

Pittsburgh Economic Quarterly

University Center for Social and Urban Research (UCSUR)

Do Lead Water Laterals Affect Property Values?

■ by Michael Blackhurst

The Pittsburgh Water and Sewer Authority (PWSA) provides drinking water for a majority of Pittsburgh's residents. In late 2016, lead samples in Pittsburgh exceeded the federal action level. Since then, the PWSA, residents, and community stakeholders have worked to clarify the extent of lead exposure and formulate solutions to protecting public health.

Lead water service laterals are the primary source of lead in drinking water. The water service lateral (or water service line) is the pipe connecting your home to the main water system. Ownership of lead laterals is split between municipalities and property owners. Municipalities own the lateral extending between

the main water system and the shut-off valve located near the street curb. Private property owners own the lateral located between the shut-off valve and the water meter located on private property.

While Federal and state regulations require replacing lead laterals when elevated lead levels persist, communities face a number of challenges replacing them. Full replacements require that municipalities and property owners both agree to replace their portion. Line replacements are expensive, and the benefits to property owners are often unclear. If the benefits do not exceed the cost, private property owners are unlikely to participate.

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Geography of Population Migration Flows Impacting the Pittsburgh Region

■ by Christopher Briem

How does migration impact Pittsburgh's population? Population migration is one factor impacting population change in the Pittsburgh region. In addition to population migration, natural population change results from differences between the number of deaths and the number of births. While natural population change mostly reflects the age distribution of the population and changes slowly over time, population migration flows show greater volatility year over year, often reflecting differences in economic conditions between the Pittsburgh metropolitan region and other regions of the country.

The Internal Revenue Service (IRS), in partnership with the U.S. Census Bureau, compiles data on migration based on year-to-year address changes reported on individual income tax returns. Data on population flows include the total number of filings,

the total number of exemptions, and the aggregate adjusted gross income moving between states and between individual counties each year. The latest migration data made available by the IRS reflects migration between 2015 and 2016. The total number of exemptions can be interpreted as the total number of residents represented by the IRS data. While the IRS has estimated this data captures around 80% of population migration within the United States, it is less likely to include the migration of population groups who are not required to, or fail to, file tax returns with the IRS. Underrepresented groups include those in low income households or individuals filing tax returns for the first time.

The county-to-county migration data available from the IRS has been compiled here to show the geographic pattern of migration between the

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Do Lead Water Laterals Affect Property Values?

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What might affect the benefits and costs of a lateral replacement? Property owners may or may not accurately perceive the costs and benefits. For example, typical replacement costs range from \$4,000 and \$15,000, depending upon the length and depth of the lateral and any restoration costs. Property owners may not properly understand why these costs vary and misestimate their replacement cost. Benefits vary demographically and are

likely much higher in homes with expecting mothers or children ages six and under.

Private property owners also face transaction costs, or the time and expense incurred in participating in a replacement and any subsequent restoration. Transaction costs have been shown to limit engagement in energy efficiency opportunities, even when those opportunities are clearly profitable to property owners. Given the high transaction costs of a lateral replacement, property owners may prefer filtration, even if the long-term hard costs of filtration exceed replacement costs.

The benefits and costs of a replacement may not be evenly shared, a situation

referred to as a “split incentive.” Landlords and pending sellers would realize little to no health benefits of replacement lead lines, shifting the risks to renters and pending buyers. As a result, it is not often clear if and under what property-specific conditions the benefits of a lateral replacement exceed the cost.

The State of Pennsylvania and PWSA recently made publically-funded full line replacements feasible. Municipal approval to fully replace lead laterals is helpful. However, municipalities still need both the permission of private property owners and the resources to fully replace a lateral. In 2018, PWSA intends to replace 2,100 lead laterals, which covers roughly 10% of PWSA’s estimated inventory of lead service laterals.

In the short-term, how do municipalities prioritize limited resources available for full line replacements? Potential replacement strategies include prioritizing at-risk populations, implementing a cost-effectiveness strategy, asking willing property owners to partially pay for replacements, or some combination thereof.

The objective of this study is to identify potential lead lateral replacement strategies by drawing on relationships between property sales values and the presence of lead drinking water laterals.

Why study property sales? Property sales and rental prices often reflect how people weigh a variety of property characteristics and nearby amenities. For example, people often positively value the size of the property, the number of bathrooms, proximity to transit, and the quality of public schools. They also often devalue high crime areas, unsafe conditions, and exposure to pollution. The net balance of these amenities is reflected (or “capitalized”) in sales and rental prices. By studying the relationship between real estate prices, property characteristics, and nearby amenities, analysts can better understand if and to what extent people value particular characteristics or

Table 1. Summary of model fitting prices of 2,833 homes sold in Pittsburgh, PA between Jan. 2012–Feb. 2018 to property characteristics, year sold, location, and the presence of a lead water lateral. Model coefficients for neighborhoods are suppressed for clarity.

Variable	Estimate	Std Error	P-value
Intercept (B0)	10.822	0.266	<0.001
Lead expected	-0.049	0.028	0.079
Bedrooms - 2	0.164	0.087	0.059
Bedrooms - 3	0.339	0.087	<0.001
Bedrooms - 4	0.437	0.089	<0.001
Bedrooms - 5	0.593	0.096	<0.001
Bedrooms > 6	0.559	0.097	<0.001
Lot size in square feet	0.000	0.000	<0.001
Condition - Poor to fair	0.596	0.138	<0.001
Condition - Average	0.978	0.137	<0.001
Condition - Good to excellent	1.294	0.139	<0.001
Year - 2013	0.170	0.045	<0.001
Year - 2014	0.194	0.047	<0.001
Year - 2015	0.321	0.047	<0.001
Year - 2016	0.339	0.046	<0.001
Year - 2017	0.324	0.047	<0.001
Year - 2018	0.006	0.115	0.959
Homestead - Rental	-0.230	0.019	<0.001
Lead expected: Lot size in square feet	0	0	0.759

Residual standard error: 0.461 on 2739 degrees of freedom

Adjusted R-squared: 0.709

F-statistic: 86.9413884 on 80 and 2739 DF, p-value: < 2.2e-16

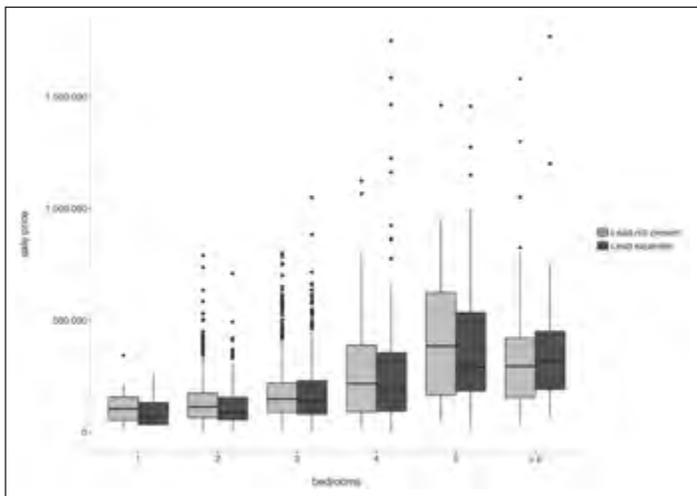


Figure 1. Sale prices of 2,833 homes in Pittsburgh, PA between January 2012 and February 2018 by bedroom size and the expected presence of a lead water line.

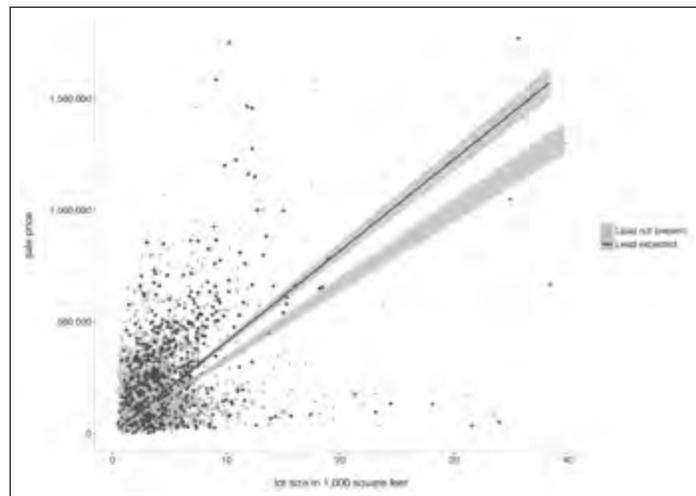


Figure 2. Sale prices of 2,833 homes in Pittsburgh, PA between January 2012 and February 2018 by lots and the expected presence of a lead water line. Zero y-intercepts were forced into the fitted linear models.

amenities. In this study, we explore if and to what degree the presence of lead service laterals effects property sales values in Pittsburgh, PA and discuss the implications for replacement strategies.

Property characteristics data and property sales records from January 2012 to February 2018 were provided by Allegheny County. Data describing service laterals by address were provided by PWSA. Lead laterals were assumed present at the time of sale if any historical PWSA data indicated lead was present and no more recent information (e.g., inspections) indicated otherwise.

The sample used for analysis consists of 2,833 market sales of residential properties in 63 of Pittsburgh’s 90 neighborhoods. Approximately half of the sold properties were expected to have a lead drinking water service line. Figure 1 summarizes variation in prices by bedroom and indicators of a lead service line. Figure 1 indicates that the presence of a lead water line appears to decrease the median sale price for all home sizes except for those larger than 5 bedrooms.

Assuming lot size serves as a reasonable proxy for replacement costs, Figure 2

explores whether the market reflects variation in replacement costs. The fitted lines in Figure 2 diverge with increasing lot size, meaning that lead’s effect on price increases with increasing lot size. These results suggests that buyers and sellers may correctly perceive lateral replacement costs.

Linear regression models describing the sale price as a function of property characteristics, nearby amenities, year of sale, and the historical presence of lead were explored. Using standard model diagnostics (error distributions, overall fit, and adjusted R²), the preferred model is summarized in Table 1.

Table 1 indicates that all selected factors are significant at the 10% level except year 2018 and the interaction between lead and lot size. Thus, the trend in which lead’s effect on price increases with lot size observed in Figure 2 is not statistically significant for the sample studied.

The coefficient for expected presence of a lead lateral is -0.049, and is significant at the 5% level ($p = 0.079$). These results suggest that lead laterals are correlated with a -4.9% decrease in sales price.

On average, lead laterals reduced the sales price by \$9,700 (\$6,500 for a 2-bedroom home and \$13,000 for a 4-bedroom home).

Readers should be sensitive to limitations of data quality and causality. These results indicate that lead’s estimated reduction in sale prices aligns with casually understood cost estimates for lead line replacements. This does not necessarily mean that the market values lead mitigation at its cost. The price effects of lead could simply be a product of home buying practices. Prior to finalizing a sales agreement, it is common for buyers to inspect properties, receive quotes for any desired improvements, and negotiate the sales price accordingly prior to closing. Thus, the presence of lead laterals could be bargaining power for buyers, not a reflection of how they value lead mitigation. More information would be needed to determine if buyers allocate savings from a price reduction to lead mitigation.

Challenges to causality are also apparent when one considers the seller’s perspective. Given the low replacement rate of lead laterals, sellers apparently do not value the marginal cost of their replacement given the potential marginal increase in sales

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Geography of Population Migration Flows Impacting the Pittsburgh Region

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Pittsburgh Metropolitan Statistical Area (MSA) and other metropolitan areas in the United States. The Pittsburgh MSA is currently defined as a seven-county region of southwestern Pennsylvania comprised of Allegheny, Armstrong, Beaver, Butler, Fayette, Washington, and Westmoreland counties.

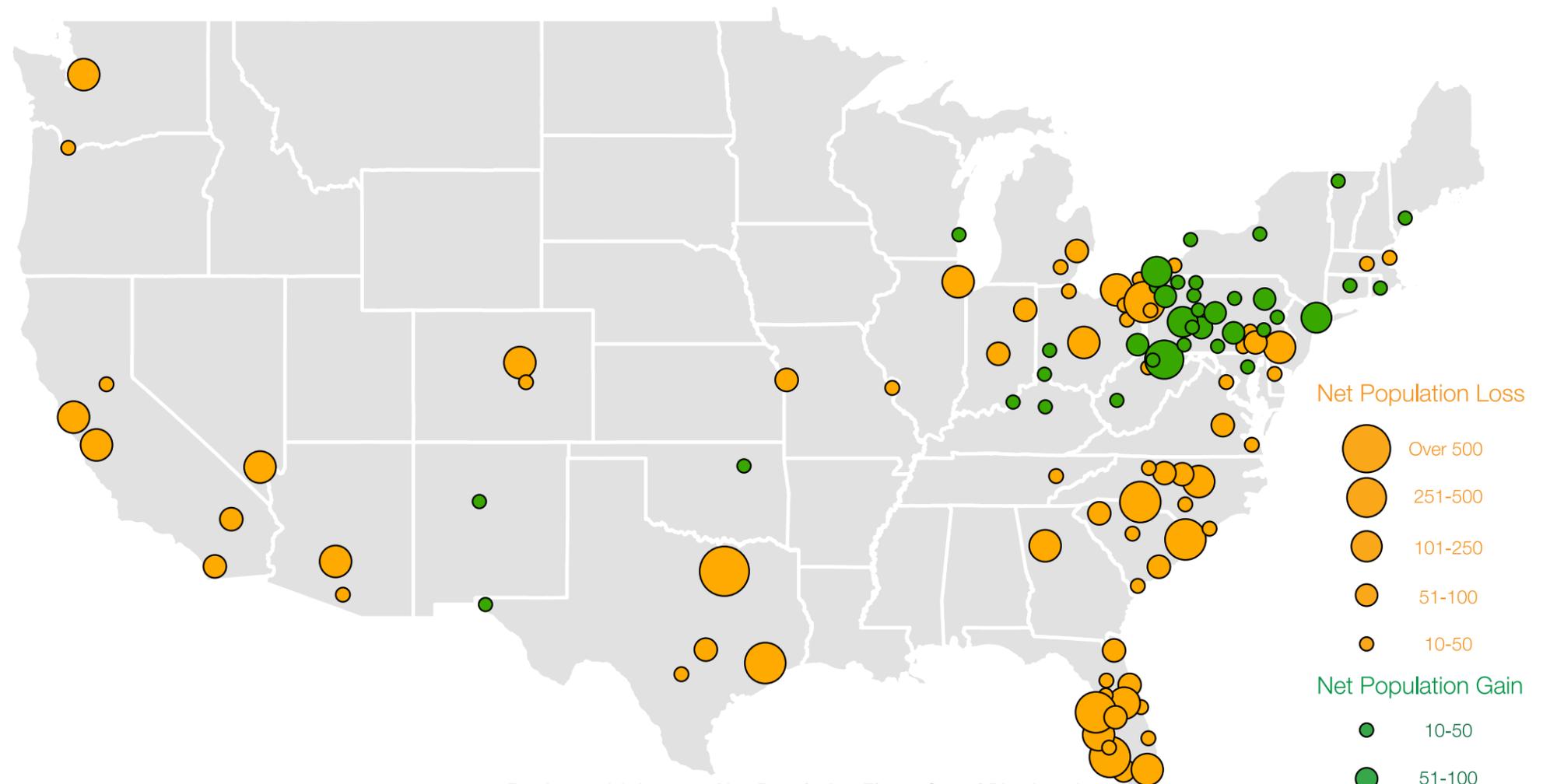
IRS data indicates that 45,837 individuals moved out of the Pittsburgh MSA between 2015 and 2016, compared to a total of 38,030 who moved in, resulting in a net population loss due to migration of 7,807. The largest flows of population both into and out of the Pittsburgh region typically are generated by large metropolitan regions in proximity to Pittsburgh. In 2016, the New York City, Washington, DC, and Philadelphia, PA MSAs were among the four regions generating both the largest inflows and the largest outflows of population impacting Pittsburgh. Migration flows between Pittsburgh and other large MSAs are typically evenly balanced.

The MSAs which generated the largest net migration losses for Pittsburgh include Dallas, Tampa, and Houston. With the exception of the New York City MSA, the regions which generate the largest net migration gains into the Pittsburgh region are MSAs in close proximity to Pittsburgh or elsewhere within Pennsylvania, including Morgantown, WV, Erie, PA, Wheeling, WV, and Altoona, PA.

Population migration is the result of several different factors. Migration of the working age population is most often tied to employment opportunities and relative economic conditions between regions. Retiree migration is another major source of migration, and likely is reflected in the concentration of net loss of population from Pittsburgh to regions concentrated in Florida, North

Largest Net Migration Flows Impacting the Pittsburgh Metropolitan Statistical Area between 2015-2016

This data was compiled from the county-to-county population migration files prepared by the Internal Revenue Service (IRS) in collaboration with the U.S. Census Bureau. This data tracks changes of address for individual tax returns over successive years. The total number of exemptions reported on tax filings is assumed to reflect the total population. Data was recompiled to reflect the population flows moving between the seven-county Pittsburgh Metropolitan Statistical Area (MSA) and other MSAs within the United States. The map shows the MSAs with the largest net migration flows into or out of the Pittsburgh MSA between 2015 and 2016. Not shown are net migration flows between Pittsburgh and non-metropolitan counties, or where total net migration flows between Pittsburgh and other MSAs are less than 10.



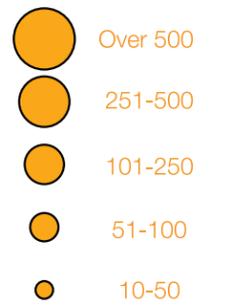
Regions with Largest Net Population Flows Into Pittsburgh

Metropolitan Statistical Area	Inflow	Outflow	Net
Morgantown, WV	510	220	+290
Erie, PA	648	428	+220
New York-Newark-Jersey City, NY-NJ-PA	1,289	1,110	+179
Wheeling, WV-OH	184	99	+85
Altoona, PA	176	108	+68
Scranton--Wilkes-Barre--Hazleton, PA	106	38	+68
Harrisburg-Carlisle, PA	317	257	+60
State College, PA	177	120	+57
El Paso, TX	49	0	+49
Allentown-Bethlehem-Easton, PA-NJ	159	113	+46

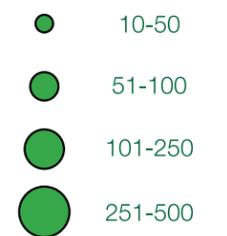
Regions with Largest Net Population Flows Out of Pittsburgh

Metropolitan Statistical Area	Inflow	Outflow	Net
Dallas-Fort Worth-Arlington, TX	235	792	-557
Tampa-St. Petersburg-Clearwater, FL	199	682	-483
Houston-The Woodlands-Sugar Land, TX	224	535	-311
Charlotte-Concord-Gastonia, NC-SC	157	429	-272
Youngstown-Warren-Boardman, OH-PA	715	987	-272
Myrtle Beach-Conway-North Myrtle Beach, SC-NC	35	296	-261
Cape Coral-Fort Myers, FL	63	318	-255
Phoenix-Mesa-Scottsdale, AZ	213	457	-244
Columbus, OH	241	448	-207
Cleveland-Elyria, OH	293	488	-195

Net Population Loss



Net Population Gain



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Geography of Population Migration Flows Impacting the Pittsburgh Region

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Carolina, and South Carolina. The large net outmigration from Pittsburgh to regions in Texas is not typical, and may reflect changing employment patterns in the oil and gas industries over recent years.

The IRS migration data can also be used to measure the population migration flows within the Pittsburgh MSA. Between 2015 and 2016, 27,879 residents of the Pittsburgh MSA moved to a different county, but remained within the region. The largest inter-county net migration flow was a net loss of 1,071 people from Allegheny County and Butler County. Allegheny County experienced a net loss of population to suburban counties of 3,306 people over the year.

Trends in IRS migration flows impacting Pittsburgh are not included here because of recent changes in the methodology used by the IRS and Census Bureau in compiling migration data; current data may not be directly comparable to previous data and similar compilations. Previous reports on migration in the Pittsburgh region utilizing IRS data include: *Migration Trends in the Pittsburgh Region: Update Through 2010*, available on the UCSUR web page: www.ucsur.pitt.edu.

Largest Population Flows Impacting Pittsburgh between 2015 and 2016

Top Destinations for the Population Leaving Pittsburgh		Top Originations for the Population Coming to Pittsburgh	
New York	1,110	New York	1,289
Philadelphia	1,036	Washington	997
Washington	1,016	Philadelphia	880
Youngstown	987	Youngstown	715
Dallas	792	Erie	648
Tampa	682	Morgantown	510
Chicago	562	Chicago	405
Houston	535	Los Angeles	362
Los Angeles	523	Baltimore	355
Miami	500	Weirton	348

Regions reflect Metropolitan Statistical Areas

Net Migration Flows within the Pittsburgh MSA between 2015 and 2016

		Destination County					
		Allegheny	Armstrong	Beaver	Butler	Fayette	Washington
Origination County	Armstrong	-5					
	Beaver	-362					
	Butler	-1,071	12	57			
	Fayette	18					
	Washington	-988		57	35	-45	
	Westmoreland	-898	28	8	38	-74	21

UCSUR Continues Partnership with RAND in PHRESH 2018

UCSUR, in partnership with the RAND Corporation, is in its 7th year working on the PHRESH: *Pittsburgh Hill/Homewood Research on Neighborhood Change and Health* project. PHRESH began in 2011, studying residents' health and nutrition, food shopping (where they bought food, how they got there), perceptions about their neighborhood, and access to healthy food options. Since then, the PHRESH study has expanded in several ways and continues to look at whether and how neighborhood improvements affect health and well-being through:

- Diet and exercise habits
- Resident use of parks and neighborhood green spaces
- Transportation access
- Perceptions of neighborhood safety
- Heart health, including blood sugar and blood pressure

UCSUR's Survey Research Program provides interviewer training, questionnaire programming, database management, and data collection support for this research. The study began with a cohort of nearly 1400 households in the Hill District and Homewood neighborhoods in Pittsburgh and follows the households and the neighborhood environment over time. In addition, researchers from RAND Health, part of the RAND Corporation, are collaborating with the Hill House Association, Operation Better Block, Inc., and Homewood Children's Village. Data Collection for PHRESH 2018 Starts in May.

Do Lead Water Laterals Affect Property Values?

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value. It could be that the average seller is unaware of lead's effect on sales values or that buyers' value more the marginal benefit of lead mitigation. Sellers likely expect to occupy the home for less time than a buyer. Buyers may also have more children than buyers and, as a result, value more the benefits of lead mitigation. Here again, more information - such as a survey of buyers and sellers - would be needed to clarify these circumstances.

These results do suggest that the average home buyer in Pittsburgh is likely aware that some properties are served by a lead water line. As a result of this awareness, buyers are either willing to pay more for properties served by non-lead laterals,

sellers are willing to accept less for homes with lead lines, or likely some combination thereof.

As public agencies weigh how to gain participation in full replacement programs, pending sellers may provide a good pool of participants. The results profiled here suggest that lead laterals devalue homes at an amount consistent with typical lateral replace costs. Since any municipal incentive (e.g., a rebate) for a full line replacement is unlikely to exceed the replacement cost, the market suggests that any municipal rebate for a full replacement is simply additional profit from a pending sale.

Pending or recent buyers may also be helpful participants in a municipal replacement incentive program. However, more analysis would be needed to determine if lead laterals are primarily a bargaining chip for buyers, or if buyers follow through on lead mitigation after closing. (The Allegheny

County Health Department maintains permits for private plumbing and could provide helpful information regarding lateral replacement following a home purchase.)

Finally, these results may help engage owners of rental properties, where line replacements are likely to be challenging due to tenant-landlord split incentives between the costs and benefits of line replacement. Absent similar market trends between rental prices and lead laterals (where data are missing), demonstrating a positive correlation between property values and lead-free laterals, are likely a helpful strategy for engaging landlords with respect to replacing lead water laterals.

Additional information can be found on the UCSUR web page under *Center Reports* at https://ucsur.pitt.edu/center_reports.php



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