Snitching: Whom to Inform about Pollution from Car Battery Repair

Mikey Jarrell Nathan Lazarus

July 7, 2025

Abstract

How can an externality from a polluting activity be internalized when not even the internality from same activity is being internalized? Battery repairmen (people who repair lead-acid batteries) are a ubiquitous but understudied presence in poor countries. Existing evidence suggests that battery repairmen create substantial amounts of lead pollution, causing lead poisoning for themselves and for others, including family members or people who live or work nearby. Repairmen, and the community at large, appear to be unaware of this fact. We propose an information intervention to improve safety practices of battery repairmen in Lagos, Nigeria.

1 Introduction

All automotive vehicles — with the exception of some electric vehicles such as the newest Tesla models — rely on lead-acid batteries for ignition. In rich countries, when this battery dies and can no longer be resuscitated by jump-starting, it is simply disposed of and replaced. In poor countries, where purchasing a new battery requires a formidable outlay (e.g., a typical battery costs about one-quarter of a month's income for the median Nigerian), a consumer might find it worthwhile to pay a small fee to a battery repairman in hopes that he might extend the battery's lifespan by a few months and delay the need to purchase a new one. This is even more true for lead-acid batteries designed for off-grid solar systems, which are much larger and more expensive.

The problem is that repairing these batteries runs the risk of creating lead pollution. Handling lead plates when removing them from the batteries sends lead dust flying, while soldering together new plates when replacing dead cells generates invisible lead fumes. This is likely causing lead poisoning. Though limited (in quantity and quality), existing studies of

battery repairmen find that they do, in fact, have worryingly high blood-lead levels (Peter, 2009; Ogbenna et al., 2017; Ozomata and Ogunnowo, 2025). Others may be in danger as well: family members may be poisoned when a repairman comes home before changing out of his lead dust-covered work clothes, while people living or working near a repairman's workshop may be breathing lead fumes regularly. The evidence on the extent of this externality is also limited, but it is at least as alarming as the evidence on the internality (Matte et al., 1989; Nunez et al., 1993; Ipeaiyeda and Modupe, 2008; Ahmed et al., 2008; CDC, 2013; Kinally et al., 2023).[1]

Even more worrying is that repairmen appear to be entirely unaware of the health risks they're imposing on themselves or others. We spoke to four repairmen during our preliminary fieldwork in Lagos, and none of them knew that lead was more harmful than any other metal — in line with the findings of Uddin et al. (2019) on this same industry in Bangladesh. It is thus not surprising that none of the repairmen we spoke to used any form of personal protective equipment (PPE), which also aligns with existing studies (Rasheed, 2018).

This suggests that there may be large returns to providing repairmen with information about these health risks — and safety practices that would reduce those risks. In fact, the setting here contains several elements captured by the literature on promoting health-seeking behavior in poor countries by reducing information gaps (Dupas, 2011). As is in Karing (2024), the health benefits here too are invisible: these are likely to be mostly sub-clinical levels of lead exposure, i.e., unlikely to require hospitalization. They are therefore susceptible to procrastination, as in Banerjee et al. (2010b). Here, the challenge is particularly vexing because taking up safety practices may come at the cost of one's productivity today — *à la* Schilbach (2019). As Bassi et al. (2022) showed, entrepreneurs in Africa are perfectly willing to locate their firms in the most polluted parts of the city if that's where the business is.

Even if repairmen had perfect information and had the capacity to act on it, entirely eliminating the internalities, they still would not arrive at the socially efficient outcome because repairmen would be failing to take into account the externalities they cause (Miguel and Kremer, 2004). The most likely victims of a repairman's externalities are his family members — particularly his children, who at a given pollution level, absorb about four times as much lead as adult do, and whose brains are still developing and therefore vulnerable to permanent damage with effects persisting through adulthood (Leggett, 1993; Patrick, 2006; Reyes, 2007). How exactly a child's human capital enters into a parent's utility function is a well-studied but open question (Becker and Lewis, 1973; Duflo, 2003). Other families are likely being affected as well; how a child's human capital enters into the utility function of

[1] Although not the focus here, a major contribution of this study will be to quantify the occupational hazard and the externality of this profession.

some unrelated adult is even more of an open question (Enke et al., 2023).

We might view this externality challenge as one for which we can deploy the tools developed for solving the tragedy of the commons (Ostrom, 1990). The pollution here is mostly airborne and therefore diffuse, difficult to observe, and disobedient of borders (barbed wire or otherwise; (Hornbeck, 2010)) — making enforcement challenging (Jack et al., 2025). This also inhibits a Coaseian (1959) solution, but perhaps providing sufficiently credible information could trigger net welfare-enhancing bargaining. To sustain such a solution, however, would require substantial community involvement, e.g., monitoring. Community participation is a promising direction in which to look (Björkman and Svensson, 2009; Christensen et al., 2021), although it's not infallible (Olken, 2007; Banerjee et al., 2010a); and low willingness to pay for environmental quality in poor countries may pose a challenge to community monitoring (Kremer et al., 2011; Greenstone and Jack, 2015; Baylis et al., 2023).

2 Design

Recruit a sample of 400 battery repairmen in Lagos, Nigeria.[2] The experiment is an information intervention that creates exogenous variation in the recipient of the information and measures its effect on safety behavior.

(T1) Internality. Repairmen randomized into T1 will be invited to a workshop where they will receive the following.

- Information: the dangers of lead poisoning, how to prevent lead exposure from battery repair work, and the results of a test of the lead content of their blood and that of their children.
- PPE to wear while working, including a mask and dedicated work clothing.
- An offer to do battery repair work at a government-approved "mechanics village," which keeps the pollution away from crowded areas. (Picture going a Bassi et al. (2023)-esque collection of self-employed individuals sharing a production space.)

(T2) Family. T2 is the same as T1 except that the family of repairmen in T2 (e.g., their wife and a child) will be invited to the workshop and therefore will be presented with the information.

[2]Repairmen are not hard to find; we estimate that there are at least 1,000 of them in Lagos. If, unexpectedly, Lagos does not have a large enough sample to meet our needs, we will extend the study to Onitsha, a city of almost 2 million inhabitants.

(T3) Community. T3 is the same as T2 except that a "neighbor" (somebody who lives near the repairman's shop) and the "chairman" (the local political leader) of repairmen in T3 will also be invited to the workshop and therefore will be presented with the information.

(C) Control. C is the same as T1 except that they instead receive placebo version of the information intervention, where they learn about general fire safety instead of lead exposure and occupational hazards.

3 Outcomes

The outcome of interest is take-up of occupational safety behaviors that repairmen will learn about during the intervention. These behaviors will have been selected — through what I imagine will be a lengthy process of focus groups and piloting — to be both effective at reducing exposure to lead and not prohibitively costly (in terms of money, time, or annoyance). What we learn during this piloting will inform the exact contents of the intervention: what information, equipment, etc., we provide. For now, assume that the intervention will be as described above. Then the primary outcomes of interest are adoption of the safety behaviors that we prescribe. These behaviors can be categorized as follows.

(O1) Internality: wearing PPE (e.g., a mask) at work

(O2) Family: changing out of work clothes before coming home and showering immediately after work

(O3) Externality: doing repair work in the mechanics villages (or otherwise away from crowded areas)

We will also measure upstream outcomes — e.g., beliefs — to capture mechanisms, and downstream outcomes — e.g., lead pollution, lead poisoning — to capture ultimate impacts.

References

Ahmed, K., Ayana, G., and Engidawork, E. (2008). Lead exposure study among workers in lead acid battery repair units of transport service enterprises, Addis Ababa, Ethiopia: A cross-sectional study. *Journal of Occupational Medicine and Toxicology*, 3(1):30.

Banerjee, A. V., Banerji, R., Duflo, E., Glennerster, R., and Khemani, S. (2010a). Pitfalls of Participatory Programs: Evidence from a Randomized Evaluation in Education in India. *American Economic Journal: Economic Policy*, 2(1):1–30.

Banerjee, A. V., Duflo, E., Glennerster, R., and Kothari, D. (2010b). Improving immunisation coverage in rural India: Clustered randomised controlled evaluation of immunisation campaigns with and without incentives. *BMJ*, 340(may17 1):c2220–c2220.

Bassi, V., Kahn, M., Gracia, N. L., Porzio, T., and Sorin, J. (2022). Jobs in the Smog: Firm Location and Workers' Exposure to Pollution in African Cities. Technical Report w30536, National Bureau of Economic Research, Cambridge, MA.

Bassi, V., Lee, J. H., Peter, A., Porzio, T., Sen, R., and Tugume, E. (2023). Self-Employment Within the Firm.

Baylis, P., Greenstone, M., Lee, K., and Sahai, H. (2023). Is the Demand for Clean Air Too Low? Experimental Evidence from Delhi. *Working Paper*.

Becker, G. S. and Lewis, H. G. (1973). On the Interaction between the Quantity and Quality of Children. *Journal of Political Economy*, 81(2, Part 2):S279–S288.

Björkman, M. and Svensson, J. (2009). Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda. *The Quarterly Journal of Economics*, 124(2):735–769.

CDC (2013). Take-Home Lead Exposure Among Children With Relatives Employed at a Battery Recycling Facility—Puerto Rico, 2011. *JAMA*, 309(13):1340.

Christensen, D., Dube, O., Haushofer, J., Siddiqi, B., and Voors, M. (2021). Building Resilient Health Systems: Experimental Evidence from Sierra Leone and The 2014 Ebola Outbreak. *The Quarterly Journal of Economics*, 136(2):1145–1198.

Coase, R. H. (1959). The Federal Communications Commission. *The Journal of Law and Economics*, 2:1–40.

Duflo, E. (2003). Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa. *The World Bank Economic Review*, 17(>1):1–25.

Dupas, P. (2011). Do Teenagers Respond to HIV Risk Information? Evidence from a Field Experiment in Kenya. *American Economic Journal: Applied Economics*, 3(1):1–34.

Enke, B., Rodríguez-Padilla, R., and Zimmermann, F. (2023). Moral Universalism and the Structure of Ideology. *The Review of Economic Studies*, 90(4):1934–1962.

Greenstone, M. and Jack, B. K. (2015). Envirodevonomics: A Research Agenda for an Emerging Field. *Journal of Economic Literature*, 53(1):5–42.

Hornbeck, R. (2010). Barbed Wire: Property Rights and Agricultural Development. *Quarterly Journal of Economics*, 125(2):767–810.

Ipeaiyeda, A. and Modupe, D. (2008). Heavy metals contamination of topsoil and dispersion in the vicinities of reclaimed auto-repair workshops in Iwo, Nigeria. *Bulletin of the Chemical Society of Ethiopia*, 22.

Jack, B. K., Jayachandran, S., Kala, N., and Pande, R. (2025). Money (Not) to Burn: Payments for Ecosystem Services to Reduce Crop Residue Burning. *American Economic Review: Insights*, 7(1):39–55.

Karing, A. (2024). Social Signaling and Childhood Immunization: A Field Experiment in Sierra Leone. *The Quarterly Journal of Economics*, 139(4):2083–2133.

Kinally, C., Antonanzas-Torres, F., Podd, F., and Gallego-Schmid, A. (2023). Solar home systems in Malawi: Commercialisation, use and informal waste management. *Sustainable Production and Consumption*, 42:367–379.

Kremer, M., Leino, J., Miguel, E., and Zwane, A. P. (2011). Spring Cleaning: Rural Water Impacts, Valuation, and Property Rights Institutions. *The Quarterly Journal of Economics*, 126(1):145–205.

Leggett, R. W. (1993). An age-specific kinetic model of lead metabolism in humans. *Environmental Health Perspectives*, 101(7):598–616.

Matte, T. D., Figueroa, J. P., Ostrowski, S., Burr, G., Jackson-Hunt, L., Keenlyside, R. A., and Baker, E. L. (1989). Lead Poisoning among Household Members Exposed to Lead-Acid Battery Repair Shops in Kingston, Jamaica. *International Journal of Epidemiology*, 18(4):874–881.

Miguel, E. and Kremer, M. (2004). Worms: Identifying impacts on education and health in the presence of treatment externalities. *Econometrica*, 72(1):159–217.

Nunez, C. M., Klitzman, S., and Goodman, A. (1993). Lead exposure among automobile radiator repair workers and their children in New York city. *American Journal of Industrial Medicine*, 23(5):763–777.

Ogbenna, A. A., Ayandokun, O. A., Roberts, A. A., Adewoyin, A. S., and Famuyiwa, C. O. (2017). Hematologic Profile of Battery Repair Workers Occupationally Exposed to Lead in Lagos, Nigeria. *Annals of Tropical Pathology*, 8(2):68.

Olken, B. A. (2007). Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy*, 115(2):200–249.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Canto Classics. Cambridge University Press, Cambridge.

Ozomata, E. A. and Ogunnowo, B. (2025). Assessment of blood lead and haemoglobin levels among battery technicians and local government office workers in South-western Nigeria. *Journal of the College of Community Physicians of Sri Lanka*, 30(4):228–239.

Patrick, L. (2006). Lead toxicity, a review of the literature. Part 1: Exposure, evaluation, and treatment. *Alternative Medicine Review: A Journal of Clinical Therapeutic*, 11(1):2–22.

Peter, A. O. (2009). Total blood and urinary lead levels in battery charging artisans in two metropolitan cities of South West Nigeria. *Journal of Applied Biosciences*, 14:796–799.

Rasheed, T. O. (2018). Safety Practices on Lead Poisoning Among Battery Technicians in Lagos Nigeria, 2017. *Central African Journal of Public Health*, 4(1):27.

Reyes, J. W. (2007). Environmental Policy as Social Policy? The Impact of Childhood Lead Exposure on Crime. *The B.E. Journal of Economic Analysis & Policy*, 7(1).

Schilbach, F. (2019). Alcohol and Self-Control: A Field Experiment in India. *American Economic Review*, 109(4):1290–1322.

Uddin, M. K., Majumder, A. K., Hossain, M. S., and Nayeem, A. A. (2019). Pollution and Perceptions of Lead in Automobile Repair Shops in Dhaka, Bangladesh. *Journal of Health and Pollution*, 9(22):190609.