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Social and Environmental Stressors of Urban Oil and Gas Facilities in Los Angeles County, California, 2020

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Objectives. To examine patterns of cumulative environmental injustice with respect to operations of urban oil and gas development in Los Angeles County, California.

Methods. Using CalEnviroScreen (CES) 4.0, oil and gas data permit records, and US census data, we examined the association between CES score (grouped into equal quintiles, with the lowest representing low cumulative burden) and oil and gas development (presence or absence of an oil and gas production well) within 1 kilometer of a census block centroid.

Results. Among census blocks in the highest quintile of CES score, we observed 94% increased odds of being within 1 kilometer of a well compared with census blocks in the lowest quintile of CES score (odds ratio = 1.94; 95% confidence interval = 1.83, 2.10). In our multivariable model, the proportion of Black residents and higher quintiles of CES score were also associated with increased odds of a nearby oil and gas well.

Conclusions. These findings suggest that oil and gas facilities are operating in neighborhoods already cumulatively burdened and with higher proportions of Black residents. (*Am J Public Health*. Published online ahead of print July 27, 2023:e1–e9. https://doi.org/10.2105/AJPH.2023.307360)

Social inequalities and discriminatory policies related to race, ethnicity, and socioeconomic status have led to spatial patterning in health risk factors. Certain groups, including Hispanic and Black populations, are disproportionately exposed to environmental hazards such as air pollutants and industrial facilities, and to place-based social stressors such as poverty, substandard housing quality (e.g., lead paint), and neighborhood deprivation.[1] These cumulative environmental exposures and social stressors can be experienced at the neighborhood level and contribute to health inequities.[2] In response to evidence that environmental pollutants and population vulnerabilities may jointly contribute to adverse health outcomes, methods have been developed to assess cumulative burden at a neighborhood scale.[3]

In the past decades, the United States experienced rapid growth in domestic oil and gas (OG) production, extracting from more than 1 million active onshore OG wells.[4] OG development produces a range of environmental hazards including noise and chemicals that can be distributed across and persist in neighborhood-level air, water, and soil.[5,6] These pollutants include known irritants, carcinogens, and endocrine disruptors and can be volatilized or aerosolized via active evaporating pits, flares, surface spills, acidization, processing, and transportation.[5] Studies in communities living near petroleum activity have observed adverse health impacts associated with OG extraction such as worse birth outcomes,[7] adverse respiratory impacts,[8] and a range of acute health symptoms.[9] Previous research, predominantly based in rural communities facing new hydraulic fracturing, suggests distributive injustices in populations living near OG development.[10–12] However, there is limited research examining the existing cumulative burdens facing urban neighborhoods near OG facilities.

Los Angeles (LA) County, California, has one of the highest concentrations of petroleum extraction facilities in the world with thousands of OG wells spanning 70 communities.[13] The oil industry in LA County has operated for longer than a century. By the mid-1920s, LA County was the largest oil-exporting region in the world.[14] As government and industry negotiated to continue oil drilling within residential zones, oil extraction in LA County became increasingly hidden from public view, often by utilizing tall walls or hedges, and consolidating operations into fewer neighborhoods.[15] LA County currently requires no buffers or setbacks between oil extraction and homes. Recent research in LA County has documented unparalleled proximity and density of urban OG drilling and potential impacts on community health.[8,16]

LA County has a distinct residential and industrial landscape that has resulted in residential neighborhoods adjacent to multiple environmental hazards.[17] These neighborhood-level hazards may contribute to the disparities in health outcomes experienced by certain communities in LA County.[18] While growing evidence demonstrates the health impacts of living proximate to OG development, OG emissions are not yet considered a part of the environmental hazards that may burden low-income communities of color in cumulative burden metrics. Thus, we examined whether OG development was more likely to occur in environmentally burdened and socially vulnerable neighborhoods in LA County.

METHODS

We examined the location of onshore OG production wells in LA County with respect to the cumulative environmental hazard and social vulnerability score of the neighborhood.

Oil and Gas Data

The location and information about all OG wells were retrieved from California Geologic Energy Management Division.[19] We extracted the well location, American Petroleum Institute identification number, well status (active, idle, closed), and well production type. We included both active (drilled and completed wells) and idle wells (wells that have not been used for 24 consecutive months but have also not been properly plugged and abandoned, so they can be reactivated[19]) in our analysis. We included OG wells classified as active or idle as of May 30, 2020, in the analysis (Figure A, available as a supplement to the online version of this article at https://ajph.org). We extracted monthly OG production volumes from 2010 through 2019 from Enverus.[20]

Cumulative Vulnerability Score

Our primary analysis examined the presence of OG wells in relation to CalEnviroScreen (CES) 4.0 score. CES is a tool to identify and map the combined environmental hazards and social burden of communities.[3] The racial/ethnic composition of the census tract is not considered in the development of CES. CES ranks every populated census tract in California based on 13 indicators of pollution burden and 8 indicators of population characteristics, which are described in detail elsewhere.[3] While OG hazards are not explicitly included in the CES pollution burden indicators (other than production ponds from well stimulation activity in the groundwater threats indicator), OG production contributes to neighborhood-level hazards and emissions.[21,22] We extracted CES 4.0 data from the CA Office of Environmental Health Hazard Assessment in December 2021. We assigned tract-level CES scores to each census block in the study area.

Study Area and Exposure

We abstracted census block (referred to as “blocks” from here on) demographic and population data from the IPUMS National Historical Geographic Information System based on the 2010 US Census.[23] We included all populated blocks in LA County. No wells were identified on Santa Catalina and San Clemente islands, and, thus, they were excluded. We considered a block to be near a well if the centroid of the block was located within a 1-kilometer circular buffer of an active or idle OG well. One kilometer was selected as the primary buffer distance based on the growing body of evidence in California suggesting adverse health impacts at a minimum of 1 kilometer from extraction sites.[7,8] In addition, we calculated the total well count and the combined production of OG for wells within a 1-kilometer buffer of each block centroid. We calculated production volumes for active OG wells by converting the gas production into barrels of oil equivalent (BOE) and then summing it with the oil production.[7]

Statistical Analysis

We examined the association between CES score and race/ethnicity (10% increase in the proportion of Hispanic, Black, and Asian residents in a block) with the presence or absence of an OG production well within 1 kilometer of a block centroid separately, using univariable logistic regression models. We included race/ethnicity based on its absence in CES. We included communities of color that comprised at least 5% of the total population in LA County. We also examined a multivariable model that included CES score and race/ethnicity. We grouped CES scores into equal quintiles with the lowest indicating the lowest environmental and social burden.

We further disaggregated CES score into the 2 main components and considered the association between pollution burden, population characteristics, and race/ethnicity with the presence or absence of a well within 1 kilometer. In addition, we examined the change in the number of OG production wells using a negative binomial model. We assessed the average annual OG production (annualized BOE volume 2010–2019) with respect to CES score through a linear regression model. We replicated the methods at 500 meters and 1.5 kilometers as sensitivity analyses. Lastly, as a sensitivity analysis, we used a generalized linear mixed model with a logit link to examine the association between quintiles of CES score and the presence of an OG well within 1 kilometer. This model included a random intercept for census tract and addressed spatial autocorrelation using a spherical correlation structure. All models employed robust standard errors when possible. We conducted the statistical analyses using Stata IC version 16 (StataCorp LP, College Station, TX) and R version 4.1.1 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

There were 109 115 total blocks in LA County, with 75 048 (68.8%) containing 1 or more residents. For populated blocks, the median number of residents per block was 85 (interquartile range = 115). We identified 5576 active and idle OG wells in the study area. Of those wells, a total of 124 million BOE were produced between 2010 and 2019. In total, 947 blocks contained at least 1 well, and 108 168 blocks had no wells. In addition, 2962 blocks, 7614 blocks, and 13 318 blocks were located within 500 meters, 1 kilometer, and 1.5 kilometers of an active or idle OG well, respectively. Among the blocks near an active or idle well (within 1 kilometer), the median number of wells was 2 with a range from 1 to 621 (1st percentile = 1 well; 25th = 1; 50th = 2; 75th = 15; and 99th = 313). Approximately 500 000 residents lived in blocks scoring in the highest quintile of CES score in LA County (among the most cumulatively burdened in California; 90th–100th percentile) and were located within 1 kilometer of an active or idle OG well (Table 1). Of the Black residents, Hispanic residents, and Asian residents living in the most cumulatively burdened neighborhoods (highest CES score quintile), 32.0% of the Black residents, 21.5% of the Hispanic residents, and 29.6% of the Asian residents lived within 1 kilometer of an active or idle OG well, respectively.

We observed a 94% increased odds of being within 1 kilometer of an active or idle well among blocks in the highest CES quintile as compared with blocks in the lowest CES quintile (odds ratio [OR] = 1.94; 95% confidence interval [CI] = 1.83, 2.05; Table 2). The ORs were higher among all blocks with scores in the second through fifth quintiles compared with the lowest quintile. In the univariable race/ethnicity model, each 10% increase in the proportion of Black residents was associated with 16% increased odds of an active or idle well within 1 kilometer (OR = 1.16; 95% CI = 1.15, 1.17). Positive but smaller ORs were reported for each 10% increase in Asian (OR = 1.05; 95% CI = 1.04, 1.06) and Hispanic (OR = 1.02; 95% CI = 1.02, 1.03) residents. Furthermore, the multivariable results followed a similar pattern with both 10% increases in the proportion of Black and Asian populations and higher quintiles of CES score associated with an increased odds of an OG well nearby. For example, we observed a 112% increase in the odds of a nearby active or idle well among the highest quintile of CES score compared with the lowest quintile (OR = 2.12; 95% CI = 1.97, 2.28). However, a small decreased odds of a nearby active or idle well was observed for each 10% increase in the proportion of Hispanic residents (OR = 0.97; 95% CI = 0.96, 0.97).

Secondary Analysis

Table 3 presents the ORs for the presence of an OG well within 1 kilometer from the multivariable model incorporating both quintiles of pollution burden and population characteristics, and racial/ethnic composition. Blocks in the highest quintile of pollution burden had a 315% increased odds of a nearby active or idle OG well compared with blocks in the lowest quintile (OR = 4.15; 95% CI = 3.86, 4.47). We did not observe notable associations based on population characteristics for almost all the CES quintiles—yet the highest quintile of population characteristics had a lower odds of a nearby well (OR = 0.56; 95% CI = 0.51, 0.60). In comparison, each 10% increase in Black residents was associated with significantly increased odds of a nearby active or idle well (OR = 1.17; 95% CI = 1.16, 1.19).

Table 4 presents the rate ratios (RRs) for the change in the number of active and idle OG wells within 1 kilometer from the multivariable model incorporating CES quintiles and racial/ethnic composition. Blocks with CES scores in the highest quintile had an average of 5.91 (95% CI = 5.01, 6.98) more wells compared with blocks with CES scores in the lowest quintile. Similarly, each

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TABLE 1— Population 500 Meters, 1 Kilometer, and 1.5 Kilometers From an Active or Idle Oil and Gas Well and Total Black, Hispanic, and Asian Residents Within 1 Kilometer of an Active or Idle Oil and Gas Well by CalEnviroScreen (CES) Score Quintile: Los Angeles County, CA

CES Score Quintile (Statewide Percentile Range)	Total Population,[a] No.	Population in Blocks, No.			Total Residents Within 1 km of a Well, No. (%)[b]		
		Within 500 m of a Well	Within 1 km of a Well	Within 1.5 km of a Well	Black	Hispanic	Asian
First (0.29th–34.8th)[c]	1 483 694	74 689	222 250	387 373	5 808 (13.0)	28 811 (13.0)	31 026 (12.9)
Second (34.82nd–55.21st)	1 667 011	149 719	361 942	567 018	23 528 (25.5)	62 988 (14.6)	79 422 (24.9)
Third (55.23rd–74.1st)	1 957 865	137 286	365 247	605 121	49 654 (27.7)	156 827 (18.1)	67 304 (20.6)
Fourth (74.17th–89.7th)	2 353 846	238 018	559 509	935 076	63 313 (27.3)	345 668 (23.9)	75 435 (26.7)
Fifth (89.71st–99.97th)[d]	2 311 566	199 380	532 557	902 109	83 559 (32.0)	368 490 (21.5)	43 917 (29.6)
Total population	9 773 982	799 092	2 041 505	3 396 697	225 862	962 784	297 104

Source. Data from the 2010 US Census,[23] 2021 CalEnviroScreen 4.0,[3] and 2020 California Geologic Energy Management Division.[19]

[a]Total population among census blocks with CES scores.

[b]The percentage of residents of a racial/ethnic group (Black, Hispanic, Asian) within 1 kilometer from an active or idle well in each quintile of CES score. For example, of the Black residents living in the fifth CES score quintile, 32% of them lived within 1 km from an active or idle oil and gas well.

[c]Lowest burden.

[d]Highest burden.

10% increase in the proportion of Black and Asian residents was associated with a slight, but not extremely notable, increase in the number of proximate wells (RR Black = 1.08 wells [95% CI = 1.05, 1.10]; RR Asian = 1.08 wells [95% CI = 1.10, 1.11]). By contrast, we did not observe a notable positive association for Hispanic populations.

The association between CES quintiles and OG production per year was nonmonotonic. Blocks with CES scores in the second, third, fourth, and fifth quintiles were near wells that produced, on average, 7072 (95% CI = 6418, 9525), 3282 (95% CI = 1922, 4642), 5923 (95% CI = 4459, 7286), and 3709 (95% CI = 2246, 5172) more BOE per year, respectively, compared with blocks with CES scores in the lowest quintile.

Sensitivity Analyses

The documented pattern of an increased burden from OG development in blocks already burdened by cumulative neighborhood stressors held when using a 500-meter and 1.5-kilometer buffer. In general, at 500 meters, many of the associations previously reported at 1 kilometer were strengthened (Table A, available as a supplement to the online version of this article at https://ajph.org). At 1.5 kilometers, both higher and lower ORs were observed compared with 1 kilometer (Table B, available as a supplement to the online version of this article at https://ajph.org). Notably, the ORs for higher quintiles of CES in the univariable model and race/ethnicity in both the univariable and multivariable models were slightly higher at 1.5 kilometers compared with 1 kilometer. Finally, the mixed effects model including a random intercept for census tract

TABLE 2— Comparison of the Presence or Absence of an Active or Idle Oil and Gas Well Within 1 Kilometer by CalEnviroScreen (CES) Quintile, by CES and Race/Ethnicity, and by Race/Ethnicity Only: Los Angeles County, CA

	OR (95% CI)
CES quintile	
First (Ref)	1
Second	1.38 (1.30, 1.47)
Third	1.34 (1.27, 1.43)
Fourth	1.82 (1.71, 1.92)
Fifth	1.94 (1.83, 2.05)
CES and race/ethnicity	
First CES quintile (Ref)	1
Second CES quintile	1.39 (1.30, 1.47)
Third CES quintile	1.35 (1.27, 1.44)
Fourth CES quintile	1.93 (1.81, 2.07)
Fifth CES quintile	2.12 (1.97, 2.28)
Proportion Black (10% increase)[a]	1.10 (1.09, 1.12)
Proportion Hispanic (10% increase)[a]	0.97 (0.96, 0.97)
Proportion Asian (10% increase)[a]	1.03 (1.02, 1.04)
Race/ethnicity only (10% increase)[a]	
Proportion Black	1.16 (1.15, 1.17)
Proportion Hispanic	1.02 (1.02, 1.03)
Proportion Asian	1.05 (1.04, 1.06)

Note. CI = confidence interval; OR = odds ratio.
Source. Data from the 2010 US Census,[23] 2021 CalEnviroScreen 4.0,[3] and 2020 California Geologic Energy Management Division.[19]
[a]A 10% increase in the proportion of Hispanic, Black, or Asian residents in a census block.

and accounting for spatial autocorrelation reported slightly higher associations compared with the main models, which supported our findings of an increased odds of the presence of OG activity among higher quintiles of CES score (Table C, available as a supplement to the online version of this article at https://ajph.org). Of note, the 95% CIs between the main and sensitivity analyses overlapped.

DISCUSSION

OG development has an extensive footprint in LA County with wells operating in densely populated urban neighborhoods near homes, schools, playgrounds, and health care facilities.[15] As research has identified higher levels of environmental pollutants near OG extraction sites,[21,24] there has been increasing attention toward identifying the populations at risk and the role proximity to these facilities may play in contributing to adverse health outcomes.[4] Residents in these neighborhoods may be facing exposure to environmental hazards from OG development including poor air quality and noise, in addition to other exposures from other nearby polluting sources.[1] Our analysis observed that higher quintiles of the overall CES score and pollution burden score and higher proportions of Black residents were associated with increased presence of OG operations.

Research in LA County has demonstrated neighborhood-level exposure to these pollutants and environmental toxics near OG operations.[16,21,22] Yet, aside from the consideration of production ponds from well stimulation activities as part of the groundwater threats indicator, the distribution of OG hazards with existing environmental and social stressors has not been considered in statewide metrics for assessing neighborhood-level burden. Statewide air pollution indicators capture regional air pollutants (e.g., ozone and particulate matter that is 2.5 micrometers or smaller in diameter [$PM_{2.5}$]) and have not incorporated neighborhood-level air pollutants (e.g., volatile organic compounds and other hazardous air pollutants) produced by OG operations. Furthermore, the air pollutants incorporated in CES that may be produced by OG operations (diesel PM, $PM_{2.5}$) do not directly correlate with OG development, because these pollutants are produced by other sources (including combustion of gasoline), and they are estimated at a larger scale (e.g., diesel PM at a 1 kilometer × 1 kilometer grid) that may not adequately reflect local, neighborhood-level exposures experienced by communities living, working, or playing near these facilities. Therefore, while OG development contributes to a variety of environmental hazards that are reported to burden certain communities in LA County,[16,21,22] it is not adequately captured in current neighborhood-level exposure metrics.

Environmental justice dimensions of OG development have been less studied, particularly in urban contexts. Previous research has considered questions around neighborhood sociodemographic characteristics, largely in rural communities, with differing

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TABLE 3— Multivariable Model of the Presence or Absence of an Active or Idle Oil and Gas Well Within 1 Kilometer by Quintiles of Pollution Burden, Quintiles of Population Characteristics, and 10% Increase in the Proportion of Each Racial/Ethnic Group: Los Angeles County, CA

	OR (95% CI)
Pollution burden	
First quintile (Ref)	1
Second quintile	2.14 (2.00, 2.29)
Third quintile	2.61 (2.44, 2.79)
Fourth quintile	3.32 (3.13, 3.59)
Fifth quintile	4.15 (3.86, 4.47)
Population characteristics	
First quintile (Ref)	1
Second quintile	1.03 (0.97, 1.09)
Third quintile	0.91 (0.86, 0.97)
Fourth quintile	1.00 (0.93, 1.07)
Fifth quintile	0.56 (0.51, 0.60)
Race/ethnicity (10% increase)[a]	
Proportion Black	1.17 (1.16, 1.19)
Proportion Hispanic	1.00 (0.99, 1.00)
Proportion Asian	1.01 (1.00, 1.02)

Note. CI = confidence interval; OR = odds ratio.
Source. Data from the 2010 US Census,[23] 2021 CalEnviroScreen 4.0,[3] and 2020 California Geologic Energy Management Division.[19]
[a]A 10% increase in the proportion of Hispanic, Black, or Asian residents in a census block.

TABLE 4— Multivariable Model of the Change in the Number of Active and Idle Oil and Gas Wells by CalEnviroScreen (CES) Score Quintiles and 10% Increase in the Proportion of Each Racial/Ethnic Group: Los Angeles County, CA

	RR (95% CI)
CES score quintiles	
First (Ref)	1
Second	2.06 (1.85, 2.29)
Third	2.35 (2.05, 2.69)
Fourth	5.14 (4.44, 5.95)
Fifth	5.91 (5.01, 6.98)
Race/ethnicity (10% increase)[a]	
Proportion Black	1.08 (1.05, 1.10)
Proportion Hispanic	0.92 (0.90, 0.94)
Proportion Asian	1.08 (1.06, 1.11)

Note. CI = confidence interval; RR = rate ratio.
Source. Data from the 2010 US Census,[23] 2021 CalEnviroScreen 4.0,[3] and 2020 California Geologic Energy Management Division.[19]
[a]A 10% increase in the proportion of Hispanic, Black, or Asian residents in a census block.

results. A study in Ohio presented evidence that the odds of a block group containing an injection well decreased as median income increased.[11] Similar findings from the Marcellus Shale reported that census tracts near unconventional gas wells had a significantly higher percentage of people below the poverty line compared with census tracts farther away.[25] Researchers examining housing costs and the location of active wells reported lower home values within 500 feet of OG wells in 2 basins that have a history of substantial OG development.[10] An analysis in South Texas reported that neighborhoods with high Hispanic populations were less likely to live within 5 kilometers of active OG development, yet more likely to be near active gas flaring and wastewater wells.[12]

LA County is one of the few regions in the United States where OG extraction occurs in densely populated communities. More than 500 000 residents live in blocks within 1 kilometer of an active or idle well that are also among the most cumulatively burdened in the state (CES score > 90th percentile). Furthermore, we found that blocks with higher quintiles of CES scores had an increased odds of being near OG facilities. Our sensitivity analysis adjusting for spatial autocorrelation presented stronger associations but generally aligned with our main analysis. Past research examining neighborhood-scale environmental injustices suggests that accounting for spatial autocorrelation may produce similar findings.[26]

We observed an increased odds of a nearby (1 kilometer) OG production well with an increase in the proportion of Black residents. These findings support previous research (based on CES 1.1) demonstrating that non-Hispanic Black, Hispanic, Native American,

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Asian/Pacific Islander, and multiracial populations were more likely to live in the top 10% of burdened zip codes compared with non-Hispanic White populations.[27] Furthermore, another study that examined disparities in methane super-emitters in California (including dairy, manure, and OG production) reported that increases in the percentage of non-Hispanic Black, Hispanic, and Native American residents was observed to be associated with an increased odds of exposure.[28] By contrast with previous research, we did not find strong associations for the odds of a nearby well with increasing proportions of Hispanic and Asian residents. As Hispanic populations are the largest growing ethnic group in LA County (47.7% of the population in this study), other factors may influence where they live. Future research on OG development in LA County should examine more specific ethnic groups that are predominant in the county instead of using broad racial/ethnic classifications.

Our findings of inequities in the location of OG development based on the proportion of Black residents and CES score (notably pollution burden score) may be attributable to racial, political, and social disenfranchisement where low-income communities and communities of color frequently host undesirable industrial operations and facilities because of a perceived lack of political clout or following the "path of least resistance" because of limited resources.[29] We observed stronger effects based on the racial/ethnic composition of the block rather than the CES population characteristics indicator, pointing to the role of environmental racism as an important factor to consider in the historical locations of OG facilities.

In multiple models, the odds of a nearby OG well were positively associated with the proportion of Black residents, suggesting racial patterning. While some previous research has identified that measures of socioeconomic status are positively associated with OG production,[25] others presented evidence that even after adjusting for poverty, racial disparities in the presence of disposal wells persist—which could indicate that race/ethnicity may be more of a driving factor in the presence of OG development compared with socioeconomic status.[30] Furthermore, higher quintiles of pollution burden were associated with an increased odds of the presence of an OG well. This finding adds to the evidence of LA County being an environmental "riskscape" where multiple polluting facilities and hazardous pollutants are clustered in low-income communities of color.[17]

Limitations

Our analysis focused on available data from the 2010 Census and does not capture changes in population over time. From 2010 to 2020, the population of LA County increased by almost 200 000, which may indicate a larger population at risk depending on migration and housing patterns within the county.[23] We also used blocks for this analysis (the smallest spatial unit) but, without residential parcel data, we do not know the location of residents within blocks. In addition, assigning the tract-level CES score to each block limits our ability to identify block-level disparities. However, CES scores are only available at the census tract level, and we did conduct a sensitivity analysis including a random effect for census tract, which presented slightly stronger results. As with many geospatial analyses using discrete boundaries as the spatial unit, our findings may be limited by the "modifiable areal unit problem." There may also be misclassification of blocks as unexposed based on our categorization of blocks as within 1 kilometer based on the block centroid.

Public Health Implications

Our findings suggest greater proximity to OG development among cumulatively burdened communities, which may result in higher exposures to a range of environmental hazards[5,6] and amplify existing health disparities.[7] Additional research should further explore the associations between cumulatively burdened communities in California and other threats from OG development. Furthermore, future efforts should focus on ensuring that OG operations are included in neighborhood-level cumulative burden indexes because these environmental hazards are not currently adequately captured.

While these actions will help elucidate the environmental hazards found in neighborhoods across California, they will not directly reduce OG-related exposures.[31] Recently, LA County voted to phase out OG production in unincorporated areas, which would reduce exposure burdens from these operations if enacted.[32] The city of Los Angeles also passed a motion to phase out oil drilling in city boundaries over the next 20 years.[33] However, other incorporated cities within the county, such as Carson, would require their own policy response to ongoing oil operations. Policies that aim to reduce exposure at the neighborhood level, such as setbacks and phase-outs, and address existing environmental injustices attributable to OG extraction are central to reduce overall exposures and support the creation of healthier environments for burdened communities. Our findings suggest that OG facilities are operating in neighborhoods already cumulatively burdened and with higher proportions of Black residents and may guide the development of future policies and neighborhood-level indexes aiming to identify communities at risk and reduce cumulative exposures. AJPH

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CONTRIBUTORS

M. Chan abstracted the data, conducted data analysis, and prepared the article. B. Shamasunder conceptualized the research question and oversaw the interpretation of the results and article preparation. J. E. Johnston conceptualized the research question and oversaw the abstraction of data, data analysis, interpretation of the results, and article preparation.

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CONFLICTS OF INTEREST

The authors have no potential or actual conflicts of interest to report.

HUMAN PARTICIPANT PROTECTION

No human participants were involved.

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