Using Community Education Interventions to Build Resilience and Avert Crises: How Accidental Dwelling Fires Decreased in Essex County, UK[1]

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Abstract

Can public administrators use community education interventions in disaster management? We examine community education interventions as tools that raise awareness of hazards, communicate risks, and develop resilience in communities. We study a programme in Essex County, UK, in which Essex County Fire and Rescue Services used the results of proportional hazards modelling to identify localities at risk of accidental dwelling fires and to target community education interventions. We then assess the intervention's impact by comparing the incidence of accidental dwelling fires before and after the Parish Safety Volunteer programme began, as well as between treated and untreated areas, in a difference-in-difference regression. We find that there are greater reductions in accidental dwelling fires in treated areas than in untreated areas, and argue that community education interventions can forge vital networks and increase safety for vulnerable people, as well as build trust and resilience important for disaster and crisis prevention.

Keywords: resilience, community education intervention, proportional hazards modelling, fire safety, difference-in-difference, impact evaluation.

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1 Introduction

Community education programmes have grown and waned in popularity as tools of policy implementation. They are cheap to design and implement, and do not require a large or necessarily specialised cache of expertise to deliver. Unfortunately, we know little about whether or not these interventions are effective at changing behaviour. Additionally, evaluations of community education that can be found rarely venture outside of public health literature (for example (Mhurchu et al. 2009)), leaving policy makers and scholars to wonder how education interventions in other fields function.

Assessing the impact of community education interventions (CEIs) is an endeavour that appears to suffer from at least two main issues. First, there are challenges inherent in measuring causal effects of public education on behaviour – scholars have difficulty isolating educational or informational campaigns as drivers of behavioural change, and often publish intervention designs without including results (Lacey et al. 1989). Second, there are natural limitations on the amount of behavioural change CEIs can accomplish (Davies et al. 2008; Dietrich et al. 1992). Null or negative findings of educational campaigns thus often cannot be attributed to whether the intervention was poorly executed, or whether it was simply the wrong intervention for the job at hand. Evidence on CEI effectiveness and potential impact is therefore mixed and contradictory (Cornish and Banerjee 2013).

We set out to determine the conditions under which CEIs can be effective at changing individual behaviour. We argue that because CEIs are interventions specifically designed to spread information, their value is in reducing information asymmetries. Behaviours that are based on misinformation, or a lack of information, are therefore those behaviours we can expect CEIs to change. Those behaviours that are based on informed choice, however, are much less likely to be changed by CEIs.

In this article we evaluate a CEI intended to increase public safety and help prevent disasters. We report on recent work with stakeholders of a pilot disaster prevention programme in Essex County, United Kingdom. Researchers undertook an evaluation of the factors placing homes at risk of accidental dwelling fires (ADFs) using data on fire and rescue service incidents and household socio-demographics. Proportional hazards modelling (Cox 1972) helped identify characteristics of households 'at-risk' for an ADF occurring in Essex County prior to 2016. Results were reported to Essex County Fire and Rescue Services (ECFRS).

In 2016, ECFRS created the *Parish Safety Volunteers (PSV) Pilot Project,* which involved two main parts. First, ECFRS launched community education campaigns about home and fire safety across the county. Second, ECFRS trained volunteers to visit local homes, review fire and burglary safety, and deliver emergency preparedness and mitigation information.

We assess PSV impact by comparing the incidence of ADFs both before and after the PSV intervention (both the general information and the home visit) took place. Considering the intervention to be the treatment, we also compare ADF incidents between treated and untreated areas, in a difference-in-difference quasi-experimental design. We find reductions in ADFs in treated areas, while ADF rates in untreated areas stay the same. PSV-treated locations experienced greater incidence of accidental dwelling fires than untreated locations prior to treatment, whilst after treatment there is no longer a statistical difference between treated and untreated areas.

Results are thus consistent with the idea that these informational visits, and the awareness campaigns preceding them, are associated with a reduction in household dwelling fires in targeted communities. Our study suggests that CEIs can be successful in changing behaviour. We suggest that this success depends in part on targeting information appropriately, and on predicating the interventions on realistic goals and expectations.

We contribute to local government policy making with an example of how a local authority can use existing administrative data and statistical risk models to understand engagement and education. The example here illustrates how a programme based on event incidence and analysed with proportional hazards models can help isolate the most effective places and ways to deliver community education. Though CEIs may not entirely eradicate local government problems, they can solve problems based on information asymmetries.

We also contribute to the literatures on disaster management and policymaking. Research on the relationship between disasters and policy has been instrumental in not only advancing academic knowledge on the policy process, but also informing practitioner understanding of the ways social institutions organise and operate under conditions of extreme stress and uncertainty (Birkland 1997, 2006; May 1991; May and Koski 2013; Nohrstedt 2008). We expand this knowledge with evidence of how community education interventions can deliver policy outcomes in the realm of crisis prevention. CEIs can dispel ignorance and misinformation, change public behaviour, and address some local government concerns with low cost.

2 Community Education Interventions and their Limitations

Community education interventions (CEIs) are programmes designed to educate the general public about issues of particular importance. These interventions are meant to transmit knowledge and information from one group of people to another. Typically the information flows from public officials, health care workers, or non-profit organisations to members of a community.

CEIs are intended to address an underlying problem by dispeling information asymmetries. If people know more about the consequences of a particular undesirable behaviour, they may be able to change their behaviour and eliminate some of the problem themselves. Thus CEIs in the past have included campaigns to alert the public to the harmful effects of smoking, illegal drugs, and talking to strangers, as well as a variety of public health issues from cancer screening to safe sex.

We have a few insights into how CEIs work. For one, we know that different people receive information in different ways. People in affluent areas, for example, tend to receive information well over the internet, while people in economically stressed areas tend to receive information better through community networks (Medina et al. 2006). If a CEI is to be successful at reducing asymmetries between groups, then, it must be delivered in ways that account for such differences.

We can also imagine limits to what CEIs can accomplish. Because they deliver information, CEIs can only address parts of an underlying issue that exist due to lack of information. This means that problems not resulting from information asymmetries must be addressed by other types of interventions.

Consider a stylised example of anti-smoking efforts in the US. In 1944, 41% of adult Americans thought smoking caused lung cancer, compared to 90% in 2002. The increase in awareness corresponded to a decrease in smoking among adults from 45% to 25% during the same time (Dugan 2018). For the next decade, however, smoking rates did not drop any further. In fact, they did not drop again until local governments began banning smoking in public. Recently Gallup announced that the 16% of American adults who smoke are the lowest rates on record (ibid.).

It appears that campaigns about the effects of smoking helped reduce rates of smoking roughly 20 percentage points, but no more. The 25% of adults who continued to smoke despite better knowledge of its effects represent what many CEIs cannot accomplish – changing behaviour that is not based on ignorance, but rather on informed choice. A further reduction in smoking rates only came as local governments took measures to ban and fine smoking, as well.

This example illustrates an important lesson in terms of how we should expect CEIs to perform. When CEIs are successful at sharing information, they often bring communities to a point where they need to 'do something', or rather, 'do something *else'*, problems, that are based on informed choice. We should expect that despite being informed, some people will make choices counter to public administrators' advice. To understand how this might happen, we now discuss resilience and the possibilities and limitations of public education campaigns in contributing to it.

3 Building Disaster Resilience with CEIs

When it comes to disaster prevention and risk reduction, community education interventions can reduce information asymmetries substantially. Effectively communicating risk engages the local community in disaster and crisis prevention and preparation and helps public officials manage critical situations because everyone gets the same base knowledge and a common crisis vocabulary (Ross 2014). Sharing information has the additional long-term benefit of building and improving community resilience (Blackman, Nakanishi, and Benson 2017; Eikenberry, Arroyave, and Cooper 2007; Henly-Shepard et al. 2015), enabling communities to 'bounce back', minimise the effects of a disaster, and facilitate recovery.

Practitioners, policy makers, and researchers agree that resilience is an important aspect of disaster prevention and recovery and a *de facto* policy goal (De Bruijne, Boin, and Van Eeten 2010; Manyena 2006). Yet a common definition of resilience does not exist. Demiroz & Haase (2018) summarise three main views of resilience, based on a system's ability to *resist* (Bruneau et al. 2003), *absorb* (Davis and Robbin 2015), and *adapt,* or *bounce forward*, in response to a disturbance (Manyena et al. 2011).

For Ross (2014), resilience is motivated in part by community engagement. Involving the community in disaster planning and recovery makes individuals responsible for their own safety, and is critical to the creation and reinforcement of community resilience

(Kapucu, Hawkins, and Rivera 2013). Programmes whereby Local Authorities (LAs) work with volunteers from the community are thus a potential avenue for building resilience.

Education is also an important part of building resilience. UNESCO and UNICEF recently dedicated a decade to disaster risk reduction education (2004-2014) with the aim of creating a 'learning culture of safety and resilience', (UNESCO and UNICEF 2014). Such education must be promoted to families and communities and therefore targeted beyond delivery through public school systems (Tuladhar et al. 2014). Higher Education Institution (HEI) consortia aim to do exactly that by uniting local groups with colleges and universities to spread information throughout communities (Fernandez & Shaw, 2016; Lee & Denham, 2018).

Thus, community education interventions are potentially powerful ways to reach diverse sectors of a community. CEIs can forge community ties that lead to cooperation during critical events (Aida et al. 2013) and enhance coping capacity (Henly-Shepard et al. 2015). When informed citizens decide whether or not to participate in preparation, mitigation, rebuilding, and recovery, they should be able to base those decisions on the information CEIs deliver and the community connections the CEIs have forged. We now turn to the case of a prevention programme in Essex County, United Kingdom, to see whether and how a CEI might be successfully delivered.

4 The Parish Safety Volunteers Pilot Program

Essex County Fire and Rescue Services (ECFRS) conceived the Parish Safety Volunteers Pilot Programme in late 2015. Parish Safety Volunteers (PSV) was a joint pilot between the ECFRS and Essex Police (EP) Community Safety Departments (ECFRS 2014). The aim was to deliver a volunteer scheme in partnership with local authorities (LAs) across 36 out of 241 total parishes in Essex County, England. The scheme would support national objectives to strengthen communities (HM Government 2012) by increasing safety and resilience and decreasing the likelihood of accidental dwelling fires (ADFs).

PSV was designed to ease the ECFRS and EP workload by training and authorising volunteers to conduct home safety visits that would have otherwise been assigned to ECFRS technicians. Funded by the Essex Partnership Board through a national Transformation Challenge Award, the scheme received £77,544 from Essex County Council to launch a pilot across Essex in 2016.

ECFRS was aware that socio-cultural factors determine how people understand risk, which in turn affects mitigation and preparation behaviour (Twigg 2003, 2013). Aligning with similar initiatives in Australia (Tannous et al. 2018, 2016) and the United States (Wolters et al. 2017), ECFRS sought to identify sectors of the community at higher than average risk of ADFs. With the use of proportional hazards modelling (reported below), several of these sectors were identified, including low-income residents of social housing, transient singles, and wealthy rural homeowners.

Administrators then launched announcement efforts across the county, hoping to find both PSV volunteers and households willing to receive visits in at least 36 of the parishes visited. ECFRS paid for some targeted advertising on Facebook, and ran press articles pushing the opportunity to either volunteer as PSVs or sign up for a household visit. ECFRS personnel attended multiple parish council meetings, fairs, and events across the county to promote the service, and the ECFRS wider community engagement and communications teams pushed the service in their outreach activities and social media outlets (ECFRS 2017).

The promotional material indicated that PSV visitors would be trained and endorsed by ECFRS, and that they would visit the home of interested individuals to advise on fire and burglary safety. Upon gathering self-submitted contact information, ECFRS contacted every individual who signed up. If, after two phone call attempts and one written letter, the individual was unresponsive or unwilling to set up a visit, the contact was deleted from their records. Out of 414 households/individuals that signed up to be contacted, 274 (53.3%) canceled, and 240 (47.7%) resulting in PSV visits. All visits were agreed to and scheduled with the consent of the homeowner.

Volunteers were recruited from the local community and trained jointly by ECFRS and EP to deliver home safety visits. ECFRS equipped volunteers with official clipboards, paperwork, and hats and shirts to wear during visits. Volunteers' mission was to educate and raise awareness of fire and crime safety practices and hazards. During a visit, volunteers provided assistance in areas of home safety within the remit of the fire and police services, including installing smoke detectors, devising evacuation plans, and advising modifications to enhance security.

PSVolunteers received quarterly training and were empowered to refer residents to other services for health and wellbeing guidance. Each visit lasted approximately one hour. Volunteers delivered approximately 240 one-hour home safety visits across 72 parishes (29.9% of total parishes) in Essex over 12 months, beginning in March 2016.

The PSV Pilot can be considered a community education intervention because its overarching goal was to reduce the incidence of accidental dwelling fires (ADFs) in parishes receiving visits. The initial announcement/publicity campaigns soliciting participation was the first message that safety could be improved. Then a small number of visits was designed to encourage information sharing among neighbours and community members and thereby improve fire safety across the community. In this way, a visit to one home in a parish was hoped to reduce ADF incidence across the area.

5 Data and Analysis

In this section, we present the data and analysis for two different portions of the PSV Pilot. First, we demonstrate the proportional hazards analysis that highlighted socio-demographic groups who might be at greater than average risk of accidental dwelling fires, as well as their preferred means of contact. Subsequently, we present the difference-in-difference analysis of ADF incidence in treated versus untreated communities, and demonstrate the reduction in ADFs among treated communities over time.

We base the below analyses on several data sources. ECFRS provided administrative (operational) data on fire incidents and parish safety visits from their own records (2006-2017) under a data sharing agreement with the authors' university. We combined this with Experian Mosaic Data (2016), a dataset created to help categorise households according to socio-demographic indicators, such as stage in life, home ownership, and income (see References for full links and Appendix for full list of classifications). From the UK Office of National Statistics we were able to cull geographic boundary information regarding *lower layer super output areas* (LSOAs)[i]. One LSOA may contain multiple parishes or parts of parishes, and we classified PSVs into LSOAs using the *Lower Layer Super Output Area (2001) to Lower Layer Super Output Area (2011) to Local Authority District (2011) Lookup in England and Wales* (ONS 2017) dataset. For data on the number of dwellings per LSOA, we used Table 100: Number of Dwellings by Tenure and District, England from the Live Tables available via the Department for Communities and Local Government, UK website.

5.1 Defining at-risk community groups

To identify segments of the community at greatest risk of ADF, we conducted survival analysis with a Cox proportional-hazards model (Cox 1972) adjusted for Mosaic group classifications. The Cox model allows us to examine how specified factors influence the hazard rate of a particular event happening (e.g., catching fire accidentally) at a particular point in time. The model has been gaining traction in the disaster and emergency management literature (Shen and Zeng 2010; Mojtahedi, Newton, and Von Meding 2017) as it can evaluate the effect of several factors on survival. We estimate the likelihood of households in each Mosaic category to 'survive' without an accidental dwelling fire over time based on incident data prior to 2016. Our unit of analysis is a fire incident, as classified by ECFRS, which includes any time ECFRS was called out to address a fire.

Our estimation equation is as follows:

$$h(t) = h_0(t) \times exp\ (b_1x_1 + b_2x_2 + ... + b_px_p)$$

The hazard function *h(t)* can be interpreted as the risk of dying at time *t*, which is calculated as the logarithm of the hazard, regressed on the covariates X_i. The $exp(b_i)$ are hazard ratios (HR). A value of b_i greater than zero, or equivalently a hazard ratio greater than one, indicates that as the value of the *i*th covariate increases, the event hazard increases and the length of survival decreases.

There are over 60 Mosaic categories. We reduce these into 12 overarching groups based on preliminary Anova analysis (please consult authors for full results). Table 1 presents estimation results for ADF incidence for these 12 groups, using Stata's *stcox* and *predict*.

<<< Insert Table 1 approximately here. >>>

A hazard ratio above 1 indicates that a covariate is positively associated with the event probability, and thus negatively associated with the length of survival. Findings suggest that households subsisting on low incomes in social housing are 28% more likely to experience ADFs than the average homeowner, while transient singles are 7% more likely, and wealthier older householders in rural locations and edges of towns are 20% more likely (all $p<.01$). Meanwhile, poorer elderly householders living in social housing are 12% less likely

(p<.05), and owner-occupiers in older style housing 17% less likely, to experience ADFs (p<.01).

ECFRS felt that the program delivery time frame was too rushed to try to target the at-risk groups by focusing the announcement campaign in areas where these types of households were known to exist. Instead, they hoped to reach these groups via their preferred method of communication. Analysis of Mosaic data also revealed these methods for each of the at-risk groups (see Table 2).

<<< Insert Table 2 approximately here. >>>

As you can see in Table 2, all three of the most at-risk groups have face-to-face and local papers as preferred channel sfor receiving services, while none have the internet. People in Group 1 (low-income social housing and benefits recipients) and Group 2 (transient singles) also include the national paper, SMS text, and Interactive TV as preferred means, while Group 3 (wealthier older households in rural locations and town edges) include magazine and phone. As ECFRS knew it could not afford to target small areas of a given household type, it chose to push the PSV intervention via face-to-face interactions and local papers across the county, as described above.

5.2 Assessing programme impact

Announcements about the opportunity to receive a PSV visit began in January 2016, and PSV visits ran February-December of the same year. We set about assessing impact in 2017 using the LSOA-month as our unit of analysis. We consider an LSOA to be 'treated' if it received at least one PSV visit during the pilot period, and 'untreated' if not. Though there were 240 PSV visits in total, some LSOAs might receive multiple visits in a given month. Thus, the total number of LSOA-months that received at least one visit is 65, while the number that received 0 visits is 1147 (1212 total LSOA-months).

We compare the incidence of accidental dwelling fires (ADFs) in a difference-in-difference regression, analysing the number of accidental dwelling fires in treated versus untreated localities, both before and after the PSV programme took place. Our dependent variable is the number of Accidental Dwelling Fires (ADFs) per LSOA per month.

We offer results based on comparisons between groups on time and treatment. Treatment is either treated (1) or untreated (0). Time is either before February 2016 (0) or after December 2016 (1). We thus end up with four groups: pre-2016 incidence among LAs that do not receive visits; post-2016 incidence among LAs that do not receive visits; pre-2016 incidence among LAs that will receive visits and post-2016 incidence among LAs that have received visits. Our estimation equation is:

$$y_{it} = b_0 + b_1 x_i + b_2 z_t + b_4 x_i z_t + e_i$$

Where for any LA *i* in month *t*, y_{it} is the number of accidental dwelling fires, x_i is 1 if treated and 0 if untreated, z_t is 0 if pre-treatment and 1 if post-treatment, and e_i is an error term. Because time and treatment are interacted: b_1 is the difference between treated and untreated groups before the PSV pilot; b_2 is the difference between pre- and post-treatment ADFs among untreated LAs; and b_3 shows how the effect of time differs between treated and untreated groups.

Table 3 presents estimation results for ADF incidence. Because interaction effects can be difficult to interpret, at the bottom of the table we give joint effects of treatment and time. Estimations were performed with Stata's *regression* and *lincom* commands.

<<< Insert Table 3 approximately here. >>>

The significant positive coefficient on *PSV Treatment* indicates that before the pilot program, the treatment group averaged .58 more ADFs per month than the control group. The insignificant coefficient on *Time* shows that the control group did not change in fire incidence from pre- to post-pilot, while the insignificant coefficient on the *Treatment*Time* interaction indicates that time (pre- versus post-treatment) does not differ in its effect on treated versus untreated groups.

<<< Insert Figure 1 approximately here. >>>

We plot the marginal effects for each group in <<< Insert Figure 1. As the significant coefficient on treatment group indicates, prior to the PSV pilot the treatment group had more fires than the control group. After the PSV pilot, however, that difference is eliminated. This change is due to a decrease in fire incidence in PSV-treated locations from 5.73 pre-treatment to 4.92 post-treatment, for an average of 0.81 fewer ADFs per locality per month (4 fewer ADFs per treated locality per 5-month period).

An accidental dwelling fire in the UK is estimated to cost £51,129 in fees to ECFRS alone (HM Treasury, Public Service Transformation Network, and New Economy 2014). This estimate does not include health care costs due to injury or death, long-term costs to police departments or social services, or property/insurance costs, but simply the cost of fire and rescue services in the short term. The PSV program generated 65 LSOA months. Thus, the visits conducted during the PSV Pilot yield an estimated savings of (savings per reduction in fires per month)*(reduction in fires per month in treated locations)*(number of treated locations), or:

$$£51{,}129 * .81 * 65 = £2{,}691{,}941.85$$

For a total benefit of:

$$£2{,}691{,}941.85 - £77{,}544 = £2{,}614{,}397.85$$

6 Discussion

Our findings suggest that local authorities visited by Parish Safety Volunteers (PSVs) experienced greater incidence of accidental dwelling fires prior to treatment (i.e. the visits), when compared to locations that were not visited, but that after the visits, accidental dwelling fires (ADFs) reduced in treated areas to the point where there is no longer a statistical difference between localities. While confident that these differences are statistically and substantively real, we acknowledge that we cannot assert a causal relationship between PSV visits and the reduction in ADFs. Due to the multi-stage selection process for homes receiving visits, we do not know if the reduction was due to the campaigns announcing the PSV program, the information shared during the visits, or a self-acknowledgement in the community that the risk of ADFs should be reduced.

In unreported estimations, we performed poisson estimations to determine the relationship between each additional PSV visit and ADF incidence (please consult authors for details), and found that a greater number of visits was not associated with a greater reduction ADFs. We therefore conclude that information shared either during the targeting campaigns or the visits themselves was all that was necessary to spread safety information, and judge that the overall effort was successful.

It is also important to note that the PSV programme was implemented in 2016, and post-pilot data is only available for 2017. This limited post-treatment time frame means it is impossible to know whether the informational benefits have taken hold in the long term. In line with (Cole and Murphy 2014), however, our findings nevertheless support the idea that the PSV disaster risk reduction education programme has built on existing strengths of the local authority in the community by using community-preferred communication methods to their maximum potential. ECFRS targeted community education to at-risk groups and shared emergency management education concurrent with a decrease in ADFs.

7 Conclusion

With this article, we sought to understand how disaster risk reduction education and hazard risk communication can act as a disaster prevention mechanism. We investigated how involving community members in the delivery of a prevention programme can be successful, particularly in the context of local authority-administered fire emergency services in the UK. To these ends, we presented a case in which the local fire and rescue service worked with volunteer community members to raise awareness of safety issues, educate the community about risks, and ultimately reduce the number of accidental dwelling fires.

ECFRS identified at-risk community sectors through proportional hazards modeling, and visited individual households with the goal of changing perceptions and encouraging them to play an active role in protecting their homes and communities. Though initially higher than that in untreated communities before the CEI, the rate of ADFs in treated communities decreased to the point that after the CEI, there was no longer a significant difference between communities.

This paper has contributed to the literature on building resilience at the prevention (pre-disaster) stage of disaster and emergency management. Targeted interventions based on at-risk identification have been increasingly reported in fire safety literature (Cooper et al. 2012; Coty et al. 2015; Warda, Tenenbein, and Moffatt 1999), but rarely explored in light of information campaigns. Our work extends this endeavour by examining community information campaigns delivered according to preferred methods for at-risk groups.

We have also given evidence suggesting that despite emergency and crisis services often being placed solidly in the realm of governmental provision, volunteer participation in the delivery of such programs can help build community resilience by reducing information asymmetries. And yet it does appear that there is a threshold past which the reduction of fires may not be able to go without further intervention. It is possible that the level of ADFs at which both treated and untreated communities now sit is a floor that cannot be breached unless a different type of policy is enacted. Further policy interventions and investigations into this possibility could bring even more knowledge to the field of fire safety.

Table 1. Hazard ratios of the effects of Mosaic categories on ADF occurrence

		Model 1
	ADFs occurring in Essex in 2016:	(all ADFs)
Community groups (*Mosaic groups in italics*)		
Group 1	Households on low incomes living in social housing (*K51, N61, O68, O69*)	1.28*** (0.14)
Group 2	Transient singles (*G33, I43*)	1.07*** (0.18)
Group 3	Poorer older householders living in social housing (*N58, N59, N60, N61)*	0.88** (0.22)
Group 4	Couples and young singles in modern starter homes (*H36, H37*)	0.92 (0.17)
Group 5	Owner occupiers in older style housing (*J45, J46*)	0.83** (0.06)
Group 6	Wealthier older householders in rural locations and on edges of towns (*A01, A02, B05, C13*)	1.20*** (0.02)
Group 7	Low income families (*O62, O64, O65, O66, M53, M54, M55, M56, K47, K48)*	0.73 (0.01)
Group 8	Renters (*L49, L50, L51, L52, J40, K41, K42, K43, K44)*	0.11 (0.10)
Group 9	Urban households living comfortably *(I36, I37, I38, I39, H30, H31, H32, H33, H34, H35)*	0.14 (0.04)
Group 10	Rural households living comfortably *(G26, G27, G28, G29)*	0.29 (0.15)
Group 11	Suburban households living comfortably *(F22, F23, F24, F25, E18, E19, E20, E21, D14, D15, D16, D17)*	0.14 (0.07)

Group 12	Wealthy households *(A03, A04, B06, B07, B08, B09, C10, C11, C12)*	0.77 (0.07)
	Number of observations	699
	Failures	699
	Log Likelihood	-4006.02
Notes:	*Standard errors in parentheses*	
	**Significant at the .05 level.	
	***Significant at the .01 level.	

Table 2. Mosaic Types in Essex County over-represented in Accidental Dwelling Fires: Preferred channels for receiving services

Household composition	Social housing and benefits	Transient Singles	Wealthier older households, rural and town edges
Phone			●
Magazine			●
Face-to-face	●	●	●
National Paper	●	●	
Local Paper	●	●	●
Internet			
SMS text	●	●	
Interactive TV	●	●	

Table 3. Difference-in-Difference Estimation of Accidental Dwelling Fires

	Accidental Dwelling Fires
PSV Treatment	0.58***
	(0.22)
Time	-0.33
	(-0.66)
Treatment*Time	-0.48
	(-0.78)
Total effect of treatment	-0.81
	(0.42)
Total effect of time	0.11
	(0.75)
Constant	5.15***
	(-0.18)
Observations	1212
R-squared	0.01

Standard errors in parentheses

**** p<0.01, ** p<0.05*

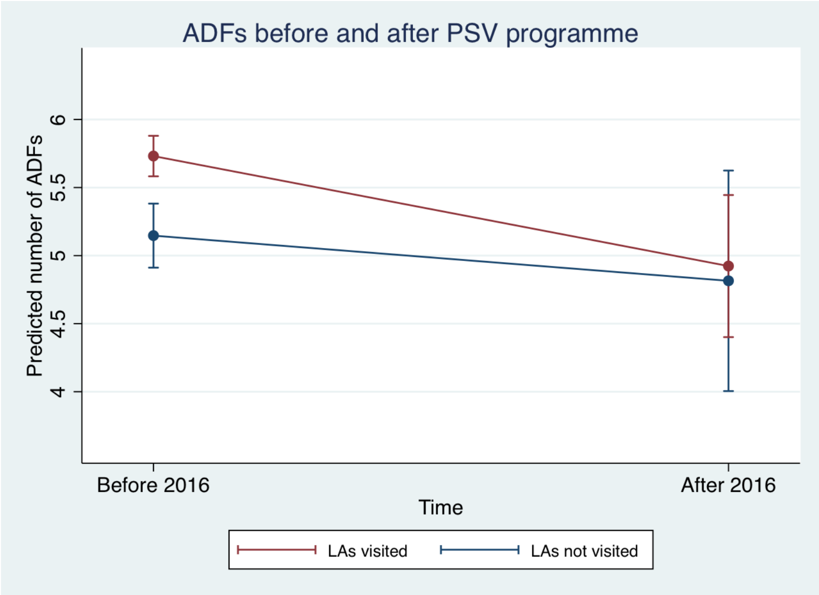

Figure 2. Predicted Number of ADFs by Treatment and Time

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Appendix 1: Mosaic Group Classifications and ADF Incidence

Group 1 - Householders on low incomes living in social housing:

Mosaic Types K51 (Often indebted families living in low rise estates), N61 (Childless tenants in social housing flats with modest social needs), O68 (Families with varied structures living on low rise social housing estates) and, to a lesser extent, O69 (Vulnerable young parents needing substantial state support) had more accidental dwelling fires than expected. These Mosaic Type households comprise 7.9% of Essex households (59,000 households) and 14.2% of all accidental dwelling fires.

K51 households were likely to be well-established having lived in their properties for at least 10 years or more; this Type had the largest overall number of ADFs. Lone occupants from Type N61 also recorded a relatively large number of ADFs; these occupants were slightly more likely to be male. All these Mosaic Types are linked through their likelihood of having relatively low incomes and of being in receipt of benefits, especially unemployment benefit (this may mean that these Types are more likely to be at home in the daytime and thus more at risk of fire in the home). These Types are also likely to be heavy smokers. Lone parent households suffering ADFs were often householders on low incomes living in social housing.

Group 2 - Transient singles:

Mosaic Types G33 (Transient singles, poorly supported by family and neighbours) and I43 (Older town centres terraces with transient, single populations) have more ADFs than expected. These Types comprise 3.1% of Essex households (23,000 households) and 6.2% of all accidental dwelling fires.

These householders were often living alone in terraces and flats which they rent privately or from the council or housing association. Mosaic also shows that there is a higher than average incidence of smoking, alcohol misuse and substance abuse amongst Types G33 and I43, as well as higher levels of unemployment and benefit claiming.

Type G33 households tend to be a mixture of ages, usually without children and often living alone or as homesharers. Type I43 households tend be younger (under 40); many single parent families suffering ADFs were also from household Type I43. Car ownership is low for both household Types.

Group 3 - Poorer elderly householders living in social housing:

Mosaic Group M households (Elderly people reliant on state support) comprise 5.6% of Essex households (41,000 households) and 3.9% of all accidental dwelling fires.

Analysis suggests that elderly people from Group M households, many of whom live alone, are at increased risk of being injured or dying in an accidental dwelling fire. The most vulnerable were Type M56 (Older people living on social housing estates with limited budgets) and Type M58 (Less mobile older people requiring a degree of care).

The vast majority of M householders are elderly women living alone, usually in relatively small houses and flats (social housing) that they have occupied for 10 years or more. Low incomes, benefits claimants, low car ownership and poor health are some characteristics of this group.

Group 4 - Couples and young singles in modern starter homes

Mosaic Types H36 (Young singles and sharers renting small purpose built flats) and H37 (Young owners and rented developments of mixed tenure) comprise 5.2% of Essex households (39,000 households) and 5.1% of all accidental dwelling fires.

Type H36 recorded more chip pan fires than other household Types. Although the overall number here was small, chip pan fires were identified as one of the relatively frequent fire ignition sources causing kitchen injuries. Type H36 householders were often owner-occupiers living in converted flats. Most have only lived in their flats for a short period (1-2 years), few have children and many perceive it difficult to cope on their income. Car ownership is below average with most travelling to work on public transport.

A lack of alarm systems might be an issue for H36 households; almost one third of the ADFs recorded in these households did not have a smoke alarm or any active safety system in place.

Group 5 - Owner occupiers in older style housing

Mosaic Types J45 (Low income communities reliant on low skill industrial jobs) and J46 (Residents in blue collar communities revitalised by commuters) comprise 5.7% of Essex households (42,000 households) and 5.2% of all accidental dwelling fires, as well as 11.5% of smoking-related ADFs.

Householders were usually long-term residents living in owner-occupied terraced housing. J45 Types tended to be of mixed age and household composition; J46 Types contained fewer elderly householders, comprising mainly of middle-aged families. A lack of alarm systems could be an issue for J45 and J46 households; almost one fifth of the ADFs recorded in these households did not have a smoke alarm or any active safety system in place.

Group 6 - Wealthier older households in rural locations and on town edges

Mosaic Types A01 (Rural families with high incomes, often from city jobs), A02 (Retirees electing to settle in environmentally attractive localities), B05 (Better off empty nesters in low density estates on town fringes) and D13 (Higher income older champions of village communities) make up 11.8% of all households (88,000 households) in Essex and 13.9% of all accidental dwelling fires.

Although ADFs in B05 households were more likely to have started in the kitchen, those in the other household Types were more likely to have started in other rooms in the home (as well as a relatively high proportion of chimney fires). B05 households were the least likely of these "household types" to have installed a smoke alarm (64% of ADF incidents recording the presence/absence of an alarm system noted a lack of alarm system).

Household members of these types were more likely to be long term residents (11 years or more), living in owner-occupied detached or semi-detached housing. Adults in Types A01 and D13 were more likely to be middle aged whereas those in A02 and B05 households were more likely to be retired; few households of any of these Types had children. Mosaic analysis of Injury ADFs suggests that lone householders from Types A01, B05 and D13 were the most vulnerable, though the number of incidents was relatively low (24).

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[i] In the United Kingdom, a *lower layer super output area* (LSOA) is a geographic area designated by the Office for National Statistics (ONS) for generating community-level statistics. By definition, an LSOA has 1000-3000 residents, and 400-1200 households.