JOHNS HOPKINS MEDICINE

POPULATION HEALTH ANALYTICS

An Introduction to Some of the Supplementary Markers Produced by the ACG System

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AGENDA

- Introductions
- Quick Review of First Webinar
- Introduction to Additional & Supplementary Markers
- How to Access Recordings and Slides
- Next Session
- Questions & Answers

KEY MARKERS & MODELS IN THE ACG SYSTEM

Main Markers

- Aggregated Diagnostic Groups – ADGs
- Adjusted Clinical Groups – ACGs
- Resource Utilisation Bands – RUBs
- Expanded Diagnosis Clusters – EDCs
- Pharmacy Based Markers – Rx-MGs
- Predictive Models
- Patient Need Groups - PNGs

SUPPLEMENTARY MARKERS IN THE ACG SYSTEM

Supplementary Markers

- Hospital Dominant Condition Marker
- Frailty Markers
- Chronic Condition Count
- Care Coordination Markers
- Condition Markers
- Pharmacy Markers
  - Pharmacy Adherence Markers
  - Active Ingredient Count
  - Medicine Management Scores
- Laboratory Markers
- Emergency Department Classification

HOSPITAL DOMINANT MORBIDITY TYPES

- Also known as Hosp Dom count
- A count of ADGs containing trigger diagnoses indicating a high probability (typically greater than 50%) of future admission.
- Can be used as a filter in case finding activities

ICD-10 Code	Description
C34.1	Malignant Neoplasm, Upper Lobe, Bronchus or Lung
F31.6	Bipolar affective disorder, mixed episode
A40	Streptococcal Septicaemia
J44.1	Obstructive Chronic Bronchitis with acute exacerbation
J96.1	Acute Respiratory Failure
N17.9	Acute Renal Failure, unspecified
R18	Ascites

UPDATED FRAILTY MARKER

Frailty concepts

- MAL Malnutrition and/or catabolic illness
- DEM Dementia
- VIS Severe vision impairment
- URC Major problems of urine retention or control
- DEC Decubitus ulcer
- WLK Difficulty in walking
- WEI Loss of weight
- SSN Social support
- FAL Fall
- DTS Danger to self
- AFC Absence of Fecal Control

Markers

- Frailty Concept Count
- Severity level for each concept:
  - 1. Minor
  - 2. Intermediate
  - 3. Major

Frailty Flag	Frailty Concepts	Frailty Concept Count
☑	DEM WLK	2
☑	DEM FAL	2
☑	DEM FAL	2
☑	URC WLK	2
☑	URC	1
☑	WLK	1
☑	WEI	1

CHRONIC CONDITION COUNT

- Within the ACG System there is an additional EDC-based Marker - **Chronic Condition Count**
- The chronic condition count is a subset of 2,600 diagnosis codes that represent persistent and/or progressive chronic illness
- Cost, activity and future risk rise almost exponentially as the CCC increases

Chronic Condition Count	% of Population	Rate of Emergency Admissions Compared to Mean	Rate of A&E Attendances Compared to Mean	Mean Total Cost for 12 Months (£)	Mean of Predicted Cost Ratio	Mean of Risk of Emergency Admission
Whole Popualtion	100%	1.0	1.0	925	0.95	5%
0	52.8%	0.4	0.8	360	0.32	2%
1	22.2%	0.8	1.0	778	0.79	4%
2	10.4%	1.3	1.2	1317	1.41	6%
3	5.8%	1.9	1.4	1886	2.10	9%
4	3.5%	2.6	1.5	2553	2.84	13%
5	2.1%	3.5	1.7	3254	3.54	16%
6	1.3%	4.5	2.0	3885	4.18	21%
7+	1.9%	7.5	2.9	5760	5.62	31%

CARE COORDINATION MARKERS

- The care coordination markers in the ACG System were developed on US data and American health care concepts
- In 2022 these were recalibrated to align with UK health concepts
- The assignment methodology is based upon the following four variables:
  - Unique Provider Count
  - Generalists Seen
  - Specialty Count
  - Majority Source of Care
- Patients are allocated to one of the following three risk categories:
  - **Likely Coordination Issues (LCI)** – the small percentage of patients who are likely to be most at risk of poorly coordinated care
  - **Possible Coordination Issue (PCI)** – patients who may be at risk of poorly coordinated care
  - **Unlikely Coordination Issue (UCI)** – patients who are unlikely to be at risk of poorly coordinated care

IMPACT OF COST AND ACTIVITY

RUB (Complexity Band) **Very High & High** Total Population c. 700,000

Category	No. of Patients	% of Patients	Mean Specialty Count	Mean Total Cost (£)	Mean Inpatient Activity	Mean Emergency Department Activity	Mean Risk of Hospitalisation 12 Months
LCI	1,205	8.6%	6.7	7,027	2.7	2.1	0.6
PCI	2,999	21.4%	5.7	6,104	2.4	1.6	0.6
UCI	9,816	70.0%	2.5	2,060	0.8	0.6	0.3
Total	**14,020**	**100.0%**	**3.5**	**3,352**	**1.3**	**0.9**	**0.4**

Likely Coordination Issue (LCI)

V

Unlikely Coordination Issue (UCI)

x 3

x 3.5

x 3.5

x 2

OPPORTUNITIES

- Three main use cases:
  1. An impactability marker that can be used where care management capacity is limited
  2. Identifying people suitable from support from a new role withing primary care in the English NHS – 'Care Coordinators'
  3. Flagging older people seeing multiple specialist who could have their care provided by a geriatrician instead

CONDITION MARKERS (1)

- Age-related Macular Degeneration
- Bipolar Disorder
- Congestive Heart Failure
- COPD
- Chronic Renal Failure
- Deficiency Anemia
- Depression
- Diabetes
- Glaucoma
- Human Immunodeficiency Virus
- Disorders of Lipid Metabolism
- Hypertension
- Hypothyroidism
- Immunosuppression/Transplant
- Ischemic Heart Disease
- Low Back Pain
- Osteoporosis
- Parkinson's Disease
- Persistent Asthma
- Rheumatoid Arthritis
- Schizophrenia
- Seizure Disorders

CONDITION MARKERS (2)

- For each condition determine evidence of condition
  - NP = Condition not present by any data source
  - ICD = Condition is identified by diagnosis only
  - Rx = Condition is identified by pharmacy only
  - BTH = Condition was identified by both diagnosis and pharmacy criteria but minimum treatment criteria were not met
  - TRT= The condition was identified according to specific treatment criteria which include a minimum of two prescriptions

CONDITION MARKERS DETAIL - SAMPLE

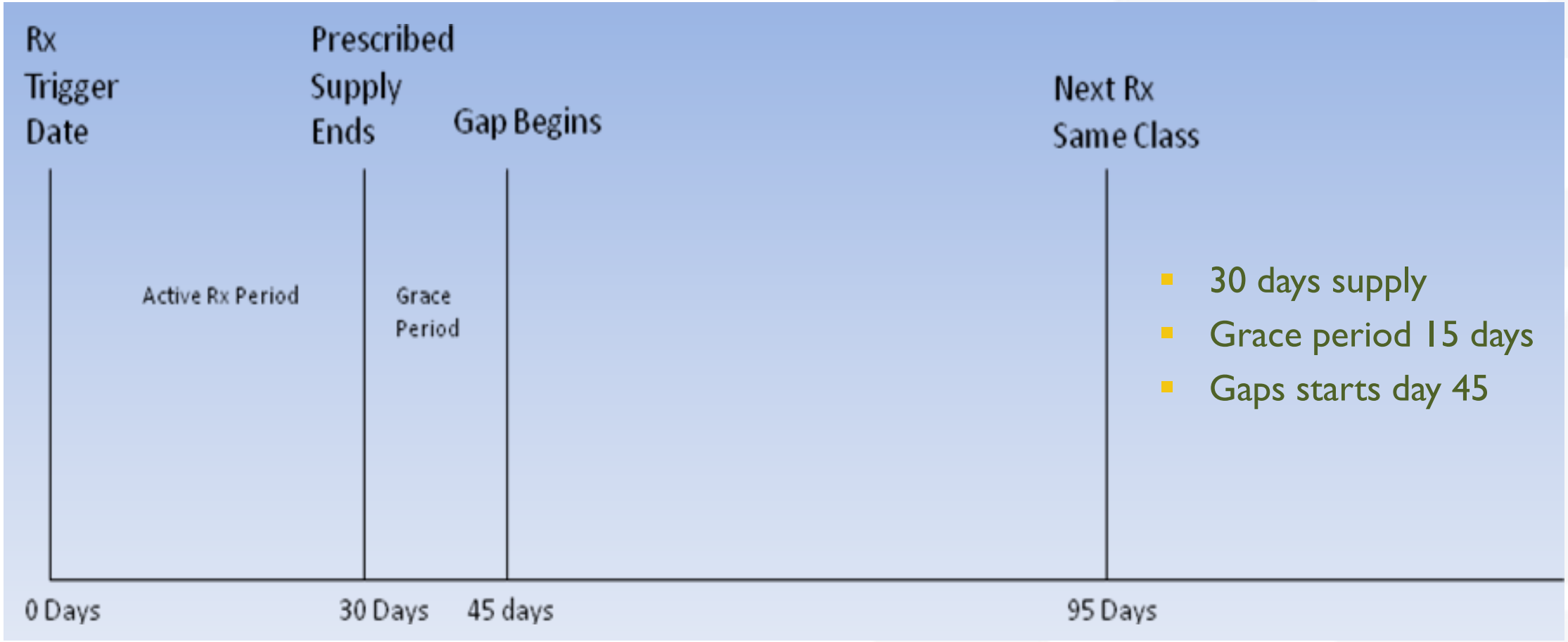
Definitions of Condition Markers

Condition	Diagnostic Criteria	Pharmacy Criteria	Treatment Criteria	Untreated Criteria
Age-related macular degeneration	EYE15	Anti-angiogenic ophthalmic agents	N/A	N/A
Bipolar disorder	PSY12	N/A	Diagnostic criteria plus 2 prescription fills (within 120 days of each other) in at least one of the drug classes: Anti-convulsants, Anti-psychotics	Diagnostic criteria with less than 2 prescription fills (within 120 days of each other) in a single drug class: Anti-convulsants, Anti-psychotics
Congestive heart failure	CAR05	N/A	Diagnostic criteria plus 2 prescription fills (within 120 days of each other) in at least one of the drug classes: ACEI/ARB Aldosterone receptor blockers Beta-blockers Diuretics Inotropic agents Renin Inhibitors Vasodilators	Diagnostic criteria with less than 2 prescription fills (within 120 days of each other) in a single drug class: ACEI/ARB Aldosterone receptor blockers Beta-blockers Diuretics Inotropic agents Renin Inhibitors Vasodilators
Depression	PSY09, PSY20	PSYx040	Diagnostic criteria plus 2 prescription fills (within 120 days of each other) in the drug class: Anti-depressants	Diagnostic criteria with less than 2 prescription fills (within 120 days of each other) in the drug class: Anti-depressants

PHARMACY ADHERENCE MARKERS

- **Number of Gaps:** Count of occurrences where time interval between end of supply of one prescription and onset of next prescription for the same medication is more than the grace period.
- **Medication Possession Ratio (MPR):** Total number of days for which medication is dispensed (excluding final prescription) divided by the total number of days between the first and last prescription.
- **Continuous Single-Interval Measure of Medication Availability (CSA):** Ratio of days supply to days until the next prescription averaged across all prescriptions.
- **Proportion of Days Covered (PDC):** Ratio of days supply divided by days between the first prescription fill and the end of the observation period.
- **Untreated:** No evidence of treatment with a designated class of pharmaceuticals.

WHAT IS A PHARMACY GAP?



- 30 days supply
- Grace period 15 days
- Gaps starts day 45

ACTIVE INGREDIENT COUNT

- Count of unique active ingredient/route of administration combinations encountered in the patient's drug claims.
- A count greater than or equal to 20 adds weight to the predictive model.

Active Ingredient Count	% of Patients	Mean Annual Pharmacy Cost Per Patient (£)
0	41.0%	0
1	14.8%	9
2	10.4%	26
3	7.3%	49
4	5.4%	76
5	4.1%	110
6	3.2%	150
7	2.6%	192
8	2.0%	223
9	1.8%	281
10	1.4%	314
11	1.1%	354
12	0.9%	395
13	0.8%	436
14 +	3.2%	633

MEDICATION MANAGEMENT SCORES

1. **Medication Complexity Scores** highlight medications with complex instructions for use, including routes of administration, frequency, or those which require devices

    - ***Medication Complexity Score:*** The overall score based on summing the complexity scores of a patient's individual prescriptions
    - ***Complex Medication***: A binary marker triggered if any one individual medication is considered complex

2. **High Caution Medication Scores** highlight medications with inherent risk of adverse drug events (ADEs) including life threatening complications, or those that require therapeutic drug monitoring for safety

    - ***High Caution Rx Score***: *Overall count based on the number of distinct categories of high caution medications a patient is receiving.*
    - ***High Caution Medication***: *A binary marker triggered if patient is receiving any high caution medication.*

LAB MARKERS

Data Input

- Patient Identifier
- Lab Result Date
- Lab Code Set (LOINC)
- Result Value

Condition	Identification Goal	Lab Component
Diabetes Mellitus (DM)	Impaired glucose tolerance	Hemoglobin A1c
	DM	Hemoglobin A1c, Random glucose, 2-hr 75-g OGTT
	Uncontrolled DM	Hemoglobin A1c
Dyslipidemia (DL)	Dyslipidemia	LDL, HDL, Total cholesterol
	Uncontrolled dyslipidemia among persons with *high risk conditions*	LDL
Deficiency Anemia (DA)	Deficiency anemia	Hemoglobin
Kidney disease (KD)	Kidney disease	Creatinine Blood Urea Nitrogen (BUN)

**high risk conditions* = aortic aneurysm, CAD/CHD, cerebrovascular disease, diabetes, peripheral vascular disease

From: https://www.hopkinsacg.org/wp-content/uploads/2018/04/5C-Klaus-Lemke-presentation.pdf

LAB MARKERS

- Version 12 of the ACG system introduces a set of Lab markers which are calculated by the system from laboratory data. The set of lab markers are:

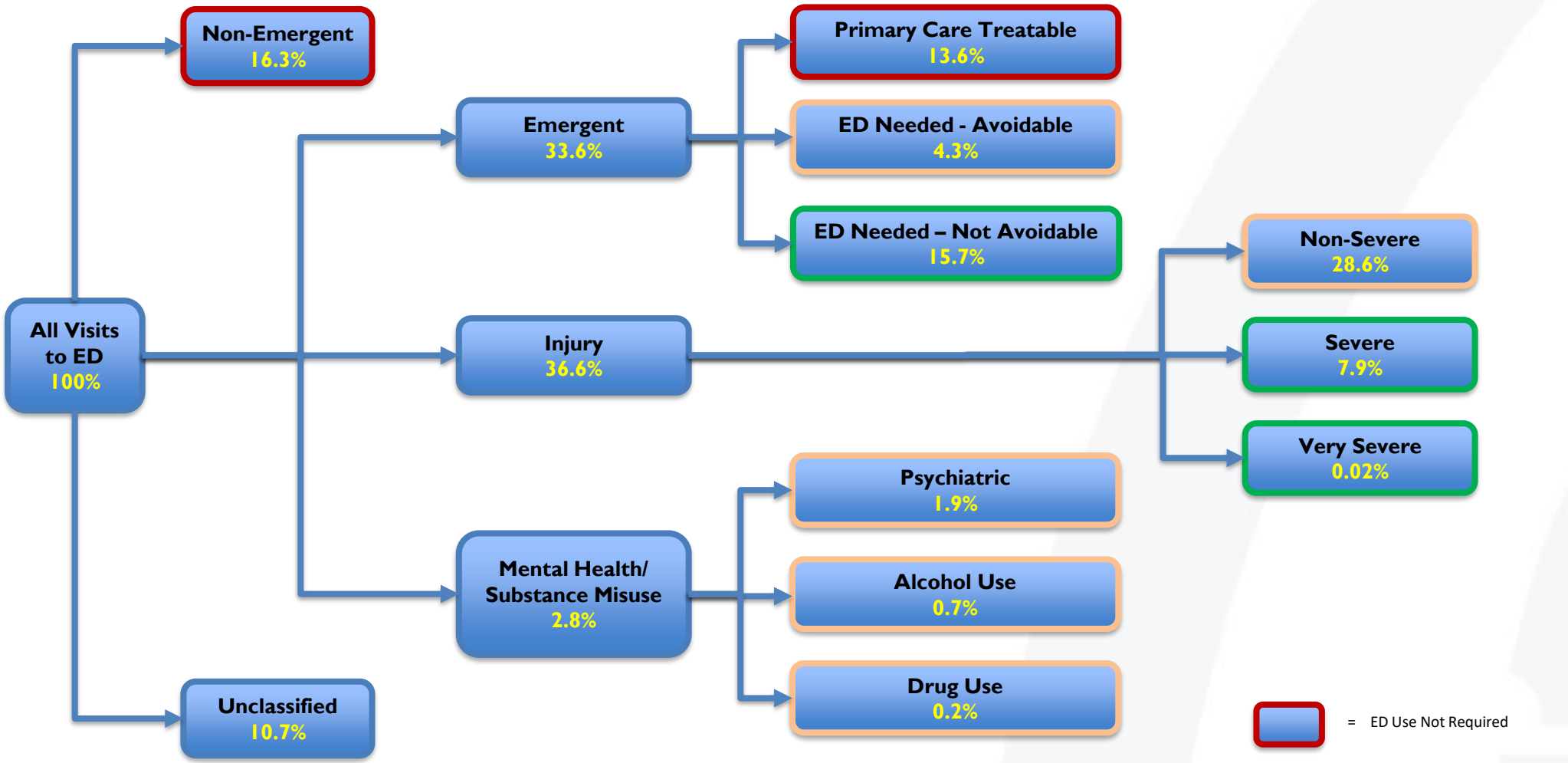
Condition	Diagnosis and/or Medication Present	Lab Marker	Description
Diabetes	Yes	ENDDM_RAC	Diabetes, recognized / adequate glycaemic control
	Yes	ENDDM_RNC	Diabetes, recognized / inadequate glycaemic control
	No	ENDDM_IGT	Impaired glucose tolerance/pre-diabetes
	No	ENDDM_ACL	Diabetes, unrecognized / adequate glycaemic control
	No	ENDDM_NCL	Diabetes, unrecognized / inadequate glycaemic control
	No	ENDDM_LAB	Diabetes, unrecognized / lab indication
Dyslipidemia	Yes	CARDL_RAC	Dyslipidaemia, recognized / adequate LDL cholesterol control
	Yes	CARDL_RNC	Dyslipidaemia, recognized / inadequate LDL cholesterol control
	No	CARDL_LAB	Dyslipidaemia, unrecognized / lab indication
Deficiency Anemia	No	HEMDA_LAB	Deficiency anaemia, unrecognized / lab indication
Kidney Disease	No	RENKD_LAB	Chronic kidney disease, unrecognized / lab indication

EMERGENCY DEPARTMENT VISIT CLASSIFICATION

- An expansion and update of the NYU ED visit algorithm
- Results: Eleven categories have been determined

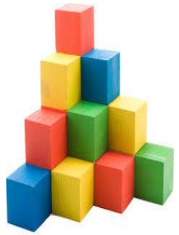
Category Type	Category	Example
Non-emergent / Emergent	Non-emergent	Fever, headache, nausea, vomiting
	Emergent, primary care treatable	Bronchitis, non-specific abdominal pain, other chest pain
	Emergent, ED care needed, potentially avoidable	Dehydration, acute asthma attack, tractable epilepsy
	Emergent, ED care needed, not potentially avoidable	Kidney stones, chest pain, syncope and collapse
Mental Health / Substance Abuse	Psychiatric	Depressive episode
	Alcohol use	Inebriation
	Drug use	Heroin overdose
Injury	Injury, non-severe	Lacerations, muscle strains, sprains
	Injury, severe	Closed fractures, concussions, post-procedure infection
	Injury, severe and inpatient hospitalization likely	Multiple rib fractures, subdural hemorrhage following injury, traumatic pneumothorax
Unclassified	Unclassified	

UK EXAMPLE FROM CCG X



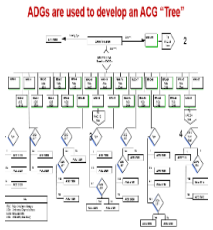
THE ACG SYSTEM IN A NUTSHELL

Aggregated Diagnoses Groups (ADGs):
The Building Block



ADGs classify diagnoses into a limited number of clinically meaningful, but not disease-specific, morbidity groups.

Adjusted Clinical Groups (ACGs):
Patient-Centric Measure of Health Status



Each ACG includes individuals with:

- A similar pattern of morbidity
- Similar expected resource use

Can be collapsed into 6 RUBs to easily assess casemix in different populations

Expanded Diagnosis Clusters (EDCs):
Groups of clinically similar diagnoses

284 groups that can be combined into 27 Major EDC categories of clinical conditions.

Facilitates disease and condition based profiling and sophisticated case finding activities.

Patient Need Groups (PNGs)
An innovative segmentation model

Eleven mutually exclusive population segments, applicable to all age groups, building upon ACG's whole-person approach to health needs across their lifespan.

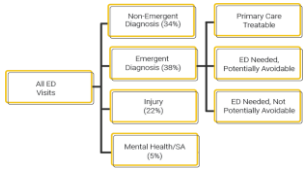
The Johns Hopkins ACG® System

ACG System Predictive Models
Assessing Future Risk

More than a dozen models that predict future resource use (eg total cost, pharmacy cost) and risk of future adverse events (eg hospitalisation).

Additional Mortality Risk Score model assists with identification of patients who may require end-of-life care

Emergency Department Classification



The ACG System's ED classification algorithm categorises people who attend ED based on the condition/diagnosis.

It can be used to identifying people with non-emergent or primary care treatable conditions

Pharmacy-Based Markers
Making Use of Primary Care Prescription Data

A range of markers derived from prescription data including:

- Active ingredient count as a marker of polypharmacy
- Medicine Complexity Score describing each patient's regimen complexity

Additional Markers & Measures

For example:

- Flag of conditions likely to require hospitalisation
- A frailty marker
- Flagging patients likely to have care coordination issues
- Laboratory based markers to assess control of LTC like diabetes

RECORDINGS

Please click the links below to view the presentation slides and webinar recordings.

An Introduction to the ACG System and Main Markers (Wednesday 01 March 2023)

Click here for a printable copy of the presentation slides.

- https://www.hopkinsacg.org/acg-uk-webinar-recordings/

NEXT TIME - PATIENT NEED GROUPS (PNGs)

Day	Date	Time (UK)	Subject	Speakers	Link
Wednesday	29 March 2023	13.00 - 13.45	Segmentation & Stratification Methodologies and an Introduction to the Patient Need Groups (PNGs)	James Barrett & Paul Molyneux	Click here to join the meeting

High

Low

Frailty	11 Frailty	*Adults aged 65 and older with evidence of 2 or more frailty concepts*
High Complexity; Multi-Morbidity	10 Multi-Morbidity, High Complexity	*Multi-morbidity with high complexity (major and unstable chronic conditions)*
Dominant Chronic	09 Dominant Major Chronic Condition	*Somatic condition with high impact on health, without treatment the condition is progressive and unstable over time*
	08 Dominant Psychiatric/Behavioral Condition	*Psychiatric condition with high impact on health, without treatment the condition is progressive and unstable over time*
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 moderate complexity conditions*
	04 Multi-Morbidity, Low Complexity	*Multi-morbidity with low complexity conditions*
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 acute morbidity and no more than one low complexity condition*
	01 Non-User	*Individuals who have no diagnosis*

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Thank You

Questions?