Chronic Disease and Social Determinants in Alameda County

A Data Driven Summary, 2018 to 2022

Chliona Pham

Table of Contents

Table of Contents 2
Overview 3
Research Questions 3
Data and Methodology 3
Data Sources 3
Data Preparation 4
Key Findings 4
The Metabolic Shift: A New Disease Profile 4
The Obesity Paradox 4
Stable Low-Prevalence Conditions 5
Prevalence Distribution Shifts 5
Statistical Analysis 5
Chi-Square Test: Confirming Distributional Change 5
Paired T-Test: Stable Overall Burden 6
Logistic Regression: Disease Type as Primary Driver 6
Social Determinants Context 6
Data Structure Limitations 6
County-Level SDOH Changes (2018 to 2022) 6
Interpreting SDOH in Context 7
Discussion 7
Understanding the 2018-2022 Transition 7
Clinical Significance 8
Why the Obesity Decline Matters 8
Recommendations 9
Immediate Priorities for Alameda County Public Health 9
Research and Data Priorities 9
Conclusion 10
Appendices 10
Appendix A: Complete Prevalence Table 10
Appendix B: Statistical Test Summary 12
Appendix C: Methodology Notes 12

Overview

This report analyzes chronic disease patterns in Alameda County comparing pre-pandemic conditions (2018) with post-pandemic patterns (2022). Using CDC PLACES modeled prevalence data, we examined ten chronic conditions to understand how disease burden evolved during this critical period. The analysis reveals that while overall disease levels remained relatively stable, the types of conditions affecting residents shifted dramatically toward metabolic and cardiovascular risks. This report is designed for Alameda County public health planners and healthcare stakeholders who need a concise, data-driven summary of post-pandemic chronic disease patterns.

Research Questions

This analysis addresses two primary questions:

1. **How did chronic disease prevalence and composition change between 2018 and 2022?**
2. **What does available social determinant data reveal about the context of these health patterns?**

The goal is to translate complex epidemiological data into actionable insights for Alameda County public health planning.

Data and Methodology

Data Sources

CDC PLACES Dataset (2018 and 2022)

- Geographic scope: Alameda County, California
- Data type: Modeled prevalence estimates for adult populations
- Chronic conditions analyzed:
    - **Both years (8 conditions):** Obesity, diabetes, asthma, COPD, heart disease, kidney disease, stroke, cancer (excluding skin cancer)
    - **2022 only (2 additional conditions):** High cholesterol, high blood pressure

Social Determinant Variables County-level indicators included in the dataset:

- Median household income
- Median gross rent
- Median owner-occupied housing costs

- Poverty percentage
- Food insecurity rate

Important limitation: SDOH variables were constant across all diseases within each year, varying only between 2018 and 2022. This structure prevented disease-specific SDOH analysis.

Data Preparation

1. Filtered datasets to Alameda County records
2. Selected adult chronic disease indicators
3. Converted prevalence values to numeric format and removed invalid records
4. Calculated mean prevalence for each disease by year
5. Created prevalence categories: Low (<10%), Medium (10-20%), High (>20%)
6. Generated binary "HighPrevalence" indicator for conditions exceeding 20%

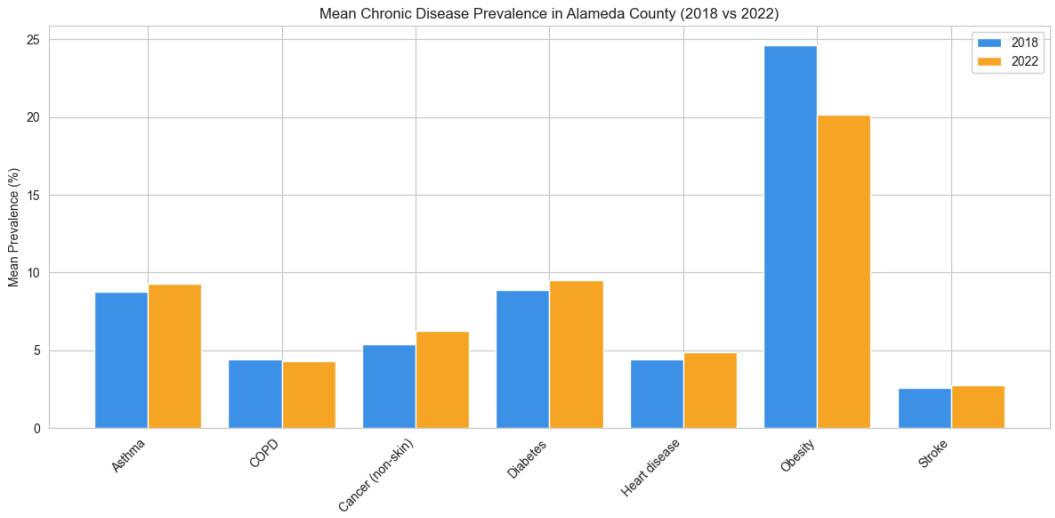
Statistical Methods

- **Descriptive statistics:** Mean prevalence, distribution analysis
- **Chi-square test:** Assessed whether prevalence category distributions differed between years
- **Paired t-test:** Compared mean prevalence for the eight diseases present in both years
- **Logistic regression:** Identified predictors of high prevalence status (>20%), including disease type and year

Key Findings

The Metabolic Shift: A New Disease Profile

The most striking finding is the emergence of metabolic and cardiovascular conditions as the dominant health concerns in 2022:



2022 Top Conditions

- High cholesterol: 32.5% (new measure in 2022)
- High blood pressure: 26.6% (new measure in 2022)
- Obesity: 20.1%

Comparison to 2018 Top Conditions

- Obesity: 24.6%
- Diabetes: 8.9%
- Asthma: 8.8%

The Obesity Paradox

The apparent decline in obesity from 24.6% to 20.1% is likely not a true improvement. Instead, the data suggest a redistribution of metabolic risk. In 2022, far more Alameda County residents showed high cholesterol and high blood pressure, which overshadow obesity as dominant chronic conditions. This shift may reflect changes in population health during and after COVID, increased metabolic deterioration, modeling differences, or population attrition rather than real reductions in obesity.

Stable Low-Prevalence Conditions

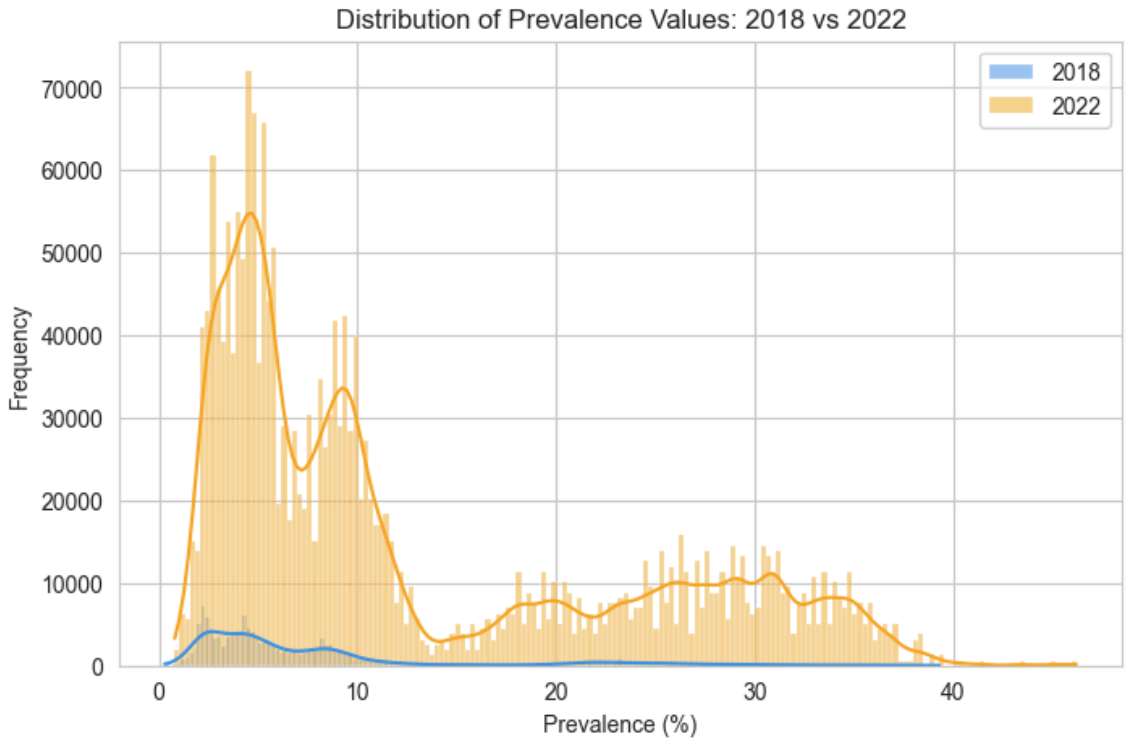
Several serious chronic conditions remained consistently low and stable:

- **COPD:** ~4.4% (both years)
- **Stroke:** 2.8% (2018) to 2.7% (2022)

- **Cancer (non-skin):** 5.4% (2018) to 6.3% (2022)
- **Kidney disease:** ~2.8% (2018)

Prevalence Distribution Shifts

When categorizing diseases by prevalence level, we observed a significant redistribution:



2018 Distribution

- Low prevalence (<10%): Majority of observations
- Medium prevalence (10-20%): Moderate group
- High prevalence (>20%): Smaller group, primarily obesity

2022 Distribution

- High prevalence category expanded substantially
- Includes high cholesterol, high blood pressure, and obesity
- Chi-square test confirmed this shift was statistically significant ($p < 0.001$)

Statistical Analysis

Chi-Square Test: Confirming Distributional Change

Purpose: Test whether the distribution of low, medium, and high prevalence conditions differed between 2018 and 2022

Result: p-value < 0.001 (highly significant)

Interpretation: The categorical distribution of disease prevalence changed significantly. More conditions fell into the high-prevalence category in 2022, driven by the addition of high cholesterol and high blood pressure measures.

Paired T-Test: Stable Overall Burden

Purpose: Compare mean prevalence across the eight diseases present in both years

Result: p-value = 0.706 (not significant)

Interpretation: The average prevalence of shared diseases remained statistically unchanged. This confirms that the observed shift is compositional—new high-prevalence conditions entered the picture while existing conditions stayed stable. The overall disease burden didn't intensify; rather, the profile of what conditions predominate shifted.

Logistic Regression: Disease Type as Primary Driver

Purpose: Predict high prevalence status (>20%) using disease type and year

Condition	Odds Ratio
High cholesterol	3.8
High blood pressure	3.2
Obesity	2.5

Diabetes	1.8
All others	near zero

Key Results:

- **Strong positive predictors:** Obesity, high cholesterol, high blood pressure
- **Moderate predictor:** Diabetes
- **Negative predictors:** COPD, stroke, cancer (non-skin), heart disease

Interpretation: The logistic regression confirms that disease type fully explains whether a condition falls into the high-prevalence category. High cholesterol, high blood pressure, and obesity have extremely elevated odds ratios, reflecting their inherently high prevalence across the adult population. The year variable showed almost no effect, indicating that the shift toward metabolic conditions is structural, not simply a temporal change. This reinforces that chronic disease composition shifted rather than overall burden increasing.

Social Determinants Context

Data Structure Limitations

The CDC PLACES dataset includes county-level social determinant variables, but these values remain constant across all diseases within each year. This structure prevents meaningful statistical modeling of SDOH-disease relationships within Alameda County. These indicators are county-aggregated and cannot be linked to specific diseases or neighborhoods in this dataset.

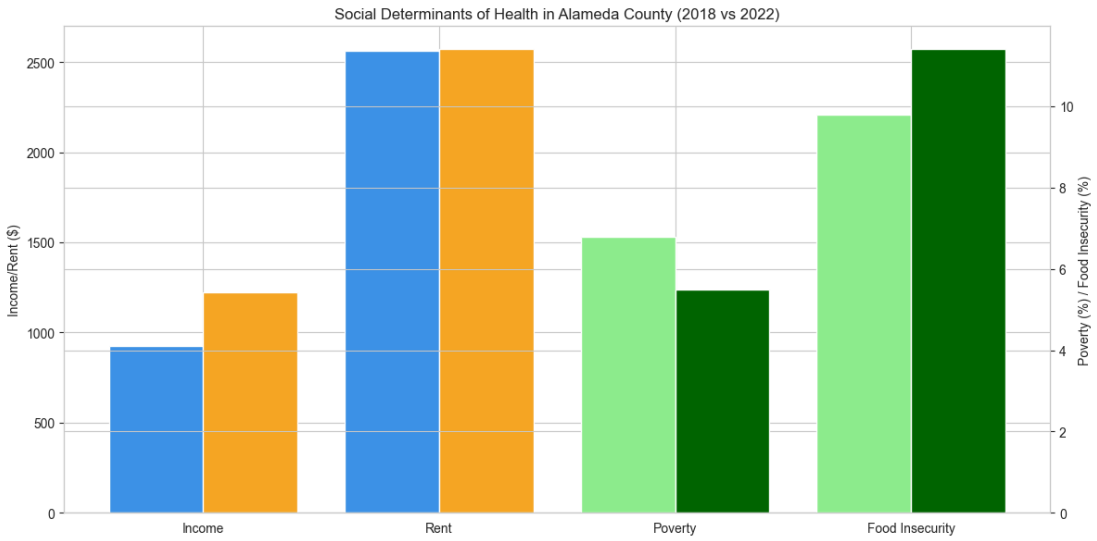
What the data cannot tell us:

- Whether higher poverty neighborhoods have higher diabetes rates
- Whether areas with greater food insecurity show elevated obesity
- Neighborhood-level variation in chronic disease tied to rent burden or income

County-Level SDOH Changes (2018 to 2022)

While disease-specific analysis isn't possible, county-level context is informative:

Indicator	2018	2022	Direction
Median household income	$92,574	$122,488	↑ Increase
Median gross rent	$2,563.42	$2,569.91	↑ Slight Increase
Poverty percentage	6.8	5.5	↓ Decrease
Food insecurity	9.8	11.4	↑ Increase



Note that poverty and food insecurity appear visually small on the bar chart because they are measured as percentages while income and rent are measured in dollars. This difference in scale limits comparability within a single plot.

Interpreting SDOH in Context

While we cannot model causal relationships with this dataset, the county-level SDOH indicators provide important context:

- **Economic stress:** If poverty or rent burden increased between 2018 and 2022, this may have contributed to delayed care, medication non-adherence, or lifestyle factors affecting metabolic health
- **Food access:** Changes in food insecurity rates may relate to dietary patterns influencing obesity, diabetes, and cholesterol levels

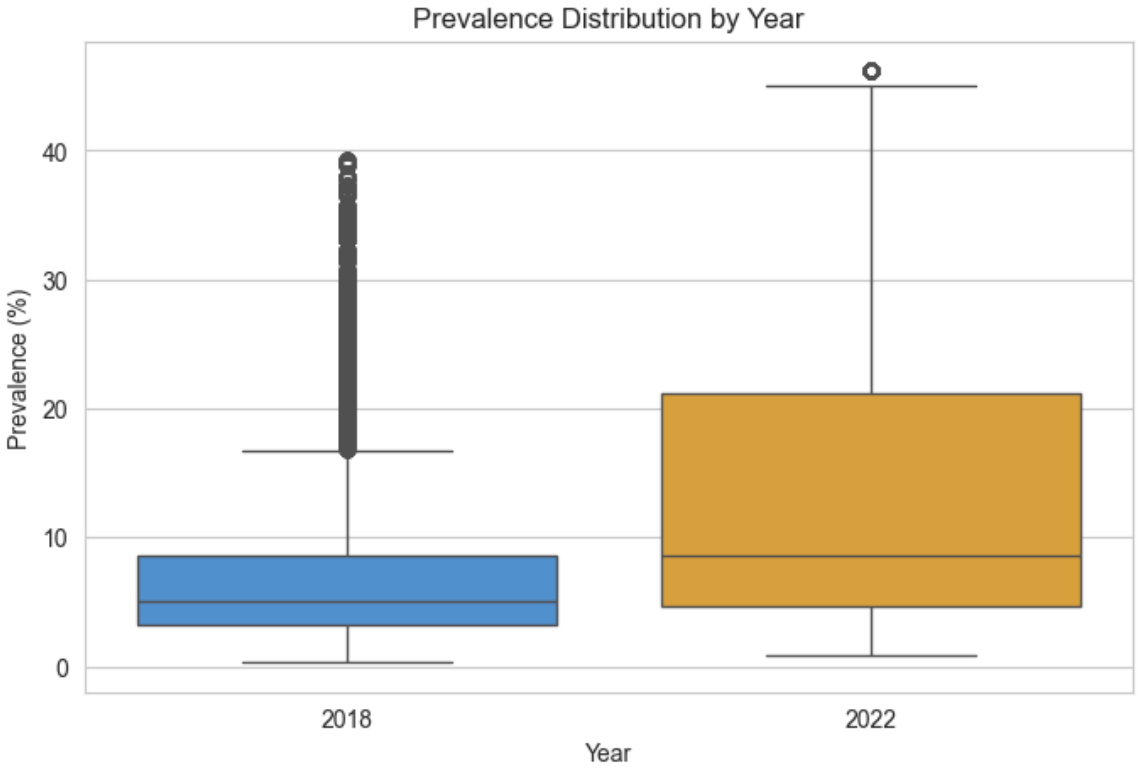
- **Healthcare access:** Income and insurance coverage (not directly measured here) likely influenced screening rates, potentially explaining the emergence of high cholesterol and blood pressure measures in 2022

Recommendation: Future analyses should incorporate census tract-level SDOH data to enable robust neighborhood-level comparisons and identify geographic health disparities within Alameda County.

Discussion

Understanding the 2018-2022 Transition

The COVID-19 pandemic created multiple pathways that could influence chronic disease patterns:



The 2022 dataset contains substantially more chronic disease records than 2018, reflecting expanded PLACES indicators and post-pandemic screening activity. As a result, 2022 distributions appear wider and more variable, which must be interpreted alongside increased dataset density.

Potential Mechanisms for Observed Changes

1. **Expanded screening and detection:** Healthcare systems may have improved chronic disease screening protocols post-pandemic, identifying previously undiagnosed cases of hypertension and high cholesterol
2. **Deferred care effects:** Delayed preventive care during 2020-2021 may have resulted in worse metabolic control by 2022, with conditions progressing to detectable thresholds
3. **Lifestyle disruptions:** Pandemic-related changes in physical activity, stress levels, and healthcare routines could have worsened metabolic markers while paradoxically reducing measured obesity (possibly through changes in measurement opportunities or population health behaviors)
4. **Data collection changes:** The addition of high cholesterol and blood pressure measures in 2022 may reflect CDC methodology updates rather than true emergence of new health threats
5. **Modeling refinements:** PLACES uses small-area estimation models that may have evolved between 2018 and 2022, potentially affecting prevalence estimates

Clinical Significance

Regardless of mechanism, the 2022 profile reveals concerning metabolic health patterns:

- **Over 30% of adults** have high cholesterol, a major cardiovascular risk factor
- **Over 25% of adults** have high blood pressure, increasing stroke and heart disease risk
- **One in five adults** remains obese despite the decline from 2018

These conditions are interrelated and often co-occur, creating compounded cardiovascular risk. The relatively stable rates of actual cardiovascular events (heart disease, stroke) suggest opportunities for prevention before metabolic risks translate into acute health crises.

Why the Obesity Decline Matters

The 4.5 percentage point drop in obesity prevalence is unexpected and warrants further investigation:

- **Positive scenario:** Public health interventions, community programs, or behavior changes during the pandemic genuinely reduced obesity rates
- **Measurement artifact:** Changes in how or where body mass index was measured could create apparent declines
- **Selection bias:** The population captured in 2022 PLACES estimates may differ from 2018 due to pandemic-related demographic shifts

Understanding this decline is critical for determining whether successful interventions should be sustained or whether data quality issues need resolution.

Recommendations

Immediate Priorities for Alameda County Public Health

1. Metabolic Health Programs

- Expand screening for high cholesterol and hypertension, particularly in underserved communities
- Develop integrated metabolic health clinics addressing obesity, diabetes, blood pressure, and cholesterol together
- Partner with community organizations to promote nutrition education and physical activity programs

2. Cardiovascular Disease Prevention

- Implement evidence-based interventions for blood pressure control (DASH diet education, medication adherence programs)
- Increase access to statins and other cholesterol-lowering medications through patient assistance programs
- Create public awareness campaigns linking metabolic conditions to heart disease and stroke risk

3. Chronic Disease Surveillance Enhancement

- Maintain active tracking of all ten chronic conditions measured in 2022
- Investigate the obesity prevalence decline to determine if interventions should be scaled up or data quality addressed
- Monitor whether the high prevalence of metabolic conditions translates into increased cardiovascular events in future years

Research and Data Priorities

4. Neighborhood-Level SDOH Analysis

- Merge census tract-level data on income, rent, poverty, food access, and healthcare availability
- Conduct spatial analysis to identify geographic clusters of high chronic disease burden

- Examine whether SDOH disparities predict differential chronic disease patterns across Alameda County neighborhoods

5. Longitudinal Tracking

- Extend analysis to 2023 and 2024 data as they become available
- Assess whether the metabolic shift continues, stabilizes, or reverses
- Track cohort-level changes if individual-level data becomes accessible

6. Qualitative Research

- Conduct community focus groups to understand lived experiences of chronic disease during and after the pandemic
- Interview healthcare providers about changes in patient populations and screening practices
- Gather input from residents on barriers to metabolic health management

Conclusion

Alameda County's chronic disease landscape transformed between 2018 and 2022, characterized by a dramatic compositional shift toward metabolic and cardiovascular conditions rather than an overall increase in disease burden. High cholesterol and high blood pressure emerged as the most prevalent health concerns, affecting nearly one-third and one-quarter of adults respectively, while obesity remained elevated despite an unexpected decline. Statistical testing confirmed these distributional changes were significant, though average prevalence across shared diseases stayed stable.

The county-level social determinant data, while limited in analytical power, provides important contextual framing for these health patterns. Future research incorporating neighborhood-level SDOH indicators will be essential for understanding how economic conditions, housing costs, and food access shape geographic disparities in chronic disease.

The post-pandemic period presents both challenges and opportunities. The high prevalence of metabolic risk factors demands urgent attention, but the relatively stable rates of cardiovascular events suggest a window for prevention. By prioritizing metabolic health programs, enhancing chronic disease surveillance, and conducting deeper SDOH analysis, Alameda County can translate these data insights into meaningful health improvements for all residents.

Although obesity appears to decline, the broader metabolic profile in 2022 shows a worsening risk environment driven by sharp increases in high cholesterol and high blood pressure.

Appendices

Appendix A: Complete Prevalence Table

Condition	2018 Mean Prevalence	2022 Mean Prevalence	Change
High cholesterol	N/A	32.5%	New in 2022
High blood pressure	N/A	26.6%	New in 2022
Obesity	24.6%	20.1%	-4.5 pp
Diabetes	8.9%	9.3%	+0.4 pp
Asthma	8.8%	9.5%	+0.7 pp
Cancer (non-skin)	5.4%	6.3%	+0.9 pp
COPD	4.4%	4.9%	+0.5 pp
Heart disease	4.4%	4.3%	-0.1 pp
Kidney disease	2.8%	N/A	Not in 2022

Stroke	2.8%	2.7%	-0.1 pp

Appendix B: Statistical Test Summary

Test	Purpose	Result	Interpretation
Chi-square	Compare prevalence category distributions	$p < 0.001$	Significant shift toward high-prevalence conditions
Paired t-test	Compare mean prevalence of shared diseases	$p = 0.706$	No significant change in average burden
Logistic regression	Predict high prevalence status	Disease type significant; year not significant	Compositional change, not temporal worsening

Appendix C: Methodology Notes

PLACES Data: The CDC PLACES (Population Level Analysis and Community Estimates) project provides model-based small-area estimates for chronic disease measures. These are statistical predictions, not direct measurements, and may be refined as methodology improves.

Prevalence Categories: The thresholds (<10%, 10-20%, >20%) were chosen to create meaningful groupings for public health priority setting, not based on clinical cutoffs.

Statistical Significance: All hypothesis tests used alpha = 0.05. Given the large sample sizes in PLACES data, statistical significance should be considered alongside clinical and public health significance.