

# Universal background checks for handgun purchases can reduce homicide rates of African Americans

Elinore J. Kaufman, MD, MSHP, Christopher N. Morrison, PhD, Erik J. Olson, MD, David K. Humphreys, PhD, Douglas J. Wiebe, PhD, Niels D. Martin, MD, Carrie A. Sims, MD, PhD, Mark H. Hoofnagle, MD, PhD, C. William Schwab, MD, Patrick M. Reilly, MD, and Mark J. Seamon, MD, Philadelphia, Pennsylvania

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<b>BACKGROUND:</b>	Federal law requires background checks for firearms purchased from licensed dealers, but states can extend requirements to private sales of handguns and purchases at gun shows (universal background checks for handguns [UBC-HG]). Although firearm homicide disproportionately affects African Americans, little is known about how UBC-HG impacts African Americans. We hypothesized that implementation of UBC-HG would reduce rates of firearm homicide of African Americans.
<b>METHODS:</b>	We collected Centers for Disease Control firearm homicide counts for African American and white populations in the 50 states, 1999 to 2017. Laws were drawn from the State Firearm Laws Database. The exposure and outcome of interest were UBC-HG adoption and firearm homicide. We included non-Hispanic African American and non-Hispanic white populations. We used Poisson regression to perform a differences-in-differences analysis. A categorical variable for state accounted for time-stable state characteristics. We controlled for year to account for trends over time unrelated to policy. We controlled for state-specific, time-variable factors, including median household income, population younger than 25 years or 65 years or older, alcohol consumption, and count of firearm laws (UBC-HG excluded). Standard errors were adjusted for clustering at the state level.
<b>RESULTS:</b>	The firearm homicide rate among whites was 1.8 per 100,000 (interquartile range, 1.2–2.7) ranging from 1.4 in 2011 to 1.8 in 2016. The firearm homicide rate was 15.6 per 100,000 (interquartile range, 11.6–21.0) among African Americans, ranging from 14.0 in 2009 to 19.6 in 2017. While no significant difference in firearm homicides among whites (incidence rate ratio, 0.93; 95% confidence interval, 0.73–1.20) was appreciated, the passage of UBC-HG was associated with an 19% decrease in African Americans firearm homicides (incidence rate ratio, 0.81; 95% confidence interval, 0.70–0.94; $p = 0.006$ ).
<b>CONCLUSION:</b>	Implementing UBC-HG was associated with decreased firearm homicides among African Americans—the population most at risk. Expanding UBC-HG may be an effective approach to reducing racial disparities in firearm homicides. ( <i>J Trauma Acute Care Surg.</i> 2020;88: 825–831. Copyright © 2020 Wolters Kluwer Health, Inc. All rights reserved.)
<b>LEVEL OF EVIDENCE:</b>	Epidemiological, level III.
<b>KEY WORDS:</b>	Firearm homicide; injury prevention; health policy; background checks; guns.

There were 14,542 firearm homicides in 2017, and firearm injury is increasingly recognized as a public health crisis in the United States.<sup>1</sup> Leading professional organizations have spoken out in support of data-driven, consensus-based policies to reduce firearm violence.<sup>2–5</sup> Impact is not spread equally among the population; however, and African American populations experience high rates of firearm injury and homicide.<sup>6</sup> In 2017, African American boys and men aged 15 years to 34 years had the highest rate of firearm homicide of any demographic group in the United States, with 81 deaths per 100,000 population compared with 2.4 deaths per 100,000 in white boys and men of the same ages.<sup>7</sup> It is crucial to assess the impact of firearm policy on this key, vulnerable population. While stricter overall firearm policies have been associated with lower firearm homicide rates in several studies,<sup>6,8</sup> this benefit may not apply to African Americans.<sup>9,10</sup>

One appealing approach to reducing firearm violence involves preventing individuals with criminal convictions from

accessing firearms. Since 1993, the Brady Act has required federally licensed firearm dealers to conduct background checks of prospective firearm purchasers to prevent individuals with felony convictions or certain domestic violence misdemeanor convictions from purchasing firearms.<sup>11</sup> Background check results are usually instant, and there have been more than 3 million denials.<sup>12,13</sup> Several states have extended federal background check requirements to include sales of handguns conducted privately and at gun shows (universal background checks for handguns [UBC-HG]). Between 1999 and 2017, 19 states had laws requiring background checks for all handgun purchases, including private sales.<sup>14</sup> Evidence on the impact of these expanded laws has been mixed and limited to studies focused on a single state. For example, Missouri's 2007 UBC-HG repeal was associated with a 25% increase in firearm homicides,<sup>15</sup> while earlier repeals in Tennessee and Indiana in 1998 were not associated with increased mortality.<sup>16</sup> More recently, Connecticut saw a 40% decrease in firearm homicides after instituting universal background checks.<sup>17</sup> In a national study of multiple firearm law types, Knopov et al.<sup>18</sup> found that UBC laws were associated with lower overall firearm homicides. Although not conclusive, these data suggest that universal background laws reduce homicide rates at the state level. However, it is unknown whether these benefits are equally distributed among at-risk populations. In this study, we evaluate the impact of universal background checks for handgun purchasers on firearm deaths among African American and white populations. We hypothesized that UBC-HG implementation would be associated with a reduction in homicides among African American populations.

## METHODS

### Data Sources and Population

We computed firearm homicide counts for non-Hispanic African American and non-Hispanic white populations of each of the 50 states for 1999 to 2017. These data were derived from

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From the Division of Traumatology, Surgical Critical Care, and Emergency Surgery (E.J.K., N.D.M., C.A.S., C.W.S., P.M.R., M.J.S.), University of Pennsylvania, Philadelphia, Pennsylvania; Mailman School of Public Health (C.N.M.), Columbia University, New York, New York; Department of Epidemiology and Preventive Medicine, Monash University (C.N.M.), Melbourne, Australia; Naval Medical Center San Diego (E.J.O.), San Diego, California; Department of Social Policy and Intervention, Oxford University (D.K.H.), Oxford, United Kingdom; Department of Biostatistics and Epidemiology (D.J.W.), University of Pennsylvania, Philadelphia, Pennsylvania; Division of Acute and Critical Care Surgery, Washington University in St. Louis (M.H.H.), St. Louis, Missouri.

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Address for reprints: Elinore J. Kaufman, MD, MSHP, Division of Traumatology and Surgical Critical Care, University of Pennsylvania, Medical Office Building, Penn Presbyterian Medical Center, Suite 120, 51 North 39th St, Philadelphia, PA 19104; email: [elinore.kaufman@penntmedicine.upenn.edu](mailto:elinore.kaufman@penntmedicine.upenn.edu).

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the Centers for Disease Control Wide-ranging Online Data for Epidemiologic Research (CDC WONDER). Other races and ethnicities were excluded from this analysis.<sup>7</sup> The CDC suppresses death counts of fewer than 10. Of 950 total state-years, 134 had suppressed counts for whites and 288 had suppressed counts for African Americans, and these state-year-race combinations were excluded from the primary analysis. We performed several sensitivity analyses. First, we estimated a state-race-specific value. To do this, we calculated the total deaths in that state-race combination over the 19-year study period, subtracted the total nonsuppressed deaths, and divided the remainder by the number of years with suppressed data. For state-race combinations where the count was suppressed for the total study period, we assumed that the total death count was 9 (the maximum suppressible count) and divided this by 19 years, yielding an average annual death count of 0.5. These estimates accounted for only 0.5% of total firearm homicide deaths overall. Second, we set all suppressed counts to 0, and third, we set these counts to 9. We did not analyze Asian, Hispanic, or other racial and ethnic populations because there were not enough firearm deaths to generate stable death counts for analysis in an adequate number of states. The Boston University State Firearms Laws database provided detailed, annual information on state firearm laws.<sup>14</sup>

## Exposures and Outcomes

The exposure of interest was implementation of a law requiring background checks to be performed for all handgun purchases (UBC-HG), including gun shows and private sales. States may implement this requirement in two ways. Eleven states require point-of-sale background checks for all purchases. Nine states issue permits for purchase and require the background checks to be performed during the permitting process (see Fig. 1). We did not consider background check requirements for long gun purchases, because the vast majority of homicides involve handguns.<sup>19–21</sup> The primary outcome was counts of

firearm homicide. Population denominators included in CDC WONDER are drawn from the U.S. Census, 1999 to 2017.

## Analysis

We estimated the effect of UBC-HG on firearm homicide using a difference-in-differences (DID) analysis. The DID analysis is a quasiexperimental design that combines the advantages of a pre-post analysis with the advantages of a between-state comparison. The aim of this analysis is to conduct two comparisons simultaneously. The first is a pre-post comparison for every state that enacted the policy. With this approach, we compared firearm homicide in each state that adopted UBC-HG before and after the policy change, allowing each state to serve as its own control. The second compares these states to the other states that did not change their policy. This helps prevent changes that were occurring in national homicide rates from being falsely attributed to the policy. States are very different from one another in ways that may impact both their likelihood of passing the law and their homicide rates. Many of these differences would be very hard to measure. Therefore, rather than attempting to control for every demographic or cultural variable that makes each state unique, we simply include each state separately in the analysis, which is termed state fixed effects. Likewise, homicide rates have fluctuated over time nationally. We, therefore, also control for each year of measurement. Because these national trends may not be linear, we include each year as a categorical rather than a continuous variable.

We used Poisson regression to analyze homicide counts using state population as the model offset. We included a categorical variable for each of the 50 states. These state fixed effects accounted for any characteristics of a given state that were stable over time. A categorical variable for year accounted for trends over time. By using states without policy change as an additional control, we simultaneously controlled for national trends in homicide rates over the period, subtracting the change that

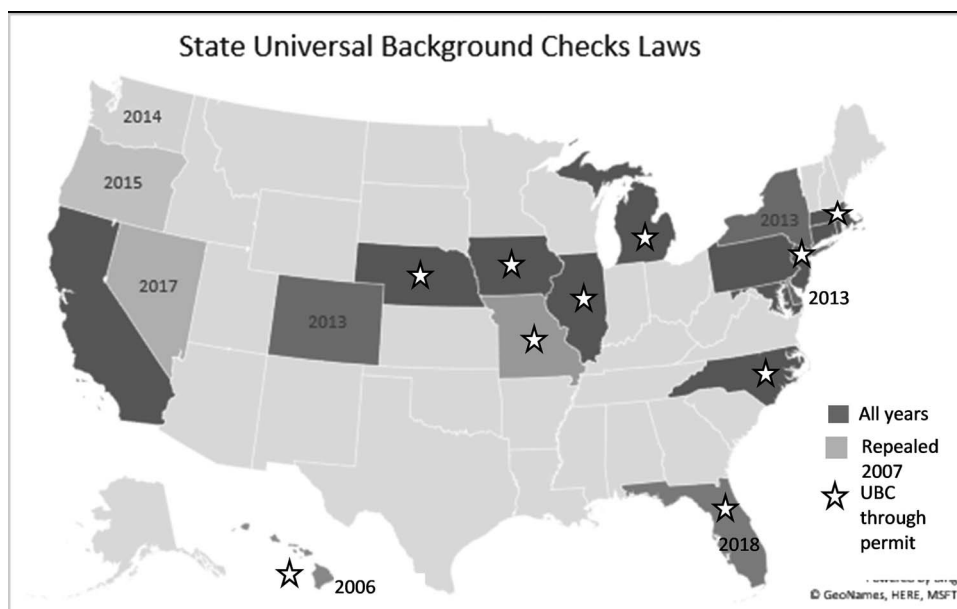


Figure 1. Map of states with universal background check laws.

occurred in states without the policy from the change we observed in states that implemented UBC-HG.<sup>22–24</sup> This analysis yields estimates in the form of incidence rate ratios (IRR). Incidence rate ratio is analogous to an odds ratio derived from logistic regression. This study compares counts of deaths in states, and each death count must be controlled for population. The incidence rate is the number of deaths divided by the population. The incidence rate ratio is the ratio of the incidence rate in the presence of a given exposure to the incidence rate in the absence of that exposure.

We further controlled for factors commonly associated with firearm violence that might vary over the study period within a given state: median household income, population younger than 25 years or 65 years or older, per capita alcohol consumption,<sup>25</sup> and total count of firearm laws (UBC excluded) from the State Firearm Laws database.<sup>14</sup> Standard errors were adjusted for clustering at the state level.<sup>26</sup> We also stratified the analysis by victim sex. We used model-predicted events multiplied by the population exposed to calculate potential lives saved.

## Specification Testing

To ensure the validity of our results, we performed several specification tests common to DID analysis.<sup>26</sup> We tested the trend in firearm homicide prior to policy adoption to the trend over the same period in states that did not adopt the policy. To assess whether the comparison between groups of states was valid, we tested whether trends in homicide rates were parallel in the preintervention period by testing the significance of an interaction term between time trend and group.<sup>27</sup> For this step, we compared UBC-HG states to never-adopting states from 1999 to 2005, before the first new UBC-HG law was implemented. We conducted this analysis with and without including states that had the law throughout the study period.

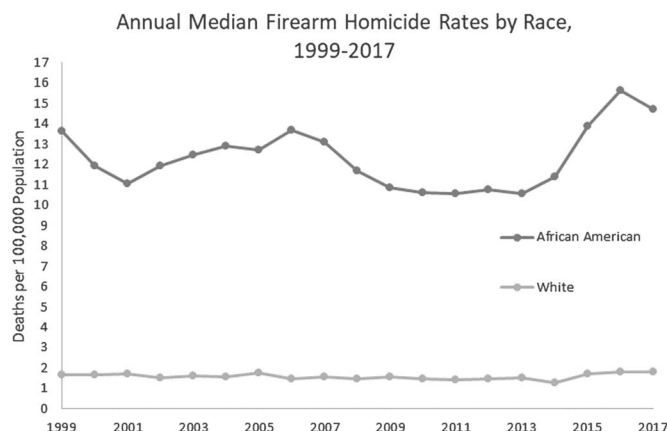
A law may not take maximum effect immediately after passage. Therefore, to account for dissemination and enforcement time, we also analyzed the data using a 1- and 2-year time lag after policy adoption. We also performed a “placebo test” for the policy<sup>28</sup> by assessing the impact of UBC-HG on homicides not involving firearms, an outcome that we did not expect to be associated with this policy.

The primary analysis included all 50 states, but because Missouri was the only state that repealed a UBC-HG policy during the study period, we conducted a sensitivity analysis excluding this state. Further sensitivity analyses excluded states that had the UBC-HG policy in place throughout the entire study period (implemented before 1999).

We used Stata for all analyses (version 14.0; StataCorp, College Station, TX).

## RESULTS

The median firearm homicide rate among African Americans was 15.6 per 100,000 population per year (interquartile range [IQR], 11.6–21.0 with a low of 14.0 in 2009 and a high of 19.6 in 2017). Among whites, the rate was 1.8 per 100,000 (IQR, 1.2–2.7) with a low of 1.4 in 2011 and a high of 1.8 in 2016 (Fig. 2). A figure showing firearm homicide rates by



**Figure 2.** Annual median firearm homicide rates by race, 1999 to 2017.

UBC-HG status is included in the Supplemental Digital Content, Figure 1, <http://links.lww.com/TA/B623>.

In the DID analysis, passage of UBC-HG was associated with a 19% decrease in firearm homicide of African Americans (IRR, 0.81; 95% confidence interval [CI], 0.70–0.94;  $p = 0.006$ ). There was no association between UBC-HG and firearm homicide of whites (IRR, 0.93; 95% CI, 0.73–1.20;  $p = 0.599$ ). The total count of firearm laws was associated with a small decrease in homicide of African Americans (IRR for a 10-law increase, 0.91; 95% CI, 0.85–0.97;  $p = 0.003$ ), but increased firearm laws did not impact the homicide rate of whites. There was substantial variation among states with IRR ranging from 0.48 to 2.58 for African Americans and 0.16 to 1.32 for whites. Full results for the main analysis are shown in Table 1, and results of models in which we stratified by sex are shown in Table 2, demonstrating that the findings were consistent for both males and females. We calculated that the National UBC-HG application could have saved 29,297 (95% CI, 7536–45,057) lives in the states that lacked this provision during the study period.

## Tests of Specification

There was no significant difference pre-2006 trends in firearm homicide for states that later did and did not adopt UBC-HG, confirming that these groups of states are appropriately comparable. Tests of a time lag yielded similar results for 0 year, 1 year, and 2 years after policy adoption. No lag is included in the main results for the sake of simplicity. The main analysis excluded state-race-year combinations with suppressed death counts. Sensitivity analyses for missing data yielded nearly identical results.

Firearms accounted for the majority of homicides among both whites and African Americans. Among whites, there were 1.3 (IQR, 1.0–1.6) nonfirearm homicides per 100,000 population per year. Implementation of UBC-HG was associated with a decrease in nonfirearm homicides among whites (odds ratio, 0.93; 95% CI, 0.88–0.97). There were 4.2 (IQR, 3.5–5.2) nonfirearm homicides per 100,000 per year among African Americans. We found no association of UBC-HG with nonfirearm homicides among African Americans. Findings were similar when



**TABLE 1.** Regression Model Results for Homicide of African Americans and Whites, 1999–2017

	Homicide of African Americans			Homicide of Whites		
	IRR	95% CI	<i>p</i>	IRR	95% CI	<i>p</i>
Universal background checks for handguns	0.81	0.70–0.94	0.006	0.93	0.73–1.20	0.599
% of population age <25 y	1.06	0.95–1.18	0.317	1.07	0.97–1.18	0.180
% of population age ≥65 y	0.97	0.86–1.08	0.553	0.95	0.85–1.07	0.403
Median household income (per US \$10,000)	1.00	0.91–1.10	0.994	1.04	0.93–1.18	0.485
Alcohol consumption per capita (gallons)	0.95	0.66–1.35	0.762	1.31	0.87–1.98	0.196
Other firearm laws (for each 10 laws)	0.91	0.85–0.97	0.003	0.96	0.90–1.02	0.191
Year						
1999	Reference			Reference		
2000	1.04	0.96–1.13	0.307	0.98	0.93–1.04	0.475
2001	1.06	0.97–1.16	0.197	1.05	1.01–1.10	0.029
2002	1.12	0.98–1.28	0.085	1.05	0.96–1.15	0.244
2003	1.14	1.00–1.31	0.048	1.05	0.95–1.16	0.313
2004	1.11	0.93–1.31	0.242	1.04	0.93–1.16	0.497
2005	1.20	1.01–1.42	0.042	1.07	0.93–1.23	0.329
2006	1.29	1.08–1.53	0.004	1.07	0.93–1.24	0.317
2007	1.25	1.05–1.48	0.012	1.09	0.95–1.25	0.219
2008	1.19	1.00–1.41	0.056	1.09	0.97–1.24	0.156
2009	1.13	0.93–1.37	0.206	1.05	0.97–1.24	0.448
2010	1.13	0.93–1.38	0.241	1.01	0.87–1.17	0.904
2011	1.15	0.91–1.44	0.243	1.02	0.84–1.24	0.843
2012	1.25	0.98–1.60	0.075	1.06	0.86–1.31	0.561
2013	1.27	0.97–1.67	0.083	1.06	0.85–1.33	0.616
2014	1.27	0.95–1.68	0.102	1.07	0.85–1.34	0.564
2015	1.55	1.14–2.10	0.005	1.26	0.97–1.64	0.089
2016	1.76	1.26–2.45	0.001	1.43	1.06–1.92	0.018
2017	1.82	1.28–2.59	0.001	1.50	1.08–2.08	0.016
State fixed effects: range for included states	0.48–2.58			0.16–1.32		

Missouri was excluded and when states with pre-1999 UBC-HG laws were excluded.

## DISCUSSION

State implementation of a universal background check requirement for all handgun purchases, including private sales and gun shows, was associated with a 19% decrease in the incidence of firearm homicide of African Americans. To our knowledge, this is the first national evaluation of the impact of implementation of new background check requirements on homicide stratified by race. These findings are particularly important as firearm legislation has not always proven protective for African

Americans.<sup>9</sup> and firearm homicides rates are nearly eight times higher among African Americans than whites.<sup>9</sup> This disparity is multifactorial and is rooted in a legacy of structural racism, poverty, and disadvantage.<sup>29,30</sup> Many UBC-HG laws were passed during years in which homicide rates were increasing across the country, and rates continued to rise in some of these states. However, the DID analysis reveals that this trend was tempered in states that passed UBC-HG laws.

Although federal law has required federally licensed firearm dealers to conduct criminal background checks on all purchasers since the Brady Act of 1993, this Act has been criticized as a failure because it did not lead to a reduction in firearm homicide.<sup>31</sup> However, the Brady Act is not a universal

**TABLE 2.** Association of Implementation of Universal Background Checks for Handguns With Homicide by Race and Sex

	Firearm Homicides Per 100,000, Median (IQR)	IRR for UBC-HG, (95% CI)
African American male	28.5 (21.5–39.1)	0.82 (0.70–0.95)
African American female	3.3 (2.7–4.6)	0.79 (0.71–0.87)
African American, total	15.6 (11.6–21.0)	0.81 (0.70–0.94)
White male	2.7 (1.8–4.2)	0.94 (0.71–1.24)
White female	1.1 (0.8–1.4)	0.92 (0.77–1.09)
White, total	1.8 (1.2–2.7)	0.93 (0.73–1.20)

mandate and up to 40% of firearms are purchased at gun shows or through private sales and may bypass this requirement.<sup>32</sup> In fact, in a 2015 survey, 50% of firearm owners who had purchased a firearm within the previous year via private sale did so without undergoing a background check.<sup>33</sup> Importantly, as many as 10% of such private purchasers would have failed a background check if they had attempted to purchase through a licensed dealer.<sup>34</sup> Similarly, in a survey of people convicted of firearm offenses, 96% had previous convictions that would have prevented them from legally obtaining a firearm, yet they obtained their firearm without a background check. These dynamics may explain why Ludwig and Cook<sup>31</sup> determined that the implementation of the Brady Act was not associated with a reduction in firearm homicide.

Nearly 90% of Americans support implementing universal background checks, regardless of political affiliation or gun ownership.<sup>35,36</sup> The impact of UBC-HG on firearm homicides has been mixed in single-state studies, perhaps due to small sample size or variable impacts across states. Only one of three states included in a 2018 study saw increased background checks with the implementation of a universal background check requirement, perhaps because the requirement itself deters individuals who expect to be rejected from attempting to purchase a firearm.<sup>13,37</sup> Implementation of a universal background check requirement was associated with decreased firearm homicides in Connecticut,<sup>17</sup> while repeal of the same requirement in Missouri was associated with a 25% increase in firearm homicides.<sup>15</sup> These studies have not examined the impact of UBC-HG on African Americans specifically, and our findings suggest that expanding this policy across the United States could prevent deaths and reduce racial disparities in firearm homicide. Importantly, we found no corresponding increase in nonfirearm homicide, indicating that would-be assailants did not resort to alternative means when guns were unavailable. We did identify a significant decrease in nonfirearm homicides of whites. This may be related unmeasured confounding, misspecification of means of death, or to a general decrease in violence associated with UBC-HG laws. Reducing the use of firearms cannot eliminate violence. However, because firearms are a particularly lethal means of violence, reducing their use gives trauma clinicians the opportunity to save lives, providing our patients, our communities, and our policy makers a second chance.

## Limitations

Our study has several limitations. Our ability to assess causality with this retrospective study is limited. We only included fatal injuries, which represent a minority of firearm injuries. There is no comprehensive data source for nonfatal firearm injuries in the United States, and the effect of UBC-HG on nonfatal injuries is unknown. We included only white and black or African American populations because too few states have stable death counts in any other racial/ethnic group for this analytic approach. We cannot assess the impact of this law on other groups. Future studies that focus on states with large populations in any particular racial and ethnic group would do well to attend to the impact of policy changes on these groups. Because homicide rates of whites were so much lower than homicide rates of African Americans, we may have failed to detect a significant effect in whites due to Type II error. Knopov et al.<sup>18</sup> used slightly

different methods and identified a significant decrease in overall firearm homicides. Although the state fixed effects model accounts for time-invariant state characteristics, there may be unmeasured, shared features of these states that confound our findings. State-level implementation, enforcement, and culture vary in ways that this study cannot capture, as does the impact on homicides. The effect we identify here may not be replicated in other states that differ in measured and unmeasured ways. Comparison states may be more different from UBC-HG states than we can capture here. Regression to the mean may account for decreases in some areas, but we would expect this to affect states with and without the policy change approximately equally. Moreover, important variation exists within each state, and dynamics affecting homicide may well be local. This analysis assesses only state-level exposures and outcomes and may obscure larger, smaller, or opposite effects at the local level. Further research is needed to identify the optimal combination of firearm laws and enforcement strategies to reduce firearm violence and death. We focused on UBC-HG because handguns are involved in the vast majority of firearm homicides. The UBC laws for long guns may have an additional effect on homicides and mass shootings that we did not assess here. Lastly, prior research has shown that laws in one state have a small, but significant, impact on outcomes in other states, as firearms can cross state lines.<sup>8,10</sup> We did not directly account for these dynamics here, which may have biased our results.

## CONCLUSION

Implementing a universal background check requirement for all handgun purchases was associated with decreased firearm homicides among African Americans—the population most at risk. Our results suggest that expanding the federal background check policy to include all gun shows and private sales may be an effective approach to reducing firearm homicide of African Americans.

## AUTHORSHIP

E.K. and M.S. conceived and designed the study. E.K. collected and analyzed the data. E.K. and M.S. drafted the article. All authors contributed critical review of the article.

## DISCLOSURE

The authors declare no funding or conflicts of interest.

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