BMC Health Services Research 2015, Volume 15 Suppl 2
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BMC Health Services Research

MEETING ABSTRACTS Open Access

Patient Classification Systems International 2014 - Patient information for better choice: abstracts

Doha, Qatar. 20-23 October 2013

Published: 15 June 2015

These abstracts are available online at http://www.biomedcentral.com/bmchealthservres/supplements/15/S2

MEETING ABSTRACTS

A1

Improving patient outcomes: leveraging data to drive innovation in health care – New South Wales' Activity-Based Funding management portal

Alfa Damato
New South Wales Health / Activity-Based Funding Taskforce, Ministry of Health, North Sydney, New South Wales, 2060, Australia
E-mail: adama@doh.health.nsw.gov.au

BMC Health Services Research 2015, **15(Suppl 2):**A1

Background: Clinical and non-clinical health leaders both seek to leverage data to drive innovative improvements in models of care and create sustainable and effective health systems. For the last three years, Activity-Based Funding (ABF) has been the main driver for funding public hospitals in New South Wales (NSW), Australia. The data generated by the implementation of ABF has been used for both policy and funding decisions. As quality improved, the data became more relevant to a wide range of stakeholders, and drove improved interactions and conversations between clinicians and administrators.

These conversations and opportunities were particularly relevant for patient-level clinical costing. This process uses a large range of data sets to allocate costs, and is presented with patient activity data that are familiar to clinicians. Clinical analytics, which leverages on cost and activity data, are being used to shape the future of local health systems, improve service delivery, and enhance patient outcomes. This shift moves the system from ABF to Activity-Based Management (ABM), through which data can be used not only for funding the annual budgets of Local Health Districts (LHDs) but also to inform local policy decisions.

For several years, LHDs have submitted annual patient costing data returns to the Ministry of Health. Until recently, however, they saw few benefits from the effort required to submit these data, since state-wide benchmarking and variance analysis were limited and/or provided with significant time delays. The ABM Portal was created and launched to address this issue.

The Portal provides a rich data source that can support local decision-making about clinical care evaluations, reduce unwarranted clinical variations, improve care models, facilitate service planning, and effectively manage services within budget. The ABM Portal was developed with significant input from clinicians and is currently being expanded to incorporate additional data elements. The ABM Portal contains data aggregated to LHDs from patient-level data, enabling users to drill down to the lowest-level information and understand the causes of any identified variances (i.e., in cost or length of stay).

Materials and methods: A number of steps were employed to support the health system's transition to ABM, and use of the ABM Portal. These included redesigning processes to provide data to the Ministry of Health, establishing data quality assurance processes, and establishing clinical engagement strategies.

Redesigning processes focused on streamlining and merging a number of data collections to enable a single submission to be used for multiple purposes. Following the process redesign, significant effort was invested in improving data quality and accessibility to stakeholders, thereby creating a supportive environment for data improvement exercises.

The final, critical step was designing data associations and relationships that are meaningful for clinicians and maintain a bridge with the administrators. In addition to benchmarking at the hospital level, the change to ABM enabled the system to focus on patients.

Results: The move to ABM has fostered a significant cultural change in NSW Health, driven by the transparency of information contained in the ABM Portal. Stakeholders can now access information about their own and their peers' services in a more timely manner. The level of detail contained in the ABM Portal enables users to test common hypothesis about their services, such as whether their patients are older, sicker, and/or more complex, compared to their peers' patients. As a result, performance issues can be unbundled further, in order to identify core issues that drive costs and establish a clear relationship between all domains of performance including those that are activity-related and financial.

Users can access comprehensive information about the "Patient Journey" via the ABM Portal. Because the information contained in the ABM Portal is at the patient level, users can easily identify the most frequent patients, analyze their journey through the system, and assess the treatments received and their associated costs in a variety of settings. This has facilitated a shift from traditional case-mix approaches, which are anchored in care type, to a more holistic and patient-centered health care system.

This shift has been critical to implementing changes in models of care that improve patient outcomes. It has supported a more effective and productive planning from the clinical and non clinical point of views, as well as the establishment of a more expansive and integrated health care system.

Users are now empowered and can find answers to their questions, rather than having to request a report and wait several weeks for it to be prepared. This process has improved the efficiency of sourcing and using relevant organizational information, and is driving changes across the health care system.

Conclusions: As Australian health care budgets tighten, and more is learned about the impact of ABF, clinicians and managers increasingly rely on data. Yet, this reliance requires suitable tools and appropriately skilled and experienced staff to manage large, complex health information repositories, and thereby drive changes across the health care system.

The ABM Portal is an important step to help create a sustainable health care system that uses innovative care models to improve patient outcomes. The Portal's development has been successful in an economic climate of high urgency and low funding availability.

The ABM Portal solution jump-started NSW Health's use of data. The Portal places patient care at a system grounded in data that are easily used to support clinical and administrative decisions, transparent, and focused on a comprehensive health care service model. The AMB Portal's "Patient Journey" feature is a clear example of how complex data can support local clinical and non-clinical decision-making. This development

is leading to more integrated care systems that will have a positive impact on patient outcomes.

A2

Possible options for introducing quality aspects in Activity-Based Funding pricing

James Downie
Independent Hospital Pricing Authority, Sydney, New South Wales 2000, Australia
E-mail: james.downie@ihpa.gov.au
BMC Health Services Research 2015, **15(Suppl 2):**A2

Background: In 2011, all of the Australian governments committed to health care reform in which they agreed to use a nationally consistent "Activity-Based Funding" approach for public hospital services in Australia. This reform sought to increase the transparency of public hospital funding and improve the efficiency of public hospital services. As part of this reform, the Independent Hospital Pricing Authority (NIHA) was created, to determine the National Efficient Price (NEP) for public hospitals services, as well as the classification, costing, and counting standards used in setting the NEP.
One criticism of Activity-Based Funding is that it fosters increases in hospital activity without measuring quality, safety, or outcomes. To address this criticism, in the last two years, the IHPA has begun to develop several options for introducing quality components into the NEP. The work has been carried out in partnership with the Australian Commission on Safety and Quality in Healthcare, and is overseen by a Joint Working Party (JWP) comprised of senior clinicians from across the country. This paper gives an overview of the time-consuming and complex, but ultimately productive, work that has been carried out to date.
Materials and methods: The JWP conducted a Literature Review about healthcare pricing models. The JWP also commissioned a project to undertake a clinician-led process to identify, specify, and group a national set of high-priority Hospital-Acquired Complications, in order to facilitate routine local reporting and review. The project included three key activities:

1. A review of safety literature and of reports from hospital incident reporting systems;
2. A clinician-led and iterative identification of high-priority complications; and.
3. An analysis of identified complications that used hospital inpatient morbidity data to support clinician-identified complications.

Finally, the JWP assessed the impact of removing Hospital-Acquired Complications from DRG assignment. Its analysis of the existing administrative datasets for admitted patients demonstrated that a Hospital-Acquired Complication is reported for about 10% of patients.
Results: The literature review revealed that a rich literature exists that argues these models should reward quality and safety and many of the arguments in the literature are inherently appealing. While strong in their arguments, however, we found that most of the literature is weak on evidence.
The review project identified 39 high-priority preventable complications, 37 of which can be measured in the existing patient diagnosis datasets using the Condition On-Set Flag. The JWP subsequently launched a six-month proof-of-concept project to test this set of preventable complications' utility at the hospital level.
The JWP found that a Hospital-Acquired Complication diagnosis costs around A$9,000 per episode, and increases the patient's length of stay by approximately 5 days. The impact of ignoring these diagnoses in DRG assignment is much smaller, however, with only 3.1% of cases impacted.
Conclusions: This paper provides a detailed overview of the JWP's work to date, and highlights future areas for work.

A3

Investigating the predictors of chronic care annual funding requirements under activity-based funding

Steve Gillett[1*], Kylie Houlihan[2], Wilf Williams[3]
[1]SSAKG Consulting, Mulgrave, Victoria, 3170, Australia; [2]Queensland Health Department, Brisbane, Victoria, 4000, Australia; [3]KPMG, Brisbane, Queensland, 4000 Australia
E-mail: stephengillett2@gmail.com
BMC Health Services Research 2015, **15(Suppl 2):**A3

Background: Most health systems in developed countries are struggling to contain the costs of providing high-quality health care to their populations. Factors such as population growth, demographic aging, changing clinical practices, and lower mortality all result in increased demand for hospital services. In addition, falling mortality rates result in a larger number of people living with chronic conditions for a longer amount of time. The increased demand for services and the prevalence of chronic disease lead to higher health care costs.
Increasingly, countries are focusing on ways to keep people living with chronic conditions relatively healthy and being treated within the primary care setting — rather than allowing their condition to deteriorate until hospital care is required. Doing so requires implementing funding models that encourage integrated, effective, and preventive care.
As a first step in developing such alternative models, it is useful to understand the costs of providing care under the current model, and to be able to predict which individual patients might benefit under an alternative care model.
Materials and methods: We examined hospital utilization data for patients admitted to a Queensland (Australia) public hospital between 2009-2010 and 2011-2012 who were reported, on at least one admission, to have a chronic disease diagnosis.
We estimated the funding associated with the chronic disease by assessing the impact of specific chronic ICD codes on the activity-based funding payments (National Weighted Activity Units) for a 12-month period following a patient's first hospital admission with a reported chronic diagnoses. Adjustments were made for people who were not subsequently admitted in the 12-month period.
We used our simple model to stratify patients into risk categories based upon their predicted use of services. Actual annual hospital use was then compared between risk categories (described below).
Results: Approximately 80% of patients were rated as relatively "low risk," with only 2% rated as "extreme risk." Members of the "extreme" group used, on average, four times the resources of the low-risk group.
We found that a combination of specific conditions, indigenous status, proximity to death, and remoteness all influenced not only funding requirements but also re-admission in the 12 months following the first admission. Age was not found to be a consistent factor after adjusting for these other variables.
Further, the specific parameter estimates appear to have face validity, with increasing funding requirements stemming from more complete combinations of chronic disease; this suggests the possibility of using a person's previously documented illnesses to predict future care requirements.
Conclusions: We describe a relatively simple way of integrating an annual payment model for chronic care within an activity-based funding structure. This methodology provides hospitals with a level of funding based upon the anticipated use of resources to treat individual patients' chronic conditions over the year.
While this predictive power is currently modest, we demonstrate that a person's previous admission history can be used to predict resource requirements and, potentially, identify patients for alternative care models. In presenting these findings we recognize and discuss the limitations of our study design and discuss possible ways forward.

A4

DRG data for better decision-making in Croatia: planning for a greater use of same-day surgical admissions

Karolina Kalanj*, Karl Karol
Karol Consulting, Zagreb, 10,000, Croatia
E-mail: karolina.kalanj@zg.t-com.hr
BMC Health Services Research 2015, **15(Suppl 2):**A4

Background: In 2006, Croatia implemented AR-DRGs with the aim of increasing hospital output transparency, incentivizing efficient resource use, and measuring hospital performance and quality. Despite the intentions of this initiative, up until very recently, the hospital payment system continued to be based on historical budgets, although hospitals have been reporting inpatient activity using the DRG classifications. Only now is transition to a DRG-based payment system being planned.
In 2013-2014, a Hospital Master Planning Project was undertaken to rationalize the hospital service delivery network and to improve efficiency.

The Project also sought to create incentives to encourage the greater use of same-day inpatient services and improve the organization of the delivery of rehabilitation and palliative care services. The Project reported that the Croatian Health Insurance Fund (HZZO) does not have a strategy to encourage the utilization of same-day admissions. These services are primarily counted as part of the total DRG output for all admitted cases. Croatia uses AR-DRG version 5.2, which provides for 20 designated same-day DRGs.

In the case of same-day surgical cases, the HZZO pays hospitals through two parallel systems. The first is through DRGs, where there are only 2 are same-day surgical groups (C15B and C16B); the second is through the outpatient system, which has 17 same-day surgical case categories that, in terms of clinical activity, are replicated in the DRG system. The use of both systems and their uncoordinated pricing creates a situation in which hospitals do not have financial incentives to increase the use of same-day surgical procedures.

Recognizing that the increased use of same-day admissions would improve hospital efficiency, the Master Planning Project recommended that these admissions should be increased by 20% to 40% over a 3-year period. It appears, however, that these recommendations were made in the absence of a detailed analysis of the types of same-day procedures currently provided by hospitals. The Project did not recommend how hospital could increase their volume of same-day inpatient services, describe individual hospitals' capacity to do so, or analyze hospital waiting lists.

Materials and methods: We analyzed DRG activity data for Croatian Clinical Centres, because these institutions have both the greatest volume and the greatest potential to increase the number of same-day inpatient procedures, given appropriate incentives.

The analysis looked at HZZO DRG data from all of the Centres' surgical cases in which patients were discharged either same-day or after one-night stay (one-day cases). The methodology was selected because it was probable that many of the one-day cases could have been treated on a same-day basis, given the appropriate financial incentives.

The data analysis also looked specifically at cataract surgery, which is included in both the DRG payment model (C15B) and the outpatient payment model. The analysis compared the incidence of same-day cataract surgery cases in other hospital systems.

Results: According to HZZO's DRG data, five Croatian Clinical Centres reported that between 22% and 33% (an average of 29%) of all surgical admissions were either same-day or one-day surgical cases (see Table 1). This is consistent with research from Italy reporting that one-day and same-day cases account for around 20% and 25% of all surgical cases [1].

The number of cataract surgery cases performed by the Centres was comparatively low, compared to levels in other European Union (EU) countries. On average, 13% of the Croatian Clinical Centres' cataract cases were undertaken on a same-day basis (see Table 1), compared to a 15-country EU average of 71% [2]. Other research indicates that low rates of same-day surgery for cataracts and other interventions result from disadvantageous payment models that do not provide incentives for same-day admissions [3].

Conclusions: The Croatian hospital contracting model that is currently in use does not encourage the use of same-day admissions, and the payment system does not provide hospitals with incentives to discharge patients the same day. With the right incentives, however, we conclude that the Croatian Clinical Centres can significantly increase same-day admissions, which would improve their efficiency.

Croatian decision-makers should make appropriate use of the available DRG data to develop strategies to increase the use of same-day procedures, where clinically appropriate.

We also believe that, by not utilizing the available DRG data, it is likely that the Hospital Master Planning Project substantially underestimated the opportunity to increase same-day surgical cases.

References

1. Porcellini A, Ventura P, Federico L: **Ordinary hospitalisation, day surgery and one-day surgery: appropriateness and economic considerations in the DRG era.** *Chir Ital* 2007, **59(4)**:461-6.
2. Lafortune G, Balestat G, Durand A: **Comparing activities and performance of the hospital sector in Europe: how many surgical procedures performed as inpatient and day cases?** Paris: Organisation for Economic Co-operation and Development (OECD) Health Division, Directorate for Employment, Labour and Social Affairs 2012.
3. Castoro C, Bertinato L, Baccaglini U, Drace CA, McKee M: **Day surgery: making it happen - Policy Brief.** Copenhagen: World Health Organization European Region and the European Observatory on Health Systems and Policies 2007.

A5

Mixed model performance contracting and casemix in limited settings – the case of Lebanon

Jade Khalife[1*], Walid Ammar[1,2], Jihad Makouk[1], Rita Freiha[1], Hilda Harb[1], Fadi El-Jardali[2]
[1]Ministry of Public Health, Beirut, Lebanon; [2]Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon
E-mail: jade.khalife@yahoo.com
BMC Health Services Research 2015, **15(Suppl 2):**A5

Background: Lebanon is an upper-middle income country with 4.5 million inhabitants (as well as more than 1.2 million refugees) and total health expenditures at 7.3% of the Gross Domestic Product. Lebanon has a mixed public and private healthcare sector. The Ministry of Public Health (MoPH) functions as 'insurer of last resort' for approximately 54% of the population that would otherwise lack hospitalization coverage. The MoPH contracts 26 public and 105 private hospitals and covers about 240,000 hospital admissions annually.

Since 2001, hospital contracting is based on a link between reimbursement rate and accreditation. Accreditation has encouraged the development of a healthcare quality culture among providers, and has likely contributed to total quality management. Yet, the sole link between accreditation and reimbursement has imposed limitations that are apparent to both MoPH and the hospitals. To address this problem, since 2009, a MoPH cross-collaboration team (with membership that includes implementers, policymakers, and researchers) has worked to develop a system to capture additional dimensions of healthcare performance.

Materials and methods: We examined the appropriateness of linking hospital accreditation to reimbursement. Yang and Reinke (2006) suggest that, in the absence of national DRGs, an ICD-based casemix index (CMI) may be used, and we adopted this approach. We used the CMI to assess 122 hospitals for findings based on accreditation, ownership, and size.

Table 1(abstract A4) DRG patient data distribution, 2012

Clinical Centre	Number of admissions (NA)	Number of surgical admissions (SA)	Same-day and one-day surgical admissions (SOD)	SOD/ SA %	Same-day cataract surgery cases as % of all cataract surgical cases
Zagreb	72,733	28,956	9,446	33%	11%
Split	51,030	19,249	5,465	28%	21%
Osijek	40,622	15,187	4,944	33%	0.3%
Rijeka	40,439	17,606	5,185	29%	25%
Sisters of Mercy	56,603	25,745	5,689	22%	9%
Total/ Average	**261,427**	**106,743**	**30,729**	**29%**	**13%**

Source: 2012 DRG data from Croatian Health Insurance Fund (HZZO)

Findings indicate that only the highest-accredited (and reimbursed) hospital category had a high CMI, and that there is significant variation within accreditation categories, which suggests the presence of unfairness and inefficiencies.

Following dissemination of our findings and discussion with stakeholders, we used hospitalization data for the most recent year (2012-13) to calculate CMI for all surgical and 2-15 day medical hospitalizations (using ICD coding for medical cases, and CPT coding for surgical cases). The dataset included about 76% of the MoPH-covered admissions that occurred between June 2012 and May 2013.

Contracting scores were developed for each hospital based on the following factors and weights: a. 2012 accreditation results (40%); b. Casemix index (35%); c. Patient satisfaction (10%); d. ICU patient proportion (5%); e. Surgical-to-medical patient proportion (5%); and f. MoPH deduction for inappropriate billing (5%). The goal was to create a pricing system that reflects service complexity and quality, incentivizes good hospital practices, and discourages abuse. We calculated contracting score mean and standard deviation. Hospitals with z-score of 0 or above had the highest tariff (T1); those with z-scores between 0 and -0.5 had the middle tariff (T2); and those with z-scores below -0.5 had the lowest tariff (T3).

Results: Among private hospitals 29 were T1, 44 were T2, and 33 were T3. Among public hospitals 9 were T1, 6 were T2, and 9 were T3. Results were discussed by policymakers from MoPH and the Syndicate of Private Hospitals; implementation of the updated tariffs occurred in November 2014.

Conclusion: The new system, a 'mixed-model' for performance contracting, incorporates accreditation, casemix, patient satisfaction, and policy-oriented indicators. Additional indicators on patient outcomes are expected to be included in the upcoming 2015 contracting round. Evidence on the impact of pay-for-performance suggests early gains in several countries, but these changes may not be sustained over the long term. A locally tailored approach, which is updated and informed by policymakers and recent evidence, is critical to improve patient outcomes and resource allocation efficiency — particularly in limited-setting countries like Lebanon.

A6

Pricing the national health insurance scheme in Qatar – opportunities and challenges

Finn Goldner[1], Jim Pearse[2], Deniza Mazevska[2*]
[1]National Health Insurance Company, Doha, Qatar; [2]Health Policy Analysis, Sydney, 2065, Australia
E-mail: DMazevska@healthpolicy.com.au
BMC Health Services Research 2015, **15(Suppl 2):**A6

Background: In 2013, Qatar introduced a national health insurance scheme, called "Seha." Stage 1 of the scheme covered women aged 12 years and older for health care and maternity services. Stage 2 was launched in 2014, and covered all Qatari nationals for a much broader set of services. In the future, Stages 3 and 4 will extend coverage to all non-Qatari residents within the country as well as visitors.

The National Health Insurance Company (NHIC) manages Seha, with a Third-Party Administrator (TPA) contracted to manage provider claims. The Supreme Council of Health (SCH) acts as the scheme's overall regulator, and is responsible for activities such as specifying coverage and approving pricing.

A range of steps was taken to prepare for Seha's launch. SCH mandated clinical coding using ICD-10-AM, and hospitals recruited and/or trained clinical coders to use this system. The Australian Refined Diagnosis Related Groups (AR-DRGs) tool was adopted, and public sector hospitals embarked on the clinical costing of their services.

In Stage 1, SCH decided to use a bundled payment method for health care services. AR-DRGs were chosen for pricing acute inpatient care, using 76 AR-DRGs relevant for women and maternity services. A modification of the Australian Tier 2 classification was adopted for specialist medical services, using 9 classes relevant to women's health. In addition, a primary health classification was adopted based on 4 levels of complexity. Mammography and MRI were unbundled from the specialist and primary care service, but other imaging, laboratory, and pharmacy services were bundled into the price. Although this was not included in Stage 1, previous work had also recommended the adoption of Urgency Related Groups (URGs) classification for emergency care.

Stage 1 was implemented with a limited network including both private and public hospitals. The launch of Seha involved providing information to prospective providers and conducting subsequent sessions to assist in operationalizing the price schedule and business rules.

Seha's challenges for Stage 2 included: pricing a much wider range of services than were included in Stage 1; expanding the scheme to a wider range of providers, including "stand alone" providers (i.e. those without the capacity to provide ancillary services); and addressing the limited availability of activity and cost information from the private sector.

Materials and methods: This paper outlines the approach to pricing Stage 2, including some of the challenges encountered, and discusses the next steps for Seha's pricing over the next financial year and beyond.

An initial step involved consultations with both public and private providers. A benchmarking study of international prices for comparable services was also undertaken to provide a basis for understanding the extent to which prices and relativities aligned with other countries both within the region and around the world.

The authors obtained available activity information from the major government providers. AR-DRG cost estimates were available from a previous study undertaken at the major government hospitals (although these were impacted by the fact they were not based on ICD-10-AM coded data). High-level cost estimates, which were available for other care streams, were used towards pricing.

Similar data from private providers were not always available. Instead, researchers sought to use current price lists, aggregate costs, and summary data (where unit record activity data were not available) from these providers.

Results: Various payment policy options were explored and advice developed. These included issues such as unbundling pharmacy costs from specialist and general practice costs and creating differential pricing for initial, subsequent, and repeat specialist attendances. In addition, a price schedule was developed for the full range of admitted and non-admitted services, accompanied by a comprehensive set of business rules.

The information being gathered in Stage 2 will be used as the basis for pricing services and fine-tuning business rules to improve the existing methodology and prepare for Seha's next stage. Using the standard network agreement, NHIC has gained a commitment from all providers to report their costing data to SCH, which will provide additional information towards pricing.

Conclusions: The design of the payment system underpinning Seha was ambitious in beginning with a bundled model across both inpatient and outpatient sectors. The desire for a bundled system had to be balanced with the need to collect information at a granular level to enable analysis of service use and morbidity patterns, and for decision-support in implementing the National Health Care Strategy.

Challenges remain that will be addressed in the pricing schedule's future refinements. The first challenge is to gain insight from claims data for use in fraud and abuse prevention, clinical quality assessments, and cost-efficiency evaluations.

The second is to ensure a provider structure based on a sustainable payment model that allows providers to sustain their business model, and enables payers to avoid unsustainable cost increases over time. Qatar's provider structure is diverse and further costing data will generate insights into the relationship between cost, quality, and prices. This will enable the introduction of models that reward providers for quality of care, while retaining the overall philosophy of a standard price list.

The final challenge is to leverage the specific opportunities provided by a new payment system to introduce innovative models of payments and incentives — especially with respect to bundled payments for outpatient services.

The steps taken thus far provide a beneficial starting point for making such improvements in the future.

A7

Cost impact of hospital acquired diagnoses and impacts for funding based on quality signals

Jim Pearse[1,2*], Deniza Mazevska[1], Terri Jurgens Jackson[3]
[1]Health Policy Analysis, St Leonards, New South Wales, 2065, Australia; [2]Australian Health Services Research Institute, University of Wollongong,

Wollongong, New South Wales, 2522, Australia; [3]Northern Clinical Research Centre, University of Melbourne, Epping, Victoria, 3076, Australia
E-mail: JPearse@healthpolicy.com.au
BMC Health Services Research 2015, **15(Suppl 2):**A7

Background: Internationally, there have been efforts to adjust hospital funding based on the quality of care provided by the hospital. A variety of approaches has been used by different countries and payers. Incorporating quality signals into activity-based funding is also a possibility for Australia.
This study set out to explore the cost impact of potentially poor quality care in Australian hospitals, and to understand the implications from a funding perspective.
Materials and methods: Since 2008, Australia has incorporated into its routinely collected hospital data a flag to indicate whether each diagnosis was pre-existing at the time of admission, or if it arose during the hospital stay (i.e., a hospital-acquired condition). This is known as the Condition Onset Flag (COF).
This study used the Admitted Patient Care National Minimum Data Set (NMDS) and the National Hospital Cost Data Collection for 2011-2012. These are routine national collections of admitted patient data, and activity-based costing data, respectively.
The analysis of the cost impact was limited to medium and large hospitals (i.e. facilities with approximately 2,000 or more separations annually, using the national peer group classification). Within these peer groups, the analysis included only hospitals that coded the COF. The analysis was further restricted to acute episodes of admitted patient care (for example, excluding rehabilitation and palliative care episodes), and a set of Australian Refined Diagnostic Related Groups (AR-DRGs) identified by the Australian Commission on Safety and Quality in Health Care (based on volume, cost, and priority areas for quality and safety initiatives). Just over 400,000 episodes were included in the detailed analysis.
The primary analysis was based on a Generalized Linear Model in which differences in cost or length of stay were modeled using the presence of hospital acquired conditions as explanatory variables, together with a range of control variables (including age, emergency care status, and the presence of other comorbidities). Alternative specifications for the presence of hospital-acquired conditions were estimated, using the Classification of Hospital Acquired Conditions (CHADx) [1]. Models were estimates for each adjacent AR-DRG.
Results: An estimate was made of the total incremental impact of the presence of hospital-acquired conditions, both within the sample, and scaling it to reflect all acute episodes allocated to the selected conditions and/or interventions (mapped to Adjacent DRGs) in the selected public and private hospitals.
Across the sample of conditions and/or interventions identified by the Commission, the mean incremental impact of the presence of any COF diagnosis was estimated to be 9,244 AUD (with a median of 6,710 AUD).
Scaled to all acute episodes, hospital-acquired conditions accounted for between 12% and 16.5% of total costs within the sample, and between 11.6% and 15.9% of costs across all hospitals for the selected conditions.
Across all acute episodes assigned to Adjacent DRGs of the selected conditions, the incremental cost of hospital-acquired conditions was estimated to be between 634 million and 896 million AUD. To place this estimate in context, total expenditures for public hospitals were 40,384 million AUD in 2011-2012, of which approximately 28,000 million AUD (70%) was related to admitted patients.
The highest costs were associated with less costly (per case) but more frequent complications. Total cost impacts of these conditions ranged from 10.9 million AUD for pressure ulcers (1,866 episodes) to 27.4 million AUD for electrolyte disorders without dehydration (9,808 episodes).
Conclusions: This study's estimate of the cost impact of hospital acquired diagnoses offers insights into costs that could be shifted, if incorporating quality signals into activity-based funding reduced these complications.
Four broad options for how quality signals might be incorporated into funding are:
1. Maintain the current core activity-based funding approach and create a separate funding / payment stream related to performance against quality-related measures / benchmarks, including those based on analysis of hospital acquired conditions.
2. Exclude all hospital-acquired complications when assigning DRGs, so the presence of such a diagnosis does not impact the patient's DRG (and the facilities' subsequent funding).
3. Exclude a subset of hospital-acquired complications in the AR-DRG assignment.
4. Exclude the costs of hospital-acquired complications in calculating the price weights for each DRG.
While not all hospital-acquired conditions can be prevented with current medical knowledge, incorporating quality signals into pricing might motivate greater efforts to reduce them, where possible.
The limitations of the study should be noted. We found coding of the COF to vary between hospitals and states. The study is vulnerable to endogeneity bias because of the circular relationship between length of stay and rates of hospital-acquired harms. Length of stay may be extended by complications that arise during the admission, but longer stays also expose patients to a higher probability that a hospital-acquired condition will occur. Both are highly correlated with higher costs.

Reference

1. Jackson T, Michel JL, Roberts RF, Jorm CM, Wakefield JG: **A classification of hospital-acquired diagnoses for use with routine hospital data.** *Med J Aust* 2009, **191(10)**:544-548.

A8

Creating the foundation data for building a population grouping methodology – lessons learned at the Canadian Institute for Health Information (CIHI)

Heather A. Richards[1*], Jingbo Zhang[2], Laura Faye[3]
[1]Case Mix Department, CIHI, Victoria, British Columbia, Canada V8W2B7; [2]Case Mix Department, CIHI, Ottawa, Ontario, Canada K2A4H6; [3]Case Mix Department, CIHI, Toronto, Ontario, Canada M2P2B7
E-mail: HRichards@cihi.ca
BMC Health Services Research 2015, **15(Suppl 2):**A8

Background: In April 2013, CIHI initiated a project to develop a population grouping methodology that stratifies a population based on past clinical information and produces risk measures (i.e., costs for the prospective year). The methodology includes all individuals in the population at a given moment, including those who are not using the health system.
The foundation data for this project include historical clinical administrative and utilization data that are linkable at the individual level. Ideally, such a methodology includes multiple years of data that cover multiple health sectors and the full population. For example, if two years of data are used to develop clinical profiles, and if predictive indicators aim to estimate need one year in the future, then three consecutive years of data are needed. It is also important to assess the stability of the predictive indicators over time and to determine the optimal historical review period for the clinical classification; as a result, there is a need for additional years of data for such a project.
One goal for this project was for the methodology to be useful to the majority of Canadian provinces. A province will not benefit from any methodology where person-level linkable clinical information are not available to apply (vs. develop) the methodology. Clinical data only are needed to apply the final methodology, so they need to be of a consistently high quality across the provinces.
This rationale influenced the choice of health sectors to incorporate into the methodology. CIHI does not have full pan-Canadian coverage of patient-level linkable clinical data for all health sectors. Some sectors have partial or no coverage within some provinces (e.g., emergency department, home care, long-term care, drug prescriptions). Some sectors have full coverage within the provinces, but CIHI does not have access to patient-level linkable data (e.g., physician billing). Additionally, while data coverage may be sufficient in the present, historical data can be limited. These coverage issues influenced the sectors and provinces included in the foundation data.
Materials and methods: We found that many data issues affected the methodology development. Physician billing data are critical for this methodology but, unfortunately, have notable quality issues. There are few standards or edits in place to capture diagnoses; physicians use ICD-9 to capture diagnoses but some supplement this classification with additional non-ICD codes. Physicians typically report one diagnosis per billed service, which increases the risk that comorbidities are missed. Sometimes the diagnosis reported is a symptom of an underlying disease; sometimes no diagnosis is reported for a billed service.

For the development of predictive indicators, the foundation data need to also represent the health system resource use for each individual. But, it was too restrictive to limit the foundation data to persons for whom complete cost information exists (for example, an individual might visit multiple hospitals, and/or see multiple physicians, etc. over a two-year period and all these costs need to be accounted for when building the foundation data). Instead, this project established estimation methods to address gaps in the cost data. Shadow billing was used to impute patient-level costs for the physicians on alternative payment plans. For non-case-costed hospital encounters, the cost weights generated from CIHI's casemix methodologies were used and converted to a dollar scale.

A population grouping methodology includes health system non-users who are not currently captured by CIHI data. Initially, we believed that pseudo records for non-users could be imputed by comparing population census estimates to health system user counts in CIHI's data. However, when compiling data over multiple years, over-coverage issues in CIHI's data became significant: not all of those who had left the province or died could be identified with CIHI data. To address this issue, we added the registered persons database (which is maintained by provincial ministries) to the foundation data; this database tracks the enrolment start and end date for each person who is eligible to receive public health care.

Results: Person-level cost information is a combination of actual and imputed patient-level costs. The foundation data include four Canadian provinces that have sufficient historical clinical and cost data and where a registered persons file could be obtained. The data include six consecutive years of physician claims data, hospital inpatient data, day surgery data, emergency department data, and long-term care assessment data. The health sectors included in the foundation data were chosen based on data coverage considerations as well as the relative contribution that the health sector makes to understanding disease burden in a population.

Conclusions: Creating foundation data for the development of a population grouping methodology is a significant undertaking. This paper focuses on the elements that were important for methodology development. Not discussed in this paper are the technical challenges of manipulating very large databases and standardizing data across databases and over multiple years.

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Predictive models of the risk of hospital admission and re-admission: current and future development

Stephen Sutch*, Klaus Lemke, Chad Abrams
Johns Hopkins University, Baltimore, Maryland, 21218, USA
E-mail: ssutch1@jhu.edu

BMC Health Services Research 2015, **15(Suppl 2):**A9

Background: A number of models are available in the United States (US) and the United Kingdom (UK) for use in predicting the risk of hospitalization, from general and insured populations. These models are being used in order to respond to health policies, such as Pay for Performance measures, aimed at reducing unnecessary hospital admissions, and to help patients avoid hospital admissions that are expensive and create risks to patient safety. These predictive models are being used for a variety of purposes including: screening patients for Case Management Programs and/or Disease Management Programs, organizational profiling, and assessing financial risk.

Materials and methods: The analysis was conducted using data from US commercial and Medicare populations, and from the UK National Health Service General Populations. The predictive models were derived using patient-level data (including population health and primary, community and secondary care data), with the classification of diagnostic, pharmaceutical, and historic utilization data. The Johns Hopkins Adjusted Clinical Groups (ACG) Case-Mix System was used in order to reduce the number of variables and provide measures of multi-morbidity.

Logistic Regression was undertaken to produce models on the dichotomous outcomes of hospitalization within 6-12 months, emergency and/or unplanned hospitalization within 12 months, re-hospitalization within 30 days, and long-stay hospitalization.

The models were validated using split-half method, and providing ROC (Receiver Operating Characteristic) analyses to compare different model performance.

Results: The models work well in explaining the top 1% and 5% of data; they also perform well in discriminating risk occurring "lower in the population pyramid" in order to identify potential emerging risk. The results demonstrate the importance of case-mix classifications to reduce data complexity and provide robust measures of multi-morbidity.

Conclusions: While these models focus on identifying the highest-risk individuals, there is also a public health interest in recognizing earlier and emerging risks where more preventative methods can be informed, such as chronic disease self-management programs. In their current form, these models are being used to identify populations, but work on newly evolving data from Electronic Health Records, Personal Health Records, and Social Care data is expected to provide greater insight into both these populations and those with highest need.

Cite abstracts in this supplement using the relevant abstract number, e.g.: Sutch *et al.*: Predictive models of the risk of hospital admission and re-admission: current and future development. *BMC Health Services Research* 2015, 15(Suppl 2):A9