# *Supplementary Appendix 1*

## Operation Installation

In a previous study of house fire-related deaths and injuries in Dallas, TX, we had performed calculations of rates of these deaths and injuries for every census tract in Dallas for 1991-1997.[1] That study and others showed that house fire-related deaths and injuries were highest in the census tracts with lowest median income, [1-5] and in houses without functioning smoke alarms.[6, 7] To address this problem, we began a joint effort along with the Dallas Fire Rescue Department, to install smoke alarms in houses in high-risk census tracts in Dallas through a program called "Operation Installation" (OI). Ongoing surveillance allowed us to evaluate the impact of OI on rates of house fire-related deaths and injuries for residents of the houses that received smoke alarms through OI, compared to the rate in residents of houses in the same census tracts that did not receive a smoke alarm through OI.

Operation Installation has been a joint project of the Injury Prevention Center of Greater Dallas (IPC), the Dallas Fire Rescue Department (DFRD), and the Dallas chapter of the American Red Cross (ARC). With each OI, volunteers assist DFRD firefighters and prevention staff as they go into homes to install smoke alarms and collect information about each home. OI was patterned after the Oklahoma City program that was begun in 1990;[8] the main difference from that program is that in OI, all smoke alarms have been installed by OI personnel, and only lithium-powered ionization-type smoke alarms were installed. The process of OI involves canvassing the target census tract, going door-to-door to offer installation of smoke alarms in the home, along with brochures about how to decrease the risk of fires and to develop and practice an escape plan. OI typically takes place 8-10 times per year, on a Saturday morning, with 16 teams (consisting of a fireman, a fire prevention officer, and a volunteer) canvassing the census tract along with 4 firefighting vehicles (fire trucks, ladder trucks, etc.) in a pre-arranged manner, for 3-4 hours. Approximately 200-400 houses are typically canvassed in each session. Each census tract takes ~2-3 sessions to complete, depending on the size of the tract. For houses where no one was home at the time of the canvassing, teams leave door hangers with information about how to request a smoke alarm to be installed by the DFRD. Only houses and duplexes were included in OI, because Dallas city has had a code requiring apartments to have functioning smoke alarms, and as a result, DFRD has prioritized houses and duplexes for this intervention. For purposes of this study, a house was defined as a single-family or two-family dwelling (essentially, a house or a duplex). Smoke alarms were provided from donations by various groups and persons between 2001 and 2006, and by a grant from CDC from 2007-2011.

Target census tracts were chosen because they were high risk tracts, which included those with high rates during the 1991-1997 study,[1] and those with lowest income. OI first took place in October of 1999, but we did not begin systematically collecting data with a standardized survey form until April 28, 2001. There were a total of 32,480 homes in the 36 target census tracts. OI installed smoke alarms in 25% of the homes; in 57%, no one answered the door; in 10% the resident refused to allow the OI team to enter; in 8% the resident had adequate smoke alarm coverage and did not want more installed.

**References:**

1. Istre G, McCoy MA, Osborn L, et al. Deaths and injuries from house fires. N Engl J Med 2001;344:1911-1916.

2. Warda L, Tenenbein M, Moffatt MEK. House fire injury prevention update. Part II. A review of the effectiveness of preventive interventions. Inj Prev 1999;5:217-225.

3. United States Fire Administration. Socioeconomic Factors and the Incidence of Fire. Federal Emergency Management Agency, U.S. Fire Administration, National Fire Data Center (FA 170). June 1997. Washington, D.C..

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5. Karter MJ, Donner A. The Effect of Demographics on Fire Rates. Fire Journal. January 1978:53-65.

6. Marshall SW, Runyan CW, Bangdiwala SI, Linzer MA, Sacks JJ, Butts JD. Fatal residential fires: who dies and who survives? JAMA. 1998 May 27;279(20):1633-7.

7. Ahrens M. Smoke alarms in U.S. home fires. Fire analysis and research division. National Fire Protection Association. Quincy, MA. September 2011.

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## *Supplementary Appendix 2*

### Information Collected for Program Houses

Information collected on the survey form for each program house included address, type of residence (house, duplex), rented vs. owned, number of residents who lived in house, number of residents who were >64 years old and the number < 5 years old, the race/ethnicity of the head of the household, the presence of a telephone, and the number of smokers in the residence, among other variables. Information for total number of residents was missing from the surveys for 109 (1.3%) program houses. We used a multiple imputation technique to impute values for these missing fields, with the "impute" function for STATA 11, which utilizes the approach of Little and Rubin[1] The following variables were used for the imputation: age and race of head of household, and owned/rented status. Through STATA we conducted 20 imputations for each of the missing values and combined the results into a single multiple-imputation result. Using these imputed values changed the denominator by about 1%, which made minimal difference in the calculation of rates for the study, either with or without the imputation, and did not affect the results. For example, the following were the rates per 100,000 population for the Program and Non-program populations, the CMLE Rate Ratios, and the calculated Preventive Fractions, respectively: **with** imputed data: Program rate, 3.12; Non-program rate, 9.62; CMLE RR, 0.324; Preventive Fraction, 67.6%; **without** the imputed data: Program rate, 3.15; Non-program rate, 9.59; CMLE RR, 0.329; Preventive Fraction, 67.1%. Complete addresses were missing for 111 (1.4%) program houses; these were excluded from the analysis.

### Definitions of Program Population, Non-program population, and Cohort denominators

A program house was defined as one that received at least 1 smoke alarm through OI; a non-program house was any other house in the census tract. Program households were measured directly by the surveys outlined above, at the time of installation of the smoke alarm. For non-program households, aggregated survey results for program houses were subtracted from the totals for that census tract estimate for the house population for the year that OI was carried out in the tract. Because the study interval covered the years 2001-2011, census tract data for the year of OI were estimated by linear interpolation of 2000 and 2010 census data for houses and duplexes in the tract. For example, if OI took place in 2004 in a census tract, demographic data for the houses and duplexes in the census tract were estimated to reflect their expected levels in 2004 given the known 2000 and 2010 census counts, using simple linear interpolation. Thus, for each census tract, we identified the population in the cohort of houses that received a smoke alarm through OI (program population), and the population in the cohort of houses that did not receive a smoke alarm through OI (non-program population), for the year of OI. Because the house/duplex population of the target census tracts changed by < 10% between 2000 and 2010, whether we used this interpolated census data, or the 2000 census data, or the 2010 census data made little difference in the calculations of rates, and did not change the significance of the findings.

## Reference

1. Little R, Rubin D. *Statistical Analysis With Missing Data*. Hoboken, NJ; John Wiley & Sons; 2002).

# *Supplementary Appendix 3*

## Case Definition

For the outcome measure for this study, we defined a Case as a house fire-related death or injury (HF-D/I) in one of the 36 target census tracts. A death was defined as person who the Dallas County Medical Examiner determined to have died from a house fire that occurred in a target census tract, and a non-fatal injury was defined as a person who was injured but did not die from a house fire that occurred in a target census tract, and who was identified through the Emergency Medical Services database as having been transported by ambulance to a hospital. This approach is similar to the definition we had used in our earlier study.[1] We then identified the address of each fire that resulted in a Case, and determined whether the address was a program home or a non-program home. To do this, we linked each death and injury by the date, time, DFR incident number and address from the DFR fire incident file, and compared the address of the incident to the list of homes that had received smoke alarms through OI, to determine whether home was a program home or a non-program home.

## Pre-Study Period

We designated a pre-Study period as beginning Jan 1, 1998, which was after the initial study that identified risk factors and high rate census tracts,[1] and ending on the date of first study OI in the census tract. During the pre-study period, the population of the study tracts was followed for a mean of 8 years (range, 3.3-13.1 years), for a total of 906,247 person years. During this time period, there were 84 Cases (35 deaths and 49 non-fatal injuries), which was a rate 9.3 cases per 100,000 person-years. By comparison, the case rate during the original study that covered the time period 1991-1997, was 9.9 cases per 100,000 population (data not shown).

## Study Period

For each census tract, the Study Period began on the date of OI in the census tract, and ended on 4/27/2011 (10 years after the first OI of this study) or when a 2$^{nd}$ OI was done, whichever was first. The follow-up period varied for each tract depending on the date of OI. Follow-up duration ranged from 10 years in the earliest tract, to 2.5 months in the latest OI tract. For these first 10 years of the study, 36 census tracts were canvassed (“target tracts”); 20,127 smoke alarms were installed in 8134 houses that had 28,570 population**.** Since OI was an ongoing process, the dates of OI ranged from April 28, 2001 in the first census tract, until February 12, 2011 in the 36$^{th}$ census tract. As a result of the staggered dates of OI, the follow-up time for the census tracts ranged from 2 months to 10 years (mean, 5.2 years; median, 4.6 years). For three census tracts, OI was repeated in the tract before the full 10 years of follow-up (after 9.0 years, 8.6 years, and 6.6 years, respectively), and these were counted as program houses/target tracts only until the date of the second OI.

## Smoke Alarm Follow-up

A random sample of houses that received smoke alarms approximately 2, 4, 6, 8, and 10 years previously were re-visited by DFR personnel to assess presence and functioning of the OI smoke alarms that had previously been installed. Detailed description of methods and results of this survey can be found in a companion paper.[2]

**References**


1. Istre G, McCoy MA, Osborn L, et al. Deaths and injuries from house fires. N Engl J Med 2001;344:1911-1916.
2. McCoy MA, et al. (*Injury Prevention* submitted companion paper)

## *Supplementary Appendix 4*

### Statistical Analysis

Data were analyzed with Epi Info (TM) 3.5.3 (CDC, Atlanta, GA) and STATA version 11.2 (STATA Corp, College Station, TX). Rates were calculated as cases per 100,000 person years of follow-up. Comparison of two rates done with a conditional maximum likelihood estimate of the Rate Ratio with exact confidence limits.[1]

Two multivariate analytic approaches were taken to evaluate the effect of OI. The first, taking a two-independent samples approach, treated the program population rates and non-program population rates as collected from two independent samples. Each rate was weighted for the size of the denominator (i.e., the number of person years for program and non-program populations in the tract). The analysis fit a multiple regression model, with program and non-program case rates for each census tract as the dependent variable, an indicator variable for program and non-program populations, and demographic variables for the program and the non-program populations as covariates, including type of residence, rented vs. owned, number of residents who lived in houses, whether there were persons >64 years old, the race/ethnicity of the head of the household, among other variables. A test of the coefficient for the indicator variable provided a test for significance of intervention effect. The analysis further allowed the calculation of adjusted case rates for program and non-program populations, adjusting for the covariates mentioned.

A second analysis used the difference between house fire-related case rates for the program vs. non-program household populations in a paired comparisons methodology for assessing case rate difference for each of the 36 census tracts. Specifically, the program population case rate was subtracted from the non-program population case rate within each census tract, producing a difference that was assumed free of extraneous factor effects within a tract and a function of intervention effect. Using these resulting rate differences as outcomes, a multiple regression model was fit where case rate difference within a tract served as the dependent variable, and census variables were covariates. The objective of this model was to reduce the error variance for testing the hypothesis that mean case rate difference equals zero. The covariates included census tract data from each target census tract (but not separately for the program and non-program populations): age > 64 years, race and gender of head of household, household median income, percent of households that had paternal presence, and percent of dwellings that were owned.

For the cumulative mortality rate graph, case rates over time for the program and non-program populations were compared by the Kolmogorov-Smirnov equality of distributions test. [2]

### Reference

1. Martin DO; Austin H (1996) Exact estimates for a rate ratio. Epidemiology 7, 29-33.

2. Conover WJ. *Practical Nonparametric Statistics*. 3rd edition. New York: Wiley; 1999.