

Supplementary material

SETTING THE X-AXIS SCALE FOR FIGURES (UNSTRATIFIED ANALYSIS)

For each combination of visit type and outcome, we calculated the maximum achievable variable importance using the performance of the full model including predictors from all time periods. For AUC, the maximum achievable importance is the difference between the AUC of the full model and 0.5 (the AUC of a null model). For sensitivity at a given cut-point, the maximum importance is the difference between the sensitivity of the full model and the proportion of visits flagged using that cut-point. For PPV, the maximum importance is the difference between the PPV of the full model and the overall event rate. In each figure, the upper limit of the x -axis is set to the maximum achievable importance.

VARIABLE IMPORTANCE WITHIN SUBGROUPS

In addition to the primary analyses in the four outcome-setting pairs, we also performed analyses in subgroups defined by self-reported race and ethnicity. Due to the small number of suicide deaths in some subgroups, we performed stratified analyses only for self-harm, in both mental health and general medical settings. Race/ethnicity categories included White, Hispanic, Black/African American, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, multiracial or other race, and no race or ethnicity recorded. For each outcome-setting pair, penalized regression models were fit using all visits. Subgroup-specific estimates of predictiveness were then computed using only visits corresponding to that subgroup. For sensitivity and specificity, subgroup-specific risk score quantiles were used.

Performance of risk prediction models using predictors from all time periods is reported in Tables S3 and S4 Variable importance estimates are shown in Figures S5–S8.

SUPPLEMENTARY TABLES AND FIGURES

Health system	Data start date	Last date with complete cause of death data ^a
HealthPartners	January 1, 2009	December 31, 2016
Henry Ford Health	December 1, 2012 ^b	December 31, 2015
Kaiser Permanente Colorado	January 1, 2009	December 31, 2017
Kaiser Permanente Hawaii	January 1, 2009	December 31, 2016
Kaiser Permanente Northwest	January 1, 2009	December 31, 2016
Kaiser Permanente Southern California	January 1, 2009	December 31, 2016
Kaiser Permanente Washington	January 1, 2009	December 31, 2016

Table S1: Data availability dates for participating sites.

^aThe study sample includes visits up to September 30 of the year with complete capture of cause of death data to allow for 90 days follow-up after mental health visits. For example, visits through September 30, 2016 are included for health systems with cause of death data complete through December 31, 2016.

^bOnly visits that occurred after the implementation of a new electronic health records system at Henry Ford were included in the sample.

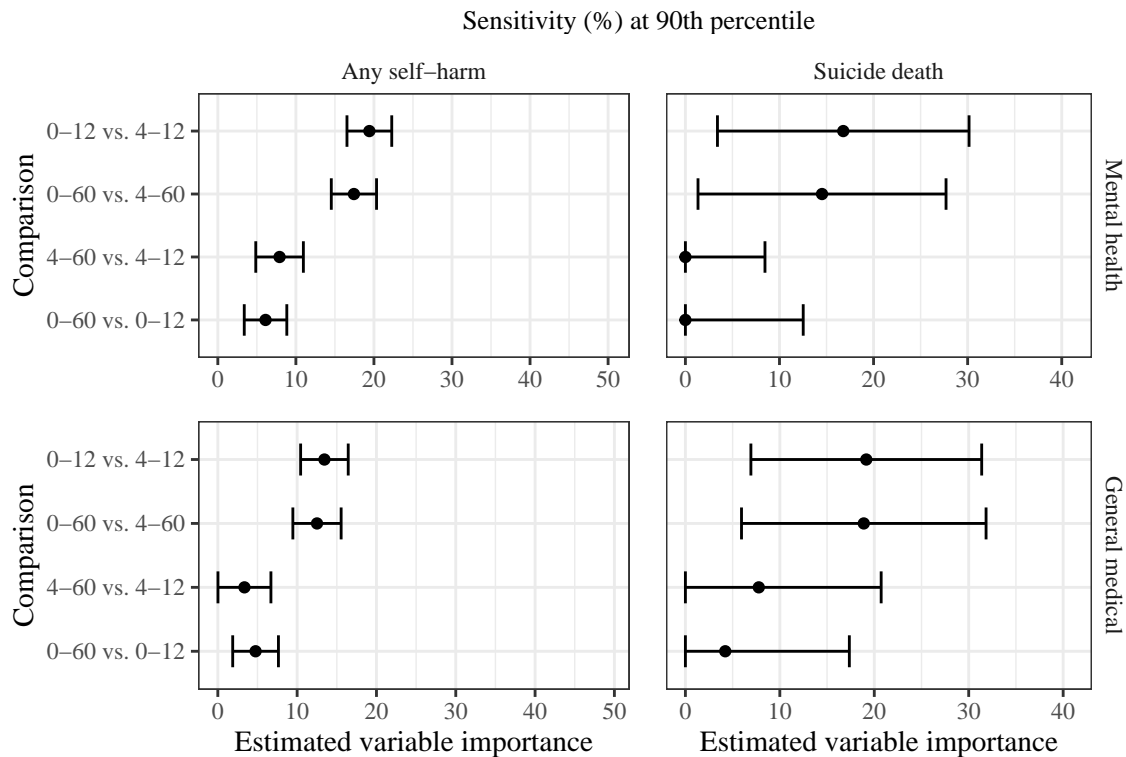


Figure S1: Estimated variable importance for temporal predictor groups in terms of **sensitivity at the 90th percentile** of risk scores. Note the different *x*-axis scales for each outcome-setting pair, which are based on the estimated maximum possible variable importance (see Supplementary Material for details).

Base predictors	
Age	Sex
Race	Hispanic ethnicity
Medicaid coverage at visit	Commercial insurance coverage at visit
Private pay insurance at visit	State-subsidized insurance at visit
Self-funded insurance at visit	Medicare insurance at visit
Other insurance at visit	High-deductible insurance at visit
Median household income <\$25k at visit (census-based)	Median household income <\$40k at visit (census-based)
Neighborhood <25% college educated at visit (census-based)	
Temporal predictors ^a	
Depression diagnosis	Anxiety diagnosis
Bipolar diagnosis	Schizophrenia diagnosis
Other psychological disorder diagnosis	Dementia diagnosis
ADD diagnosis	ASD diagnosis
Personality disorder diagnosis	Alcohol use disorder diagnosis
Drug use disorder diagnosis	PTSD diagnosis
Eating disorder diagnosis	Traumatic brain injury diagnosis
Antidepressant prescription fill	Benzodiazepine prescription fill
Hypnotic prescription fill	Second generation antipsychotic prescription fill
Inpatient encounter with MH diagnosis	Outpatient MH specialty visit
Emergency/urgent care encounter MH diagnosis	Any self-inflicted injury/poisoning
Self-inflicted lacerative violent injury	Other self-inflicted violent injury
Any injury/poisoning diagnosis	Natal delivery diagnosis
Modal PHQ9 9th item response	Maximum PHQ9 9th item response
Number of PHQ9 9th item responses	

Table S2: Overview of variables included in prediction models. MH: mental health.

^aEach temporal predictor is a binary indicator of presence/absence in 0–3 months, 3 months – 1 year, or 1–5 years prior to the index visit.

	AUC	Sensitivity (%)		
		90 th perc.	95 th perc.	99 th perc.
American Indian/Alaska Native	0.846	58.1	41.6	11.6
Asian	0.840	56.6	42.9	16.3
Black/African American	0.827	53.9	40.6	16.4
Native Hawaiian/Pacific Islander	0.802	49.6	37.3	16.7
White	0.854	61.1	46.1	19.2
Multiple or other races	0.849	55.9	45.0	20.1
Hispanic	0.851	58.7	44.0	18.8
No race/ethnicity indicated	0.807	55.0	42.4	18.0

Table S3: Performance of any self-harm (fatal and non-fatal) prediction models including predictors from all time periods in the mental health setting.

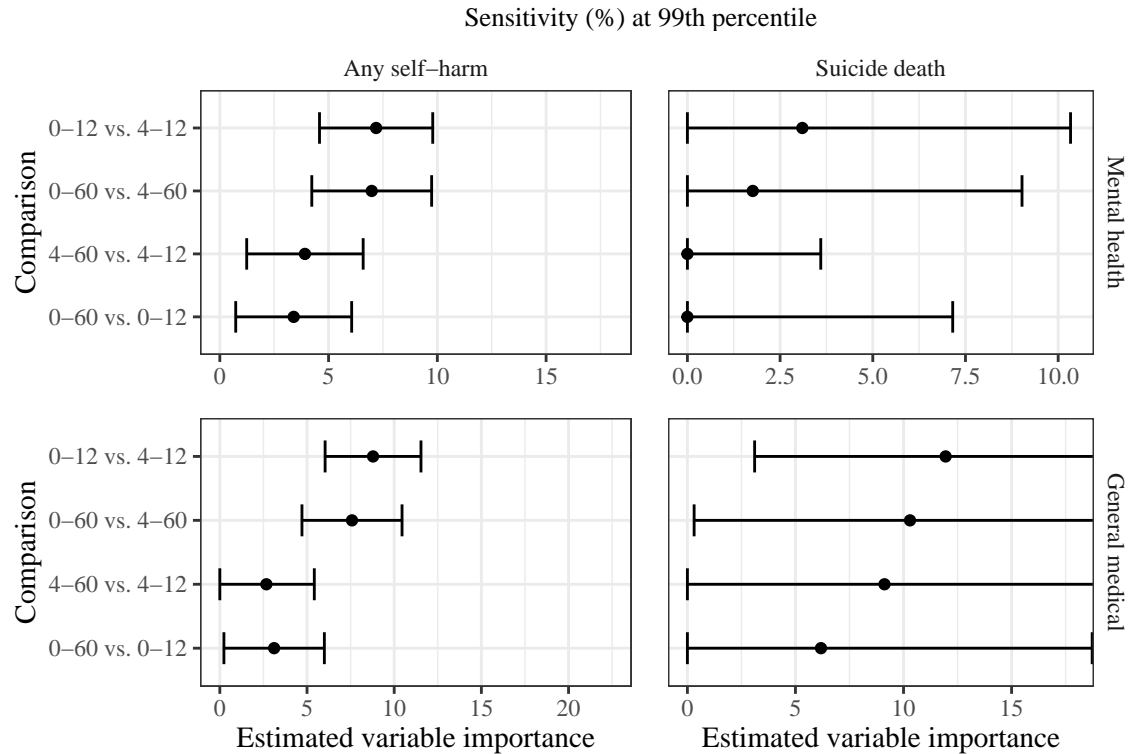


Figure S2: Estimated variable importance for temporal predictor groups in terms of **sensitivity at the 99th percentile** of risk scores. Note the different *x*-axis scales for each outcome-setting pair, which are based on the estimated maximum possible variable importance (see Supplementary Material for details).

	AUC	Sensitivity (%)		
		90 th perc.	95 th perc.	99 th perc.
American Indian/Alaska Native	0.845	61.1	49.4	14.1
Asian	0.808	55.6	44.8	22.5
Black/African American	0.831	58.4	42.9	20.8
Native Hawaiian/Pacific Islander	0.820	54.5	34.5	17.9
White	0.829	59.5	47.3	24.2
Multiple or other races	0.798	50.9	42.2	28.1
Hispanic	0.839	60.8	48.2	23.2
No race/ethnicity indicated	0.810	58.2	47.3	20.4

Table S4: Performance of any self-harm (fatal and non-fatal) prediction models including predictors from all time periods in the general medical setting.

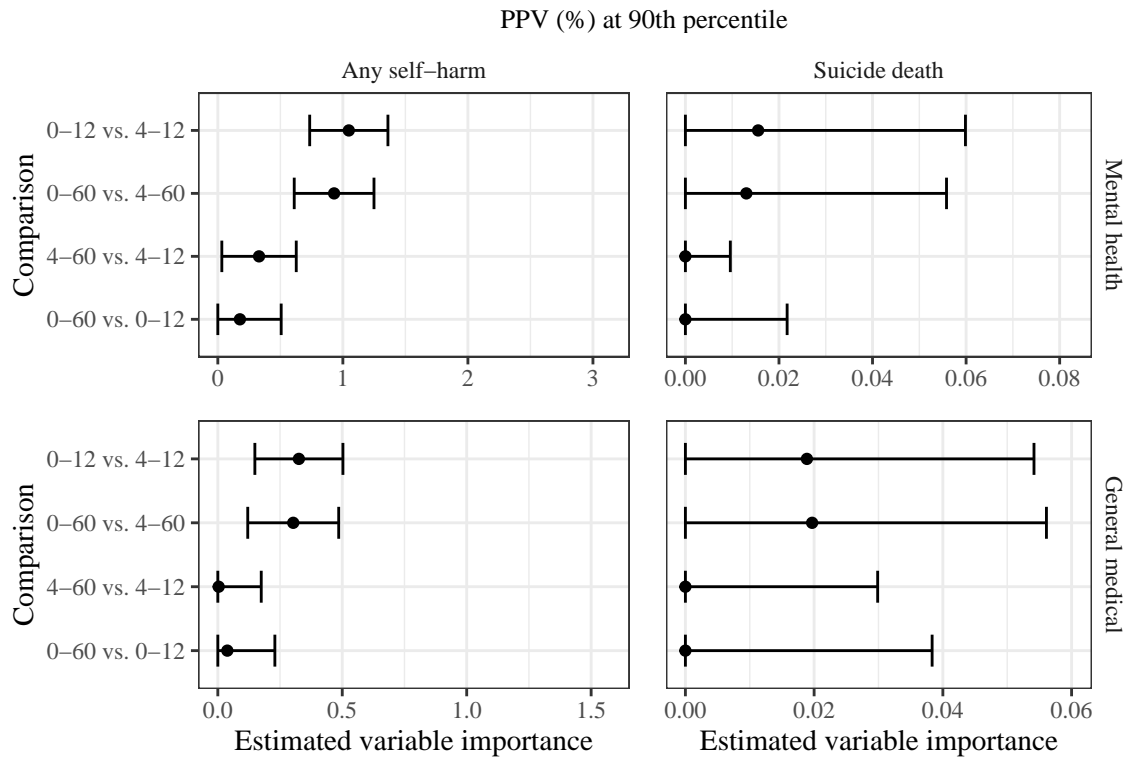


Figure S3: Estimated variable importance for temporal predictor groups in terms of **PPV at the 90th percentile** of risk scores. Note the different *x*-axis scales for each outcome-setting pair, which are based on the estimated maximum possible variable importance (see Supplementary Material for details).

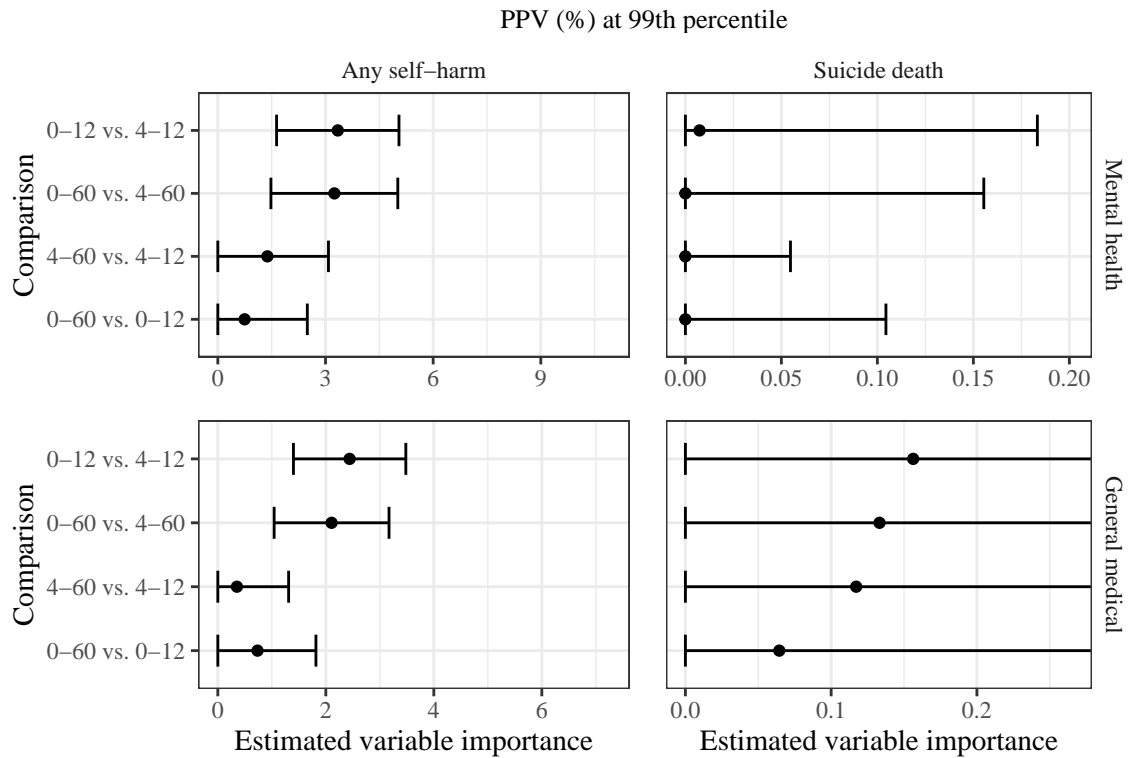


Figure S4: Estimated variable importance for temporal predictor groups in terms of **PPV at the 99th percentile** of risk scores. Note the different x -axis scales for each outcome-setting pair, which are based on the estimated maximum possible variable importance (see Supplementary Material for details).

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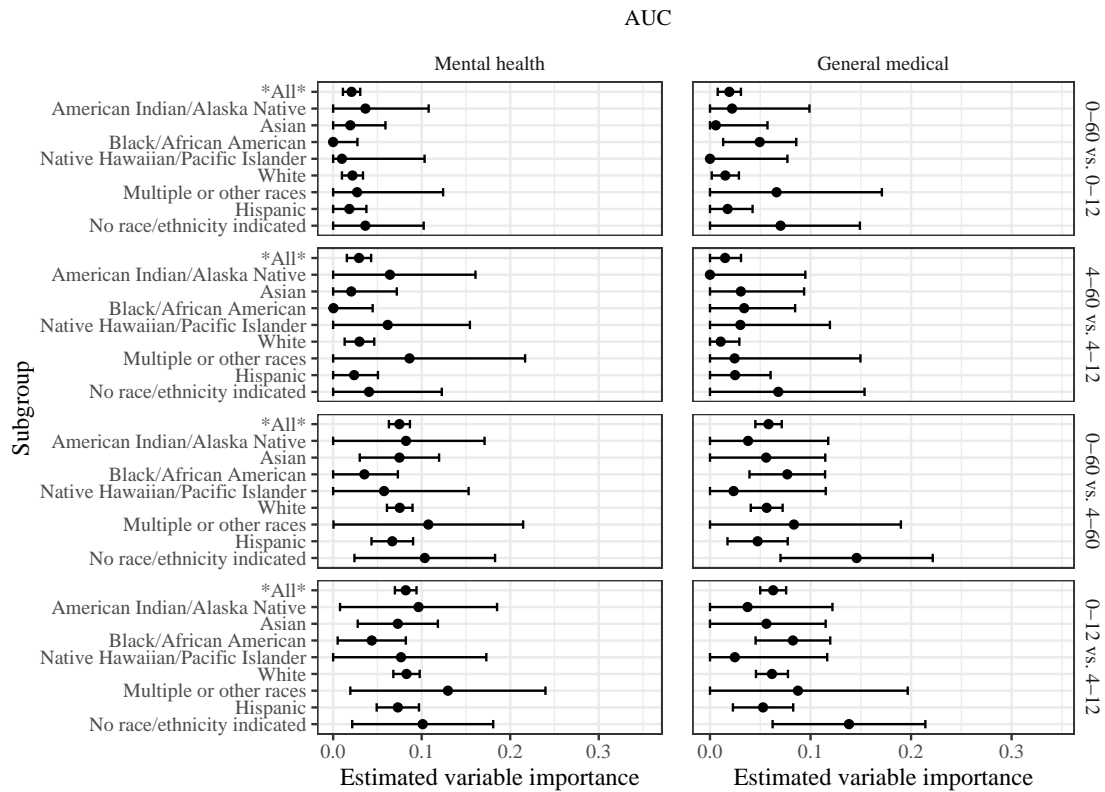


Figure S5: Estimated variable importance for temporal predictor groups in terms of AUC, stratified by race and ethnicity.

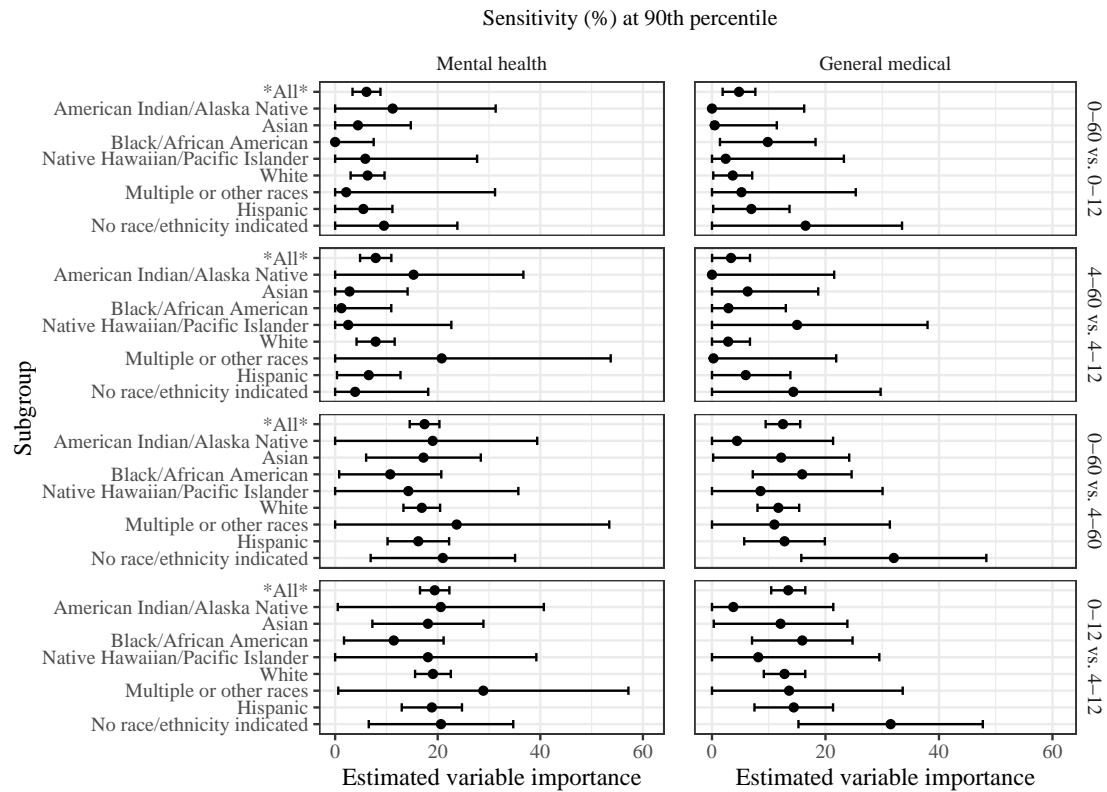


Figure S6: Estimated variable importance for temporal predictor groups in terms of **sensitivity at the 90th percentile** of risk scores, stratified by race and ethnicity.

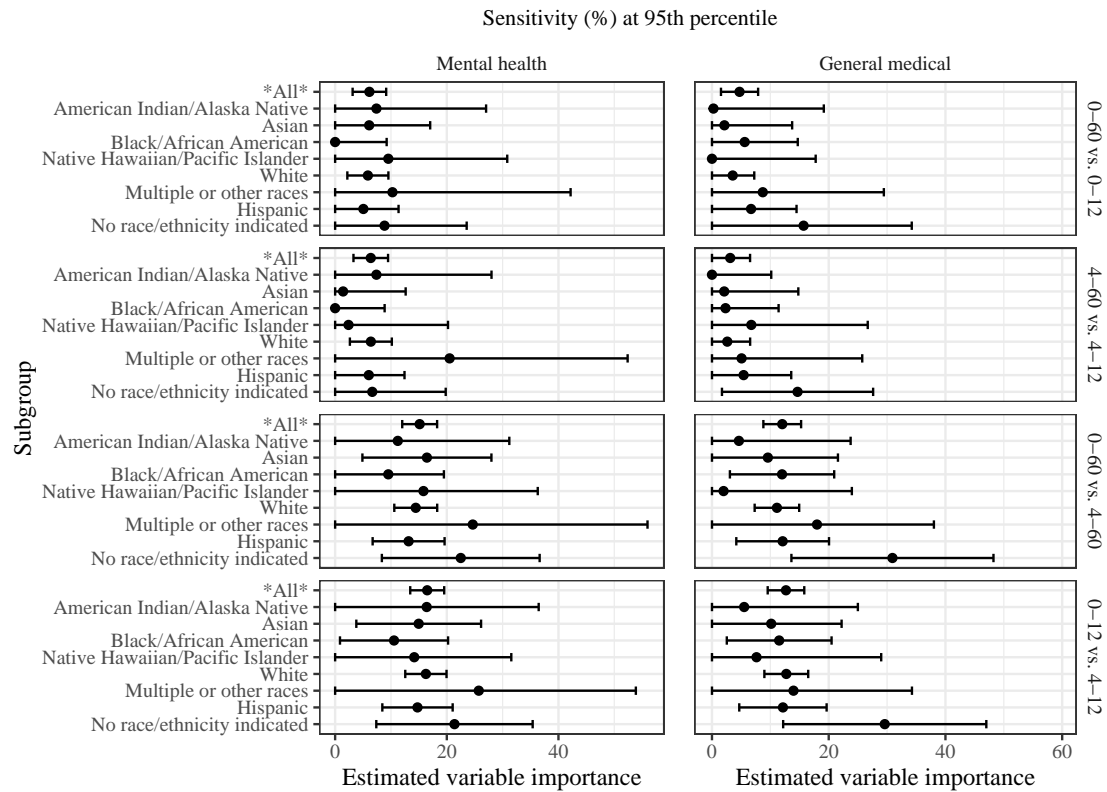


Figure S7: Estimated variable importance for temporal predictor groups in terms of **sensitivity at the 95th percentile** of risk scores, stratified by race and ethnicity.

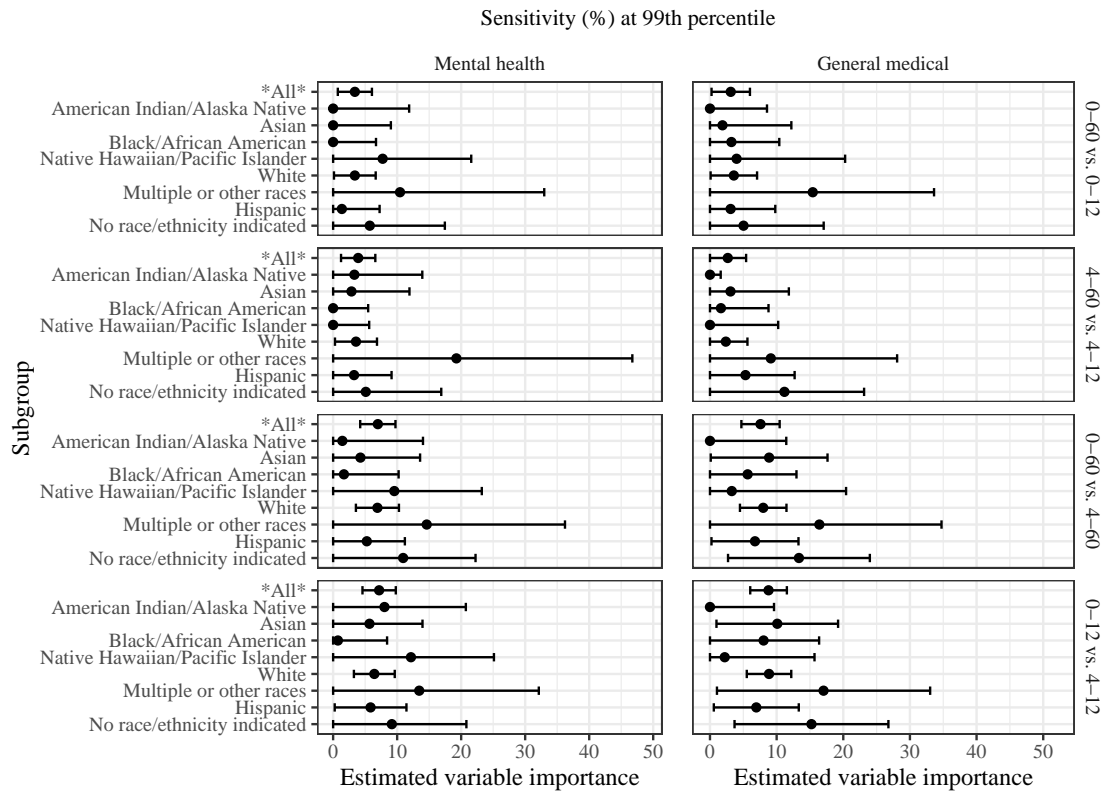


Figure S8: Estimated variable importance for temporal predictor groups in terms of **sensitivity at the 99th percentile** of risk scores, stratified by race and ethnicity.