6th Capacity Building Seminar In Health Care Insurance
The Pllazio Hotel, Gurugram
2nd August 2018

Indemnity Product Performance Review

Neha Taneja, Consultant - Healthcare
Rachin Aggarwal, Consultant - Healthcare
Milliman

Institute of Actuaries of India

Cover

- This presentation is a part of the “6th Capacity Building Seminar In Health Care Insurance (CB HCI)” organised by Institute of Actuaries of India (IAI) held on 2nd August 2018.
- The purpose of this presentation is to provide a brief description of what encompasses a product performance review and the reasons for carrying it out regularly with key emphasis on the ways to carry out a robust performance review to help with informed decision making. This will include discussion on the importance of data, steps to prepare the data along with various basic and advanced tools and techniques for performing the review.

Note:

- These slides are illustrative and should not be relied upon for decision-making. They are a summary and necessarily omit details that may in some situations be relevant. We recommend that should you intend to act upon the content of this presentation, you should consult with the presenter for appropriateness for your use.
- The contents of this presentation should not be quoted, referred to or shown to any other parties without our prior written consent. Milliman assumes that users of this presentation will seek explanation and/or amplification of any part of the presentation that they consider unclear. We remain available to answer any questions which may arise regarding this presentation.
- Some of the information contained within this presentation has been obtained from the public domain. We have not performed a thorough audit of this information, but have carried out basic checks for reasonableness. Milliman is not responsible for the accuracy of this information.

Agenda

01	**Introduction**
02	**Product Performance Review**
03	**Data quality and standardisation**
04	**Analytics**
05	**Final thoughts**

- What
- Why
- How

- Basic
- Advanced

1 Introduction

Moving towards advanced analytics…

Institute of Actuaries of India

Health Insurance Value Chain

Indemnity Plan	Managed Care	Integrated Delivery System

Financing and Insurance		Care Management			Care Delivery
Planning Marketing and Sales	**Actuarial & Operations**	**Member Management**	**Provider Management**	**Care Management**	**Care Delivery**
• Branding • Product development • Sales channel management	• Pricing & reserving • Claims • Enrollment & eligibility • Billing • Connectivity • Management reporting & analysis • Utilisation & unit cost targets	• Member engagement education & information • Appeals/ grievances • Member services	• Network development provider contracting • Provider reimbursement • Provider relations • Credentialing • Provider profiling	• Utilisation management • Case management • Demand management • Disease management • Clinical outcomes measurement • Quality measurement & improvement	• Primary care • Specialty care • Hospital care • Physician practice management • Pharmacy • Ancillary service • Skilled nursing care • Long-term care • Rehabilitation care

"Standard" insurer analytics → Basic clinical data & analytics → Advanced power analytics, combining clinical and financial

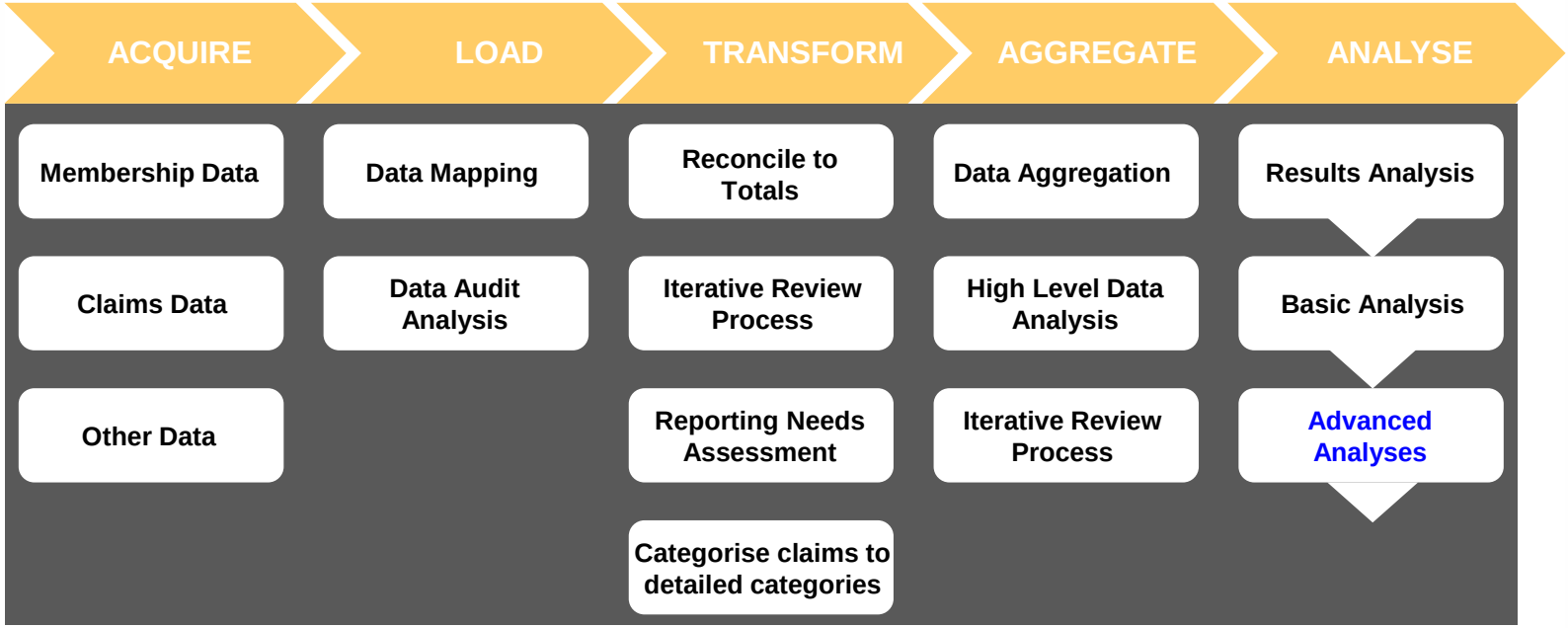
WHAT is product performance review?

- Primary **foundation** of actuarial work.
- Exercise of **analysing claims experience** of a product that occurred within a pre-determined time period pertaining to the population insured under that product.
- Identification of the **trigger events** that often result in financial loss or gain for the insurer.
- Compares the actual outcome with previously established expectations (**A/E**).
- A complete product performance review for a typical indemnity product is likely to include an **A/E analysis** of:
  - Business mix
  - Claim incidence
  - Average claims cost
  - Trends
  - Expenses

WHY is product performance review required?

- Provides **insightful results** that can improve decision making.
- Key outcomes can be embedded in operational processes to help **improve efficiency** and deliver improvements.
- Produce results to **serve various stakeholders**.
- **Benchmarks** from own data to improve underwriting performance.
- **Provider profiling**.
- **Population profiling**.
- Help understand **key drivers** behind historical results.
- Help with development of assumptions for **pricing, valuation and financial analyses**.

HOW to carry out product performance review?



GOOD QUALITY DATA IS KEY TO CARRY OUT THE ANALYSIS AT AN ACCEPTABLE LEVEL OF ACCURACY!

Institute of Actuaries of India

2 Data quality and standardisation

Complications faced in data processing

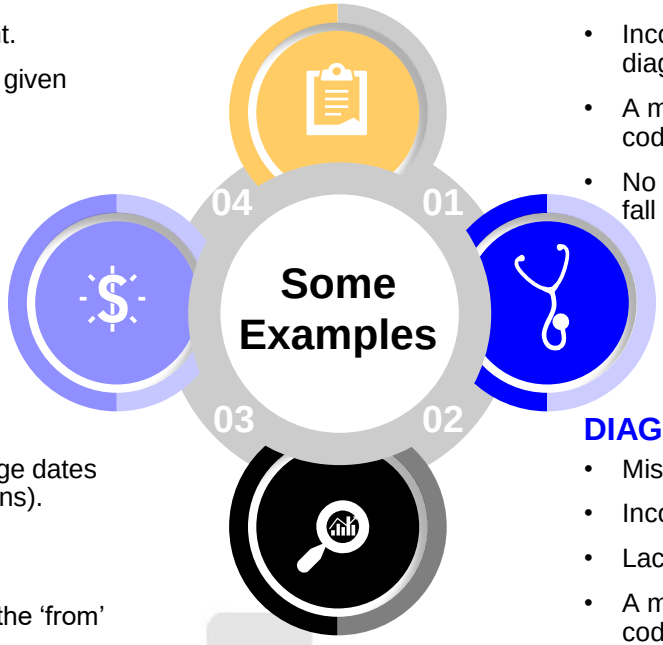
Commonly found complications in various parts of different datasets that limits the use of that data in all the analyses – particularly advanced analytics.

CLAIM AMOUNTS:

- Zero allowed amounts.
- Billed amount less than paid amount.
- Negative aggregated amounts for a given claim.

PROCEDURE CODES:

- Missing.
- Incorrectly coded (e.g. does not match the diagnosis code).
- A mix of ICD10 PCS codes and internal coding.
- No standardised coding for procedures that fall outside the ICD10 PCS.



DATES IN THE CLAIMS DATA:

- Overlapping admission and discharge dates (underestimating inpatient admissions).
- Missing discharge dates (leading to misestimating length of stays).
- Claims with ‘to’ date is set equal to the ‘from’ date, regardless of length of stay.

DIAGNOSIS CODES:

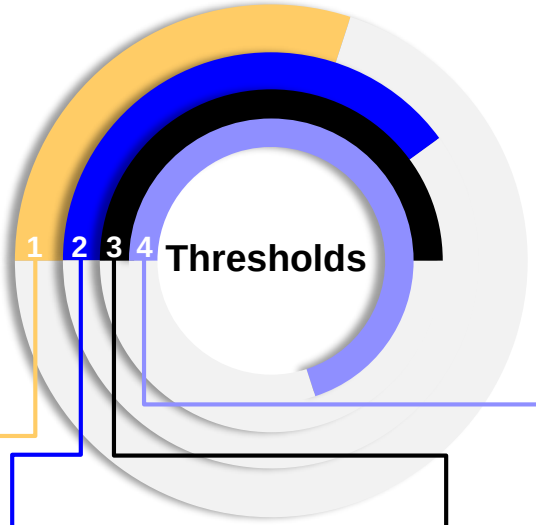
- Missing.
- Incorrectly coded.
- Lack of granularity (e.g. codes ending in “0”).
- A mix of ICD9/ICD10 codes and internal codes or descriptions.

Costs of bad data

- Research predicts poor quality data can cost business on average 12% of revenues, ranging from impact on marketing and sales to compliance and certainly risk management.
- Bad data is costly because it is time consuming and often expensive to address.
- Fixing errors can become part of the data analysis process rather than a one time fix.
- Leads to difficulty in ever getting to an automated processing environment.
- As well as high costs of admin, high risks of error and low employee self – service.
- Low confidence in data and analysis from data reduces chances of carrying out advanced analytics to solve business problems.
- Can be a barrier to meet market service level standards – or even to just measure the level of service provided.

Data quality assessment tools

Structure



Data validation, edits and thresholds:

- Review key fields.
- Establish thresholds - quantify quality standards.
- Field level edits for consistency checks.

Data Audit:

- Data credibility assessment.
- Investigate data issues.
- Data audit summaries.

Combinational Integrity:

- Dataset coherency to bind data from different systems.
- Quantifying fall out of data.
- Longitudinal study of members possible?

Reconciliation:

- To financial/ accounting information, and to control totals.
- Ease.

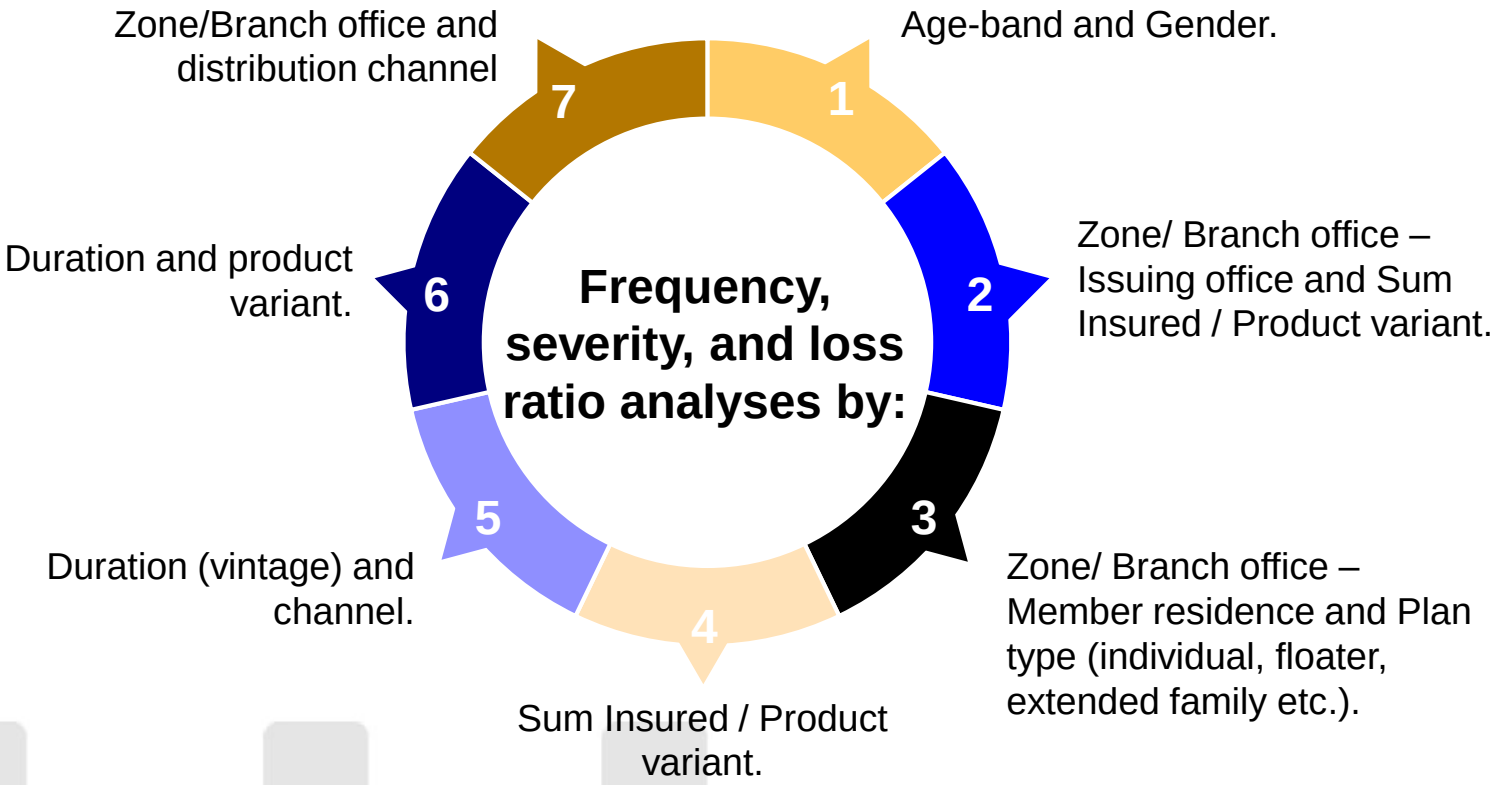
3 Basic Analyses:

1. One way analyses
2. Two-way/ multi-way analyses

One-way analyses

- One-way premium analyses (number of policies, members, premium, persistency):
  - By state
  - By sum insured / product variant
  - By distribution channel
  - By agents
  - By branch
- One-way claims analyses (number and amount):
  - Top 100 providers
  - Top 20 diagnosis
  - Top 20 procedures
  - Medical vs surgical
  - In-network vs out-of-network
  - Cashless vs reimbursement
  - Claim status (Paid, Rejected etc.)
  - Rejection reason analysis
- Frequency, severity, and loss ratio analyses by:
  - Age-band
  - Gender
  - Zone/ Branch office – Issuing office
  - Zone/ Branch office – Member residence
  - Plan type (individual, floater, extended family etc.)
  - Sum Insured / Product variant (silver, gold, platinum etc..)
  - Duration
  - Family combination
  - Underwriting year month / qtr
  - Accident (exposure) year month / qtr
  - Distribution channel
  - Benefit category (IP, OP etc.)
  - New business vs Renewal business
  - Ported vs non-ported

Two-way / multi-way analyses



Institute of Actuaries of India

4 Advanced Analyses:

1. HCG grouper
2. CCHG grouper
3. Generalised linear modelling
4. MARA

Institute of Actuaries of India

4.1 HCG: Milliman's Health Cost Guidelines™

What is HCG?

Background

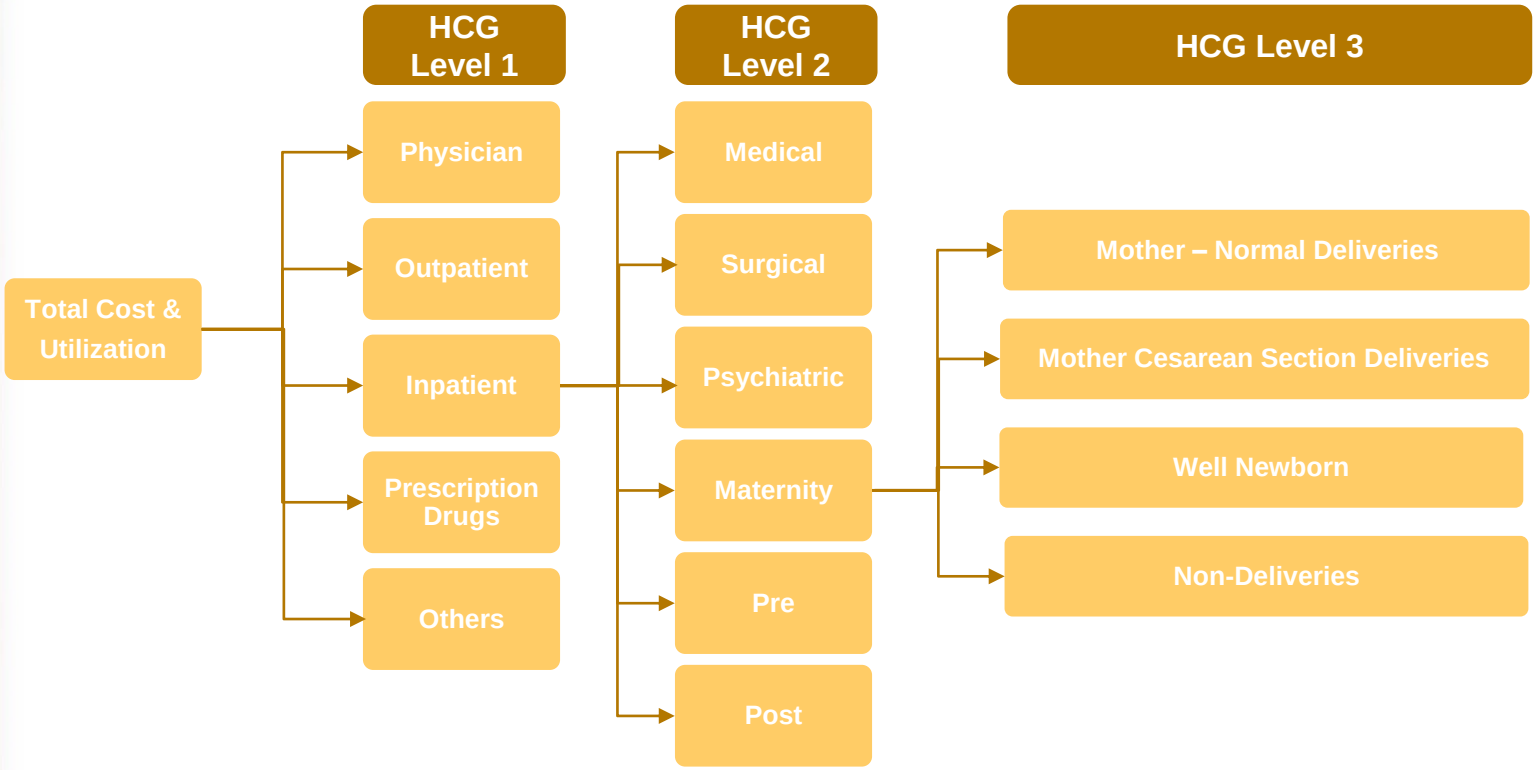
- Milliman Health Cost Guidelines (HCGs) - Industry standards to classify claims into service categories.
- More than 100 insurers in the US rely on our proprietary methodologies and comprehensive data to model their healthcare costs and utilisation.
- Annual revisions to incorporate latest trends in hospital, surgical, medical, pharmaceutical, and other categories.
- Milliman has also built HCGs in other countries:
  - UK - Collaborative effort of several companies to contribute data to create the HCGs. This is now a bi-annual exercise.
  - Hong Kong – An HCG project resulted in a comprehensive database constructed on some companies data. This is the only credible data available in the market which is cited and used by many stakeholders.
  - Mexico - HCGs were built at the request of the association of insurers.
  - We have also built HCGs in UAE, KSA, Chile, and South Africa.

Benefits of HCGs

- Having a **market data based benchmarks** will provide a credible estimate of certain parameters which may be a concern area for the entire market for example underpriced segments such as lower sum insured, higher ages etc.
- Assess the **performance** against the peers/market on key parameters such as incidence rates, average claim costs, claim distribution etc.
- Develop accurate **quotations** for group health accounts.
- **Pricing** including assessing the impact of disease -wise limits, sum insured limits, deductibles, copays etc.
- Identify areas for driving **efficiency** or **saving** by trying to perform at par or better than the benchmarks

Example of HCG hierarchy

HCGs Capture 100% of Claims Utilization and Cost



Institute of Actuaries of India

4.2 CCHG: Chronic Condition Hierarchical Groups

Chronic conditions hierarchical groups (CCHGs)

- A unique, clinical, care-based methodology for enhancing population health management based on patient and chronic condition information.
- CCHGs consist of 43 unique condition groups, of which roughly half represent chronic conditions, and the other non-chronic conditions and healthy members:
  - Using diagnosis codes we identify claims made for conditions that link to chronic conditions, and otherwise.
- The analysis identifies key causes for utilisation and cost trends, and analysis can be used to:
  - Better explain the trends in utilisation and costs than use of standard GLM factors such as age and gender.
  - Measure resource utilisation.
  - Clinical quality.
  - Population based budgets.
  - Other outcomes such as provider profiling.
- Data requirements for detailed analysis:
  - Matching exposure to claims data.
  - Secondary and tertiary diagnosis and procedure codes to identify condition that is most ‘clinically relevant’.

Patients are assigned to the following 43 categories

Institute of Actuaries of India

CCHG Categories			
101	Major psychosis	123	Dermatologic disorders
102	Severe dementia	124	Unhealthy newborns and preemies
103	Active cancer	125	Other chronic conditions
104	Renal failure - post transplant	126	Healthy Infant (0-1)
105	Liver disease (Hepatitis, Cirrhosis) – post transplant	127	Healthy Child (2-5)
106	HIV	128	Healthy Male (6-15)
107	Severe rheumatic & other connective tissue disease	129	Healthy Male (16-40)
108	Severe heart failure/transplant/rheumatic heart disease/non-rheumatic valvular heart disease	130	Healthy Male (41-64)
		131	Healthy Male (65-69)
109	Hemophilia & sickle cell & chronic blood disorders	132	Healthy Male (70-74)
110	Both CAD & diabetes	133	Healthy Male (75-79)
111	CAD without diabetes	134	Healthy Male (80-84)
112	Diabetes without CAD	135	Healthy Male (85+)
113	Hypertension (Includes stroke & peripheral vascular disease)	136	Healthy Female (6-15)
114	COPD	137	Healthy Female (16-40)
115	Asthma	138	Healthy Female (41-64)
116	Neurologic disorders	139	Healthy Female (65-69)
117	Learning disability / congenital anomaly	140	Healthy Female (70-74)
118	Chronic musculosketetal/osteo arthritis/osteporosis	141	Healthy Female (75-79)
119	Other mental health/substance abuse	142	Healthy Female (80-84)
120	Gastrointestinal disorders	143	Healthy Female (85+)
122	Thyroid disorders	144	Other Healthy (Unknown Age or Gender)

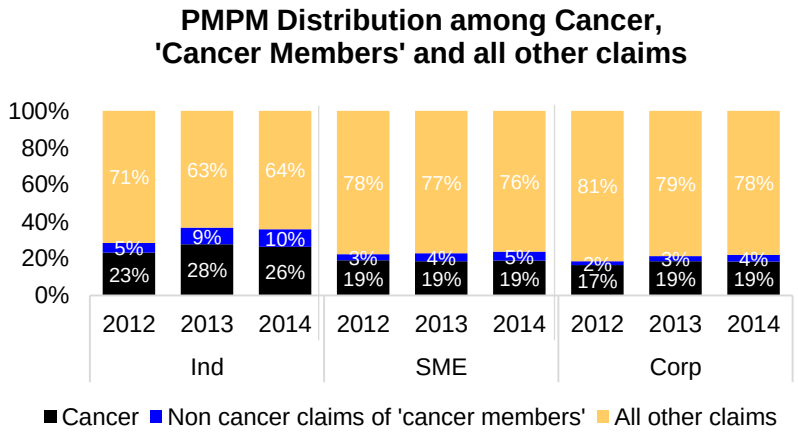
CCHG profile report (illustrative sample)

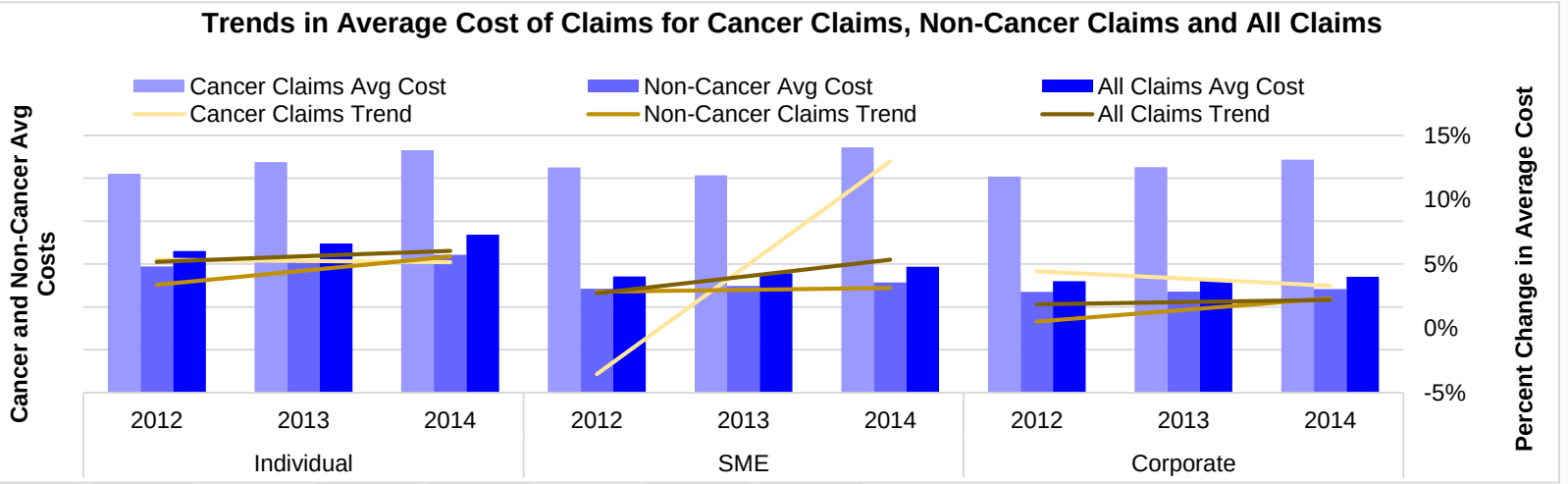
Institute of Actuaries of India

CCHG Category	Unique members	% Distribution chronic disease	Inpatient admits/1000	Day case admits/1000	Average cost per year	Average premium per year	Loss ratio	Average age
Active Cancer	76	6%	12.1	6.7	18,950	22,500	84%	57
Both CAD and Diabetes	69	6%	4.3	2.5	16,580	26,200	63%	69
CAD without diabetes	278	22%	3.0	1.6	19,800	19,800	100%	63
Diabetes without CAD	179	14%	0.2	0.0	14,800	15,600	95%	53
Hypertension (incl stroke & peripheral vascular disease)	61	5%	0.4	0.2	13,650	14,800	92%	63
COPD	54	4%	0.2	0.0	18,700	28,200	66%	75
Asthma	132	11%	0.1	0.1	14,680	10,200	144%	42
Chronic musculoskeletal	165	13%	1.1	0.4	12,680	14,600	87%	53
Other chronic diseases (aggregated)	232	19%	1.4	0.5	8,650	9,680	89%	46
Healthy male (16-40)	5,730		3.3	1.4	1,468	6,100	24%	28
Healthy female (16-40)	4,182		2.7	1.2	2,654	7,500	35%	33
Healthy male (41-64)	7,687		5.2	3.3	1,890	7,070	27%	51
Healthy female (41-64)	7,469		4.9	3.1	2,100	7,800	27%	52
Healthy others	6,267		4.0	2.3	3,680	12,600	29%	67
Totals	32,581				150,282	202,650	74%	

UK Cancer analysis – CCHGs feasibility test

- Reviewed the cancer claim trends in UK PMI data over the years.
- Developed an algorithm based on patient and clinical condition information to examine claims related to members with cancer.
- Reviewed per member costs for cancer claims, non-cancer claims of “cancer members”, and all other claims.
- Analysis was partially limited by inconsistent clinical coding.

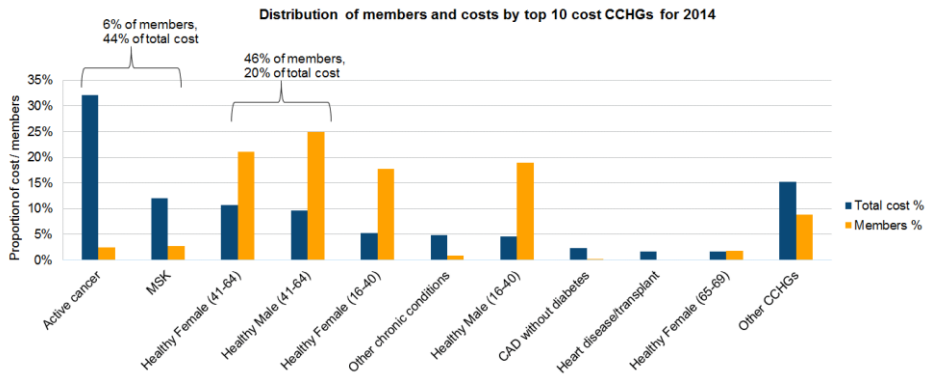




Chronic condition hierarchical groupers (CCHGs)

Example output and insights:

- Using CCHGs, we can identify high-resource utilisation members while identifying each member's most severe condition.
- In the example below, 6% of members account for 44% of total costs while 46% of members in "healthy state" categories account for only 20% of cost.
- In the particular example below, cancer accounted for a large proportion of costs and we therefore further segmented this category into cancer type to gain additional insights*.



*http://uk.milliman.com/uploadedFiles/insight/2018/risk-adjustment-uk-pmi-market.pdf

Goodness of fit:

- We have found that using CCHGs as a predictor of healthcare resource use is significantly more powerful than using age/gender alone.
- This dramatic improvement in goodness of fit indicates a key result:

Two members with the same clinical condition and a different age/sex profile are more similar than two members of the same age and sex with different or no clinical conditions.

Institute of Actuaries of India

4.3 MARA: Milliman Advanced Risk Adjusters

Milliman advanced risk adjusters (MARA)

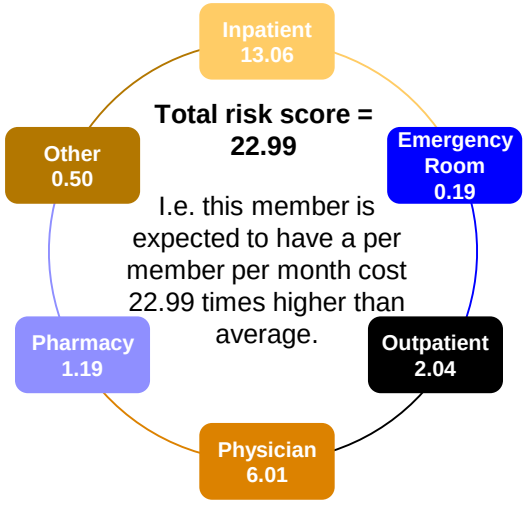
- A population stratification tool that uses longitudinal data assets and advanced statistical methods to calculate a total risk score per member.
- Total risk score represents the expected overall healthcare resource utilisation for each member relative to the average.
- Risk score can be further broken down into service categories.
- These results can also be used to calculate each member’s likelihood of hospitalisation within a 12 month period.
- Output summarising each member's clinical conditions and how they contribute to the overall risk score, if at all.
- Using results from this tool we are able to:
  - Understand the risk profile of a particular population/sub-population .
  - Assess how risk profiles have changed over time.
  - Compare risk profiles between different populations.

MARA output

Total risk score by service category

For each member in the population, MARA produces their expected relative healthcare resource utilisation relative to the population average at a total level and by service category.

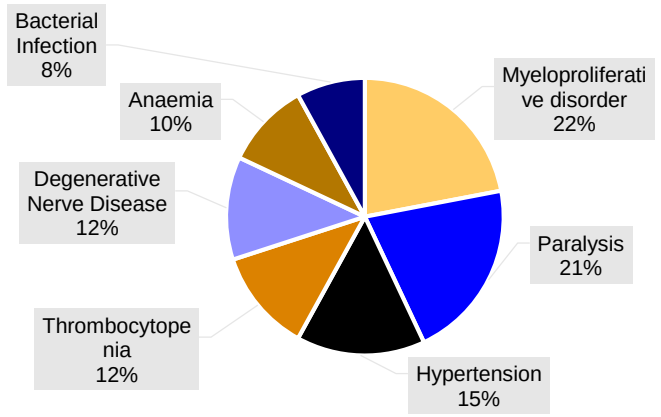
Example risk score, male aged 51 – Very high risk



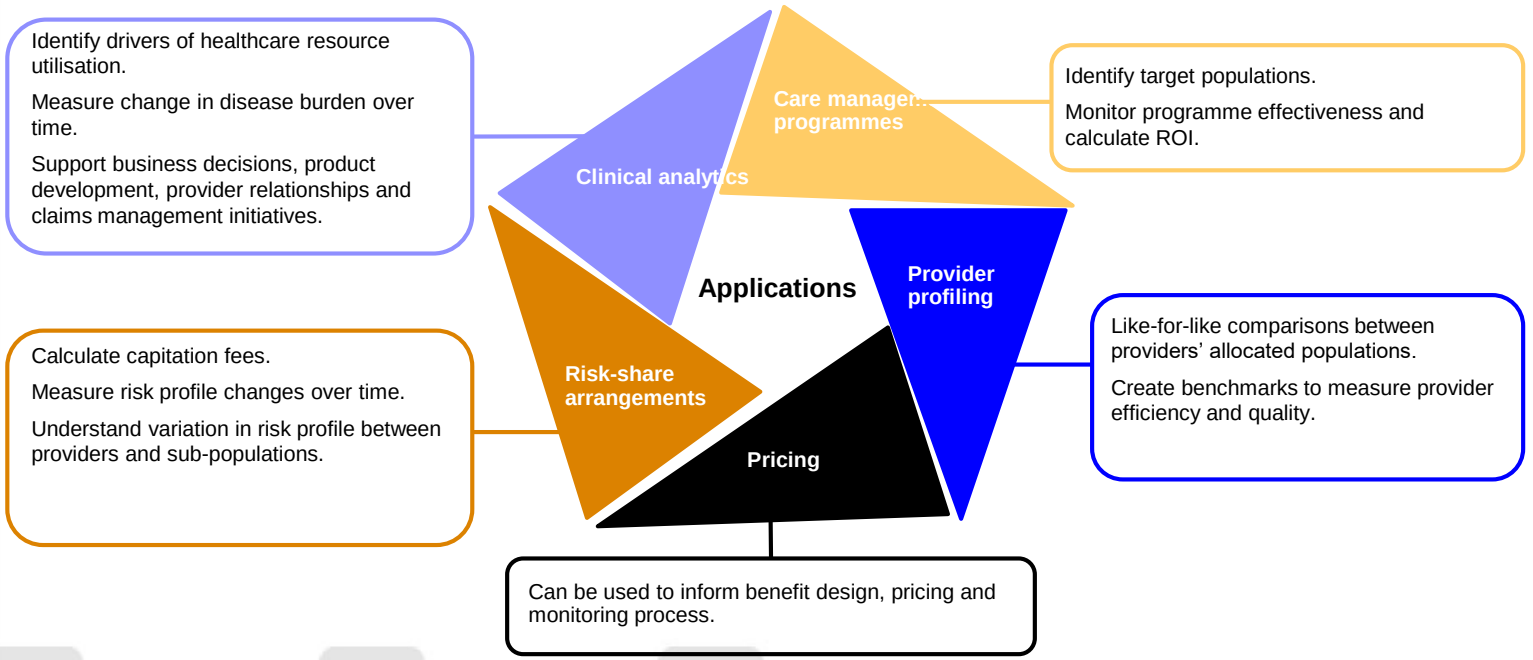
Contribution of clinical conditions to risk score:

For each member in the population, MARA produces a list of clinical conditions and how each condition contributes to the total risk score for each member, if at all. Some identified clinical conditions will not influence the risk score but are included in the list (e.g. Vitamin D deficiency will have a 0% contribution).

Clinical condition contribution to risk score



Application of risk stratification tools



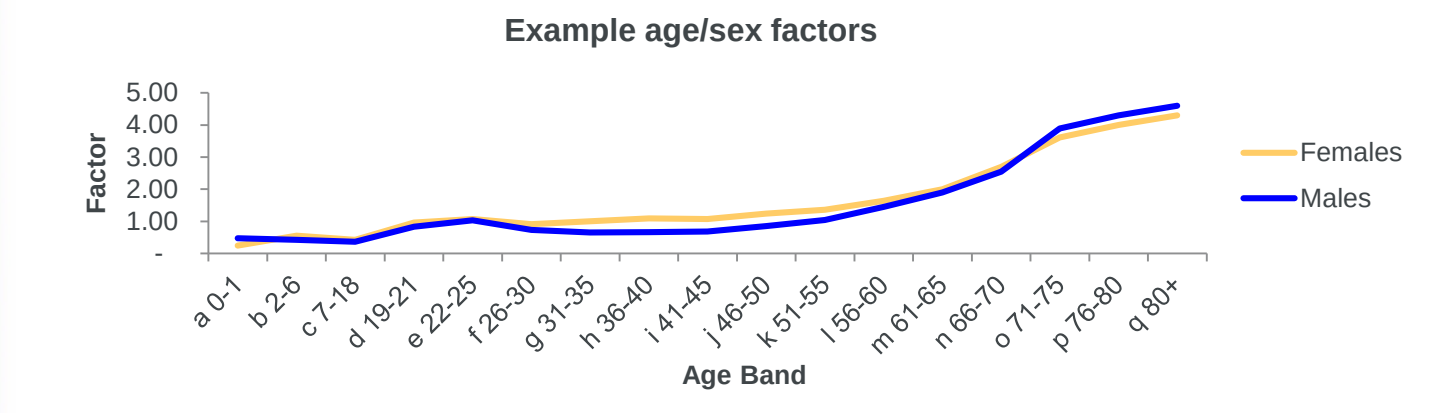
Institute of Actuaries of India

4.4 GLM: Generalised Linear Modelling

General linear modelling (GLM)

What?

- GLMs have become the global industry standards for pricing segmentation.
- In running GLM, we can use a blend of statistical diagnostics, practical tests and our business acumen to select rating factors.
- Can be used beyond rate making – customer behaviour analysis; underwriting; marketing.
- Below is an example of age/sex factors derived using GLM techniques.



5 Final Thoughts

Conclusions

- Identify the business question that you are trying to answer with the performance review:
  - Pricing and re-pricing.
  - Profitability and market share.
  - Risk stratification / customer segmentation.
- Identify the data needed to answer that question.
- With due consideration to the business question, data available and data needed, identify the most suitable analysis.

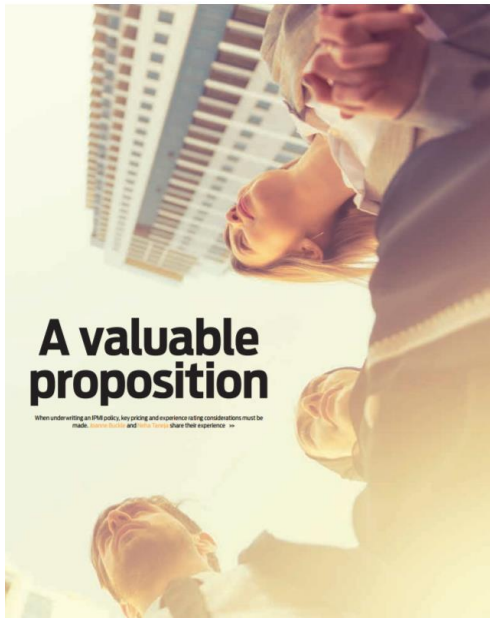
CAVEAT

Decision confidence will only come from data confidence!!!!

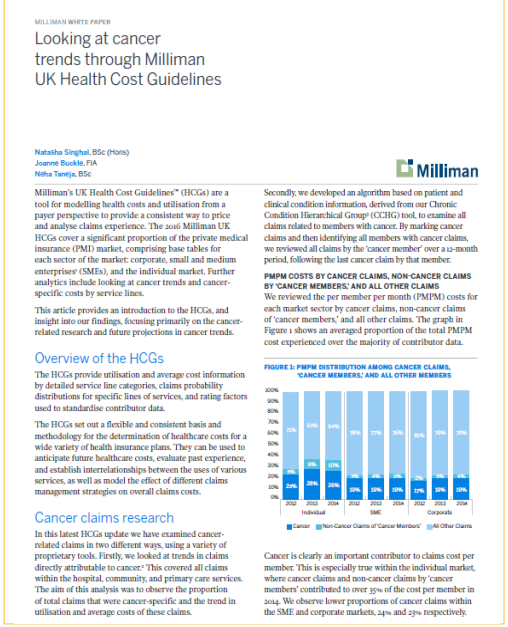
References

Institute of Actuaries of India

A look into international private medical insurance market
July 2017



Looking at Cancer Trends through Milliman Health Cost Guidelines
February 2017



MILLIMAN WHITE PAPER

Looking at cancer trends through Milliman UK Health Cost Guidelines

Natasha Singhal, BSc (Hons)
Joanne Buckle, FIA
Nitha Tarelja, BSc

Milliman

Milliman's UK Health Cost Guidelines™ (HCGs) are a tool for modelling health costs and utilisation from a payer perspective to provide a consistent way to price and analyse claims experience. The 2016 Milliman UK HCGs cover a significant proportion of the private medical insurance (PMI) market, comprising base tables for each sector of the market: corporate, small and medium enterprises (SMEs), and the individual market. Further analytics include looking at cancer trends and cancer-specific costs by service lines.

This article provides an introduction to the HCGs, and insight into our findings, focusing primarily on the cancer-related research and future projections in cancer trends.

Overview of the HCGs

The HCGs provide utilisation and average cost information by detailed service line categories, claims probability distributions for specific lines of services, and rating factors used to standardise contributor data.

The HCGs set out a flexible and consistent basis and methodology for the determination of healthcare costs for a wide variety of health insurance plans. They can be used to anticipate future healthcare costs, evaluate past experience, and establish interrelationships between the uses of various services, as well as model the effect of different claims management strategies on overall claims costs.

Cancer claims research

In this latest HCGs update we have examined cancer-related claims in two different ways, using a variety of proprietary tools. Firstly, we looked at trends in claims directly attributable to cancer.[1] This covered all claims within the hospital, community, and primary care services. The aim of this analysis was to observe the proportion of total claims that were cancer-specific and the trend in utilisation and average costs of these claims.

Secondly, we developed an algorithm based on patient and clinical condition information, derived from our Chronic Condition Hierarchical Group® (CCHG) tool, to examine all claims related to members with cancer. By marking cancer claims and then identifying all members with cancer claims, we reviewed all claims by the 'cancer member' over a 12-month period, following the last cancer claim by that member.

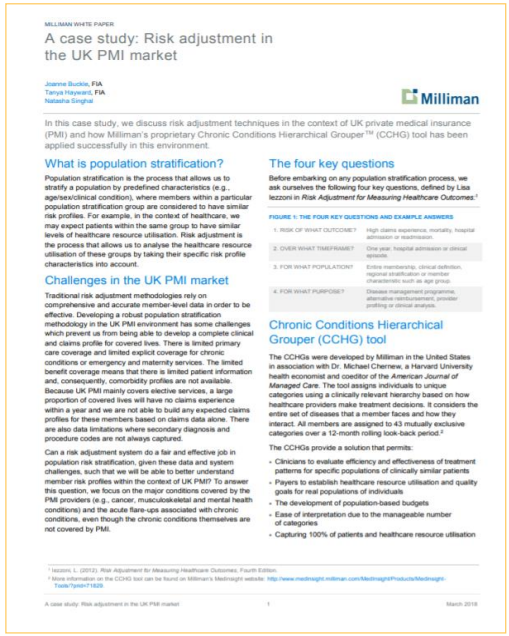
PMPM COSTS BY CANCER CLAIMS, NON-CANCER CLAIMS BY 'CANCER MEMBERS,' AND ALL OTHER CLAIMS

We reviewed the per member per month (PMPM) costs for each market sector by cancer claims, non-cancer claims of 'cancer members,' and all other claims. The graph in Figure 1 shows an averaged proportion of the total PMPM cost experienced over the majority of contributor data.

FIGURE 1: PMPM DISTRIBUTION AMONG CANCER CLAIMS, 'CANCER MEMBERS,' AND ALL OTHER MEMBERS

Cancer is clearly an important contributor to claims cost per member. This is especially true within the individual market, where cancer claims and non-cancer claims by 'cancer members' contributed to over 35% of the cost per member in 2014. We observe lower proportions of cancer claims within the SME and corporate markets, 24% and 23% respectively.

Risk Adjustment in the UK PMI market
March 2018



MILLIMAN WHITE PAPER

A case study: Risk adjustment in the UK PMI market

Joanne Buckle, FIA
Tanya Hayward, FIA
Natasha Singhal

Milliman

In this case study, we discuss risk adjustment techniques in the context of UK private medical insurance (PMI) and how Milliman's proprietary Chronic Conditions Hierarchical Grouper™ (CCHG) tool has been applied successfully in this environment.

What is population stratification?

Population stratification is the process that allows us to stratify a population by predefined characteristics (e.g., age/sex/clinical condition), where members within a particular population stratification group are considered to have similar risk profiles. For example, in the context of healthcare, we may expect patients within the same group to have similar levels of healthcare resource utilisation. Risk adjustment is the process that allows us to analyse the healthcare resource utilisation of these groups by taking their specific risk profile characteristics into account.

Challenges in the UK PMI market

Traditional risk adjustment methodologies rely on comprehensive and accurate member-level data in order to be effective. Developing a robust population stratification methodology in the UK PMI environment has some challenges which prevent us from being able to develop a complete clinical and claims profile for covered lives. There is limited primary care coverage and limited explicit coverage for chronic conditions or emergency and maternity services. The limited benefit coverage means that there is limited patient information and, consequently, comorbidity profiles are not available. Because UK PMI mainly covers elective services, a large proportion of covered lives will have no claims experience within a year and we are not able to build any expected claims profiles for these members based on claims data alone. There are also data limitations where secondary diagnosis and procedure codes are not always captured.

Can a risk adjustment system do a fair and effective job in population risk stratification, given these data and system challenges, such that we will be able to better understand member risk profiles within the context of UK PMI? To answer this question, we focus on the major conditions covered by the PMI providers (e.g., cancer, musculoskeletal and mental health conditions) and the acute flare-ups associated with chronic conditions, even though the chronic conditions themselves are not covered by PMI.

The four key questions

Before embarking on any population stratification process, we ask ourselves the following four key questions, defined by Lisa Iezzoni in *Risk Adjustment for Measuring Healthcare Outcomes*.[1]

FIGURE 1: THE FOUR KEY QUESTIONS AND EXAMPLE ANSWERS

1. RISK OF WHAT OUTCOME?	High claims experience, mortality, hospital admission or readmission.
2. OVER WHAT TIMEFRAME?	One year, hospital admission or clinical episode.
3. FOR WHAT POPULATION?	Entire membership, clinical definition, regional stratification or member characteristic such as age group.
4. FOR WHAT PURPOSE?	Disease management programme, alternative reimbursement, provider profiling or clinical analysis.

Chronic Conditions Hierarchical Grouper (CCHG) tool

The CCHGs were developed by Milliman in the United States in association with Dr. Michael Chernew, a Harvard University health economist and coeditor of the *American Journal of Managed Care*. The tool assigns individuals to unique categories using a clinically relevant hierarchy based on how healthcare providers make treatment decisions. It considers the entire set of diseases that a member faces and how they interact. All members are assigned to 43 mutually exclusive categories over a 12-month rolling look-back period.[2]

The CCHGs provide a solution that permits:

- Clinicians to evaluate efficiency and effectiveness of treatment patterns for specific populations of clinically similar patients
- Payers to establish healthcare resource utilisation and quality goals for real populations of individuals
- The development of population-based budgets
- Ease of interpretation due to the manageable number of categories
- Capturing 100% of patients and healthcare resource utilisation

[1] Iezzoni, L. (2012). *Risk Adjustment for Measuring Healthcare Outcomes*, Fourth Edition.
[2] More information on the CCHG tool can be found on Milliman's Medinsight website: http://www.medinsight.milliman.com/MedinsightProducts/Medinsight-Tools/?pid=71826

A case study: Risk adjustment in the UK PMI market 1 March 2018

- **Creating a Data-Driven Organization – by Carl Anderson**

Thank You

Neha Taneja
Neha.Taneja@milliman.com
Rachin Aggarwal
Rachin.Aggarwal@milliman.com