

# Cluster analysis of medication adherence in Pacific patients with high cardiovascular risk

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# EMR-enabled systematic estimation of medication adherence



- General Practice Electronic Medical Records (EMRs) indicate the availability of prescription medications to patients.
- *Medication possession ratio* (MPR) is a percentage of days covered with medication supply.
- An  $MPR < 80\%$  is commonly interpreted as indicating non-adherence



# The Caring Does Matter (CDM) intervention



- Targeted delivery
  - High cardiovascular disease risk (CVR $\geq$ 10%, 5-year event risk)
  - Low MPR (<80%)
- Practice nurse-led structured chronic care model
  - setting up automatic reminders
  - undertaking patient contact, education and follow-up



# Research methods – variables



- Demographics (gender, age, Pacific ethnicity subgroup, and quintile deprivation index)
- Baseline MPR and physiological measures (BP, lipids, HbA1c & BMI)
- Other risk factors at baseline (smoking status, CVR score and diabetes)
- $\Delta$ MPR &  $\Delta$ Measures from baseline to 1-year follow-up

# Research methods – clustering

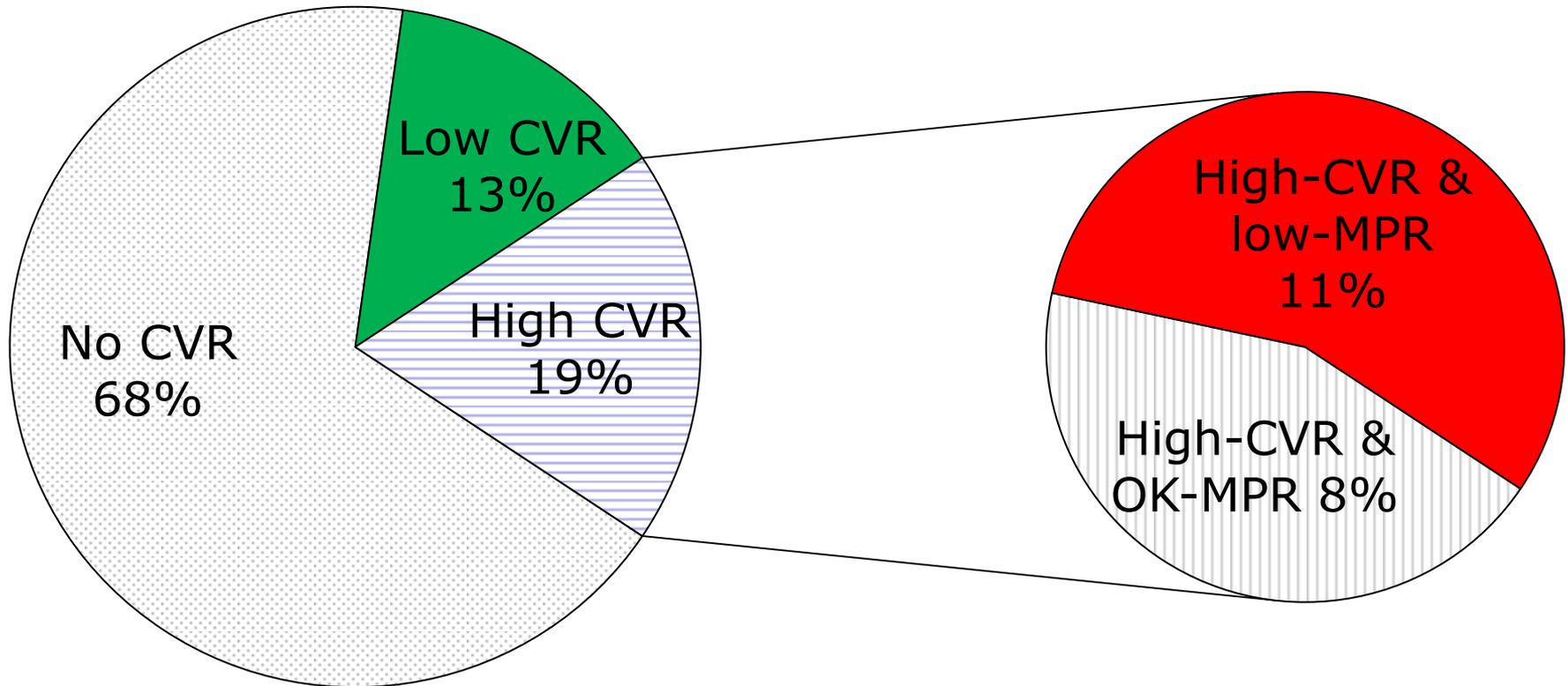


- K-means clustering (3 tiers of variables)
  1.  $\Delta$ MPR
  2.  $\Delta$ MPR + demographics
  3.  $\Delta$ MPR + demographics +  $\Delta$ Measures + baseline measures + other risk factors
- CCC values for 2-6 clusters were examined to choose best # of clusters
- Wilcoxon test & chi-square to compare clustered patient groups ( $p < 0.05$ )

# Results – study participants



**Total=10,863 Pacific adults**



# Characteristics of high-CVR Pacific patients (n=1786) at baseline



- 45% women
- Mean age = 60 (SD=10.6)
- Mean BP = 132/80 (SD=14.9/10.2)
- Mean total-HDL ratio = 3.98 (SD=1.04)
- Mean HbA1c = 59 (SD=19.2)
- Mean BMI = 35 (SD=7.4)

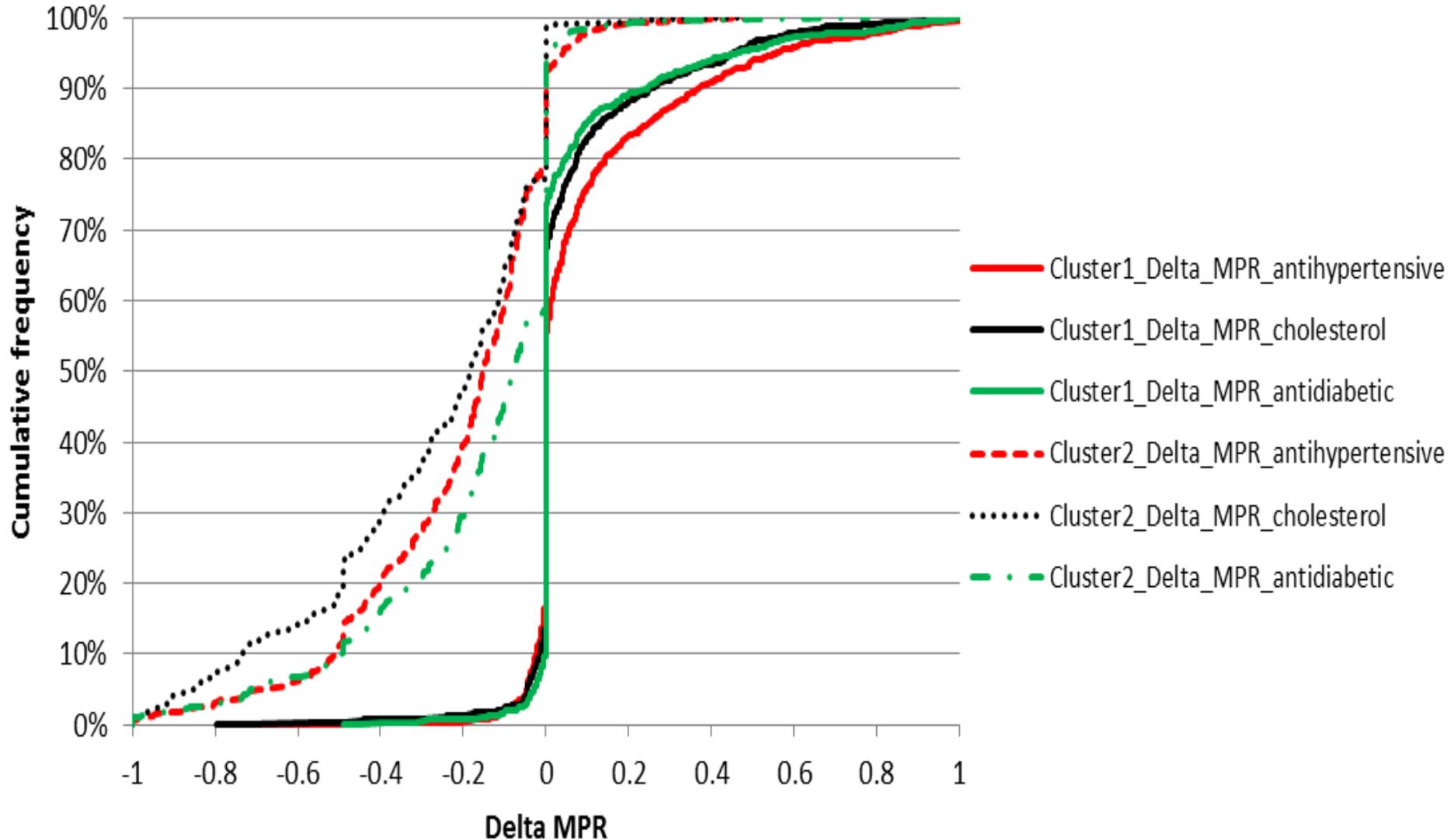
# Tier 1 clusters (by $\Delta$ MPR)



Cluster	1	2
Patient #	1262	524
Mean $\Delta$ MPR - antihypertensive	0.09	-0.21
Mean $\Delta$ MPR - cholesterol	0.06	-0.27
Mean $\Delta$ MPR - oral antidiabetic	0.06	-0.16
Mean $\Delta$ SBP	-0.64	1.75
Baseline diabetes %	50%	70%
Mean baseline HbA1c	57.40	60.96
Mean baseline CVR	17.84	19.23

- Patients who failed to improve adherence during CDM had higher prevalence of diabetes.
- But no significant diff. in demographics,  $\Delta$ DBP,  $\Delta$ HbA1c,  $\Delta$ total-HDL ratio,  $\Delta$ BMI, baseline smoking status, or other baseline measures.

# Tier 1 clusters (by $\Delta$ MPR)



# Tier 2 clustering



- By  $\Delta$ MPR + demographics
- No clear clusters are identified, with  $CCC < 0$  for each of the clustering approaches between 2 clusters to 6 clusters.

# Tier 3 clusters (by all variables)



<b>Variables</b>	<b>Cluster 1</b>	<b>Cluster 2</b>	<b>Cluster 3</b>
Patient #	460	530	796
Mean $\Delta$ MPR - antiHT	2%	2%	-2%
Mean $\Delta$ SBP	-17.11	-2.16	8.7
Mean $\Delta$ DBP	-9.05	-2.09	3.75
Mean $\Delta$ HbA1c	-0.29	-15.03	1.38
Mean baseline (BL) SBP	148.89	130.58	123.81
Mean BL DBP	88.63	79.84	76.03
Mean BL Total-HDL ratio	3.93	4.21	3.93
Mean BL HbA1c	52.61	95.32	52.47
Mean BL BMI	34.51	36.47	35.06
Mean BL CVR	20.12	15.82	18.79
BL Diabetes %	52%	51%	61%
BL non-smoker %	57%	49%	57%
BL ex-smoker %	25%	23%	23%
BL smoker %	17%	27%	20%
Age	63.4	56.62	60.47
Quintile	3.89	4.14	3.9

# Tier 3 clusters (by all variables)



- One cluster was characterized by higher but improving blood pressure
- Another cluster characterized by higher but improving HbA1c
- But no significant diff. among the 3 clusters in gender, Pacific islands,  $\Delta$ MPR – cholesterol,  $\Delta$ MPR – antidiabetics,  $\Delta$ total-HDL ratio, or  $\Delta$ BMI.

# Discussion



- Clustering of patients from programme data can guide further study to better understand and tailor interventions
  - Why didn't the intervention work uniformly for all patients?
- In this case, no 'smoking gun' but some significantly different groups
  - Basis for patient focus groups based on cluster membership
  - May reveal themes that dictated their direction during the intervention period

# Limitations



- May not be the ‘right’ data
  - We used what we had, but didn’t collect items like health beliefs and level of family/social support
- Can just be seeing ‘random’ variation
  - Those measured at a high point then tend to drift lower (‘regression to the mean’)
  - But there’s a difference between variation that’s unaccountable in the available model and that which is ‘truly’ random
    - E.g. you can get a high BP reading because you had a bad day, but deciding to skip heart medication for six months probably has a cause that is theoretically amenable to intervention

# Conclusion



- Cluster analysis reveals statistically distinct patient groups
- EMR analysis can assist quality improvement initiatives
  - To better understand the characteristics of the population under intervention
  - To evaluate for whom the intervention was more or less effective

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