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MEDICINE

POPULATION  
HEALTH ANALYTICS

# Understanding Population Health Segmentation and Stratification through the use of Patient Need Groups (PNGs)

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- Why whole population segmentation is a good idea – 5 mins
- Our approach – 10 mins
- Segmentation outputs – 5 mins
- Segmentation in practice – 5 mins
- Discussion



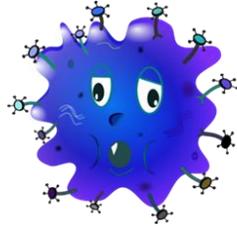
- For a population of  $1m$  lives, ideally, we would be able to create  $1m$  entirely unique care models for each of the residents
- While we don't have this ability, grouping people will help us create models that are based on similar, holistic, individually-focused needs



- With increasingly comprehensive datasets, we know much more about individuals in the population, and we have more confidence that this profile is truly reflective of their clinical circumstances.
- By segmenting we can develop meaningful, clinically coherent groups of people



↑ Ageing population



↑ Chronic Disease



↓ Less Money



Desire for Equity

To provide efficient care we need to understand the health profile of our population.

Access to big  
data



Availability of powerful knowledge engines and  
analytical tools to summarise the data

This (relatively recently) has made it possible to create new models to help understand the health needs of the population.

Technique	Purpose
<b>Segmentation</b>	<ul style="list-style-type: none"> <li>• Segmentation is one of several analytical techniques that can be used to understand how disease and morbidity are distributed within a population</li> <li>• The purpose is to group sub-segments of a population who share similar needs and will benefit from the same type of intervention or treatment</li> <li>• The resulting segmentation analysis can inform the design of care management programmes that help achieve the triple aim of improved quality, better outcomes and lower cost</li> </ul>
<b>Stratification</b>	<ul style="list-style-type: none"> <li>• Risk stratification differs from segmentation in that it identifies people at high risk of a certain event or high health care costs</li> <li>• Put another way, risk stratification ranks a population based on degree of need, whereas segmentation groups people within that population based on what that need actually is</li> </ul>



- Framework for population strategies in integrated care:
  - Whole populations, (Macro level integration),
  - Subpopulations (Meso), and
  - high-risk populations (Micro)
- Patient segmentation supports these strategies by tailoring care models
- Important to consider trade-offs between simplicity and precision
- Conclusion: segmentation provides many benefits to integrated care, and we encourage policy makers to support its use.

## POPULATION HEALTH

By Sabine I. Vuik, Erik K. Mayer, and Ara Darzi

### ANALYSIS & COMMENTARY

## Patient Segmentation Analysis Offers Significant Benefits For Integrated Care And Support

**ABSTRACT** Integrated care aims to organize care around the patient instead of the provider. It is therefore crucial to understand differences across patients and their needs. Segmentation analysis that uses big data can help divide a patient population into distinct groups, which can then be targeted with care models and intervention programs tailored to their needs. In this article we explore the potential applications of patient segmentation in integrated care. We propose a framework for population strategies in integrated care—whole populations, subpopulations, and high-risk populations—and show how patient segmentation can support these strategies. Through international case examples, we illustrate practical considerations such as choosing a segmentation logic, accessing data, and tailoring care models. Important issues for policy makers to consider are trade-offs between simplicity and precision, trade-offs between customized and off-the-shelf solutions, and the availability of linked data sets. We conclude that segmentation can provide many benefits to integrated care, and we encourage policy makers to support its use.

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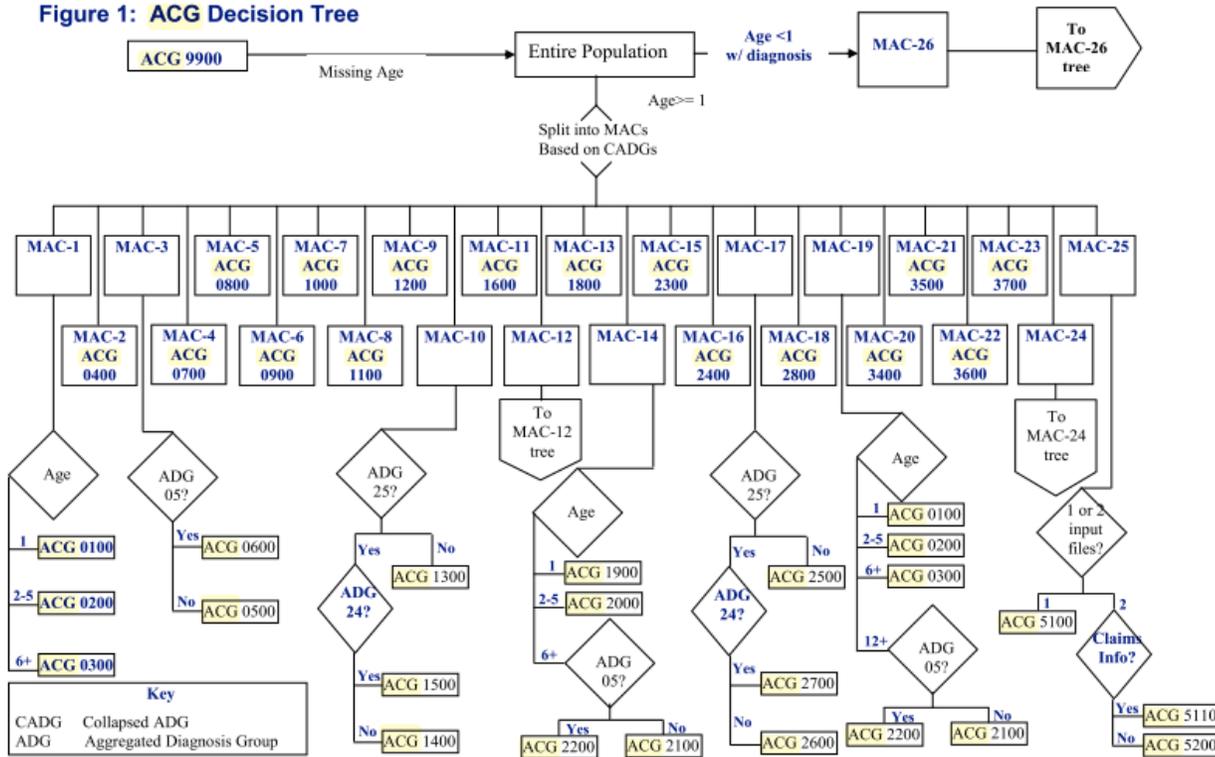
**Erik K. Mayer** is a clinical senior lecturer at the Centre for Health Policy, Imperial College London.

**Ara Darzi** is executive chair of the World Innovation Summit for Health, Qatar Foundation, and director of the Institute of Global Health Innovation, Imperial College London.

Too many?

Too few?

Figure 1: ACG Decision Tree



5 - Very High Morbidity

4 - High Morbidity.

3 - Moderate Morbidity

2 - Low Morbidity

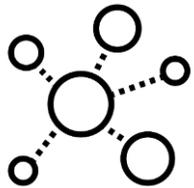
1 - Healthy User

0 - Non-user

# THE PATIENT NEED GROUPS (PNGS)



**Patient Need Groups.** An innovative segmentation model, applicable to all age groups, building upon ACG's whole-person approach to health needs across their lifespan.



**Population segments anchor the Patient Need Groups.** They categorize individuals in a population into each segment based on their health needs for a defined time interval (e.g., a year).



**Eleven (11) mutually exclusive and hierarchical segments describing an individual's health need.**



The Patient Need Groups methodology allows segmentation and stratification of the population, using available markers and predictive models from the Johns Hopkins Adjusted Clinical Groups (ACG®) System. There are three components:

## Component 1: Patient Need Groups

Eleven (11) mutually exclusive population segments based on an individual's range of morbidities, conditions and care needs.

These segments are an extension of ACG's patient-centric methodology and the anchor of the PNG feature.

## Component 2: Care Modifiers

An optional feature of the PNG tool, Care Modifiers are individual traits with opportunities for intervention. These offer actionable data points within each segment.

## Component 3: Risk Stratification

An optional feature of the PNG tool, population segments can be stratified by predicted total cost risk level, allowing for nuanced understanding.



High



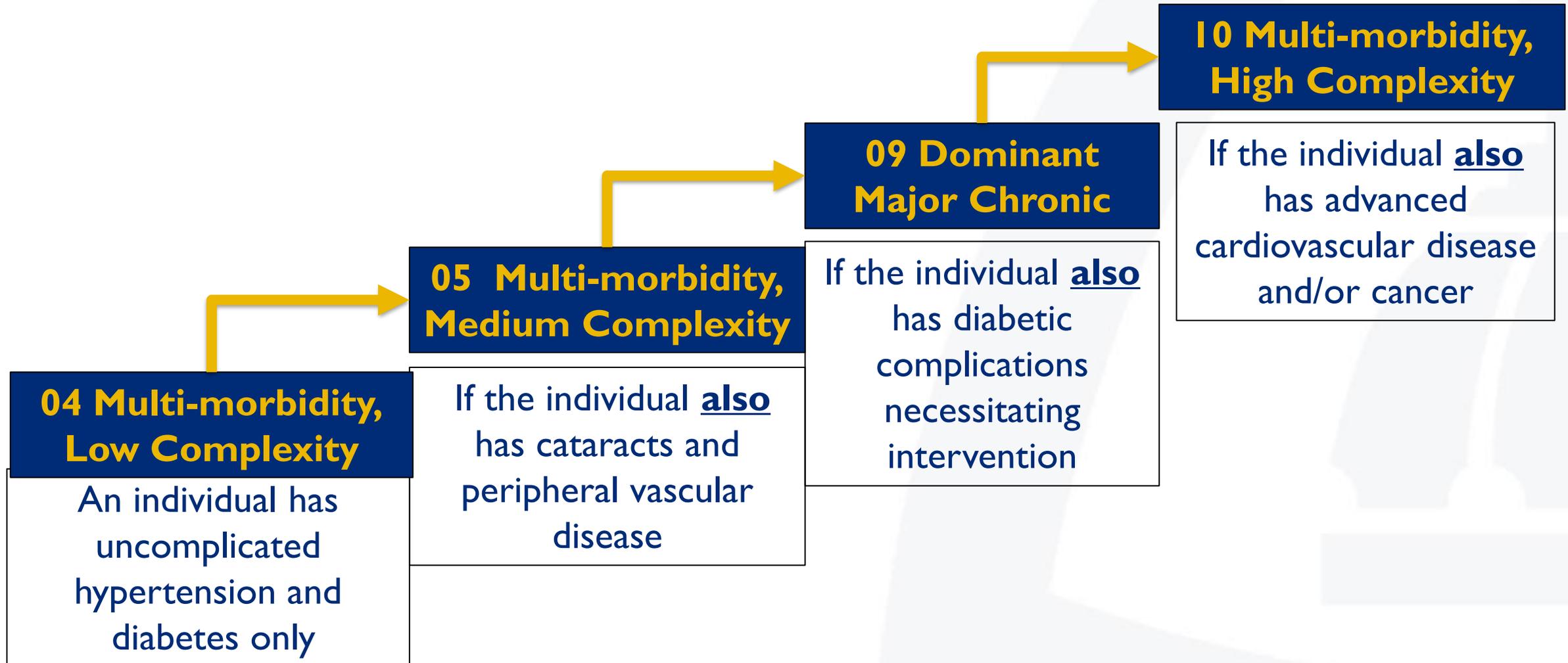
Low

High	Frailty	11 Frailty	Adults aged 65 and older with evidence of <u>2 or more frailty concepts</u>
	High Complexity; Multi-Morbidity	10 Multi-Morbidity, High Complexity	Multi-morbidity with <u>high complexity</u> (major and unstable chronic conditions)
	Dominant Chronic	09 Dominant Major Chronic Condition	<u>Somatic condition with high impact on health, without treatment the condition is progressive and unstable over time</u>
		08 Dominant Psychiatric/Behavioral Condition	<u>Psychiatric condition with high impact on health, without treatment the condition is progressive and unstable over time</u>
	Pregnancy	07 Pregnancy, High Complexity	Pregnancy with or without delivery among women with high morbidity burden
		06 Pregnancy, Low Complexity	Pregnancy with or without delivery among women with low morbidity burden
	Moderate Needs	05 Multi-Morbidity, Medium Complexity	Multi-morbidity with <u>moderate complexity conditions</u>
		04 Multi-Morbidity, Low Complexity	Multi-morbidity with <u>low complexity conditions</u>
	Healthy	03 Low Need Adult	Adults aged 18 and older with acute morbidity and no more than one low complexity condition
		02 Low Need Child	Children aged 0 to 17 with <u>acute morbidity</u> and no more than one low complexity condition
		01 Non-User	Individuals who have <u>no diagnosis</u>
Low			

The “color coded” groupings of PNGs which can be nested together to form larger segments when appropriate



- Individuals are categorized into higher PNGs segments based on the severity of their condition and co-morbidities.





Care modifiers are a unique grouping of **actionable patient-specific factors** with known opportunity to improve care.

**Modifiers can be mixed and matched** to add additional granularity within PNG segments.



“Starter Set” of Care Modifiers		Description
<b>Demographic</b>	Age	Age groups 0-17, 18-44, 45-64, 65-79, 80+
	Sex	Female, Male, Other
<b>Psychiatric / Behavioral</b>	Non-Major Psychiatric Condition	One or more psychiatric or behavioral condition that is <u>not</u> included among the dominant psychiatric / behavioral conditions
	Major Psychiatric Condition	One or more psychiatric or behavioral condition that is included among the dominant psychiatric/ behavioral conditions
	Substance use	Substance use diagnosis or treatment
	Tobacco use	Tobacco use diagnosis or treatment
<b>Special Medical Needs</b>	Cardio-metabolic risk	Cardio-metabolic conditions including hyperlipidemia, hypertension, diabetes and obesity
	Polypharmacy, 5+ Rx types	Medications include 5 or more active ingredients
	Severe polypharmacy, 10+ Rx types	Medications include 10 or more active ingredients
	Cancer treatment	Cancer diagnosis with treatment
	End-stage renal disease	ESRD diagnosis
	Functional Impairment	Adult aged 18-64 years old with 2 or more frailty concepts
	Complicated newborn	Newborn status includes low birth weight, prematurity and disorders of newborn period
<b>Coordination Needs</b>	Care coordination opportunity	Likely coordination issue based on ACG ambulatory care coordination markers
	Lack of primary care	No generalist seen

## Care modifiers reveal **actionable patient-specific cost-savings opportunities**

### PNG 09: Dominant Major Chronic Disease



- 57% of patients have an impactable cardiometabolic risk factor
- 33% have severe polypharmacy
- 12% lack adequate primary care
- 9% have a care coordination opportunity

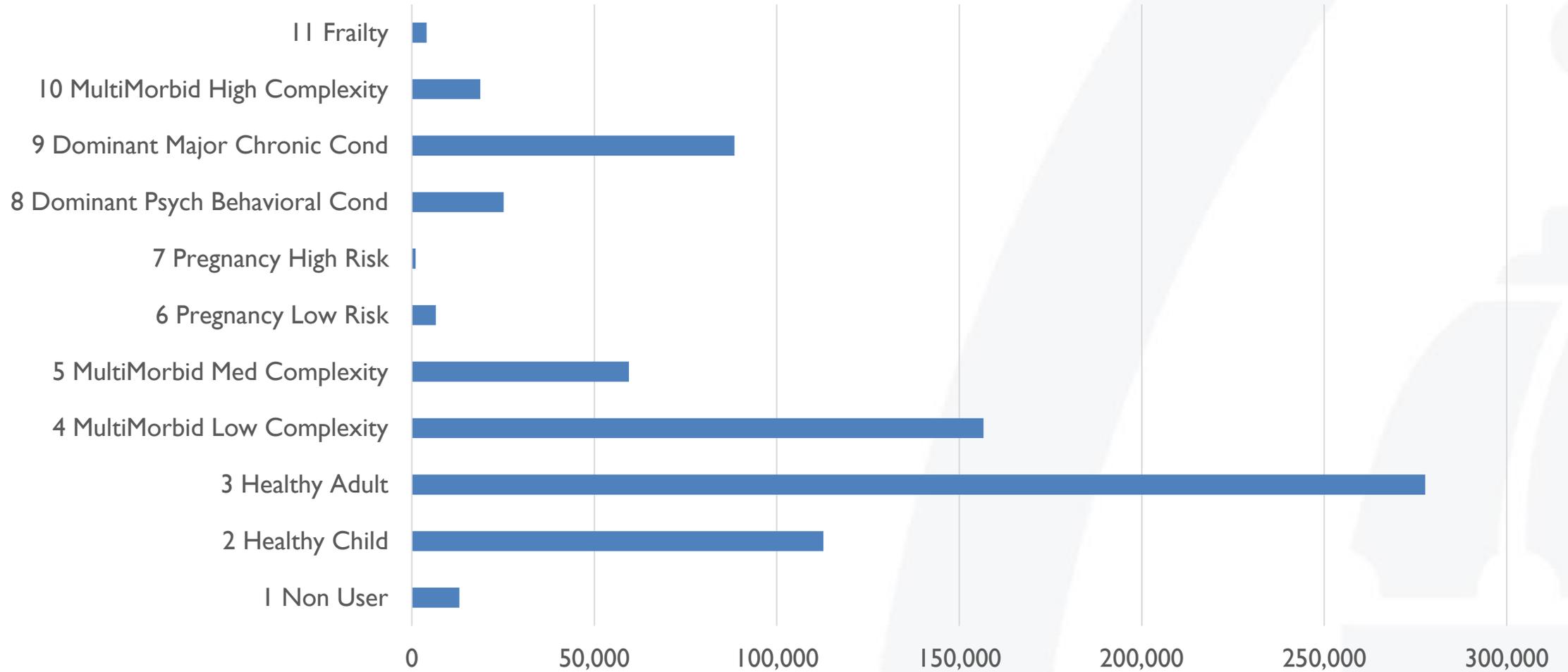
## Annual Cost Savings Opportunities within PNG 09



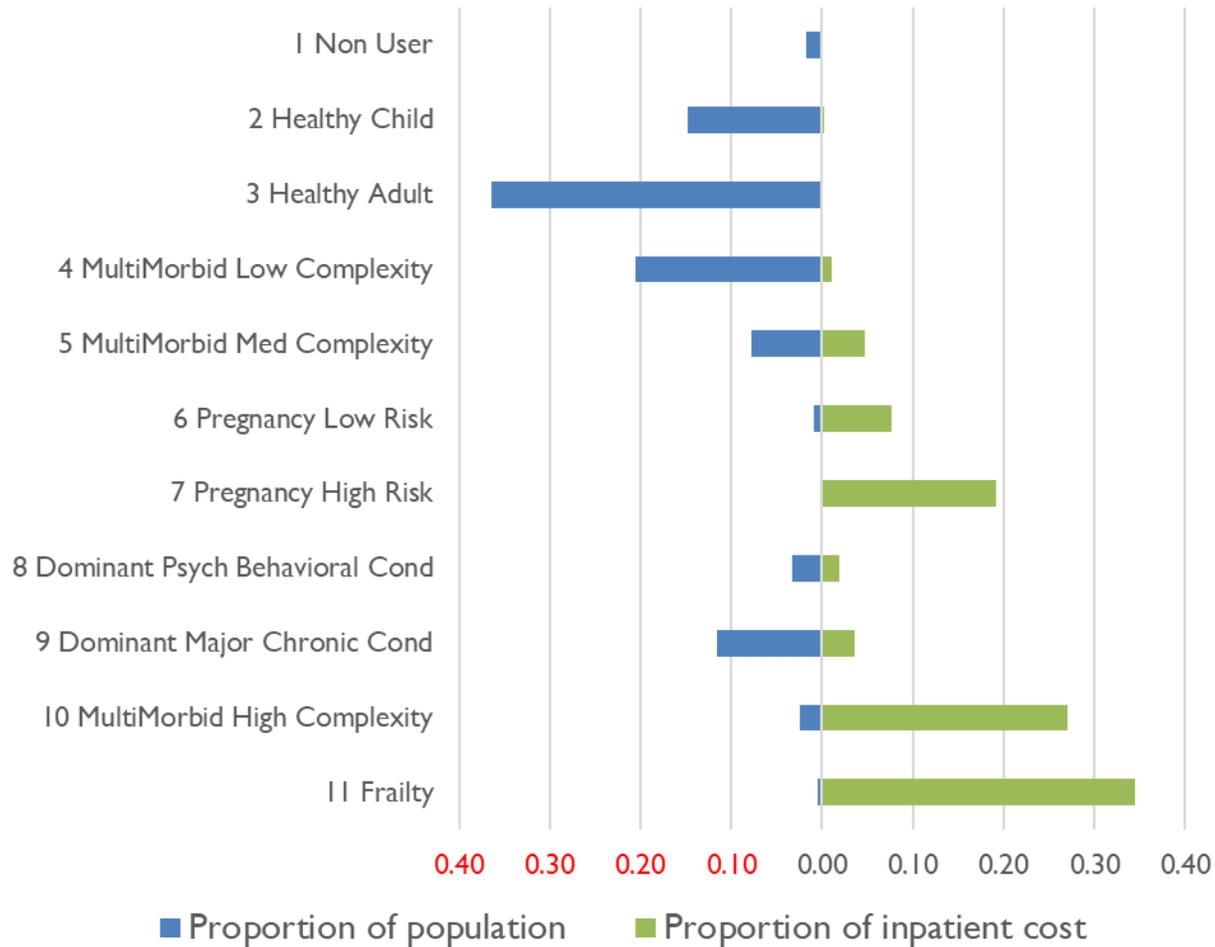
**Combines clinically-oriented health needs with predicted total cost, to identify high-need high-cost patients.**

<b>HIGH</b>	<b>MEDIUM</b>	<b>LOW</b>
Predicted Total Cost Rank $\geq 90\%$	Predicted Total Cost Rank 60-90%	Predicted Total Cost Rank $< 60\%$

PNG Population Distribution

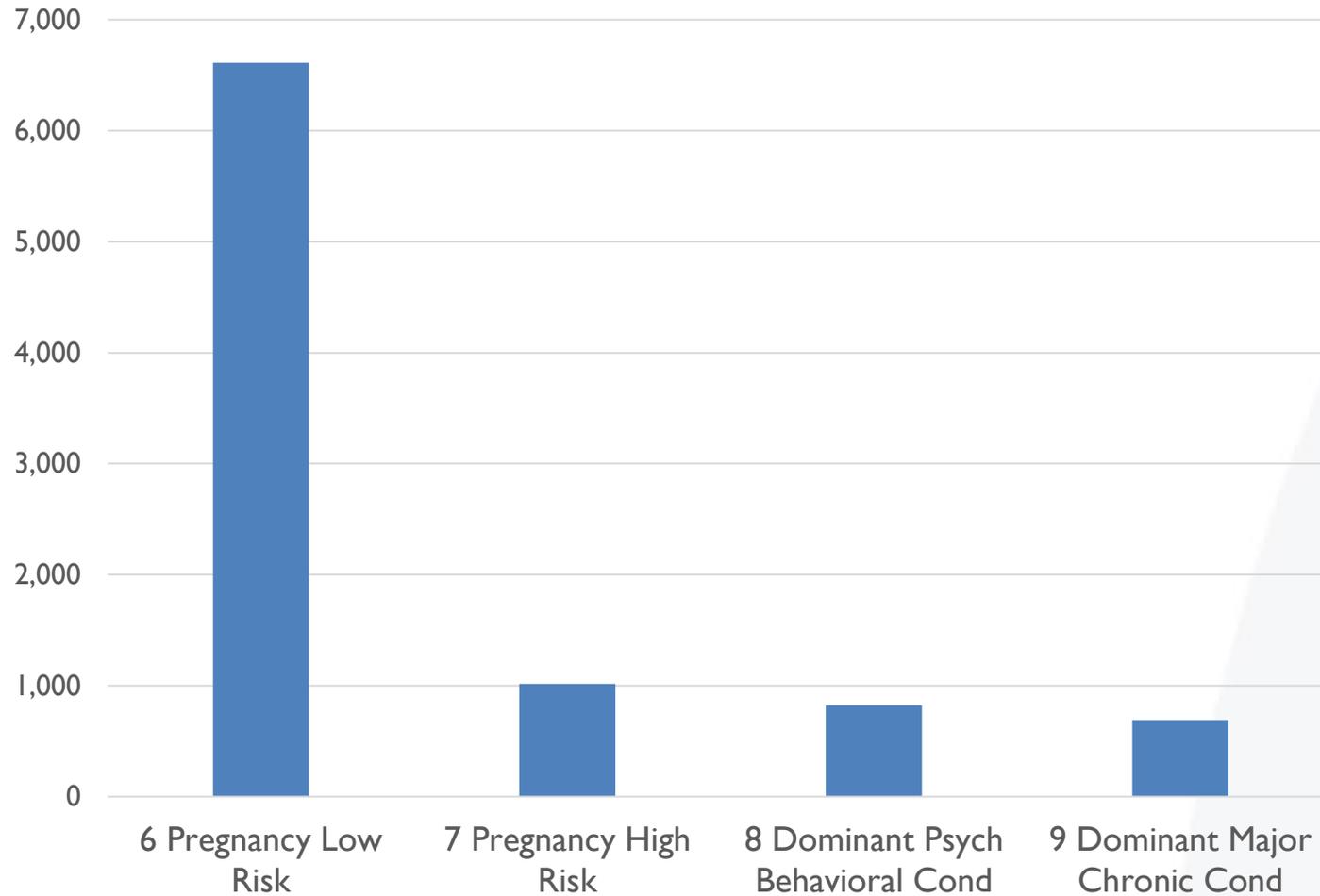


### Population Profiling



- At a population or organisation level, gain an ‘at a glance’ understanding of different population groups and their associated costs (or utilization)

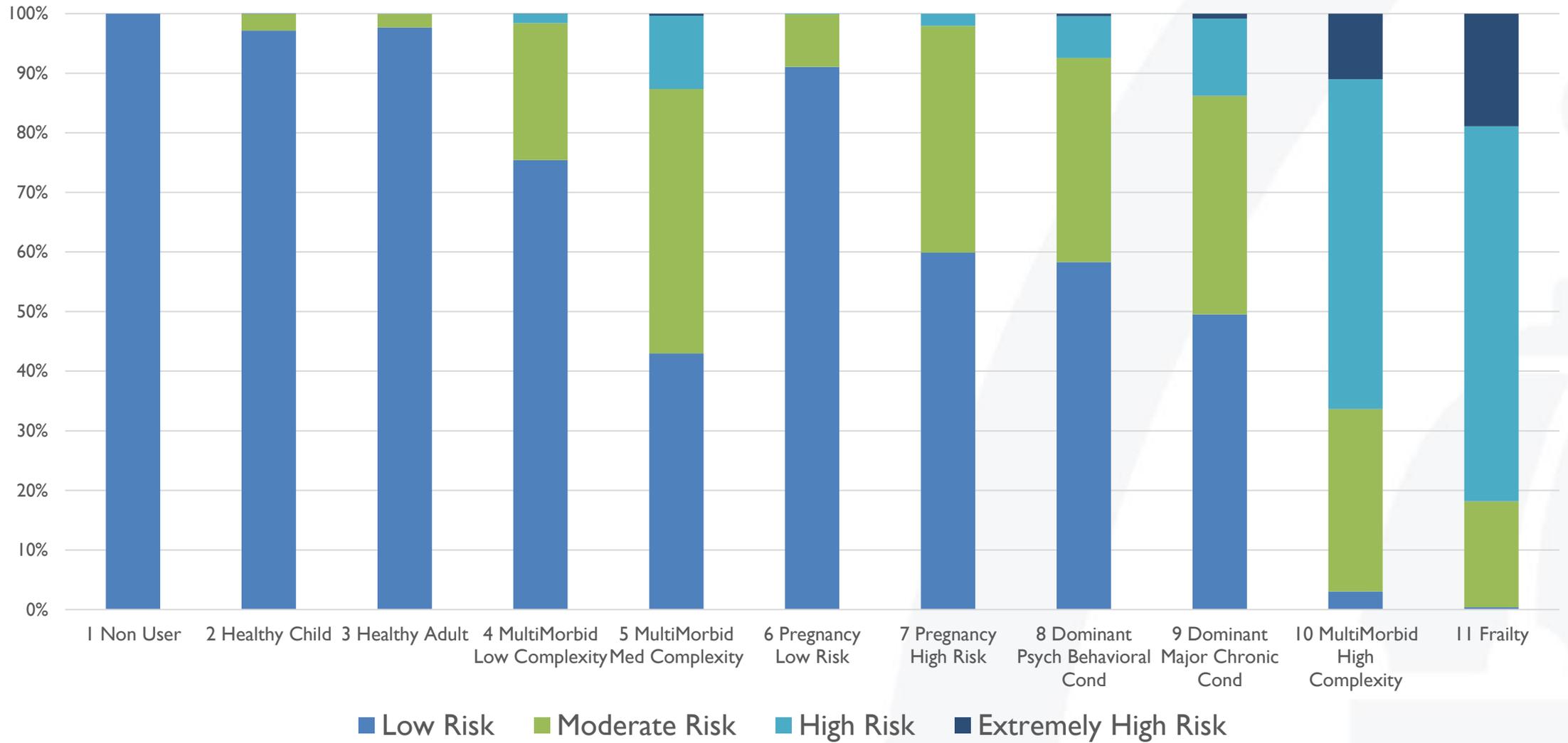
## Pregnancy by PNG



- It is possible to be creative and use a range of different modifiers and PNGs in concert
- Left: we can see the distribution of pregnant women by PNG



# SEGMENTATION & STRATIFICATION





## Supporting Design of Care Management Programs

PNG	% Population	Avg Cost
Frailty	0.5%	£6,451
High Complexity; Multi-Morbidity	2.5%	£5,053
Dominant Chronic	14.9%	£594
Pregnancy	1.0%	£1,720
Moderate Needs	28.3%	£381
Healthy	52.8%	£29

Most cost, utilization, and potentially preventable hospitalizations occur in the frail and multi-morbid groups. **Are they receiving proactive care-coordination services?**

Almost 30% of pregnancies have an underlying risk factor, placing them at high risk of maternal/newborn outcome. **How are they being supported in your pop health strategy?**

These individuals have meaningful underlying health needs but have not yet escalated to needing extensive inpatient or ED services. **How can we prevent their circumstances worsening?**

Healthy now – **best target for preventive screenings and health promotion**



## An **innovative approach** to patient categorization from the Johns Hopkins ACG System

### **Component 1: Patient Need Groups**

A core set of 11 population segments

### **Component 2: Care Modifiers**

Individual traits with opportunities for clinical intervention

### **Component 3: Risk Stratification**

Levels used for insightful overlay of predicted cost with current health needs



- **Health promotion and service design**
  - Tailoring information or resources required to improve individual's health
- **Transition modelling**
  - How do people move between segments and can these transitions be used to estimate what our population composition will look like in 5-10 years time?
- **Cohorting as a service**
  - Through using a combination of the PNG segmentation components, users can easily define, monitor and federate specific cohorts (e.g. people who are frail that are high risk of mortality that are also likely to have care coordination issues)
- **Allocative efficiency**
  - It is possible to not only understand how observed costs are distributed by 'need' but also plan for resources to be more aligned with anticipated need
- **Understanding inequalities**
  - Is there 'unfairness' within specific PNGs that are influenced by organisational or geographical boundaries or socio-economic status?
- **Real time utility**
  - Through advances in digital technology and mature information sharing agreements it is possible to share an individual's PNG to support real-time reactive models of care



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This is available  
now – how will  
you be using it?

