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Title: Policy Interventions and Human Security in the U.S.: Critical Perspectives

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Abstract

Background: Based on a critical human security framework, this study examines how state-level policy interventions were associated with health security in the United States during the recent pandemic, with attention to whether associations varied by the proportion of racially and economically marginalized populations.

Materials and Methods: Employing a quasi-experimental design, this study estimated difference-in-differences models using state-level panel data for 2019 and 2021 (N=100 state-years). Specifically, two-way fixed effects models estimated associations between three state-level emergency health policy interventions and health outcomes measured with COVID-19 and drug overdose mortality, with interaction terms assessing moderation by racial minority share and poverty rate of each state. Standard errors were clustered at the state level.

Results: All three policies were negatively associated with COVID-19 mortality across specifications. Expanded access to telehealth services and early prescription refill requirement were also negatively associated with drug overdose mortality, whereas paid sick leave showed no consistent association with overdose deaths. Associations were heterogeneous: estimated mortality reductions were attenuated in higher-poverty states and, for some policies, varied systematically by racial minority composition.

Conclusions: Findings indicate that state emergency health policies were associated with mortality outcomes in context-dependent ways. Rather than uniform effects, associations varied across demographic and socioeconomic environments. These results highlight the importance of equity-informed, context-sensitive policy design to strengthen human security during public health crises.

Keywords: human security, policy interventions, health outcomes, marginalized populations, COVID-19, difference-in-differences

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Introduction

Human security means protection from both long-term and sudden threats that impose hardship on people's livelihood, well-being, and dignity [1-3]. This concept emphasizes that a person's basic functions and capabilities are necessary for every individual to thrive [4]. This security is not shaped solely by individual efforts but is profoundly influenced by systemic contexts—such as socio-economic and political factors—within social groups and communities. Therefore, a critical line of studies emphasized the importance of incorporating these additional aspects for a comprehensive assessment of human security [5-7].

COVID-19 became one of the greatest threats to human security. In particular, situations revolving around COVID-19 intensified systemic human security challenges [5, 8]. Studies and media highlight that the characteristics of the infectious disease, coupled with various socio-economic and cultural challenges—such as hunger, poverty, racial conflict, and accessibility—exacerbated insecurities among historically oppressed or marginalized populations, especially communities of color [5, 6]. This implies that the costs and impact of COVID-19 were not evenly distributed or uniformly experienced across diversely situated populations within a country and around the world [9, 10].

The present study argues that the impacts of pandemic policies on human security may vary across different population segments if the structurally marginalized populations were more likely to become vulnerable than the majority populations during the pandemic. Specifically, uniform and universal policies, which do not account for disparities experienced by marginalized groups, could become a source of future insecurity for the marginalized populations who live below the statistically set central tendency [11, 12]. It has been reported that policy measures intended to protect human security, such as lockdowns, were often enforced with a punitive and disproportionate approach that targeted marginalized communities [13]. This reliance on such enforcement was perceived to create new barriers, discouraging these groups from seeking essential services and care for fear of being criminalized or judged [13].

Among a range of policy interventions implemented during the pandemic, telehealth expansion, paid sick leave, and early prescription refill policies warrant particular attention. Telehealth became a critical mechanism for maintaining healthcare, especially when in-person visits were limited [14]. A growing body of research has examined whether racial inequality emerged in telehealth utilization during the COVID-19 crisis, but the findings are inconsistent. While some studies find no statistically significant differences across racial groups [15], other analyses indicate that racial minorities were more or less likely to use telehealth compared to White patients[16-18]. Income level is another important factor affecting access to and utilization of telehealth [19, 20]. Lower income individuals and families often face restricted access and reduced use, although some studies find no significant association [21].

Paid sick leave has also been recognized as an important means of ensuring timely access to healthcare when people need it most [22]. Without guaranteed paid sick leave, workers face a higher risk of getting sick(er) due to limited institutional protection, and especially during the outbreak of infectious diseases such as COVID-19, the inability to take leave can pose a greater

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threat to public health [23-25]. More importantly, prior work has found that certain racial groups, such as Hispanics and Black workers, are less likely to have access to paid sick leave in the absence of a mandated policy, often because they are employed in sectors or firms that do not provide such benefits [26-28]. At the same time, evidence indicates that marginalized populations have lower odds of taking paid sick leave even when it is available [29]. The similar pattern is observed among economically marginalized populations, with lower-income individuals and families tending to have more limited access [27, 28].

Although some studies have examined early prescription refill policies during COVID-19, primarily focusing on refill claims and medication receipt [30, 31], less is known about whether systematic differences exist across racial groups or people across different economic strata in access to or utilization of this service during the pandemic. Together, these findings suggest that patterns of access to and utilization of these policies vary across populations.

Disparities in access to telehealth, paid sick leave, and early prescription refill are not only important in their own right. These differences can reinforce or exacerbate preexisting health inequities [32, 33]. A few studies examining paid sick leave have found that lack of access was negatively associated with worse health outcomes during the pandemic, including mortality rates and mental health [22, 34]. Also, a limited number of research shows that health consequences were disproportionate across different racial groups during COVID-19. [35]. Although evidence is limited, existing research finds an association between economic hardship and adverse health outcomes, such as depression, and shows that guaranteed leave ameliorates the adverse effect [36]. The health effects of telehealth utilization, in contrast, are generally not distinguishable from those of in-person visits [37]. Although substantial evidence shows racial disparities in telehealth access, whether the health effects of telehealth differ by race or income level remains understudied. A comparable gap is evident in the literature on early prescription refill policies. To our knowledge, no study has specifically assessed whether the effects of early prescription refill on health outcomes vary by race or income groups.

These findings suggest that the efficacy of uniform and universal policies may not be uniform and that policy design and implementation may have actively contributed to the uneven distribution of the pandemic's impact. However, the majority of existing studies focus on a broad analysis of pandemic policy types and their effects on the human security of the overall population [38, 39]. The effects of COVID-19 policies on human security of diverse sub-segments of the entire population have remained un(der)explored. Therefore, this study addresses a critical scholarly gap by accounting for various systematic challenges when exploring the relationships between COVID-19 policy interventions and human security outcomes [40, 41].

Taking this *critical* human security perspective, which emphasizes the pervasive influence of underlying systemic factors [6, 38], this study examines the disproportionate impacts of state-level COVID-19 policies on structurally marginalized groups in the United States (US). A particular emphasis is placed on the moderating effects of the size of the racially economically marginalized populations on health outcomes in the 50 states in the US. The US provides a unique context for this study due to its diverse populations, ongoing systemic challenges, and its federal system, which led to a fragmented and inconsistent pandemic policy enforcement across states [39]. The

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variety of types and scales of policy enforcement across states, which were not always correlated with outbreak severity, provides a critical and data-rich environment for this study. Specifically, this study asks: To what extent do state government COVID-19 policy interventions protect human security, focusing on health outcomes as moderated by racially and economically marginalized populations in the US states? The findings of this study provide critical and practical insights into the design of equitable and effective public health policies in future crises.

Materials and Methods

Quasi-Experimental Design

This study employs a quasi-experimental design to examine associations between state-level policy interventions and health outcomes using non-randomized data [42]. Specifically, we use a difference-in-differences (DiD) estimation to compare changes in outcomes between states that did and did not implement specific COVID-19–related health policies before and after policy adoption [43, 44]. This design also allows estimation of whether these associations are moderated by the size of marginalized populations within states.

Unit of Analysis, Data Sources, and Structures

The unit of analysis is the U.S. state. Consistent with the health dimension of the human security framework proposed by the United Nations Development Programme (UNDP) (1994) [1], the analysis focuses on state-level health outcomes. The dataset was constructed from five primary sources: the Kaiser Family Foundation (KFF), the Medicaid and Children's Health Insurance Program (CHIP) Payment and Access Commission (MACPAC), Statista, the U.S. Census Bureau, and the Centers for Disease Control and Prevention (CDC).

Policy interventions were implemented in early 2020. Outcome and covariate data were observed in 2019 (pre-intervention) and 2021 (post-intervention), yielding a balanced panel of 50 states over two years (N=100 state-year observations). Table 1 provides detailed variable definitions, measurements, and data sources.

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Table 1. Variable Descriptions and Data Sources

Variable	Operationalization	Measurement & Data Source
Outcome Variable		
Human Security Outcomes	Health Outcomes	• Each state's rate of COVID deaths per 100,000 measured in 2019 and 2021 (January1- December 31). • Each state's rate of drug overdose deaths (excluding suicidal intention) per 100,000 in 2019 and 2021. Source: Centers for Disease Control and Prevention
Treatment Variable		
Policy Interventions	State-level Emergency Health Policies Implemented in Early 2020	• Binary data of 0 and 1, 1 to states that expanded access to telehealth service, 0 to states that did not. • Binary data of 0 and 1, 1 to states that required early prescription refills, 0 to states that did not. • Binary data of 0 and 1, 1 to states that enacted paid sick leave during, 0 to states that did not. • Sources: Kaiser Family Foundation, State COVID-19 Health Policy Actions
Moderating Variable		
Marginalized Populations	Racially Marginalized	• % of minority (non-white) population in each state in 2019 and 2021 • Sources: Kaiser Family Foundation, Population Distribution by Race/Ethnicity
	Economically Marginalized	• % of population whose pre-tax annual income falls below poverty line in each state in 2019 and 2021

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	• Source: Kaiser Family Foundation, Population Distribution by Race/Ethnicity
Control variables	
Unemployment	• % unemployed population in each state in 2019 and 2021 • Source: U.S. Census Bureau
Median Household Income	• State Median Income (per $10,000) in 2019 & 2021 • Source: Statista
State's Contribution to Medicaid Benefit	• Total state spending on Medicaid benefits (per $1,000,000) in 2019 & 2021 • Source: MACPAC, MACPAC reports

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Variables

Policy interventions (treatments). Three state-level emergency health policy interventions were examined: (1) expanded access to telehealth services (including both new access and expansion of existing coverage), (2) enactment of paid sick leave, and (3) early prescription refill requirement. Each policy was coded as a binary indicator equal to 1 if the policy was implemented (including temporary measures) in early 2020 (March-April, 2020) and 0 otherwise.

Health outcomes. Health outcomes were measured using cause-specific mortality rates (per 100,000 population), with higher mortality indicating lower human security. COVID-19 mortality was selected to capture acute health outcomes directly targeted by the policies. Drug overdose mortality was included as a chronic health outcome [45, 46] potentially affected by pandemic-related policy responses. Also, the choice of the chronic health outcome variable was supported by previous research documenting substantial increases in overdose mortality in the U.S. and links between infectious disease outbreaks and behavioral health risks [47]. Both outcomes were measured for 2019 and 2021.

Moderators: racially/economically marginalized populations. To assess heterogeneity consistent with a critical human security perspective, moderation was examined using the percentage of racial minority (non-White) populations and the percentage of the population below the federal poverty line, measured at the state level in 2019 and 2021.

Control variables. Models include time-varying controls for state unemployment rates, median household income, and Medicaid spending. Unemployment rates and median household income are well-documented social determinants of health affecting a wide range of health outcomes,

including mortality [48, 49]. Unemployment rates capture an abrupt, negative impact of COVID-19 on the labor market, which may contribute to cross-state variation in mortality rates [50, 51]. Medicaid spending is included to account for differences in state commitment to one of the largest public health insurance programs in the US, which is an important factor associated with various health outcomes [52, 53]. Data sources and measurement years for these variables are provided in Table 1. Table 2 reports descriptive statistics for all variables by outcome, treatment, moderation, and control status.

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Table 2. Descriptive Statistics

Variable		Obs.	Mean	S.D.	Min	Max
Outcome variable						
Health Outcomes	COVID death rate (per 100,000 state population)	100	49.7	55.30	0	158.8
	Drug overdose death rate (per 100,000 state population)	100	28.2	13.48	8.7	90.9
Treatment variable						
State-level Emergency Health Policies Implemented in Early 2020	Expanded access to telehealth services (count)	100	.76	.43	0	1
	Paid sick leave enactment (count)	100	.34	.43	0	1
	Early prescription refill requirement (count)	100	.24	.48	0	1
Moderating variable						
Marginalized Population	Racial minority (non-white) population (%)	100	32.7	15.81	6.8	80.4
	Population whose pre-tax annual income falls below poverty line (%)	100	11.37	3.08	3.7	19.60
Control variables						
Unemployment (%)		100	4.17	1.20	2.1	7.3
Median household income (per $10,000)		100	6.81	1.50	4.58	9.73
State's contribution to Medicaid benefit (per $1,000,000)		100	5.95	2.22	2.33	12.89

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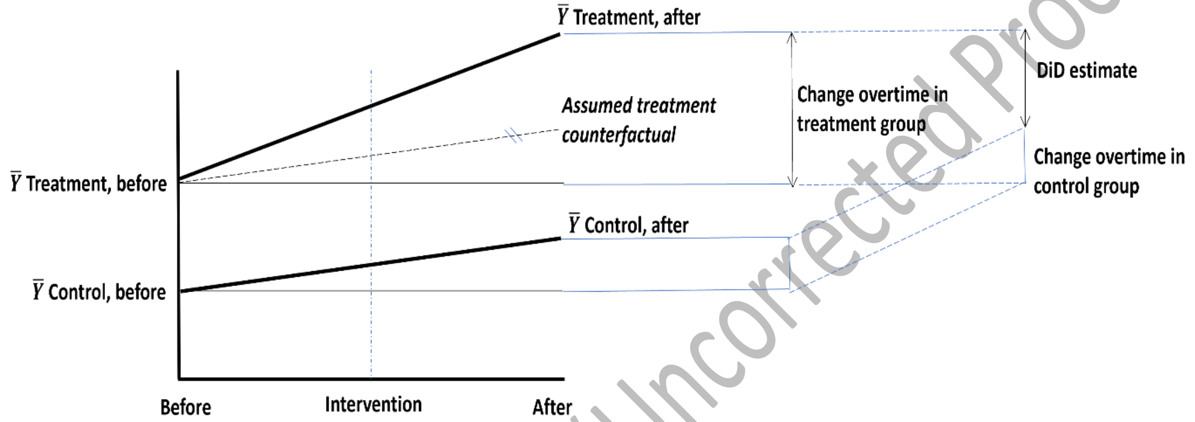
Statistical Methods: The difference-in-differences model

We estimated DiD models to examine associations between policy interventions and changes in health outcomes over time. As shown in Figure 1, the DiD approach compares outcome changes in states that implemented a given policy to contemporaneous changes in states that did not, before and after policy adoption, thereby accounting for common temporal shocks and time-invariant state characteristics [54, 56].

Figure 1. Difference-in-Differences Estimation



Source: Adapted from Fredriksson & Oliveira (2019)[11]

Model specification

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We estimated the DiD models with two-way state and year fixed effects, specified as:

$$HSO_{st} = \beta_1 X_{st} + \beta_2 (X_{st} \times M_{st}) + \beta_3 Z_{st} + \alpha_s + \lambda_t + \varepsilon_{st}$$

where HSO_{st} denotes health outcomes (COVID-19 deaths or drug overdose deaths) in state s and year t. X_{st} represents policy intervention indicators. β_1 captures average associations between policy intervention and health outcomes. A positive β_1 indicates negative association between policy intervention and health outcomes. M_{st} includes measures of racial minority share and poverty rate; β_2 captures heterogeneity in associations by marginalized population size. A positive β_2 indicates attenuation of policy associations in more marginalized contexts. Z_{st} includes time-varying covariates for socioeconomic conditions and health commitment. α_s and λ_t denote state and year fixed effects, respectively, and ε_{st} is an idiosyncratic error term. Standard errors are clustered at the state level.

Validity Checks and Power Considerations

For chronic health outcomes (drug overdose mortality), we assessed the parallel trends assumption using pre-intervention data from 2015–2019. Visual inspection and statistical tests indicated no significant differences in pre-treatment trends between treatment and control states (P>0.05).

Placebo tests were also statistically insignificant, suggesting no evidence of spurious treatment effects.

Parallel trends and placebo tests could not be conducted for COVID-19 mortality due to the absence of pre-2020 observations. Accordingly, estimates for COVID-19 outcomes are interpreted as associational rather than causal.

Given the limited sample size (50 states over two years), degrees of freedom are constrained, particularly in models with interaction terms. To assess statistical power, we conducted a simulation-based power analysis using 500 simulated datasets matching the observed panel structure, covariates, fixed effects, and clustered standard errors. The simulations indicate adequate power to detect moderate-to-large main policy associations but very low power (<1%) to detect interaction effects. Consequently, non-significant interaction estimates may reflect limited power rather than true null relationships, and we interpreted these estimates cautiously.

Results

Tables 3–5 report estimates from moderated DiD models with two-way state and year fixed effects, implemented in R (version 4.5.2; packages: *fixest*). The models estimate associations between three state-level emergency health policy interventions—telehealth access expansion (Table 3), paid sick leave enactment (Table 4), and early prescription refill requirement (Table 5)—and mortality outcomes in states with and without these policies adopted in early 2020. Columns COVID (1) & (2) present results for COVID-19 deaths, while columns DOD (1) & (2) report results for drug overdose deaths.

All models exhibit high overall fit (R^2>0.93). Within-state R^2 values indicate that covariates explain approximately 34–54% of within-state variation in COVID-19 mortality and 20–46% for drug overdose mortality over time. The inclusion of interaction terms substantially increases within-state explanatory power, suggesting that heterogeneity by poverty and racial composition accounts for a meaningful share of temporal variation in mortality outcomes. Standard errors are clustered at the state level to account for serial correlation, and identifying variation derives from within-state changes before and after the policy interventions.

Additionally, this study analyzed the marginal effects (Figures 2–4) derived from the fully interacted two-way fixed effects DiD models (R packages: *ggeffects, ggplot2*) to illustrate how the estimated associations between each policy intervention and mortality outcomes vary across levels of racial minority composition and poverty.

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Table 3. Expanded Access to Telehealth Services (ET) (Num Obs.=100)

	COVID (1)	**COVID (2)**	**DOD (1)**	**DOD (2)**
Economically Marginalized (EM) (%)	1.702 (4.007)	0.088 (3.034)	-1.379* (0.773)	-1.480* (0.761)
Racial Marginalized (RM) (%)	-3.609 (7.574)	1.375 (5.776)	-0.385 (1.632)	-0.029 (1.794)
Unemployment (%)	-14.365*** (5.142)	-10.374** (4.911)	-1.711 (1.366)	-0.470 (1.608)
Median Income (Per $10,000)	-27.654*** (7.852)	-10.754†† (6.432)	-3.906† (2.940)	-1.434 (3.554)
State Medicaid Benefit (Per $1M)	-1.556 (4.878)	-1.550 (3.989)	-0.102 (0.957)	0.106 (0.977)
DiD (ET)	**-15.037†** **(11.429)**	**-109.643***** **(18.969)**	**-2.601** **(2.204)**	**-18.797***** **(5.500)**
DiD (ET) × EM		**6.466***** **(1.379)**		**1.360***** **(0.455)**
DiD (ET) × RM		**0.230** **(0.357)**		**-0.052** **(0.075)**
R^2	0.939	0.957	0.939	0.951
R^2 Adj.	0.860	0.897	0.860	0.880
R^2 Within-State	0.343	0.540	0.200	0.351
AIC	919.5	888.0	637.3	620.5
BIC	1068.0	1041.7	785.8	774.2
RMSE	13.58	11.37	3.31	2.98
St. Errors	by: \`State\`			
FE: \`State Name\`	X			
FE: YEAR	X			

† P<0.2, †† P<0.15, * P<0.1, ** P<0.05, *** P<0.01

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Table 4. Enactment of Paid Sick Leave (PSL) (Num Obs.=100)

	COVID (1)	COVID (2)	DOD (1)	DOD (2)
Economically Marginalized (EM) (%)	1.621 (4.121)	0.696 (3.997)	-1.260†† (0.829)	-1.261†† (0.836)
Racial Marginalized (RM) (%)	-1.305 (7.758)	0.570 (7.309)	-0.905 (1.733)	-0.840 (1.801)
Unemployment (%)	-12.049* (6.834)	-9.562†† (6.047)	-2.546†† (1.604)	-2.283† (1.750)
Median Income (Per $10,000)	-29.538*** (6.939)	-25.259*** (6.771)	-5.001†† (3.195)	-5.462* (3.253)
State Medicaid Benefit (Per $1M)	-0.889 (4.227)	-12.393** (5.198)	-0.334 (0.889)	-0.187 (1.350)
DiD (ET)	**-18.598† (12.898)**	**-235.093*** (71.792)**	**2.610 (2.280)**	**-3.457 (18.119)**
DiD (ET) × EM		**14.837** (5.698)**		**1.305 (1.418)**
DiD (ET) × RM		**1.343*** (0.439)**		**-0.230* (0.117)**
R^2	0.940	0.950	0.939	0.942
R^2 Adj.	0.861	0.879	0.859	0.859
R^2 Within-State	0.349	0.460	0.196	0.234
AIC	918.7	903.9	637.9	637.1
BIC	1067.1	1057.6	786.4	790.8
RMSE	13.52	12.31	3.32	3.24
Std.Errors	by: `State`			
FE: `State Name`	X			
FE: YEAR	X			

† P<0.2, †† P<0.15, * P<0.1, ** P<0.05, *** P<0.01

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Expanded Access to Telehealth Services

Expanded access to telehealth services was negatively associated with COVID-19 mortality and drug overdose deaths. Across specifications, telehealth expansion was associated with approximately 110 fewer COVID-19 deaths per 100,000 population per state-year ($P<0.01$) and 19 fewer drug overdose deaths per 100,000 population ($P<0.01$). These associations were robust to state and year fixed effects.

Interaction terms indicate that the negative association between telehealth expansion and both outcomes was attenuated in higher-poverty states ($P<0.01$), while interactions with racial minority composition were not statistically significant ($P>0.20$).

Figure 2 illustrates heterogeneity in the marginal associations of expanded telehealth access across racial minority composition and poverty levels. For COVID-19 mortality, the marginal association of telehealth expansion becomes less negative—and shifts toward positive values—as racial minority share increases, particularly at higher poverty levels. This pattern indicates attenuation, and in some demographic contexts, reversal of the average negative association observed in the main DiD estimates. For drug overdose mortality, marginal effects vary more modestly across poverty strata, but similarly trend upward with increasing racial minority share, suggesting weaker protective associations in more racially diverse settings. Overall, telehealth expansion is associated with lower mortality on average, but these associations are substantially conditioned by demographic and socioeconomic context.

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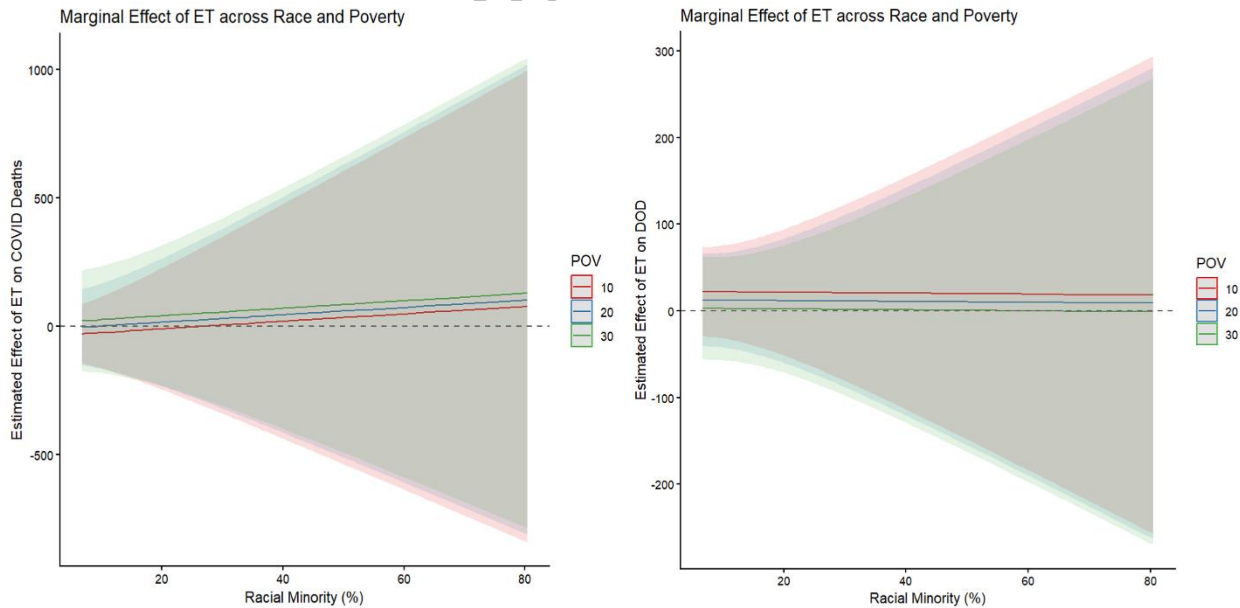
Figure 2. Marginal Effect Plots of Expanded Access to Telehealth Services across Racial Minority (%) and Poverty (%)



Paid Sick Leave Enactment

Paid sick leave enactment was negatively associated with COVID-19 mortality. Difference-in-differences estimates indicate associations ranging from approximately 235 fewer COVID-19 deaths per 100,000 population per state-year (P<0.01). In contrast, paid sick leave enactment was not consistently associated with drug overdose mortality, with estimates small and statistically insignificant across specifications (P>0.20).

Interaction terms show that associations with COVID-19 mortality were attenuated in higher-poverty states (P<0.05) and further weakened in states with larger racial minority populations (P<0.01). In contrast, the association with drug overdose mortality became significantly protective in states with larger racial minority populations (P<0.10), while the association is still insignificant in higher poverty states (P>0.20).

Figure 3 displays heterogeneity in the marginal associations of paid sick leave enactment across racial minority composition and poverty levels. For COVID-19 mortality, the marginal association of paid sick leave weakens as racial minority share increases and becomes closer to or above zero in more racially diverse states, particularly under higher poverty conditions. This pattern is consistent with the interaction terms indicating attenuation in disadvantaged contexts. For drug overdose mortality, although average DiD estimates are small and statistically imprecise, marginal effects show declining estimates with increasing racial minority share, suggesting that any potential associations are context-specific rather than uniform across states.

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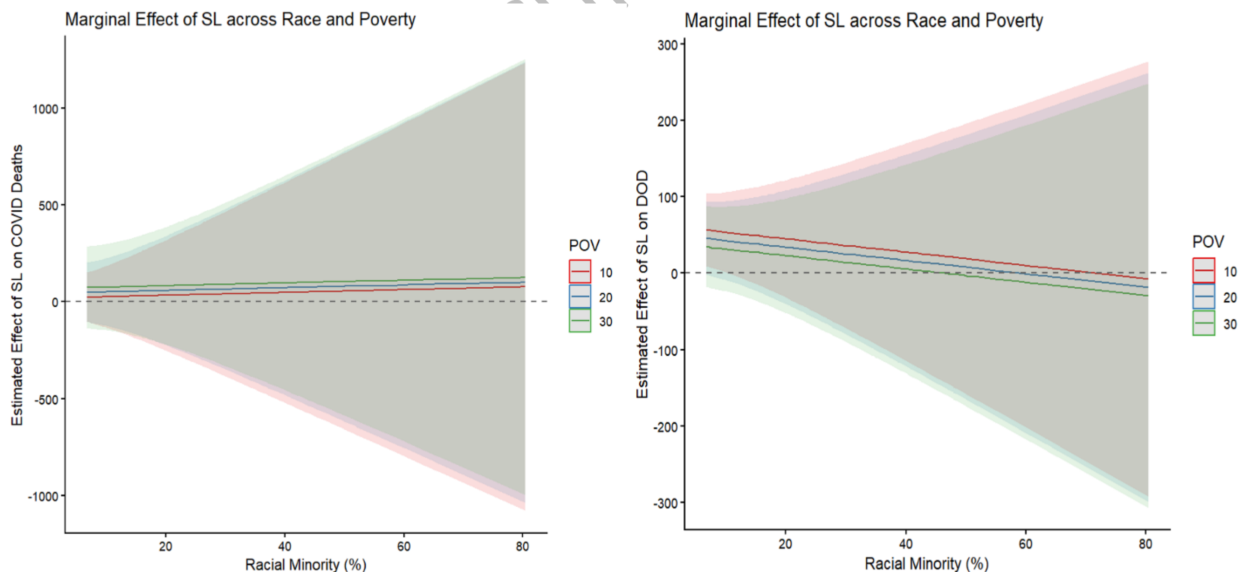
Figure 3. Marginal Effect Plots of Enactment of Paid Sick Leave across Racial Minority (%) and Poverty (%)



Early Prescription Refill Requirement

Early prescription refill requirement was negatively associated with COVID-19 mortality, with estimates ranging from approximately 75 fewer deaths per 100,000 population per state-year (P<0.01). These policies were also associated with lower drug overdose mortality, with estimated declines of 15 deaths per 100,000 population (P<0.01). Results were robust to fixed effects and clustered standard errors.

Interactions indicate that associations with both COVID-19 and drug overdose mortality were attenuated in higher-poverty states (P<0.01 to P<0.05), while associations with drug overdose mortality were stronger in states with larger racial minority populations (P<0.05 to P<0.10).

Figure 4 shows that for COVID-19 mortality, marginal associations are modestly positive at low racial minority shares and decline toward zero as racial minority composition increases, indicating that the average negative association observed in the DiD models is attenuated—and in some contexts offset—across demographic settings. For drug overdose mortality, marginal effects are slightly positive at lower poverty levels but decrease and approach or cross zero as poverty rises, with relatively limited variation across racial minority shares. These patterns suggest that associations between early refill policies and mortality outcomes vary by the intersection of race and poverty, rather than operating uniformly across states.

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Figure 4. Marginal Effect Plots of Requiring Early Prescription Refill across Racial Minority (%) and Poverty (%)

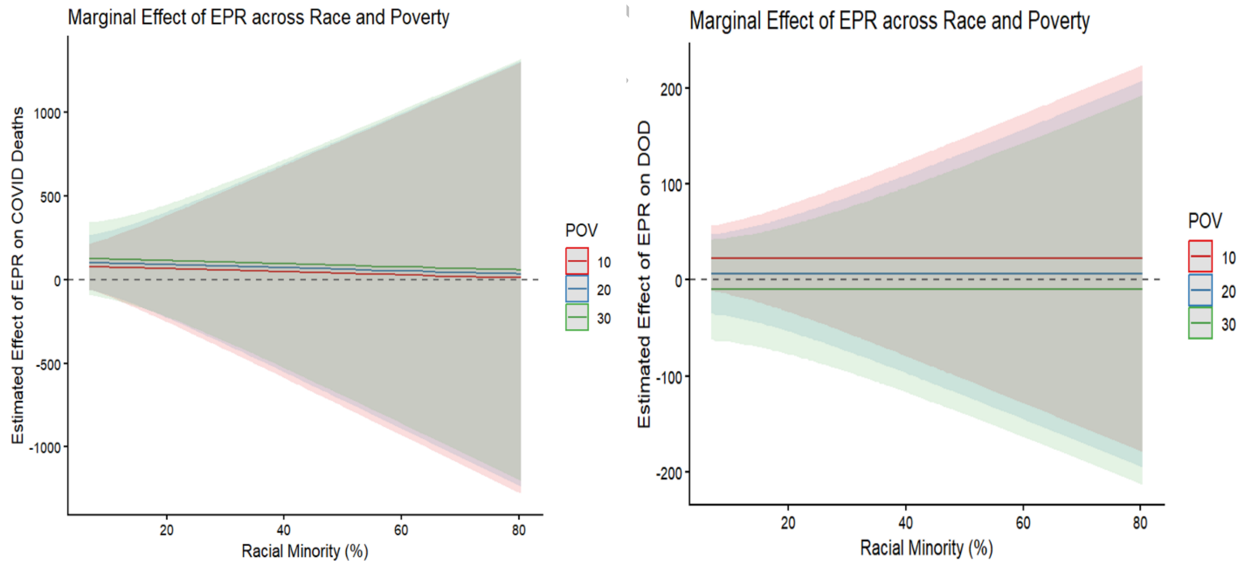

Table 5. Requiring Early Prescription Refill (EPR) (Num Obs.=100)

	COVID (1)	COVID (2)	DOD (1)	DOD (2)
Economically Marginalized (EM) (%)	2.274 (4.170)	1.581 (4.044)	-1.484* (0.796)	-1.973** (0.745)
Racial Marginalized (RM) (%)	-3.911 (7.922)	-0.959 (8.103)	-0.728 (1.385)	0.032 (1.257)
Unemployment (%)	-15.788*** (5.541)	-13.465** (6.097)	2.141†† (1.393)	-0.498 (0.957)
Median Income (Per $10,000)	-33.258*** (7.986)	-28.127*** (8.526)	-3.739 (2.969)	-1.788 (2.046)
State Medicaid Benefit (Per $1M)	-2.389 (4.873)	-2.246 (4.972)	0.106 (0.976)	0.031 (0.836)
DiD (ET)	**-5.309 (8.802)**	**-74.475*** (24.749)**	**3.845* (2.180)**	**-14.614*** (4.897)**
DiD (ET) × EM		**4.748** (1.827)**		**1.984*** (0.369)**
DiD (ET) × RM		**0.279 (0.221)**		**-0.190** (0.091)**
R^2	0.937	0.942	0.942	0.959
R^2 Adj.	0.854	0.859	0.866	0.901
R^2 Within-State	0.316	0.372	0.235	0.462
AIC	923.5	919.1	632.9	601.6
BIC	1072	1072.8	781.4	755.3
RMSE	13.86	13.28	3.24	2.72
Std.Errors	by: \`State\`			
FE: \`State Name\`	X			
FE: YEAR	X			

† P<0.2, †† P<0.15, * P<0.1, ** P<0.05, *** P<0.01

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Discussion

This study examines associations between three state-level emergency health policies—expanded telehealth access, paid sick leave enactment, and early prescription refill requirements—and acute and chronic mortality during the COVID-19 pandemic. Across specifications, all three policies were associated with lower COVID-19 mortality, and telehealth expansion and early prescription refill requirements were also associated with lower drug overdose mortality. These associations, however, were not uniform across demographic and socioeconomic contexts. Both the magnitude and direction of estimates varied systematically by racial composition and poverty, underscoring the need to interpret average effects within their demographic and socioeconomic context. In general, associations were attenuated in higher-poverty states and, for some policies, shifted across levels of racial minority composition.

For telehealth, the average association with COVID-19 mortality was negative, but marginal estimates weakened as poverty increased and moved toward null or positive values in more racially diverse states. For drug overdose mortality, more negative associations emerged in states with higher racial minority shares, particularly at elevated poverty levels, suggesting that benefits were concentrated in specific contexts rather than uniformly distributed. These heterogeneous patterns likely reflect persistent disparities in health insurance coverage and digital access. Racially and economically marginalized populations are less likely to have stable insurance coverage and reliable broadband access, both of which are prerequisites for effective telehealth use [10, 57, 58]. Thus, although telehealth expansion may have increased service availability during the pandemic, it appears to have disproportionately benefited populations already positioned to access digital health resources. This interpretation aligns with evidence that the pandemic both introduced new barriers to care and intensified pre-existing inequities in healthcare access [10, 59].

Paid sick leave enactment was associated with sizable reductions in COVID-19 mortality, but these associations diminished in higher-poverty and more racially diverse states. Such patterns are consistent with labor market stratification and policy design features that limited effective access. Racial minority workers are disproportionately represented in frontline and essential occupations with minimum wages [10], where access to paid leave is often constrained. Moreover, exemptions for large employers during the pandemic reduced coverage among many frontline workers [60]. No consistent association was observed with drug overdose mortality, suggesting that paid sick leave is more closely linked to short-term infection control mechanisms than to longer-term behavioral health outcomes.

Early prescription refill requirements also exhibited contextual variation. Although associated on average with lower COVID-19 and overdose mortality, marginal associations differed across race and poverty, particularly for overdose deaths. Administrative and access-related barriers may partially explain these patterns. Early refill policies were not automatic; individuals had to have medical or prescription insurance prior to the service, contact providers, obtain authorization, navigate insurance requirements, and coordinate with pharmacies. Marginalized populations, therefore, may have been less able to secure early refills. Reduced exposure to extended medication supplies could, in turn, have limited risks of misuse in some contexts. At the same time, the contrasting patterns across poverty levels suggest that expanded prescription duration, if not accompanied by appropriate monitoring and safeguards, may carry unintended risks [10].

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Overall, the findings reinforce evidence that emergency public health policies can generate uneven associations across populations when underlying structural disparities are not explicitly addressed [61-62]. Consistent with a critical human security framework and the principle of targeted universalism, these results highlight the importance of designing and implementing policies that account for differential access, capacity, and need in order to promote more equitable health outcomes [59, 63-65].

Limitations and Future Directions

This study has several limitations. First, the analysis relies on non-randomized, state-level data with two primary observation periods (2019 and 2021), limiting statistical power and precluding formal tests of pre-treatment trends. Because the design does not permit assessment of parallel trends—particularly for COVID-19 mortality—findings for both COVID-19 and drug overdose mortality were interpreted as associational rather than causal. Although estimates are consistent across specifications and robust to state and year fixed effects, alternative explanations remain possible. Future research using longer time horizons and additional pre- and post-policy periods would allow more rigorous evaluation of dynamic effects and the identification of assumptions.

Second, residual confounding may persist due to unobserved cross-state differences, including variation in epidemic timing, testing and reporting practices, baseline health infrastructure, health system capacity, and population health profiles. More granular data on policy implementation intensity, healthcare access, and behavioral responses could help clarify underlying mechanisms.

Third, the study focuses on health outcomes, while human security encompasses broader dimensions, including labor, digital, food, and environmental security. Future research could examine how these domains interact to shape policy effectiveness during large-scale crises.

Finally, because the analysis is limited to the United States, future studies should assess the generalizability of these findings in comparative or international contexts with different institutional arrangements and social protection systems.

Conclusion

Using a critical human security framework, this study examines associations between state-level COVID-19 policy interventions and mortality outcomes, with attention to socioeconomic and racial heterogeneity. Expanded telehealth access, paid sick leave enactment, and early prescription refill requirement were associated with lower COVID-19 mortality, while telehealth and early prescription refill policies were also associated with lower drug overdose mortality. However, these associations were not uniform, with benefits attenuated in higher-poverty states and varying across racial minority composition.

Given data limitations and the observational design, findings were interpreted cautiously as associational rather than causal. Nonetheless, the results suggest that structural inequalities condition how policies align with human security outcomes. Taken together, this study underscores the importance of context-sensitive policy design as well as the need for future research using richer data to clarify mechanisms and inform more equitable responses to public health crises.

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Data Availability Statement

Data will be made available upon reasonable request.

Ethics approval

Ethics approval is not required because the primary data were collected from open sources and public documents, which did not involve any human subjects.

Competing interests

All authors declare that they have no conflicts of interest.

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Table 6. Abbreviations

Full Name	Abbreviation
Centers for Disease Control and Prevention	CDC
Children's Health Insurance Program	CHIP
Difference-in-Differences	DiD
Drug Overdose Death	DOD
Kaiser Family Foundation	KFF
Medicaid and CHIP Payment and Access Commission	MACPAC
United Nations Development Programme	UNDP

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