The implant revision for any reason was defined as the endpoint. The body side of the intervention is however not mentioned on the claim. For patients with bilateral THAs performed at different times, it thus becomes impossible to compute the survival time of the implant. We checked the presence of a first THA intervention since 01/01/1990. 25% of patients had

(1) Admission at night, surgical reduction of fracture, absence of hip imagery between six months and two weeks preceding admission, traction of lower limb, bipolar prosthesis, implanting only a stem, intervention on Sunday.

Table I. — Study population, elective unilateral THA of CSF members in Belgium (2000-2009)

Age	Male	Female	Total	%
≤ 40	635	356	991	2,69
41 - 50	1.508	788	2.296	6,24
51 - 60	3.173	2.711	5.884	15,99
61 - 70	4.686	6.499	11.185	30,40
71 - 80	4.317	8.822	13.139	35,71
> 80	880	2.423	3.303	8,98
Total	15.199	21.599	36.798	100
%	41,30	58,70	100	

two interventions, and were excluded from the study. For specific implant types, data can only be computed from 2002 on, because of a change in reimbursement codes.

Over a 10 year period between 2000 and 2009, 94142 claims have been identified in the CSF database. 26% of these were classified as hip fractures through our validated algorithm and 11% as unclear. 25% concerned bilateral interventions.

Statistical analyses

All analyses of variables describing hospital stays are univariate. Implant survival has been computed using the univariate Kaplan-Meier methodology with 95% confidence intervals. A hazard ratio based on a Cox regression model with 95% confidence intervals, standardised for age and sex, was used to compute the relative risk of revision. Statistical analysis was carried out using statistical package SAS (9.1.3).

RESULTS

Population

The final database was limited to interventions performed between 1/1/2000 and 31/12/2009 and included 36798 primary, unilateral and elective interventions. 1038 revisions were traced during the same period among these patients. 10.69% of included patients died during the observation period.

Table I shows the sex and age distribution of the population for the primary elective interventions in 2000-2009.

Costs and selected indicators of care practices can be found in Table II.

Table II. — Selected indicators of care practices: elective THA (CSF, Belgium, 2008-2009)

Results 2008-2009	All admissions			Hospitals	
	Average	Median	P90-P10	Lowest average	Highest average
Overall length of stay (acute and rehabilitation care wards)	11	8	13	6	18
Acute ward	9	8	9	6	17
Overall costs (euros)					
Reimbursed by SHI	7661	6675	5679	5654	16628
Patient direct costs	1836	1414	2626	1030	3611
Transfusion rate	25%			0%	75%
Intensive care admission rate	12%			0%	83%
Costs of physiotherapy (euros)					
Reimbursed by SHI	775	709	1189	324	1374
Patient direct cost	652	612	1241	252	1049

Length of stay

Length of stay (LOS) has been defined as the difference between the admission and exit days in acute care services. Rehabilitation care days were excluded.

We estimated the variability of the LOS inside each hospital by subtracting its P10 from its P90. The median variability was 8 and the mean 8,42 days. The largest variation inside a hospital was 28 and the smallest 3 days.

Figure 1 shows the variability between the P10 and the P90 inside each hospital.

Costs

Costs have been divided between costs reimbursed by the Belgian Social Health Insurance (SHI) and out-of-pocket costs. Table II describes some cost categories for the years 2008-2009.

Figure 2 shows the variability between the P10 and the P90 inside each hospital.

On the average, a hospital claim for a THA in Belgium thus amounts to 9496 Euros, of which 19% are out-of-pocket costs.

Care activities

Transfusion

Figure 3 describes the variation of transfusion rates between hospitals after elective THA. The x-

axis represents the percentage of THA patients in each hospital who benefited from a blood transfusion. The y-axis shows the median cost of blood products for the transfused patients.

All blood products are included in the analysis, with more than 95% of the corresponding costs representing erythrocytes. The median cost per transfused patient of 204 Euros corresponds to 2 units of packed and leukoreduced erythrocytes.

Intensive care activities

The mean rate of patients benefiting from intensive care activities is 12%. The mean cost of specific intensive care activities per treated patient is 157 Euros.

Physiotherapy

To estimate the volume of activities, we calculated the costs for acts of physiotherapy from one month before to 6 months after the intervention. Table II shows a similar variation as well for hospital as for ambulatory costs.

Prosthesis types and costs

Using implant (sub)part codes, we divided the multiple combinations of prosthetic materials into five main categories (totally cemented, hybrid prostheses with either a cemented stem or cup, cementless and resurfacing arthroplasty). Figure 4

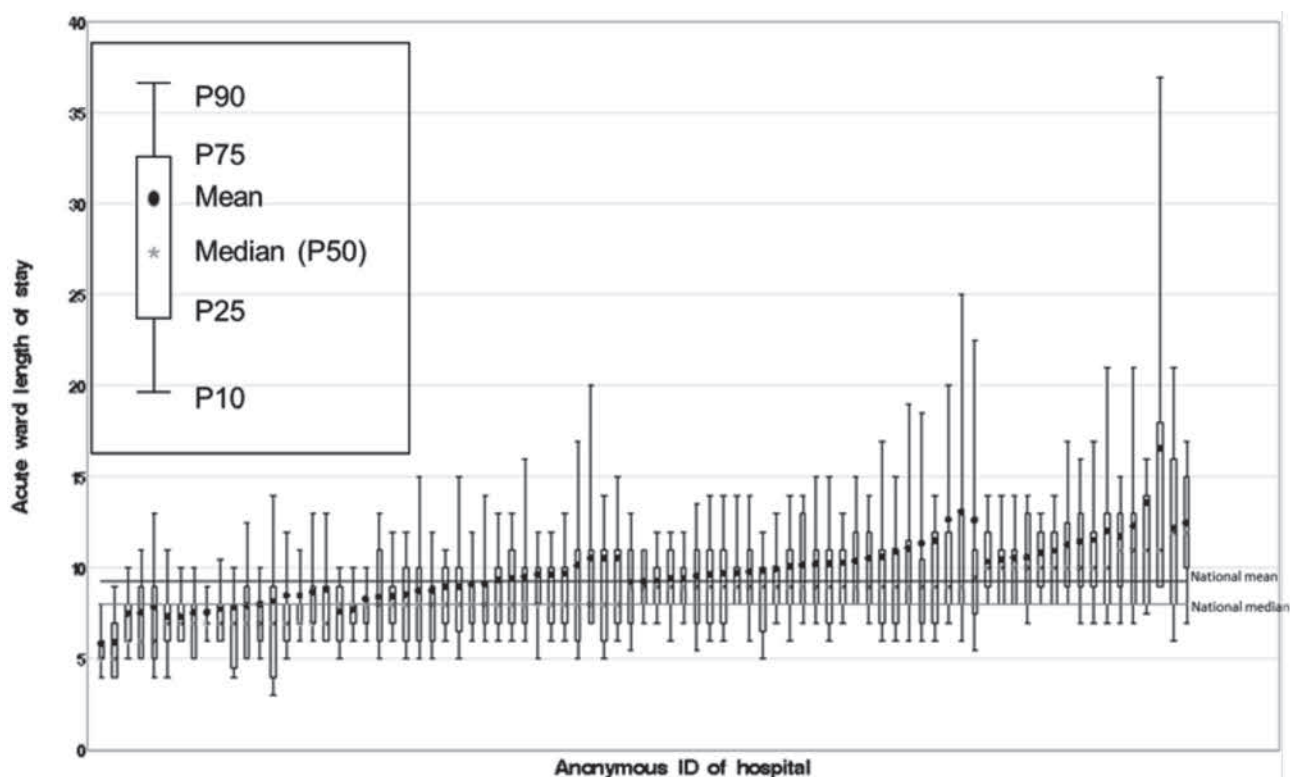


Fig. 1. — Acute ward length of stay for elective THA of CSF members, Belgium, 2008-2009. (Hospitals with min. 30 THA patients in 2008-2009).

describes the evolution of each type from 1994 to 2009.

From the turn of the century on, the use of uncemented prostheses has been steadily increasing and reached 67% in 2009.

Prosthesis survival

Based on a Kaplan-Meier analysis, the overall survival of an elective THA in Belgium between 2000 and 2009, is 93% (95%CI : 92,42%-93,86%).

We standardised the underlying patient population for age and sex and applied a Cox regression model to the data. Totally cemented and stem cemented implants had significantly lower revision risks than uncemented or cup cemented implants (Table III). Resurfacing arthroplasty presented intermediate outcomes.

We also applied the same model to compare hospitals. One hospital with 225 primary prostheses

over the period had no revisions in our database between 2000 and 2009. In figure 5, the hazard ratios of the other hospitals range from 0,19 to 3,00.

Volume-outcome relationship

We finally compared high with low volume hospitals and surgeons, using the overall market share of the CSF in each hospital as a proxy to calculate its real volume. We found that people operated in hospitals performing between 100 and 300 interventions a year, had an increased risk of revision of 15% compared to those in a hospital with more than 300 interventions per year ($p = 0,0024$; CI95% : 1,052-1,264). Similarly, patients of experienced (min. 5 years) surgeons with ≤ 5 interventions/year have an increased revision risk of 51% compared to surgeons with > 20 interventions/year ($p < 0,0001$; CI95% : 1,300-1,760).

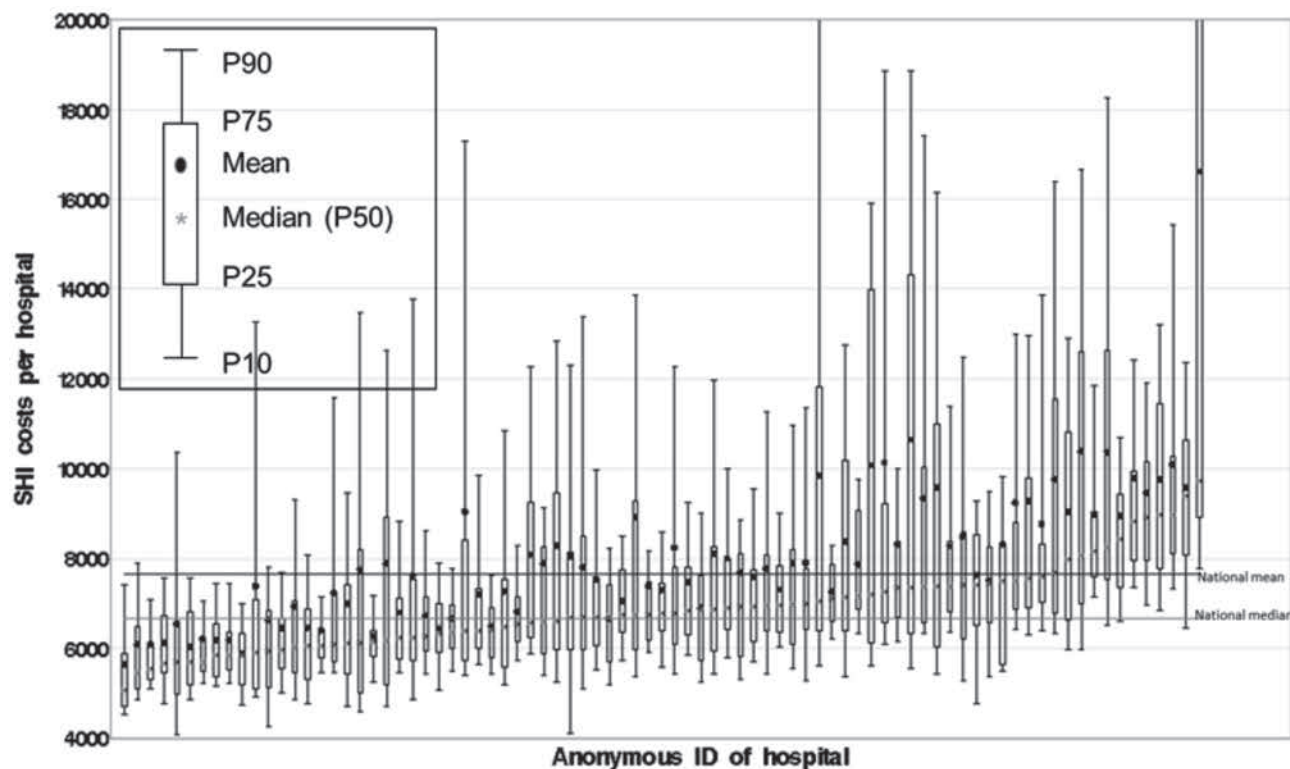


Fig. 2. — Costs reimbursed by SHI for elective THA of CSF members, Belgium, 2008-2009. (Hospitals with min. 30 THA patients in 2008-2009).

DISCUSSION

Thanks to the mainly fee for service based Belgian sickness insurance system, the granularity of CSF claims data is very high. Still no clinical information on patient status and functional outcomes is available. Other lacking data forced us to reduce the size of the initial database significantly. Registries are much more precise and we thus plead here for the generalisation of this tool for all care activities that could benefit from them.

As in many Western countries (3,7,24,25) the number of elective THAs increases in Belgium from year to year. Between 2002 and 2007 the annual increase was 2,91% (1). More women than men benefit from this intervention. The age distribution widens over time, mainly but not only, towards younger patients.

The median and the average total LOS have been reduced by more than a week compared to a former CSF study (1). The variation between hospitals however remains as important as ten years ago. The reduction in LOS is a general phenomenon that is not typical of THA. Much lower figures than in Belgium can be found in the literature (13), especially in the USA (9), but not without debate (28). Di Gioia *et al* (11) seem to have established a kind of benchmark, with an average LOS of less than 3 days and very low complication rates. They attribute their results to the patient centred organisation of care they developed and do not refer to the choice of specific implant types.

It is striking that overall SHI crude costs have only increased by 0,45% between 1998 and 2007 (1). Since prostheses have become more expensive and doctor fees higher, the main factor here is the

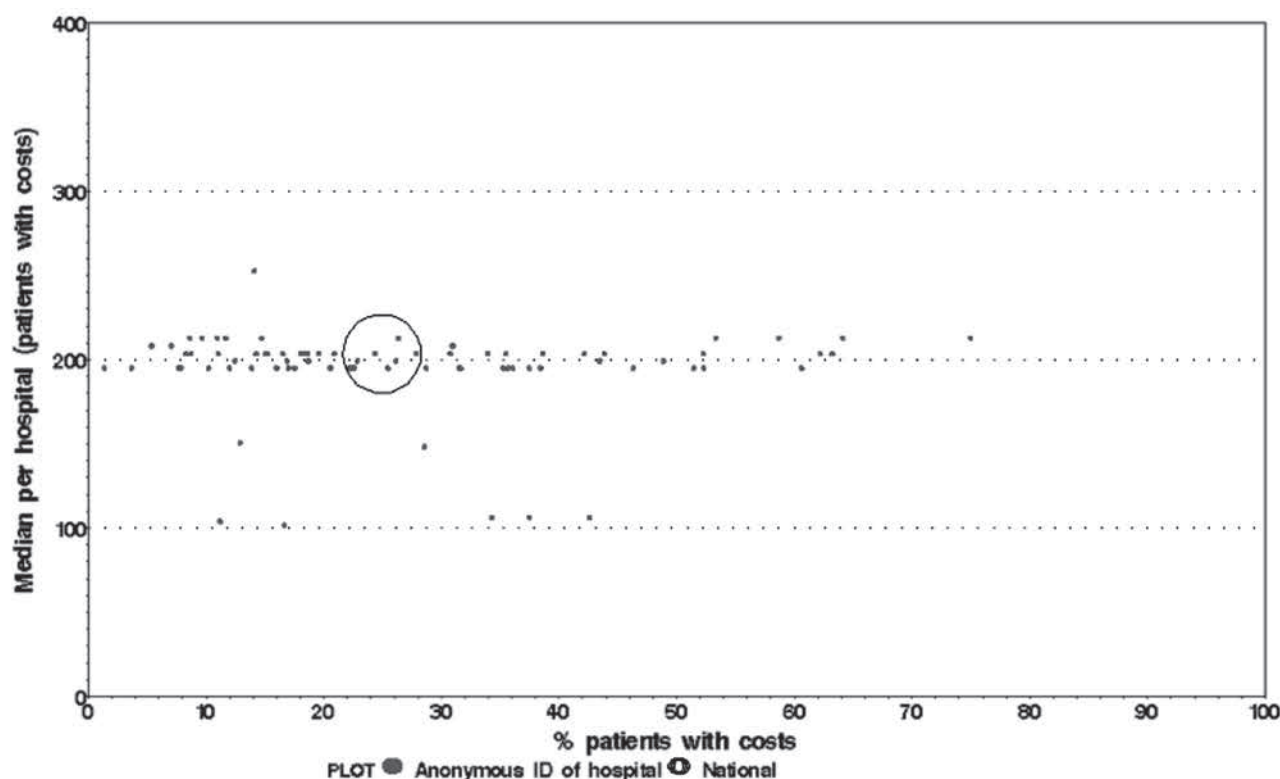


Fig. 3. — Transfusion rates during admission for elective THA of CSF members, Belgium, 2008-2009. (Hospitals with min. 30 THA patients in 2008-2009).

Table III. — Multivariate revision risk for implant types (N = 31306) (CSF, Belgium, 2002-2009)

Implant type	N	hazard ratio	CI 95%	CI 95%
Hybrid cup cemented	394	2,18	1,25	3,82
Cementless	16500	1,35	1,11	1,65
Resurfacing arthroplasty	3648	0,98	0,70	1,37
Hybrid stem cemented	7616	0,75	0,59	0,96
Totally cemented	3148	0,63	0,43	0,91

reduction in LOS. Since the health related consumer price index in Belgium for the period 1998-2007 is 17% (21), the SHI thus bears lesser real term charges than before for elective THA.

Over the same period, direct patient costs have increased by 23% (1), which in turn is higher than the health related consumer price index increase. Despite the reduction in LOS, patients pay more overall than in 1998, and especially for their implants and for physician fees. The role of private complementary insurance in this increase has not been studied, but is often quoted. Other factors such

as the direct contribution of physicians to hospital financing probably play a role as well.

Reimbursements after hip replacement vary widely between countries (4). Stargard cites figures between 1903 to 8964 Euros (23). Further analysis is needed to increase the comparability of these figures with ours.

In Belgium, both autologous blood transfusion and hemodilution have been used widely to optimize the results of a THA and minimize the risks of a transfusion (6,12). Recently, clinical practice guidelines have recommended to abandon autolo-

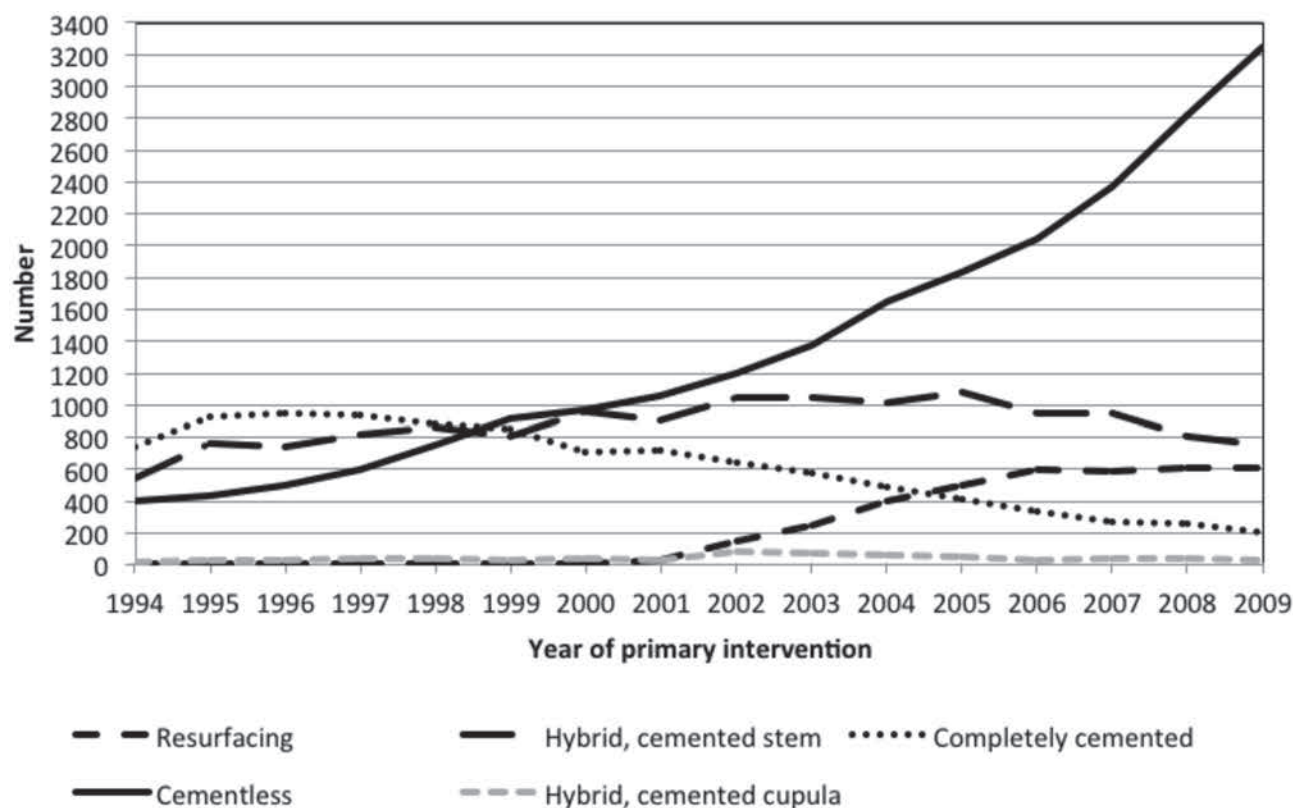


Fig. 4. — Evolution of implant types for elective THA of CSF members, Belgium, 1994-2009

gous transfusion (18) and to reduce transfusion rates to stricter indications (8,17). The drop in transfusion rates from about 60% in 1998 (1) to 25% in 2008-2009 reflects this evolution, but, as elsewhere (5,14) the wide variation in transfusion rates between Belgian hospitals remains a cause for concern.

We expected to find low rates of intensive care use in our population. The variation of 0-83% of patients between hospitals is preoccupying.

The variations we observed in the use of physiotherapy could be linked to professional habits, patient expectations and even reimbursement modalities. There does not seem to be a clear cut consensus about the indications and the intensity of physiotherapy after elective THA. Early start of rehabilitation and clinical pathways may provide benefits (15).

Our analysis uses revisions as an endpoint. Functional and radiographic assessments are

complementary endpoints (22) that were not available. Based on the Kaplan-Meier estimate, 10 year THA survival has improved by 2.5% since 1990-1999 (2).

As has been shown since many years by national registries in Scandinavia (24,25) and elsewhere (3,7), hip prosthesis survival depends at least in part on the choice of implant. While for years, cemented implants have shown better survival rates, the same literature is showing now that uncemented implants become as reliable. Our data do not yet confirm this trend. At the level of hospitals however, we find significantly better and significantly worse hazard ratios with similar types of implants (data not shown). Other factors, such as patient characteristics, the organisation of care and surgeon characteristics and experience thus possibly play a role as well.

Different patient characteristics top the list of possible factors. We eliminated the influence of age

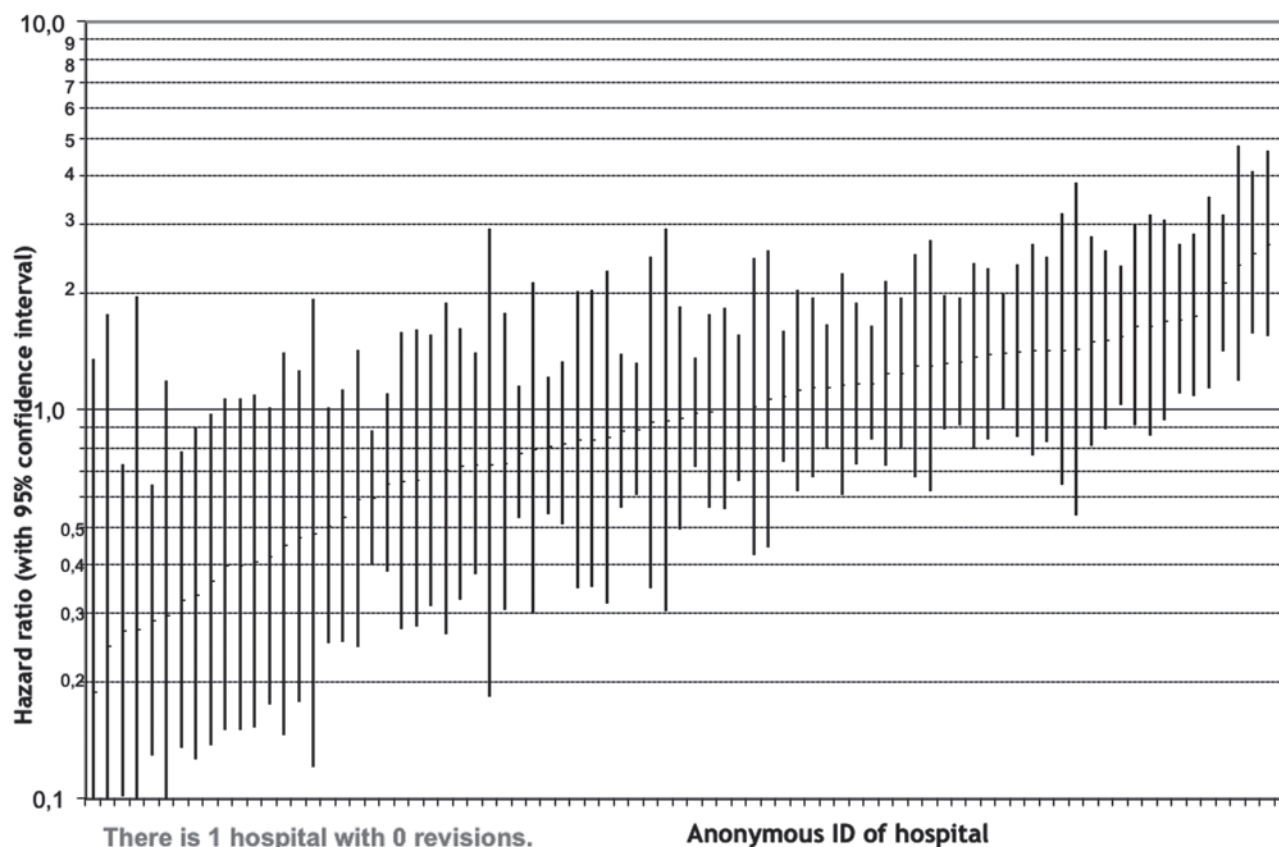


Fig. 5. — Ten-year sex and age standardised risk of revision for elective THA of CSF members, Belgium, 2000-2009. (Hospitals with min. 30 THA patients in 2008-2009).

and sex in our multivariate analysis. Indications and complications of surgery require the collection of additional data. This is true for the primary intervention, but even more so for revisions. The latter decision often relies on the clinical balance between the need for autonomy of the patient, the ‘bearability’ of pain (20), the risks of a major surgical intervention and the expected ease of replacing the implant. Textbooks (19) provide guidance, but no systematic study seem to exist.

Hospitals certainly represent another factor as evidenced in figure 5. Volume according to our data, plays a role, although others (27) did not identify the same relationship in Belgium, but on an observation period of only 18 months. Quality experts plead for increased standardization of care, in the operating ward or throughout the hospital stay through clinical pathways (26).

Surgeon experience and workload, the latter expressed as number of interventions per year, also seem to play a role according to our data.

Balancing all these factors is a huge challenge. Our study adds the variability in care practices to the variability in outcomes highlighted by all THA registries. No single factor explains the whole variation of HRs. Possibly some implant types require more demanding implantation processes than others. In the hands of experienced and well organized surgeons and teams, they will yield the results seen in the most promising series. But practices and settings might not be optimal everywhere, increasing the variability of outcomes. A study of these factors has been launched through meetings with orthopaedic teams in selected hospitals.

Quality of care suffers from unexplained variation. Methods and means to streamline and improve

clinical practice have been proposed (16), as well as to monitor the quality of THA care (3,7,24,25). We plead for a rapid implementation of registries, benchmarking and evidence based practices in all Belgian hospitals.

REFERENCES

- Ackaert K, de Béthune X, Mertens R.** Prothèses totales de hanche en Belgique : analyse de suivi. Partie 1. Nombre de prothèses de hanche et coût d'une prothèse totale de hanche. *MC-Informations* 2009 ; 236 : 24-32.
- Ackaert K, de Béthune X, Mertens R.** Prothèses totales de hanche en Belgique : analyse de suivi. Partie 2. Variation des types de prothèses et durée de survie. *MC-Informations* 2009 ; 238, 3-18.
- Australian Orthopaedic Association.** National Joint Replacement Registry. https://aoanjrr.dmac.adelaide.edu.au/nl_BE (last accessed 12/11/2013).
- Barbieri A, Vanhaecht K, Van Herck P et al.** Effects of clinical pathways in the joint replacement : a meta-analysis. *BMC Med* 2009 ; 1 : 7-32.
- Barr PJ, Donnelly M, Cardwell C et al.** Drivers of transfusion decision making and quality of the evidence in orthopedic surgery : A systematic review of the literature. *Transfusion Medic Rev* 2011 ; (Epub ahead of print) : 1-13.
- Beguín C, Closon MC, Vandekerckhove P et al.** Concentration of transfusion resources on a few pathologies and a few patients : analysis of the comprehensive in-hospital patient database. *Transfusion* 2007 ; 47 : 217-27.
- Canadian Institute for Health Information.** Canadian Joint Replacement Registry. <https://secure.cihi.ca/estore/productFamily.htm?locale=en&pf=PFC2209&lang=en&media=0> (last accessed 12/11/2013).
- Carless PA, Henry DA, Carson JL et al.** Transfusion thresholds and other strategies for guiding allogeneic red blood cell transfusion. *Cochrane Database Syst Rev* 2010 ; 6 : CD002042.
- Cram P et al.** Clinical characteristics and outcomes of medicare patients undergoing total hip arthroplasty, 1991-2008. *JAMA* 2011 ; 305 : 1560-1567.
- Diels J.** Prothèse totale de hanche. Variations des pratiques médicales et résultats à long terme. *Dossier thématique MC* 2000 ; 2 : 1-48.
- DiGioia A, Greenhouse PK, Levison TJ.** Patient and Family-centered Collaborative Care. An Orthopaedic Model. *Clinical Orthopaedics And Related Research* 2007 ; 463 : 13-19.
- Goodnough T et al.** Transfusion medicine : Blood conservation. *NEJM* 1999 ; 340 : 525-533.
- Husted H, Hansen HC, Holm G et al.** What determines length of stay after total hip and knee arthroplasty ? A nationwide study in Denmark. *Arch Orthop Trauma Surg* 2010 ; 130 : 263-268.
- Jans Ø, Kehlet H, Hussain Z, Johansson PI.** Transfusion practice in hip arthroplasty - a nationwide study. *Vox Sang* 2011 ; 100 : 374-80.
- Khan F, Ng L, Gonzalez S, Hale T, Turner-Stokes L.** Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy. *Cochrane Database Syst Rev* 2008 ; 16 : CD004957.
- Langley G, Moen R, Nolan K.** *The improvement guide : A Practical Approach to Enhancing Organizational Performance.* 2nd Edition, John Wiley and Sons, 2009, pp 490 and <http://www.ihl.org/knowledge/Pages/Publications/ImprovementGuidePracticalApproachEnhancingOrganizationalPerformance.aspx>.
- Naylor JM, Adie S, Franssen M, Dietsch S, Harris I.** Endorsing single-unit transfusion combined with a restrictive haemoglobin transfusion threshold after knee arthroplasty. *Qual Saf Health Care* 2010 ; 19 : 239-243.
- Parvizi J, Chaudhry S, Rasouli MR et al.** Who needs autologous blood donation in joint replacement ? *J Knee Surg.* 2011 ; 24 : 25-31.
- Puget J, Chaminade B.** *Reprise des prothèses totales de hanche.* Elsevier Health Sciences Ed., 2010, 416pp.
- Rolfson O, Dahlberg L, Nilsson J, Malchau H, Garellick M** Variables determining outcome in total hip replacement surgery *J Bone Joint Surg Br* 2009 ; 91-B 2 : 157-161.
- Service Public Fédéral Economie belge.** http://statbel.fgov.be/fr/modules/publications/statistiques/economie/prix_a_la_consommation_a_partir_de_1920_et_indice_sante_a_partir_de_1994.jsp (last accessed 7/07/2013).
- Söderman P, Malchau H, Herberts P et al.** Outcome after total hip arthroplasty : Part II. Disease-specific follow-up and the Swedish National Total Hip Arthroplasty Register. *Acta Orthop Scand.* 2001 ; 72(2) : 113-119.
- Stargardt T.** Health service costs in Europe : cost and reimbursement of primary hip replacement in nine countries. *Health Econ.* 2008 ; 17 (1 Suppl) : S9-20.
- Swedish Arthroplasty Hip Registry :** Annual Report - Available online at : <http://www.shpr.se/en/default.aspx> (last accessed 12/11/2013).
- The Norwegian Arthroplasty Register.** Annual reports. Available online at : <http://nrlweb.ihelse.net/eng/default.htm> (last accessed 12/11/2013).
- Van Herck P, Vanhaecht K, Deneckere S et al.** Key interventions and outcomes in joint arthroplasty clinical pathways : a systematic review. *J Eval Clin Pract* 2010 ; 16 : 39-49.
- Vrijens F, De Gauquier K, Camberlin C.** Het volume van chirurgische ingrepen en de impact ervan op de uitkomst : haalbaarheidsstudie op basis van Belgische gegevens. Good Clinical Practice (GCP). *KCE reports* 2009 ; 113A. <https://kce.fgov.be/nl/publication/report/het-volume-van-chirurgische-ingrepen-en-de-impact-ervan-op-de-uitkomst-haalbaarhe> (last accessed 18/7/2013).
- Zmistowski B, Hozack W, Parvizi J.** Readmission rates after Total Hip Arthroplasty. *JAMA* 2011 ; 306 : 825.