Sociodemographic disparities in energy insecurity among low-income households before and during the COVID-19 pandemic

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Abstract: Energy insecurity is a growing public health threat among low-income populations in the United States. Prior research has shown that energy insecurity is associated with adverse health effects and can lead people to engage in risky coping strategies. Here, we evaluate rates of energy insecurity, which factors contribute to it, and how the early months of the COVID-19 pandemic has exacerbated the problem. We show that energy insecurity is highly prevalent among households at or below 200 percent of the federal poverty line. We further show that Black and Hispanic households are more likely to experience energy insecurity and face utility disconnection, as are households with young children, individuals that require electronic medical devices, and those in dwellings with inefficient or poor conditions. These conditions exist under normal circumstances, and the COVID-19 pandemic seems to have exacerbated the overall incidence of energy insecurity.

Energy insecurity—conceptualized as the inability of a household to meet its basic energy needs 1, 2)—is a pervasive problem in the United States and elsewhere (3). Scholars use terms such as energy poverty, fuel poverty, and energy vulnerability to capture similar conditions (4-8) that involve both affordability and access to reliable energy sources. Although electricity is necessary for essential services (e.g., heating, cooling, cooking, lighting, medical devices), policymakers have failed to recognize the scope and scale of the energy insecurity problem (9). In response to energy insecurity, vulnerable households are more likely to engage in risky behaviors to meet their energy needs (10), including using high-interest payday loans (11), relying on dangerous heating sources like space heaters or ovens (12), or forgoing other basic needs such as food and medical care (13). Individuals in energy insecure households are more likely to remain in poverty for longer periods of time (14) and are more likely to suffer adverse mental and physical health consequences (15-18), including increased incidences of death (19); and these impacts are especially prevalent for children (20,21) and the elderly (22,23).

The economic disruption thus far caused by the COVID-19 pandemic has increased pre-existing inequalities, including those associated with energy insecurity. Black and Hispanic communities have been impacted by disproportionate rates of coronavirus-related infections, hospitalizations, and mortality (24,25); and people of color, young workers, mothers of school-aged children, and low-educated individuals have experienced large employment shocks (26-28). This study expands this work by examining which American families experience energy insecurity during a public health crisis. In so doing, we also contribute to a growing literature on energy justice, material hardship, and vulnerable populations (1,30,31).

The extant literature on energy insecurity has found that Blacks, Hispanics, those without a college degree, and households with young children, respectively, are more likely to be energy insecure (2,31,32). These studies provide a strong foundation that scholars and practitioners currently rely on to understand the problem of domestic energy insecurity. Current knowledge of the scope and scale of energy insecurity, however, primarily comes from analysis of two limited data sources: the Residential Energy Consumption Survey (RECS) (33) and the American Community Survey (ACS). The RECS contains few energy insecurity questions, is administered only every four years, does not provide state-level geographic identifiers, and examines the public at large rather than the most vulnerable populations; and, while the ACS contains items on energy expenditures, it does not capture affordability (34). Analyses using these datasets have made important contributions to our understanding of energy insecurity, but neither the ACS nor the RECS enable a comprehensive empirical analysis of U.S. energy insecurity.

To address these shortcomings, we administered a nationally representative survey of 2,381 adults with household incomes at or below 200 percent of the federal poverty line (FPL) in April and May 2020. The survey captures multiple measures of energy insecurity; collects demographic, health, and housing conditions information; and enables the evaluation of energy insecurity over the course of a year, allowing us to compare the prevalence and correlates of energy insecurity during both “normal” circumstances and in the early months of the COVID-19 pandemic (35, 36).

To summarize our findings, energy insecurity is highly prevalent among low-income American households, especially among households that identify as Black and Hispanic. We find that those who require use of an electronic medical device and live in worse or less efficient housing conditions experience higher rates of energy insecurity. The COVID-19 pandemic has thus far deepened the prevalence of energy insecurity among low-income households, as some speculated may occur (37), with some indication of growing disparities.

Describing Energy Insecure Households

We evaluate energy insecurity across three measures, representing a range in severity: inability to pay an energy bill; receipt of a utility disconnection notice; and disconnection from electricity service. All measures rely on respondent recall about conditions over the past year (since roughly April/May of 2019) and over the past month (April/May of 2020), respectively. Although we cannot rule out recall bias, we believe it is likely that most respondents accurately remember events such as being unable to pay a bill, learning that they will soon be disconnected unless urgent action is taken, or being disconnected from the grid and losing access to electricity.

The survey results (Figure 1) reveal that 25 percent (95% confidence interval (CI) is 23.0-27.0%) of low-income households could not afford to pay an energy bill in the last year and nearly 13 percent (95% CI 10.9-14.9%) could not afford their bill in the last month. In the last year, just over 25 percent (95% CI 23.6-27.6%) of respondents received a notice from their utility provider that their power may be disconnected due to lack of payment, and over 10 percent (95% CI 8.6-12.6%) had their service disconnected. In the last month, during the onset of the economic dislocation from the COVID-19 pandemic, 9 percent (95% CI 7.2-11.2%) of respondents had received a notice and 4 percent (95% CI 2.4-6.4%) were disconnected.

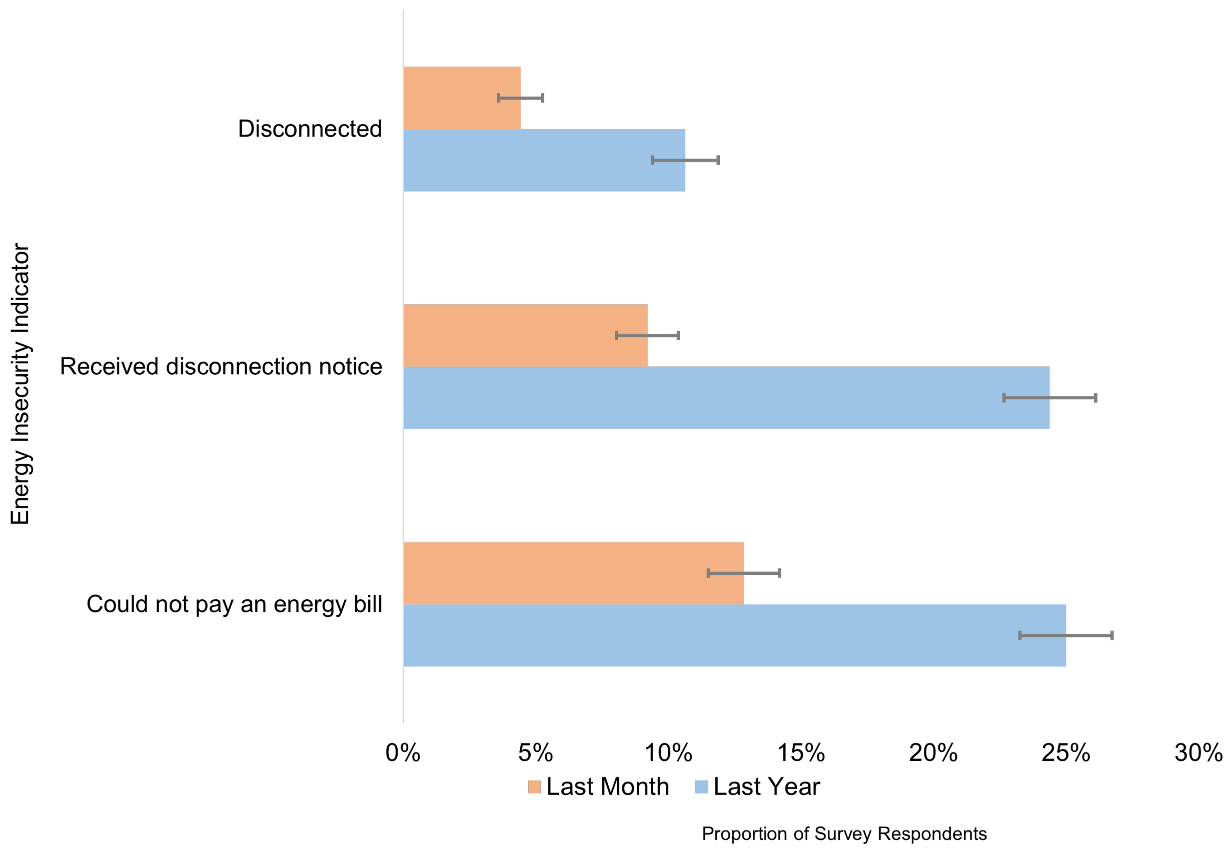

Fig 1. Proportion of Survey Respondents Facing Energy Insecurity.
Respondents that report an inability to pay their energy bill, received a disconnection notice, or were disconnected in the last year (blue) and in the last month (orange). The grey bars represent 95% confidence intervals (n=2,381).

To further characterize the general prevalence of energy insecurity among low-income U.S. households, as well as its incidence since the onset of the COVID-19 pandemic, we combine the survey data with estimates from the 2018 ACS for those living at or below 200 percent of the FPL to approximate the number of U.S. households and individuals that are energy insecure. Specifically, we extrapolate from the survey data to the U.S. population by multiplying the proportion of survey respondents that reported some level of energy insecurity by the number of

U.S. households (individuals) that the ACS estimates to be at or below 200 percent of the FPL. As shown in Table 1, we estimate that, in the last year, approximately 4.7 (24.3) million households (individuals) could not pay an energy bill, with just over 50 percent—2.4 (12.5) million households (individuals)—indicating that at least one of the bills they could not pay was in the last month. While we estimate that 4.8 (24.9) million households (individuals) received a disconnection notice and approximately 41 percent of these households were disconnected in the last year, the proportion of households that were disconnected from the grid after receiving a notice rose to about 48 percent during the COVID-19 pandemic.

	Could not pay an energy bill	**Received notice**	**Disconnected**
	Number of Households in millions [estimate range]		
Last Year (April/May 2019-April/May 2020)	4.7 [4.4 – 5.2]	4.8 [4.5 – 5.3]	2.0 [1.6 – 2.4]
Last Month (April/May 2020)	2.4 [2.1 – 2.8]	1.7 [1.4 – 2.1]	0.8 [0.5 – 1.2]
	Number of Individuals in millions [estimate range]		
Last Year (April/May 2019-April/May 2020)	24.3 [22.4 – 26.3]	24.9 [23.0 – 26.9]	10.3 [8.4 – 12.3]
Last Month (April/May 2020)	12.5 [10.6 – 14.5]	8.9 [7.0 – 10.9]	4.3 [2.3 – 6.2]

Table 1. **Estimates of U.S Households Experiencing Energy Insecurity.**
The approximate number of households—defined by the ACS as family members residing together—and individuals suffering from energy insecurity in the U.S. based on 2018 ACS estimates (38) of households living at or below 200% of the FPL and proportion of respondents that reported they could not pay an energy bill, received a disconnection notice, or were disconnected from electricity service. The range represents the 95% CIs for the estimates.

To put these estimates into context, we compare them to the RECS survey, which provides a nationally representative snapshot of all domestic housing units in the U.S. According to the most recent RECS, 17 million households received a disconnection notice in 2015, and 3 million households had their electricity disconnected. We can approximate from our 2020 survey that roughly 30 percent of all U.S. households receiving disconnection notices had incomes at or below 200 percent of the FPL, while nearly two-thirds of these disconnections came from households at or below 200 percent of the FPL. Although these approximations should be interpreted cautiously given differences in survey methodology and timing, we can infer that low-income households are being disconnected at much higher rates after receipt of a notice from their utility than average- to high-income households.

To further understand energy insecure households, we disaggregate the indicators of energy insecurity by race, number of dependents, health, and housing conditions. These findings are illustrated in Fig. 2, where each full bar represents the proportion of survey respondents who reported being energy insecure in the last year. We find that Black households, Hispanic households, households with young children, those with a member that relies on an electronic medical device, and those who reside in poor housing conditions (e.g., mold, holes in the wall/floor, plumbing problems, broken heating and air conditioning, exposed electrical sockets, non-working stove/refrigerator, or poor insulation) all reported higher incidences of energy insecurity. These characteristics are positively associated with all three energy insecurity measures, demonstrating that these disparities are prevalent during typical circumstances (i.e., the year prior to the onset of the COVID-19 pandemic, which was characterized by a normal to strong U.S. domestic economy (39)).

Fig. 2 further suggests that many of these disparities have grown since the beginning of the COVID-19 pandemic. Although the survey data do not enable us to make precise year over year comparisons, there is a higher prevalence of energy insecurity across many of these sociodemographic and household attributes during the early period of the COVID-19 pandemic (dashed bars in Figure 2). For example, 20 percent of white households and 30 percent of Black households could not pay an energy bill in the past year, which accounts for 12 full months; whereas 9 percent of white households and 16 percent of Black households indicated that they had trouble paying their energy bill in just the last month alone, a month that is not typically a weather aberration, nor was it extreme in 2020. Additionally, Hispanic respondents were 2.4 times more likely than white respondents to be disconnected from the grid in the last 12 months, but 4.7 times more likely to be disconnected during the early period of the COVID-19 pandemic. Similar patterns emerge across the other indicators displayed in Fig 2., which provides some evidence of increasing disparities in energy insecurity during the beginning of the public health and economic crisis resulting from the COVID-19 pandemic.

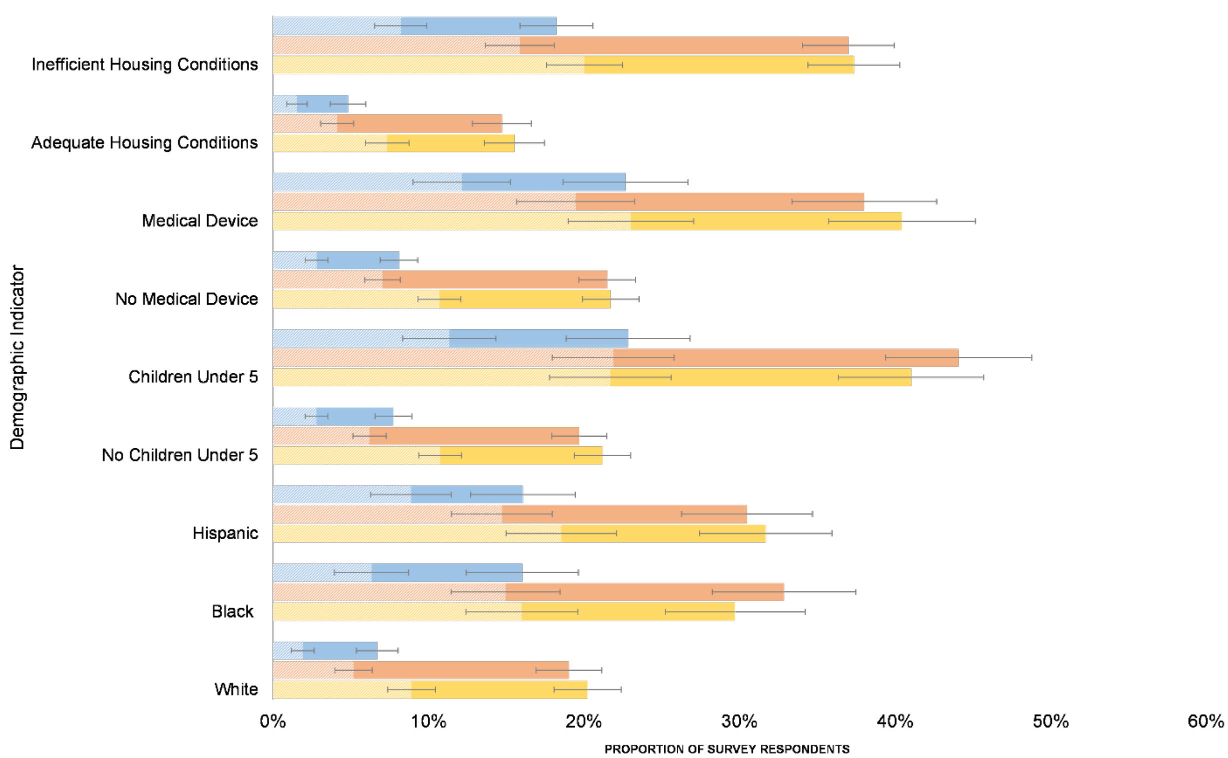

Fig. 2. Energy Insecurity by Demographic Characteristics.
The proportion of households that could not afford an energy bill, received a disconnection notice, or were disconnected from the grid in the last year (full bars) compared to the last month alone (dashed components), according to key indicators. Grey bars represent the 95% confidence intervals (n=2,381).

Socio-Demographic Predictors of Energy Insecurity

To better identify the determinants of household energy insecurity, we estimate a series of logistic regression models. This analysis evaluates the correlates of energy insecurity over the past year and in the last month to compare patterns of household energy insecurity during typical circumstances and the potential unique hardships that these households experienced since the onset of the pandemic. For brevity, we present the results of our models in Fig. 3 for the demographic, health, and housing characteristics that are consistently statistically associated with at least two of our indicators of energy insecurity. For clarity, we discuss our findings in terms of odds ratios. Full model regression results are also presented in Supplementary Table 1. In the models, we also include measures for households with a disabled member, other race categories (including Asian, Native American, and mixed households), if the household is situated in an urban or rural zip code, whether the household received government assistance, and the respondent's age, gender, employment status, and level of educational attainment. See Supplementary Table 2 for a full list of variables.

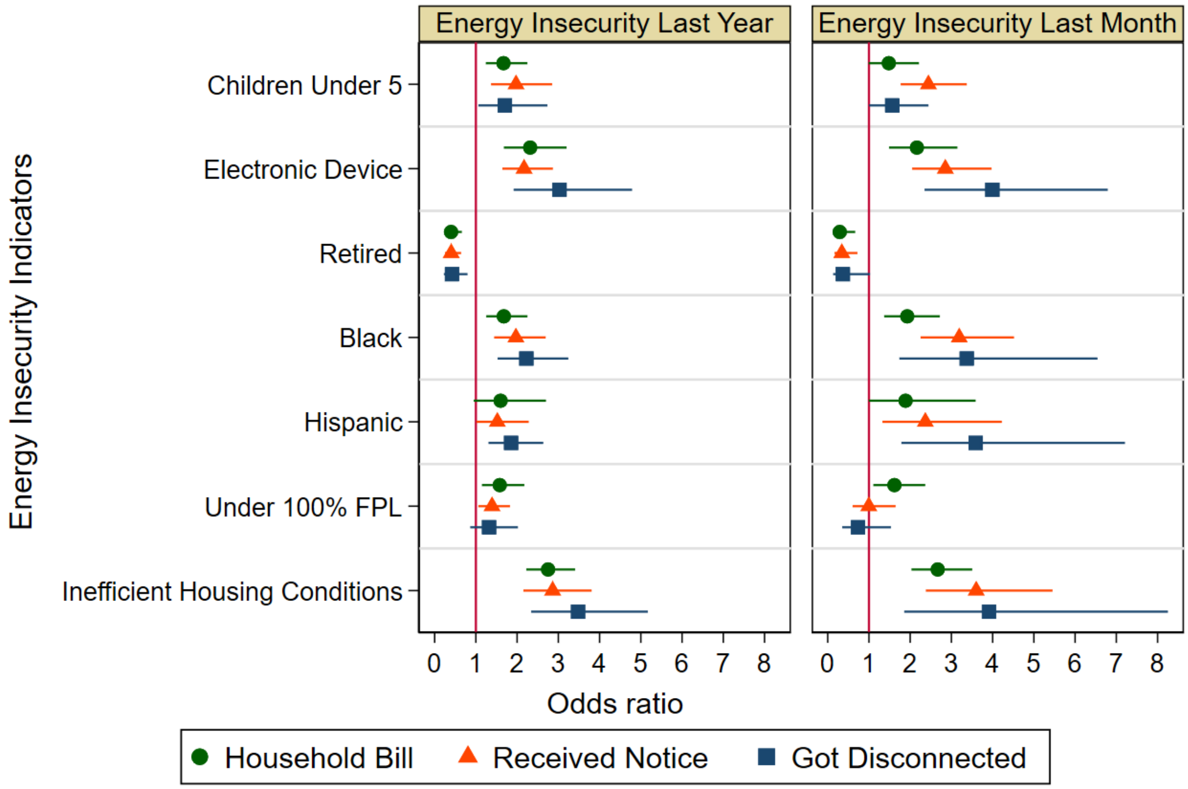

Fig. 3 Sociodemographic correlates of Energy Insecurity.
Values are odds ratios with 95% confidence intervals, estimated from logistic regression models (n=2,359). Models also include variables for household member with a disability, unemployed, other race or ethnicity, gender, age, education, dwelling type (mobile home, apartment, attached home), percent zip code urban, and receipt of government assistance. Full model estimates are provided in Supplementary Table 1.

As illustrated in Fig. 3, Black respondents were more likely than white respondents to be energy insecure across all three energy insecurity measures in the last year, with Hispanic households more likely to receive a notice of disconnection or be disconnected from the electric grid. More specifically, compared to whites, Black and Hispanic households experienced more severe forms of energy insecurity at higher rates. Black households experienced 1.9 times greater odds of receiving a disconnection notice and 2.2 times greater odds of having their utility service disconnected than white household respondents. Hispanic households faced disconnection at 1.9 times greater odds than white household respondents.

Moreover, the COVID-19 pandemic appears to have increased racial disparities. The regression analysis suggests that Black respondents were more likely to face all three forms of insecurity and Hispanic respondents were more likely to receive a notice or be disconnected in the time since the pandemic began compared to over the course of the previous year. Blacks (Hispanics) were at 3.4 (3.6) greater odds of being disconnected from their utility service during the pandemic than white respondents. These temporal differences in prevalence across racial groups is suggestive that energy insecurity intensified during the early months of the pandemic, though we cannot infer this definitively from the statistical analysis since the confidence intervals for the coefficients across the models overlap.

Similarly, respondents living in households where at least one person requires the use of a home electronic medical device were more likely to be unable to pay their bills, receive a notice, and be disconnected, both over the course of the prior year and during the early period of the COVID-19 pandemic. During the early months of the pandemic, for example, electronic device users faced 4.0 times greater odds of having their utility service disconnected compared to those who do not require the use of a medical device, which suggests that this vulnerable population is at high risk of losing power and facing substantial health risks. In addition, households with children under the age of five, those living in poor or inefficient dwelling conditions, and those that have received government assistance in the past month also faced higher risk of experiencing energy insecurity. We find that retired individuals, on average, were less energy insecure.

Lastly, respondents that had a household income under 100 percent of the FPL were more likely to be unable to pay their energy bill in both the last year and the last month as well as more likely to receive a disconnection notice in the last year, as compared to those whose household incomes were between 150 and 200 percent of the FPL. The lack of a statistical association between income levels and disconnection from the electric grid is a noteworthy null finding. It suggests that economic characteristics are not the sole predictors of the most severe measure of energy insecurity and that race, health, and housing conditions remain positive correlates of energy insecurity across all three measures even when income is accounted for.

The Impact of COVID-19 on Energy Insecurity

To this point, the analysis has provided suggestive evidence about the relationship between the early period of the COVID-19 pandemic and energy insecurity by comparing the prevalence and determinants of energy insecurity at different points in time. To further examine this relationship, we analyze the responses to several COVID-19 related survey items: whether they had received a COVID stimulus payment (part of the Coronavirus Aid, Relief, and Economic Security Act (CARES) Act); if their employment status had changed due to the pandemic; and if someone in their household had symptoms of or a positive test for COVID-19. Lastly, we include a factor score (see Supplementary Table 3) to measure 'COVID hardship,' or the material hardship (e.g. financial, food, and medical insecurity) a respondent experienced in the immediate aftermath of the pandemic.

A larger proportion of households that were adversely affected by the public health crisis also experienced all three levels of energy insecurity in the last month (Fig 4). Additionally, those that received a stimulus check were less likely to face issues as the pandemic began to unfold.

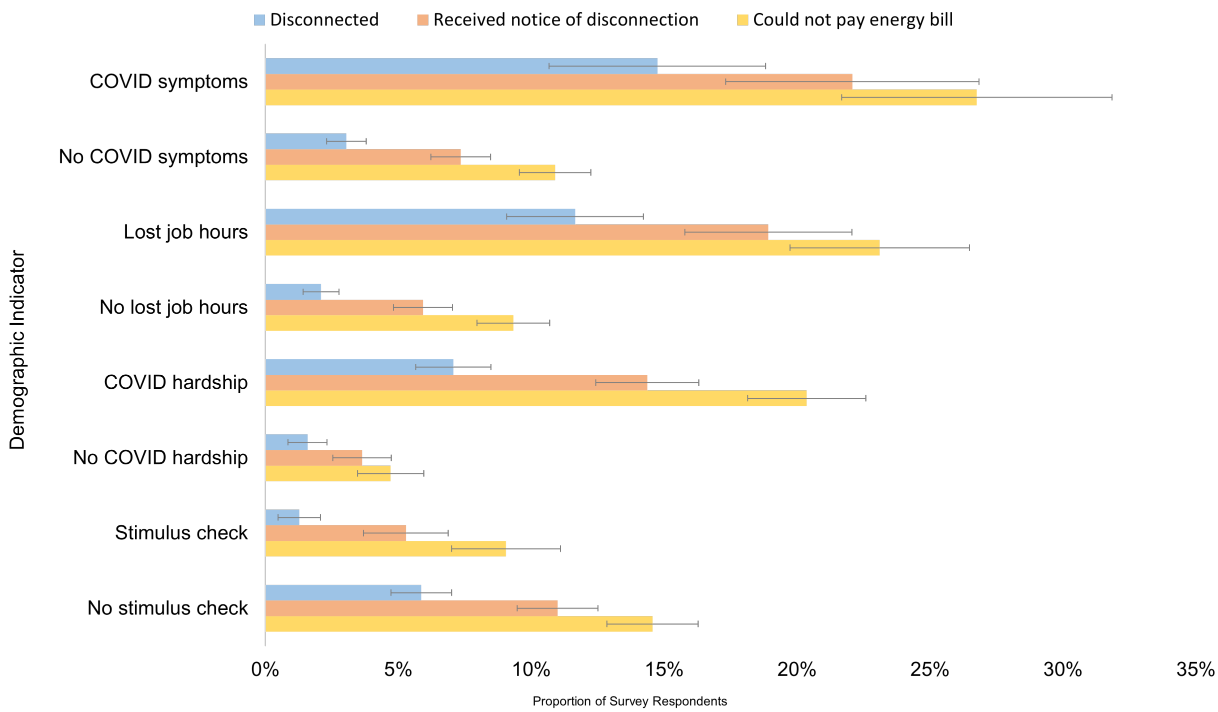

Fig. 4. COVID-related conditions and Energy Insecurity.
The proportion of households that could not afford an energy bill, received a disconnection notice, or were disconnected from the grid in the last month, by various COVID-related measures. Grey bars represent 95% confidence intervals (n=2,381).

Next, we re-estimate the logistic regression model for the energy insecurity measures reported during the early COVID-19 period and include these variables as regressors. The full set of results (see Supplementary Table 4) reveal that, in general, the same set of covariates that were correlated with energy insecurity in the last year remain statistically associated with energy insecurity in the last month, even while controlling for the potential confounding effects of COVID-19.

Conditions associated with COVID-19 are positively associated with energy insecurity (Fig 5). Material hardship and unemployment/lost hours due to the pandemic are statistically associated with all three forms of energy insecurity. Those that reported having a household member with symptoms or a COVID-19 diagnosis had greater odds of reporting an inability to pay one's energy bill; whereas, those who received a stimulus check had greater odds of avoiding utility disconnection. The results regarding the COVID stimulus assistance may also capture unobserved characteristics about those that received this cash assistance (i.e., stable residence, bank accounts). It is important to note that only about a third of respondents reported having received a stimulus check.

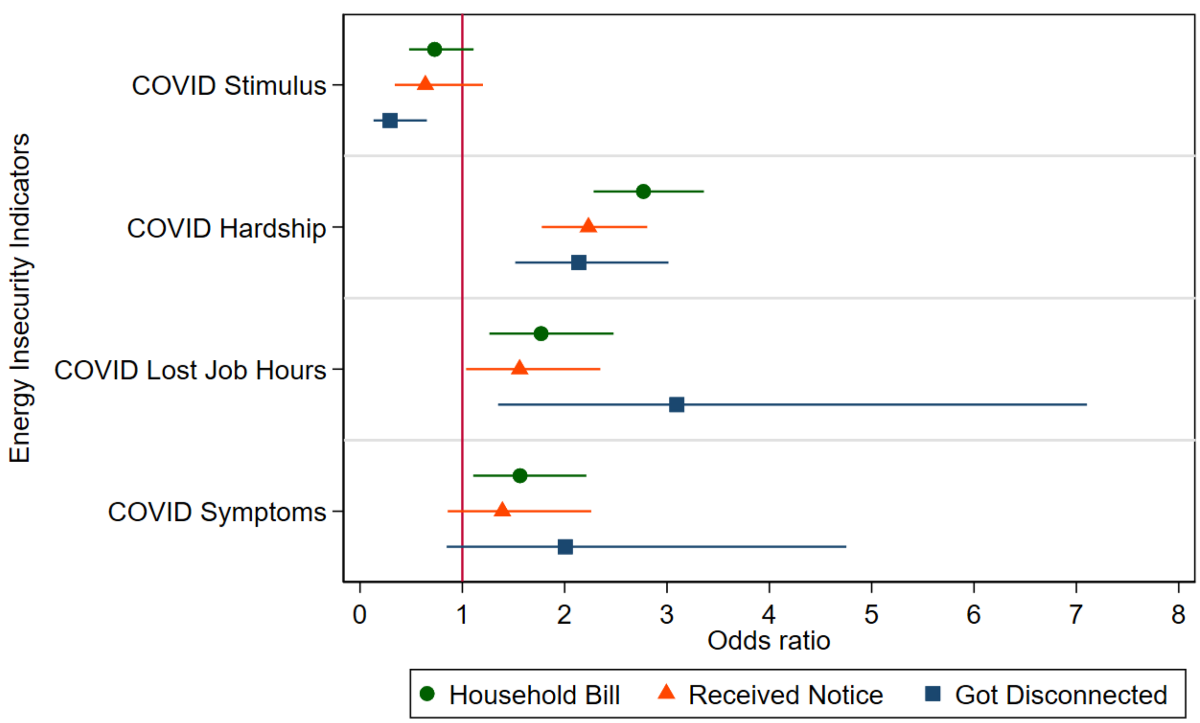

Fig. 5 COVID-related Correlates of Energy Insecurity.

Odds ratios with 95% confidence intervals, estimated from logistic regression models (n=2,287). Models also include variables for households with children under 5, household member with a disability, unemployed, household member using an electronic device, retired, Black, Hispanic, other race or ethnicity, gender, age, income, education, dwelling type (mobile home, apartment, attached home), housing conditions, percent zip code urban, and receipt of government assistance. Full model estimates are provided Supplementary Table 4. Robustness checks using ordinary least squares estimation and other variations defined in the Methods section are presented in Supplementary Tables 5-12.

Addressing Energy Insecurity is Imperative

This study provides estimates of the prevalence of energy insecurity among low-income households in the U.S, revealing that approximately 4.8 million households were unable to pay at least one energy bill during the past year and a similar number received a notice from their utility that they faced the threat of disconnection from electricity service. Of those that received a notice, more than two in five families had their electricity shut off. These numbers equate to tens of millions of Americans.

We also find notable disparities across all three indicators of energy insecurity, including race, families with young children, households where an individual relies on an electronic medical device, and people living in residences in poor condition. The latter results are consistent with past work that identifies housing conditions and inefficient housing stock as a leading contributor to energy insecurity in the U.S. (34, 40-43). It is important to emphasize, moreover, that these inequalities exist, especially between households of color and white households, while accounting for income. Given that people experiencing these circumstances also tend to suffer from other types of material hardship, such as food insecurity (20, 13) and limited access to affordable health care (43), these disparities in energy insecurity likely amplify challenges that these vulnerable populations face.

Further, our analysis indicates that energy insecurity has intensified because of the COVID-19 pandemic. Both the economic dislocation and, to some extent, the virus itself, is associated with difficulty in meeting household energy needs during the early period of the pandemic. Moreover, our results provide strong suggestive evidence that the sociodemographic disparities that existed pre-pandemic—that is, during "normal" circumstances—widened during the early months of the crisis. This finding is consistent with past research that has shown that economic downturns tend to exacerbate material hardship among already vulnerable populations (44, 45).

During the early months of the pandemic, U.S. federal, state, and local governments put a range of emergency measures in place to help households cope with material hardship (e.g., eviction and utility shutoff moratoriums, expanded unemployment insurance, discounted housing payments, and direct cash assistance). In the case of electricity service specifically, many states adopted temporary shutoff protections to supplement the patchwork of existing state-level policies limiting the circumstances in which utilities can disconnect customers (46). As these temporary measures elapse, one might anticipate further incidence and severity of energy insecurity. In the short-term, additional financial assistance programs, extensions of state-level protections, and the establishment of a national moratorium on electricity disconnections would mitigate household energy insecurity through the duration of the pandemic. In the long-term, potential government interventions might include investments in energy efficiency programs to help households afford energy.

There remains much to learn about the prevalence and determinants of energy insecurity. The findings in this study about race and ethnicity require further inquiry. Past work has emphasized that Blacks and Hispanics disproportionately experience energy insecurity (47); the analysis presented here indicates that this association holds, even after controlling for income and housing conditions. That is, there is something left unexplained about the energy experiences of Black and Hispanic households that needs to be identified to fully understand the prevalence of energy insecurity in these groups.

Among other unanswered questions are what strategies people employ to cope with energy insecurity. There are at least two important dimensions to examine. The first dimension relates to the financial strategies that people adopt to balance their energy needs with material hardship. Sociological research on material hardship, for example, has found that households engage in credit balancing and strategic nonpayment to manage their overall expenses (48). This type of behavior may result in households accruing long-term debts, which may turn a short-term problem into a longer-term one. Households may also seek out relief or financial assistance from both formal (e.g., utilities and government programs like the Low Income Home Energy Assistance Program or the Weatherization Assistance Program) and informal sources (e.g., family and friends, faith-based organizations, and other nonprofit organizations).

Beyond the financial aspects, scholars should also continue to examine the behavioral response of individuals to energy insecurity (1), by which we mean how people cope with less electricity consumption, either because of concerns of affordability or due to losing service as a result of nonpayment. For example, little is known, at least from large, quantitative studies, about how people stay cool during the summer months or warm during the winter months if they cannot afford to turn on their air conditioning or heat. Research on behaviors during times of crisis suggests that individuals may do more risky things (9, 10), which in this context could lead to severe adverse effects to health and well-being.

Methods

Survey design and implementation

The survey was fielded in an online format through a contract with YouGov, a private polling and market research firm. YouGov generates representative samples using a matched sample methodology. YouGov develops a target population from general population studies, from which it draws a random set of respondents to create a target sample. Using a matching algorithm, the firm selects potential respondents from its U.S. panel of approximately two million opt-in participants that match the target sample (49), working with partner organizations to enhance its sample when necessary. YouGov's survey approach has been validated extensively (49-51).

For this survey, YouGov interviewed a total of 2,914 respondents who were matched down to the final dataset of 2,381 participants, using a sampling frame on gender, age, race, and education constructed by stratified sampling from the 2017 ACS 1-year sample of individuals whose income is at or below 200 percent of the Federal Poverty Level (FPL). The matched cases were weighted to the sampling frame using propensity scores, and then the matched cases and the frame were combined and a logistic regression was estimated for inclusion in the frame. The propensity score function included age, gender, race/ethnicity, education, and geographic region. The propensity scores were grouped into deciles of the estimated propensity score in the frame and post-stratified according to these deciles. The weights were then post-stratified on a four-way stratification of gender, age (4-categories), race (4-categories), and education (4-categories), to produce the final weight which was used in all reported results and analyses. The survey has a margin of error of two percent.

Our research design focuses on low-income households because energy insecurity tends to be more heavily concentrated among households in this economic category (52). We selected an income threshold of at or below 200 percent of the FPL for several reasons: 1) scholars (53) and practitioners (54) have previously relied on 200 percent of the FPL as an indicator of low-income households in the U.S.; 2) federal energy assistance programs set their income limits at 150 percent of the FPL so surveying households at or below 200 percent of the FPL allows us to collect a sample of households that are within and above income eligibility thresholds; and 3) we were more likely to achieve a nationally representative sample of U.S. households by sampling households at or below 200 percent of the FPL, rather than 100 percent of the FPL.

The survey was administered between April 30 and May 25, 2020, and took respondents, on average, ten minutes to complete. We asked survey respondents to answer a series of questions about their housing conditions, health status, and energy insecurity over the last year, as well as over the past month (a period that we define in this study as during April or May 2020). We also asked a series of questions specifically about how respondents' circumstances had changed since the onset of the COVID-19 pandemic, which we defined as beginning the second week of March 2020, which roughly coincides with the timing of when state governments began to enact stay-at-home orders and social distancing measures.

Statistical Analysis

To measure the determinants of energy insecurity, we employ a series of logistic regressions. The binary dependent variables measure whether 1) a respondent's household could not pay their energy bill; 2) their household received a disconnection notice; and 3) their household electricity was disconnected. The survey asked respondents about these outcomes for different time frames, enabling us to compare energy insecurity over the course of the last year with that in the last month, during the economic crisis brought about by the pandemic. To control for potential omitted variable bias due to unobserved interstate (across state) variation, we include a series of state dummy variables, allowing us to exploit within-state variation. We further cluster standard errors at the state level to account for within-cluster correlations. We also conduct the year, month, and COVID-19 specific analysis using linear regression analysis (see Tables S5 and S6). Like the logistic regressions, we include state dummy variables and cluster our standard errors at the state-level. We find consistent outcomes across both the logistic and linear empirical specification for all three of our models.

Lastly, we conduct a final set of robustness checks employing both the logistic and linear regression empirical specifications. To test whether our COVID-19 measures are accounting for unmeasured variation, we narrow the sample to those who experienced energy insecurity in the last year but not the last month. This allows us to check whether the material hardship, economic, and health factors that relate to the pandemic remain statistically linked to energy insecurity. If the factors remain correlated, it would suggest that the COVID-19 measures are merely accounting for some omitted variable and are not specific contributors to energy insecurity in the last month, or as the public health crisis began to unfold. Both the logistic (see Supplementary Table 7) and linear (see Supplementary Table 8) models largely reveal a loss of significance across the COVID-19 measures, indicating that the pandemic and the economic disruption it caused is, in fact, responsible for deepening energy insecurity in the last month across our survey population. We also test a set of regressions with an additional control variable for respondents' self-reported average monthly energy bill expenditure. While household energy expenditures is a positive and significant predictor of our measures of energy insecurity in both time periods, we do not include this as a variable in our main models because 110 survey respondents did not report this value. Therefore, the missing observations would reduce our sample size by roughly 5 percent. Importantly, when controlling for energy expenditures, our results remain relatively consistent for both the logistic (see Supplementary Table 9 and Supplementary Table 10) and linear (see Supplementary Table 11 and Supplementary Table 12) models.

Ethics. This research involved human subjects. It was approved by the Indiana University Office of Research Compliance, under protocol number 2004296209. In accordance with this protocol, informed consent was provided by all study participants.

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Author Contributions

All authors contributed to the conceptualization, research design, analysis, and writing of this article.

Competing Interest Statement

The authors declare no competing financial or non-financial interests.

Data Availability Statement

Data and associated materials used in this study are available in the Harvard Dataverse repository (55), including the original survey data and codebook, the STATA data processing do-file, and the STATA data analysis do-file. Replication sources can be found at: https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/OMJWNB

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