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Title: Social diffusion of energy efficiency programs among disadvantaged communities: Community learnings and strategy co-development

Authors:

Rachel Coleman*, University of Massachusetts Lowell, Climate Change Initiative and Environmental Science, Lowell MA, USA

Arie Perliger, University of Massachusetts Lowell, Climate Change Initiative and School of Criminology and Justice Studies, Lowell MA, USA

Juliette N. Rooney-Varga, University of Massachusetts Lowell, Climate Change Initiative and Environmental Science, Lowell MA, USA

200 word abstract: Climate change is making it increasingly challenging for households to maintain comfortable and healthy living environments. Events including heatwaves, cold snaps, floods, and energy supply disruptions are becoming more frequent as climate change progresses, increasing the burden on households to manage and mitigate these stressors. Disadvantaged households are at disproportionately greater risk from these events due to their limited resources; however, energy efficiency programs (EEPs) can help ease this burden through subsidized home upgrades that are free or low-cost to residents, including home energy assessments, insulation and weatherization, heat pumps, rooftop solar, and energy-efficient appliances. Participation in these programs is low among disadvantaged communities, yet they have the most to gain. Our project seeks to demonstrate an innovative approach to increasing participation in EEPs through social network analysis and co-developing social diffusion strategies within a pilot community in Lowell, Massachusetts. Preliminary results indicate strong community social networks that could but currently do not facilitate social diffusion because of multiple barriers including distrust of government, language isolation, and lack of awareness. Culturally relevant strategies for activating social diffusion have been co-developed with community organizations and will be tested for their potential to accelerate EEP participation and other climate-resilient behaviors.

Extended abstract

Energy use is intrinsic to quality of life, with lighting, heating, and cooling vital for human health. But not everyone has the same access to energy, with costs and inadequate infrastructure prohibiting many from living in a healthy and comfortable environment. Living in a home without appropriate heating, cooling, or ventilation exposes residents to greater risks of illness and disease, which then further drains their resources for managing home maintenance needs and energy costs. Climate change compounds risks of inadequate housing on human health and extreme temperature and weather events increase energy and maintenance costs (IPCC, 2021). In many states and countries, government programs subsidize energy efficiency upgrades at no or reduced cost to residents, cutting energy costs and improving comfort and resilience to climate extremes (Berg et al., 2020; Stanton, Marzan, and Alisaia, 2018). But the households with the most to gain from these programs, including environmental justice communities and low- to moderate-income, minority status, and renter households, typically have low participation rates (Barbier and Hochard, 2020; Benevolenza and DeRigne, 2019; Brown et al., 2020; DNV, 2020; Navigant, Illume, and Cadeo, 2020; Stanton, Marzan, and Alisaia, 2018). This is true in the city of Lowell Massachusetts, where our project is taking place.

Efforts to increase participation in energy efficiency programs have traditionally relied on advertising by the program provider, but these methods are known to have limited effectiveness, particularly among historically marginalized populations. Instead, our approach will accelerate participation in energy efficiency programs through mobilizing social diffusion within existing community networks (Moglia, Cook, and McGregor, 2017; Uidhir et al., 2022). This innovative and participatory approach for increasing uptake of energy efficiency programs within underrepresented communities was developed through partnerships across the University of Massachusetts Lowell, the City of Lowell, All In Energy, and local community organizations in Lowell.

As the Bass diffusion model shows (Bass, 1969; Stermann, 2000), social diffusion has the ability to rapidly share information across communities through the power of people simply communicating with others in their social network, such as family members, friends, neighbors, and coworkers. Some examples of what this can look like include friends sharing their experiences with each other at social gatherings, family members texting and calling each other to ask or give advice, coworkers discussing topics during work, community groups sharing information via email, community leaders providing guidance, community events, and individuals posting to social media. The effect of a person communicating about a topic with others in their social network, and then those people communicating about the topic with their social network, and so on and so on, generates reinforcing feedbacks that can foster rapid diffusion of information across the community (Bradley et al, 2020; Henrich, 2009; Kraft-Todd et al., 2018; Olivares and Staffetti, 2021; Rahmandad, Lim, and Stermann, 2021; Sy et al., 2020). Information dissemination strategies that leverage social diffusion have the benefit of using the community's existing social resources, including its social networks and the community members within these networks. If successful strategies are identified, they can be readily adapted and scaled to other communities, regions, and climate mitigation strategies.

We focus our pilot work on the Cambodian American community in Lowell, Massachusetts. Our approach combines two methods to realize effective social diffusion. The first is social network analysis, which will provide insight into avenues for mobilizing social diffusion through the social networks

already present in the community, including popular community events and community members who are well-connected. The second aspect of our approach involves co-developing methods for activating self-reinforcing social diffusion with the community. Co-development with the community is vital, since the community's knowledge of their social context enables effective identification of gaps in culturally relevant EEP resources and the most relevant and effective avenues for social diffusion.

Data on the present extent of social diffusion of EEPs, community social networks, participation in EEPs and general awareness of EEP within disadvantaged communities of Lowell was gathered through interviews with community leaders and community members, focus groups, and surveys.

Analysis of the data provided in the interviews and focus groups with community leaders and members indicates that the present state of social diffusion of EEPs within disadvantaged Lowell communities is extremely limited. We also learned of a number of common barriers that disadvantaged households experience when trying to access energy efficiency programs; including unawareness of programs, language accessibility, concerns about program legitimacy, lack of support in all stages of program participation, perceived cost, lifestyle inconveniences, and structural building issues.

Through collaboration with the community, we determined that most of these barriers can be addressed by tailoring strategic social diffusion efforts to the community's specific context and needs. This approach includes developing culturally-relevant resources, training trusted community members to function as energy efficiency program ambassadors and promote EEP uptake and further EEP information sharing among their networks, and supporting community events where EEP information can be shared and EEP information sharers are celebrated (Ashraf, Bandiera, and Jack, 2014, Karlan and McConnell, 2014, Yoeli et al., 2013). These strategies demonstrate a mindful combination of research and community engagement for activating community-relevant methods of social diffusion to increase participation in energy efficiency programs.

With its ability to adapt the methods to local contexts and needs, our project has the potential to increase participation in energy efficiency programs among those who are most at risk from climate-induced energy emergencies across diverse communities. Additionally, a focus on intra-community and interactions and civic engagement can build trust among communities, leaders, and governments and can facilitate rapid uptake of climate change mitigation technologies and behaviors and generate collective action towards climate resiliency as the impacts of climate change grow.

Our analyses of the data from the preliminary phase of learning from the community and co-developing research-informed social diffusion strategies are currently ongoing, and, pending funding, we expect full project implementation to occur later in 2023 with more comprehensive results available in 2024.

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