Multi-funder Data Analytics : Potential Opportunities

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BACKGROUND

Globally health costs are becoming an unsustainable burden on national budgets.   Pressures on healthcare costs include a change in societal demographics with older citizens representing a larger percentage of the population and increases in the cost of state-of-the-art treatments and procedures. Most industrialised countries are committed to ensuring the provision of universal or near-universal health care through a combination of public and private insurance and/or equivalent publically-funded and operated health programs.   In the US the total cost of healthcare is moving towards representing 20-25% of GDP[1].   In Australia the total cost of healthcare is estimated to be circa $120 billion per annum, with public healthcare costs amounting to $70 billion, and the remaining $50 billion fragmented among other healthcare funders, predominantly public and private health and accident compensation insurers.   It should also be noted that consumers fund an increasingly significant component of their own health care, but are technically not classified as funders.

As funding organisations grapple with the issue of how to improve health outcomes while keeping spiralling costs under control it becomes clear that these seemingly irreconcilable goals require massive volumes of quality, contemporary data to guide policies and to manage activities to ensure the optimal balance of these goals.

The National Health and Hospitals Reform Commission [1] has outlined a number of reform goals to address the increased demand for health services as the population is ageing and more people are living with chronic disease.   A major objective is the smart use of data and information to:

    a) manage *efficient* services, in particular high cost services for both chronic and acute care;

    b) monitor *health system performance* through measurable health outcome indicators; and

    c) promote *health improvement* and preventive health strategies, for the entire range of healthcare services provided by both private and public sectors across the health services network.

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[1] Payments made by the US publically funded Medicare (over 60s) and Medicaid (safety net) schemes are in the region of $1.3 trillion per annum.

However, health data in Australia is notoriously fragmented as a direct result of the multi-pronged funding regime referred to above. In relation to collecting and analysing data to assure improved population-wide health outcomes, the key Australian public sector strategy seems to rely upon the 're-use' of the data to be collected via the Personally-controlled Electronic Health Record (PCEHR) scheme. Examining progress to date, and the experiences of other countries, it is unlikely that this scheme will deliver on this promise for at least one or two decades, if ever, given that many Australians may not opt into this scheme.

Viewed in this context, transactional data collected and managed by public and private insurance schemes, ideally augmented by data in a similar form for publically funded hospital admissions, present some unique opportunities to plan for and manage improved health outcomes and improved cost efficiencies. This is because both business data (e.g. cost of services) and clinical data (in the form of CMBS procedure codes, ICD-10 Diagnosis codes and DRG codes) are available to them through the claims submitted by doctors and hospitals as well as via the Hospital Case-mix Protocol (HCP) data submitted by public and private hospitals. Using an expanded transactional data set by combining business data in the claims with clinical data in the HCP records gives us the capability to measure several nationally-accepted indicators [5], and analyse key aspects of health economics such as efficiencies, as well as health outcome and clinical performance indicators of several services identified as national priority areas. These possibilities have been incorporated into the CMC-HIBIS and I+PLUS[2] software solutions of CMC Insurance Solutions, a subsidiary of the Capital Markets Cooperative Research Centre. The I+PLUS solution provides advanced performance analytics based upon claims-scoring and predictive modelling. The solution computes, analyses and predicts trends and patterns in areas of cost, efficiency and quality of care, and has been designed to apply to public and private health and accident compensation insurance as well as publically funded health areas such as hospitals and the state and federal funding bodies.

CLAIMS ANALYTICS FOR A SINGLE HEALTH FUNDER

Most health insurance (PHI) organisations have a clinical audit department that reviews abnormal claims or claiming anomalies where the focus is usually on individual claim data received from doctors and hospitals for each patient admission and then determines the claim anomalies to be followed up with the relevant provider. However, as we move from individual claim anomalies to patterns of anomalous claims, we start to get an idea of some interesting trends.

Within a particular health fund, when claims and claim anomalies from multiple providers are analysed, a variety of provider-based and medical procedure-based trends start to emerge. These trends can provide decision makers with information related to (comparative) costs and services, which in turn can be used to review performance of providers as well as specific clinical services. These reports can basically augment the actuarial reports used by PHIs, enabling 'informed' contract negotiations and service agreements with medical and hospital providers.

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[2] http://www.cmc-is.com/index.php/main/solutions

MULTI-FUNDERS ANALYTICS: A UNIQUE OPPORTUNITY

Currently privacy and confidentiality concerns have meant that, in general, claim-based analytics are only performed with each insurer's silo.   However, multi-funder analytics provides a unique opportunity to a wide range of healthcare stakeholders to a view claims and treatments, and claiming and treatment patterns within a broader perspective. This could encompass focusing on a set of standard national indicators as developed by AIHW [5]. The organisations that could benefit include: the individual private and public health insurance providers, the Health Insurance sector overall, statutory agencies such as Work Cover Authorities of State Governments, Compulsory Third Party Insurance (CTP), State Government Health Departments, the Federal Government Department of Health and Ageing, as well as Public and Private Hospitals.

Key to achieving this will be:

a. Privacy preserving technologies that assures Australians (and the appropriate regulators and advocates) that linkage of data across 'silos' will be done at a level of abstraction that protects their privacy rights.

b. Confidentiality preserving technologies that assures health and accident compensation insurers that there will be no compromising of their competitive positions.

c. Data handling facilities that can effectively manage the massive data volumes inherent in such a multi-funder analytics scheme.

d. Researchers that can add value by undertaking research that transcends the 'interesting' and produces genuinely 'actionable' outcomes.

e. Data handling and analytical technologies tuned to not merely managing and interpreting the data but ensure its delivery to the point of activity be this funding or end-patient service provision.

When positioned in an appropriate privacy-preserving, secure platform, the expanded transactional data set of claims and HCP (and ideally public hospital equivalents) has the potential to offer Multi-Funder Analytics Services to each of the agencies mentioned above, by taking a *population-based approach,* rather than an individual institutional approach, in the national Priority Areas of: (a) Managing efficiencies, (b) Monitoring health outcomes, and (c) Promoting health improvement.

While each Funder can have their own analytics platform, we need the collective will power of what we have called "multi-funders" to position their claims (or claims-equivalent) data in the larger context of the whole sector, enabling both a local view and a sector-wide view of the trends and patterns related to costs and health outcomes.

While (multi-funder) analytics will necessarily have to be performed at the population level, the underlying data will have the richness of individual episodic level of admissions and discharges, lending a robust credibility to the population-based analytics.

Next we present a framework to enable individual health funders as well funding and performance assessment agencies such as the Independent Hospital Pricing Authority (IHPA), and the National Health Performance Authority (NHPA) to perform Multi-funder Analytics in a privacy-preserving secure platform.

A FRAMEWORK FOR MULTI-FUNDER ANALYTICS

The framework presented here is based around a secure platform supported with a range of tools and techniques to provide new information services that can contribute to the overall health sector. The proposed platform enveloped with appropriate high security protocols and controls can enable different stake holders to perform advanced analytics to measure and review the health status of the population under their jurisdiction and also measure their own individual performance in the context of the overall health system performance. Some examples include:

i. Analysis of provider behaviour (to analyse effectiveness and sustainability)
ii. Analysis of outcomes of specific (high cost) procedures (to study health outcome)
iii. Evidence and outcome-based analysis (to improve quality of clinical services)

The first (base) layer deals with *de-identified* claims data from multiple service providers processed by each individual funder. This includes: (a) claims (or equivalent) data from doctors and hospitals, HCP data from hospitals, claims data from ancillary service providers; (b) Claim anomalies data pertaining to individual claim anomalies, and provider anomalies, identified using e.g. the CMCIS leakage-detection and predictive modelling solutions as applied to the claims of each specific funder.

The second (middle) layer provides a larger multi-funder context to all stake holders where de-identified aggregated data from each individual fund contributes towards advanced analytics at the sector level. For example, assessment of health outcomes of specific treatment procedures, comparative analysis of costs of treating specific chronic diseases, comparative analysis and performance of high-cost prosthesis, service provider profiling based on activity mix, study of disease profile and risk analysis, trends in disease progression of specific disease such as heart, cancer, and kidney disease, developing indicators to develop targeted preventive health programs.

The top most (privacy) layer provides a set of privacy-preserving wrapper tools to support a variety of requirements such as encryption of identifiers, specification of 'conditions of use' around low level claims data, and privacy preserving analytics [14] to support reported results that cannot be traced back to individual claims data.

The Multi-funder Analytics framework shown in Figure 1 has three distinct layers.
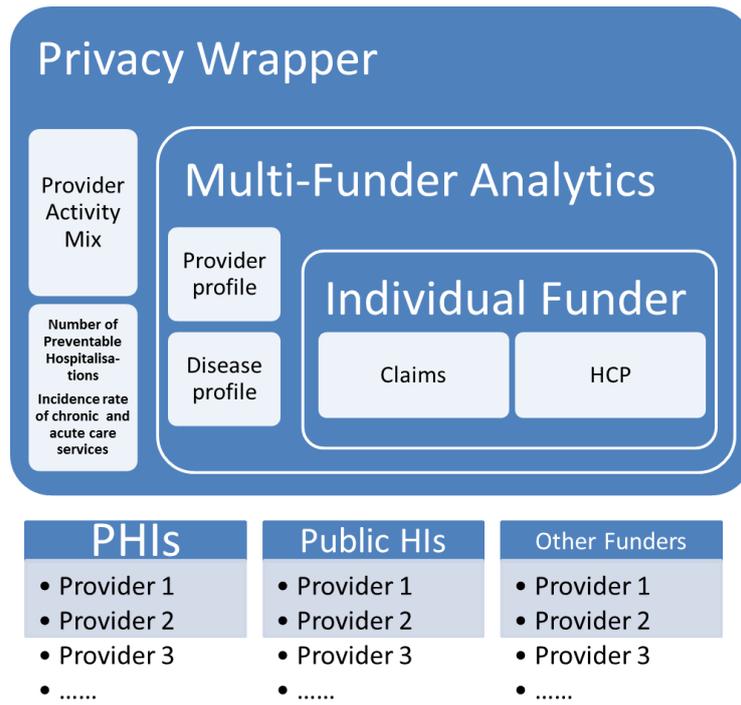
Figure 1: Multi-Funder Analytics Framework

APPLICATIONS

A. **Health System Performance: Managing Efficiencies**

The Australian Government's healthcare reform agenda [2] places significant importance on activity-based funding models. The framework for accountability for hospital networks is based on "efficient price of services" and "performance measures". Analysis of claims and HCP data (coming from medical practitioners and hospitals) to individual PHIs, when assembled in a secure platform gives individual funds a powerful way to develop some economic indicators to analyse efficiencies from several perspectives. Public hospitals have or are able to develop something that is analogous to this.

Some examples of AIHW indicators that can be measured from claims (and equivalent) data include:

    I. Survival following heart attack

    II. Survival of people diagnosed with cancer who survive '5' years after hospitalisation

    III. Adverse events treated in hospital

    IV. Falls resulting in patient harm in hospitals

    V. The average cost per separation for acute and non-acute care in public hospitals (based on actual cost and case-mix adjusted cost)

    VI. Total cost by (selected / high cost) MBS service (will be more valuable if we can get alert ratios for these services – cost of alerts)

    VII. Potentially preventable hospitalisations (These include those that are vaccine preventable such as measles, acute conditions such as ENT infections, chronic conditions such as Diabetes.)

Further Analytics can be performed to study trends in certain patterns of behaviour, which can then be used to develop some predictive models. Some examples include:

VIII.   Provider Analysis based on: Costs, Length of stay (LOS) for specific procedures/conditions, and Activity mix . A mixture of these can be used as metrics and performance indicators for analysis of provider performance

IX.   Analysis of activity by volume and frequency of specific (high-cost?) procedures. Here activity-based metrics can enable activity-based resource allocation

X.   Cost Analysis of different types of chronic and acute care procedures

XI.   A Relative Length-of-stay Index for Hospitals [3] (for chronic and acute care)

XII.   Exploring the idea of "clinical service waste" [4] as has been done in some countries e.g. USA, UK, France.

XIII.   Identify potential preventable hospitalisation

(Note: Definition of Potential preventable hospitalisation as defined by AIHW [12]: Admissions to hospitals that are potentially preventable include: vaccine preventable diseases (such as measles), acute conditions (eg ENT infections) and chronic conditions such as diabetes)

B. Health Status: Monitoring Health Outcome

In order to improve the quality and safety of health care services, we need clearly defined performance indicator sets to measure health outcomes.

AIHW has identified a number of indicators [5], many of which can be gathered from PHI data. Some examples include:

I.   Incidence of heart attacks

II.   Incidence of selected cancers

III.   Incidence of end-stage kidney disease (??)

IV.   Hospitalisations for injury and poisoning

We can also develop additional indicators from an analysis of multi-funder data to analyse specific trends in the health outcomes of specific high cost procedures such as orthopaedic and cardiac procedures, outcomes on the use of specific (high cost and frequently used) prosthetics.

Some examples of analytics include:

I.   Trends on Quality of Care (QOC) indicators (e.g. readmissions with 28 days for specific CMBS, by age groups, by post codes, etc.)

II.   Trends on high cost procedures such as hip and knee replacement procedures by medical provider, hospital, patient, and any combination thereof.

III.   Trends on prosthetics performance (based on for example frequency of revision procedures).

IV.   Risk Analysis to evaluate efficacy of high cost procedures (such as knee replacement and hip replacement procedures) based on patient profile, frequency of revision procedures.

V.   Develop some evidence-based indicators for disease progression and monitoring (for example – analysis of chemotherapy for specific cancers).

      VI.   Explore / develop "value" measures / metrics for certain treatment procedures.

C. Health Improvement and Preventive Health

The burden of chronic disease is projected to dramatically increase into the future. By 2032–33 combined spending on cardiovascular and respiratory diseases is projected to be around $40 billion annually, while spending on type 2 diabetes is projected to increase by 520 per cent between 2002–03 and 2032–33 [10].

In order to manage chronic disease in a coordinated manner for an ageing population, we need to generate metrics that can measure health outcomes in the areas of:

i.   Prevalence and Trends in of preventable disease (e.g. Type II Diabetes)

ii.   Potential preventable hospitalisation (based on AIHW code specifications)

iii.   Disease progression and Treatment patterns based on sequence of admissions and discharges including diagnosis and procedure codes for each admission, for acute care.

iv.   Disease trends that require targeted preventive health strategies (eg screening for cancer, health education for chronic conditions such as Type II Diabetes, arthritis, etc.

v.   Develop Treatment comparators [6] to study progression of certain chronic diseases.

vi.   Metrics for measuring 'effectiveness' and comparative safety? of certain (specific) treatment procedures [7] (Ref HTA paper).

vii.   Disease progression - disease pattern - to enable early detection, and early engagement / intervention to prevent onset and progression.

viii.   Developing a strategy for identification of epidemics, through analysis of Outbreaks (appearing as ICD 10 Diagnosis codes in Claims data) [8].

ix.   Developing Provider indicators [9] to sponsor targeted Preventive health programs.

AN EXAMPLE SCENARIO

In this section we provide some specific examples of indicators to analyse the health system performance using the multi-fund analytics framework specified in this paper. We illustrate the examples in the national context by using the definitions from AIHW indicator set [5].

Table 1 shows the AIHW indicators that can be extracted from claims data and HCP data received by PHIs from both Public and Private Hospitals.

AIHW Indicator	Availability in PHI Claims data	Availability in PHI HCP Data
Incidence and prevalence of important preventable disease and injury	Y	Y
Selected potentially preventable hospitalisation		Y
Unplanned readmissions within 28 days of surgical admission	Y	Y
Selected adverse events treated in hospitals		Y
Falls resulting in patient harm in hospitals		Y

AIHW Indicator	Availability in PHI Claims data	Availability in PHI HCP Data
Total cost per medical specialist NBS service	Y	Y
Cost per case-mix adjusted separation for acute care episodes in hospitals		Y

We next illustrate specific examples (of complex reports and trends) for each stake holder in the health sector.

For Health Funders

I. Provider–based analysis of high cost procedures such as hip and knee replacement procedures, including cost comparisons of specific doctor-hospital combinations, and length of stay (LOS) comparisons, leading to trends in best-practice.

Example: An initial analysis shows that patients undergoing a specific procedure (hip replacement) with certain providers have consistently longer stays at the hospitals. A closer review indicates that these are often cases where the charges are based on case payment contracts.   This can help the individual funders examine the basis of their case payment contracts/funding schemes.

II. Disease progression and related costs for expensive procedures e.g. chemotherapy

Example: An initial analysis of chemotherapy data shows a clear trend in the increase use of more expensive procedures. It is also possible to clearly identify those doctors whose charges are significantly and consistently higher than national averages for the same type of treatment procedure.

III. Analysis of health outcomes for high cost procedures such as hip and knee replacement procedures

Example: Preliminary analysis of claims for hip and knee replacement indicates that significant number of patients returns for revision procedures within a short period of time. A comparison with national Medicare statistics reveals the same trend at the national level. However, when viewed in the international context, Australia appears to have a significantly large percentage of revision procedures [16] when compared to other developed countries such as Sweden and Norway.

IV. Cost Correlation (Models) between expensive doctors, expensive hospitals and expensive patients for specific diseases / treatment procedures.

Example: Initial percentile analysis of charging pattern of providers who consistently overcharge for most of the chemo procedures. A correlation model can be used for any high cost procedure like hip replacement or chronic disease like diabetes.

V. Provider-performance in terms of hospital returns within 28 days for acute care services

For Insurance Scheme Alliances

Reports related to:

  I.   Comparative performance of Service providers for specific high cost procedures

 II.   Outcome reports - Performance of specific high cost prostheses

III.   Correlation of Activity mix of hospitals and costs

IV.   Relative stay Index of hospitals

For Work Cover Authorities

Costs of treating specific injuries example spinal injuries, relative comparison – and against national average.

Predictive models for expected outcomes and costs for specific injury types (Allan and Bavani may be able to say more here).

For Therapeutic Goods Authority

Outcome based indicators to analyse performance of specific high cost prosthetics such as defibrillators, and prosthetic components used in used in hip and knee replacement procedures.

For Medicare

Develop predictive models for health outcomes of specific high cost chronic and acute care treatments.

Compare public and private hospitals performance for specific acute and chronic diseases

Compare performance of clinical specialists based on health outcome indicators

For Hospitals

  I.   Selected potentially preventable hospitalisations
 II.   Cost Comparison of specialist services
III.   Design/develop optimum care-coordination model for acute, chronic and most expensive treatments
IV.   Provide metrics to determine quality of care - in particular identify areas where hospitals can divert expensive care into the community to reduce expensive admissions.

For State Government Departments

  I.   Compare public and private hospitals performance for specific acute and chronic diseases

 II.   Activity mix of hospitals

III.   Relative stay index of hospitals

For Federal Government Departments

  I.   Treatment Efficacy and Health Outcome metrics could be used in conjunction with external registries such as Cancer Registries (using data linking technologies) we can come up with resource allocation models based on objective outcome-based measures.

 II.   Measures for efficiency

III. Calculation of Allocative Efficiency[3] (to review balance of health services)

IV. Predictive models for health outcome

V. Rising costs of chronic care – PHI based, provider-based

VI. Trends – disease prevalence

VII. Diagnostics versus therapeutic procedures

CONCLUSIONS

Multi-funder Analytics offers a unique opportunity for Australia to address several important aspects of health system performance (in addition to reducing costs due to fraud, waste, abuse and errors addressed by e.g. CMC-HIBIS).   If appropriately executed across most or all significant funders of healthcare the operationalized version of the framework provides the opportunity for stake holders to have:

a) A facility to make informed decisions in regard to resource allocation and contract negotiation with service providers based on their performance and alert profile.

b) Tools for surveillance and risk analysis to evaluate efficacy of specific high cost procedures and treatment regimes

c) A platform to enable the development of targeted preventive health services for chronic and acute conditions;

d) A platform to enable targeted services in case of disasters and epidemic outbreaks.

Importantly, the suggested framework addresses the issues of preserving privacy and confidentiality at various levels of aggregation.

What we now need is the collective will power of health funders and a strategic vision of the regulatory bodies to seize the opportunity of achieving cost efficiencies without compromising quality of care or privacy and confidentiality.

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[3] Allocative Efficiency is defined as spending to produce clinical services that provide marginal or no health benefit over less costly alternatives; includes those services that have detrimental or small positive effects compared with less costly services

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