Impact of COVID-19 on Alaska Mortality Trends

Alaska Department of Health

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Alaska Health Summit

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Outline

1. Background and Mortality Overview
2. Excess Deaths Model and Results
3. Public Health Implications

Background and Mortality Overview

Background: Data

- Source
  - Death: Alaska Health Analytics and Vital Records, Electronic Vital Records System (EVRS)
  - Population: Alaska Department of Labor and Workforce Development
- Notes
  - Timeframe: 2010-2019 (baseline) vs 2020 (pandemic)
  - Alaska resident data
    - Includes Alaska resident deaths from out-of-state
    - Excludes non-Alaska resident deaths from in-state

Background: Identifying Deaths

- International Classification of Diseases 10th Rev. (ICD-10)
  - Coded by National Center for Health Statistics (NCHS)
  - E.g. COVID-19 (U07.1)
- Underlying and Contributing Cause of Death
  - Underlying: Disease or injury that initiated the chain of events leading to death
  - Contributing: Additional causes that contributed to the underlying cause

From Certificate to Data

Death Certificate

CAUSE OF DEATH (See instructions and examples)

32. **PART I.** Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition ---------> resulting in death)	a.	Acute respiratory distress syndrome	2 days
		Due to (or as a consequence of):	
Sequentially list conditions, if any, leading to the cause listed on line a. Enter the **UNDERLYING CAUSE** (disease or injury that initiated the events resulting in death) **LAST**	b.	Pneumonia	10 days
		Due to (or as a consequence of):	
	c.	COVID-19	10 days
		Due to (or as a consequence of):	
	d.		

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I

33. WAS AN AUTOPSY PERFORMED? ☐ Yes ■ No

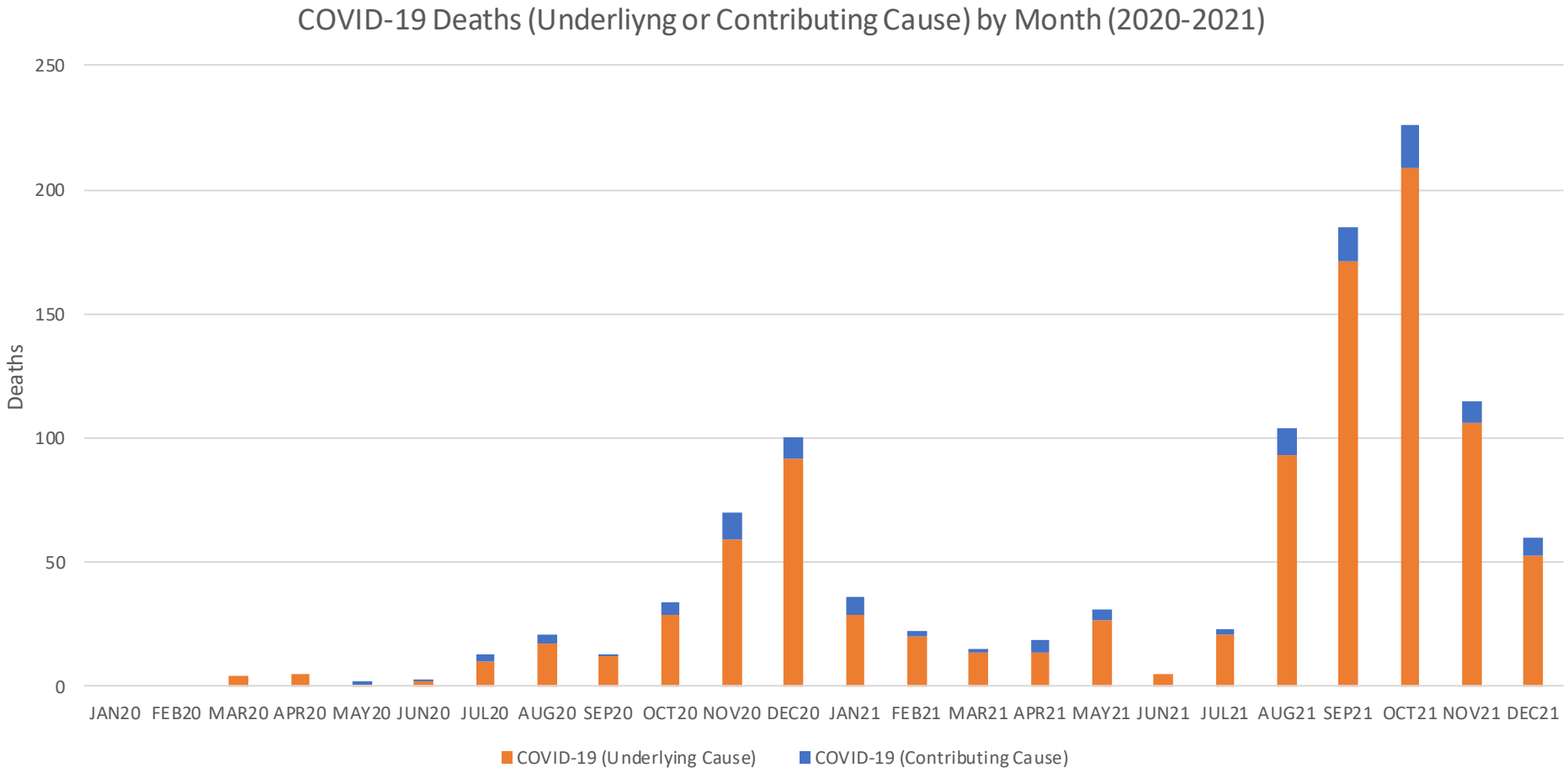
34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? ☐ Yes ☐ No

ICD-10 Coded Data

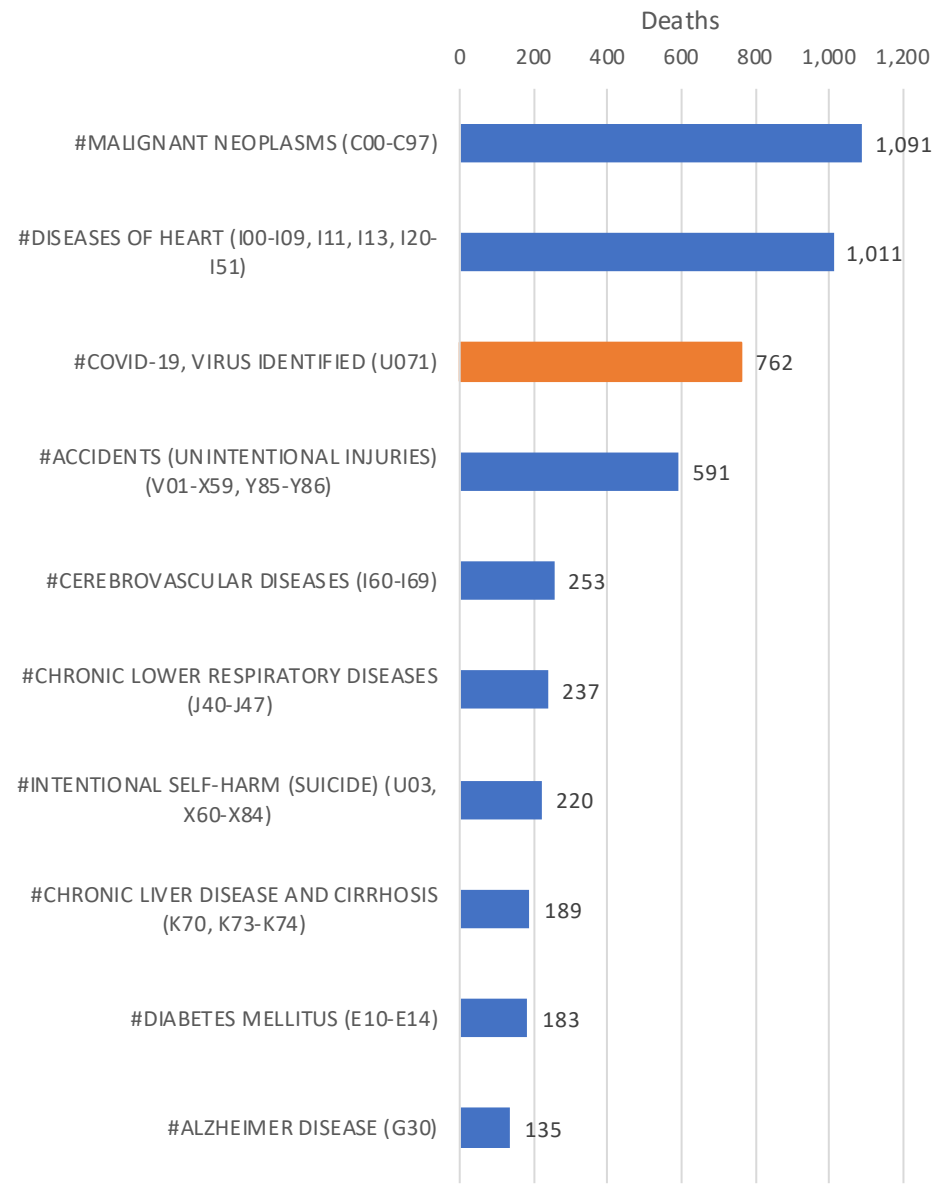
Literals			ICD-10 Codes		
Line A	Line B	Line C	Underlying Cause	Contributing Cause 1	Contributing Cause 2
ACUTE RESPIRATORY DISTRESS SYNDROME	PNEUMONIA	COVID-19	U071	J189	J80

Mortality: COVID-19

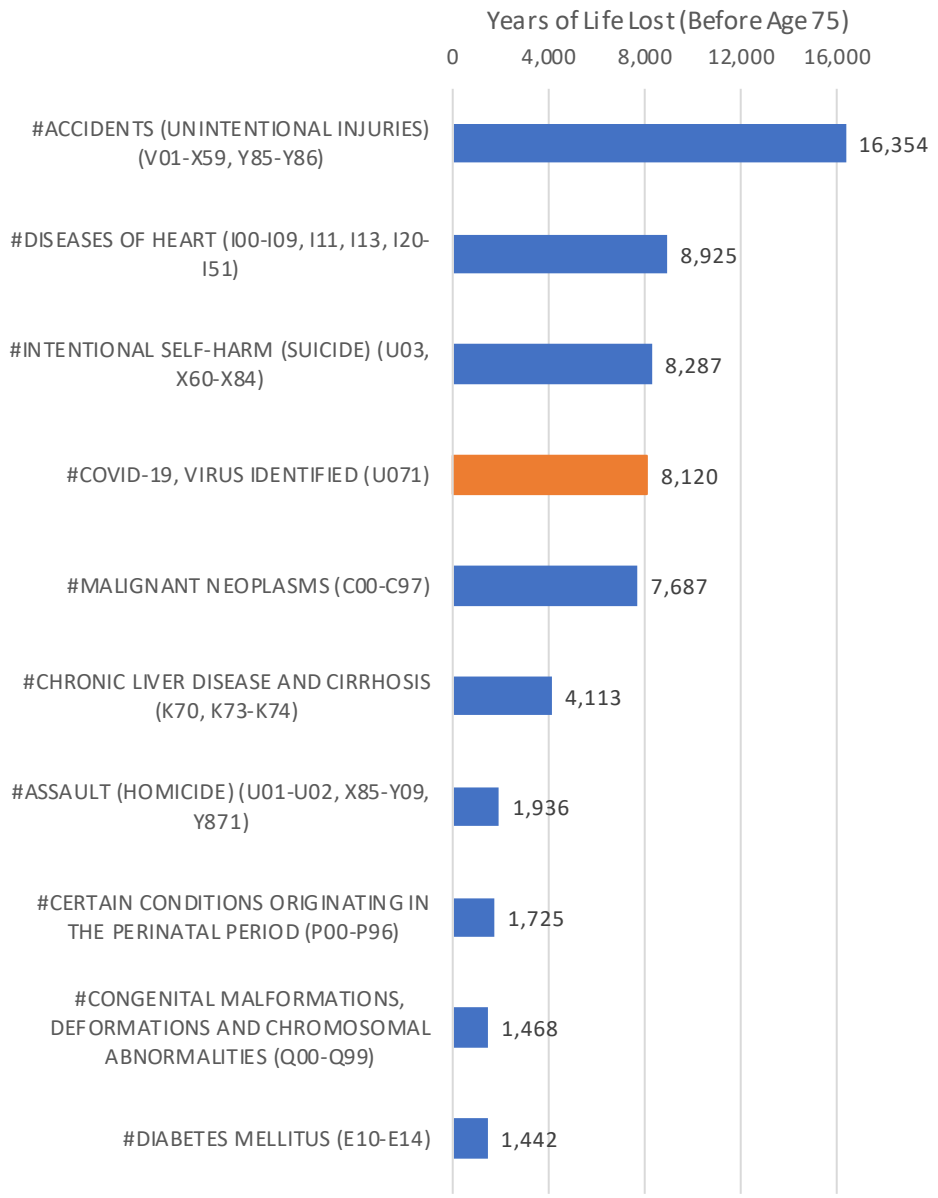
- 1,106 COVID-19-Related Deaths 2020-2021 (10% All Deaths)
  - 90% Underlying Cause / 10% Contributing Causes



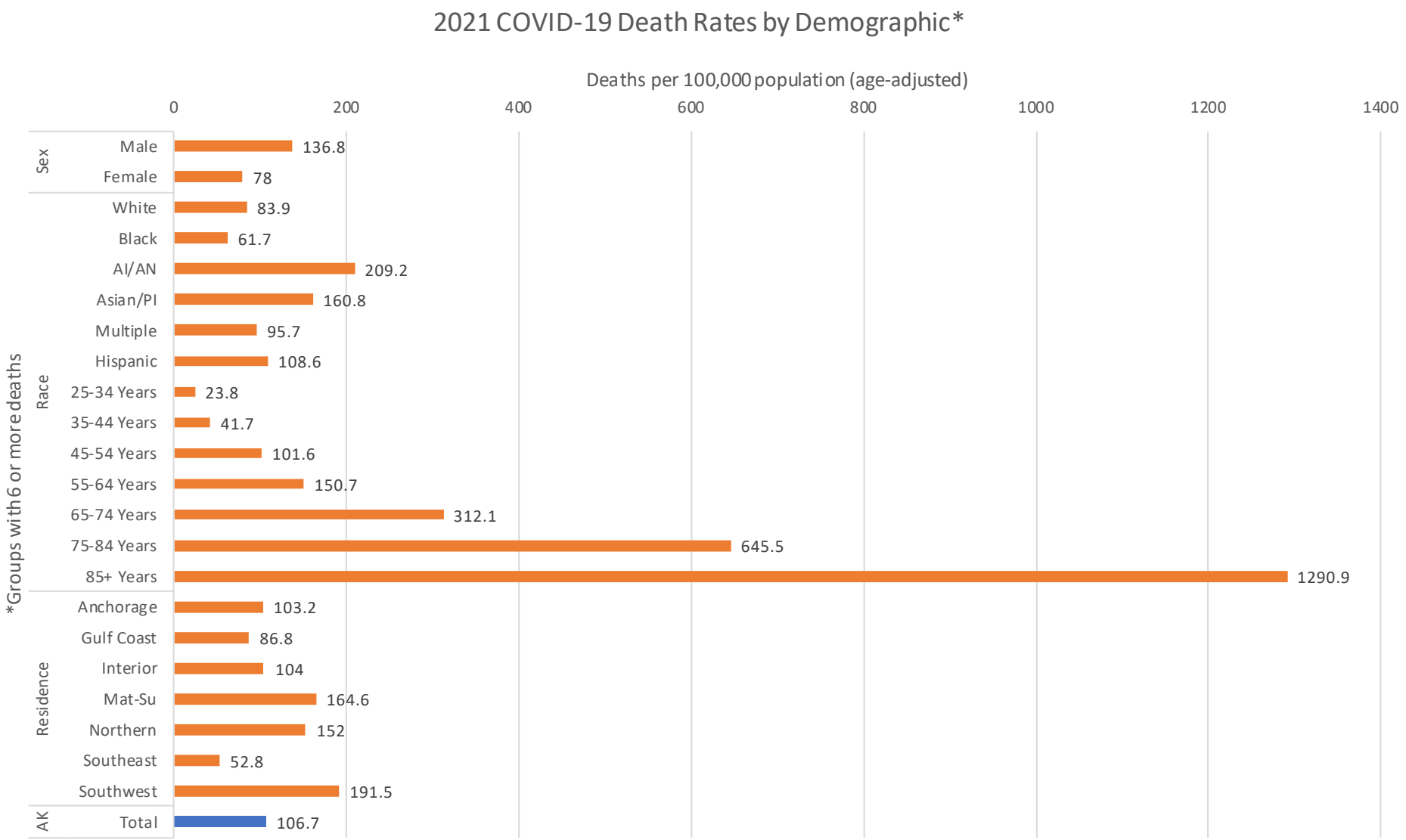
Leading Causes of Death (2021)



Leading Causes of Years Potential Life Lost (2021)

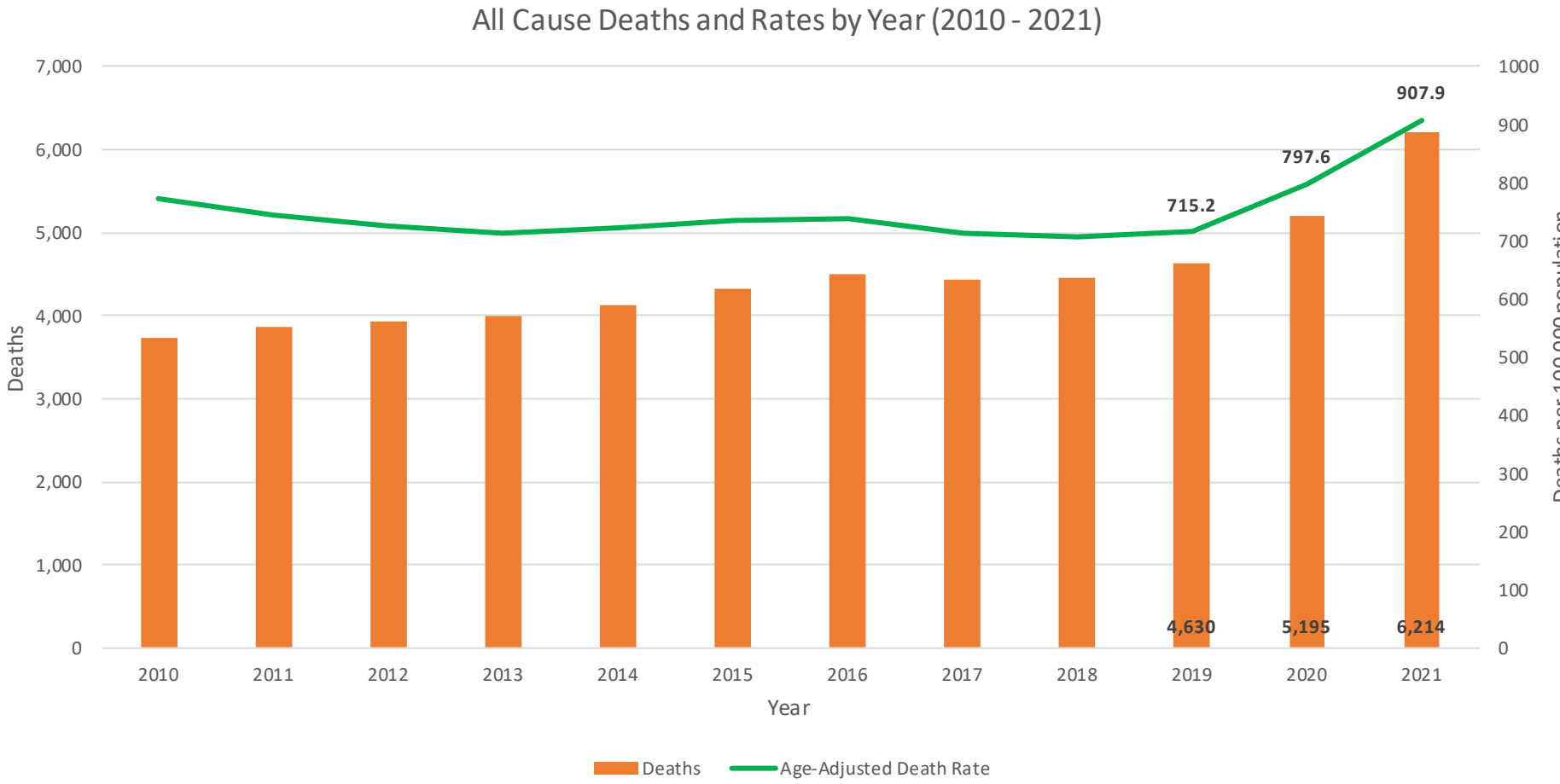


- High rates among Men, AI/AN, Asian/PI, Hispanic people, 55+ Years Old, & Mat-Su, Northern, and Southwest Alaska residents.



Mortality: All Causes

- Can only tell so much from COVID-19 death data alone
  - How to measure the indirect impact the pandemic has had on overall mortality?



Excess Deaths Model and Results

Methods

- Fit 7 Poisson Regression models on the 2010 – 2019 deaths by month to establish a baseline prediction model
  - Allowed the dispersion parameter to vary
  - Accounted for seasonal variation
  - Penalized more distal observations
- Denominators obtained from DOL to estimate rates per 100,000 people (as convention)
- Use of 95% CI for estimating model trajectory opposed to prediction intervals.

Model: $\ln(\lambda_i) = \beta_0 + \beta_{mmYYY} X_i + \beta_{mth.var} X_i + Offset + \varepsilon$

- λ = Predicted count of deaths
- β_0 = Intercept
- β_{mmYYYY} = month and year
- $B_{mth.var}$ = proportional distribution of monthly deaths
- Offset term – monthly population denominators (estimated)
- ε = error term

- Bagged across 7 model predictions

Model 1: based on 2010 – 2019

Model 2: based on 2018 – 2019

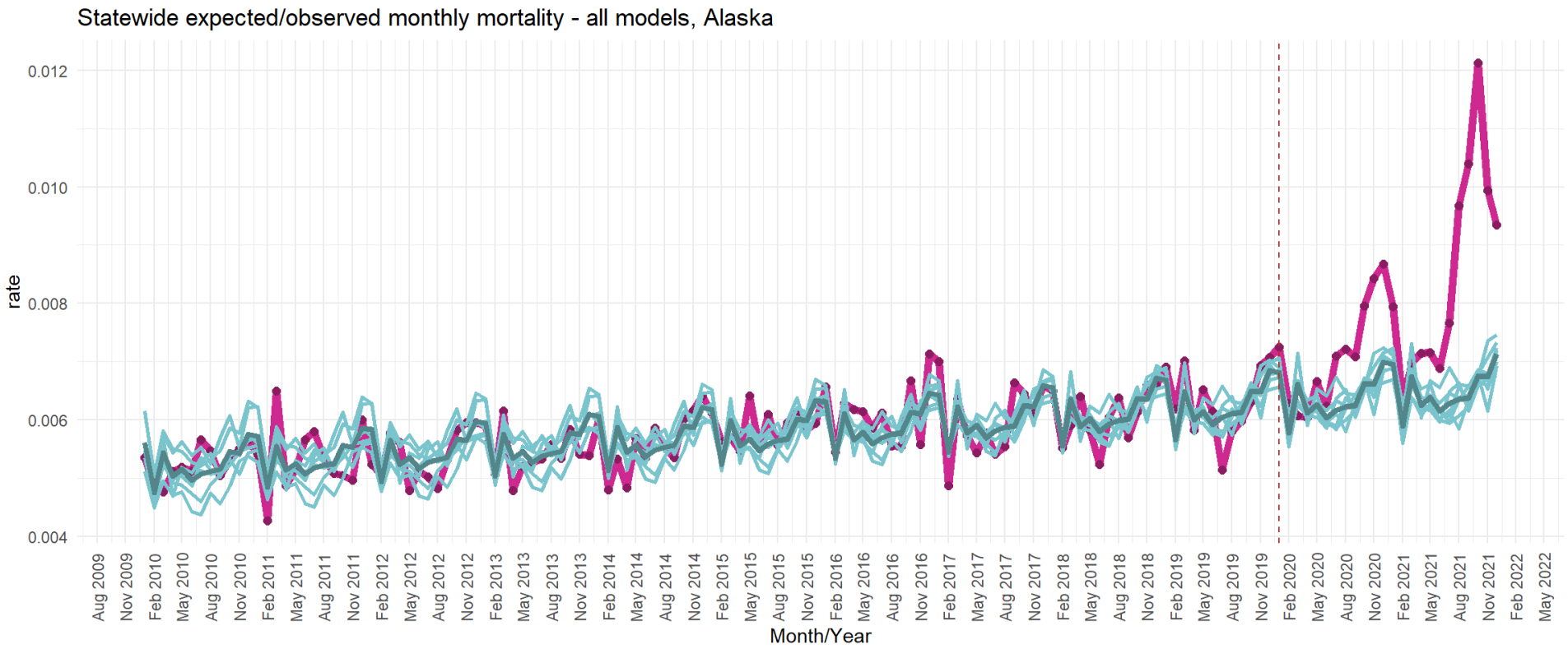
Model 3: based on 2017 – 2019

Model 4: based on 2016 – 2019

Models 5, 6 & 7: each based on a random sample of 3 years between 2010 – 2019

Final model performance, flexibility, and fit, compared against time-series STL bootstrapped, ARIMA, and forecasting models.

Statewide


Statewide expected/observed monthly mortality - all models, Alaska
rate
0.012
0.010
0.008
0.006
0.004
Aug 2009
Nov 2009
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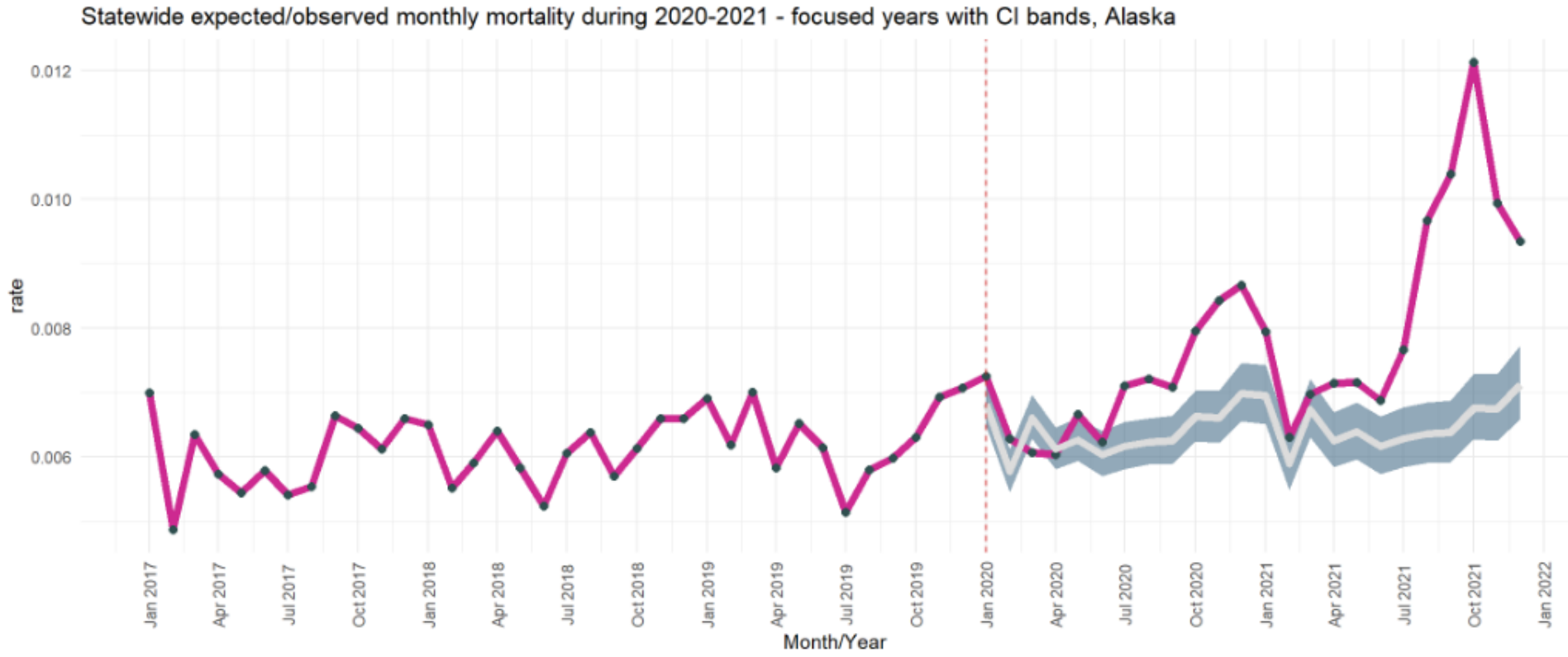
Feb 2022
May 2022
Month/Year

Statewide - focused



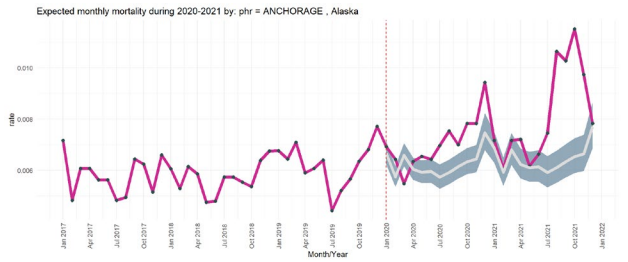
	Observed	Predicted	Excess	Lower bound	Upper bound	Sig.
2020	5194	4675.3	518.7	242.7	777.2	*
2021	6214	4774.7	1439.3	1078.2	1771.3	*

Notes: *significance at alpha = 0.05

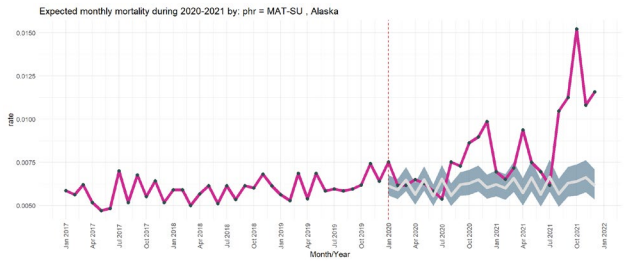
Public Health Region

	Observed	Predicted	Excess	Lower bound	Upper bound	Sig.
ANCHORAGE 2020	2057	1819.2	237.8	89.4	373.4	*
ANCHORAGE 2021	2362	1866.1	495.9	298.6	671.6	*
GULF COAST 2020	607	612	-5	-106.3	79.6	
GULF COAST 2021	780	617	163	33.1	267.1	*
INTERIOR 2020	679	609.8	69.2	-26.4	149.6	
INTERIOR 2021	844	627.1	216.9	91.2	318.4	*
MAT-SU 2020	768	654.1	113.9	36.5	180.8	*
MAT-SU 2021	997	675.8	321.2	221.7	405.1	*
NORTHERN 2020	199	201.8	-2.8	-51.9	34.7	
NORTHERN 2021	227	204.5	22.5	-41.1	68.6	
SOUTHEAST 2020	555	491.6	63.4	-17.2	130.6	
SOUTHEAST 2021	652	496.3	155.7	51.9	238.7	*
SOUTHWEST 2020	321	285.4	35.6	-40.7	94.4	
SOUTHWEST 2021	349	289.4	59.6	-44.4	133.4	

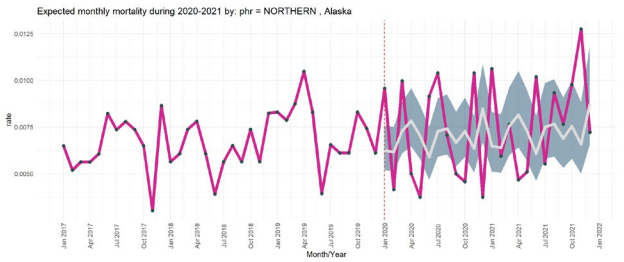
Notes: *significance at alpha = 0.05



Anchorage



Mat-Su



Northern

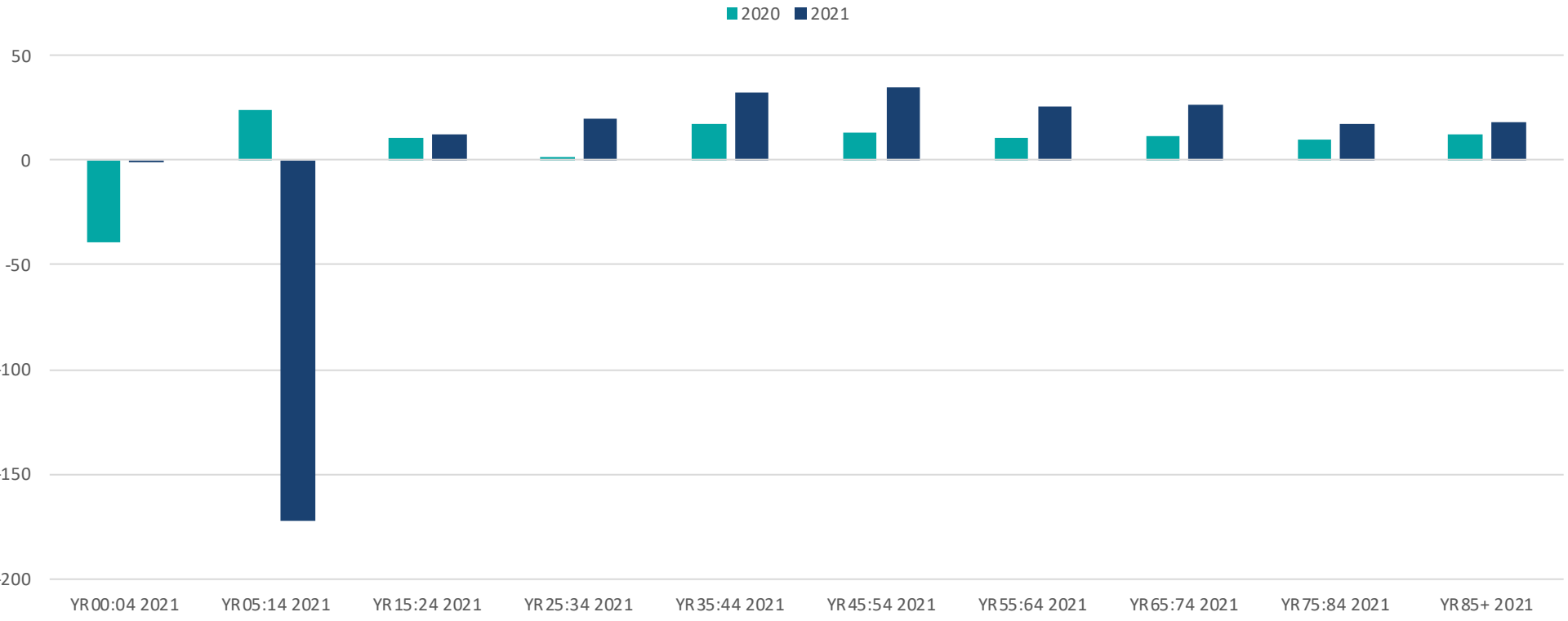
Age Group

	Observed	Predicted	Excess	Lower bound	Upper bound	Sig.
YR00:04 2020	61	84.9	-23.9	-57.4	-0.5	*
YR00:04 2021	83	83.5	-0.5	-41.9	26.4	
YR05:14 2020	35	26.5	8.5	-26.3	22.2	
YR05:14 2021	10	27.2	-17.2	-70.8	-1	*
YR15:24 2020	133	119.1	13.9	-22.8	41.1	
YR15:24 2021	143	125.4	17.6	-33.1	52.7	
YR25:34 2020	239	235.7	3.3	-61.3	52.2	
YR25:34 2021	303	243.8	59.2	-28.1	121.2	
YR35:44 2020	289	238.9	50.1	-13.5	99.2	
YR35:44 2021	377	256.2	120.8	28	186.7	*
YR45:54 2020	411	356.6	54.4	-5.5	105	
YR45:54 2021	530	342.9	187.1	113	246.7	*
YR55:64 2020	858	762.7	95.3	10.7	170.1	*
YR55:64 2021	1003	746.3	256.7	153.1	346	*
YR65:74 2020	1137	1010	127	-8.2	244.2	
YR65:74 2021	1441	1063.3	377.7	189.9	533.4	*
YR75:84 2020	1101	988.2	112.8	3.8	209.2	*
YR75:84 2021	1277	1052.2	224.8	76.1	352.4	*
YR85+ 2020	930	810.9	119.1	27.3	199.3	*
YR85+ 2021	1047	855.9	191.1	69.3	294.6	*

Notes: *significance at alpha = 0.05

Age Group

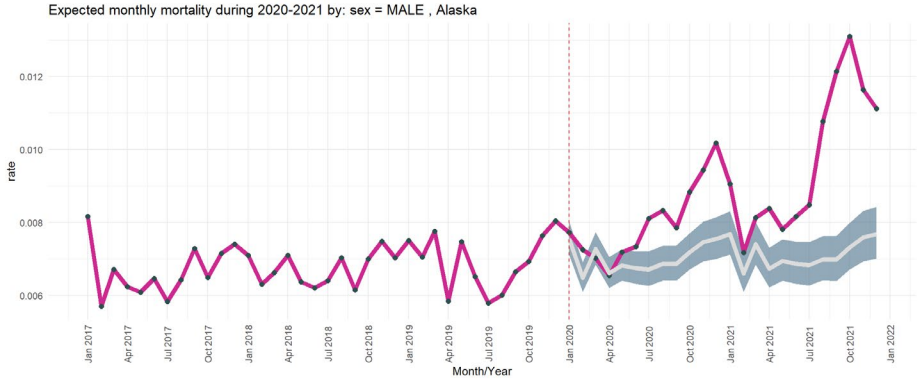
Excess/Observed by age group



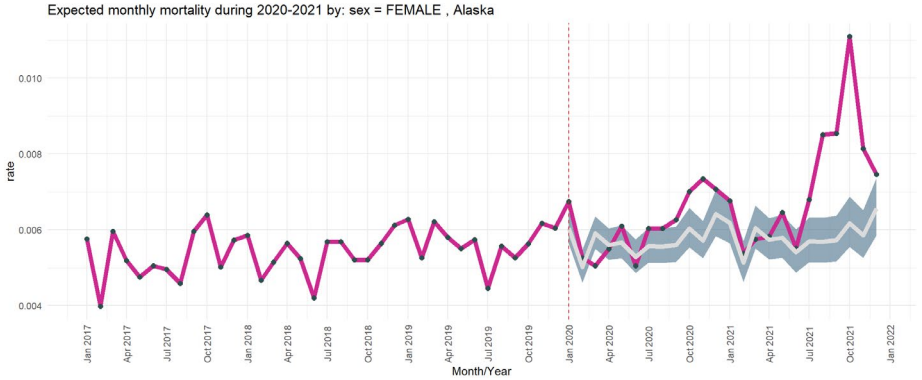
Sex

	Observed	Predicted	Excess	Lower bound	Upper bound	Sig.
MALE 2020	3014	2646.9	367.1	182.8	537.6	*
MALE 2021	3650	2696	954	715	1170.9	*
FEMALE 2020	2180	2029.7	150.3	-23.2	307.5	
FEMALE 2021	2564	2080.9	483.1	256.3	683.8	*

Notes: *significance at alpha = 0.05



Male

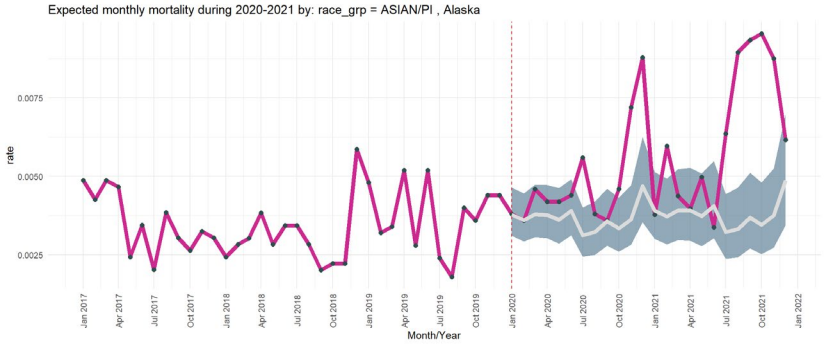


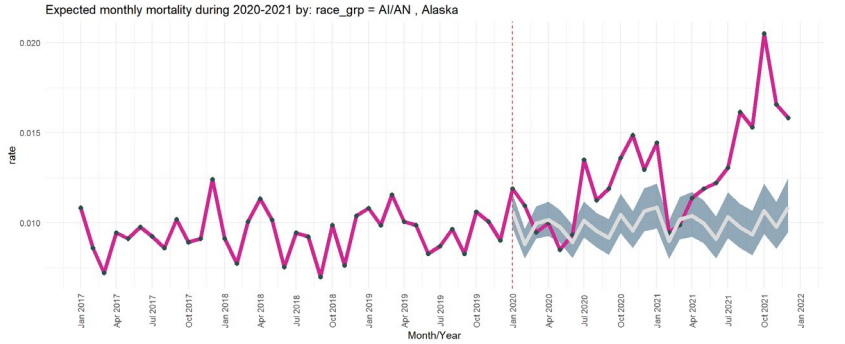
Female

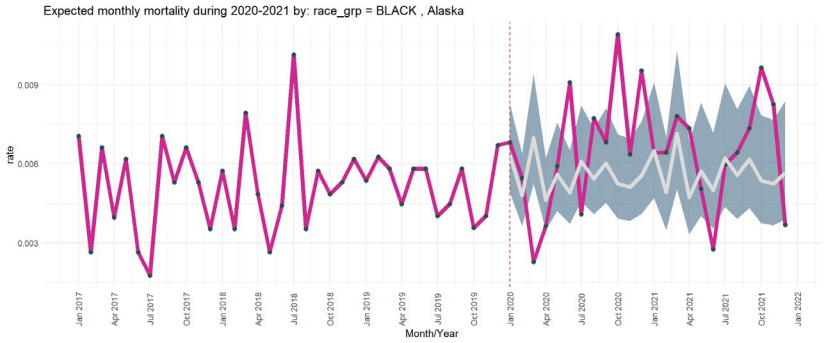
Race

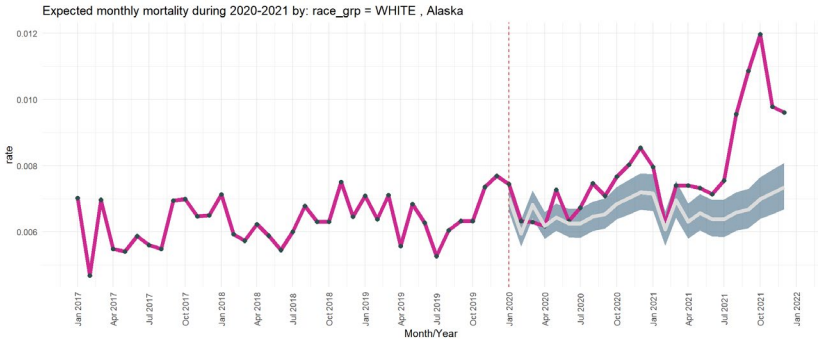
	Observed	Predicted	Excess	Lower bound	Upper bound	Sig.
ASIAN/PI 2020	292	220.4	71.6	10.8	117.7	*
ASIAN/PI 2021	380	229.2	150.8	66.2	210.1	*
AI/AN 2020	1301	1107.9	193.1	76.9	297.1	*
AI/AN 2021	1569	1131.3	437.7	286.5	569.3	*
BLACK 2020	173	146.7	26.3	-24.4	62.5	
BLACK 2021	168	148.5	19.5	-46.9	63.4	
WHITE 2020	3360	3108.5	251.5	31	455.5	*
WHITE 2021	4013	3148.2	864.8	578.4	1124	*

Notes: *significance at alpha = 0.05







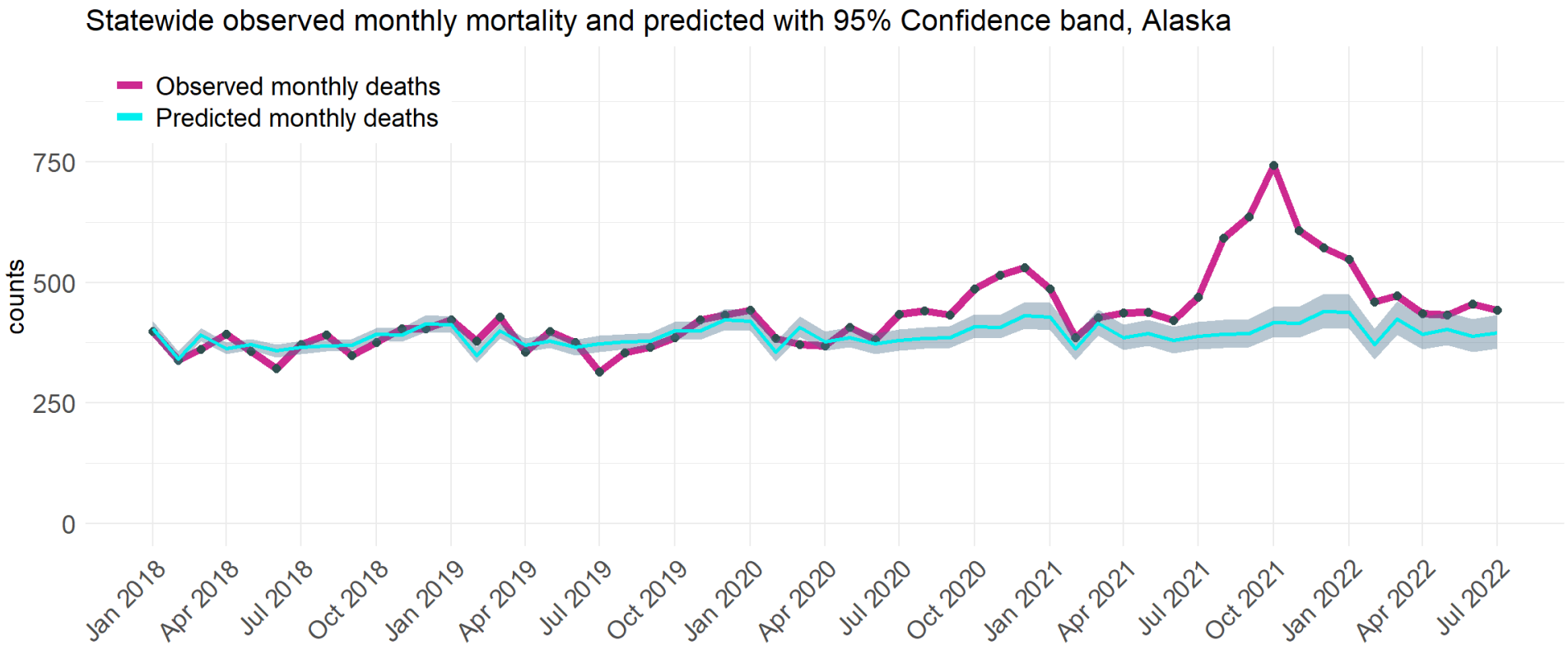


Causes of death

We observed changes in mortality for some of the top leading causes of death in 2021:

- Increase in Diseases of the Heart
- Increase in Unintentional Injuries
  - Increase in Unintentional overdose
- Increase in Chronic Liver Disease & Cirrhosis
- Decrease in Homicide

And beyond…



	Observed	Predicted	Excess	Lower est.	Upper est.	Sig.
2020	5194	4716.6	477.4	199.6	737.5	*
2021	6214	4812.5	1401.5	1039	1734.9	*
2022	3244	2811.1	432.9	181.1	660.7	*

Notes: *significance at alpha = 0.05

****NOTE****

- These are provisional and based on raw counts
- The further we follow in time the worse the model likely performs

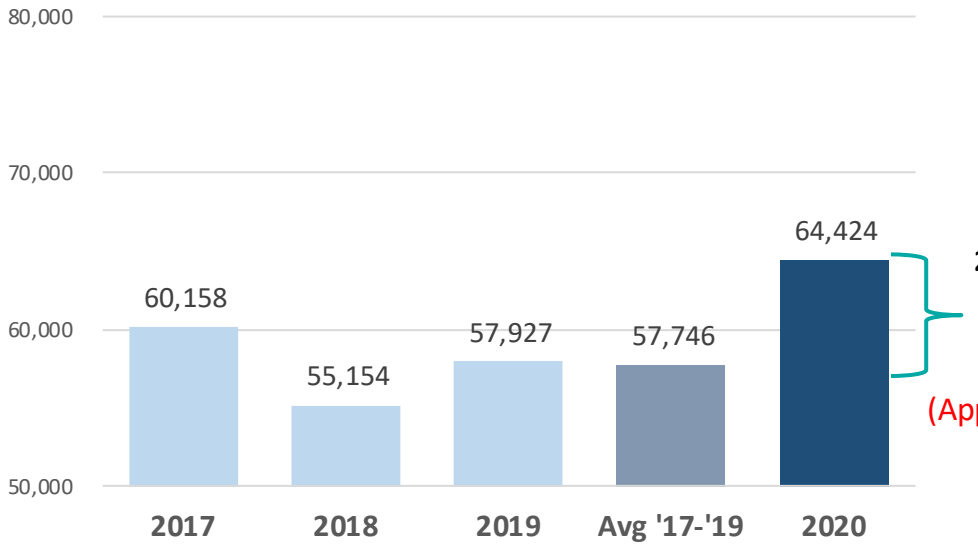
Public Health Implications

Premature Death from COVID-19

Years of Potential Life Lost (YPLL)

- Premature death expressed as YPLL = 75 years – Age at Death
- Premature deaths has a financial impact on communities → economic contributions are lost from younger generations
- If excess deaths were only among elderly, it would not lead to an increase in premature deaths

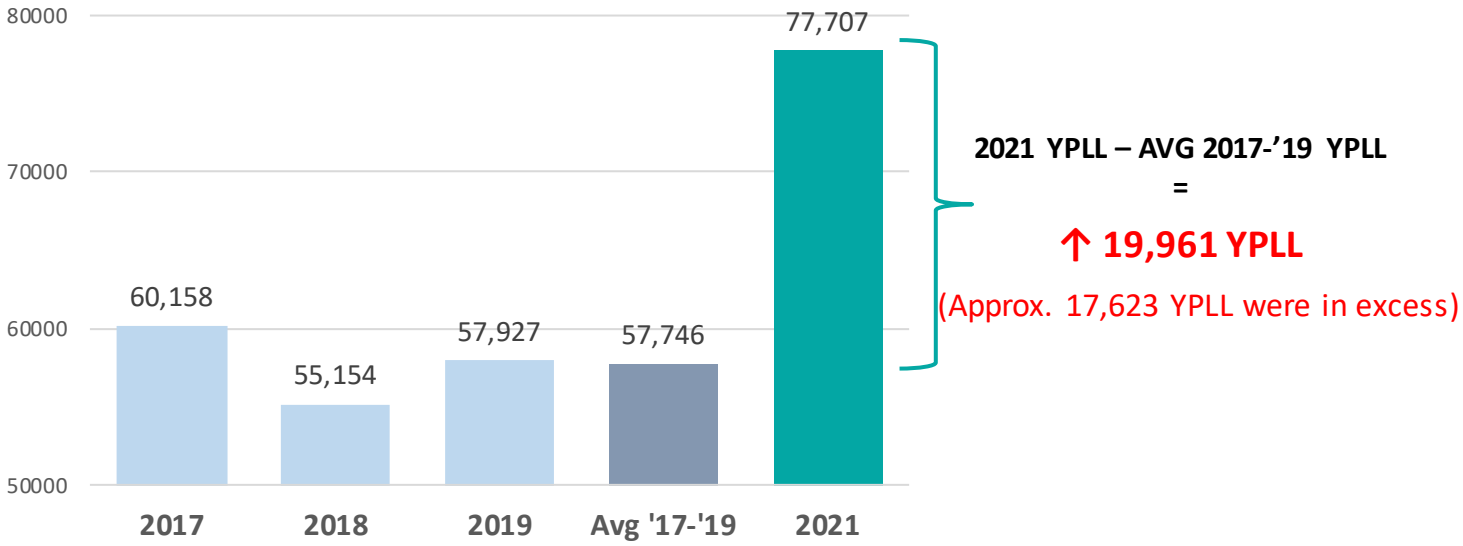
Premature Death: Total YPLL by Year



2020 YPLL – AVG 2017-'19 YPLL
=
↑ 6,673 YPLL
(Approx. 5,075 YPLL were in excess)

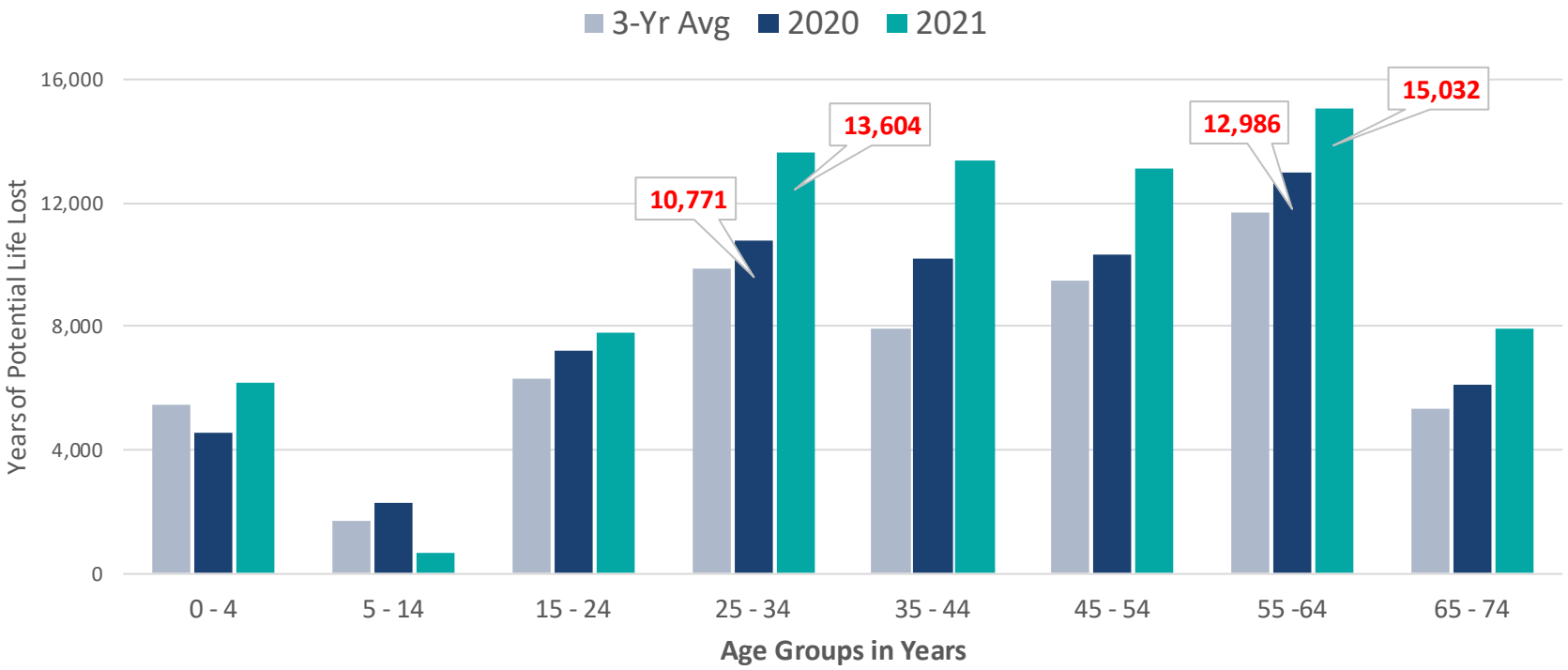
Limitation: The age cutoff of 75 may not reflect the current average life expectancy age and therefore may over or under-estimate YPLL.
Data Source: Division of Public Health, Mortality, 2017-2021
Data Accessed: October 6, 2022

Premature Death: Total YPLL by Year



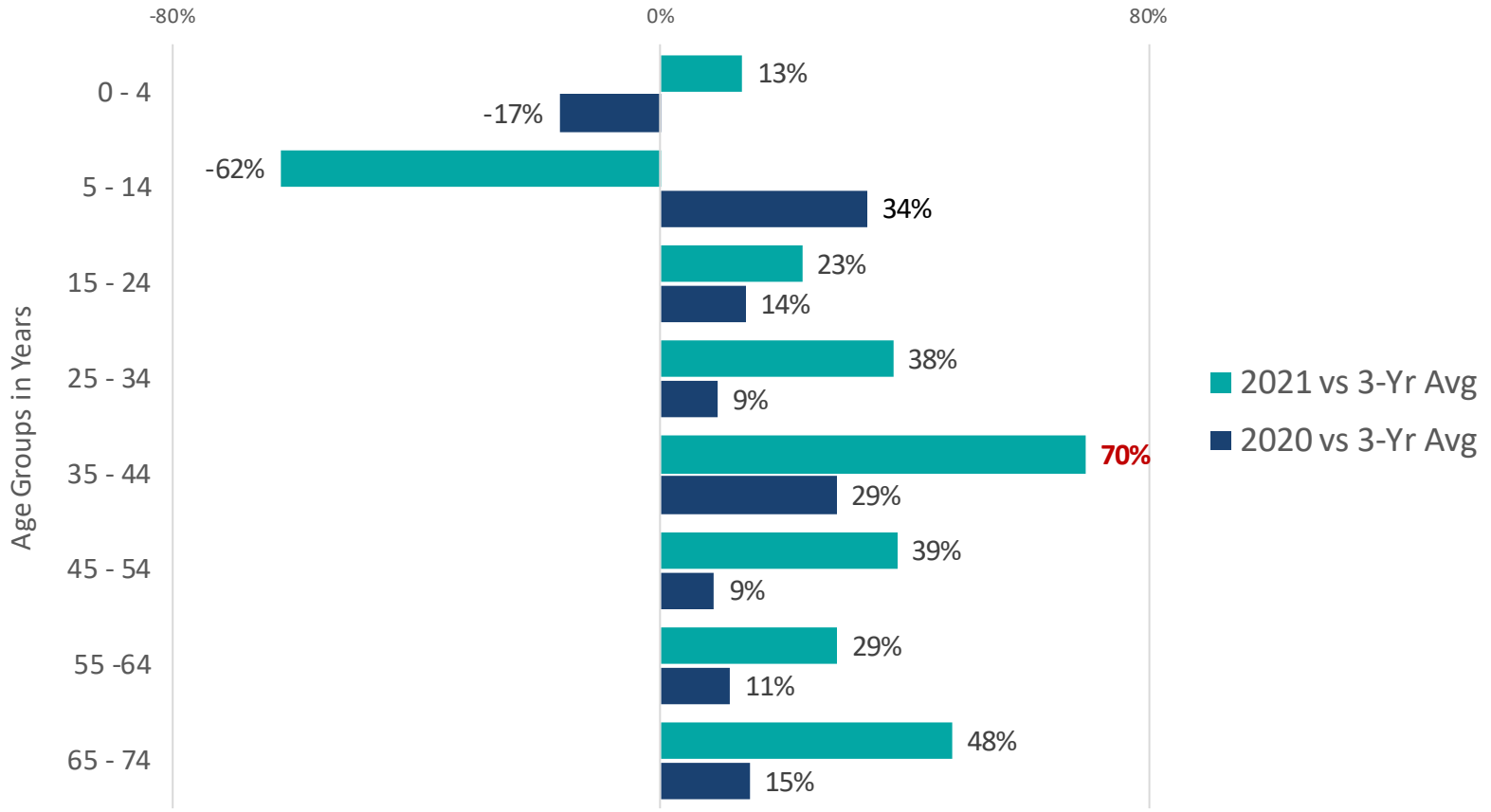
Limitation: The age cutoff of 75 may not reflect the current average life expectancy age and therefore may over or under-estimate YPLL.
Data Source: Division of Public Health, Mortality, 2017-2021
Data Accessed: October 6, 2022

Premature Death: YPLL by Age Group



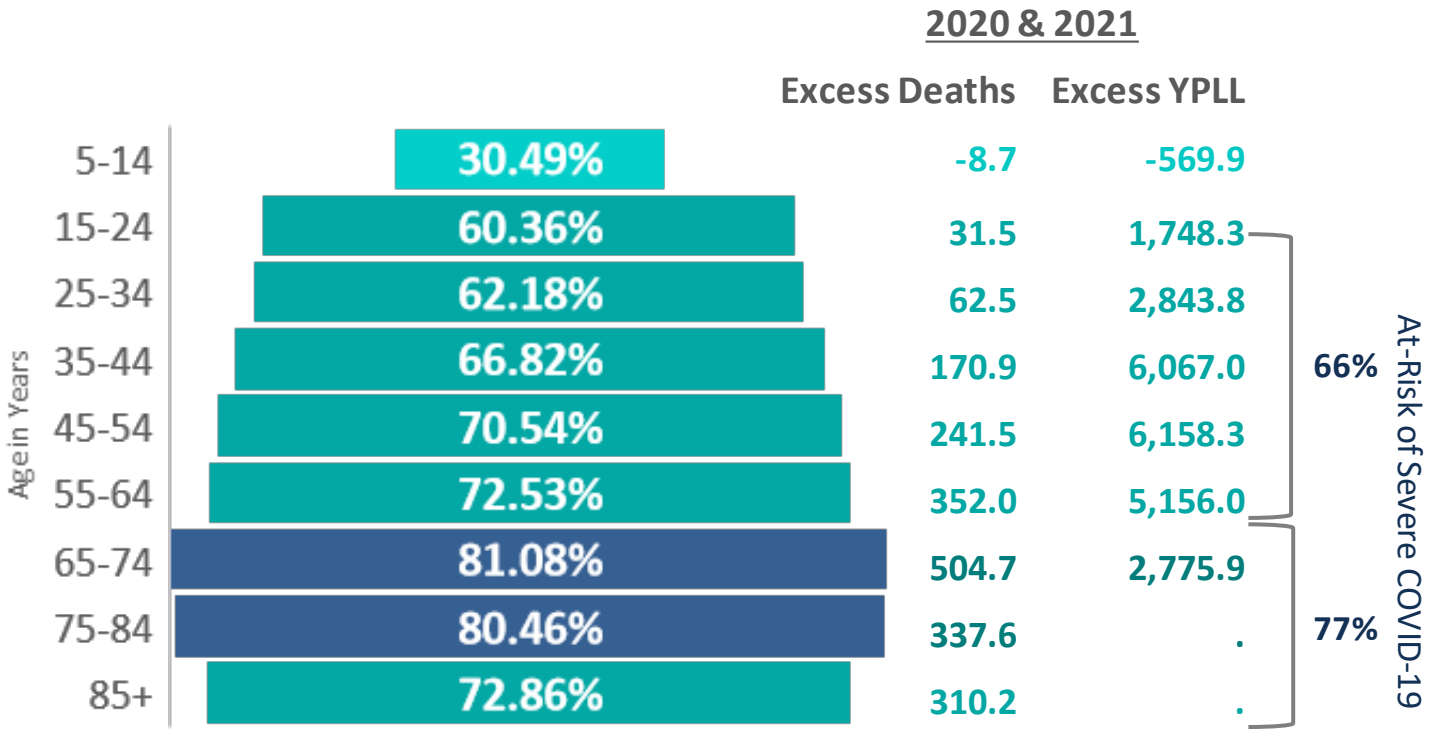
Limitation: The age cutoff of 75 may not reflect the current average life expectancy age and therefore may over or under-estimate YPLL.
Data Source: Division of Public Health, Mortality, 2017-2021
Data Accessed: October 6, 2022

Premature Death: Percent Change



Limitation: The age cutoff of 75 may not reflect the current average life expectancy age, and may be an under-estimate of YPLL.
Data Source: Division of Public Health, Mortality, 2017-2020
Data Accessed: December 10, 2021

Impact on COVID-19 Vaccinations

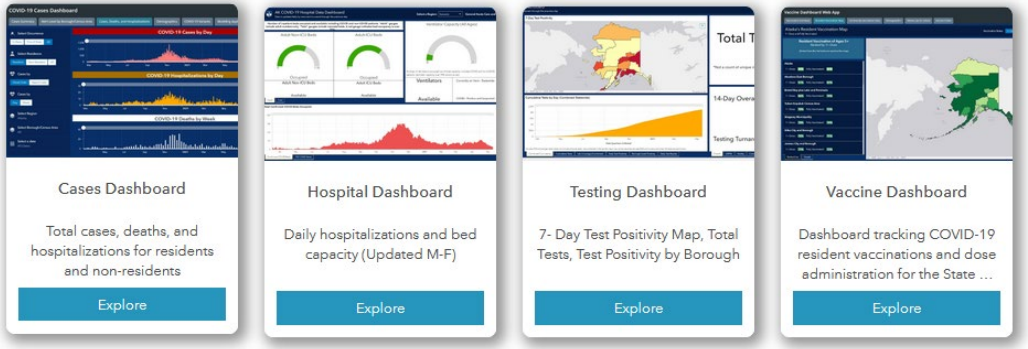


Limitation: Vaccination percent does not include veteran/military personnel vaccinated by the Department of Defense or Veteran Affairs
Data Source: Alaska Department of Health and Social Services, Division of Public Health
Data Accessed: March - December 2021

Additional Resources

Alaska COVID-19 Information Hub

Click explore below for detailed COVID-19 Dashboards



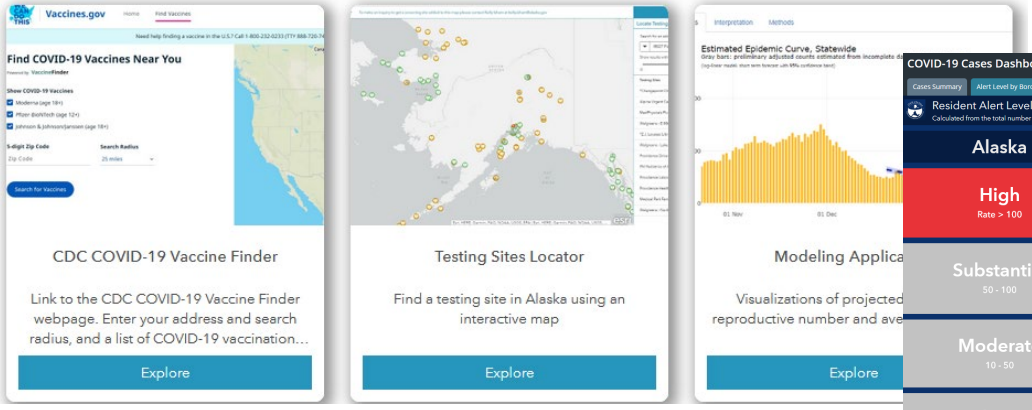
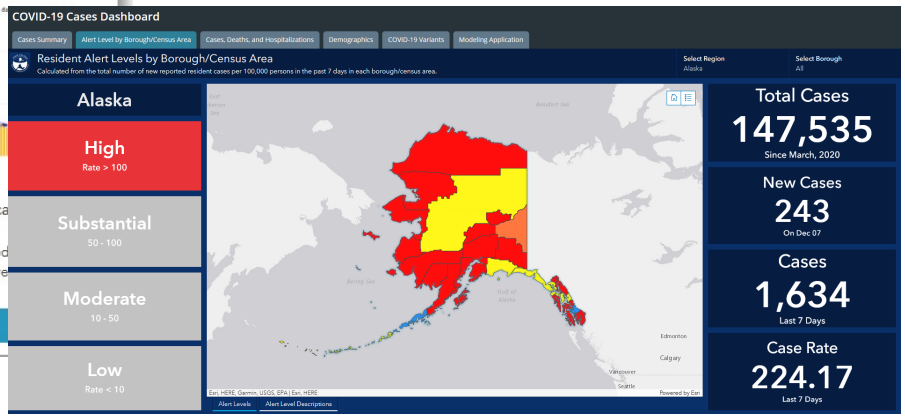


Table 3. Demographic Distribution of Cases[1]

Demographic	All Cases	All Cases (Percent)	Hospitalized Cases	Hospitalized Cases (Percent)	Deceased Cases	Deceased Cases (Percent)
Sex						
Male	74,788	50.7%	1,707	54.4%	517	60.4%
Female	72,221	49.0%	1,427	45.5%	339	39.6%
Unknown Sex	526	0.4%	4	0.1%	0	0.0%
Age Group						
<10 Years	16,300	11.0%	38	1.2%	0	0.0%
10-19 Years	21,144	14.3%	29	0.9%	0	0.0%
20-29 Years	26,443	17.9%	139	4.4%	16	1.9%
30-39 Years	27,068	18.3%	308	9.8%	32	3.7%
40-49 Years	19,377	13.1%	352	11.2%	55	6.4%
50-59 Years	17,092	11.6%	551	17.6%	110	12.9%
60-69 Years	12,443	8.4%	705	22.5%	189	22.1%
70-79 Years	5,446	3.7%	611	19.5%	229	26.8%
80+ Years	2,222	1.5%	405	12.9%	225	26.3%
Unknown Age	0	0.0%	0	0.0%	0	0.0%
Ethnicity						
Hispanic	6,701	4.5%	140	4.5%	29	3.4%
Non-Hispanic	86,537	58.7%	2,463	78.5%	751	87.7%



Additional Resources

Alaska COVID-19 Information Hub

- data.coronavirus.alaska.gov

Explaining the Death Reporting Process:

- https://dhss.alaska.gov/dph/epi/id/pages/covid-19/deathcounts.aspx

National Excess Death Data:

- https://www.cdc.gov/nchs/nvss/vsrr/covid19/excess_deaths.htm

Health Analytics and Vital Records:

- https://dhss.alaska.gov/dph/VitalStats/Pages/data/default.aspx

Links and Contacts

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STATE OF ALASKA
DEPARTMENT OF HEALTH

Promotion Prevention Protection
ALASKA DIVISION OF
Public Health