



## Thursday Morning Structural Reform 1

### Australian Subacute and Non-Acute Patient data set implementation in the 'greenfields' of Western Australian Health

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#### Introduction

The Australian Sub and Non-Acute Patient (AN-SNAP) data collection was barely known through WA Health until 18 months ago. In addition, Subacute Care wards collected separate, disparate patient-level Australian-Refined Diagnostic Related Group (AR-DRG) data. With the selection of AN-SNAP as the national proxy output classification system for Subacute Inpatient Care, an opportunity presented to champion safe, high quality care for Western Australian patients by collecting uniform data for the first time.

#### Methods

A statewide AN-SNAP implementation project based on a Prince 2 Methodology was run from August 2011 until May 2013. This included training of clinical staff in collecting AN-SNAP data, building of a statewide IT application linking with patient administration systems to house data, and data audits for compliance and quality.

#### Results

Key project successes include:

Mandatory data collection implemented across 40 wards in Rehabilitation, Geriatric Evaluation and Management (GEM), Psychogeriatric Care and Palliative Care;

Introduction of a new (and consistent) data set and training in Functional Independence Measure (FIM) for Rehabilitation and GEM wards. Over 1,300 clinical staff have been FIM trained, including Facility Trainers trained at 40% of sites;

Six state-wide networking forums have been held and a Quality and Activity Data Group has formed to explore using Subacute Care data for clinical improvement; and

Development of the state-wide Quality of Care Registry (QoCR) - a clinical web-based application to record AN-SNAP data.

From 0% groupable data to 48% groupable AN-SNAP data for Independent Hospital Pricing Authority quarterly submissions.

#### Conclusions

This new consistent patient-level data in Australia has been a huge opportunity to engage clinicians with meaningful data as well as a funding model. Undoubtedly, this is a win for activity based funding and management.

# **New South Wales Health Cost Accounting Guidelines: Breaking the silos**

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## **Introduction**

Activity-based funding (ABF) has become the core mechanism for funding hospitals in Australia. The establishment of a transparent link between the activity and the funding has been the main motivator for moving to ABF. The introduction of ABF in New South Wales (NSW) has brought together a range of stakeholders. These stakeholders include the clinical costing officers, who are deployed throughout the health system in NSW, and have been pivotal in developing casemix and can be considered as the departmental experts in ABF. A second stakeholder group includes the finance officers who had been predominately engaged in statutory reporting and overall financial accounting. This group has only had fairly recent exposure to ABF. The bridge between the two stakeholder groups has been constructed through a recent initiative, the NSW Health Cost Accounting Guidelines (2012).

In order to increase the accessibility of the initiative across the department, the guidelines use the finance officers' language and the clinical costing officers' technical casemix vocabulary. Together the two groups form a significant asset for NSW Health for the successful implementation of ABF at the NSW state level and, more importantly, at the local level (hospitals). Unlike other states and territories in Australia, NSW is renowned for its historical funding allocation that has resulted in limited transparency.

## **Methods**

A review of the main processes required for the implementation of ABF identified the weakness around the knowledge and level of engagement of finance officers in NSW Health. Clinical costing workforce had established their body of knowledge expressed in what was called Product and Program Data Collection (PPDC). The PPDC contained a set of rules that touched on a range of key accounting treatments but went further to establish a number of detailed rules for the purpose of clinical costing. This document was beneficial for clinical costing officers, but PPDC did not engage finance officers because of the level of technicality. In this respect, PPDC had limited usefulness as it was not accessible to the finance officers that play a key role in maintaining the general ledger and, therefore, they should be knowledgeable in cost allocation methodology.

As a result, a review of the PPDC was established and a number of consultations were conducted. This process generated the Cost Accounting Guidelines vol 1 and 2. The Cost Accounting Guidelines Vol 1 is more generic and aims at improving the knowledge of a broader audience in respect of costing practices and key elements and steps involved. The Cost Accounting Guidelines vol.2 was developed with a more specific set of standards applicable to NSW Health. These costing standards aligned as much as possible to the Australian Hospital Patient Costing Standards. The NSW Health additional standards included requirements around reconciliation and sign off of costing results that required the Chief Financial Officers approval as well as Chief Executives (CE).

## **Results**

At this stage, the results have been encouraging. The analysis of the clinical costing results, after the Cost Accounting Guidelines was introduced, shows that adherence to the standards is good and that reconciliation processes have significantly improved. A number of improvements have also been observed in respect to clinical costing practices at the Local Health Districts and the Ministry of Health. Clinical costing officers have been able to establish a sound working relationship with Local Health District's finance officers. Costing cycles are now run six monthly for all Local Health Districts and even more frequently for some Districts. Sign off processes have been established, which means that CEs are effectively involved at front instead of being confronted with the results afterward. Consultations with the key stakeholder groups will be conducted to further develop the guidelines.

## **Conclusions**

The Cost Accounting Guidelines represent a shift to a more inclusive audience for clinical costing processing. It is difficult to attribute the improvements to the costing data simply to the establishment of the Cost Accounting Guidelines, but it is clear that consistency has increased significantly. Consistency is critical in ensuring that clinical costing results are comparable and hence usable for benchmarking.

## **Introducing a national Activity Based Funding system in Australia**

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### **Introduction**

On 1 July 2013, a national system of activity based funding was introduced for Australian public hospitals. This move is a result of Australian governments agreeing to a broad range of reforms in the National Health Reform Agreement, which was signed in 2011. The introduction of ABF is being introduced to increase the efficiency, transparency and accountability of funding for Australian public hospitals.

Australian public hospitals are funded by two levels of government, the Federal Government, who contribute around 38% of the cost of hospitals via block funding arrangements to State governments. State governments provide the balance of funding to public hospitals, and manage the performance of the system. Whilst some states have had ABF in place for many years (Victoria, South Australia), others are still funded predominately using block funding approaches.

The new agreement means that federal funding will flow directly to public hospitals. Federal funding will be uncapped, and from 2014 will cover 45% of the price of new activity.

The agreement also recognises that small, usually rural, hospitals are not well suited to ABF systems, and these are block funded under the terms of the agreement.

This paper deals with the considerations involved in establishing a national ABF system for over 300 public hospitals, across 8 diverse jurisdictions.

### **Methods**

The national health reforms have included the establishment of a number of new national bodies, including the Independent Hospital Pricing Authority (IHPA)– the body responsible for setting the National Efficient Price (NEP), classifications and costing standards that underpin the ABF system.

The IHPA was established in December 2011, and published the first NEP in June 2012 for the 2012-13 financial year. The inaugural NEP covered acute admitted, emergency department and outpatient services. The second NEP, published in 2013-14, was expanded to cover admitted subacute and admitted mental health services.

The determination of the NEP is underpinned by the Pricing Framework for Australian Public Hospital Services, which outlines the policy positions that IHPA has adopted. This Pricing Framework was the result of an extensive consultation process with stakeholders and governments.

The national ABF system makes use of a number of classification systems:

Admitted Acute – Australian Refined Diagnosis Related Groups (AR-DRG V6.x)

Emergency Departments – Urgency Related Groups (URGs)

Non-Admitted – Tier 2 Clinics

Subacute – Australian National Subacute and Non-Acute Patient classification (AN-SNAP V3)

The NEP is based on comprehensive cost data, the National Hospital Cost Data Collection. The collection was established in the mid 1990's to support the development of the AR-DRG system, and in recent years has increased in robustness to the point that is now the primary data source for setting the NEP. The collection is underpinned by a robust set of costing standards (Australian National Hospital Patient Costing Standards).

Activity data has been routinely collected for admitted and emergency services in national datasets for many year. Non-admitted services are considerably less mature, but a new Non-admitted patient level collection has been developed and coverage is expected to increase rapidly in coming years, which will support further classification development.

The national system employs a single unit of measure, the National Weighted Activity Unit

(NWAU), which allows the comparison of activity across the various classification systems and setting of care, and the use of a single reference price.

### **Results**

The NEP in 2012-13 was \$4,808 per NWAU. This is based on the average cost. However, the cost data which this was based on was from 2009-10, which required IHPA to apply an indexation factor. This was determined by examining the growth in unit costs over the preceding 5 years.

Under the terms of the agreement, 2012-13 and 2013-14 are transitional years in which aggregate funding to states is protected. As such, the system has been able to transition slowly to the new system. But from 2014-15 the funding becomes tied to activity, and it is expected that most jurisdiction will have adopted the new pricing model by this stage.

### **Conclusions**

In the past two years, Australia has adopted a nationally consistent ABF system for funding public hospitals. This however has been built off infrastructure that has been established over many previous years, particularly the NHCCD.

There is significant work to do in coming years, including the design and implementation of a new mental health classification system, the refinement and enhancement of the non-admitted classification and data reporting systems.

## **Improving Transparency of Recalibration of Thai DRG version 5.2**

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### **Introduction**

The changes of later versions of Thai diagnosis related group have created turbulences in implementing the new versions. This research was to make recalibration of Thai DRG version 5.2 more politically and scientifically acceptable to all stakeholders.

### **Methods**

This action research employed participant observations and quantitative analysis of 2011 and 2012 inpatient data for recalibration and 2013 data for validation to assess scientifically acceptable outputs to stakeholder meetings.

### **Results**

Several stakeholders were appointed by the Ministry of Public Health as committee and subcommittee members to oversee the changes of relative weight (RW). The Thai Casemix Centre (TCMC) has been designated to recalibrate with 2011 and 2012 inpatient data from 3 public insurance schemes. TCMC mobilized more than 40 doctors and clinical coders to work as casemix facilitators (cFAs) to facilitate small group meetings (by major diagnostic categories, MDCs) in public hearing process. cFAs were keen to scrutinize consistency of six steps of recalibration and keen to pick up irregularities in coding and resource use data resulted in irregularities in RW. Fine adjustments were made after each stakeholder meeting to gain higher acceptability. R-square statistics of the new set of RW were higher than the previous version in general cases and even better in cases with high reported comorbidities and complications. Stakeholder meeting finally declined normalization process for budget neutrality when found out that the new version had lower average RW on the ground that the three insurance schemes should use the same set of RW.

### **Conclusions**

Well-informed stakeholder meetings with scientific data analysis increased transparency in recalibration process and achieved better acceptability of final product despite lower average RW in the new version.

# Data Quality 1

## The Dutch DBC-system, built for transparency in Dutch health care. An outline of successes and pitfalls

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### Introduction

In 2005 a new system for financing health care was introduced in the Netherlands: the DBC-system (Diagnosis – Treatment – Combination). The main reasons for introducing this system were:

- The ambition to increase competition in health care: better value for less money. In the Netherlands, care providers and insurers negotiate on volume, quality and price of care. This requires a system that provides sufficient insight in what is actually being done and paid for, in other words, a system that provides transparency.
- The ambition to improve quality of care: in an increasingly competitive market, negotiations are not only in price but also on quality.

During the first years after introduction, the system existed next to the old budget-system and therefore played a relatively small role in the actual financing of health care; the tariffs of 10% of the provided care were negotiated based on the new system.

After the successful introduction, a number of directions for improvement were identified fairly quickly by the various users of the system: the insurance companies, the government, the doctors and hospitals and the patients. These directions included:

- reducing the complexity of the system
- increasing uniformity of diagnoses of the particular locally developed classification
- possibility to distinguish severity of care in the system, and
- increasing the suitability of the system to play its intended role in negotiations between insurer and provider.

These directions for improvement were addressed in a programme for improvement, called DOT ("DBCs en route to transparency").

The new system was launched in 2012. At the same time the old budget-systems were removed and payment of health care is fully carried by DBCs (excluding some special functions). Also 70% of the tariffs are freely negotiable between insurer and provider. The newly introduced grouping method for deriving DBCs from the hospital's detailed registrations, improves data quality and therefore transparency of what is actually being done in Dutch health care.

### Methods

Since the introduction, data has been collected for every treated patient in specialist care. In this way, data for over a 100 million care trajectories are available, including both hospital and mental health care. These specify patient characteristics, diagnosis and information on diagnostics carried out and the treatment provided. These data are available in the DIS (DBC Information System) and provide a wealth of material to explore and provide the sought-after transparency.

### Results

Using this data, we get information such as volume and cost of care, insight in variations in the delivery of care, statistics on quality of care like readmissions and length of stay; in principle for every health issue that is treated. Analysing these data, leads to insight in striking differences in treatment between hospitals and regions. These differences may be explained by different choices that are made on medical grounds. There are however also worries, that the nature of the Dutch system motivates excessive treatment of patients, due to the incentive that higher production leads to higher income.

These insights are a starting point for further dialogue between doctors to define best practices of treatment from the viewpoint of quality and cost. Also they provide a starting point for further dialogue between hospitals and insurers, to conduct successful negotiations.

## **Conclusions**

In this presentation, we will briefly outline the ins and outs of the Dutch DBC system. Subsequently, we will provide insight in the data that is available in the DIS and give a number of inspiring examples, to illustrate the success of the DBC system and the increasing transparency. In these examples we will both address indicators for variations in practice, as well as indicators for possible over- or undertreatment of patients. The philosophy how to deal with these indicators for improving health care in the Netherlands will be explained.

## **Paying for High Quality Hospital Care: What Might it Mean?**

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### **Introduction**

Financial incentives are being adopted by healthcare policymakers in a significant number of countries as means to motivate healthcare providers to deliver efficient and high quality care. Pay-for-performance (P4P) is one such policy that has been applied in acute care settings. While P4P has been evaluated for its effects on clinical and process outcomes, little is known about its effect on patient-reported outcomes (PROs). The purpose of this project is to explore the potential relationship between P4P programs and PROs.

### **Methods**

We defined PROs as being measures of: health status, quality of life, or satisfaction/experience. Keywords were used to conduct a systematic search of relevant medical and social sciences databases. This search was restricted to articles written in English, from 2003 to present. After reviewing the articles from the initial search, further keywords were identified and a subsequent search was conducted. Collectively, these keywords were also used to systematically search Google for relevant publications/policies from the "grey literature".

### **Results**

The initial search for keywords relating to P4P, PROs, and hospital/acute care resulted in 25 articles; a review of abstracts narrowed this to 11 articles. References of these articles were used to identify other keywords that were used in subsequent searches; an additional 57 articles were identified. Fewer than half of these addressed our search criteria.

A review of the articles meeting our criteria found that P4P and PROs were reported in 5 articles, all of which pertained to patient satisfaction. In general, P4P had little significant impact on PRO indicators.

### **Conclusions**

Existing indicators of quality, such as non-payment for readmissions and hospital-acquired infections figure very prominently in hospital payment reforms in several countries. However, these measures of quality have their limitations and, in this gap, healthcare systems will explore novel mechanisms for measuring and reporting on the effectiveness and quality of hospital care.

In these same countries experimenting with hospital funding reforms, PROs are becoming increasingly important. However, there is currently no evidence-base for PROs being included as a component of P4P programs. If PROs are to be targeted with financial incentives, there is a critical gap in the literature that needs to be addressed.

# **The application of a casemix adjustment for the estimation of hospital standardised mortality ratios (HSMR)**

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## **Introduction**

While hospital standardised mortality ratios (HSMRs) are increasingly being reported by national organisations, the methodology continues to evolve.

In this presentation, the feasibility of using routine hospital discharge data for the estimation of HSMRs will be explored. In particular, an approach to using AR-DRGs as a measure of morbidity which can be integrated within the HSMR model has been developed. Given international best practice in this area, the results of an approach to estimating HSMRs at the national level will be presented.

## **Methods**

We estimated the variation between hospitals using hierarchical, or multilevel, models comprising fixed-effect logistic regression models, with hospital as a categorical variable, and random effect models, which adjusted for the extent of between-hospital variation that occurs by chance. The estimates in both sets of models were fitted without and with adjustment.

## **Results**

The approach adopted proved to be technically robust as it accounts for both fixed and random effects, incorporating a range of patient-level and hospital-level variables.

## **Conclusions**

Issues arise as to the availability of all the data required to inform a complete understanding of interhospital variation in mortality rates. HSMRs are just one approach which might be used to gain a better understanding of variations in quality of care at the national level.

# **Analysis of hospital outputs in Yunnan province using Thai DRG model**

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## **Introduction**

China is undergoing a profound health care reform. Although 1.2 billion people are covered by government medical insurance, the level of reimbursement is very limited, especially for the western undeveloped region such as Yunnan province. It is imperative for China to obtain proper payment instruments to manage financial issues of urban and rural health insurance. Yunnan province is a strategic site for healthcare reform in China based on the strong local health system and available human resources. This study used inpatient databases in four Yunnan hospitals as a case study in implementing diagnosis related group as a payment tool in China

### **.Objectives**

To group inpatient data from hospitals in Yunnan using Thai DRG grouper to explore opportunity for improvement towards efficient uses of limited health care resources for further health care reforms.

## **Methods**

Data of 2009 were obtained from four public hospitals with good hospital information systems in Yunnan province. The demographic and clinical data of the patient including age, gender, admission and discharge date, co-morbidity and complications, types of discharge, principal and secondary diagnoses and main surgical operating procedures were extracted. The hospital resource use data included length of stay, itemized service fees and all the total fees. Medical codes in electronic data records in ICD-10 for diagnoses and ICD-9CM for procedures were transformed to pass through Thai DRG grouper version 5. Data were

analyzed using R and Excel software. Categorical variables were analyzed using chi-square test and continuous variables using sample t-tests and analysis of variance.

### **Results**

A total of 925, 78 records were grouped into 1,223 DRGs (compared to 2,450 Thai DRGs of version 5). There were 516 surgical DRGs, accounting for 42.19% of total as well as 707 medical DRGs, accounting for 57.8% of total DRGs. Approximately 8035 of the total hospital discharges fell into ungroupable DRGs and 8.7% of the total classified into major diagnostic category (MDC) 26. About 12.28% of total discharges grouped into MDC05 (diseases and disorder of the circulatory system). The average length of stay of MDC05 in Yunnan was 12.82 days compared to only 5.37 days in comparable hospitals in Thailand. Average hospitalization charge in Yunnan was \$950.5.

### **Conclusions**

Quality of hospital data in Yunnan needed some modifications to group into DRG. The hospital information systems should set comprehensive plans for improvement in data quality. It is possible to use DRG for efficient utilization of limited funding. Further studies are required to accommodate DRG into the hospital payment reforms in Yunnan province.

## **Cost Calculation 1**

### **Case costing and cost per patient for breast cancer in the western region of Sweden**

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#### **Introduction**

So far clinical pathways have been the only premiss for estimating the amount of health care a breast cancer diagnosis renders. An estimation of the economical burden this diagnosis causes on the health care system can today only be performed from prognoses of prices of procedures in health care. The cost of breast cancer caused care is therefore unknown and the prognosis models lack validation. In the western region of Sweden we have at least partially used case costing systems since 1985. The system is called "cost per patient". The current method to study costs for different clinical pathways is to calculate every step in the specific healthcare process. The calculation is often based on caregiver's prices for different procedures or services. In this register study we compare this more theoretical way to calculate the (expected) cost for a specific clinical pathway with the actual (observed) cost per patient.

#### **Methods**

To obtain the actual breast cancer-related costs we have used a "cost per patient" database containing patient- and cost data for the year 2009 and 2010 for the western region in Sweden, the database also contains data when the patient was diagnosed with breast cancer. According to this database structure we can for example study how much healthcare a certain patient who was diagnosed 10 years ago consumed in 2009 and/or 2010. To select the care which is related to breast cancer we have structured the databases with a variable "active breast cancer" - yes or no, and categorized every visit such as mastectomy, radiation therapy, control visit and so on.

#### **Results**

The actual, observed cost per patient was approximately 60 percent higher than the calculated, expected cost for the breast cancer clinical pathway.

#### **Conclusions**

Our results show big differences between theoretical calculation models and actual costs. It also gives new knowledge regarding how clinical pathways can be described in terms of "cost per patient". In the future we hope that this kind of data can be used when designing new processes and clinical pathways.



# Simplifying and Stabilizing Cost Weight Calculations Through Reduction of Age Groups

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## Introduction

CMG+ is the inpatient grouping methodology used in Canada. It currently contains 562 distinct cells called CMGs. For each neonatal CMG there are three age groups while for the rest of the methodology there are a further six, containing both paediatric and adult ranges.

Canadian cost data is then used to derive standardized cost weights called Resource Intensity Weights (RIWs) for each of the CMG/age groups combinations. While the cost data are rich, they are somewhat limited in volume. As a result CMG+ currently has a number of CMG/age combinations, with little to no cost data with which to calculate accurate and stable RIWs.

The goal of this project was to determine if the number of CMG/age group cells could be reduced to improve the accuracy and stability of the RIWs without significantly compromising the explanatory power of the methodology.

## Methods

The primary issue with the number of age groups was that they created more cells than the cost data could support for RIW calculations. Our approach, therefore, was focused on reducing the number of CMG/age combinations by rolling age groups together where possible. At each step, we would submit a single change and analyse the impact on cell size and goodness of fit. As we built change upon change we hoped to reach a point where RIW calculations would be derived with much larger cost samples and that goodness of fit was not unduly compromised.

An area of particular concern at the outset was that we have paediatric age groups for all CMGs even though we had few paediatric cases in many of them. So our investigations included looking at which CMGs actually did have enough paediatric volume to test a distinction between the cost for adults and paediatrics, and if so, did a cost difference actually exist.

Our approach to this was to test all CMGs that contained at least 40% of the cases in the adult or paediatric age groups. The assumption here is that if there wasn't at least a 60/40 split, then there would be insufficient volume of one of the groups to make testing worthwhile.

We also tested other age groups for volume and cost distinction within CMG. This was done to confirm the necessity of three age groups for all neonatal CMGs, three distinct age groups for paediatrics as well as three more for adults. We also investigated the necessity for keeping paediatric and adult cost calculations separate at all for every CMG.

## Results

Our analysis results in the the following recommendations:

- For neonates, for five CMGs individual neonatal age groups were not necessary. For the balance of CMGs in this area, all three age groups would be retained.
- For three CMGs with higher volumes in each of the three paediatric age groups we retained each of those age/CMG combinations. For a further seventeen CMGs we have rolled together the three paediatric age groups but still calculate a separate paediatric RIW versus adult RIW.
- For the balance of the CMGs we will produce only a single RIW, without any age adjustments

The current methodology, using all nine age categories, achieved an R-square of approximately 76% for 2013. To obtain this number, we incorporated 3,283 CMG/Age combinations. However, 2,178 (66%) of those combinations contained cells with low (< 100 cost cases) volume, The results for the new approach do show a slight reduction of R-square, down to 73%, however there are now only 684 total CMG/age combinations with only 72 of those having low volume.

## Conclusions

This study showed that we can drastically increase the volumes with which we calculate RIWs by eliminating unnecessary age groups from those calculations. This helps to increase the accuracy and stability of the RIWs going forward. It also shows that the significant reductions in number of unique cells does reduce the explanatory power of the methodology, but only by the slightest of margins.

## The accuracy of DRGs to identify cases of visual impairment in hospital admissions: volume, mix and costs

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## Introduction

The World Health Organization uses the term “biopsycosocial” to describe the amalgam of physical, psychological and social factors that combine to shape how vision impairment impacts day-to-day functioning. Visual impairment (VI) increases the risk of depression, trauma due to falls, and social isolation. Lopez et al (2006) calculated that vision-related disability-adjusted life-years rank sixth just below HIV/AIDS. If current age-specific blindness prevalence rates were to persist, the increased longevity would lead to a rapid increase in the global nr of cases of Vi with serious economic consequences for health care systems. Preventing visual impairment and improving quality of life amongst persons with impairment should be health priorities in order avoid additional financial costs for individuals and governments. In Portugal there is no reliable information about the prevalence of VI. Knowledge about the size of the problem will help planning public health care policies to reduce costs for individuals and governments. The aim of this paper was to study the volume of hospitalizations and their costs attributable to people with or at risk of VI in Portugal.

## Methods

We identified hospital admissions and quantified the volume, mix and costs of visual impaired (VI) patients in national health system (NHS) hospitals. We used data from the Portuguese NHS hospitals discharge database during the year 2011. VI related cases were selected according with ICD9CM codes included in Bunce (2008) related to: Blindness and low vision (369.0) through Unsp. visual loss (369.9), Retinal detachment w/ retinal defect (361.0) through Unsp. retinal detach. (361.9), Blind hypotensive/ hypertensive eye (360.41/ 360.42), Prog. high degenerative myopia (360.21), Diabet. retinopathy (362.02/362.06), Retinopathy of prematurity (362.20 through 362.27), Deg. macula and posterior pole (362.50 through 362.53), Hereditary retinal dystrophies (362.70 through 362.77), Retinal edema (362.83), Retinal ischemia (362.84),Chorioretinal scars(specifically 363.32/362.35) Glaucoma of childhood (365.14),Cataract in degn. disorders (366.34),Visual field defects (specifically 368.41/368.45), Night blindness (368.60 through 368.62), Optic atrophy (377.10 through 377.16),Disorders optic chiasm (377 .5). To determine the cost of VI hospitalized we separate the episodes in which the principal diagnosis were coded with selected ICD9 codes from those with secondary diagnosis. To estimate costs we use the price tables (cost weights) that are currently in use in the NHS hospitals as a proxy of mean costs for each DRG. We have also calculated the mean cost of principal diagnosis by weighting the nr. of cases in each DRG and each principal diagnosis. In order to determine the accuracy of cost estimation using prices per DRG we also compared average cost p/ diagnosis with prices p/ DRG.

## Results

Preliminary results shows that in the year 2011, we identified 18.419 cases with Visual Impairment (VI), which represents less than 1% of total cases. The major causes of hospitalization are summarized in Table 1.VI is directly responsible for 11.704 episodes (selected icd 9 codes as principal diagnosis). For these episodes case mix index (CMI) was 0.796. Episodes were divided by: ambulatory care (82.7%), elective admission (93.5%) and surgical (98.9%). An estimate of 22.3 million euro was spent by the NHS in this type of care during the year 2011.

When we analyse VI as co-morbidity we identified 6.715 episodes, mainly as elective admission (53.5%). In this case CMI was 1.331. Inpatient care represents 64.8% of the total costs with 60.5% of these costs attributable to surgical DRGs. An estimate of 21.4 million euro was spent in this type of care during the year 2011.

When we compared average cost per diagnosis with prices per DRG we found variability between average cost per diagnosis and prices per DRG, more prominence in 48, 47, 534, 42 and 38 DRG indicate heterogeneity in resource consumption within DRGs.

## Conclusions

Visual impairment is a topic of growing interest worldwide. This study shows that visual impairment is responsible for 18.419 hospital episodes with a CMI of 0.991, and an estimate cost of 43.7 million euro. Given the variability between average cost p/ diagnosis and prices p/ DRG, we consider that to estimate hospitalization costs attributable to visual impairment would be better to rely on diagnosis rather than DRGs

Table 1: Major cause of hospitalization - Top 5 ICD9CM

ICD 9 CM code	Description	PD	SD	(PD) + (SD)	Percentage(%)	Cum. Percentage (%)
36252	Exudative senile macular degeneration	6992	226	7218	38%	38%
36202	Proliferative diabetic retinopathy	7	2003	2010	11%	49%
36900	Impairment level not further specified	2	1533	1535	8%	57%
36283	Retinal edema	614	359	973	5%	62%
36101	Recent detachment, partial, with single defect	801	47	848	5%	67%
Total		8.416	4168	12.584	67%	

*Principal Diagnosis - PD*

*Secondary Diagnosis - SD*

## The Calibration of Predictive Models to Support All-Age Groupings

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### Introduction

When applying population based risk adjustment it is often desirable to have one risk assessment (or scoring) methodology that applies to the entire population in order to rank patients from high- to-low in order to facilitate allocation of scarce healthcare resources. Age/gender interaction terms are often used to account for differences in age groupings but there is evidence that the significance or prevalence of certain diseases is not the same in geriatric as in the young adult or paediatric populations. This presentation will look at the potential benefit of calibrating separate models by age groupings and discuss ways of combining the results into a single scoring methodology to support population health and management. Such an approach can help to produce parsimonious models rather than those incorporating complex interaction terms which can be difficult to implement and interpret.

### Methods

The principal aim of this study is to demonstrate how model coefficients in the ACG® Predictive Model, which indicate various risk assessment categories, vary by age grouping and to show how predictive performance can be improved when separate models are run by age grouping when contrasted to a calibration of a model run on the total population. Additionally, this presentation will show how the results of these two separate models can be combined via a simple rescaling methodology which allows the ranking of the entire population according to risk (defined as expected cost) to support population-based disease and case-management interventions.

## Results

Analytics are currently in process but the data will be drawn from the IMS Health Payer Solutions, Watertown, MA; Subset of the Patient-Centric Database containing a national cross-section of US managed care plans; population of 3,986,599 Commercial and Medicare beneficiaries, 2008-09.

## Conclusions

A potential hazard of segmentation and breaking the population into smaller and smaller subgroups is the risk of model proliferation and the potential to offer a false sense of precision. Inherently there are many aspects of healthcare which are unpredictable and no matter how many ways the population is sub-divided, there is going to be some measure of unpredictability. However, based on years of experience looking at patterns of multi-morbidity it has become obvious that the significance of certain diseases varies by age group. This paper helps to inform the optimal means of segmenting the population into appropriate groupings for managing population health.

## Thursday Afternoon Structural Reform 2

### Baby Delivery with Different Resource Utilization in Yunnan Province Using Thai DRGs methodology

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#### Introduction

Introduction: In China, a number of pilot reforms of hospital payment mechanisms are under way. A case-based payment on DRG (diagnosis related group) has been piloted in Jining Medical College Hospital, and six Beijing hospitals. Considering significant differences in standard of living and in health care provision between regions, a single DRG system around China seems difficult. This study aims to report resource utilization for baby delivery in hospitals in Yunnan province using Thai DRG methodology. After expert consultation, Yuxi City Hospital (901 beds), Yan'an City Hospital (800beds), Gejiu City Hospital (500 beds) and Lijiang City Hospital (500 beds) were selected as the sample of this study because of their good hospital information systems.

#### Methods

Methods: HIS of 2009 from 4 hospitals provided individual inpatient data on age, sex, diagnoses, operating room procedures, length of stay and hospital charges. Thai DRG grouper version 5 was used to map data into DRG to obtain relative weight. Hospital resource utilizations for vaginal delivery and caesarean section were compared.

#### Results

Results: The average length of stay for vaginal delivery was 5.58 days (6.72 in Lijiang, 5.83 in Yan'an, 4.38 in Yuxi and 3.90 in Gejiu). For caesarean delivery, the average length of stay was 9.97 days, much higher than vaginal delivery (10.34 in Lijiang, 7.84 in Yuxi, 6.96 in Gejiu and 5.50 in Yan'an). Relative weights were almost the same among four hospitals for vaginal and caesarean deliveries (0.40 and 1.32 respectively); but were rather different in vaginal delivery with surgical procedures (average 0.73, 0.80 for Gejiu and 0.60 for Yan'an). The total fee for vaginal delivery in Yan'an was the most expensive (¥3,394 or US\$566), while the mean of four is ¥2,344. In regard to surgical groups, the mean total fee is ¥4,387 and average operation fee is ¥1,073.

#### Conclusions

Conclusions: Hospital resource utilizations for baby delivery in four hospitals were different. DRG could help explain the differences between hospitals, and also suggest how to implement DRG in Yunnan province.

## **DRG Data for Health Reform Purposes**

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### **Introduction**

The introduction on DRG-Systems caused not only a change in hospital re-imburement it also introduced a continuous source of data on certain aspects of hospital services. In many countries the DRG-system is used for the whole public funded hospital sector or at least large parts of it. So DRG documentation has a large coverage, is part of routine documentation and data in the meantime are available and comparable over longer periods of time.

DRG data are one – sometimes the only one – available source of information on in-patient health services, so it is quite logic, that those data are in use for purposes far beyond hospital re-imburement. In Austria DRG-documentation – originally a tool specifically developed for hospital re-imburement - is in use for healthcare planning and now for already two years for quality assurance with routine data on a national basis. For the recent health reform DRG data are not only used to get a picture of hospital services, in combination with other data sources they serve especially for the definition of targets and indicators and also for monitoring.

The relevance of DRG data for non-DRG purposes increases constantly. But, following the initial concept, they are mainly data for hospital financing and re-imburement. The questions for this contribution to the PCSI 2013 are, if the usage of DRG-data for other purposes than the data provision for a lump-sum re-imburement system is feasible and which purposes might that be. Is the composition and quality of DRG-data adequate for those purposes and what implications have additional or new information requirements for the future development of DRG-systems?

### **Methods**

The Austrian healthcare system is organised in a fairly complex way with different responsibilities and authorities concerning decision making and funding and different agents that are responsible for in-patient and out-patient services. It is crucial to overcome this fragmentation. The health care reform 2012/2013 aims at increasing collaboration in the health care sector and thus leading to better coordination regarding planning, governing and financing of the in-patient and the out-patient sectors.

End of 2012 it has been agreed to implement the so-called "Zielsteuerung-Gesundheit" (management by objectives in the healthcare sector). In early 2013 the concept has been transferred into federal law. The management by objectives is based on contractual provisions between the partners – the federal level, the nine federal regions (Bundesländer) and the social insurance.

A core issue of the healthcare reform is the containment of health expenditures. To ensure the financial sustainability of the healthcare sector, a "health expenditure containment path" has been implemented in order to achieve harmonization in the growth of healthcare expenditures and the estimated growth of the GDP.

The basis for the financial targets is the development of public health care spending since 1990; this figure has increased by an average of 5.2% per year (not including long-term care) since that time. The plan calls for a gradual alignment of public health care spending with the medium-term forecast for nominal GDP growth (currently 3.6%) by 2016.

### **Results**

In a presentation first the subject will be introduced and relevant questions and aspects will define the frame of the contribution.

In a second step it will be shown how DRG data are used in the current Austrian health reform, in detail for

- the "Zielsteuerung-Gesundheit" (management by objectives in the healthcare sector) for hospital capacity planning, better coordination between hospital inpatient and outpatient services, as well as ambulatory care services and using data of the Austrian DRG for definition of objectives, monitoring and steering the system by setting incentives, and  
- improving quality of services by using routine documentation for exploring lacks in quality and setting up a system (called Austrian Quality Indicators/A-IQI) where DRG-data were analysed with certain statistical methods, estimated lacks in quality are identified and then analysed and improved by peer-groups together with the treating medical facility.

In part three some relevant questions will be raised (Is the usage of DRG-data for other purposes feasible? Which purposes might that be? Is the composition and quality of DRG-data adequate for those purposes? What implications have additional or new information requirements for the future development of DRG-systems?)

## **Conclusions**

Discussion with DRG-experts at the PCSI on the presented subject.

## **Model to create transparency through welfare services**

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### **Introduction**

In Finland, the main challenges in public economy are concerned to be the growing well fare differences associated to socioeconomic status, the excessive growth of healthcare expenses and lengthening of working careers.

To be able to correct the unwanted trends in healthcare, it should evaluate the results and costs of the whole social and health care and medical treatment of a citizen. The fact is that we neither get nor utilize the data of the entity despite of our rather long history of automatic data management and electronic patient records. The main reason for the lack of management tools is that processes, data storages and data protection are built on separate organisations. The focus in politics is, though, reorganization of the public social and health care system instead of influencing the reasons for inadequate management like lack of information.

### **Methods**

We have recently created a tool for customer oriented view to social and healthcare (P.Kortekangas and Teemu Suna: Asiakastilanne- ja -prosessi jäsentävät sosiaali- ja terveydenhuollon toimintaympäristön). The tool is a model firstly allowing discussion and sharing the vision of the regional services between the ones responsible for the services, providers of the services, data administration and ICT vendors. Secondly, the model arranges metadata of the information in a way tolerant to organisational changes, the changing needs of population and progress of medical best practices. Thirdly, data stored following the concepts of the model enables separate analyzes of the chain of services for a certain need or the way the services are supplied to the customers or the individual services of a provider.

### **Results**

In this study, we demonstrate three cases using our model consisting of three main components, customer's event, customer's process and information. We point out the possible hazards to adapt today's benchmarking to the new customer oriented way of planning and supplying services.

### **Conclusions**

Public health care services in Finland will not follow the pattern to which DRG was implemented. Further discussion is needed on things like what is a product or an episode or what are we benchmarking or how to use DRG and APR parallel or how to tackle the different thinking of costs in social and health paradigm.

# **Medicines and Diagnostics :Role in Pushing Care Seekers to Impoverishment**

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## **Introduction**

Health financing in India is still predominantly based on out-of-pocket payments. Only around 10 per cent of India's population is covered by some health insurance. This can push those slightly above poverty line to further impoverishment. Health related expenses, high interest public debt and customary expenses are identified as the three important factors that push people to poverty in the country. Health care expenses figured prominently in more than half of all cases as the reason for the decline into poverty. This is highlighted in the World Bank Study which concludes that " the hospitalized Indian spends more than half of his total annual expenditure on buying health care; more than 40 percent of hospitalized people borrow money or sell assets to cover expenses and 35 percent fall below poverty line" (World Bank, National Planning Commission). Out-of-pocket expenses alone are estimated to push 2.2 percent of the population below the poverty line annually (Planning Commission).

The state of Kerala one of the smallest states in the Indian Union is well known around the world for its remarkable achievement in the field of fertility and mortality transitions. The state has one of the lowest mortality rates for all age groups as well as one of the lowest fertility rates but has one of highest levels of private financing of health care expenses, with out-of-pocket expenditure estimated to account for 87 per cent of total expenditures (NHA). The present study is an attempt to understand the factors that is pushing up the costs of health care in the state.

## **Methods**

The study depended on secondary data sources like National Health Accounts, estimates prepared by the National Planning Commission, various state development reports, economic reviews etc. Using these data the study tried to analyse the health sector of the state of Kerala for a period of three decades 80s, 90s and 2000s. It tried to identify the extend of public private participation, private financing of health expenditure especially out-of-pocket expenditure, extend of consolidation that is happening in the private sector, contribution of OP and IP in pushing up the cost of care etc. From these analysis the study makes an attempt to identify the major causative factors that are pushing the cost of care up as well as pushing people to impoverishment.

## **Results**

There is over dependence on private health care providers in the state.

Out-of-pocket expenditure which is one of the dominant mode of health spending in the state is increasing every year.

There is consolidation of small hospitals into large private hospitals.

Contrary to the belief that it is the IP that is pushing the costs up, it is the cost of care at the OP that is pulling the health care costs up.

Medicines and diagnostics are identified as the major contributing factor and of these diagnostics comes to the forefront

## **Conclusions**

With the fading away of public health care centers and the increasing dominance of private care centers along with the non-existence of insurance facilities (for the majority) the health care sector in the state is undergoing some drastic changes which will have serious consequences to the vast majority of the state's population. The public policy of favouring private participation in medical education as well as for starting multi-speciality and super speciality hospitals has led to a situation whereby the small hospitals and nursing centers are loosing their role in the health care provision as there is increasing consolidation of large hospitals. This coupled with the ailing public health care centers leaves ordinary people with no option but to approach the private-for-profit speciality care centers even for minor health related issues. As out-of-pocket spending is the dominant source of financing, the situation is pushing care seekers to impoverishment. Since, rather than the inpatient treatment it is the

out patient treatment that is escalating the cost of care unless the government intervenes with some regulations on the prescription of medicines and diagnostics, the situation might turn grave. Serious discussions and debates as well as effective policy formulations are the need of the hour.

## Coding

### Towards a multi-healthcare Terminological system based on a common ontology

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#### Introduction

Semantic interoperability relies on structured data and the use of a common controlled vocabulary (terminology, classification, or ontology). As multiple vocabularies exist, the preservation of meaning between patient-related data or aggregated population data represented using different vocabularies requires semantic harmonisation amongst those vocabularies.

This issue is addressed by the 2010 collaboration agreement between WHO and IHTSDO, which incorporates the harmonization between the upcoming revision of disease classification ICD-11 [ (used for health statistics but also in medical record systems) and the international clinical terminology standard SNOMED CT [2].

To insure this the ICD 11 will be based on a Foundation Component intended to have at its core a common ontology shared with SNOMED CT

#### Methods

This common ontology subscribes to principles of applied ontology , i.e. the meaning of domain terms (and the concepts or classes they refer to) are described by logics, rooted in an ontological framework based on three principles

(i) each class in the ICD-11 ontology core of the Foundation Component (FC) has to correspond to exactly one (pre- or post-coordinated) class in SNOMED CT, and (ii) the transitive closure of taxonomic relations in FC must be included in the transitive closure of taxonomic relations in SNOMED CT (Fig. 1). Furthermore (iii), the equivalence in meaning between aligned classes, as understood by users, will be assured by having common text definitions and descriptions, in addition to the formal axioms in description logic. Other examples will be presented

#### Results

The work is ongoing on the cardio vascular chapter of ICD11 and shows the need to represent the diseases following Description Logic representation with supporting terms based on properties as for instance for hypertension: such properties are the location of the process (systemic artery or pulmonary artery), the aetiology, cause, or mechanism (idiopathic, renovascular, endocrine), and the characteristic of the person in which the process occurs (adult, child, pregnant woman). Finally, the disease process can be further specified in terms of severity (mild, moderate, and severe).

#### Conclusions

This work will allow the creation and the maintenance a multi-healthcare terminological system able to satisfy the different users needs:clinical monitoring,clinical,research, epidemiology and health economy research, casemix use.



# Technological innovation and coding practices: state of the art in Italy

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## Introduction

The development of a coding system for procedures, frequently updated, able to identify technological innovation, especially breakthrough innovation, would be highly desirable. First of all, it would produce new knowledge and allow sophisticated analyses like comparison of alternative treatments/technologies in terms of outcomes (average length of stay, infection rate, readmission rate, mortality rate, consumption of drugs and outpatient visits). Second, it would allow the Regulator to develop the most appropriate financial instruments (e.g. frequency of update of DRG tariffs, set up of separate or supplementary payments) to facilitate the uptake and diffusion of new technologies, guaranteeing equity of access to all patients. Last, it would contribute to the ongoing debate on the determinants that affect the diffusion of new technologies.

The goal of this work is to give a snapshot of the Italian coding system and the possibility to match technological innovation with existing ICD-9-CM codes.

## Methods

Starting from January 2009, the Italian Ministry of Health introduced version 2007 of ICD-9-CM, a classification system for diagnoses and procedures, and version 24 of the Grouper to classify hospital admissions into DRGs.

To reach the goal of the work, we selected a list of innovative technologies (i.e. Ventricular Assist Devices - End Stage Heart Failure; Fractional Flow Reserve; Cardiac ablation – Atrial Fibrillation; Neurostimulation; Implantable Ocular Lenses; Mitral Ablation; Insulin pump; Renal denervation; Left Atrial Appendage closure; CRT therapy; ICD therapy). For each technology, we designed a database including the following information: possibility to unequivocally identify the use of the technology in Hospital Discharge Records (Schede di Dimissione Ospedaliera SDO), DRG code linked to the use of the technology, ICD-9-CM codes linked to the use of the technology, regional differentiation of ICD-9-CM codes, regional reimbursement scheme (e.g. DRG rates vs global budget), figure of DRG rate, existence of additional payments on top of DRG tariffs).

## Results

In 7 cases out of 11, the matching between technology and ICD-9-CM codes is impossible due to the lack of codes. For 3 technologies (i.e. ICD therapy, CRT therapy, IOL), ICD-9-CM codes exist although the level of specificity is not enough to distinguish the level of innovation (e.g. generation of the device, compatibility with MRI). The only therapies that can be investigated in depth are the ones belonging to the Neuromodulation family, i.e. Sacral Neuromodulation, Deep Brain Stimulation, Peripheral Nerve Stimulation and Spinal Cord Stimulation. Concerning regional differentiation, the Italian Regions differentiated coding practices only for Sacral Neuromodulation and Spinal Cord Stimulation. Last, supplementary payments on top of DRG rates aimed at encouraging the use of medical technologies have been developed at regional level only for Deep Brain Stimulation (in 10 regions out of 21) and Spinal Cord Stimulation (in 3 cases).

## Conclusions

Our results from the Italian health care system show that, in most of the analysed cases, the ICD-9-CM codes currently in use are dated and unable to identify the use of innovative technologies. Even when codes exist, they are not sufficiently detailed to identify the level of innovation. In our opinion, the Ministry of Health should consider to implement the coding system. One possible solution would be to add one field in the Hospital Discharge Records that hospitals have to fill in with the individual code of medical devices from the Italian National Registry of Medical Devices.

# Data quality assurance – statistical methods for the identification of suspicious data sets

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## Introduction

High data quality is a key issue for any DRG system. Usually a relatively small number of items like main and additional diagnoses, procedures, staying in an intensive care unit, length of stay and some demographic data like age and gender are summarized in a so called Minimum Basic Data Set (MBDS). There is low redundancy in the data set which could be used for an automatic online data quality or plausibility check.

## Methods

Data quality has many dimensions, like correct coding or diagnoses and procedures, completeness of all items in the data set. The conditional probability of two or more items of a DRG is used as an indicator of the plausibility of the combination of these items. The conditional probabilities are transformed into scores, e.g.:

If the item is present:

$p < 0.001$  - Score 3;  $p < 0.01$  - Score 2;  $p < 0.05$  - Score 1.

If the item is not present, but the probability is very high the following rule is used:

$p > 0,999$  - Score 3;  $p > 0,99$  - Score 2;  $p > 0.05$  - Score 1.

Of course the scoring is arbitrary and can be extended to other rules.

For each combination of items, like main or additional diagnoses, procedures, age, length of stay, intensive care etc. these scores can be calculated from the database and afterwards each admission can be evaluated using a score sum. Data sets of an admission with a very high score sum are considered as "suspicious" and the information can be used for the inspection of the data set. Furthermore profiles of hospitals regarding the amount of suspicious data sets can be calculated.

## Results

For all Austrian inpatient admissions in 2012 the data sets have been evaluated by the scoring system. Examples of the distribution of scores for DRGs and hospitals will be shown. For the first three months of 2013 all data sets will be evaluated and the most suspicious ones will be used for a data and documentation quality examination. These most suspicious data sets will be compared with the medical record of these patients.

In a previous study out of approximately 250000 data sets 300 have been examined and about 80% of them had some documentation or coding errors.

## Conclusions

Because of the huge number of data sets in DRG systems efficient and effective procedures for data quality assurance are necessary. The methods described here can help to identify the most important documentation and coding problems and can also be used to establish better documentation rules. Furthermore if there are typical coding patterns, like up-coding etc. in a hospital, this may be identified in an efficient way.

If the results of the test in Austria are convincing it could be possible that the algorithm will be included in documentation systems to avoid errors at the source of documentation.

The algorithm and some results will be presented.

## **Medical and Nursing Registration : Teamplayers ?**

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### **Introduction**

Belgium has a long tradition of recording hospital discharge data. In 1988 a nursing activity registration was set up using 23 dedicated items. Two years later, the medical registration (using ICD-9-CM) was born. In 2008 a new data model was introduced integrating medical, nursing and administrative data in a single recordset. At the same time, the nursing domain was extended to 78 activity items while the medical domain was also deepened. The HDDS is still more important regarding the prospective financing of Belgian hospitals, which represents almost 50 % of the total budget of every institution.

### **Methods**

The superiority, but also the big challenge, of an integrated hospital discharge dataset, combining medical and nursing data, is the congruency of the constitutive elements being recorded by different care providers (physicians respectively nursing teams) at different times but concerning of course the same patient.

The goal of the present study is to evaluate the concordance between medical diagnostics and procedures on the one hand and nursing activity elements on the other. Our methodology is to develop a set of congruency queries and apply them on last year's data of voluntary participating hospitals.

Another interesting point is the difference in this congruency with regard to the coding methodology – one integrated or two separate teams – of each participating facility and the availability for both medical and nursing coders of the complete patient record.

### **Results**

The results are being discussed. Feedback is given to every participant so they can review the patient record as a gold standard, and identify the origin of the discrepancies.

### **Conclusions**

In a country with a 20-year tradition of medical and nursing activity recording, the integration of both domains into a single recordset offers a unique perspective but reveals the difficulty to associate data being supplied by different care providers.

The availability of a single (electronic) patient record for all coders involved in this patient centered hospital wide dataset should improve the congruency of the captured information and reflect more correctly the health care provided.

## **Casemix and Policy 1**

### **How to Pay for Performance in Norway**

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#### **Introduction**

A White Paper about Patient safety and Quality was published in 2012. The paper introduced performance based financing as one of the measures to enhance quality in the hospital sector. The Norwegian Directorate of Health now has designed a P4P model adapted for the Norwegian specialist healthcare steering system. In Norway, four Regional Health Authorities (RHA) are responsible for providing of the specialist healthcare services on behalf of the government. The services are produced mainly by public providers, but also by some private providers on the basis of agreements.

The main objective of the existing payment schemes is to support the regional health authorities' responsibility for providing healthcare services to the population. Today, the resources are allocated with a mix of block grant financing and activity based financing in the somatic sector. A new payment scheme based on quality/results thus represents a third type

of resource allocation mechanism.

## **Methods**

About the model and the analysis

The proposed P4P scheme is based on a selection of national quality indicators, a patient experience survey and an indicator of patient rights violation. Both result and process indicators are included in the quality indicator set and the indicator groups are weighed. Total performance is a product of reported quality in four categories: 1. Reporting quality, 2. a minimum performance level, 3. improvement in performance and 4. relative performance (ranking). A set of rules has been developed to operationalize the performance calculations. To study the reallocation effects of the different components in the model, a simulation and sensitivity analysis on historic data has been performed.

Methods of data collection and calculation

The P4P model is based on existing data sources, e.g. The National Quality Indicator Program and the National Patient Satisfaction Survey. Publicly available data from these sources was first imported to a spreadsheet. Further, the data was processed into two alternative models with an established set of rules. Then, performance points were calculated as a measure for performance on the regional level. At last, a fictive global budget was re-allocated to the regions adjusted for the relative size of the region.

## **Results**

The sensitivity analysis provided useful information about the financial consequences of the regional performance. The different scenarios in the P4P model showed that the top performing region could achieve a 20 % increase in the available resources compared to the current payment scheme. Consequently, the region with the lowest scoring could be exposed to a 10-15 % decrease. The different scenarios were different with respect to outcome measured in resource reallocation.

## **Conclusions**

An important objective in the development of the payment scheme has been to include quality indicators that have legitimacy among healthcare workers and administrators, to include the patient satisfaction dimension and to reduce the risk for unintended incentives. We consider that the suggested Pay for Performance- model has met these criteria and can be implemented. However, it is up to the Norwegian government to decide whether to implement the scheme or not.

## **Curbing Moral Hazards of Providers in Development of Top-up Payment for UNU-CBG Casemix Tariff in Malaysia and Indonesia**

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## **Introduction**

UNU Case-Based Group (UNU-CBG) is an international casemix system launched by United Nations University in 2010 to support the development of the casemix system in developing countries. To date, UNU-CBG casemix system has been introduced in 18 developing countries. Most of these countries are using this system either as provider payment in their social insurance schemes or as hospital budgeting tool. Indonesia and Malaysia are the two countries that actively using this system. UNU-CBG is a unique casemix grouper that allows both acute, sub acute and chronic conditions to be classified into iso-resource groups. The first level of classification is called Casemix Main Group (CMG) and the second level of

classification is Case Based Group (CBG). In addition to the acute CMGs, the grouper contains seven additional CMGs. These CMGs are sub acute, chronic, special investigations, special drugs, special procedures, special prosthesis and ambulatory package. The seven special CMGs allows for top-up payment to the hospitals to reduce their financial risk. However this potentially expose the funding agencies to providers' moral hazards. This paper describes the steps taken to control this potential problem in Malaysia and Indonesia.

### **Methods**

The development of the special groups was carried out in five careful stages. In the first stage, the developed UNU-CBG tariff was compared with the hospital cost. Cost to charge ratio (CCR) was imputed for each CBG. Only CBG with CCR more than one were selected to be considered for topping up. In the second stage, experts groups were formed representing each clinical speciality to propose the costly procedures, drugs, prostheses and investigations. In the third stage, the selected items were matched with the CBGs. These items were only selected if the cost of the items is higher than the tariff for the respective CBG. In the fourth stage, the expert group decided the topping up rate and simulation exercise was carried out to assess on the financial implication of the topping up. In the fifth and final stage, the logic of the grouper was modified to allow only specific CBG to be topped up with the special rates as agreed by the funder.

### **Results**

Top-up payment for costly drugs, procedures, investigations and prostheses were successfully developed with consensus of the experts. The top-up payment ranging from 10% to 50% of the basic CBG tariff were developed and implemented. CBGs in Respiratory System Musculoskeletal System, Cardiovascular System, Hepatobiliary & Pancreatic System, and Myeloproliferative & Neoplasm were the most common casemix groups with top-up payment. Strict control on the top-up items was possible with the change in the grouper logic. The special CMGs for top-up payment is in the process of further refinement to be implemented for provider payment in Indonesia and Malaysia.

### **Conclusions**

The UNU-CBG provides the possible solution to increase the acceptance of casemix payment by providers especially in developing countries. All the seven special CMGs in UNU-CBG will be fully implemented in these countries in the near future. It is hope that the topping up payment will reduce the financial risk of hospitals while the moral hazards of providers is under tight control.

## **The French classification in non acute care**

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### **Introduction**

This year, we introduce a new classification for inpatient stays in non acute care. The changes in the classification are important.

The French Health Ministry wanted it as the first step in the evolution of the hospitals financing.

Nowadays, public hospitals are paid by annual budget meanwhile the private for profit hospitals are paid per day. There are big differences between hospitals in non acute care: some are specialized (for example in cardiac rehabilitation) and some are non specialized and have a mix between rehabilitation and skilled nurses facilities.

The previous classification had 83 groups (GMD) based on diagnoses and age (pediatric groups). The others criteria (disability with French ADL scale, procedures and age over 18) were taken into account with an additional continuous index. In this classification, the based unit was the week and was predictive of day costs. Some regions used it to adjust the annual hospital budget. In the new classification (GME) the based unit is the whole patient stay. It also gives diagnosis priority while taking into account the others criteria by cluster segmentations in order to lead to a better activity description.

## **Methods**

The classification construction was conducted on the national database of public and private inpatients hospital stays collected over a period of 4 years from 2007 to 2010 (3.611.462 stays) and on the cost database (74.709 stays). We also completed the work by clinician interviews.

The analysis has primarily focused on the length of stay and was consolidated with the day cost. The classification is organized as a three levels hierarchy: nosological groups (GN) based on diagnoses and classed in 15 major categories (MC). They are split if necessary in adjacent-groups (RGME) with the criteria of disability, age, surgery delay and minutes in rehabilitation procedures (based on a CART method). Those RGME are then split into two levels of severity with the secondary diagnoses and sometimes in day groups depending on the ambulatory activity (GME).

## **Results**

The new classification has 15 MC, 88 GN, 255 RGME and 684 GME. The R2 over the duration is 13.5% and over the day costs 40.1%. The differences between what is observed and is expected in average by hospital are about 18% on the length of stay and 15% on the day costs. We have verified the statistical bias focusing on the age, the disability score, the times of procedures.

The new medical groups (GN) are quite different than the previous one (GMD). In average, 55% of stays grouped in one GMD are classified in the most frequent GN for this GMD.

## **Conclusions**

Some difficulties are mentioned by professionals mainly on the description of pediatrics groups, geriatrics groups and time of rehabilitation.

The transition to an all criteria group based classification makes the activity easier-to - understand for the authorities whereas it's more difficult to take into account all predictive factors.

The work is going on. The aim is to have an improved classification in 2016 when the way of financing the hospitals in non acute care will change and will be based on the classification system even if nowadays, the way of financing is not specified. The only instruction we actually have is to take into account the episode of care for some pathologies.

## **“Money Follows the Patient” - Moving to Activity Based Funding in Ireland. Progress to date**

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### **Introduction**

Case Mix funding in Ireland at present is retrospective and Budget Neutral whereby funding is redistributed between hospitals based on the calculated measure of efficiency by comparing each hospital's costs and activity against their peers. The National Case Mix Programme uses the Australian Refined DRG Classification system and ICD -AM coding system for Inpatients and Daycases.

The Government has set out a clear policy vision for the transformation of the Irish health service. This vision is founded on a commitment to universal access to health services for the citizens of Ireland based on need rather than ability to pay and achieved through universal health insurance. There are a number of critical stepping stones on the path to universal health insurance. One of these is the introduction of a 'Money Follows the Patient' payment system whereby each patient would be funded on an individual basis.

The Department of Health Strategy document Future Health states “ A new Money Follows the Patient (MFTP) funding model will be introduced in order to create incentives that encourage treatment at the lowest level of complexity that is safe, timely, efficient, and is delivered as close to home as possible. This shift will be used as an opportunity to use money as a lever to achieve quality and safety objectives rather than simply being a means of paying for activity

The Health Service Executive Service Plan 2013 states that " The HSE will move to a 'Money Follows the Patient' approach on a shadow basis in 2013 and commence funding on this basis in 2014.

### **Methods**

As part of the move to a 'Money Follows the Patient' payment system, the Ministry of Health requested that the HSE implement a prospective funding for a number of elective Orthopaedic DRG'S on a prospective funding basis for the second half of 2011 and 2012. This was used as test run for what issues are likely to arise on full implementation of a Prospective Funding system.

### **Results**

Progress to date in has included the publishing of a Draft Policy paper on Money Follows the Patient in February 2013. There was also a report published in May 2013 on the "Establishment of Hospital Groups as a transition to Independent Hospital Trusts.

The draft policy paper on MFTP which is a consultative document, deals with

- defining the services to be covered
- designing the price around what should be included in the price and whether the price should reflect an average cost, efficient price or best practice price.
- The governance structures to support MFTP which recommends the setting up of an Independent Information and Pricing Authority and a Healthcare Commissioning Agency
- An Implementation timetable

The report on the Establishment of Hospital Groups as a transition to Independent Hospital Trusts outlines the hospitals groups that will support the introduction of UHI and MFTP.

### **Conclusions**

Money Follows the Patient' will represent a sea-change for the Irish hospital system. By its nature, it will change the basis of relationships at all levels of the system with governance, performance management and financing bound up in a fully integrated process that is founded on exchange, engagement and examination of timely patient level information. Supporting the system through this sea-change will be critical and will require a strong communications strategy and a detailed implementation plan which identifies the capacities, systems and structures which must be embedded at all levels of the system to make 'Money Follows the Patient' a successful reality.

## **Transparency of casemix costing data as a strategic planning measurement for APEX status hospital University in Malaysia**

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### **Introduction**

Become a premier university in Malaysia awarded an APEX (Accelerated Programme for Excellence) status, Universiti Sains Malaysia (USM) is heavily committed with a long term objective to transform the university into a centre of excellence at par with top universities of the world. Hospital USM, aligned with the university's autonomy and flexibility status has move towards adopting the Casemix System as their hospital administrative system. In the first year of project collaboration with United Nations University-International Institute for Global Health (UNU-IIGH), initiative that we could expect from this system is the generation of Malaysian DRG (MY-DRG) tariff from Hospital USM. It is part of our main objective to improve healthcare quality and increase efficiency of services provided at this second oldest teaching hospital in Malaysia.

## Methods

All in-patient medical records for patients discharged in 2010 till 2012 were reviewed. Coded diagnosis and procedures using ICD10 and ICD9-CM classifications respectively done by a group of well-trained coders. Whereby, the hospital costing data provided by the Finance Department and assisted by Nursing Department was analysed based on specialties available in the hospital setting. Those coded data set were exported into UNU-CBG Grouper that is intergrated to CCM Software, respectively for patient grouping and costing processes. The outcome of patient's demographic and casemix costing were then further analysed for the top five medical specialties that committed with highest total hospital (DRG) tariff.

## Results

A total of 99,415 medical records contained adequate information was grouped using the UNU-CBG Grouper. It involved respectively 55.2% and 44.8% female and male patients. Most patients were of younger age group with 24.4% below the age of 20 years, 21.6% between 20-29 years 16.4% between 30-39 years old, 20.8% between 40-59 years old and only 17.9% are above 60 years. The highest resource intensity mostly utilized for treating patients with severity I (68.1%), severity level II (24.5%) and 7.4% for patients with severity III. The CMI for this hospital is 1.001. The top five of medical specialties that committed with highest total hospital tariff in treating their patients are Surgical Department (RM2,064,2150; N=6,565 cases), Orthopaedics Department (RM884,324; N=7,702 cases), Neuroscience Department (RM831,295; N=4,834 cases), Cardiology & Cardiothoracic Department (RM784,082; N=7,249 cases) and Medical Department (RM745,605; N=19,425 cases). The ALOS for each mentioned departments is 9 days, 8 days, 6 days, 6 days and 5 days respectively.

## Conclusions

Decision of using UNU-CBG Grouper and CCM Softwares as the grouping and costing tools in Hospital USM is a brilliant step to improve quality and efficiency of its services.. An attempt to generate a MY-DRG Tariff exclusively for Hospital USM is a valuable information for the hospital management to use it as a reference for strategizing an appropriate hospital planning for years to come and it also become a justifier for a fairer decision making, and most probably able to influence provider's behavior in health care delivery. Therefore, this would achieve the inspiration of casemix principle as an initiative to improve quality and efficiency of healthcare services in Hospital USM and thus, support the University for the APEX agenda.

## Friday Morning Casemix and Policy 2

### Vital Statistics for Your Casemix System

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### Introduction

Most hospital funding models fund individual hospitals indirectly on an understanding of what the care they provide should cost. This is true of Activity Based Funding (ABF) in Australia and Money Follows the Patient (MFTP) in Ireland. In turn this understanding is generally based on the analysis of cost data pertaining to a classification (of patient characteristics and care-type) and individual hospitals. The most familiar example being a DRG classification applied to a hospital's acute admitted patients. Other care-types include Emergency Care, Outpatients and Sub-Acute admitted patients. It is not unusual for the hospital level cost estimates to be moderated by patient level demographic information and/or some characteristics of the hospital.

This paper presents a replicable step by step approach to assessing the appropriateness of a Casemix System (CS). A CS is multifaceted, encompassing a cost data collection (CDC) and its costing system(s) (CCS) along with the Patient Classification System (PCS) including the rules for handling unusual cases (outlier policy), the choice of moderating factors and the



means of applying those factors. A CS without its cost data collection and CCS is referred to as a model.

The approach taken to assessment considers the questions below directed at the performance of the CS and then employs Statistics to answer them.

1. Does the model provide information about the average cost per contact in each hospital?
2. Is the model sensitive to unaccounted for hospital effects?
3. Is the model sensitive to small numbers of extreme values of the types likely to be encountered in your cost data?
4. How many of the hospital by case-type costs are implausible?
5. Are there hospitals with extreme casemix adjusted total expenditure (CMA)?
6. Are the case-type cost relativities within hospitals consistent with the system-wide cost relativities?
7. Are adjustments (uplifts or discounts) for demographic/geographic features statistically justified?

Of course there is one big question not dealt with in this paper: Are there clinical justifications for the unusual observations?

## **Methods**

The CS chosen to demonstrate the assessment is one for Emergency Care(EC). The work was conducted for the Independent Hospital Pricing Authority in Australia. The CCS was patient level costing and the data collection was the National Hospital Cost Data Collection, Round 14 (NHCDC14). The PCS was Urgency Related Groups V0.3 (URGs) and the model was based on presentations moderated by Indigenous Status.

The first question is addressed by a clusters approach based on patterns of market share of activity within case-type. It is supplemented by a measure of data connectedness which measures the difference between hospital market share profiles.

An iterative regression methodology which incorporates the "equivalencing" of expected to observed cost at case-type level for the retained data is used to address questions 2 to 6. The retention of data is governed by model parameters from the previous iteration.

The second question also involves comparison of statistical performance and estimates of effects under models with and without Hospital fitted. In addition, question 6 uses the ratio of hospital cost ratios for the model with and without hospital effects (the RI) as a measure of the likely impact of hospitals having different case-type cost relativities.

The question related to moderating factors (flagged status 0 or 1) is tested using a Binomial Distribution.

## **Results**

1. Knowing only the EC casemix of each hospital provides an important amount of information (R-square 50%).
2. The inclusion of hospital effects in this CS has little overall impact with the Standard Deviation of the difference between the two models of 1.4% at the hospital level but some case-types are markedly affected.
3. The exclusion of a small proportion of Hospital by URG cells with extreme average costs had little effect except for a couple of hospitals and URGs contributing to the exceptions.
4. Proportionally very few Hospital by URG combinations were excluded by the iterative regression. Only a very small proportion of the presentations were excluded.
5. Exceptional CMA values were found, but largely in hospitals with very small case-load. There was no material effect on case-type costs.
6. There is evidence that the relativities between the system-wide URG average costs are not maintained within hospital.
7. The inclusion of Indigenous Status as a moderating variable is justified.

## **Conclusions**

The utility of the assessment procedure is demonstrated by the theory and the EC exemplar. These vital statistics provide a systematic approach for assessing the health of your casemix system.

# Forecasting Emergency Department Admissions as a Tool for Improved Health Service

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## Introduction

Management of large influx of patients in a short time is a real challenge for Emergency departments (ED). Epidemics are one of the factors that influence the raise of patients influx. This phenomenon is particularly manifest in wintertime when weather and pollution conditions change drastically. Patients suffering from gastroenteritis, influenza and bronchiolitis overcrowd the ED, which disrupts health care professionals and may cause medical errors.

The aim of the study is first to describe potential correlations between epidemic disease, environmental factors and ED patients' influx using French hospital casemix. Epidemics are forecast for classes of pathologies using the different correlation parameters between the infections and other factors (weather, pollution) that have been previously found. Then, the forecasting model serves as a mechanism to predict the incidence rate in ED and acts as the basis for a scheduling strategy to manage emergency departments which is the second part of the study.

## Methods

Hospital casemix from various hospitals in the Rhone-Alpes region (France) with ED input is used to estimate ED influx. Epidemic data collected from the Sentinelles network (French general practitioners network), air pollutants from the French Pollution network and meteorological data obtained from the French national meteorological service are used to consider environmental factors. They are geographically matched with ED and used to extract correlation factors between them and the epidemics. All of the data are considered from year 2009 to year 2011.

Thereafter, epidemic diseases of interest are modeled using a discretized compartmental epidemiological model (SEIR model) which allows us to track the evolution of the epidemics in four different categories of population (susceptible, exposed, infected and recovered). The variation of the infection coefficient in the epidemic model is predicted using a regression analysis. Furthermore, a study on the number of individuals entering ED following infections from the pathologies under analysis is performed which allows us to study the effects of different epidemics on ED overcrowding and deploy a strategy to organize ED human resources. A planning strategy is then devised to distribute the human resources appropriately according to the predictions made by the epidemic model under various constraints.

## Results

The epidemic model forecasts infection peaks considering multi-factor influences on epidemics. The model has been tested for the flu infection and positive preliminary results have been found with regards to the evolution of the disease and the historical data available. Furthermore, the forecast patient influx was used to test the scheduling strategy in an emergency department. Under the hypotheses defined for the scheduling problem, the model gives us the optimal distribution of shifts for ED medical staff considering stochastic demand patterns in only a few seconds for over a hundred scenarios. The overall waiting time for the patients is significantly reduced compared to the waiting time obtained by fixing the shifts to what is currently practiced in the casemix hospital.

## Conclusions

Such analyses are possible due to an effort of gathering of Hospital casemix, Sentinelles, pollution and meteorological data from a wide network available throughout all the French country. Also, the utilization of a forecasting model coupled with optimization tools helps in overcoming the difficulties of human resources organization due to high variability in ED influx.

# Using DRG Database to Suggest Location for Excellence Heart Centre in Thailand

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## Introduction

Heart problems become the leading disease burdens in Thailand and other developing countries. Thailand has benefited from the universal coverage policy for over ten years. Access to high cost services of patients with heart diseases is determined by geographical location rather than financial barrier to care.

## Methods

This research was to describe utilization patterns of inpatients with heart diseases in relation to patient's resident area and place of utilization in order to suggest location for establishing excellence heart centres outside Bangkok.

Methods: This research used 2011 inpatient databases that public insurance schemes in Thailand compiled for paying hospitals on a diagnosis related group basis. Variables on patient's resident area and hospital provided care (place of utilization) were extracted to reflect cross-boundary flows at regional level (10 regions by postcode). The net flow ratio (NFR) was calculated to reflect the size of export of patients to other regions divided by imported cases of patients resided in other regions. Health need was calculated by dividing the uses of services of patients from that region with total population of the region. The ratio of maximum to minimum was calculated by dividing the need of the highest region with the need of the lowest region to reflect disparity of need.

## Results

From 6.86 million inpatients in 2011, there were 319,434 cases (4.7% of total) grouped into diseases and disorders of the circulatory system (Major Diagnostic Category 05). The average need of MDC05 was 475/100,000 population, with the maximum to minimum ratio of 2.5 (west-central to lower-northeast region) and a 7% cross-boundary flow where Bangkok was the strong importer (NFR 0.14). The average health need for hypertension (an ambulatory care sensitive condition; ACSC or avoidable hospitalization) was 59/100,000 population, max/min ratio of 4.7 (west-central region/Bangkok), with only 3% cross-boundary where Bangkok was an exporter (NFR 1.31). The highest cross-boundary was 35% for cardiac catheterization, the average health need was 16/100,000 population, max/min ratio of 5.4 (Bangkok/lower-southern region), both Bangkok and lower-southern region were importers (NFR 0.03 and 0.41 respectively). Percutaneous cardiac interventions induced 29% cross-boundary, with a need of 11/100,000 population and the highest max/min ratio of 5.9 (Bangkok/upper-northern region).

## Conclusions

If the aim of the health systems is to keep the cross-boundary flow between regions to a minimum, creation of the excellence centres should reduce disparities of need between regions as well as reducing ACSC rate.

# Casemix Care 1

## Using episodes of care to reveal regional variation in costs and outcomes for stroke

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### Introduction

Traditional methodologies used for health care performance measurement, costing and payment tend to have a limited focus on activity within discrete, provider-specific segments of care. This silo-based approach does not provide a comprehensive picture of a patient's full pathway of care for many conditions and can mask variations in performance that become apparent when using broader windows of analysis.

Stroke is an excellent example of a health condition where more inclusive forms of classification are required to provide a full picture of costs and quality. Following an incident ischemic stroke, patients often receive services from multiple providers, including hospital care, physician services and an array of post-acute care services. Moreover, patients' health care utilization can extend for many weeks after their stroke hospitalization, with follow-up care and hospital readmissions serving as important quality markers. The use of extended episodes of care for measuring and costing activity across settings and between providers of healthcare can provide a mechanism for comprehensively representing stroke patients' costs and outcomes.

### Methods

We constructed stroke episodes of varying duration in Ontario, Canada by linking patient encounters across hospital, physician, emergency department and post-acute care services (chronic care, long-term care, rehabilitation and home care). Using 2 years of data, we linked index hospital admissions for patients diagnosed with ischemic stroke with their subsequent encounters in acute inpatient, emergency department, inpatient rehabilitation, chronic care, home care and physician care. We used case mix-based costing methodologies and physician charge data to derive costs for encounters in each setting and determine total costs for the episode.

Analyzing the linked healthcare data, we looked at rates of physician follow-up visits within 7 days of discharge and measured total episode cost, hospital readmission and ED visit rates for 30, 60 and 90 days following the initial acute discharge. We compared stroke spending and quality for residents of each of Ontario's 14 Local Health Integration Network (LHIN) health regions, as well as for the overall province.

### Results

Average episode costs for the province were \$29,032, \$34,083 and \$37,531 (\$CDN) for 30-, 60- and 90-day episodes of care. Between the 14 LHINs, these results varied considerably, with regional means ranging between \$24,187 and \$31,754 for 30 days of care, between \$28,934 and \$37,081 for 60 days of care and between \$32,798 and \$40,902 for 90 days of care.

The index hospitalization for stroke was associated with the highest component of cost during the episode, with a mean of \$19,954 (including \$17,195 in acute inpatient costs, \$676 in emergency department costs and \$2,082 in physician charges).

The proportion of total episode costs attributed to the index hospitalization declined as the episode was extended in time, from 68.7% of total 30-day costs to 58.5% of total 60-day costs and 53.2% of total 90-day costs. Conversely, post-acute care services were responsible for a rising proportion of total costs as the episode duration increased, from 33.8% (\$9,802) for 30-day costs to 44.0% (\$14,984) of 60-day costs and 49.4% (\$18,541) of 90-day costs.

Much of the variation in average LHIN episode costs may be attributed to variation in post-acute discharge setting; LHINs made different use of settings for first acute discharge, ranging from 3.9% to 16.2% for chronic care, 23.4% to 41.2% for inpatient rehabilitation and 3.1% to 8.4% for facility-based long-term care.

There was also significant regional variation in post-acute care outcomes; the 90-day readmission rates varied between LHINs from 15.4% to 26.5%, while 90-day ED visit rates ranged from 26.5% to 42.8%. Performance on these quality markers was relatively stable over different episode time windows: LHINs with relatively high readmission rates in the 30-day period tended to also have relatively high 90-day readmission rates. Notably, the two LHINs with the highest readmission rates also had the lowest rates of follow-up physician visits within 7 days of discharge.

### **Conclusions**

This is an innovative perspective on viewing the case-mix adjusted continuum of care. By applying broader definitions of time and services as our unit of analysis for ischemic stroke, we uncover significant regional variation within the same publicly funded Ontario health care system. Variations in cost between LHINs are being driven by variation in discharge practice, a marker of regional variation in institutional care capacities. The analysis provides some evidence that LHINs with the highest 90-day costs may have higher rates of discharge to long-term care, while LHINs with the highest rates of readmissions tend to have lower rates of follow-up post-acute physician visits.

## **Primary Care Diagnosis Related Groups, pDRG, as a tool for primary care decision makers**

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### **Introduction**

Primary Care Diagnosis Related Groups (pDRG) is a patient classification system for outpatient care developed by Finnish Consulting Group Ltd and 9 municipalities in Finland. The main reason developing pDRG has been specialist level healthcare moving towards outpatient care. The system is based on episodes of care, because the nature of outpatient care is series of several contacts dealt with same health problem. One patient could have several episodes at the same time. pDRG casemix system consists 48 groups which are clinically rational and the cost variation is low in each group. pDRG has been designed with primary classification ICPC2. ICD10- classification can be also used, but it requires mapping with the ICPC2 classification. In Finland pDRG is Hosted by Local and Regional Authorities and implemented by FCG Knowledge Management Ltd.

pDRG is casemix system which includes both patient classification and cost accounting logics. The system requires Cost per Patient (CPP) cost accounting in order to calculate the weights for the productivity indicators and evaluation for the grouping system. For the evaluation each pDRG groups average cost is calculated from the CPP -data, where intermediate costs are allocated to the visits. pDRG is based on basic principle that each group has low cost variation and that is needed to evaluate yearly basis.

The new Health Care Law (given in 2011) that guarantees patients' free mobility across the public health care organizations all over in Finland despite of residence is starting from 2014. For this reason money has to follow the patient and his/her health problem and the municipalities have to use transparent production when invoicing the health care organizations outside the municipality. The goal is in the end of 2013 pDRG can put to use in municipalities as a tool for planning health care services and especially as a invoicing and budgeting tool.

This study evaluates pDRG's cost homogeneous principle and the primary care data quality.

## **Methods**

In this study we are using patient level cost data from Finnish municipalities from the primary care visits. We will use outpatient data 2012 which is grouped with the latest version of pDRG. The cost variation in each pDRG group and data quality is studied using statistical methods.

## **Results**

The results are expected to give information about the functionality of pDRG casemix system. It will also provide information about the quality of the primary care's outpatient data.

## **Conclusions**

pDRG is a tool specially for health care managers and decision makers working in municipalities. It can be used as a tool when invoicing healthcare organization outside the municipalities. pDRG helps not only to plan the resource allocation in different primary health care organizations/health centers but also budgeting and predicting resource needs, comparing own primary care costs and outsourced costs or outsourcing own practicing. Though this will presume well working casemix system and a good quality of data. The topic will be presented and discussed in conference.

## **New Tools for Understanding and Managing Population Health**

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## **Introduction**

Risk assessment tools have proven their value in numerous health care systems internationally. Originally used to improve financial decision making through explanation and predictions of future health care resource need, it has increasingly been applied to clinical decision making with its ability to identify patients at high risk enabling identification for inclusion in care management interventions.

This presentation will review the latest risk assessment developments for managing population health with a special emphasis on how these tools are being applied to assist in decision making.

## **Methods**

Development of the new models was conducted on a US dataset (source: Pharmedics, a division of IMS International) of roughly 4 million patients. The development database captured data from individuals in 2008 with continued information in 2009.

## **Results**

Building on previous predictive models contained in the ACG® System, new models and markers which have been developed to address needs of users will be presented.

New models included in Version 11:

1. Likelihood of rehospitalization - predicting 30 day readmission risk.
2. Consistent High User Modelling - predicting patients who will remain high cost for more than one year.
3. Concurrent Model - providing a multivariate concurrent risk score.

Additionally, new markers and enhanced functionality will be included in Version 11 including:

- Expanded and revised psychosocial EDCs
- New EDCs to capture subsets of conditions that require extensive interventions
- Generalized care density score - assessing linkages between physicians providing care
- Inclusion of DRGs as inputs including additional tailored reports
- Inclusion of a frailty score based on a count of frailty dimensions

- A respiratory dependence marker
- Windows 8 support
- Report template for evaluating disease patterns

## **Conclusions**

Population based risk assessment has developed over the last three decades to become a critical component of health care systems facilitating clinical, financial, and managerial decision making worldwide. It continues to evolve to meet the needs of users moving into the future. The ability to identify patients who could benefit from early intervention will likely sustain better long-term outcomes while experiencing lower costs of care.

## **Cost Calculation 2**

### **Including the costs of capital financing and consumption in case-mix funding.**

*Peter Donnelly, PricewaterhouseCoopers Limited, Doha, Qatar.*

*Faleh Mohamed Hussain Ali, Husein Reka, Orsida Gjebrea, Policy Affairs, Supreme Council of Health, Doha, Qatar.*

## **Introduction**

In early 2012 The Supreme Council of Health in Qatar issued a commission to cost all current health services in the State and to recommend a fee schedule based on those costs. Inpatients were to be classified in accordance with Australian Refined DRG v 6.0x. Outpatient classifications were to be created for the various types of outpatients using case-mix principles as far as was possible and being in line with local Qatari conditions. The recommendation was to form the basis for the actual prices to be paid to providers for a pilot covering women's services and due to commence in April 2013. Capital costs needed to be included for private sector providers in order to reflect the costs incurred by them in the usage of fixed assets over time and the costs associated with the financing of those assets.

## **Methods**

The methodology involved initially determining which land, buildings and plant were used to provide women's services on 3 multi service sites and concluding a "fair value", as defined by International Accounting Standard IAS 16, for those assets. The estimated longevity of those assets, sometimes not identical to that in the accounting records, was then determined. Next, it was necessary to establish what proportion of assets should reasonably be financed by debt and conversely, what proportion by equity. Various international market data and expert opinion were taken into account in determining the debt/equity ratio as well as deciding the cost of debt financing. These data were also used to decide the risk free investment return and the equity risk premium to be applied to shareholder funding.

## **Results**

A range of options for the many variables were presented to the Supreme Council together with advice on the strength and weaknesses of the various alternatives. Subsequently, the chosen options were modeled to determine a percentage to be added to operating costs in order to calculate a fee for private sector providers.

## **Conclusions**

The conclusion is that the calculation of capital costs requires various sources of information, including knowledge of health service providers in different markets. It also requires an understanding of international and in-country financial markets and the data in these markets. These are significantly different data from the cost data which are often used as the base to calculate operating costs for case-mix funding. These new data are sometimes difficult to obtain and original and innovative approaches may be required

# Trimming for Low Cost Outliers in DRG

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## Introduction

The development of a Swedish DRG system for classification of patients according to diagnosis, procedures undertaken as well as other variables that indicated need for resources such as age and presence of complications, started during the 1980s. The main purpose of the DRG system was to describe hospital production or activity in a way that allowed comparisons between hospitals by allowing standardization for case mix. However, payers of health care were interested in using this for costing and reimbursement.

The presently used DRG system NordDRG was first introduced in 1996 and is similar in all the Nordic countries. The Swedish version now also includes a classification of ambulatory procedures and psychiatric care. There are 773 groups for in-hospital care and 439 for out-patient care. In the nation-wide Hospital Discharge Register all cases in Sweden are grouped in NordDRG. The hospitals and County Councils mainly use the DRG-information for management purposes. NordDRG also work as a prospective payment system, and reimburses today about 50 % of the Swedish inpatient cases. It is most commonly used for reimbursement of care from one county to another.

The distribution of cost in a DRG is usually asymmetric and skewed. The distribution also differs from the normal distribution by the presence of a long tail of high cost cases. In order to improve the homogeneity within the DRG, a trimming method for exclusion of these high cost outliers have been used, to further improve the explanatory value of the model (R<sup>2</sup>) and for calculating a relative weight list. When DRG is used for reimbursement the cost outliers are paid separately from the average price for the DRG.

Admissions with short length of stay (LOS), =1 day are common in Stockholm County Council. We believe that these admissions differ substantially from the normal inlier cases in DRG regarding cost and medical conditions. In this study we have analysed the effect on the DRG model by trimming for low cost outliers.

## Methods

211 000 in-hospital stays in 5 emergency hospitals in Stockholm County in the year 2011 were analyzed regarding LOS and costs. Low cost outliers were compared to DRG in this sample and to data for the same hospitals the years 2005 – 2012.

LOS was calculated as date of discharge minus date of admission. We defined short LOS as =1 day. Characteristics of cases were described and analyzed regarding number of diagnoses, procedures, mortality, costs and DRG.

Trimming of the left tail of the distribution of cases was performed with two different methods. The cost limit was calculated with the 5th percentile and the quartile method. The quartile method was calculated with the formula:  $Q1 - k(Q3 - Q1)$  where Q1 and Q3 respectively represent the first and the third quartile. The lower the value of the constant k the higher the cost limit of the left tail will be and thus an increasing number of outliers will be excluded. The result is analyzed with statistical parameters such as coefficient of variation, mean and explanatory value (R<sup>2</sup>).

## Results

82 000 (39 %) of the admissions with short LOS (=1 day) was identified in the studied database. Trimming of low cost outliers with the 5th percentile method excluded approximately 10 000 cases of which 90 % had a LOS =1 day. The average cost of these low cost outliers with short LOS were only 50 % compared to average cost of inliers. The values of several important cost parameters of the normal inlier case mix in the DRGs are improved. The coefficient of variation decreased from 167 to 164, the mean increased with 3-4 percent and the homogeneity of cost was improved. The relative weights within the normal inlier case mix increased. The explanatory value (R<sup>2</sup>) increased from 67% to 70% when trimming with the 5th percentile. Trimming with the quartile method rendered an even higher explanatory value (73%).



Low cost outliers with short LOS also differed from inliers regarding medical characteristics. Mortality rate was 40 % lower in cost outliers with a LOS less than one. However, there was no difference in the reported number of diagnosis per case. Low cost outliers have a significantly higher reported proportion of operating room procedures.

### **Conclusions**

The data shows substantial differences regarding cost and also differences in medical characteristics between average inlier cases and cases in the 5th percentile. Trimming of the left tail improves the DRG system regarding differentiation between costs and increase the usefulness of DRG as a base for reimbursement. The results are coherent between the two trimming methods. The quartile method, previously used for trimming high cost outliers, seems to give the best result when used for trimming of low cost outliers.

Further studies of differences in costs and medical characteristics between low cost outliers and inliers and their consequences for DRG as a reimbursement system are needed.

## **Culture and healthcare accounting: what are we really measuring?**

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### **Introduction**

In an era of cross-national business dealings, we have discovered that accounting is not a pure and objective science agreed upon by everyone. Furthermore numbers are not neutral elements. They have a lot of 'history ' influencing them and the meaning people derive from them. If accounting arises from often-unexamined cultural, sociological and political roots, what reality does it reflect? How sure are politicians, economists and healthcare managers that data used in cost decisions actually suggests the true cost of inputs and the financial and social value of outputs?

### **Methods**

The study explores literature from the social sciences, economics, accounting, and healthcare to determine the extent to which the cultural basis of healthcare cost accounting has been considered.

### **Results**

The literature clearly shows that accounting principles, regulation, and practice are firmly rooted in cultural and political foundations unique to each country. Research has drawn attention to the distinctiveness of healthcare cost accounting over the past decade, as well. Just emerging from these separate streams of research is consideration of how the cultural roots of accounting affect national policy and organizational decisions about delivery of healthcare. A few studies acknowledge national cultural individuality in the production and interpretation of accounting data, in general and in regard to healthcare. Some researchers have looked specifically at the development of healthcare accounting methods, particularly comparing cost identification in capitalist schemes like the US with that in countries having national health schemes. A few studies have considered the need to re-examine the cultural roots of healthcare accounting to assure data supplied to decision-makers measures what it purports to measure.

### **Conclusions**

Previously unexamined questions become salient. Why were certain measures chosen for tracking? How and why are they manipulated and reported? How are reports interpreted? How do users apply what they think they see? Culture clearly pervades each of these answers. Research is just beginning to suggest new ways to add 'cultural eyes' in 'accounting' for costs, expenses mapping, and interpretation of results.

Recognition of underlying cultural assumptions in cost accounting can allow for political, economic, and organizational innovation to reduce costs, improve quality, and assure 'lean' operation of both national schemes and healthcare organizations.

## **Friday Afternoon**

### **Casemix and Policy 3**

#### **Effective use of health data – analysing elderly patients' clinical pathways**

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#### **Introduction**

The information about patient's full clinical pathways all the way across organizations will provide the most effective, reliable and timely insight to support the decisions. Use of such knowledge reserves can lead to both improvements in patient care and more cost-effective decision making at an operational level. The sharing of information between organizations is particularly important in order to bring about more coordinated health care service delivery and obtain a better understanding of the clinical pathway that each patient follows. The main purpose of this study was to evaluate if combined data from two hospitals could be used effectively to analyse the clinical pathways of the elderly and to determine whether this data could be used to facilitate health care coordination.

#### **Methods**

Data was collected on all patients over the age of seventy-five who did not reside in an institutional setting and who had visited the emergency unit of the Turku Health centre between 2006 and 2008. The data on treatments were collected from the Pegasos® and Miranda® electronic patient record systems. Statistical reports, time-series analysis and data integration and cleaning were performed with SAS® 9.2.

#### **Results**

This study sample consisted of 24 195 elderly patients' admissions to the emergency unit of the Turku Health centre between 2006 and 2008 by individuals aged seventy-five and older, 19% (2006), 17% (2007) and 15% (2008) of them were referred to the Turku university hospital. About 79 % of them did not have the contracted diagnosis to a university hospital. The excess costs of sending patients without a diagnosis of stroke or heart attack and of those not requiring surgery in a university hospital were €1.15M in 2006, €0.78M in 2007, and €0.64M in 2008.

#### **Conclusions**

The health care managers have to have a possibility to utilise the combined data from the two hospitals to follow the elderly clinical pathways in order to manage the whole service chain effectively. There could have been remarkable saving of the taxpayers' money per year in the city of Turku with 180 000 inhabitants if the information about the elderly had been recorded and used in a proper way.

## **Need to define patients at risk : preliminary analysis.**

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### **Introduction**

As USA, more and more countries consider pay for performance system (P4P) to improve efficiency in health care. The challenges of P4P are to use a sufficient set of performance's measures, to adjust for the risk and to give adequate incentives for providers (F. Eijkenaar 2012). In order to make possible the use of such a system in Belgium, the Ministry of Health asks hospitals to note the presence on admission for each diagnosis mentioned in administrative databases. In this study, we analyze the number of diagnoses acquired during the hospital stay and compare it to a measure of patient's risk.

### **Methods**

This analysis uses the hospital's administrative database. Since 2008, for each diagnosis mentioned in the RHM a variable indicates if the diagnostic is present (POA) or not (NPOA) on the admission.

We use the Charlson index as a measure of patient's risk (Deyo 1992, Quan 2010, Sharabiani 2012). The Charlson is estimated from all secondary diagnoses mentioned in the RHM whatever the presence on admission.

We analyze the correlation between the Charlson Index and the severity level defined in the APRDRG. The 15th APRDRG version takes into account all diagnoses contained in the RHM in order to determine the APRDRG and the severity level. More recent versions of the APRDRG treat differently complications and diagnoses acquired during the stay. In these last versions, NPOA diagnoses are not taken into account in the definition of the severity level so that the stay is classified in a lower severity.

We use data of 2009 as they have already been used for hospital financing. Our sample counts 30033 in-hospital stays of patients of 18 years old or more of a general university hospital.

### **Results**

The mean number of diagnoses mentioned in the RHM is 8.2. The database contains a total of 246099 diagnoses and 16759 diagnoses were acquired during the stay. But 16.7% of stays presents at least one diagnosis acquired during the stay.

The mean score of the Charlson Index is 1.95, varying from 0 to 20 and 33.3% of the patients have a Charlson Index equal or greater than 2. If the Charlson index is equal or greater than 3, 29.5% of patients present at least one NPOA diagnoses.

Patients with a higher Charlson index present also a higher severity level: 12% of patients with a Charlson Index = 0 present a severity level 3 or 4. Among patients with a Charlson index  $\geq 3$ , this proportion reaches 58.1%. Among patient with a severity level 1, 3.2% of patients present at least one NPOA. In case of severity level 4, this proportion reaches 61.8%. For a specific severity level, the proportion of stays with NPOA diagnoses is higher for patients with a Charlson index  $\geq 1$ .

In 2012 hospital financing with the 15th version of APRDRG including all diagnoses mentioned in the RHM, the hospital is efficient: all inpatient days were reimbursed. But it is not the case for the stays with NPOA diagnoses and the inefficiency increases with the number of NPOA diagnoses. For patients with NPOA  $\geq 2$ , 2186 inpatients days are not reimbursed. This amount concerns 3% of inpatients days of these patients. More than half of days lost (58.4%) concern patients with Charlson index  $\geq 3$ .

### **Conclusions**

Our results show that the number of NPOA diagnoses increases with the patient's risk.

The Charlson index, the severity level and the NPOA diagnoses are all highly depending on the coding quality and on the exhaustive reporting. The Charlson index is also very sensitive

to rules used to define the presence on admission. For example, the code used for COPD is a "combined code", it will say that there is only one code to precise the chronic disease and the acute exacerbation. The same problem exists for other chronic diseases. Further analyses are necessary to measure the impact of these "combined codes" on both the Charlson index and the number of NPOA diagnoses.

All diagnoses including POA and NPOA diagnoses are used to estimate the Charlson index. In consequences a diagnosis could be both an indicator of "acquired problem" and also an indicator of risk. This aspect is not analysed in our study.

Until now, we measure the patients' risk only with the Charlson index. Other measures should be tested and results compared to findings obtained with the Charlson index.

Our results also show that even with the use of an APRDRG version that does not take into account in hospital financing the presence of admission for diagnoses, hospital stays with NPOA diagnoses are underfinanced. More recent versions of the APRDRG will worsen this aspect. Recent publications concerning P4P do not mention strong evidence about the long term effects of P4P (Eijkenaar 2013, Jha 2012).

## **Validation of Adjusted Clinical Groups (ACGs) case-mix system for predicting healthcare costs: use and comparison of diagnosis-based and drug-based morbidity.**

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### **Introduction**

In Veneto, the Regional Health Service (Servizio Sanitario Regionale, SSR) provides universal health coverage to all resident citizens granting primary and hospital care with a copayment only for outpatient services. Financing of the Local Health Units (21 Trusts in the Region) is based on a capitation system so far adjusted only for age, gender and area of residence. Providing a more efficient method to measure health care needs and to better understand predictors of health care costs is a priority for the Regional Government. The ability to predict health resource use in a population relies on the accuracy of risk-adjustment measures. The Adjusted Clinical Group (ACG) system is a risk-adjustment model that stratifies a population into mutually exclusive categories on the basis of clusters of morbidity using diagnostic codes from claims data. In April 2012, the Veneto Region (North-Eastern Italy), in collaboration with the Johns Hopkins University in Baltimore, started a pilot use of the Adjusted Clinical Groups® (ACG) system in two Local Health Units of Veneto Region (almost 1 million inhabitants, 20% of the Regional population). The ACG categories were used to assess each person's overall morbidity burden based on one year's (2011) diagnostic information. The aim of this study was to verify to what extent the ACG case-mix system explains the variability of individual healthcare costs in Veneto Region. We hypothesized that ACG categories better predict health resource use than age and gender only and that drug-related morbidity groups (Rx-morbidity groups or Rx-MG) can improve cost variance explanation, especially in this population where complete access to medical diagnoses, i.e. GP diagnoses, is not yet available.

### **Methods**

A population of 962,602 residents of Padova (N=485.991) and Verona (N=476.611) LHUs was included in this study. For each individual, data on diagnoses, drugs, procedures and costs were retrieved from routinely available databases during year 2011 (hospital discharge forms, ER episodes, computerized medical encounter records, disease registries and medications). Diagnosis data from GPs clinical database were available only for a small subset of residents (20.000 subjects) and were therefore not included in this study. Total

costs were calculated combining inpatient/outpatients fees and medications actual costs. Multiple linear regression models were performed to evaluate the relationship between costs and different explanatory variable sets and for each model the adjusted R-square was calculated. The analyses were performed using SAS System v. 9.1.3.

## Results

As shown in the subsequent table, the "Age+Gender" model explained only 9-10% of the variance of total costs. Adding diagnoses-related predictive variables, such as Resource Utilization Bands (RUB) or ACG categories, the R square increased to 36%. Finally, the model including also ACG's Pharmacy Morbidity Groups (RxMG) had a better predictive R-square (47%).

## Conclusions

Measuring health status, mapping co-morbidity and accounting for the case-mix provides a better prediction of health resource use of a population, rather than using age and gender only. ACG provides a valid measure of health care utilization and the use of Rx-MG is of particular value in this Italian population where diagnoses from clinical databases are not yet completely available. This risk adjustment methodology can be used for planning a more equitable health care resource allocation in the Veneto population.

R square (total costs = 97.5°pctl and excluding ACG = 5200)			
Explanatory variables	LHU 16 of Padova	LHU 20 of Verona	Total
Age + Gender	10%	9%	9%
Age + Gender + RUB	32%	31%	31%
Age + Gender + ACG	36%	37%	36%
Age+Gender+ ACG + Rx_MG	48%	47%	47%

## Information Systems and Casemix

### Diagnosis Related Groups (DRG) Grouping Standards

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#### Introduction

The Hong Kong Hospital Authority ("HA") manages 41 public hospitals/institutions, 49 specialist out-patient clinics and 74 general out-patient clinics which are organised into 7 geographical clusters, serving a population of more than 7 million people in Hong Kong.

Unlike many international healthcare providers, HA relies on its clinicians, instead of professional coders, to keep clinical documentation in the form of discharge summaries and structured text of diagnoses/procedures. These diagnoses/procedures entries, recorded mainly to facilitate clinicians' management of patients, are subsequently translated into International Classification of Diseases ("ICD") codes at the backend by a computerized system. Such ICD information, together with patient demographic data, have been serving as a conventional tool in assigning patient episodes into Diagnosis Related Groups ("DRG") through the International-Refined DRG ("IR-DRG") system where a Severity Of Illness ("SOI") level is also assigned to each episode based upon the reported secondary diagnoses ("sdx") and the pre-defined SOI levels among them.

To improve consistency in the reporting of sdx among clinicians / hospitals / clusters, the concept of DRG Grouping Standards was recently introduced. This is an automated mechanism where sdx codes are added to / removed from the DRG grouping process based upon established criterion. This approach would provide a more complete and consistent set of data for DRG allocation with no interruption to frontline clinicians.

## **Methods**

A mechanism was established to monitor and select the most frequently reported sdx over a 6-year period with IRDRG pre-defined SOI levels of 2 and 3 (indicating a complication / comorbidity and a major complication / comorbidity respectively). A designated panel of clinicians from various specialties was established to formulate criteria for the selected sdx. These criteria are formulated on the basis of objective and measurable data such as results collected from laboratory records, drugs administered in pharmacy records, operation / procedural records, and other clinical databases. The designated panel has also initiated further studies into a wider range of data such as "fields with free text" with a technique similar to natural language processing to further enhance the completeness of data.

## **Results**

Preliminary results showed major improvement in the completeness and consistency of reported sdx. Under-reported sdx such as anaemia and hypokalaemia have shown a 80% improvement in the level of completeness across HA. The application of grouping standards allows a fairer reflection of the complications and comorbidities encountered by the patient in each episode, thereby improving the integrity of Casemix data through addressing issues of over and/or under-reporting.

## **Conclusions**

HA has a very robust and highly centralised information technology system to capture patient level clinical data primarily to assist clinicians' better care management of patients. In addition to relying entirely on clinicians' reporting of diagnoses and procedures, the quality of casemix information can be further enhanced by optimising the use of HA's centralised databases.

## **Saving costs by using infection management analyses based on DRG - routine data**

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### **Introduction**

Infections in hospitals are a serious clinical issue and a major source of resource consumption. Very often, the structured analysis and definition of ideal measures of optimization are not possible, as the infection documentation is usually not linked to Casemix data and therefore not easy to access.

Moreover the costs of the treatment cannot be assessed.

### **Methods**

We made an analysis of infections in a 320 bed hospital in North-Rhine-Westfalia (Germany). The analysis was conducted with the IMR - Infectionmanagement with routine data reporting system which was developed in our institute. With the results we identified first of all the number of all patients with infections. Then we looked for the LOS of these patients compared to patients w/o infections. Finally we analyzed the extent of high outliers and their respective costs. By performing a peer review of expensive cases we found out that the therapy strategies should be improved. In a multidisciplinary group the guidelines were adapted and several trainings were performed. After 6 months a second analysis was conducted to compare the results from 2011 with 2012

### **Results**

Before intervention, we found that in 26.1% of all inpatients infections have been coded in the DRG dataset. the ALOS was 8.6 days, compared to 4.9 days for patients w/o infection. 2.1% of the patients had an infection classified as "hospital-acquired" (HAI), with an ALOS of 20.6 days. After introduction of new prevention and treatment strategies, we found infections in 24.2% of all patients, ALOS was reduced to 7.5 days. The proportion of HAI dropped to 1.3% and the ALOS of the HAI-patients was reduced to 17.7 days. Moreover the hospital was able to use the free resources for new patients. In 2012 3.5% more cases could be treated in the hospital

## **Conclusions**

With an easy-to-use software tool rapid infection analyses can be done in hospitals. Clinical and economically relevant data can be retrieved in very short time. Using the reporting tool for continuous measurement allows monitoring effects of specific programs or measures to reduce infections and optimize treatment.

Specific measures and programs combined with training of physicians and nurses and the continuous monitoring lead to quick economic savings and help generating more Case Mix Volume.

## **The use of ICT in hospitals: a Portuguese backstage analysis**

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### **Introduction**

Nowadays, information systems are essential to all areas of health care. From international comparability, to data mining or to benchmarking is unquestionable the importance of rise up a memory reporting system. ICT allows simultaneously increase the productivity and the quality of services provided at lower cost.

Several studies recognized that the nucleus part of the information systems (in)success depends more of the human, organizational and cultural factors than of technologies improvement (IOM, 2008; Herzlinger, 2006; Porter, 2006, Ammenwerth, 2006).

Beyond mere technological solutions, ICT represents changing processes that require a detailed analysis. Only this knowledge will allow quality and reliable records.

As key-actors, how health professionals use the ICT in their activity? How they perceive the ICT use and implementation? The ICT decision came from whom?

### **Methods**

This abstract presents the main results of a PhD thesis about the ICT use in Portuguese health sector. This project was developed at 3 levels: political orientation, trend practices and perceptions. This paper will focus on the last two: the meso and the micro level.

At the meso level, the ICT use was analyzed through a survey applied biennially (since 2004) by the national institute of statistics that produce information about ICT hospitals equipment (computers and peripherals), about the hospital Internet's presence, identify the areas were ICT are used most and know more about ICT availability for inpatients, among other ICT issues.

At the micro level, to understand usefulness and implementation of ICT process were interviewed 76 health professionals (physicians, nurses, administrative staff, health managers, and hospitals board) in 6 hospitals, and developed 7 case-studies : Hospital Pulido Valente (currently CHLN–North Lisbon Hospital Centre) with the medicine circuit and computerized patients' management; the Portuguese Oncology Institute of Lisbon, with intranet and institutional website; Hospital Pedro Maria Grande (currently ULSNA–Local Health Unit of North of Alentejo) with electronic prescription; Hospital Infante D. Pedro with Telematic Health Network, the ULS Matosinhos (Local Health Unit of Matosinhos) with integration of hospital and primary units clinical and administrative data (using SONHO, SINUS, SAM and SAPE applications) and Hospital da Arrábida with RisPacs project, an application that scanned part of the radiology department.

### **Results**

The meso analysis main results' can be systemized in 7 ideas:

- 1) Despite the increasing trend, the computer's number from 2004 to 2008, when compared with the users, shows a lack of computerized workplaces.
- 2) Similar trend was found within computers with internet access.
- 3) The ICT applications more used in hospitals are the anti-virus, e-mail.
- 4) The hospital back office services are the most ICT users, especially the financial and administrative management, human's resources management, stock management, (pharmaceutical stocks).
- 5) From 2004 to 2008, the capacity and speed of internet access increased (via xDSL or RIS).

6 Following the increasing trend of ICT use, the telemedicine practice, from 17% in 2004, increased to 71% in 2008.

7 The institutional sites are made mainly by external companies.

At the micro level, the 7 main conclusions are:

- 1) Lack of communication within organization workers (especially vertical);
- 2) The ICT professionals use and adoption is deeply related with the recognition of add value and professional performance improvement
- 3) The professional's lack of trust in ICT is mainly caused by network errors (inability of the network in several locations in Portugal), discontinued experiences, applications usefulness, these factors increase professional's resistance.
- 4) Physicians are the most resistant professional group to ICT use, especially the elderly. Hospital's physicians are more resistant than the primary care ones that recognize high utility levels and showed lower resistance to ICT changes.
- 5) Nurses, as a professional group, showed a more proactive adoption of ICT.
- 6) Computer departments are identified with a lower responsiveness capacity to informatics' problems.
- 7) The ICT acquisition is made without needs assessment or inclusion of professionals who will use it.

### **Conclusions**

This project found "island-hospitals" and recognized the need to develop a national knowledge and strategy to ICT health sector, supported by a network care conception (national past experience). It's also need to build a powerful and reliable technical network. It highlighted the need of decision-makers being accountable for ICT options and applications earnings in each institution; and the importance of include a ICT approach in health professionals curricula to discuss existing solutions, the importance of standardize concepts and the potential of ICT in professional practice.

## **Data Quality 2**

### **Building a signaling system to improve coding accuracy**

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### **Introduction**

In Belgium the patient record, which is the basis for any coding and auditing, and more specifically the discharge report, is the primary responsibility of the treating physician. Unfortunately the individual interpretation of what should be in the record varies widely which reflects itself in the quality of the coding, especially where additional diagnoses are concerned.

The General Rules For Other (Additional) Diagnoses in ICD-9-CM state that these diagnoses must affect patient care in terms of requiring at least one of the following: clinical evaluation, therapeutic treatment, diagnostic procedures, extended length of hospital stay, increased nursing care and/or monitoring.

Therefore the relevancy of reported diagnoses can be proven by linking them with therapeutic and diagnostic procedures and care-items. When diagnoses are unspecified or missing, one can link these items to 'likely pathology' and then ask the physician to either accept or dismiss the proposed pathology.

### **Methods**

We designed a system based on all in-house available data such as biometric measurements, lab-results, medication, radiological protocols, nursing care and monitoring. This data is parsed every day to create signals. Each signal is composed of a list of possible diagnoses together with the criteria they are based upon and are visible in the electronic medical record (EMD). The treating physician can choose and validate a diagnosis for those signals he/she deems relevant during or after the admission; coders can send a reminder to the physician for those signals that they deem probable but for which they cannot find a corresponding



diagnose in the medical file. It is only the treating physician who can validate a proposed diagnosis within the EMD and every signal can be rejected and/or commented upon by the treating physician.

### **Results**

The system has been up and running since 2007 with fast evolution over the last couple of years, as will be presented in an objective analysis.

Preliminary results show that the system could have a sensitivity of 70% (30% of coded diagnoses did not trigger a corresponding signal) and a specificity of more than 95% (for a certain signal less than 5% of admissions have a rejected signal). However these figures vary immensely between signals as the cut-off values are arbitrary, not all data is available for parsing and some signals are produced as a result of criteria pertaining to different pathologies. Unfortunately currently available data cannot prove an improvement in coding quality.

A comparison with free text questioning is also made and seems to indicate that response to signals is faster and shows significantly lower numbers of unsatisfactory answers. This is corroborated by a survey among the treating physicians.

### **Conclusions**

A signaling system as described here is a feasible way to obtain missing diagnoses and improve the accuracy of diagnoses for coding. The use of objective data to support the tentative diagnoses both helps to prove the relevancy and makes answering faster and easier for the treating physician.

On the basis of these findings, we propose that this kind of system be completely integrated in the electronic health record (EHR) and/or hospital information systems (HIS). It cannot be stressed enough that the Achilles' heel of any data gathering system is the quality and quantity of the input. It is our belief that by linking signs and symptoms to diagnoses and diagnoses to diagnostic procedures and therapy, this information gathering process can be facilitated leading to a more comprehensive and accurate EHR for both health care workers and administrative personnel.

## **Transparency of Hospital Productivity Benchmarking: A Comparison of Neurology Productivity in Two Finnish Hospital Districts**

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### **Introduction**

Huge amount of data is collected by humans and machines during various healthcare services. Unfortunately, these data often contain errors or they can be interpreted in many different ways by various users. This is a problem because the validity and consequences of decisions depend on the quality and meaning of the data they are based on.

First, data are stored into many IT systems for primary usage. Data accuracy and semantics are much better understood by the users of the primary system doing the actual hands-on work. They know the local data entry practices and collect information for their primary needs. Later, data can be used also by various other stakeholders for different purposes. For example, it can be used to optimize local health service operations or to analyse health of population across the nation in public health research.

Decisions based on secondary usage of data are affected by data inaccuracies in the primary data context and semantic mismatches between contexts. The problem is then also that these local data errors and contextual mismatches are often not recognized or understood well in the secondary usage.

### **Methods**

The quality of information product depends on series of complex events across the entire information production process. Information flows through human observations, organizational work practices, user interface interactions, application system tables, data extraction and manipulation scripts, secondary data storage's, reporting and analytical tools

and end up being used by human subjects for many kind of decision making. Tracing quality of information in such a complex process requires multi-professional expertise and complementary methodologies. Therefore, the QUALIDAT-project has chosen to use three complementary research approaches to study the same information production process:

- 1) USABILITY STUDIES: Study the users and their actual hands-on work situations.
- 2) DATA ANALYTICS: Track the entire information flow from data entry to data utilization.
- 3) MANAGEMENT STUDIES: Study information management, decision making and governance best-practices.

The QUALIDAT-project analyzes the productivity results of neurology specialty in Finnish National Hospital Benchmarking. The project will trace the entire information production process from the data entry situations to the technical data flows and all the way to the final decision making scenarios. The aim is first to identify factors affecting the National Hospital Benchmarking results. Then the project seeks ways to support managing and developing transparent healthcare information production processes.

## **Results**

Preliminary results suggest that semantic heterogeneity and inaccuracy can result from various intertwining factors. For example service model differences, organizational structures, local work practices, software system user interfaces, database structures, data extraction scripts, calculation and aggregations logic can introduce semantic heterogeneity and inaccuracies risking the validity of conclusions. Because of these hidden inaccuracies and semantic ambiguity, users find it often hard to determine what the data actually means and what kind of errors might risk the validity of their decisions. Also, heterogeneous secondary usages could have impacts to benchmarking results by embedding different individual motivations and organizational incentives to technically similar information production processes.

## **Conclusions**

Information should be managed transparently across interorganizational processes and all organizational units to recognize, fix and prevent information quality errors. Information production process should provide transparency to both human and technical factors because many inaccuracies or heterogeneity can be recognized only in relation to other perspectives. Also, transparency and quality measurement should cover entire information production process from the original data entry situations all the way to the various uses. Increasing the transparency of information production processes is active research and development area among academics and practitioners.

## **Patient-Reported Outcomes: Opportunities and Limitations**

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### **Introduction**

Patient-reported outcome measures (PROMs) are recognized as one approach to valuing healthcare interventions. Such patient-reported measures are being collected in a large scale study taking place in Vancouver, Canada (VALHUE). The VALHUE study will evaluate the changes in patients' health status pre- and post-elective surgery.

Collecting PROMs data requires selecting instruments that are supported by rigorous evaluations. In addition, since VALHUE is collecting PROMs data for a broad range of elective surgical treatments, the selection of the instruments must enable intra- and inter-condition comparisons. To facilitate this key objective, generic and condition-specific instruments were required for each surgery included in VALHUE.

The purpose of this study is to report on the selection and review of instruments for collecting patient-reported outcomes for elective surgery. PROMs information has the potential to play a valuable role in the future of case mix adjusting hospital episodes by augmenting clinical information collected by traditional discharge summaries.

## **Methods**

VALHUE encompasses 49 unique surgical categories in 9 surgical specialties. In order to systematically review PROMs instruments, we developed an evaluation framework which included as its dimensions: 1) ability to rank order health states, 2) measurement system/analytic framework for intra/inter-condition comparability, 3) availability of population norms, 4) perceived respondent burden, and 5) affordability of the instrument.

## **Results**

Generic health status instruments were easily identified. Ultimately, the EuroQoL EQ-5D (for measuring general state of health), the PEG (for measuring pain), and the PHQ-9 (for measuring depression) were incorporated into VALHUE. These were all supported by a rich body of empirical research and best satisfied the evaluation framework.

Condition-specific instruments were far more challenging. For all but a few high-volume surgeries, existing instruments are for diagnosis rather than classification purposes. Consequently, the ability to rank order or compare health states within the same condition is lacking. In addition, population norms are also rarely available, an effect which challenges interpretation of PROMs.

Lastly, many of the condition-specific instruments have a large number of questions, an effect which challenges our objective of minimizing respondent burden. However, few condition-specific instruments have licensing costs.

## **Conclusions**

We believe that PROMs will be an important and promising tool for characterizing the utilization and effectiveness of different surgical interventions. But to do this on a large, system-wide scale requires rigorous measurement and classification systems. Based on our review of the available instruments, characterizing the effectiveness of surgical care can only be confidently implemented with the generic health status instruments. Condition-specific instruments still suffer from considerable limitations that require considerable research to support their broad implementation.

These findings have important ramifications for countries considering using PROMs for case mix adjusting their hospitals. Importantly, generic health status instruments can be used to compare relative improvements in outcomes between surgical treatments and between hospitals. In contrast, detailed clinical information found on condition-specific instruments, and relevant to clinicians for treatment, has a long way to go to establish a solid base of evidence.

## **Saturday Morning International Experience with Casemix**

### **Leveraging casemix data to increase transparency in healthcare – the Singapore experience**

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## **Introduction**

Singapore introduced casemix-based financing for inpatient and day surgery cases in the public sector in 1999.

Over the years, the application of casemix has since been extended beyond financing to transparency-related applications. This began with the public reporting of public and private sector acute hospital bill sizes on the Ministry of Health's internet website in 2003. More recently, casemix data has been pivotal in the development of the Ministry of Health's performance measurement and management framework to help healthcare providers in

Singapore assess and benchmark their performance against their peers to ensure the delivery of high-quality health care.

In this paper, we will discuss and share our experiences on the use of casemix data to drive transparency of healthcare charges and quality, and hence value of care to patients locally.

### **Methods**

In Singapore, public and private hospitals submit casemix data for day surgery and inpatient admissions to the Ministry of Health. This data is subsequently used for a variety of transparency-related applications:

a) Reporting of hospital bill size: This began with the public reporting of hospital bill sizes for common medical and surgical conditions on the Ministry of Health's internet website in 2003. This initiative was aimed at increasing transparency of healthcare charges, allowing patients and their family doctors to make better informed choices on where to seek treatment, as well as to enable hospitals to compare their cost with that of their peers and in so doing, learn to stay competitive while providing good quality care to their patients. The publication highlighted variations in hospital bills, and led to pricing revisions for some conditions. The publication has been well-received by the public, with website continuing to receive over 10,000 'hits' monthly.

b) Performance measurement and management framework: More recently, casemix data has been leveraged on to provide transparency of healthcare quality under the Ministry of Health's performance measurement and management framework. In 2009, the Ministry of Health developed a series of cascading scorecards to measure quality across the healthcare system, starting from the National Health System Scorecard which is a national-level tool that uses internationally-established performance indicators (and their associated definitions) to compare performance with international benchmarks; to the Acute Hospital Scorecard which complements the National Scorecard by measuring institution-level performance. Casemix data underpins many of the indicators on both scorecards, ranging from the Prevention Quality Indicators (PQIs) related to 'avoidable admissions' to Patient Safety Indicators (PSIs); and indicators related to Readmissions and Mortality Rates. The results of these indicators are reported back to healthcare providers on a regular basis, facilitating targeting of improvement initiatives.

### **Results**

The availability of readily-available, high quality casemix data has enabled the Ministry of Health and healthcare providers in Singapore to perform comprehensive external and internal benchmarking of both healthcare charges and quality of care, while keeping the burden of additional data collection to a minimum.

### **Conclusions**

Casemix data has indeed improved transparency of healthcare charges and quality, and hence value of care for patients. It will increasingly be leveraged on for this purpose in the future.

# **The Impact of Hospital-Acquired Infections on Hospital Reimbursement - A comparison of the French and German DRG System**

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## **Introduction**

Complicated infections such as multi-resistant staphylococcus aureus (MRSA), vancomycin resistant enterococci (VRE) or Clostridium difficile (C.diff) cause high economic burden in healthcare systems. Hospital reimbursement in Germany and France is based on Diagnoses-related-groups (DRG). In Germany the G-DRG System and in France the GHM-system are in place. The common idea behind DRGs is building cost homogenous groups for similar inpatient episodes based on diagnoses and treatments.

## **Methods**

To compare the reimbursement level in France and in Germany, case examples were built that reflect common clinical constellations in which complicating infections can occur. To enable better comparability for each constellation an uncomplicated index case was built. The reimbursement level for these cases was indexed to a relative level of 1.0. Next, the reimbursement level with positive test results and treatment of MRSA, VRE and C.diff were determined and the impact on hospital payment with and without coding of an infection was calculated as "reimbursement impact factor". Moreover average costs of the cases were retrieved to calculate a cost / reimbursement ratio.

## **Results**

Positive tests and successive treatment of the cases leads to higher reimbursement levels in Germany and in France in most cases. The resulting DRG assignments vary widely between Germany and France. The systems classify patients according to different sets of variables (e.g. age, principle diagnosis, secondary diagnoses and procedures). While complicating infection cases in France have 5.5 times higher reimbursement on the average than the index case, in Germany the factor is 1.4. Costs for the treatment (mainly due to prolonged length-of-stay) are regularly higher than reimbursement levels. In France and in Germany in average only 70% of the costs are covered by the DRG payment. So despite higher reimbursement, when testing and treating hospital-acquired infections (HAI), most cases are not reimbursed to a level that covers the costs.

## **Conclusions**

We conclude that detecting and appropriately coding serious infections leads to higher payment levels in France and in Germany. As the cases regularly cost more than they reimburse, all activities to reduce length of stay (LOS), e.g. rapid diagnostics, reduction of opportunities for transmission of HAI, could pay off.

## **Methodology for adjust relative weight of Thai Diagnosis Related Group version 5**

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## **Introduction**

Relative Weight (RW) is a unit of health care resource measurement of treatment patient in each diagnosis related group (DRG). Adjust for RW for short and long length of stay (LOS) will lead to equity for both providers and payers.

## **Methods**

The objectives of this study were to synthesize formula for adjust RW of Thai-DRG version 5 from charge of care per day. Data was collected from medical records and electronic database at Regional hospital. Patients were divided into 3 group: low outlier, inlier, high outlier and medical DRG and surgical DRG.

## Results

For low outlier group, medical DRG had cumulative percentage of health care resource for day 0-10 as follow: 83.3, 94.3, 96.9, 97.9, 98.5, 99.2, 99.6, 99.8, 99.9 and 100.0. Surgical DRG had cumulative percentage of health care resource for day 0-14 as follow: 63.0, 81.9, 89.5, 92.7, 94.9, 96.6, 97.8, 98.5, 99.4, 99.7, 99.8, 99.9, 99.9 and 100.0

For high outlier group according to outlier trim point (OT) which divided into 3 groups: patients had LOS greater than OT and lower than 2OT ( $OT < LOS = 2OT$ ), patients had LOS greater than 2OT and lower than 3OT ( $2OT < LOS = 3OT$ ), and patients had LOS greater than 3OT ( $LOS > 3OT$ ). The results found that medical DRG should adjust 3 groups with 0.0481, 0.0117, and 0.041. Surgical DRG should adjust 2 groups with 0.0096 and 0.0024 of LOS plus 1.

## Conclusions

Formula for adjusting relative weights according to length of stay should concern for most frequency of DRG in both low outlier and high outlier groups, complexity of cases, severity of illness, type of hospital, and cost information together.

## The Case of Small Jurisdictions; Adaptations to the Australian Activity Based Funding Model for Tasmania

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### Introduction

The National Hospital Reform Agreement (NHRA) involves all Australian States and Territories in a move to Activity Based Funding (ABF).

The reform involves the creation of Local Hospital Network (LHNs) which receive funding from the National Funding Pool on the basis of a national activity based funding formula. The process for allocation of this funding is a National Efficient Price, determined by the Independent Hospital Funding Authority (IHPA). Other national Bodies created under this program include the National Health Performance Authority (NHPA) and the Funding Administrator of the National Health Funding Body.

Jurisdictions (State Health Departments) remain as the system manager and majority funder. They are free to set volume, activity targets and jurisdictional processes. The Commonwealth contribution is determined by the IHPA.

The basic funding unit is the National Weighted Activity Unit (NWAU) which is based on costs for admitted acute cases with other product streams expressed as a relative weight (related to the inlier acute value). Adjustments are made to the NWAU value for Indigeneity, remoteness, critical care, pediatrics, deflators for private insurance use, and other national funding contributions.

### Methods

This paper describes the development and output of the funding model developed by Tasmania to manage reporting and funding under the national Activity Based Funding outcomes. The jurisdictional funding model provides the ability to;

- 1 Report funding outcomes to the Administrator using the NWAU;
- 2 Manage the significant cost variation between the three Tasmanian hospitals that are not appropriately dealt with using the national model, and;
- 3 Provide the basis of a Tasmanian price/volume funding schedule for all hospital outputs consistent with the State role as purchaser and system manager.

A series of policies have been released to facilitate the implementation of the Tasmanian and IHPA funding model and manage the risks introduced by this move from historical block funding informed by Casemix reporting to ABF using the national model.

### Results

Given the significant differences in cost between Australian States and Territories, it was necessary to develop a model in 2 parts;

- 1 The first part using the national funding model (NWAU) for the Commonwealth contribution

and

2 A Tasmanian ABF model using a variety of classifications to permit a better fit with the issues involved in local service provision and costs.

Tasmania and the other smaller jurisdictions have higher reported costs than the larger states due to a variety of reasons including scale diseconomy, the requirement to provide comprehensive services, access to staff and issues with coding.

### **Conclusions**

The National ABF model is a complex creation developed from national costing approaches and results that continue to remain inconsistent across the country. It is also characterized by the use of a number of new classifications that are not (as yet) highly developed and remain unproven at this time with variable results from recent national cost studies. While presented as a nationally "efficient" price, the model is in fact built on an average cost but is also somewhat normative in that it discounts a number of legitimate costs of hospital services.

Tasmania is one of the smaller States in Australia, and appears to be exposed to greater risk in a funding system such as the NEP as it is derived from averages from much larger jurisdictions. Smaller jurisdictions simply do not have the numbers to allow "swings and roundabouts" to work. The development of a transparent compound model for States such as Tasmania is required at this time to produce a reliable and sustainable allocation of funding resources.

## **General Casemix**

### **Harnessing Clinician Input to Shape a Case Mix Funding System for Hip Fracture**

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#### **Introduction**

Case mix classification and funding methodologies tend to rely primarily on statistical methods to cluster patients with similar costs. In later phases of development, some countries draw on the input of clinicians to ensure that classification definitions are clinically meaningful. Few countries, however, incorporate substantive clinical input in formative stages of the development process.

In designing a new case mix-based funding system for hospitals, the government of Ontario (Canada) took the novel approach of using clinical panels with expertise in selected patient populations to define the key parameters of the funding methodology for those populations. Typical decision points included inclusion / exclusion criteria for patient groups, scope of the episode of care to be reimbursed, and patient variables for risk adjustment. This study examines the novel processes that an expert panel used to develop a case-mix funding system for hip fracture care.

#### **Methods**

Ontario established a panel of hip fracture experts from a variety of disciplines, including: orthopedic surgery, geriatrics and physiotherapy. Supported by researchers, the panel established definitions for hip fracture patient subgroups using administrative data elements. Subgroups were examined for differences in patient characteristics and resource utilization. Generalized linear models were developed to estimate the effect of patient characteristics on hospital cost and length of stay.

In a second step, hospital, physician and home care datasets were linked by patient identifier to examine hip fracture episodes of care of varying duration. The longitudinal analysis allowed clinicians to review common discharge locations and types/intensity of post-acute care.

## **Results**

The panel drew on clinical experience to recommend the cohort be stratified into 3 patient subgroups for payment purposes based on patients' pre-fracture residence and function. These subgroups consisted of a group of patients living in long-term care homes prior to fracture, a group living in the community and considered 'healthy', with no evidence of prior functional limitations, and a group living in the community considered 'frail' due to the presence of recorded functional assessment, suggesting greater complexity.

Subsequent analysis of hospital cost data validated the recommendations of the panel, revealing significant differences in cost between the three groups and median lengths of stay of 6, 8 and 10 days, respectively.

The findings revealed that, despite being the frailest of the three groups in terms of their age and burden of comorbidities, hip fracture patients admitted from long-term care had the shortest lengths of stay and lowest hospital costs of all groups. This finding suggests their institutionalized status enabled more rapid discharge from hospital.

Within each group, the panel identified patient characteristics for risk adjustment, including age, gender, co-morbidity level, fracture type and activities of daily living. These characteristics were all shown to be significantly associated with resource use, with higher comorbidity levels having the greatest incremental contribution to cost and length of stay.

At the end of the review process, the panel recommended an episode of care definition that included all health care services for 90 days following the index admission. As a unit of analysis, the 90-day episode revealed significant regional variation in use of different post-acute care settings.

## **Conclusions**

Applying a clinician-driven approach to defining the case mix methodology for hip fracture resulted in parameters that were both clinically meaningful and well-aligned with predicting resource use. Although the patient subgroups recommended by the panel were based on clinical intuition rather than statistical analysis, they proved to be superior to existing case mix definitions in predicting costs and lengths of stay. The recommended 90-day window of analysis revealed significant regional variation in post-acute care patterns, suggesting opportunities for improved efficiency.

While this study demonstrates that there is value in using the input of clinicians to inform the design of a case mix system, it also reveals some challenges; for example, not all clinical considerations could be accurately translated to administrative data elements, while others could only be captured by linking patient encounters across datasets, which may not be feasible in all systems. Nevertheless, an important advantage of the new clinician-informed grouping logic is that the new parameters are not only well-aligned with predicting resource use, they are also more relevant and intuitive to clinicians who routinely treat hip fracture patients in Ontario's hospitals, supporting more meaningful engagement of clinicians in implementing the new case mix-based funding system.



## **Introducing activity-based payment in the hospital: Evidence from French data**

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### **Introduction**

Many countries have reformed hospital reimbursement policies to provide stronger incentives for quality and cost reduction. The purpose of this work is to understand how the effect of such reforms depends on the intensity of local competition.

The objective of this study is to analyze the impact of this reform by comparing the behavior of public hospitals for which there was a progressive implementation in public hospitals in the period 2005-2008, and private for-profit hospital for which this reform is fully implemented in 2005. We study specifically the impact of this reform on the activity taking into account the competition created by this new financing system.

### **Methods**

We build a nonprice competition model to examine the effect of a shift from global budget to patient-based payment for public hospitals in France. We predict that the number of patient admissions should increase in public hospitals by more than in private clinics and that the increase in admissions is stronger in public hospitals more exposed to competitive pressure from private clinics.

We check these predictions by using annual data on hospital outcomes. Our dataset includes the number of patient admissions and average lengths of stay for all DRG and all hospitals, be it subject to the payment reform or not.

Considering the reform implemented in France between 2005 and 2008, we compare the evolution of hospital outcomes between public hospitals and private hospitals by controlling for (hospital, DRG) and (year, DRG) fixed effects as well as for many time-dependent hospital characteristics .

### **Results**

We find that public and not-for-profit hospitals have increased activity by more than private clinics during the period. Our main result, however, is that these diverging trends are magnified in competitive areas. We use an indicator for local competition based on distance-weighted number of beds at neighboring hospitals.

### **Conclusions**

We provided empirical evidence that local competition affects the way the equilibrium shifted. First, activity in not-for-profit (NFP) hospitals raised all the more after the reform than hospitals are in a competitive environment. This fact is consistent with the prediction claiming that the increase in the NFP market share after the reform should be more pronounced as competition is fiercer. Second, the average length of stay has been more reduced in not-for-profit hospitals relative to for-profit hospitals and again, this effect is stronger when competitive pressure is more intense.

## **Developing an Additional Index of Staff Productivity using Casemix information**

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### **Introduction**

The Hong Kong Hospital Authority ("HA") manages 41 public hospitals/institutions, 49 specialist out-patient clinics and 74 general out-patient clinics which are organised into 7 geographical clusters, serving a population of more than 7 million people in Hong Kong.

Delivery of acute hospital services relies on the concerted effort of multi-disciplinary healthcare professionals. As medical technology advances, the complexity of medical treatment escalates. The traditional way of assessing productivity such as 'number of patients treated per doctor' will only underestimate the workload and complexity shouldered

by our frontline. With the introduction of Casemix information in HA since 2009, we are exploring an additional perspective to reflect staff productivity by incorporating the element of treatment complexity into the equation.

This paper demonstrates the use of a Diagnosis Related Groups ("DRG")-based productivity index to project a picture of productivity for HA's acute inpatient services by linking resource input (staff cost) with output (measured in Weighted Episode "WE" using Casemix data).

This study measures the level of Casemix-adjusted output in relation to staff cost. The application of this productivity index can identify potential areas of inefficiency, facilitate timely rectification, and serve as a piece of additional management information in performance monitoring.

### **Methods**

The unit of staff cost was pre-set at HK\$10,000 and the level of staff productivity was determined through the formula below:

Staff Productivity Index of Acute Hospital Services  
= WE per \$10,000 Staff Cost  
= Total WE / Staff Cost x \$10,000

Trend analyses were performed in addition to the benchmarking of indexes, both at cluster and hospital levels, to identify the variation in the level of productivity and staff efficiency throughout the years. Two staff groups were particularly studied, namely the 'medical staff' and the 'nursing staff'.

### **Results**

The development of this DRG-based index has already assisted two clusters in identifying efficiency issues, with one successfully traced its cause to the underlying contributing factor.

### **Conclusions**

Through identifying areas of inefficiency, this index provides opportunity for improvement plans to be implemented. Benchmarking the level of efficiency across clusters can provide management with an overview of performance level in the organisation as a whole.

Such application of Casemix information beyond the general use in resource allocation provides another piece of useful management information for staff performance monitoring purpose.

## **The creation of new models to predict future resource use and future risk of hospital admission for a general population in NHS England**

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### **Introduction**

The existing predictive models in the ACG System were based on US data, which are modified (rescaled) based on local data. Early work at Imperial College and UCL showed the applicability of the ACG System to NHS data. In 2006, the first study was undertaken between Johns Hopkins University and the Kings Fund to form predictive models based on NHS data. Latterly in Leeds City PCT showed that the existing models in the ACG System could match and exceed the performance of the Combined Predictive Model (CPM) which was designed on NHS data. The predictive models are currently being used in the NHS to create patients lists of individuals for clinical review, who may benefit from care management to prevent unnecessary hospital admissions.

## **Methods**

The principal aim of the study was to apply the ACG System variables as independent variables in year 1, to predict patient outcomes in year 2. Two main dependent (outcome) variables were used in the study, total cost in year 2, and hospitalization in year 2. The objectives were to create predictive models based on English NHS data, validate those models, compare with the existing US-based models, and based on these comparative results recommend a model for application in NHS England. A linear regression model was used to predict future cost, and a logistic regression model was used to predict future hospitalisation. A split-half validation method was applied, where the model is applied to a test set of data, with the model results reported on a validation set.

## **Results**

The data consisted of 663,797 individuals in year 1, from a general population. Data was extracted from primary care practices which had completed and approved a consent process. Secondary care data was added from hospital data for cases where patients had also received hospital services.

The linear regression model to predict future (year 2) total patient expenditure produced an R-Squared result of 27.5% on untrimmed data. This compared to 8.8% for a traditional age/gender model, and 22.4% for the current US based model. With prior cost and utilisation variables added the model's performance increases to 30.9%.

The logistic model to predict future hospitalisation produced a C-Statistic of 0.80, compared to an age/gender model of 0.67 and the current US model of 0.75. For the purposes of generating lists of high risk individuals applying a cut-point such that 1% of the population are designated as "positive", the model shows a positive predictive value of 72.77%.

## **Conclusions**

The results show a statistically significant improvement over the existing models available in the ACG System implemented in the UK NHS, consistent with similar projects carried out in Sweden and Spain. The results also show that the original US models still provide sufficient estimates that have been proven to be robust in a number of countries over several decades.

A standard set of independent variables were used in the models. Additional variables could be used in future models such as BMI, Smoking Status, and social care data. Alternative models could produce higher results through the use of current utilisation and costs measures, however these models would increase bias to individuals already accessing healthcare services to the detriment of those with low current access.

## Casemix Care 2

### The use of General Practitioners (GPs) clinical database records improves the comorbidity description: the Veneto ACG project.

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#### Introduction

The Veneto Region population is not homogeneous and therefore variation in health care resource use is expected. The degree to which this variation is explainable by morbidity burden, as opposed to other well known factors such as age, gender, and geographic area of residence, was unknown.

In April 2012, the Veneto Region (North-Eastern Italy), in collaboration with the Johns Hopkins University in Baltimore, started a pilot use of the ACG System in two Local Health Units (approximately 1 million inhabitants, 20% of the Veneto population) to better understand the role of morbidity in explaining that variation. The Adjusted Clinical Group (ACG) system is a risk adjustment model that stratifies a population into mutually exclusive categories on the basis of clusters of morbidity using diagnostic codes from claims data. Measuring health status, accounting for the case-mix of a population, therefore provides a better prediction of health services resource use and allows for a more equitable allocation of health care resources.

Study goals: In the total population, (962,602 subjects) the ACG System was implemented using available claim records, or computerized medical encounter records. In a subsample of approximately 20,000 patients, additional diagnoses obtained by the clinical databases of a group of 14 general practitioners (GPs) were added to diagnoses obtained by claims or records. An objective of this study was to verify how data from GPs clinical databases modify the classification of subjects by the ACG System.

#### Methods

The following sources were used to classify subjects according to the ACG System: hospital discharge records (diagnosis coded according to the International Classification for Diseases, 9th Edition Clinical Modification – ICD9CM), chronic disease registry for copayment exemption (ICD9), emergency room visits (ICD9CM), psychiatric ambulatory care (ICD10), drug prescriptions, diagnoses obtained from admissions to nursing homes or to home-care programs (International Classification for Primary Care-ICPC). In the subset of patients cared for by the 14 participating GPs, results obtained by the ACG System (classification of patients, mean number of diagnoses, estimated complexity of medical needs, number of chronic diseases, costs distribution) were compared excluding or including the information registered in GP databases.

#### Results

The introduction in the ACG System proved an assessment of diagnoses coded by GPs and resulted in a decline from 40.3% to 18.6% in the proportion of subjects who had a contact with the regional health system (i.e. without coded diagnosis). The average number of diagnoses used for the definition of ACG categories increased from 1.3 (from data obtained from the archives without the diagnoses of GPs) to 2.7 with the inclusion for diagnoses from GPs. The number of subjects with at least one chronic condition increased from 36% to 52% when diagnoses provided by the GPs were included. The complexity of patients according to the expected consumption of resources sharply increased: subjects with moderate and high-very high Resource Utilization Bands (RUB) increased from 24% to 40%. The prevalence of ACG categories in the population was modified by the introduction of GPs diagnoses: the table (below) shows the most prevalent ACGs in the archive with GPs diagnoses, comparing the rank of each ACG category including or excluding information from GPs databases. As expected, the prevalence of minor acute events increased while the average cost for each

ACG decreased; the introduction of GPs diagnoses led to a reclassification of patients towards more complex ACGs, whereas the average cost in each ACG category declined.

### Conclusions

Diagnostic accuracy by GPs showed a wide heterogeneity; despite this limitation, the clinical data base of GPs has proven to be an important source of information for improving the description of co-morbidity in the Veneto population.

	Without GPs diagnoses	Without GPs diagnoses	Without GPs diagnoses	With GPs diagnoses	With GPs diagnoses	With GPs diagnoses
ACG	Rank	Prevalence per 1.000	Average total cost	Rank	Prevalence per 1.000	Average total cost
2-3 Other ADG Combinations, Age > 34	2	114.1	2535.31	1	176.5	1501.52
Chronic Medical, Stable	1	118.6	721.99	2	99.1	499.57
Acute Minor, Age > 5	6	19.4	650.59	3	40.5	225.90
4-5 Other ADG Combinations, Age > 44, 1+ Major ADGs	9	8.2	4874.07	4	34.8	2180.37

## Patient Focused Episodes: an innovative blending of Ambulatory Encounter, Inpatient Encounter and Population Based Groupers

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### Introduction

Accountable Care Organizations (ACO) are a major component of the current Health Care Reform in USA. To better coordinate and unify payment across the continuum of care, CMS has launched in 2009 an initiative to develop a Patient Centered Episodes (PCE) Grouper. We had been selected as one of the four organizations to propose such models. Since, we have refined our initial proposal aimed at Medicare population (only 65 years old and over) into a full-fledged new classification that includes as building blocks; 1-Enhanced Ambulatory Patients Groups (EAPG) for acute care ambulatory encounters and - All Patient Refined DRGs (APR-DRG) for Acute care Inpatient encounters to identify the type of episode ; 2-Clinical Risk Groups (CRG) to determine the chronic illness burden of the patient.

The design principles of PFE are: 1-patient centered; 2-categorical clinical model; 3-comprehensive; 4-stable clinical model with empirically derived payment weights; 5-outlier thresholds for each clinical category.

### Methods

The PFE Grouper performs three basic functions: 1-Episode Classification based on the enrollee's claims history, each enrollee is assigned to the applicable event-based episodes, disease cohort episodes and a population episode; 2-Episode Accumulator: the accumulator reports the actual expenditures in the user's data; 3-Episode Estimator: the estimator reports a relative weight that is a measure of the enrollee's expected expenditures.

The following three types of Patient Focused Episodes co-exist.

1-Event Based: Episode initiated by a specific health care event such as a hospitalization. An individual can have only one event based episode at any given time, but can have multiple event based episodes over an extended period of time.

2-Disease Cohort: All enrollees with specific chronic illness over a specified time (eg, six months). An individual can have more than one disease cohort episode at any given time

3-Population: All enrollees in a population including relatively healthy enrollees over a specified time period (eg, one year). An individual is assigned to one and only one population episode at any given time.

Three types of encounters that can initiate an Event Based Episode:

1. Hospitalization (identified using APR-DRGs)  
 2. Outpatient procedure (identified using EAPGs)  
 3. Medical visit for significant acute disease (identified based on principal diagnosis)  
 The PFE Episode Service Scope encompasses: 1-Institutional services= trigger hospital stay; readmission; hospice stay; skilled nursing facility(SNF); extended care; outpatient hospital service ; emergency room visit; outpatient clinic; same day surgery; 2- Professional Services= hospital inpatient; hospital outpatient; physician office; extended care; 3- Other Outpatient Services= home health; retail pharmacy; other pharmacy; laboratory; radiology; other ancillaries.

The PFEs form a comprehensive list of episodes: 434 inpatient event based episodes; 73 event based outpatient procedure episodes; 9 event based outpatient medical episodes; and 191 chronic disease cohort episodes.

A enrollee can only be assigned to the one event based episode at any point in time: an episode hierarchy is used to assign overlapping services to episodes: inpatient; then outpatient procedures; finally, outpatient medical visits. Episodes terminate when: an event higher in the episode hierarchy occurs; episode window ends; enrollee dies; or an unrelated readmission occurs (inpatient only).

The Relative Resources Estimator calculates relative weight as follow: the relative weight for an event-based episode is a risk adjusted measure of the expected relative costliness of the enrollee's total disease burden compared to all other enrollees in that event-based episode. The relative weight for a disease cohort episode is a measure of the expected relative costliness of the enrollee's total disease burden compared to all other enrollees who have that disease. The relative weight for the population episode is a severity adjusted measure of the expected relative costliness of the enrollee's total disease burden compared to all other enrollees in the population.

## Results

Table 1 provides examples of PFE descriptions and results including relative resource estimations (RRE) from a large US all-payers population.

## Conclusions

This represents a major innovation that complements the current quiver of grouping classifications. It will enable payers and providers to better monitor, coordinate and reimburse health services across the continuum of care.

### Event-based Episodes for case-study

<episode Type> </episode	<episode ID> </episode	<episode Name> </episode		<crg Status> </crg	<crg Severity> </crg			< End Date>	
Outpatient Therapeutic	31620	Level III Cystourethrosopy and other Genitourinary Procedures PTCA with or without Stent Respiratory Infections with Ventilator Support <96 hours Cellulitis	- - -	7	3	0.97	03/25/10	05/01/10	38
Inpatient Procedure	12461	PTCA with or without Stent	1	7	3	1.06	06/27/10	08/04/10	39
Inpatient Medical	22082	Respiratory Infections with Ventilator Support <96 hours	2	7	5	1.00	08/09/10	09/25/10	48
Outpatient Medical	53720	Cellulitis	- - -	7	5	1.59	10/04/10	11/10/10	38

# Patient Risk Estimation Using Information of the International Classification of Functioning, Disability and Health

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## Introduction

Background: In 2001 WHO published the International Classification of Functioning, Disability and Health (ICF). However its application in health care is still underway. This study aims to estimate the major risk event such as a fall using the ICF based staging system [1]. Major risks such as falls, asphyxia and dehydration are related to functional status of the patients rather than diagnosis in geriatric care. There are numerous screening programs for each risk, such as screening test for falls and pressure ulcers. However collecting this information for every elderly patient is time consuming. To overcome this problem, we used assessment system of the geriatric patient "ICF staging" as a basis for screening of major risks.

## Methods

Functional and disability information of Elderly patients were collected from fifty Geriatric Health Facility (Geriatric Rehabilitation Facility). Each facility provided information of 10% of the patients using randomization process. Functional Assessment was performed with ICF staging. ICF staging is an assessment method to describe functional status of the elderly patients based on the ICF. Of these patients, 3026 cases are followed for one year. The occurrence of major risk events, such as occurrence of fall, bone fracture, dehydration, pressure ulcer, fever, infectious disease and mis-swallowing (aspiration accident) were also collected. The relative risk of each type of event by each ICF stage was estimated. In addition to this analysis, we also analyzed the relative risk using previous incidence of major risk events.

## Results

Prevalence of major risk event was as follows; Fall 34.7% Bone fracture 5.2%. Dehydration: 4.6%. Pressure ulcer: 6.3% Fever 36%. Infectious disease: 3.1%, Mis-swallowing (aspiration): 6.9%. Relative risk was estimated using scales of the ICF staging. For example, Mobility scale was associated strongly with the occurrence of pressure ulcer. Stage 1 (Does not change lying position) of this scale showed relative risk of 4.41(95%CI 3.2-6.1) . The relative risk of a fall was the highest (1.36, 95%CI; 1.15-1.8) in Stage 4 (Does not maintain standing position, but transfer from sitting position to lying position). For dehydration, Stage 1 (Does not change lying position) showed highest relative risk. Previous incidence of major risk events also increased relative risk significantly.

## Conclusions

ICF staging is a simple tool developed based on the ICF. Each scale divided functional performance into five stages according to four ICF codes, making the measurements simple and less time-consuming. It also enables clear descriptions of elderly functioning level. This was achieved by hierarchically rearranging the ICF items and constructing Guttman-type scales according to item difficulty using the Rasch model. This is based on the fact that higher functioning elders can perform more difficult item compared to elders with severer functional problem. By using the ICF as a common taxonomy, these scales could be used internationally as assessment scales in geriatric care settings.

Because these scales clearly demarcate the functional characteristics of patients, the relative risk of each functional level can easily be estimated using cohort study.

This study showed some examples using a basic mobility scale. We would like to present full spectrum of risk estimation at the conference.

1. Okochi, J., et al., Staging of mobility, transfer and walking functions of elderly persons based on the codes of the International Classification of Functioning, Disability and Health. BMC Geriatr, 2013. 13(1): p. 16.

## **pDRG - Finnish casemix model for primary care**

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### **Introduction**

Outpatient care and Primary care

Specialist level health care has been developed towards outpatient care causing problems to apply and develop DRG type casemix systems.

Primary care has always been outpatient care (although Finland has a system of primary care wards for inpatient care). With each contact the goal is and should be to treat all problems of the patient

and each problem demands usually more than one contact. The activity therefore needs to be described as a process through episodes of care.

An episode consists of all contacts where the same problem of the patient at issue has been dealt with. A patient may simultaneously have several episodes active. In pDRG-project analysis of 5598 contacts 58% of the contacts were with 1 problem but 7% with at least 4 problems. The number of contacts for typical chronic problems was between 3 and 5 per year.

### **Methods**

How did we model pDGR?

All the diagnoses were grouped by prevalence

Clustered to product families

All the products were defined a time limit, for example chronic diseases, acute illnesses, more durable non -chronic illnesses, clear limits like pregnancy

All the work-amounts and one week workflow were tested and a calculation for work years for personnel were made

The diagnose volumes/appointments were audited (main and side dg)

The same patient groups were audited by same diagnoses to understand the entity of the episode of a same pDRG-product

recipient parties (different professionals) were defined (doctors, nurses, dieticians, physiotherapists, etc.)

contact types and their time limits were defined (telephone (5'), ac1 (15') - ac3(45'))

The economic data was opened , the most accurate was to define which cost was allocated to which moment

The annual contribution of different professions was defined (magnitude ,€)

This was valued to the costs of recipient parties (direct costs)

General costs (indirect costs) were defined

All this combined to the pDRG-data

Piloted with two municipalities economic data

### **Results**

Cost distribution within and between the groups will be presented with examples.

### **Conclusions**

The model of problem episode product works in expected way. Further development will be necessary.