

Richmond Health Survey Report

Communities for a Better Environment

June 2009

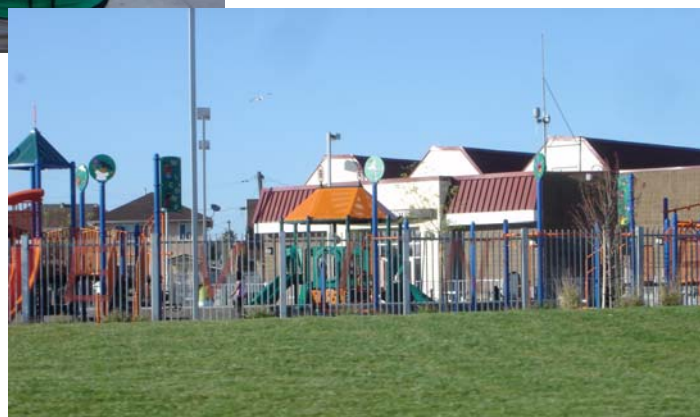


Table of Contents

Introduction.....	4
Background	5
Methods.....	8
Findings.....	9
Conclusion.....	17
CBE’s Policy Recommendations.....	18
References.....	19

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Introduction

What is environmental justice?

Environmental justice is the principle that everyone has the right to a clean and healthy environment regardless of race, gender, or income. Researchers agree that pollution is concentrated in low-income communities of color (or “environmental justice communities”), and that environmental justice communities, including those in California face higher health risks as a result (Bullard et al, 2007; Matsuoka, 2003; Morello-Frosch, 2002).

Richmond’s History of Environmental (In)Justice:

Richmond, California has a long history of industrial activity—particularly the petrochemical industry—and its consequent pollution. Contra Costa County, which includes Richmond, is second only to Los Angeles County for the distinction of being the most industrialized California County. Contra Costa is also home to five refineries and the largest refinery west of the Mississippi River.

Richmond residents have been burdened by the impacts of environmental pollution for decades, and have been struggling to achieve a healthy and just environment. In particular, elevated rates of health problems—most notably child and adult asthma—in Richmond have driven Richmond residents’ environmental justice struggle. Numerous pollutants from a multitude of local sources identified by respondents, including the Chevron refinery, the Santa Fe train, and diesel trucks along the Richmond parkway, are likely linked to these health problems.



During World War II many people migrated to the Bay Area to take military jobs, but Black families were only allowed to buy homes in Richmond. In fact, the homes in Atchison Village and Liberty Village were all originally built for war-time housing.

Richmond has a significantly larger non-white population than greater Contra Costa County: 36% of Richmond residents are African-American and 27% are Latino, as compared to 9% and 18%, respectively, for the greater county. Furthermore, 26% of Richmond residents live below the poverty line (Moore Iacofano Goltsman Inc., 2007). When considering the Chevron refinery in particular, 79% of people within one mile of the refinery are people of color, and over 25% are below the national poverty line (Morello-Frosch, 2008).

Communities for a Better Environment has calculated that there are over 350 toxic sites in Richmond, with the California Department of Toxic Substances Control identifying 41 and the City of Richmond identifying 11 more. These myriad pollutants affect an already vulnerable community where the closest full service grocery store is beyond walking distance and where access to health care is limited (CTWO, 2002).

Richmond Health Survey

The Richmond Health Survey sought to examine and document community members' shared health experiences and their perceptions of environmental factors that may affect health outcomes. Community surveyors worked to recruit and survey participants. After the information was collected, community members advised academic researchers throughout the data analysis process. The use of a community-based participatory research approach seeks to equitably involve all partners in the research process and emphasizes the importance of community knowledge in survey design, data collection, and interpretation and dissemination of research findings.



This report has three sections. The first section provides background information on the Richmond Health Survey. The second section presents our survey methods and findings. The final section discusses the implications of this research and outlines CBE's recommendations for policy and regulatory action.

Background

Communities for a Better Environment (CBE) combines grassroots organizing, science, and legal expertise for what the organization terms a "1-2-3 punch for social justice" to address local environmental health justice problems (May, 2004). CBE also has a history of collaboration with academics to increase credibility in government, strengthen research methodologies and make academic work tailored to the local



environment (Brody et al, 2007a; Morello-Frosch et al, 2002; Pastor et al, 2007; Perez et al, 2007)

The Household Exposure Study (HES) is a National Institute of Environmental Health Sciences (NIEHS)-funded collaboration between CBE, Silent Spring Institute, a non-profit research institute focused on links between the environment and women's health, and researchers at Brown University and University of California, Berkeley (Silent Spring, 2008). The Household Exposure Study (HES) monitored indoor and outdoor air and dust in the homes of 40 Richmond residents and 10 residents of Bolinas, a rural environmentalist community across the San Francisco Bay in Marin County (Silent Spring, 2008). The HES tested for over 150 analytes that come from consumer products as well as industrial and

transportation emission sources to thoroughly understand the extent to which each individual participant and the community they represented was exposed to different environmental pollutants (Brody et al, 2007; Morello-Frosch, 2008). These chemicals include endocrine disruptors (chemicals that mimic hormones), particulates, heavy metals, and industrial byproducts.

The data analysis is ongoing, but initial results have found significantly elevated levels of polybrominated diphenyl ether (PBDE) flame retardants in HES homes, compared to other locations in the US and Europe, and elevated levels of particulates and industrial pollutants in Richmond as compared to the control community of Bolinas (Zota et al, 2008; Morello-Frosch, 2008). In particular, elevated levels of vanadium, an indicator of oil combustion, which is a reproductive and developmental toxicant, were identified in the indoor and outdoor air of Richmond homes at significantly higher levels than in Bolinas (Morello-Frosch, 2008; Domingo, 1996).

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The Household Exposure Study focused on quantifying environmental exposures, but collected no information about health outcomes. As a result, the same research collaborative developed the Richmond Health Survey, through a grant from the Avon Foundation, to describe quantitatively and qualitatively health outcomes in Richmond that are known to be associated with environmental hazard exposures, particularly air pollution as well as community and individual stressors.

Rational for environmental health issues covered by survey

Metropolitan areas in California have higher levels of hazardous air pollutants than other counties in California (Morello-Frosch et al, 2000). There is a causal relationship between particulate air pollution and both morbidity, including heart and respiratory diseases, and mortality (Filleul et al, 2003).

Having local data about clusters of disease is a useful tool for policy advocacy and community mobilization (Minkler et al, 2008). However, data about local environmental health issues in Richmond did not previously exist. Our environmental health survey is based on a cumulative impact framework, which recognizes that there are community-level and individual-level stressors that affect health outcomes and vulnerability to disease (Morello-Frosch and Lopez, 2006).

Industrial pollutants can cause a wide range of health problems, including nose and throat irritation, headaches, nausea, skin allergies, and chronic conditions like developmental issues and cancer (Lerner, 2005), so our collaborative chose to ask questions about the same health problems.

Residents were also concerned about respiratory health issues: particularly asthma, which has been a major environmental justice concern across the country (Brown et al, 2003), and also respiratory allergies. Harlem Children’s Zone’s Asthma Initiative found a 28.5% prevalence of health professional-diagnosed childhood asthma in Harlem (with an additional 2% of children experiencing asthma symptoms upon physical examination), over four times the national prevalence rate of 7% (Nicholas et al, 2005; Northridge et al, 2002). The scientifically rigorous Harlem study has served as a wake-up call to quantify the true magnitude of asthma in low-income urban communities of color.

In Richmond, the Household Exposure Study found over 50% of homes tested to have indoor air levels of particulate matter above California’s ambient air quality standard, despite having taken the samples in the summer season, when particulate matter levels tend to be lowest (Morello-Frosch, 2008). Traffic-related air pollution is associated with childhood onset of asthma, suggesting that air pollutants may cause asthma (Jerrett et al., 2008). Particulate matter inflames the airways and cause oxidative stress, triggering asthma attacks (Filleul et al., 2003).

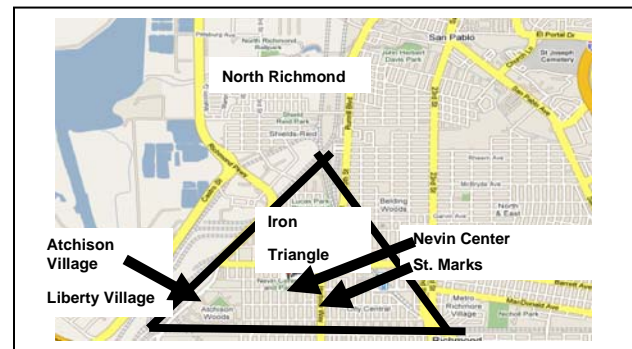
The cumulative impact model for health outcomes discussed above recognizes that there are both biological and social determinants of health (Marmot, 2005; Krieger, 2001). We asked a number of questions to understand the quality of the neighborhood and health stressors other than environmental contaminants that may be present.

Methodology

The development of the survey stems from the overall division of labor between community and academic partners: CBE staff determined the research questions based on community perceptions of local environmental health risks, and the academic partners developed a survey that could address those research questions most effectively.

Eligibility

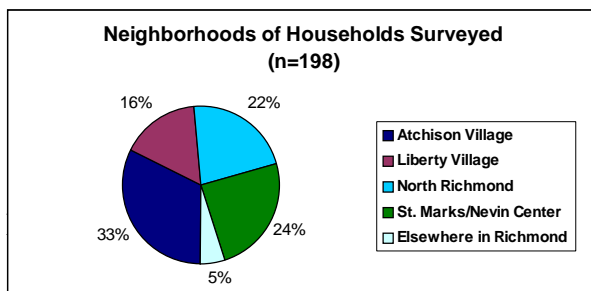
Residents of the following four neighborhoods were eligible to participate: Atchison Village, Liberty Village, St. Mark’s Church /Nevin Center, North Richmond. Participants were deemed ineligible for participation in the survey if they smoked, because of the significant effect of smoking on health outcomes. Bilingual surveyors made it possible for both English and Spanish speakers to complete the survey.



Recruitment

The recruitment effort was multi-pronged, with varying levels of effectiveness.

The first phase involved mailing letters. Letters described the project and invited people interested in participating to contact the Survey



Coordinator. Our next step in recruitment was door-knocking. Community surveyors and CBE staff traveled in bilingual pairs. In areas where door-knocking was not possible because of gates blocking access to residents' doors, recruitment was done through word of mouth and community outreach events.

Flyers were also posted in community centers inviting people to participate in the survey, and CBE staff made announcements at community meetings and at church mass to spread awareness and encourage people to participate.

Survey Administration

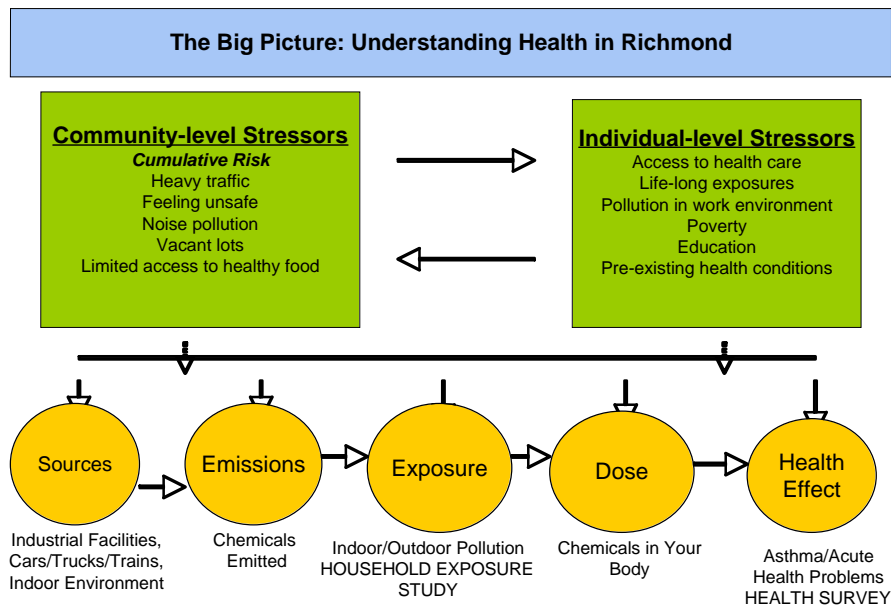
Community surveyors were identified by community-based organizations operating in each neighborhood (CBE, West County Toxics Coalition) as people who were leaders in their neighborhood and who might be interested in participating.

Data Analysis

Data was entered in Excel and analyzed in Excel and SPSS (Statistical Package for the Social Sciences) version 14.0. Data analysis was done in consultation with community surveyors and survey respondents: two small community meetings were held in January 2009 to discuss plans for data analysis, community ideas for analytic work to be done, and feedback regarding data dissemination.

Findings

The Richmond Health Survey took a comprehensive look at environmental and public health, as shown in the figure below. Results are broken down into four sections: Health Effects, Individual-level Stressors, Community-level Stressors, and Sources.



Adapted from: Morello-Frosch, 2007

Survey Participants Demographics

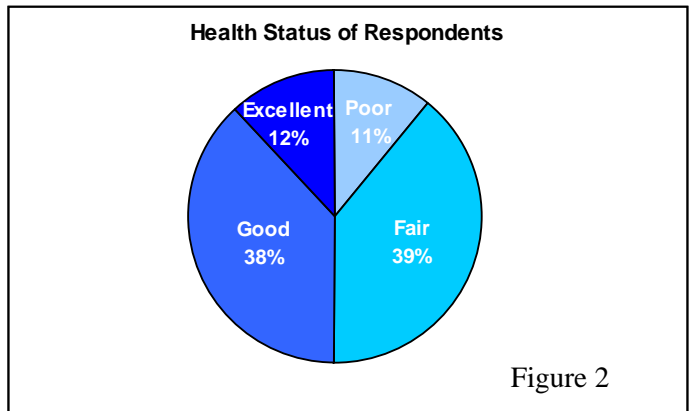
The survey was completed by 198 household respondents in four neighborhoods. Respondents were asked about the health issues of all of the members of their household, which allowed us to collect data about the health of 722 community residents in total, including 282 children (less than 18 years of age). The average number of residents per household was 3.65.

Our survey population was not representative of the City of Richmond (as described by the US 2000 Census) in terms of gender or race (see figure 1).

Figure 1	Richmond Health Survey Respondents	City of Richmond Demographics Source: US 2000 Census
% of Women	82.3%	51.4%
% of Whites	11.2%	31.4%
% of Blacks	23.0%	36.1%
% of Other	1.1%	18.7%
% of Hispanic/Latino	64.7%	26.5%

Health Effects

Respondents were asked to evaluate their own health by answering the question “Would you say your health was excellent, good, fair, or poor?” Although asking people to assess their own health status may seem to be a vague measure of health, this measure is actually well-correlated with a wide range of health outcomes and is useful as an overall indicator of general well-being. Respondents were roughly evenly divided between identifying their health as excellent or good and fair or poor (see figure 2).

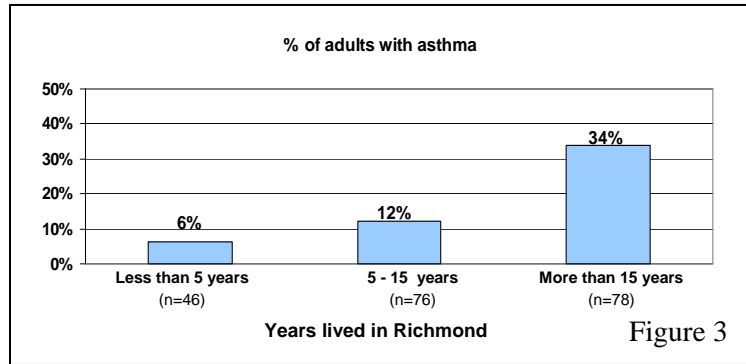


We also asked about chronic and acute health problems of the 198 household respondents and the other members of their household. For chronic health problems (asthma and cancer), analyses were separated between adults (n=440) and children (n=282), since prevalence of the diseases of interest varied based on age. For acute health problems, our analysis only looks at the prevalence and frequency of these health problems for the 198 household respondents due to underreporting of acute health problems among other people in the respondents’ households.

Chronic health conditions

Adult asthma:

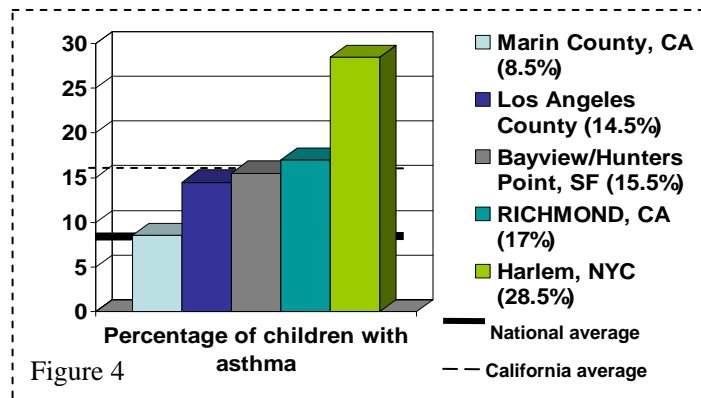
Among all adults in Richmond included in our sample (n=440), the prevalence of asthma (9.1%) was roughly the same as the national average (8.7%) and the California state average (7.5%).¹ However, adult asthma is correlated with length of time lived in Richmond, with a step-wise



function observed (see figure 3). Each of these individual rates indicated a statistically significant relationship between length of time in Richmond and likelihood of having asthma. Among life-long residents (n=20), a subset of those adults who had lived for 15 years or more in Richmond, the rate of asthma was 45.0%. Although the small sample size prevented many of the results from achieving statistical significance, the asthma rates of those who had lived in Richmond for five years or less and those who had lived in Richmond for their entire life were statistically significantly different.

Childhood asthma:

The prevalence of childhood asthma in Richmond (17%) was more than double the national average (8%), but only two percentage points higher than the California state average (14.8%) (see figure 4).²



The rate determined in our survey was roughly equivalent to the Contra Costa County asthma rate (17% vs. 18%) (State of California Center for Health Statistics, 2005). As compared to other areas of interest, Richmond’s childhood asthma rate is double that of Marin County and comparable to other similarly environmentally burdened communities (Los Angeles, Bayview/Hunters Point in San Francisco). The Richmond results are

¹ National and California averages from BRFSS 2007 data available online at: <http://www.cdc.gov/asthma/brfss/07/current/tableC1.htm>

² National and California averages are from State of California Center for Health Statistics 2005 report on asthma.

lower than Harlem, but the Harlem study did a much more thorough, diagnosis-based study.

Other chronic diseases:

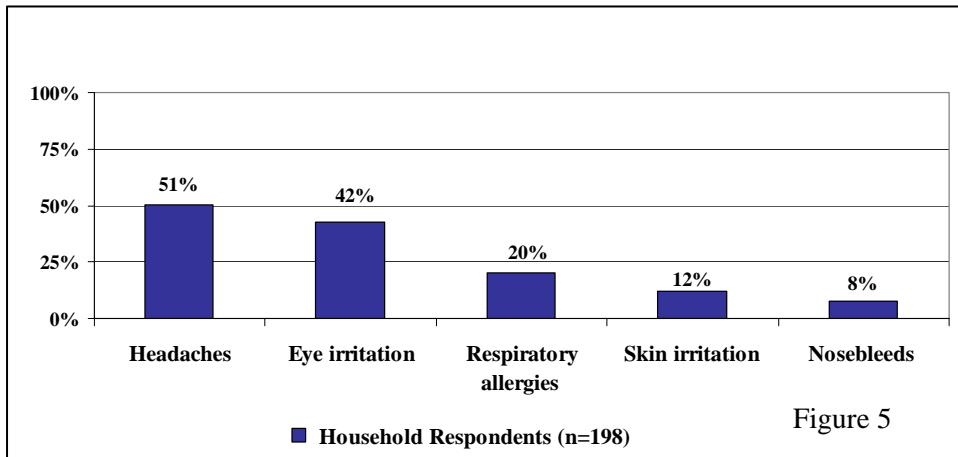
Respondents also shared information about cancer and developmental disabilities in their households. Breast cancer, in particular, had been a major source of anecdotal concern as the survey was being developed. However, only one case of breast cancer was reported among the 722 household members covered, and the sample size of people with cancer (n=20) was small enough so that no meaningful analysis in terms of age-adjustment or cancer cluster identification could be completed. Similarly, respondents reported a wide range of developmental disabilities in type and

severity of the condition, including many cases that were undiagnosed and therefore more difficult to classify. This also impeded analysis and comparison. As a result, analysis of cancer and developmental disability data is not included here.



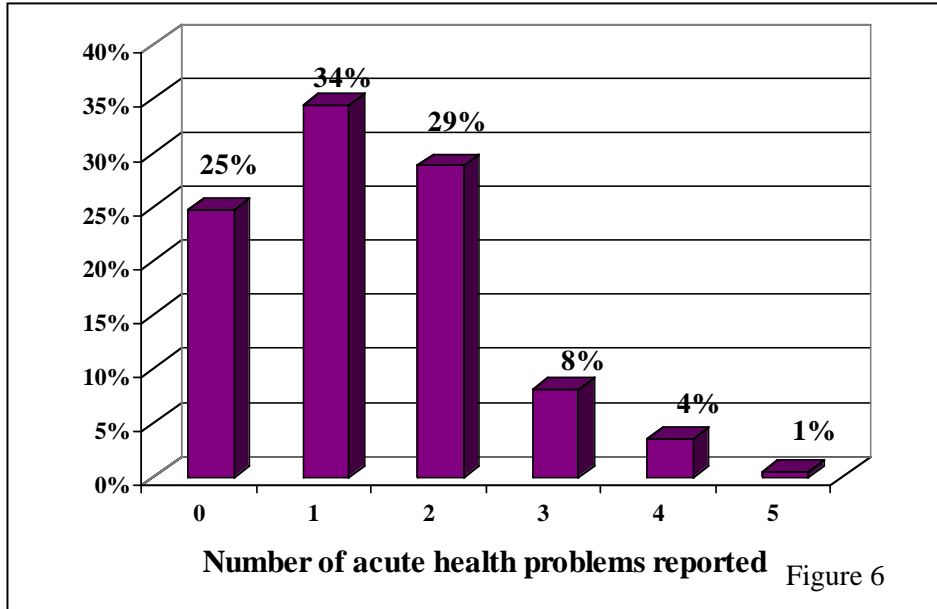
Acute health problems:

We asked about a variety of acute health problems, including eye irritation, headaches, nosebleeds, respiratory allergies other than hay fever, and skin irritation. Recall that these health problems have been associated with acute environmental exposures in other communities. Figure 5 indicates that headaches and eye irritation were the most common acute health problems reported.



The majority of respondents (63%) suffered 1-2 acute health problems; with 13% reporting three or more acute health problems (percentages in figure 6 do not add up to 100% due to rounding). Furthermore, these acute health problems are a constant

presence: the median frequency of headaches among household respondents was approximately twice per week, and the median frequency of eye irritation was just over once per month. Having headaches was associated with eye irritation ($p=.019$), perhaps because many factors trigger both acute health problems.

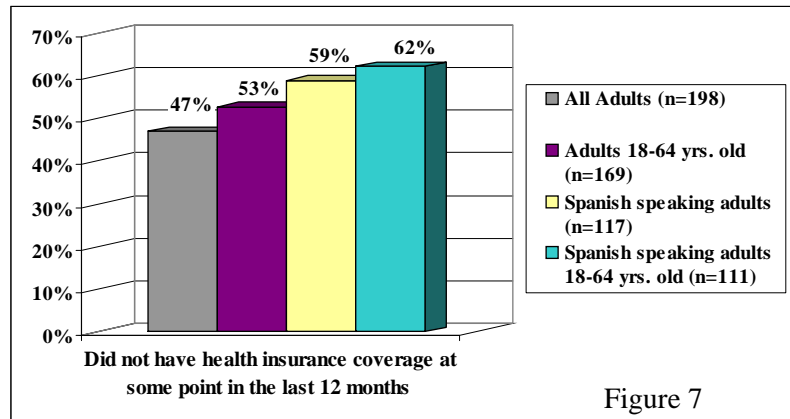


Individual-level stressors

Health Care Access:

Access to health care was a common issue for survey respondents. While 19.5% of Californians under 65 currently lack health insurance (Brown et al, 2008), 37% of all survey respondents ($n=198$) (including those aged over 65) lacked health insurance when they completed the survey.

Our analysis separates respondents by age (65 or older, and under 65), with the assumption that those over 65 were much more likely to be insured by Medicare. However, not all respondents age 65 or older ($n=29$) had health insurance coverage continuously over the past year: 13.8% did not, and all of these respondents were English speakers, making lack of citizenship an unlikely explanation. This suggests that there may be a gap in service provision and sign-up.



As seen in figure 7, a majority (52.7%) of respondents under 65 reported not having health insurance coverage continuously over the past twelve months. Spanish speaking household respondents were more likely to be uninsured: among all Spanish speakers 59% were uninsured at some point in the last year, and among those under 65, 62.2% did not have health insurance at some point in the last twelve months.

We also considered five barriers to accessing health care: no money or insurance to pay for a doctor's visit, not being able to schedule an appointment when desired, not being able to start care as early as desired, no transportation, and not being able to take time off from work. For all survey respondents (n=198), 38% reported not having enough money to pay for a doctor's visit and 23% reported not being able to schedule an appointment when they wanted one. For those under 65 (n=169), 39% of respondents could not schedule an appointment when they wanted one, and 24% did not have the money or insurance to pay for a doctor's visit. The other three barriers were of lesser concern for both populations, although still common, with 10-16% of respondents identifying each as a problem.

Community-level stressors

Neighborhood Environment:

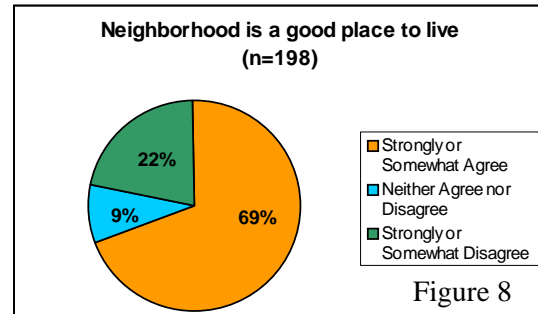
Respondents were asked several questions about their neighborhood, including many statements with scaled responses. The first question, however, was an open-ended qualitative question to "tell us a little bit about your neighborhood." Respondents were prompted to discuss environmental, health, and education issues. Responses ranged from a phrase to lengthy statements. Despite not being prompted to discuss crime or safety, this was the most common item discussed, with over 37% mentioning crime or violence. Robberies, shootings (including drive-by shootings and killings), and drug dealing were the most common concerns. St. Mark's/Nevin Center and Atchison Village respondents were most concerned about crime. Similarly, 26% of respondents mentioned safety, with many indicating that they did not feel safe in general or that they only felt safe within a small geographic area (i.e., their house, their block, or their village). Another realm of concern was racial tension, especially between Blacks and Latinos. When asked about how safe they felt in their neighborhood, 32% of respondents (n=198) said that they did not feel safe in their neighborhood. People also discussed their neighborhood environment (n=31), with only 13% of those mentioning positive attributes. The main concerns were trash, vacant houses, vandalism, and property damage. Feeling safe was associated with less perceived neighborhood blight (p=.001).

Environmental pollution was also a commonly discussed concern, with 29% of respondents mentioning this issue. Almost half (49%) of people concerned with environmental pollution (n=57) were concerned with Chevron and its proximity. Interestingly, 71% of respondents who were also Household Exposure Study participants (n=21) mentioned environmental pollution, indicating that Household Exposure Study efforts may have helped raise people's environmental awareness. Despite 29% of all respondents mentioning environmental pollution, only 4% of St. Mark's/Nevin Center respondents mentioned environmental pollution. This was the only one of the four neighborhoods included in the study that was not home to a community-based

environmental organization (CBE works with Atchison and Liberty Villages, and West County Toxics Coalition is based in North Richmond).

Despite prompts to discuss health and education, approximately 10% of respondents discussed each. Primary concerns regarding health were asthma and cancer. The main educational issues discussed were poor school quality and crime or violence near schools.

Neighborhood Quality of Life: Respondents were asked to what degree they agreed with the statement that their neighborhood was a good place to live as a measure of neighborhood satisfaction (see figure 8). The majority of respondents thought that their neighborhood was a good place to live, despite a number of issue-specific concerns described in response to subsequent questions. Neighborhood satisfaction was associated with positive self-rated health ($p=.030$).



Community-level Stressors

In addition to answering open-ended questions, people also described particular community-level stressors in their neighborhood.

Neighborhood stressors in the built environment:

Feeling unsafe:

A majority (59%) of respondents feel safe in their neighborhood. People who felt safer reported significantly less of a presence of vacant lots ($p=.001$). Feeling safe was significantly associated with the likelihood of the community to organize around crime ($p=.000$), indicating that perceived community agency can contribute to feelings of safety.

Heavy car or truck traffic:

A majority of respondents (59%) reported that there was heavy car or truck traffic in their neighborhood. While completing the survey, however, many respondents defined their neighborhood to be a smaller area than in other responses in order to exclude some of the major thoroughfares bounding the neighborhood in question. Almost three-quarters (71%) of respondents were concerned about air pollution from traffic. The presence of heavy car or truck traffic was positively associated with concern about air pollution from traffic ($p=.000$).

Loud noise from cars/motorcycles/trains/airplanes:

Over two-thirds (69%) of respondents reported that there was loud noise from cars, motorcycles, trains, or airplanes in their neighborhood, with many respondents specifying that it was only the train that caused noise pollution.

Presence of vacant lots/houses:

Just over half (53%) of respondents reported that there were no vacant lots or houses in their neighborhood, with almost half (43%) reporting that there were such properties.

Inability to find affordable and nutritious food:

The majority of respondents agreed that there was a full-service affordable supermarket in their neighborhood (58.6%) and also that they could find affordable and nutritious food in their neighborhood (56.1%), and the two measures were strongly associated with each other ($p=.000$). However, because some respondents indicated that the affordable and nutritious food that they were accessing did not necessarily come from a supermarket (for example, it came from a local food pantry), we have chosen to use access to affordable and nutritious food as an indicator for food access rather than the presence of a supermarket. Despite these relatively positive ratings, the Richmond General Plan (2009) says that almost three-quarters (72.3%) of Richmond residents live in a food desert, or an area with limited access to healthy food, as defined by fast food being more than 1.5 times as close as a grocery store.

Cumulative impact of neighborhood stressors:

We developed a cumulative risk score that combined five neighborhood factors known to be health stressors: feeling unsafe, heavy car or truck traffic, loud noise from cars/motorcycles/trains/airplanes, presence of vacant lots/houses, and inability to find affordable and nutritious food. Each of these factors was presented as a statement, and respondents were asked to what extent they agreed or disagreed with each of the statements using a Likert scale.

Statements were recoded so that all statements were directed negatively (i.e., lower scores correspond with greater cumulative risk). Responses for each of the five statements were then summed. Respondents' scores filled the entire range of possible scores, from 5-25. Respondents were categorized into high cumulative risk ($n=55$), medium cumulative risk ($n=95$), and low cumulative risk ($n=47$). The distribution of scores is noted in figure 9.

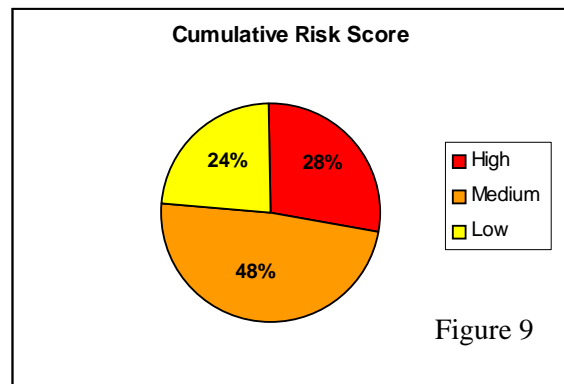


Figure 9

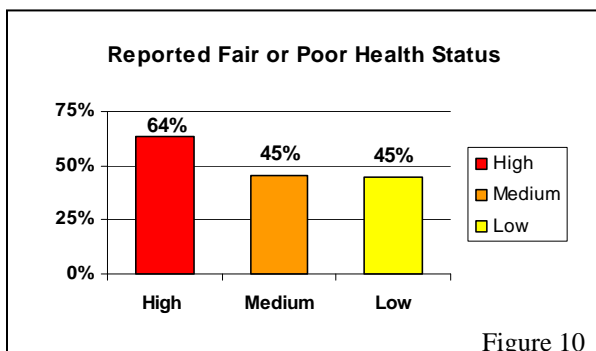


Figure 10

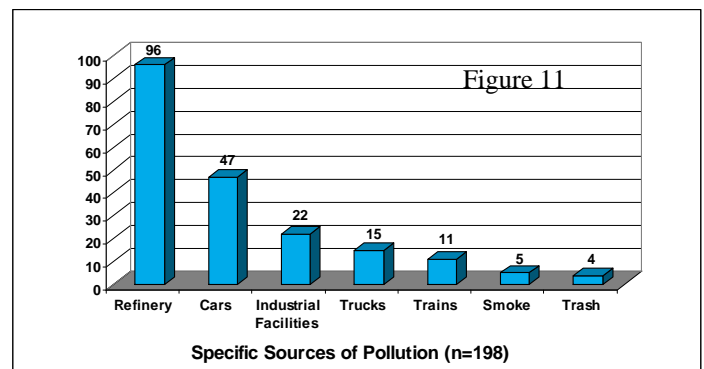
Cumulative risk score is associated with self-rated health ($p=.011$), with people who report higher perceived cumulative neighborhood risk being more likely to report fair or poor overall health. As shown in figure 10, 63% of those reporting high cumulative risk report a lower health rating, as compared to 45% of those reporting medium or low

cumulative risk. Each of the factors included in our cumulative risk score has been individually found to be associated with health in other studies, so our study supports that literature and adds to the base of research calling for considerations of the built environment and community-level stressors when considering health interventions and policies.

Perceptions of cumulative risk did not vary significantly across the four neighborhoods studied ($p=.115$), probably because the areas surveyed are all heavily burdened neighborhoods with high levels of neighborhood stressors.

Sources of Pollution

Almost all (93.4%) of respondents were concerned about pollution and its link to health. Respondents were asked about all possible types of pollution (air pollution, kids being exposed to chemicals in the dirt or sand in parks and gardens, soil contamination, contaminated vegetables and fruits from gardens, contaminated sites, and water pollution), and while respondents were more concerned about air pollution (87.9%) and childhood exposure (83.3%) than the other items, at least 73% of respondents were concerned about each type of pollution. Our results suggest that the heavy burden of pollution in these four Richmond neighborhoods has made respondents highly concerned about all types of pollution.



Eighty-five percent of respondents were concerned about industrial pollution. Respondents were asked to identify specific sources of pollution of concern (see figure 11). Having heard of Communities for a Better Environment was not associated with respondents having specific sources of pollution of concern ($p=.451$), indicating that environmental pollution is a community-identified problem rather than an issue influenced by CBE membership. The Chevron refinery was the most commonly listed source of pollution, followed by cars, industrial facilities, trucks, and trains. These are all highly visible sources of pollution and their presence is well-known. Less immediately visible or tangible pollution sources that CBE has identified to be present in these neighborhoods, including pesticide drift from a nearby nursery, leaking underground storage tanks, and indoor air pollution from household chemicals, were not listed.

Conclusion

This report quantitatively describes community perceptions of the health burdens of four Richmond neighborhoods. In particular, people felt that their neighborhood was a good place to live, indicating strong community ties, but expressed concerns about neighborhood stressors (including access to healthy food, heavy traffic, and feeling safe) and particular sources of pollution, including the Chevron refinery, motor vehicles, and the train. Respondents were affected by asthma: long-time adult residents were more likely to have asthma than those who had lived in Richmond for only a few years, and the childhood asthma rate is high relative to national and California averages. The prevalence of asthma is compounded by limited access to health care as measured by insurance coverage.

These findings validate community-identified issues and serve as a reference point for communities that embark upon their own health survey and for those communities who have similar environmental and social risk factors. The Richmond Health Survey also validates findings such as the Harlem study (Nicholas et al, 2003) that observe higher levels of health problems in heavily polluted communities, bolstering the evidence demonstrating the existence of inequitable environmental and health burdens that served as the basis of the environmental justice movement.

Finally, in line with adding to evidence of environmental injustice, findings from the Richmond Health Survey supports a cumulative risk approach to guide decision-making and interventions to improve community environmental health—namely, that people are exposed to multiple sources of pollution and stressors that can cause and intensify multiple diseases. This suggests the need to move interventions and health risk assessments beyond traditional pollutant-by-pollutant and single emission source models that fail to account for the diverse and multiple exposures communities face in the environments where they live, work and play. Environmental health scientists and environmental justice activists have begun to move away from this single polluter/single disease framework and towards a model of multiple stressors and cumulative risk, and the Richmond Health Survey findings add to the research body encouraging this movement shift.

Policy Recommendations

- Precautionary principle: Richmond City Council should adopt a principle to have zero increase in air pollution in Richmond and support green initiatives and alternatives that reduce pollution.
- Cumulative impact: Richmond City Council should implement effective cumulative impact policies that include quantifiable regulations to prevent further hazardous exposures to residents' health by recognizing the total pollution burden in a community. The Bay Area Environmental Health Collaborative defines cumulative impact as the public health and environmental effects from combined

emissions, discharges, and exposures in a geographic area where people live, work, play, and learn. In particular, address the cumulative impact of air pollution, especially in communities already disproportionately affected by poor air quality.

- **Public health:** Richmond City Council should work to increase access to healthcare, especially for underresourced ethnic and language minority populations.
- **Community Involvement:** City Planning Boards and Community Based Organizations should include community residents in the planning, development, and implementation of all the above to guarantee equitable and beneficial progress.

References

- Brody JG, Morello-Frosch R, Brown P, Rudel RA, Altman RG, Frye M, Osimo CA, Pérez C, Seryak LM. “Is it Safe?": New Ethics for Reporting Personal Exposures to Environmental Chemicals.” *American Journal of Public Health*. 2007a; 97 (9): 1547-1554.
- Brody JG, Moysich KB, Humblet O, Attfield KR, Beehler GP, Rudel RA. “Environmental pollutants and breast cancer: epidemiologic studies.” *Cancer*. 2007b; 109 (Suppl 12): 2667-2711.
- Brown P. “Qualitative Methods in Environmental Health Research.” *Environmental Health Perspectives*. 2003; 111: 1789-1798.
- Brown P, Morello-Frosch R, Brody JG, Altman RG, Rudel R, Senier L, Perez C. “IRB Challenges in Multi-Partner Community-based Participatory Research.” In: *Contested Illnesses: Ethnographic Explorations* (eds. P Brown, R Morello-Frosch, S Zavestoski), in press.
- Bullard, Robert D., Paul Mohai, Robin Saha, Beverly Wright. “Toxic Wastes and Race at Twenty, 1987-2007: Grassroots Struggle to Dismantle Environmental Racism.” United Church of Christ report. 2007. Accessed on: 23 Nov. 2008. Available online at: <www.ejrc.cau.edu/TWART-light.pdf>.
- City of Richmond. “2006 and Beyond: A Demographic Profile of the City of Richmond, California.” 24 April 2006. Planning and Building Services Department, City of Richmond. Accessed on: 9 Oct. 2008. Available online at: <<http://www.ci.richmond.ca.us/index.asp?nid=241>>.
- Domingo JL. “Vanadium: a review of the reproductive and developmental toxicity.” *Reproductive Toxicology*. 1996; 10 (3): 175-182.
- Filleul C, Medina S, Cassadou S. “La pollution atmosphérique particulaire urbaine: de l'épidémiologie à l'impact sanitaire en santé publique.” *Rev Epidemiol Sante Publique*. 2003; 51: 527-542.
- Jerrett M, Shankardass K, Berhane K, Gauderman WJ, Kunzli N, Avol E, Gilliland F, Lurmann F, Molitor JN, Molitor JT, Thomas DC, Peters J, McConnell R. “Traffic-related air pollution and asthma onset in children: a prospective cohort study with individual exposure measurement.” *Environmental Health Perspectives*. 2008; 116 (10): 1433-1438.
- Krieger, Nancy. “Theories for social epidemiology in the 21st century: an ecosocial perspective.” *International Journal of Epidemiology*. 2001; 30: 668-677.

Lerner, Steve. *Diamond: a struggle for environmental justice in Louisiana's chemical corridor*. Cambridge, MA: MIT Press, 2005.

Marmot, Michael. "Social determinants of health inequalities." *Lancet*. 2005; 365 (9464): 1099-1104.

Matsuoka, Martha. "Building Healthy Communities From the Ground Up: Environmental Justice in California." September 2003. Report for Asian Pacific Environmental Network, Communities for a Better Environment, Environmental Health Coalition, People Organizing to Demand Environmental and Economic Rights, and Silicon Valley Toxics Coalition/Health and Environmental Justice Project. Available online at: <www.cbecal.org/pdf/healthy-communities.pdf>.

May, Julia. "Refinery Flaring in the Neighborhood: Routine flaring in the San Francisco Bay Area, the need for new regulation and better environmental law enforcement, and the community campaign to get there." Communities for a Better Environment report. Spring 2004. Available online at: <www.cbecal.org/pdf/refinery-neighborhood.pdf>.

Minkler, Meredith, Victoria Breckwich Vasquez, Charlotte Chang, Jenesse Miller, Victor Rubin, Angela Glover Blackwell, Mildred Thompson, Rebecca Flournoy, and Judith Bell. "Promoting Healthy Public Policy through Community-Based Participatory Research: Ten Case Studies." PolicyLink report. 2008. Available online at: <http://www.policylink.org/documents/CBPR_final.pdf>.

Moore Iacofano Goltsman, Inc. "Richmond General Plan Update: Issues & Opportunities Paper #8: Community Health and Wellness." Draft report. July 2007.

Morello-Frosch RA, Woodruff TJ, Axelrad DA, Caldwell JC. "Air toxics and health risks in California: the public health implications of outdoor concentrations." *Risk Analysis*. 2000; 20: 273-291.

Morello-Frosch R. "Discrimination and the political economy of environmental inequality." *Environment and Planning C: Government and Policy*. 2002; 20: 477-496.

Morello-Frosch R, Pastor M, Porras C, and Sadd J. "Environmental Justice and Regional Inequality in Southern California: Implications for Future Research." *Environmental Health Perspectives*. 2002; 110 (suppl 2): 149-154.

Morello-Frosch R and Lopez R. "The Riskscape and the Colorline: Examining the Role of Segregation in Environmental Health Disparities." *Environmental Research*. 2006; 102(2): 181-196.

Morello-Frosch R. Presentation. "Citizens, Science, and Data Judo: Environmental Justice and the Science of Community Environmental Health." Dec. 2007.
Morello-Frosch R. Report to Richmond City Permitting Council on Proposed Changes in Refinery Operations. Unpublished document. 7 Apr. 2008.

Morello-Frosch R, Brown P, Lyson M, and Cohen A. "Who Bears the Burden? An Environmental Justice Framework on Vulnerability, Resilience, and Recovery from Hurricane Katrina." Under review. 2008.

Nicholas SW, Jean-Louis B, Ortiz B, Northridge M, Shoemaker K, Vaughan R, Rome M, Canada G, and Hutchinson V. "Addressing the Childhood Asthma Crisis in Harlem: The Harlem Children's Zone Asthma Initiative." *American Journal of Public Health*. 2005; 95: 245-249.

Northridge ME, Jean-Louis B, Shoemaker K, Nicholas S. "Advancing population health in the Harlem Children's Zone Project." *Social and Preventive Medicine*. 2002; 47: 201-204.

Pastor M, Sadd J, and Morello-Frosch R. "Still Toxic After All These Years: Air Quality and Environmental Justice in the San Francisco Bay Area." February 2007. Report for the Bay Area Environmental Health Collaborative.

Perez C, Zota A, and Altman RG. "Exposure Research and Community Capacity Building: Household Exposure Monitoring in Massachusetts and California Communities." National Institute of Environmental Health Sciences Environmental Justice Program Grantees Meeting, Boston, MA. Presentation. 11 Dec. 2007.

Silent Spring Institute. "Household Exposure Study in Richmond and Bolinas, CA." 2008. Accessed: 18 Oct. 2008. <<http://www.silent.spring.org/our-research/everyday-chemical-exposures/household-exposure-study-richmond-and-bolinas-california>>.

Zota AR, Rudel RA, Morello-Frosch RA, and Brody JG. "Elevated House Dust and Serum Concentrations of PBDEs in California: Unintended Consequences of Furniture Flammability Standards?" *Environmental Science and Technology*. 2008 (web release).