Identifying avoidable admissions using international benchmarks
Benchmarking UK PMI claims experience

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Agenda and overview of analysis

In this presentation we compare our international best practice benchmarks to UK PMI experience and touch on additional benchmarking and analysis undertaken on PMI data.

Our UK Private Medical Insurance (PMI) Health Cost Guidelines (HCGs) benchmark insurer experience against the market as well as providing additional insights from advanced analysis

- The HCGs model entire PMI healthcare systems with a focus on *utilisation* and *average cost*, *claim probability distributions* and *rating factors*

- They can be used as an invaluable tool for *pricing* and *benchmarking* claims experience against the market

- We have produced UK private medical insurance (PMI) HCGs six times since 2004

- Milliman has been producing *US HCGs* for over 50 years and in a number of countries over the last decade

- *Five insurers* contributed to the current production of our UK PMI HCGs results, with 10.7 million life years included in our analysis

International benchmarks for surgical inpatient utilisation

We have used the HCGs data to compare UK PMI inpatient surgical utilisation to our international, evidence-based, real-world benchmarks.

These benchmarks allow us to quantify potentially avoidable admissions and beddays within a healthcare system to identify potential value opportunities.

Data quality

Our data quality tool helps us evaluate the quality of UK PMI data using the following types of tests (scored out of 10):

1. Data validation, edits and thresholds
2. Data audits
3. Combinational integrity
4. Reconciliation

Population segmentation

We have applied our chronic condition hierarchical grouper (CCHG) tool to segment the UK PMI market populations into clinically relevant groups based on how healthcare providers make treatment decisions.

Population segmentation is a powerful tool that allows us to understand the risk profile of a particular population and compare it over time as well as to other population groups.

Risk adjusted cost and utilisation

Using our proprietary HCGs basic table (BT), we summarise cost and utilisation by major service category for the UK PMI market on a risk adjusted basis for each market type (Corporate, SME and Individual).

International best practice benchmarks

Milliman's international best practice benchmarks (IBPBs) help quantify potentially avoidable admissions and beddays within a healthcare system to identify potential value opportunities

- Our international benchmarks represent real, empirical and achievable utilisation experience.
- They are not theoretical benchmarks, nor are they comparisons to other health economies that may be operating in a constrained supply-side system.
- The benchmarks represent a standard of what is possible with optimal infrastructure and strict use of evidence-based pathways to limit unwarranted variation.

- Benchmarks are adjusted for local demographics.
- We use a degree of healthcare management scale (DoHM) to describe a spectrum of utilisation rates representing well-managed through to loosely managed systems.

- Clients report that the IBPBs provide independent and valid challenges to existing thinking on where to focus resources and concentrate reconfiguration and service design efforts.

Degrees of healthcare management (DoHM)

DoHM

Well managed

Loosely managed

Using our International Best Practice Benchmarks, we are able to classify healthcare systems by their degree of health management. This will often be an indication of a system's:

- Compliance to evidence-based care guidelines
- Access/restriction to services
- Use of incentives (overuse, outcome based, not linked to cost control or perverse)

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Creating a view of Milliman IBPBs to compare to the UK PMI Market

Data preparation

- The benchmarking exercise applies to surgical inpatient admissions
- We mapped the top 300 CCSD codes within the UK PMI HCGs data to Diagnostic Related Grouper (DRG) categories.
  - Covering 75% of total costs and 75% of total inpatient surgical admissions.
- We then mapped the DRGs to Milliman Clinical Categories (MCCs).
  - We have developed MCCs for benchmarking NHS inpatient activity and have applied it here as it provides a summarised view of the more granular DRG categories while providing more detail than major diagnostic categories (MDCs).

Applying international best practice benchmarks

- To ensure that our benchmarks are meaningful, we have included DRGs that we identified to reflect medical coverage provided by UK PMI providers, rather than providing a comprehensive healthcare system view.
  - We have estimated that the surgical admissions covered by the UK PMI industry account for approximately 20% of total admissions and approximately 87% of surgical admissions covered by a comprehensive healthcare system.
- The benchmarks are adjusted to reflect the UK PMI market's age/sex distributions.
- We have compared UK PMI inpatient utilisation to a 75% Degree of Healthcare Management (DoHM).
  - This represents a benchmark that is challenging, yet achievable.

Interpretation

- We compare the UK PMI markets actual surgical admission rate and actual beddays to the 75% DoHM benchmark and identify the volume of potentially avoidable admissions and beddays by major clinical categories.
- This view can help to inform claims management initiatives and provider discussions by identifying areas with value opportunities that are based on evidence-based benchmarks as well as in-market comparisons.

Benchmark admissions per 1,000 lives by MCC

- The UK PMI market's total surgical inpatient admission rate is above the 75% DoHM benchmark.
- The main drivers for this are MSK, Female Genital Tract (FGT) and other admissions that did not get mapped to a DRG.
- This high level view can help the market/insurers know "where to look" when considering ways to reduce inefficiencies.

Benchmark annual admissions per 1,000 lives by MCC
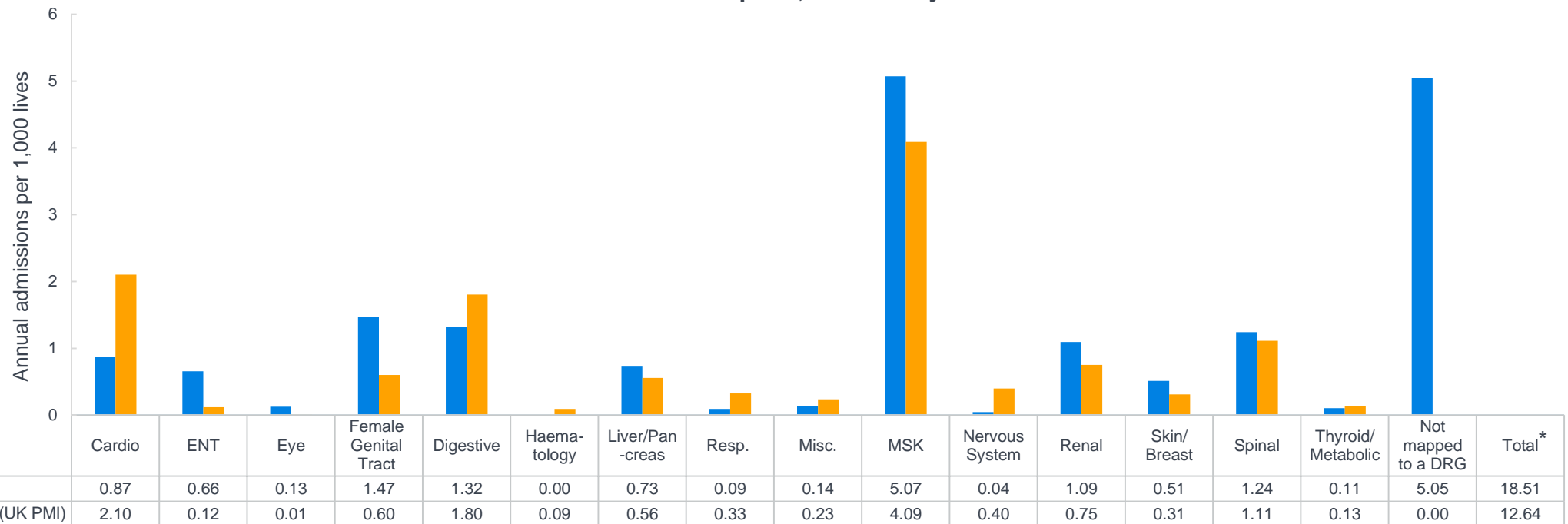
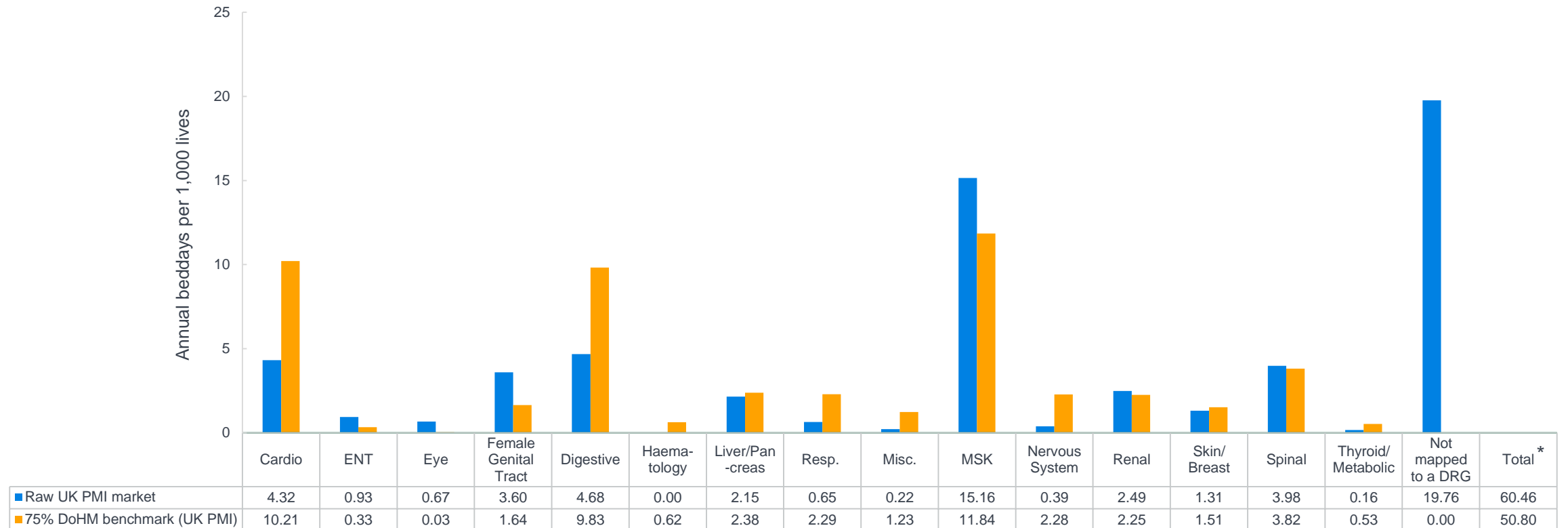|	Cardio	ENT	Eye	Female Genital Tract	Digestive	Haema-tology	Liver/Pan-creas	Resp.	Misc.	MSK	Nervous System	Renal	Skin/Breast	Spinal	Thyroid/Metabolic	Not mapped to a DRG	Total*
Raw UK PMI market	0.87	0.66	0.13	1.47	1.32	0.00	0.73	0.09	0.14	5.07	0.04	1.09	0.51	1.24	0.11	5.05	18.51
75% DoHM benchmark (UK PMI)	2.10	0.12	0.01	0.60	1.80	0.09	0.56	0.33	0.23	4.09	0.40	0.75	0.31	1.11	0.13	0.00	12.64

The total bar has been excluded from this chart to avoid distorting the scale for other categories.

Benchmark beddays per 1,000 lives by MCC

- The UK PMI market total surgical inpatient beddays per 1,000 lives is above the 75% DoHM benchmark.
- The UK PMI market beddays per 1,000 lives are higher than the benchmark for MSK and Female Genital Tract admissions.

Benchmark annual beddays per 1,000 lives by MCC

	Cardio	ENT	Eye	Female Genital Tract	Digestive	Haema-tology	Liver/Pan-creas	Resp.	Misc.	MSK	Nervous System	Renal	Skin/ Breast	Spinal	Thyroid/ Metabolic	Not mapped to a DRG	Total *
Raw UK PMI market	4.32	0.93	0.67	3.60	4.68	0.00	2.15	0.65	0.22	15.16	0.39	2.49	1.31	3.98	0.16	19.76	60.46
75% DoHM benchmark (UK PMI)	10.21	0.33	0.03	1.64	9.83	0.62	2.38	2.29	1.23	11.84	2.28	2.25	1.51	3.82	0.53	0.00	50.80

The total bar has been excluded from this chart to avoid distorting the scale for other categories.
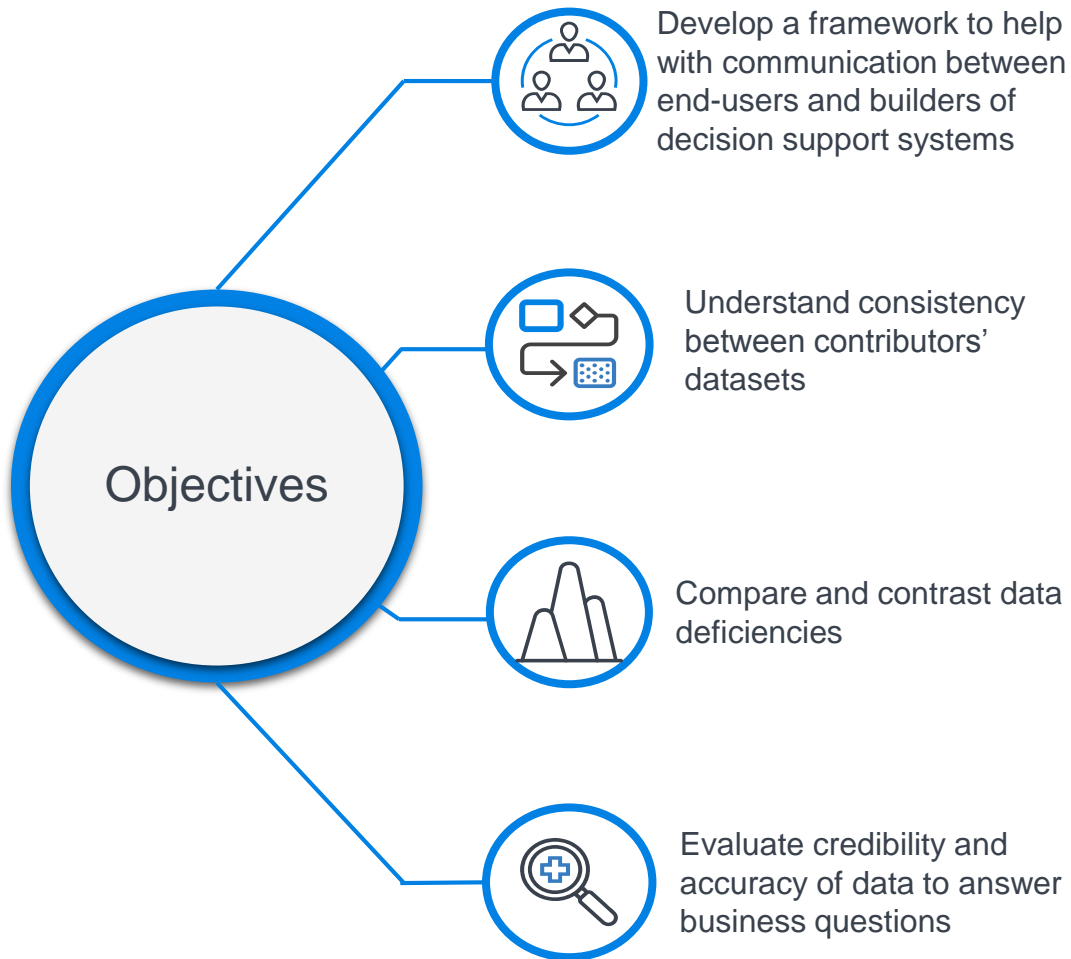
A closer look at musculoskeletal benchmarks

- As MSK is a major area of spend in the UK PMI industry, and an identified value opportunity area, we have looked at MSK benchmarking in more detail to show the additional detailed insights the benchmarks can provide.
- Overall for MSK, the UK PMI market has higher admissions and beddays per 1,000 lives compared to the benchmark.
- Shoulder/elbow, knee, foot and uncomplicated hip/femur procedures have the highest potentially avoidable admissions for the UK PMI market.

Musculoskeletal sub-categories	Annual admissions per 1,000 lives			Annual beddays per 1,000 lives		
	Raw UK PMI Market		75% UK PMI Benchmark (UK PMI)	Raw UK PMI Market		75% UK PMI Benchmark (UK PMI)
Foot procedures	0.42	▲	0.03	0.61	▲	0.13
Hand procedures	0.04	▲	0.02	0.12	▲	0.06
Knee procedures	0.78	▲	0.06	1.10	▲	0.22
Primary/revision hip/knee replacement	2.52	▼	2.90	10.95	▲	7.22
Shoulder/elbow procedures	0.74	▲	0.04	0.92	▲	0.10
Soft tissue/muscle/tendon/ligament/other bone procedures without complications	0.05	▼	0.23	0.11	▼	0.62
Uncomplicated hip/femur procedures	0.36	▲	0.09	0.64	▲	0.31
Other musculoskeletal procedures	0.16	▼	0.73	0.72	▼	3.18
Total musculoskeletal procedures	**5.07**	▲	**4.09**	**15.16**	▲	**11.84**

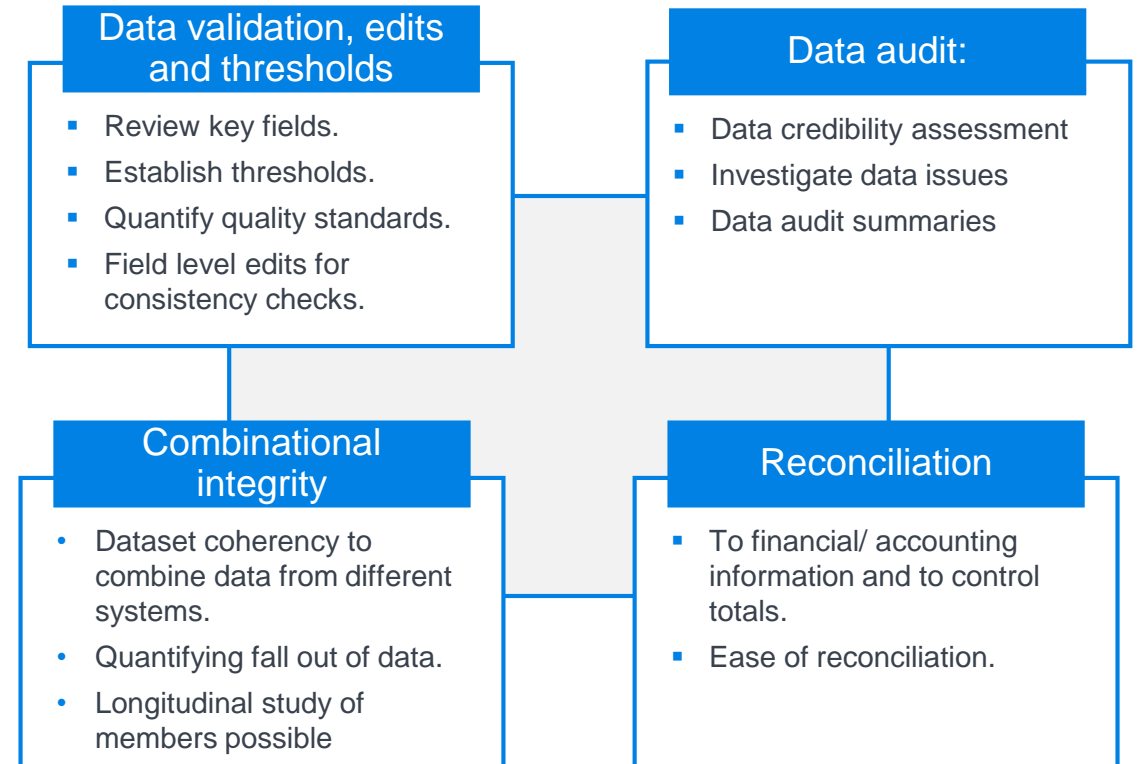Actual admissions/beddays per 1,000 lives compared to 75% DoHM benchmark:

- ▼ Lower
- = Equal
- ▲ Higher

Data quality benchmarking

Data quality matrix

We have run our data quality matrix with the following objectives in mind:

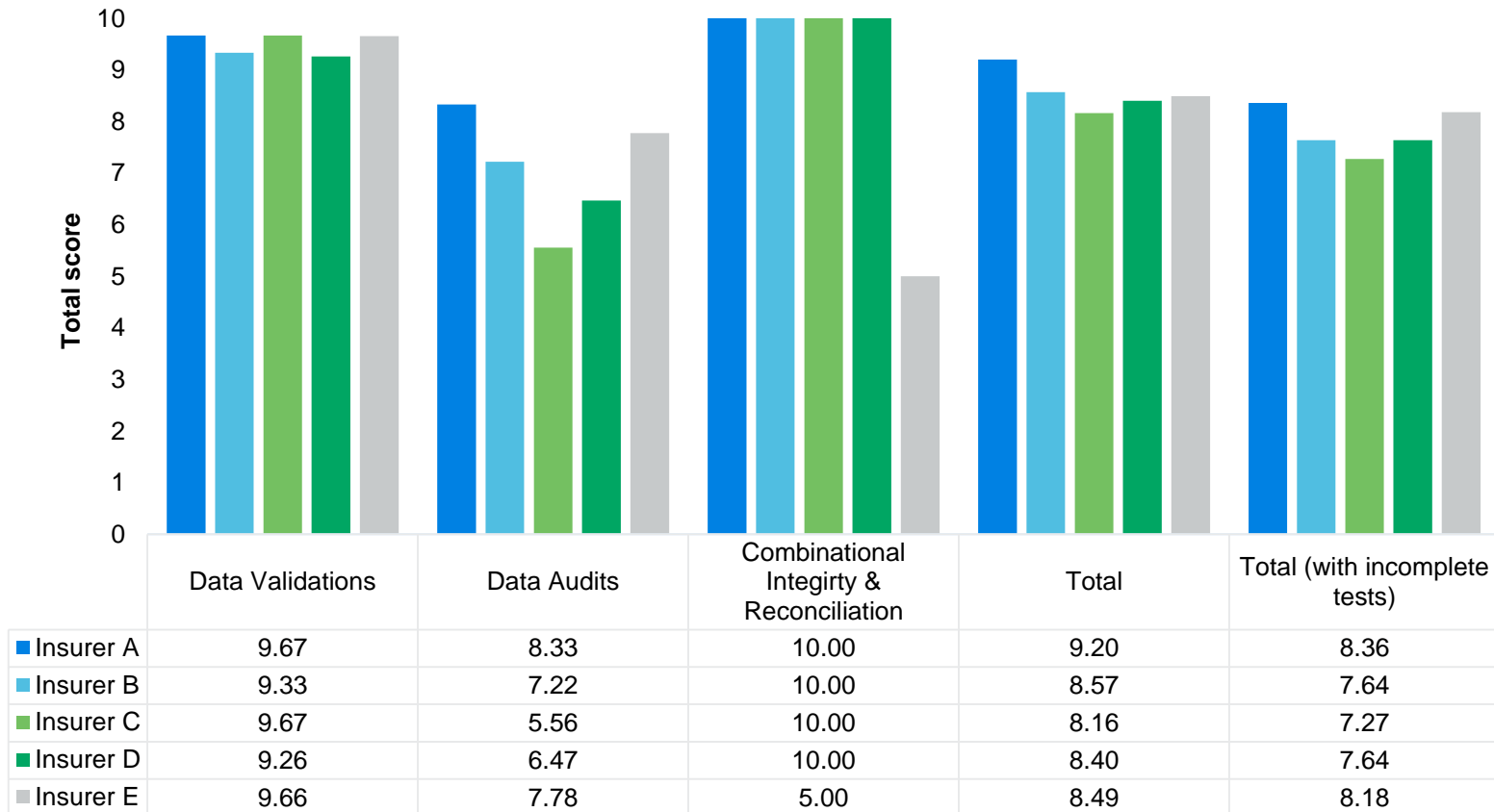Develop a framework to help with communication between end-users and builders of decision support systems

Understand consistency between contributors' datasets

Objectives

Compare and contrast data deficiencies

Evaluate credibility and accuracy of data to answer business questions

The data quality matrix comprises four main components:

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 combine data from different systems.
- Quantifying fall out of data.
- Longitudinal study of members possible

Reconciliation

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

Each test includes a benchmark for the quality expected within the data for this type of analysis. To pass each test, the dataset must meet the threshold set.

Data quality matrix – all contributors' results

Data Quality Tool Results – all contributors

	Data Validations	Data Audits	Combinational Integirty & Reconciliation	Total	Total (with incomplete tests)
Insurer A	9.67	8.33	10.00	9.20	8.36
Insurer B	9.33	7.22	10.00	8.57	7.64
Insurer C	9.67	5.56	10.00	8.16	7.27
Insurer D	9.26	6.47	10.00	8.40	7.64
Insurer E	9.66	7.78	5.00	8.49	8.18

DATA VALIDATION:
- Overall most insurers scored well on the data validation tests, showing these data sets are in general accurate and complete.

DATA AUDIT
- Data audit was a lower scoring area. Areas identified that would significantly improve advanced analytical capabilities included:
 1. **Complete and accurate coding** of clinical conditions. E.g. use standardised code sets, such as CCSD code sets and ICD-10 code sets.
  2. **Complete sets of clinical codes** – difficulty with advanced analytics where too many admissions were missing codes.
  3. **Maintaining similar field descriptions over time**. For example, if name of benefit is updated with no real change to the actual benefit, also apply an update to previous years will ensure consistency within the data set.
  4. **Improved maintenance of admission and discharge dates** for hospital visits. Allowing for accurate calculations of the length of a hospital stay.

COMBINATIONAL INTEGRITY & RECONCILIATION
- All but one of the data sets allowed matching of membership data to claims experience. Not being able to match policyholder characteristics to their claims experience meant the data set had to be excluded from any advanced analytics.

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Population segmentation

What is population segmentation?
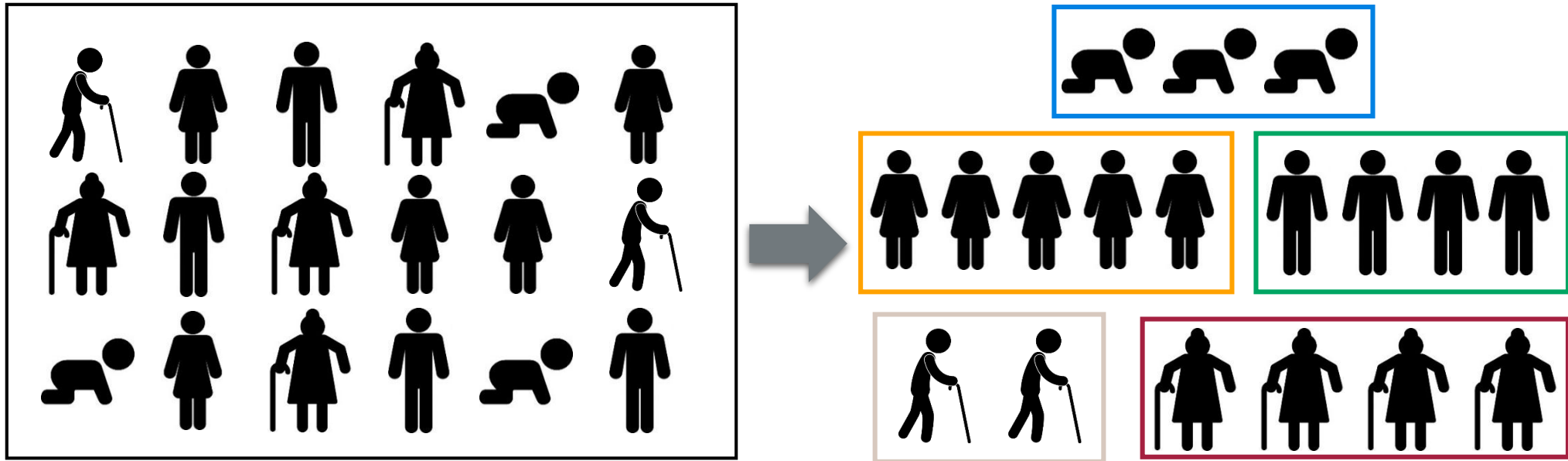
- Population segmentation is the process of segmenting a population into homogeneous groups that are defined by characteristics that members within a group have in common E.g. age, sex and clinical conditions.
- Members within a particular group are estimated to have a similar risk profile to other members within the group.
- Risk adjustment can then be performed to explain how each group's characteristics contribute to their healthcare resource utilisation.
- This can be used to:
  - Compare the risk profile of a particular population over time.
  - Compare the risk profile of two different populations.

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Understanding the population

High users

Moderate users

Healthy users
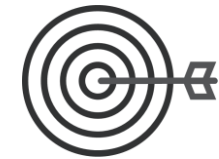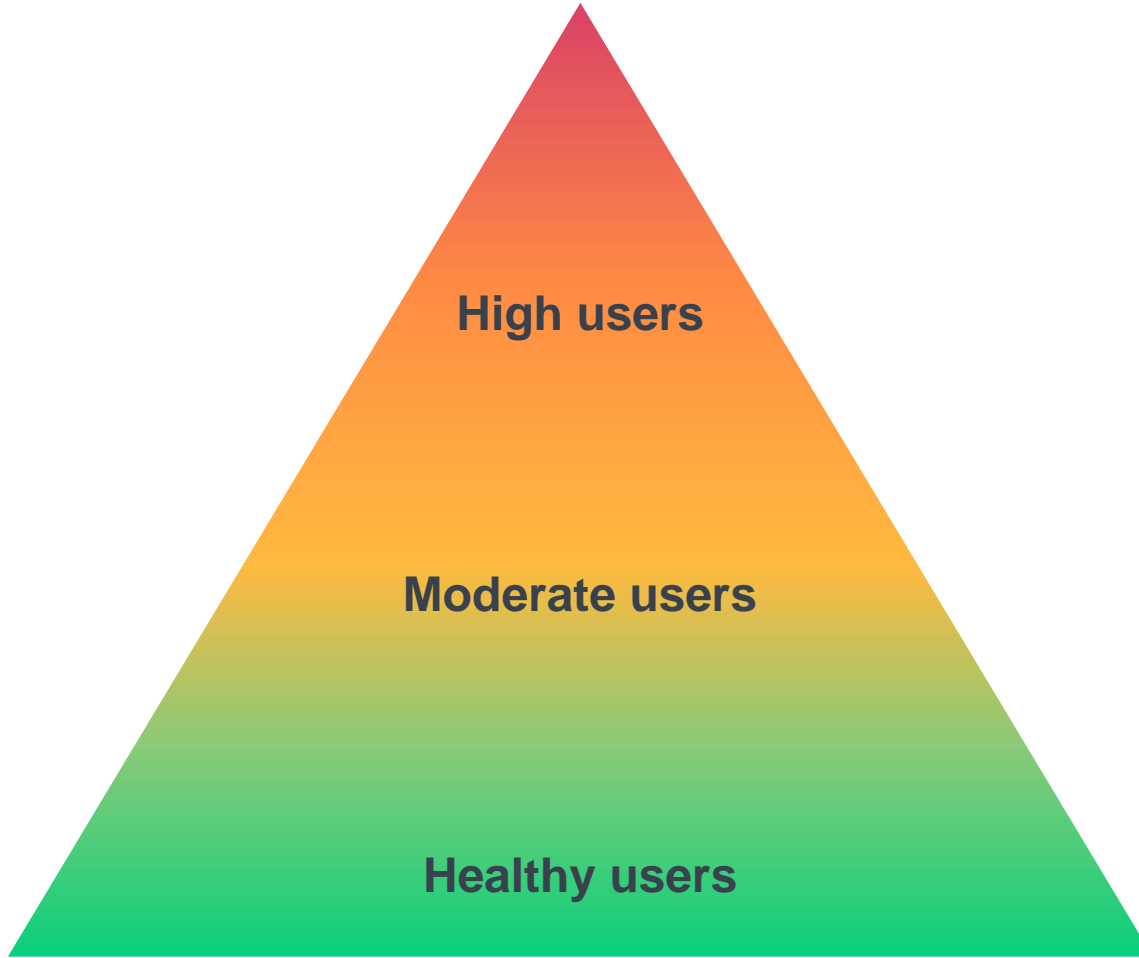
Being able to segment a population according to its expected healthcare utilisation can add tremendous value in multiple business areas and help with developing appropriate strategies for appropriate sub-populations

The four key questions

These questions help guide the population segmentation process and ensure appropriate risk adjustment strategies are applied
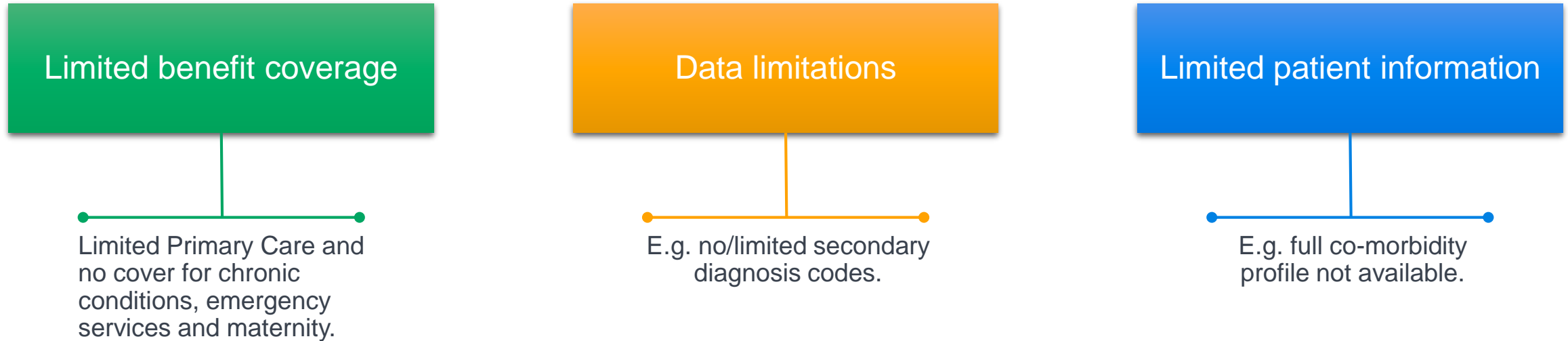
Four key questions

1. Risk of what outcome?
- E.g. High claims experience, mortality, hospital admission, re-admission.

2. Over what time frame?
- E.g. One year, hospital admission, clinical episode.

3. For what population?
- E.g. Entire membership, selected by clinical definition (e.g. diabetes, cancer), regional segmentation, other definition (e.g. age).

4. For what purpose?
- E.g. Capitation, provider profiling, clinical analysis, disease management.

Source of key questions: Lisa Iezzoni, Risk Adjustment for Measuring Healthcare Outcomes, Fourth Edition

UK PMI data

There are various challenges associated with UK PMI coverage and data

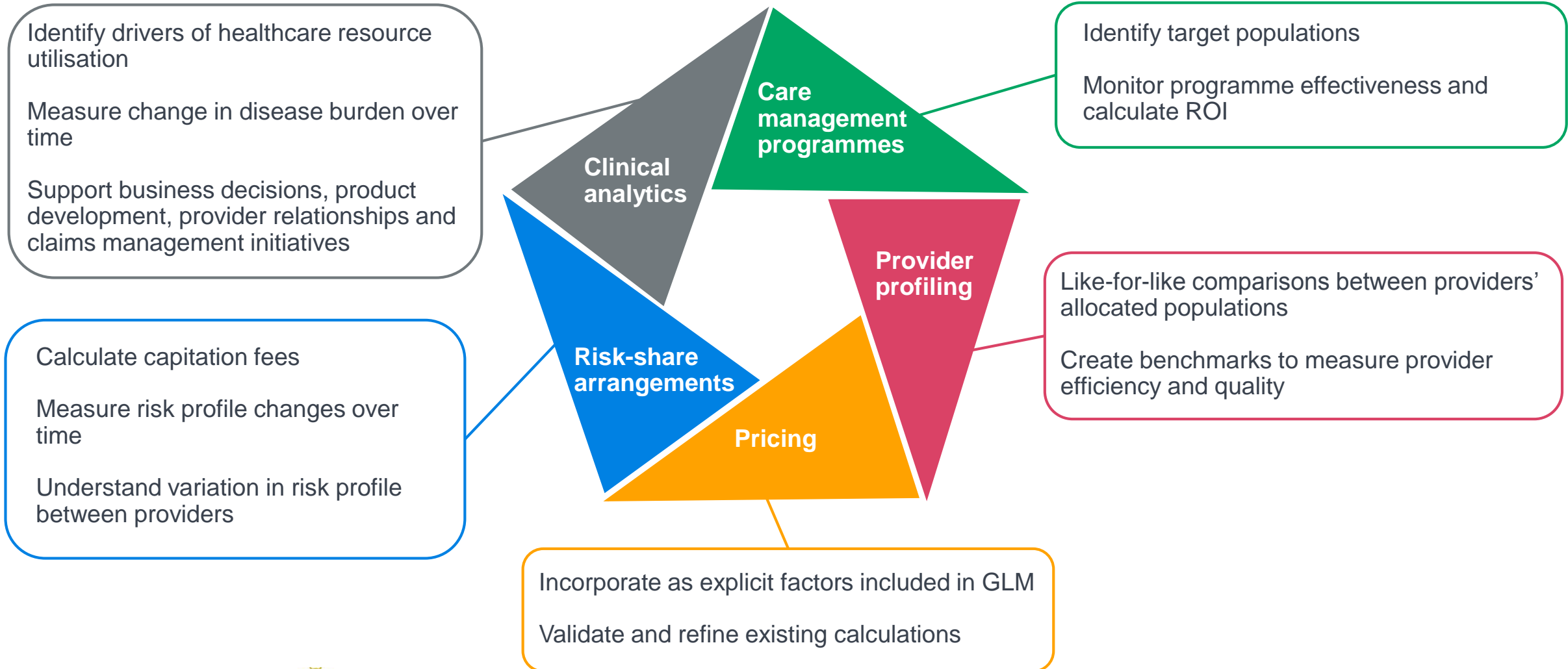| Limited benefit coverage	Data limitations	Limited patient information
Limited Primary Care and no cover for chronic conditions, emergency services and maternity.	E.g. no/limited secondary diagnosis codes.	E.g. full co-morbidity profile not available.

Despite these challenges, we have explored population segmentation options that allow us to:
- Understand member profiles and risk within the context of their PMI coverage.
- Make use of the data that we do have available. For example, we are able to focus on major conditions covered by PMI providers such as cancer, musculoskeletal conditions and mental health conditions.
- Factor in chronic diagnoses to a certain extent when members access treatment for acute flare-ups associated with their chronic conditions.

Applications of population segmentation

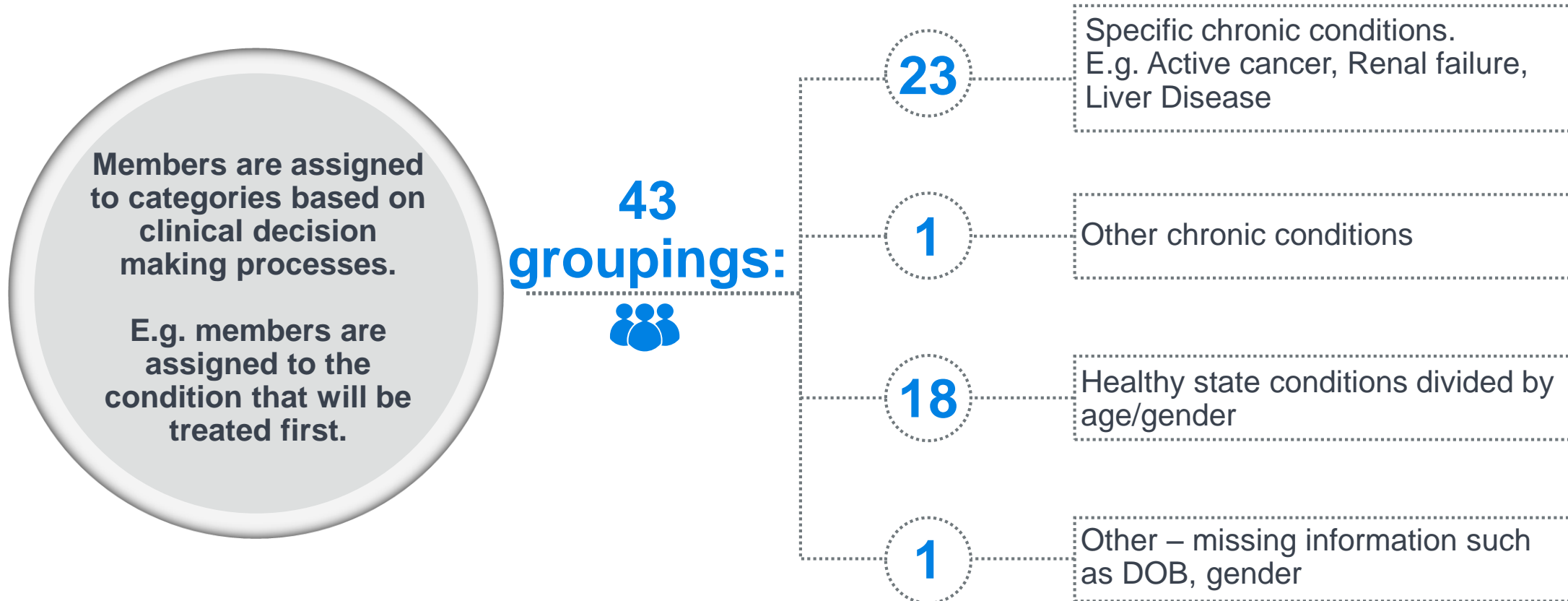- In a UK PMI context, population segmentation has multiple valuable applications

Care management programmes

Clinical analytics

Provider profiling

Risk-share arrangements

Pricing

Identify drivers of healthcare resource utilisation

Measure change in disease burden over time

Support business decisions, product development, provider relationships and claims management initiatives

Identify target populations

Monitor programme effectiveness and calculate ROI

Like-for-like comparisons between providers' allocated populations

Create benchmarks to measure provider efficiency and quality

Calculate capitation fees

Measure risk profile changes over time

Understand variation in risk profile between providers

Incorporate as explicit factors included in GLM

Validate and refine existing calculations

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Chronic conditions hierarchical groups (CCHGs)

The CCHGs tool is a unique clinical care-based methodology for enhancing population health management

- The CCHGs were developed by Milliman in the United States in association with Michael Chernew, Harvard health economist and co-editor 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 these interact.

- All members are assigned to mutually exclusive categories over a 12 month rolling look-back period.

  - We have applied the 'adult' CCHGs to UK PMI data and our analysis includes members aged 16 and over.

- The CCHGs provide a solution that permits:

  - Clinicians to evaluate efficiency and effectiveness of treatment patterns for specific populations of clinically similar patients;

  - Commissioners/funders 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; and

  - Capturing 100% of patients and resource utilisation.

CCHG categories are ranked based on how much they influence treatment plans and are designed to organise and report medical utilisation and cost in a clinically relevant manner.

Members are assigned to categories based on clinical decision making processes.

E.g. members are assigned to the condition that will be treated first.

43 groupings:

23 — Specific chronic conditions. E.g. Active cancer, Renal failure, Liver Disease

1 — Other chronic conditions

18 — Healthy state conditions divided by age/gender

1 — Other – missing information such as DOB, gender

UK HCG data CCHG results

The table below shows the top five conditions in the CCHG hierarchy

| CCHG category | UK PMI Market, 2017 – members aged over 16 | |
	Proportion of members	Proportion of cost
Major psychosis	0.0%	0.0%
Severe dementia	0.0%	0.0%
Active cancer	1.6%	26.7%
Renal failure	0.0%	0.1%
Liver disease	0.0%	0.0%
Other chronic CCHGs	3.4%	24.6%
Total chronic CCHGs	**5.0%**	**51.5%**
Total non-chronic CCHGs	**95.0%**	**48.5%**
Total	**100.0%**	**100.0%**

CCHGs enable us to identify high resource utilisation members while identifying each member's most severe condition.

Chronic CCHGs group members in a way that highlights the low proportion of members that contribute significantly to costs. For example, the 5% of members that have a chronic CCHG condition contribute to approximately 52% of total claim costs.

When testing the goodness of fit of the CCHGs model, we identified a key result:

Two members with the same clinical condition and a different age/gender profile are more similar than two members with the same age and gender.

CCHG results

The top 10 CCHGs by cost for the UK PMI market

CCHG category	UK PMI market	
	Proportion of members	Proportion of cost
Active cancer	1.6%	26.7%
Healthy Female (41-64)	20.9%	12.5%
Healthy Male (41-64)	23.7%	11.1%
MSK	1.5%	9.3%
Healthy Female (16-40)	19.1%	6.4%
Healthy Male (16-40)	20.0%	5.7%
Other chronic conditions	0.7%	4.8%
CAD without diabetes	0.3%	3.0%
Healthy Female (65-69)	2.2%	2.1%
Healthy Male (65-69)	2.3%	1.9%
Other CCHGs	7.8%	16.6%
Total	**100.0%**	**100.0%**

The top 10 CCHG categories include healthy categories, representing claims for which the most severe condition is not considered to be chronic.

Goodness of fit and impact of censoring

- **We measured the goodness of fit using the R^2 measure:**

  - R^2 ranges from 0% to 100% with higher value results being more favourable.

  - An R^2 of 100% implies that the expected costs calculated by our risk adjustment factors will match the actual costs perfectly.

  - Due to the significant variability inherent in healthcare data, we would usually expect to see R^2 values between 20% and 40% for a powerful population segmentation tool.

- **We also censored the data using the inter-quartile range method to remove high value outliers from skewing our benchmarks:**

  - For each CCHG, we calculated a censor point. Member records where the annual costs exceeded the censor point were censored (i.e. their costs were adjusted downwards to the censor point).

  - Censor point = 25th percentile + k*(75th percentile – 25th percentile)

  - We performed sensitivity adjustment on our results for various values of k and below we show results where k = 3 as it provided the best balance of proportion of data censored vs. improving goodness of fit.

Population segmentation method	R^2 No censoring	R^2 censored, k=3	Proportion of cost censored	Proportion of member records censored
Age and Gender	1.1%	4.4%	26.0%	1.3%
CCHGs	9.0%	27.4%	20.8%	1.3%

- CCHGs add significant predictive power compared to only using age and gender.

- Censoring the data improves goodness of fit for both population segmentation methods significantly.

- Although a significant proportion of costs are censored, the associated proportion of members whose costs are censored is less than 2% which suggests that a low proportion of members are responsible for a high proportion of the outlier costs.

- The dramatic improvement between goodness of fit from using age/gender to CCHGs also indicates the key result mentioned earlier:

Two members with the same clinical condition and a different age/gender profile are more similar than two members with the same age and gender.

Impact of censoring on top 5 costing CCHGs

- When investigating which conditions contribute to the total censored costs, we found that the active cancer CCHG accounted for 43.6% of censored costs. Given that active cancer is the largest CCHG category and accounts for over 28% of total costs, censoring 33.8% of these cancer costs is a considerable proportion of the total data.

- To improve the fit for the active cancer CCHG and lower the proportion of costs being censored, we further segmented the active cancer CCHG in the following ways:

  - **Method 1**: Number of Cancer diagnoses each member had within the year with groupings for 1, 2, 3+ Cancer types.

  - **Method 2**: Dividing the 'One Cancer' group into the top 15 cancer types and grouping smaller categories as 'Other'. Groups '2 Cancer Types' and '3+ Cancer Types' were kept the same as for method 1.
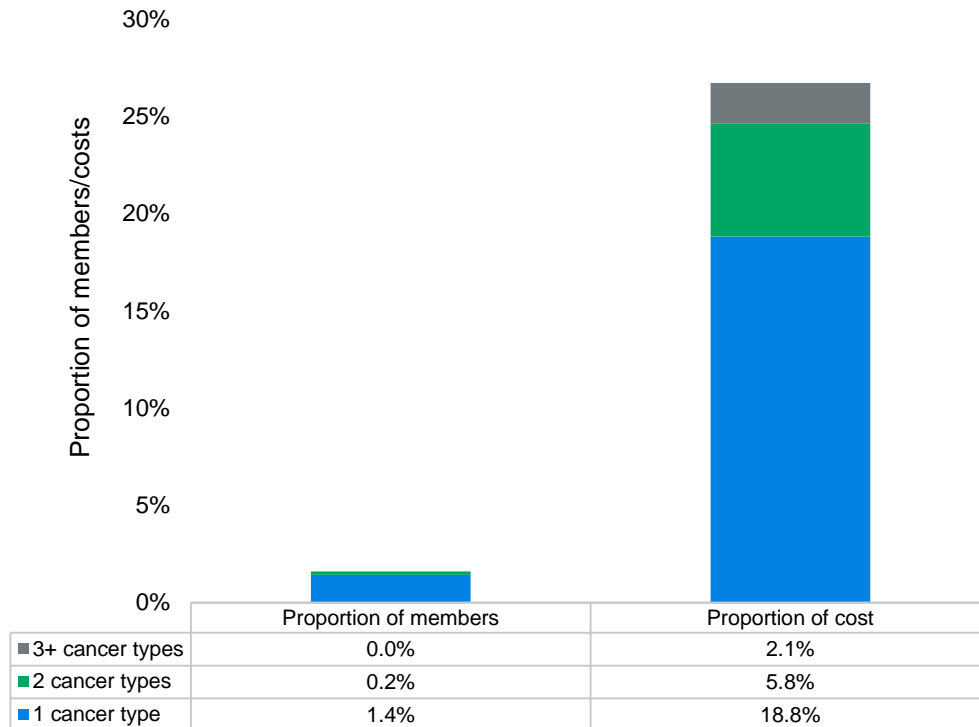
Population segmentation method	R^2 No censoring	R^2 censored, k=3	Proportion of cost censored	Proportion of member records censored
Age and gender	1.1%	4.4%	26.0%	1.3%
CCHGs (original)	9.0%	27.4%	20.8%	1.3%
CCHGs method 1	10.9%	33.6%	19.3%	1.3%
CCHGs method 2	11.5%	33.8%	18.3%	1.3%

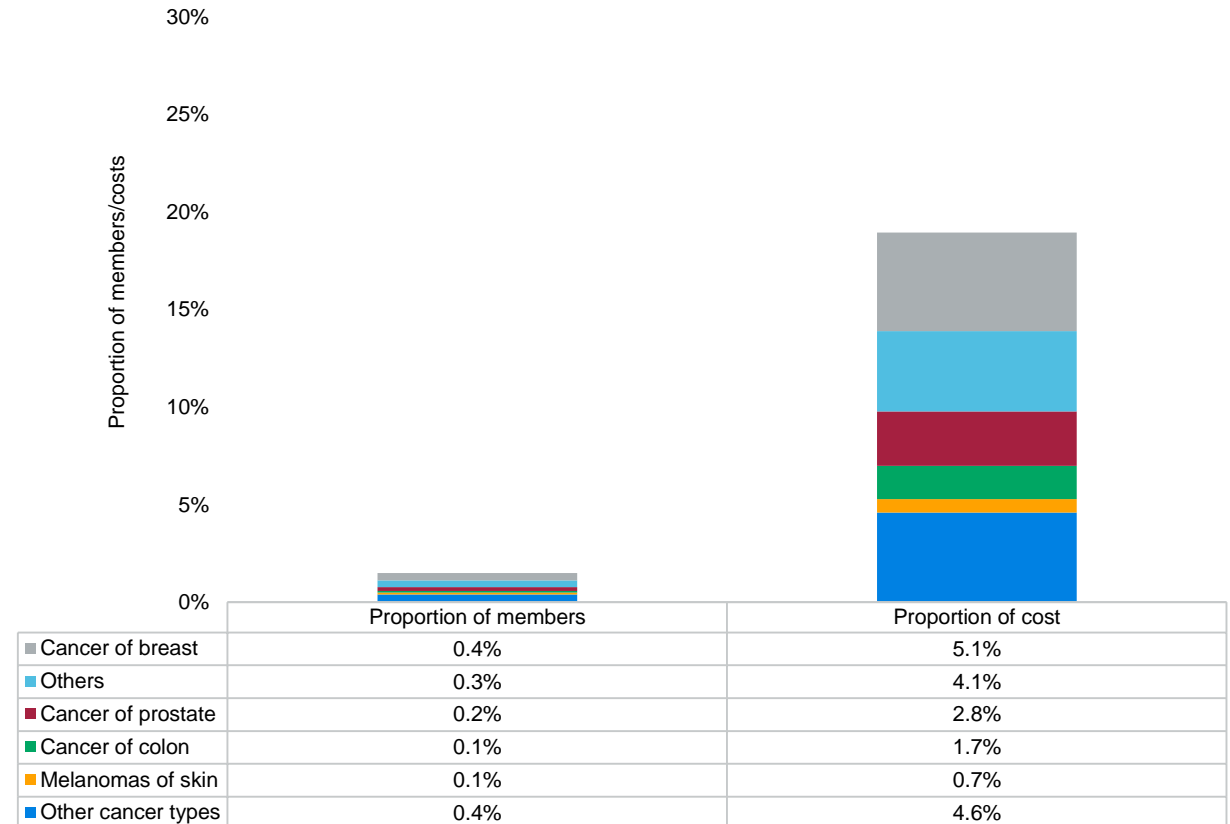# Distribution of costs and members using cancer segmentation

- The majority of membership and costs are allocated to the '1 cancer type' category.
- Within the UK PMI market, the proportion of members with more than one cancer type is less than 0.5% yet these members account for almost 8% of total cost.

- The graph below shows the top five cancer types by proportion of costs for the UK PMI market

Cancer segmentation option 1 - Distribution of members and cost

	Proportion of members	Proportion of cost
■ 3+ cancer types	0.0%	2.1%
■ 2 cancer types	0.2%	5.8%
■ 1 cancer type	1.4%	18.8%

'1 cancer type' - Distribution of members and cost

	Proportion of members	Proportion of cost
■ Cancer of breast	0.4%	5.1%
■ Others	0.3%	4.1%
■ Cancer of prostate	0.2%	2.8%
■ Cancer of colon	0.1%	1.7%
■ Melanomas of skin	0.1%	0.7%
■ Other cancer types	0.4%	4.6%

Summary on UK HCGs benchmark analysis

In this presentation we have given an overview of how we have used various benchmarking analyses on the UK PMI market data we hold.

Our in-market and international benchmarks give UK PMI providers valuable insights. Insurers are able to see how their cost and utilisation compares to the market as a whole and using the international evidence-based benchmarks insurers can identify potential value opportunities.

Using International best practice benchmarks we observe that MSK and female genital tract clinical areas have higher admissions and longer beddays than expected. MSK is a major area of spend in the UK PMI industry and by drilling into MSK further, the benchmarks can highlight specific key areas of focus.

Our data quality tool has helped stimulate conversation with insurers to identify components within their data that can help make clinical and advanced analytics even more powerful. Improving the collection of clinical coding and collection of admission and discharge dates within the PMI market can help significantly.

Using different clinical analysis methods, population segmentation allows us to consider ways to better understand the lives covered and the likely claims experience. Our key finding from using our CCHG tool is that two members with the same clinical condition and a different age/gender profile are more similar than two members with the same age and gender.

Thank you for joining us for this webinar. If you have any questions for us or would like to discuss any part of our presentation, please feel free to contact us :

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Questions

Comments

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