Persistence and Duration of Out-of-Control Biometric Measures in Patients with Cardio-Metabolic Conditions

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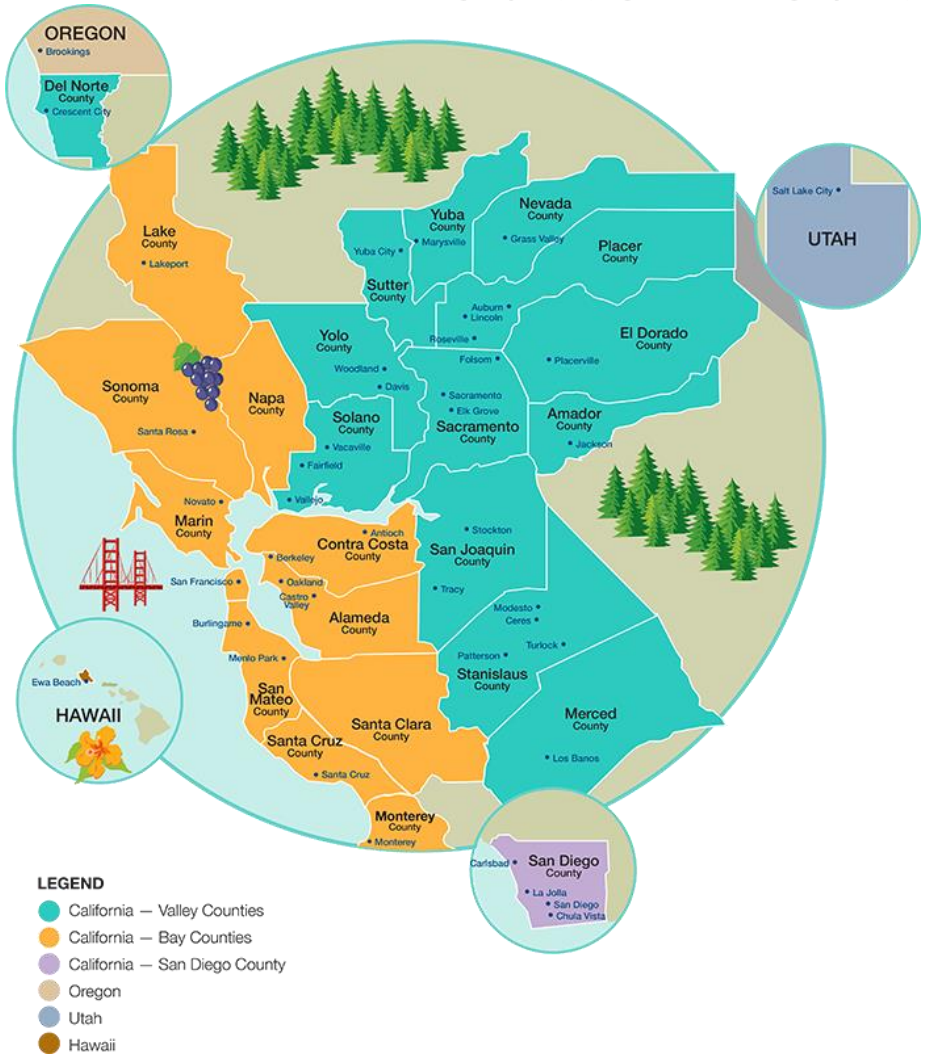
Overview

- Background
- Methods
- Results
- Limitations and Conclusions

Background

Sutter Health Not for Profit Network



- 14,000+ physicians & advanced practice clinicians
- 24 acute care hospitals
- 53,000+ employees
- 36 ambulatory surgery centers
- 7 cardiac centers
- 9 cancer centers
- 5,000 volunteers
- Home health and hospice services throughout Northern California
- Medical research and medical education/training
- 3,000,000+ patients cared for

Poorly Controlled cardiometabolic (CM) biometric measures are risk factors for Cardiovascular Diseases.

More than half of patients with CM conditions (Hypertension (HTN), dyslipidemia, diabetes mellitus(DM)) have multimorbidity

<50% patients achieve control for CM condition related clinical measures[1]:

- e.g., blood pressure (BP), low-density lipoprotein cholesterol (LDL-C), HbA1c
- We define ***health gaps*** as out of optimal range clinical measures

1 Kazemian P, Shebl FM, McCann N, Walensky RP, Wexler DJ. Evaluation of the Cascade of Diabetes Care in the United States, 2005-2016. *JAMA Intern Med*. 2019;179(10):1376-1385. doi:10.1001/jamainternmed.2019.2396
Buffery D. The Continuing Clinical and Economic Burden of Cardiometabolic Health. *Am Health Drug Benefits*. 2015;8(6):295.
Chobufo MD, Gayam V, Soluny J, Rahman, EU, Enoru, S, Foryoung, JB, et al. Prevalence and control rates of hypertension in the USA: 2017-2018. *Int J Cardiol Hypertens*. 2020;6:100044. Published 2020 Jul 31. doi:10.1016/j.ijchy.2020.100044
Centers for Disease Control and Prevention (CDC). Vital signs: prevalence, treatment, and control of high levels of low-density lipoprotein cholesterol--United States, 1999-2002 and 2005-200. *MMWR Morb Mortal Wkly Rep*. 2011;60(4):109-114.

Biometric Control is Mediated in Part by Both Clinician and Patient Level Factors

Clinical Inertia: Failure to initiate or titrate therapy according to clinical guidelines when treatment goals are not achieved.

Clinical inertia is very common in managing chronic conditions

Adherence to CM related medications varies significantly by medication types and by underlying conditions

Few studies have looked at both clinical inertia and medication adherence in disease control

Clinician-level factors (e.g., knowledge, communication, familiarity of guidelines, clinical inertia)

Patient-level factors (e.g., environment, lifestyle, medication adherence, genetics, etc.)

Health Gaps and Close Health Gaps

Disease	Health Gap Criteria [1]	Achievement of Disease Control
Hypertension	Diastolic BP ≥ 90 mmHg OR systolic BP ≥ 140 mmHg in two consecutive clinical encounters	Diastolic BP < 90 mmHg AND systolic BP < 140 mmHg in two consecutive clinical encounters
Dyslipidemia	If CHD 10-year risk [2] > 20% then LDL health gap was defined as ≥ 100 mg/dL	If CHD 10-year risk [2] > 20% then LDL health gap was defined as < 100 mg/dL
	If there were 2+ risk factors [2] or the 10-year risk ≤ 20% then the LDL health gap was defined as ≥ 130 mg/dL	If there were 2+ risk factors [2] or the 10-year risk ≤ 20% then the LDL health gap was defined as < 130 mg/dL
	If there were 0–1 risk factors then the LDL health gap was defined as ≥ 160 mg/dL	If there were 0–1 risk factors then the LDL health gap was defined as < 160 mg/dL
Type II Diabetes	HgA1c ≥ 8.0%	HgA1c < 8.0%

1—Criteria are consistent with the American College of Cardiology (ACC)/American Heart Association (AHA) guidelines. 2—Factors used to estimate CHD risk: age, total cholesterol, smoking status, HDL, systolic BP, and antihypertensive treatment. The formula can be found in ATP III guidelines.

Therapeutic Inertia

	Clinical Inertia Status	Criteria of Actions Taken to Close Therapeutic Inertia
Therapeutic Clinical inertia Criteria	No	Treatment is initiated or intensified by increasing the dose of at least one medication or by adding a second medication to the existing regimen
	Yes	Medication is the same as the pre-health gap medication(s), or no medication was prescribed in the post health gap period
	Uncertain	Total number of medications is the same, part of the medication regimen has been changed, and for medications that are not changed doses are the same

Medication Adherence

Proportion of Days Covered (PDC)* is a conservative measure of refill record-based adherence. Medication dispense data is used to calculate PDC

PDC[1]

$$= \frac{Number\ of\ days\ in\ period\ "covered"}{Number\ of\ days\ between\ first\ fill\ date\ and\ the\ end\ of\ time\ period}$$

*The Pharmacy Quality Alliance (PQA) published a review of the two calculations, Medication Possession Ratio (MPR) and PDC, in which they proclaimed PDC as their "preferred method" of adherence calculation.

1. Wang, S., Huang, Z., Traubenberg S. Measuring Medication Adherence with Simple Drug Use and Medication Switching. SAS Global Forum 2013: Pharma and Health Care; 168-2013. Retrieved on March 28, 2022 from http://support.sas.com/resources/papers/proceedings13/168-2013.pdf

Objectives

Examine the association between clinical inertia, medication adherence and biometric control for each cardiometabolic condition, and for patients with multimorbidity.

Additional Questions:

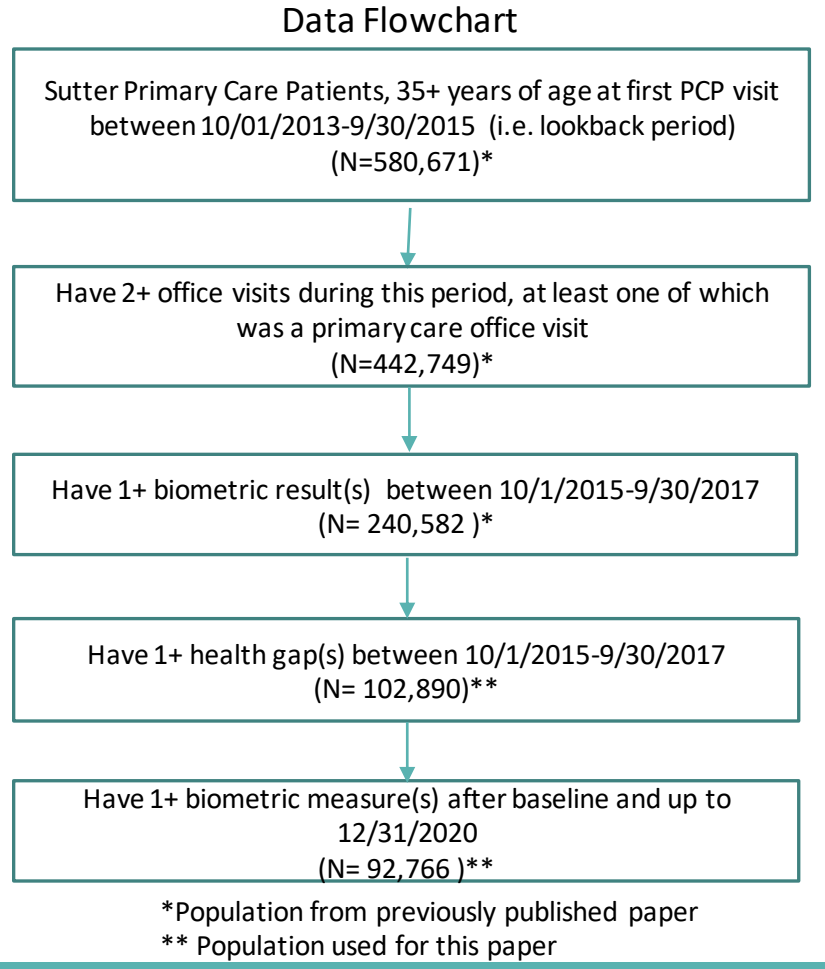
Does being well controlled in one cardiometabolic biometric measure translate to being well controlled in another biometric measure?

Do patients who adhere to one condition specific medication also adhere to other medications?

Methods

Definitions

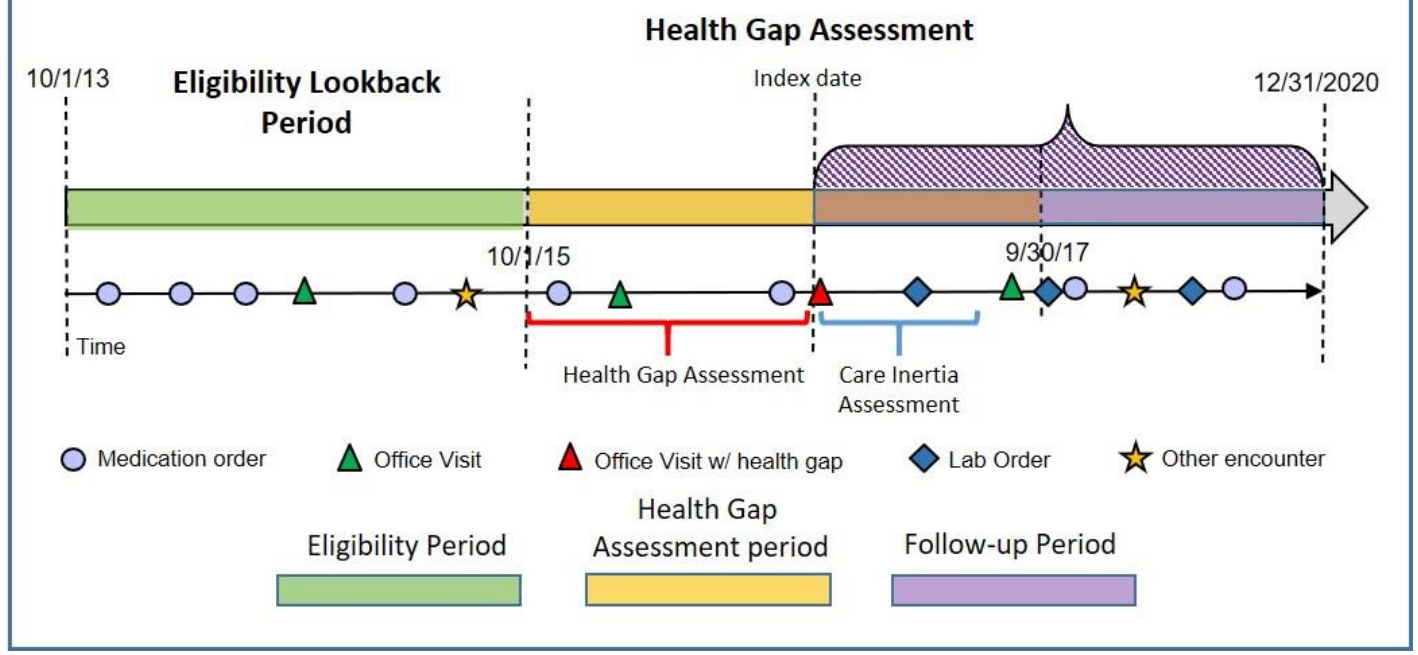
- **Population:** Sutter primary care patients 35 years +, diagnosed with at least one CM condition, at least 1 health gap (e.g. elevated biometric measure) and follow up measure
- **Time Period:** Electronic health record data 10/1/2013-12/31/2020
- **Medication adherence** or proportion of days covered (PDC) from Surescripts medication dispense data
  - Adherent = Medication ordered and PDC ≥ 80%
  - Non-adherent= Medication ordered and 0 < PDC < 80%
  - Medication not retrieved= no dispense data for a given medication order



Definitions Continued and Methods

- **Index date:** Date of first health gap (e.g. elevated biometric measure)
- **Therapeutic inertia:** Absence of medication order or medication intensification within 6 months from index date
- **Outcome:** First date on which a biometric measure was under control after identification
- Cox-regression modeling applied to estimate whether baseline PDC and therapeutic inertia were associated with health gap closure

Figure: Retrospective use of EHR data to identify eligible primary care patients, health gap, clinical inertia and follow-up period



Results

Patient Gap, Medication Adherence and Clinical Inertia Status

		HbA1c Gap only (N=8,302)	BP gap only (N=41,606)	LDL Gap only (N=22,843)	HbA1c and BP gap (N=3,666)	LDL and BP gap (N=11,714)	HbA1c and LDL gap (N=2,534)	All three gaps (N=2,101)
DM PDC status	Not adherent	20.7%	-	-	24.3%	-	24.7%	26.4%
	Adherent	39.0%	-	-	39.1%	-	33.9%	35.4%
	No medication retrieved	40.4%	-	-	36.6%	-	41.3%	38.2%
HTN PDC Status	Not adherent	-	12.0%	-	18.8%	-	14.9%	23.2%
	Adherent	-	38.1%	-	46.3%	-	38.4%	40.5%
	No medication retrieved	-	49.9%	-	34.9%	-	46.7%	36.3%
LDL PDC Status	Not adherent	-	-	7.0%	-	8.7%	12.7%	14.4%
	Adherent	-	-	10.9%	-	16.0%	21.6%	23.4%
	No medication retrieved	-	-	82.1%	-	75.3%	65.8%	62.2%
DM Clinical Inertia	No	42.6%	-	-	40.8%	-	45.9%	43.8%
	Yes	40.8%	-	-	40.0%	-	34.8%	35.9%
	uncertain	16.6%	-	-	19.3%	-	19.3%	20.3%
HTN Clinical Inertia	No	-	32.3%	-	39.1%	32.2%	-	38.7%
	Yes	-	18.1%	-	21.0%	19.4%	-	19.9%
	uncertain	-	49.7%	-	39.8%	48.4%	-	41.4%
LDL Clinical Inertia	No	-	-	25.3%	-	26.3%	36.6%	34.5%
	Yes	-	-	7.7%	-	11.5%	14.0%	15.8%
	uncertain	-	-	67.1%	-	62.2%	49.4%	49.7%

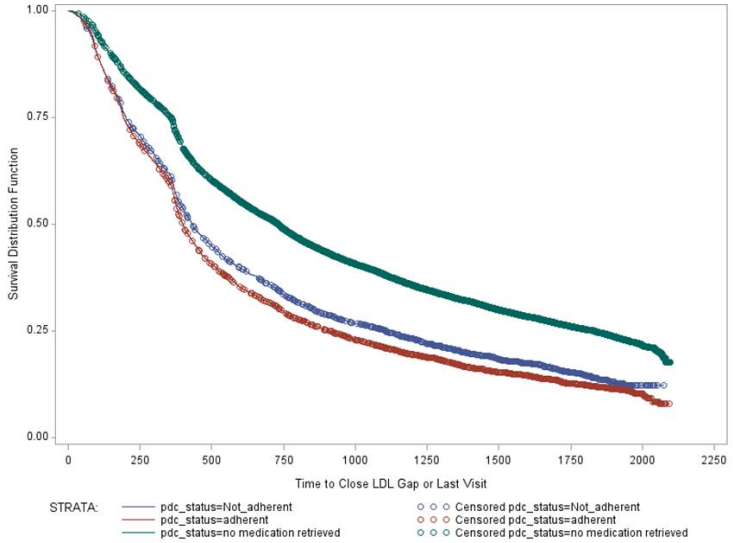
Kaplan-Meier Survival Curves for Each Biometric Measure Time to Control- Stratified by Medication adherence (PDC) and Therapeutic Inertia (TI)

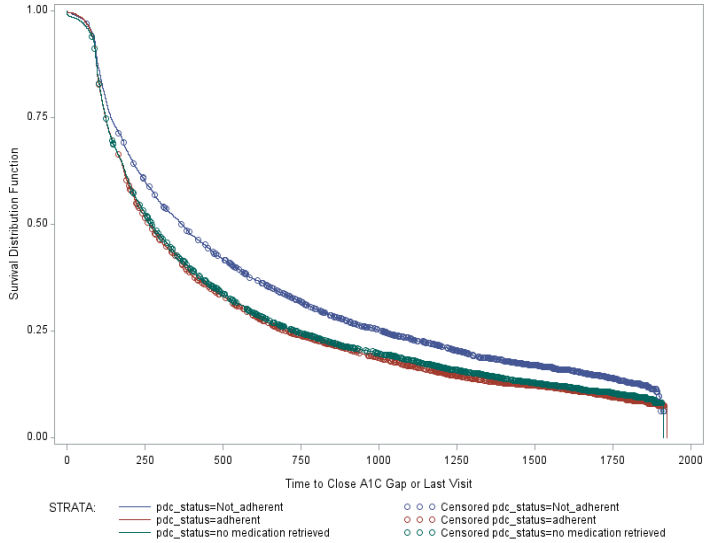
LDL Control

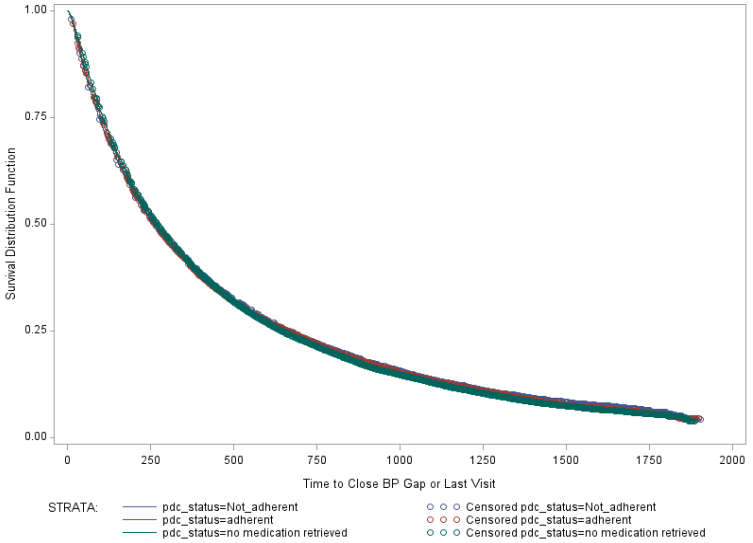
HbA1c Control

BP Control

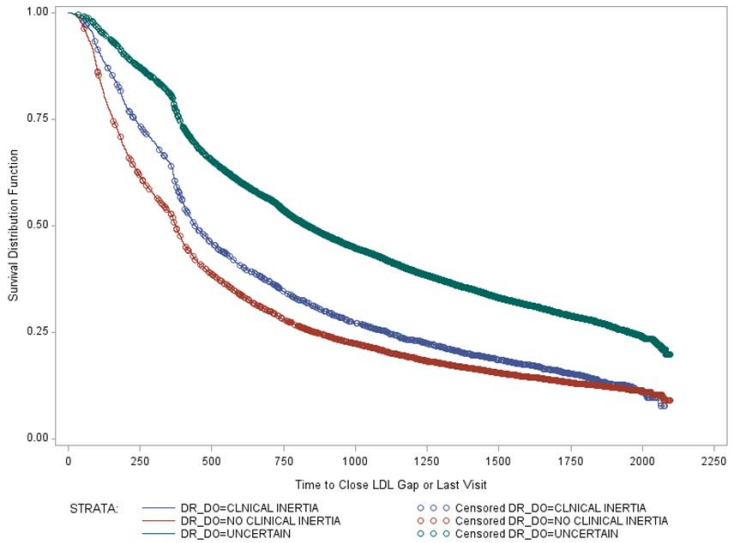
PDC

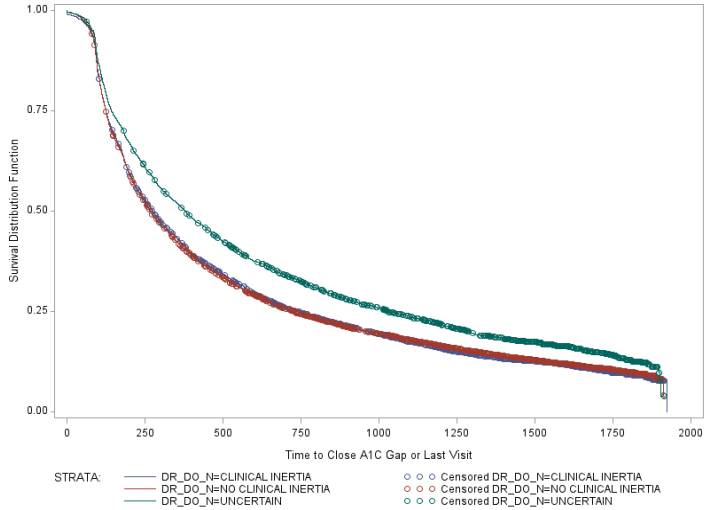


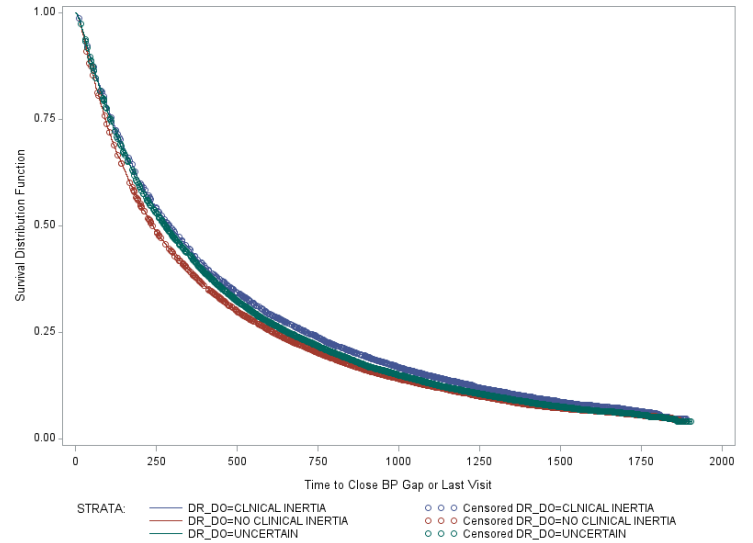




TI







Hazard Ratio estimate from Cox regression models for each biometric measure during 5 year of follow-up[1]

Variable	BP control	LDL-C control	HbA1c Control
	HR (95%CI)		
Therapeutic inertia			
No	Ref	Ref	Ref
Yes	0.90 (0.88-0.93)	0.48 (0.46-0.50)	0.91 (0.87-0.95)
Uncertain	0.95 (0.93-0.96)	0.46 (0.45-0.47)	0.88 (0.80-0.96)
Baseline Medication adherence			
Adherent	Ref	Ref	Ref
Not Adherent	1.0 (0.97-1.03)	0.98 (0.93-1.03)	0.92 (0.84-1.0)
Not Retrieved	1.01 (0.99-1.03)	0.58 (0.55-0.60)	0.93 (0.88-0.97)
Number of CM Conditions			
1	Ref	Ref	Ref
2	1.10 (1.07-1.12)	0.47 (0.44-0.50)	1.16 (1.01-1.33)
3	1.18 (1.15-1.21)	0.23 (0.21-0.24)	1.09 (0.96-1.25)
Length with Disease			
<1	Ref	Ref	Ref
1-4	0.71 (0.67-0.75)	0.85 (0.80-0.91)	0.44 (0.41-0.48)
5+	0.70 (0.67-0.74)	1.04 (0.94-1.07)	0.51 (0.47-0.56)

[1] Controlling for baseline characteristics, including age groups, gender, race/ethnicity, BMI, CCI, smoking status, alcohol status, insurance, and corresponding baseline biometric value

Variation explained by PDC and Therapeutic inertia

Outcome	Somers' D for full model	Somers' D for reduced model without Therapeutic inertia variable	Variation explained by Therapeutic inertia*	Somers' D for reduced model without Medication adherence variable	Variation explained by Medication adherence*
HbA1c	0.214	0.212	0.2%	0.214	0%
LDL-C	0.318	0.222	9.6%	0.292	2.6%
BP	0.194	0.190	0.4%	0.194	0%
*Difference between Somers'D for full model and reduced model					

Conclusions and Limitations

Conclusions

- Therapeutic inertia, compared to medication adherence, has a much stronger impact on biometric control
- Time to achieve LDL disease control on average is significantly longer (more than 400 days) than that to achieve BP or HbA1c control (<250 days).
- Patients with two health gaps, if one is LDL-C, are less likely to achieve disease control for another biometric measure
- Findings underscore a need for improvement strategies based on number of health gaps, rather than number of comorbidities, to prioritize patient subpopulation and clinical management

Limitations

- Study in a single health care system but with a diverse population.
- Medication dispense data may be inaccurate but is inexpensive and easy way to assess a large volume of patients
- Therapeutic inertia defined by structured data only

Questions?

Thank you

For more information, contact Sherry Yan at yanSX@sutterhealth.org