Right Decisions yield "Smarter Communities"

THE RIGHT DECISION

Evidence-based Decision Making for Government Professionals

Urban
Regional
Information
Systems
Association

February - 2017

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Effective Decision-Making in the Changing World of Public Safety

COST

VALUE

Why is Evidence-Based Research Important?

What is Evidence-Based Decision Making (EBDM)?

Evidence-based decision making is a strategy for making the best decision possible based on facts and evidence compiled using a set of planning and analysis tools.

Why is Evidence-Based Research Important?

- External decision-makers who approve departmental budgets may not view departmental requests as justified if they lack clear and compelling evidence

Why is Evidence-Based Research Important?

- Policies and strategies that are evidence-based often produce better results, which can increase credibility and support for the department as a whole

Navigating the World of Evidence

- Problem construction and definition
- Evaluating evidence and thinking critically
- Contextualizing evidence
  - ➤ Explanatory value
  - ➤ Environmental scan
  - ➤ SWOT (Strengths, Weaknesses, Opportunities, and Threats)
- Articulating evidence and making decisions

The Roots of Evidence-Based Approaches

- Increasing governmental fiscal pressures during the 1980's

- Increasing efforts to link research and clinical practice to support positive medical outcomes

Leaders and EBDM: Challenges

- Administrators often feel pressured to make decisions quickly and with incomplete and/or outdated information

- Most people rely on personal experience, observation, or "gut instinct" when having to make a choice

- Poorly made decisions increase conflict and diminish morale

Understanding the Term *Evidence*

- **Quantitative research** involves generating numbers and statistics, and leveraging analytics

- **Qualitative research** involves generating subjective information that is helpful in determining preferences, values, or perspectives of those responding to the questions
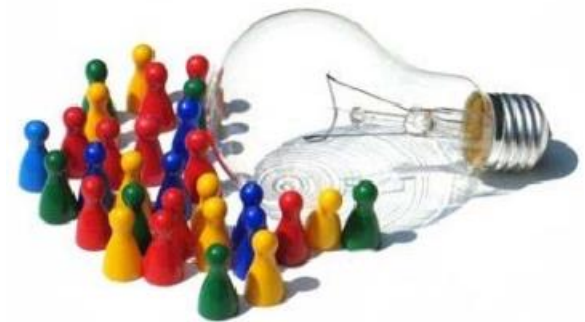
Developing a Plan: Statement of Organizational Values

- Organizational purpose

- Short, mid, long-term organizational vision

- Representation of core beliefs

Developing a Plan: Statement of Goals and Objectives

- Organizational goals are the broader targets for which one is aiming

- Objectives are the midterm steps one sets to achieve those goals

- We must find an explanation that is consistent with at least most of the evidence we have to date

- We must then conduct secondary tests to see whether those explanations hold up

- Working and null hypotheses

Collecting Evidence: Environmental Scans

Types of Environmental Scans:

- Using Internet Search Engines

- Effective Searches on Google

- Framing Your Environmental Scan

- Example: Reviewing changes in the United Kingdom Police / Fire Services

Statistics

- A Tool for Decision-Making

- A Discussion of Measurement

- Descriptive Statistics

- Inferential Statistics

- Statistical Modelling

Descriptive Statistics

- Descriptive statistics summarize the characteristics of a group

- Measuring *typicality*

- Measuring *variability*

Statistics: Inferential Statistics

- Population Estimates

  - Random selection
  - Equal chance
  - Independence

- Significant Differences

Evidence based decision making with Key performance Management -
Evidence to Practice

- ❑ Strategies deployed by Surrey Fire Service

- ❑ Building the environment for continued success

- ❑ Measuring what matters

Examples of Organizational Goals and Objectives within the Fire Services

Broad goals may be such things as setting targets for reducing the number of residential fires, fatalities and injuries in the community, or increasing the unit's capacity to handle a broader range of service demands

Examples of Organizational Goals and Objectives within the Fire Services

To achieve the goal of reducing the number of residential fires, fatalities and injuries, it is often necessary to make a list of objectives that form a series of intermediate steps

For example, one objective might be to conduct research into best practices to determine if others have had success
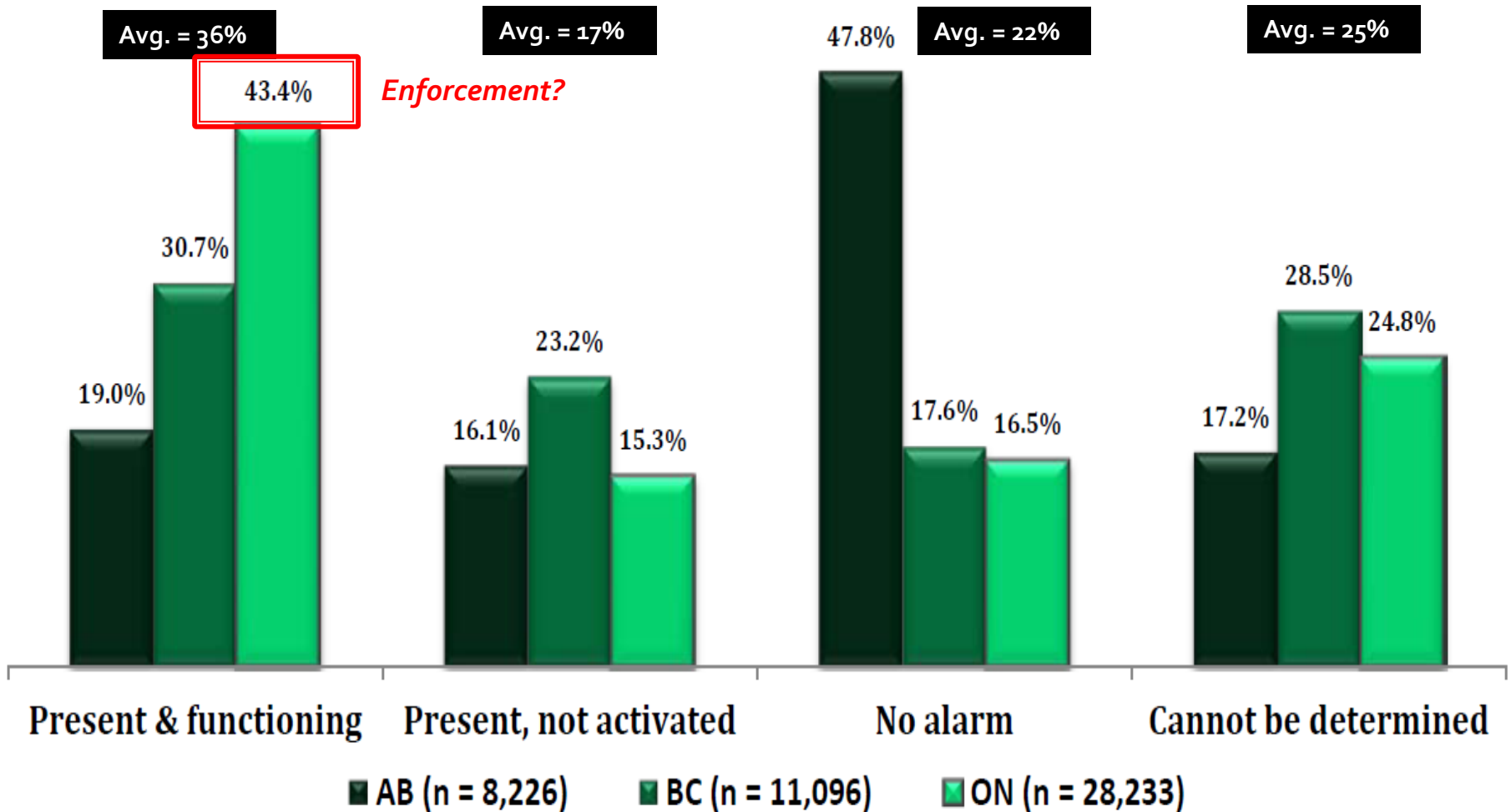
Smoke Alarms Don't Work Forever 1988 – 2007: the Problem
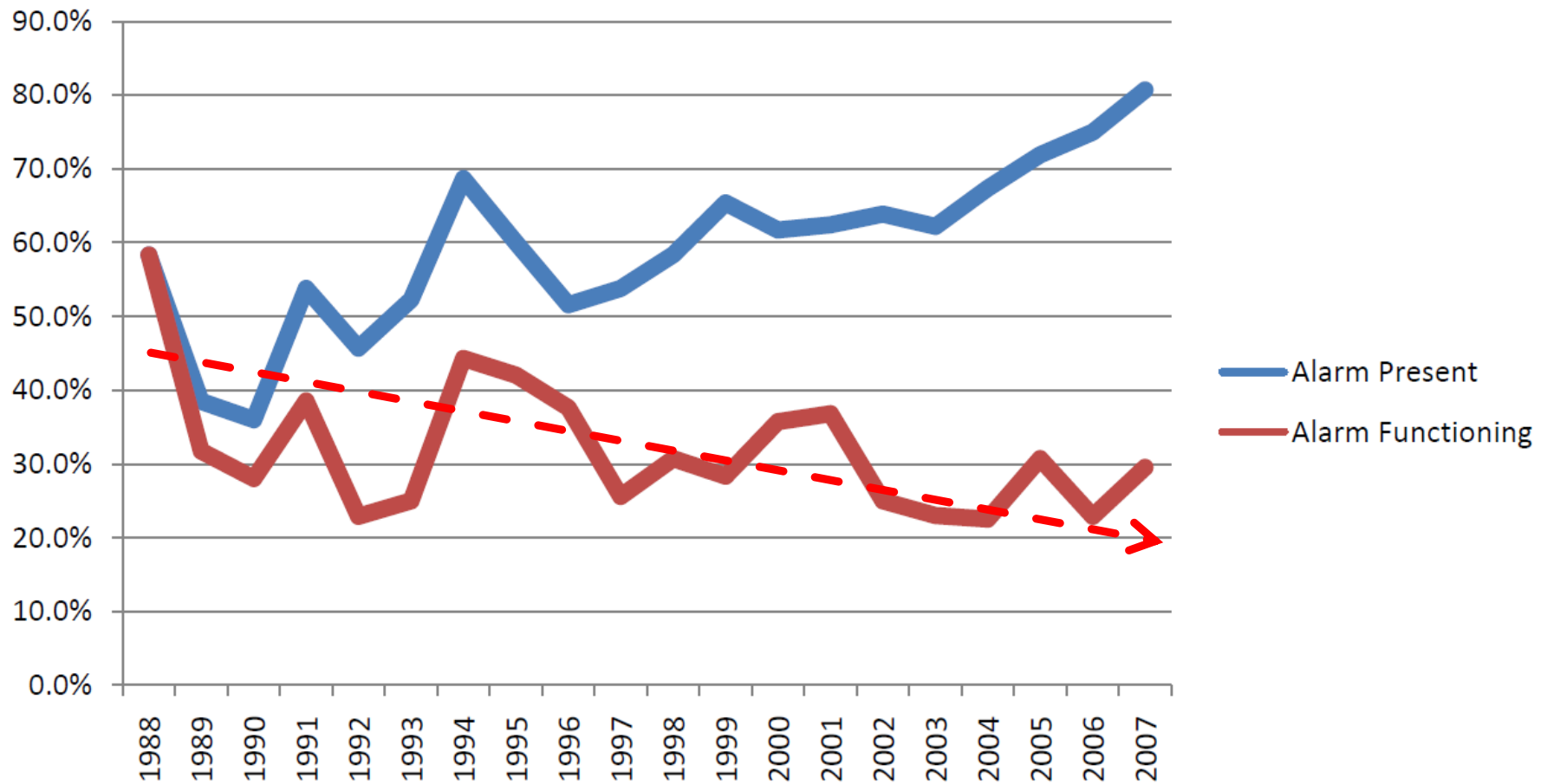
The Local Origin of the Program: Understanding a Local Problem

- **20-year review of fires in Surrey, BC** (completed 2008)

  - 75% of fires were residential properties
  - 30% of fires had a functioning smoke alarm

- **International best practices demonstrate** (UK)

  - Functioning smoke alarms save lives
  - Fire risk is non-random: high-risk people, properties, places
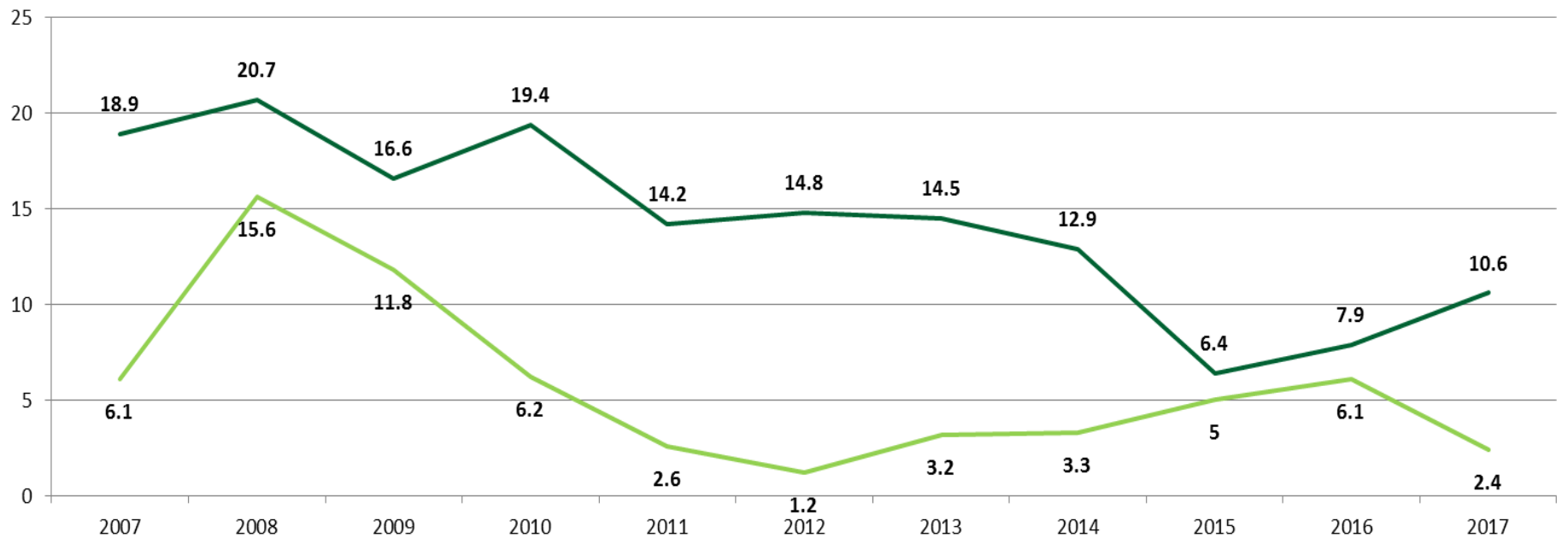 - Fire-prevention home visits and education make a difference

The National Score Card is Very Poor…

	Present & functioning	Present, not activated	No alarm	Cannot be determined
Avg.	36%	17%	22%	25%
AB (n = 8,226)	19.0%	16.1%	47.8%	17.2%
BC (n = 11,096)	30.7%	23.2%	17.6%	28.5%
ON (n = 28,233)	43.4%	15.3%	16.5%	24.8%

Enforcement?

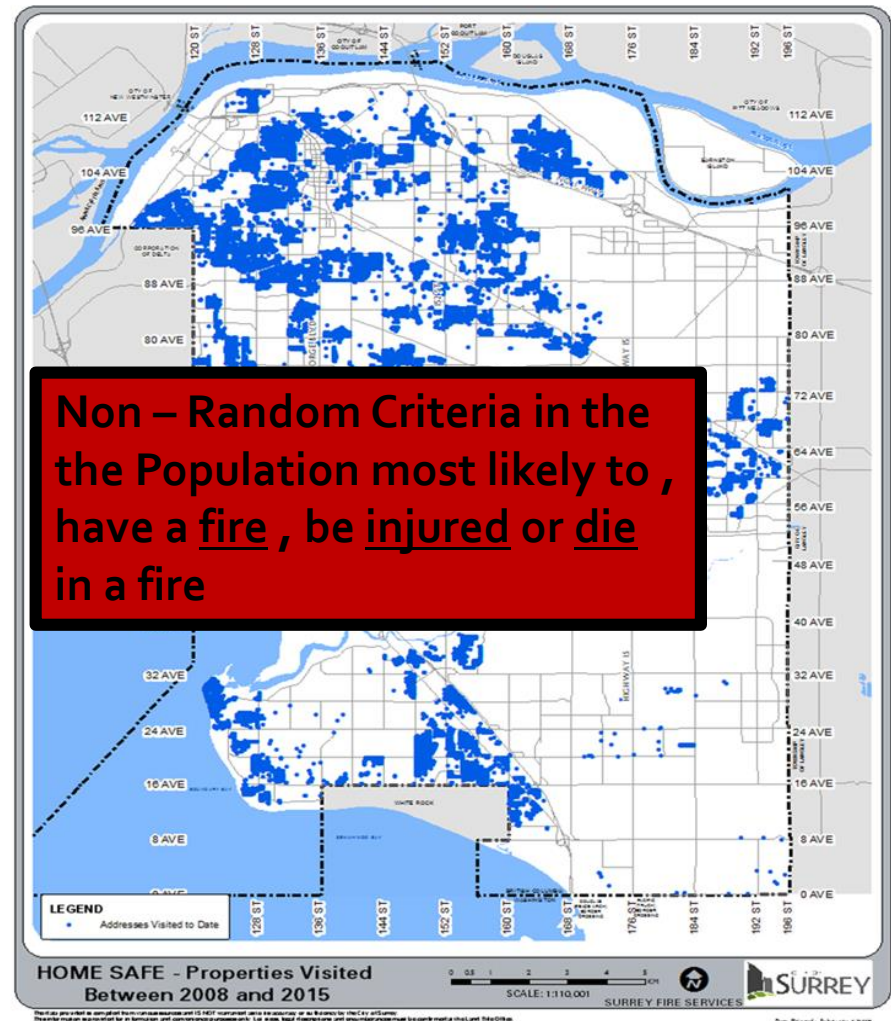# Death Rates Based on Status of Smoke Alarm 2007-2017

BC <u>Residential</u> Structure Fires - Death Rate per 1,000 Fires
Comparing Working Smoke Alarms and Non-Working Smoke Alarms

— Working Smoke Alarms: Death Rate per 1,000 Fires   — No Working Smoke Alarms: Death Rate per 1,000 Fires

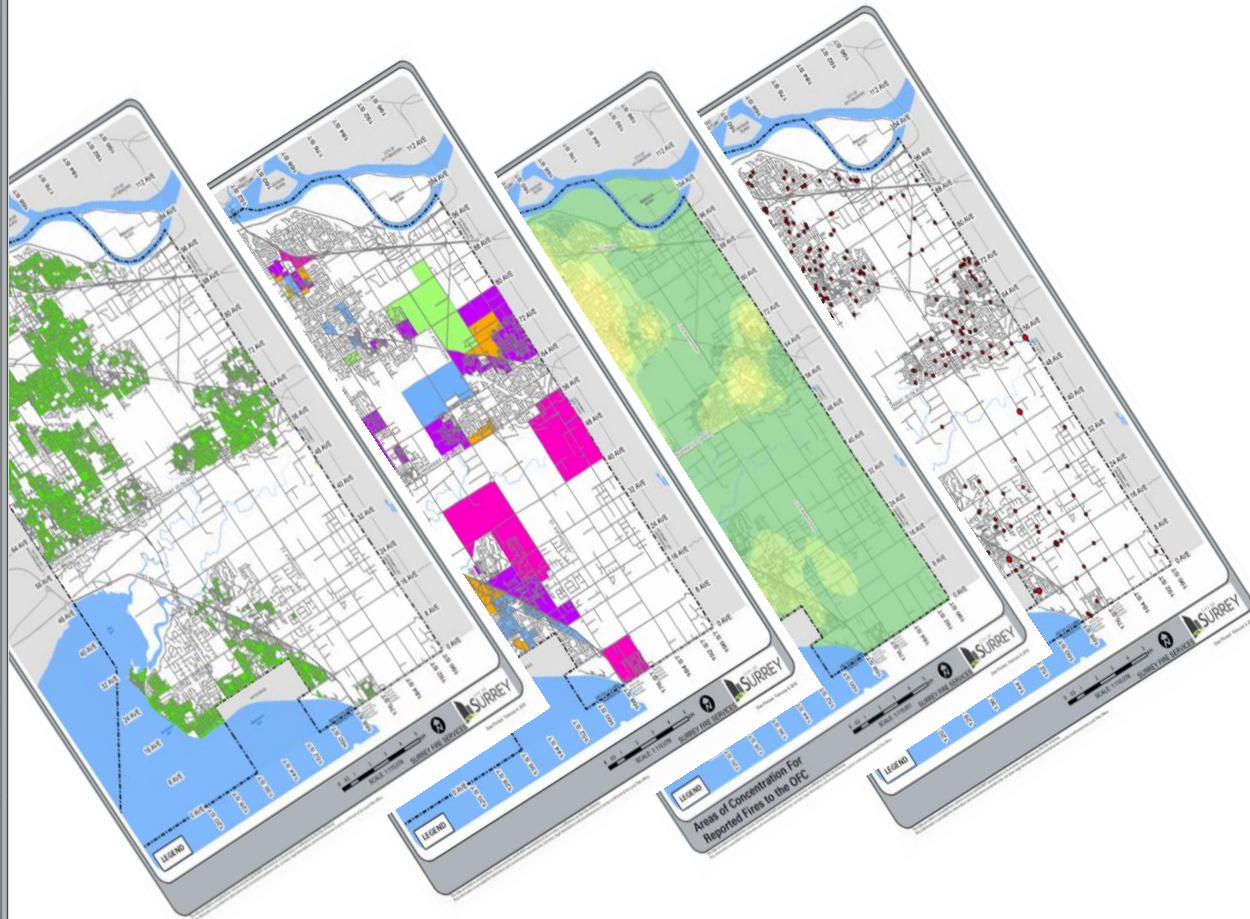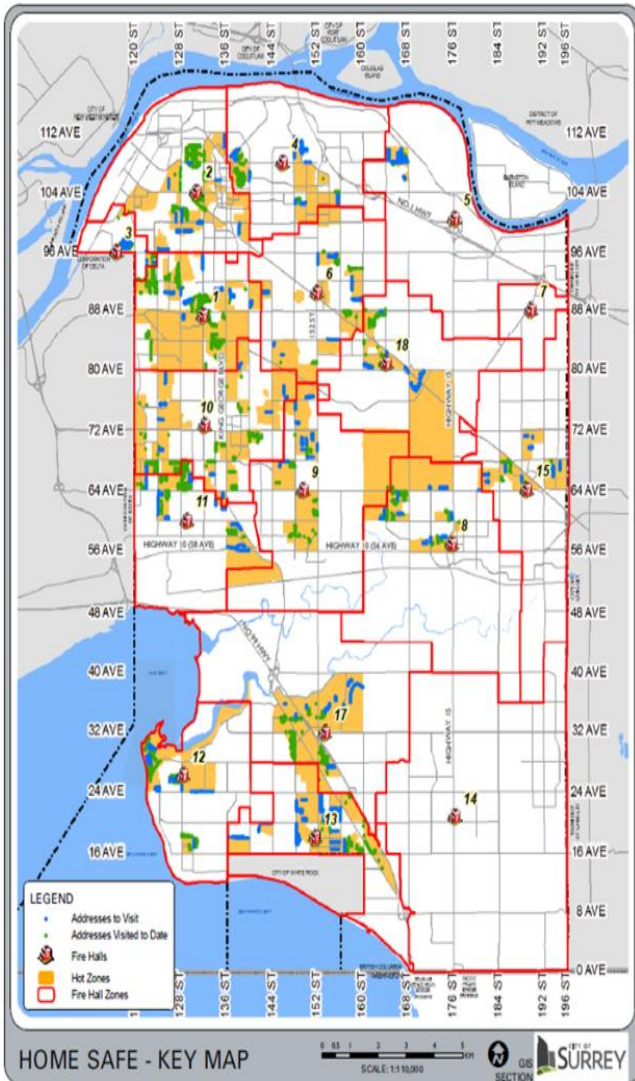| Year	No Working Smoke Alarms	Working Smoke Alarms
2007	18.9	6.1
2008	20.7	15.6
2009	16.6	11.8
2010	19.4	6.2
2011	14.2	2.6
2012	14.8	1.2
2013	14.5	3.2
2014	12.9	3.3
2015	6.4	5
2016	7.9	6.1
2017	10.6	2.4

Leverage of Surrey on Duty Resources for Prevention Outreach Initiatives: Residential
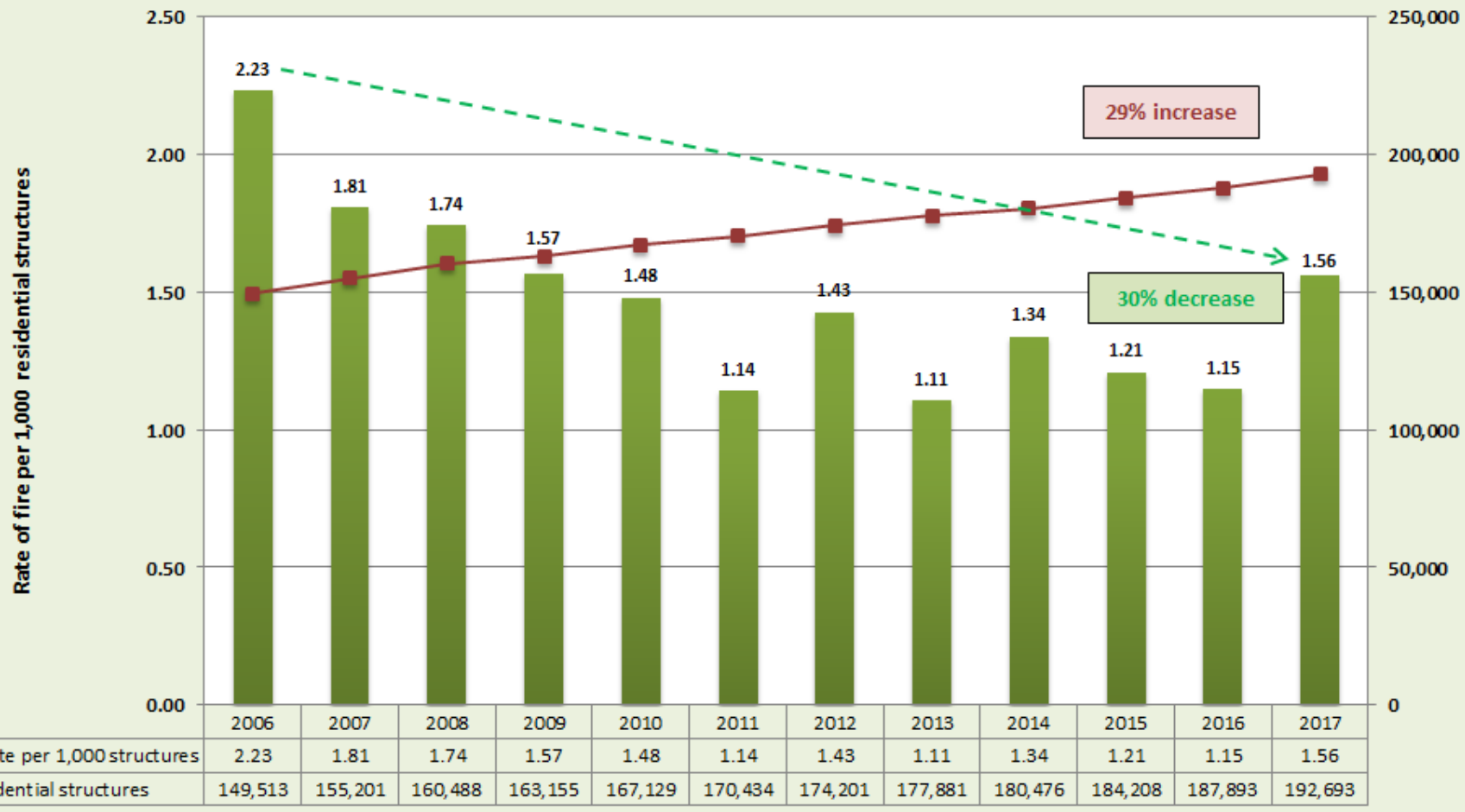
- **<u>Reseach told us how to identify high-risk dwellings in the city</u>**.
- Data driven decisions were made to identify high-risk areas – top 10% for the following:
  - **High proportion of elderly citizens (over 64 yrs), and young children (under 6 yrs)**
  - **Disadvantaged: Unemployed; Single-parent families**
  - **High residential mobility**
  - **Combined with *hot-spots* for recent fire incidents**

Non – Random Criteria in the the Population most likely to , have a <u>fire</u> , be <u>injured</u> or <u>die</u> in a fire

HOME SAFE - Properties Visited Between 2008 and 2015

SCALE: 1:110,001

SURREY FIRE SERVICES

Finding the Vulnerable Areas

Fitting this into the Bigger Picture?

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fire rate per 1,000 structures	2.23	1.81	1.74	1.57	1.48	1.14	1.43	1.11	1.34	1.21	1.15	1.56
# Residential structures	149,513	155,201	160,488	163,155	167,129	170,434	174,201	177,881	180,476	184,208	187,893	192,693

29% increase

30% decrease

Fitting this into the Bigger Picture?

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Rate per 10,000 residents	1.16	0.49	0.26	0.52	0.44	0.62	0.59	0.38	0.81	0.43	0.15	0.69
# Residents	432,000	445,697	457,756	465,149	475,453	483,713	492,776	501,302	507,373	516,424	525,224	535,555

Surrey – Residential Structure Fires % of Working Smoke Alarm

City of Surrey Residential Structure Fires: Working Smoke Alarm (%)

——— Smoke Alarm Working

Year	%
2005	25%
2006	19%
2007	25%
2008	16%
2009	22%
2010	28%
2011	31%
2012	32%
2013	35%
2014	54%
2015	58%
2016	47%
2017	43%
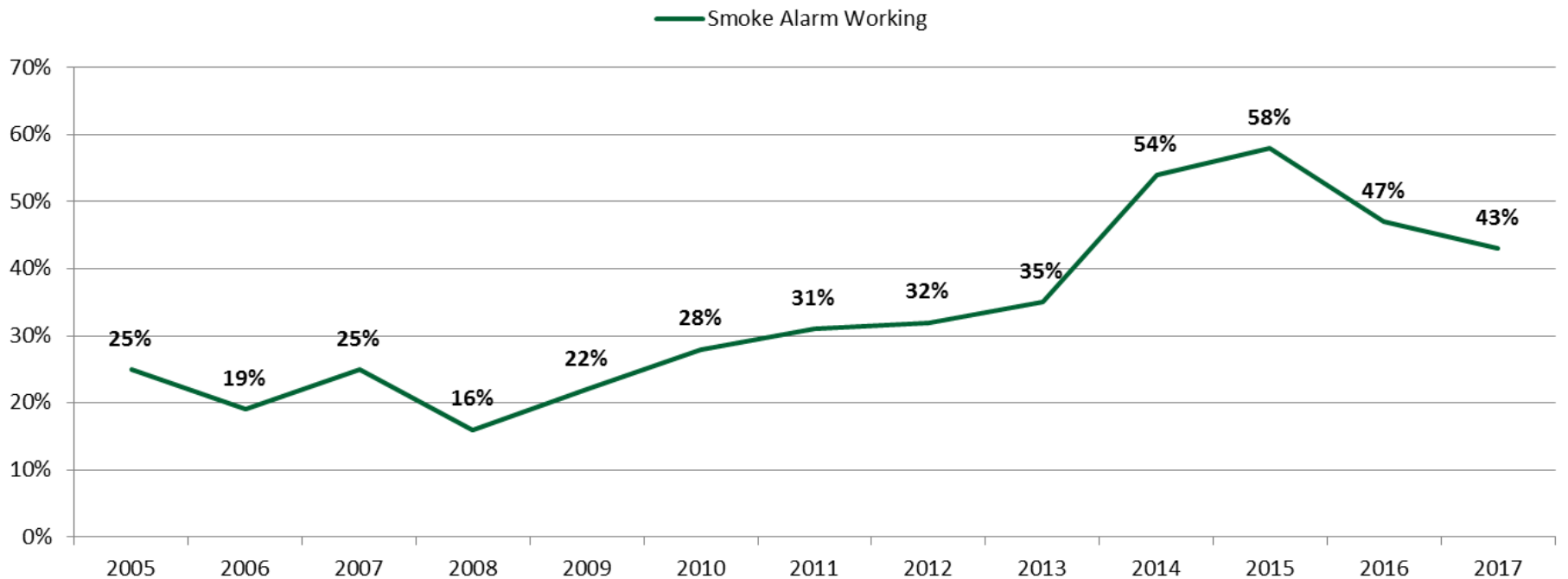
Data was accessed January 11, 2018 from the OFC.

Home Safe Analysis

CohortHSPropertyId
1 2 3 5 6 7 8 9
10 11 12 13

CohortHSLocationStrno...
1 2 3 5 6 7 8 9
10 11 12 13

CohortHSLocationStrnoId
1 2 3 5 6 7 8 9
10 11 12 13

InsClassName
HSC - Contact Made Home Safe Visit
HSD - Delivery Only Home Safe Visit

Search

# of PropertyId	# of LocationStrnoUnitId	# of LocationStrnoId	InsMaster (Row Count)
37,553	**37,335**	**31,648**	**38,240**

InsClassName — HSC - Contact Made Home Safe Visit, HSD - Delivery Only Home Safe Visit

[<<] [Clear] [>>]

OFCReportType
Structure

PROPERTY COMPLEX
3100 Residential - row, garden, town housing,...
3200 Residential - apartment
3300 Hotel, motel, lodge, hostel, boarding h...
3400 Residential - single detached
3500 Residential - duplex, 3-plex, 4-plex
3700 Camp site/RV park
3800 Residential - mobile home/trailer park
3900 Residential - with business/mercantile, ...

Cohort by LocationStrnoUnitId

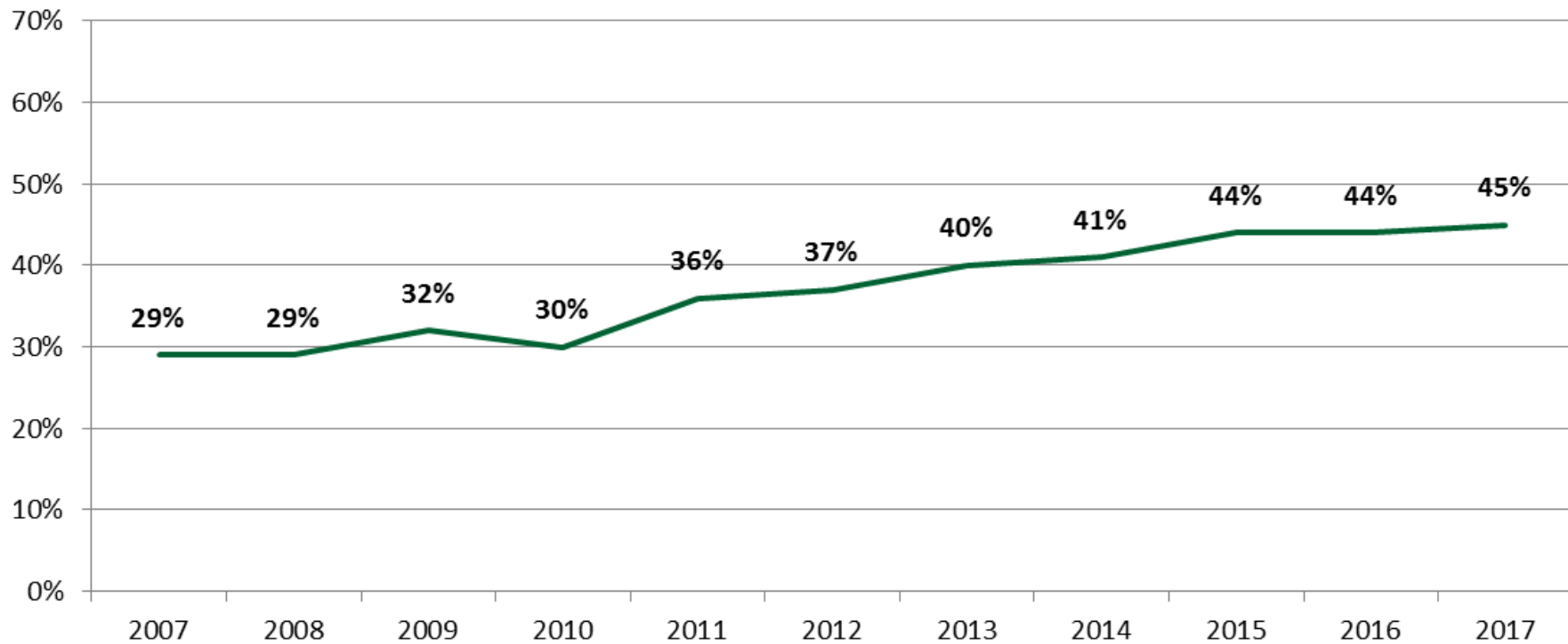| CohortHSLoca...	CohortHSLocationStrno...	# Locations (Loc-Strno-U...	Before (2 yrs)	Pre Fire Rate (per Year)	After	# Years	Post Fire Rate (per Year)	Rate Change	Rate Change
		37,335	133	1.78	244		1.45		
1	10/15/08	2,724	14	2.57	26	6.3	1.50	-41.4%	
2	6/22/09	2,662	6	1.13	13	5.7	0.86	-23.4%	
3	8/04/09	2,626	10	1.90	19	5.5	1.31	-31.4%	
5	10/11/09	2,612	4	0.77	13	5.4	0.93	21.4%	
6	3/15/10	2,799	9	1.61	17	4.9	1.23	-23.4%	
7	7/13/10	2,391	5	1.05	14	4.6	1.27	21.7%	
8	10/04/10	2,712	19	3.50	11	4.4	0.93	-73.5%	
9	3/05/11	2,557	10	1.96	14	4.0	1.38	-29.2%	
10	5/23/11	2,621	9	1.72	16	3.7	1.63	-4.9%	
11	8/02/11	2,207	5	1.13	7	3.5	0.89	-21.0%	
12	10/02/11	3,089	9	1.46			2.20	51.3%	
13	6/27/12	8,335	33	1.98			3.23	62.9%	
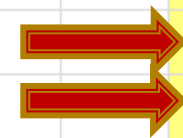
Retreatment 2015
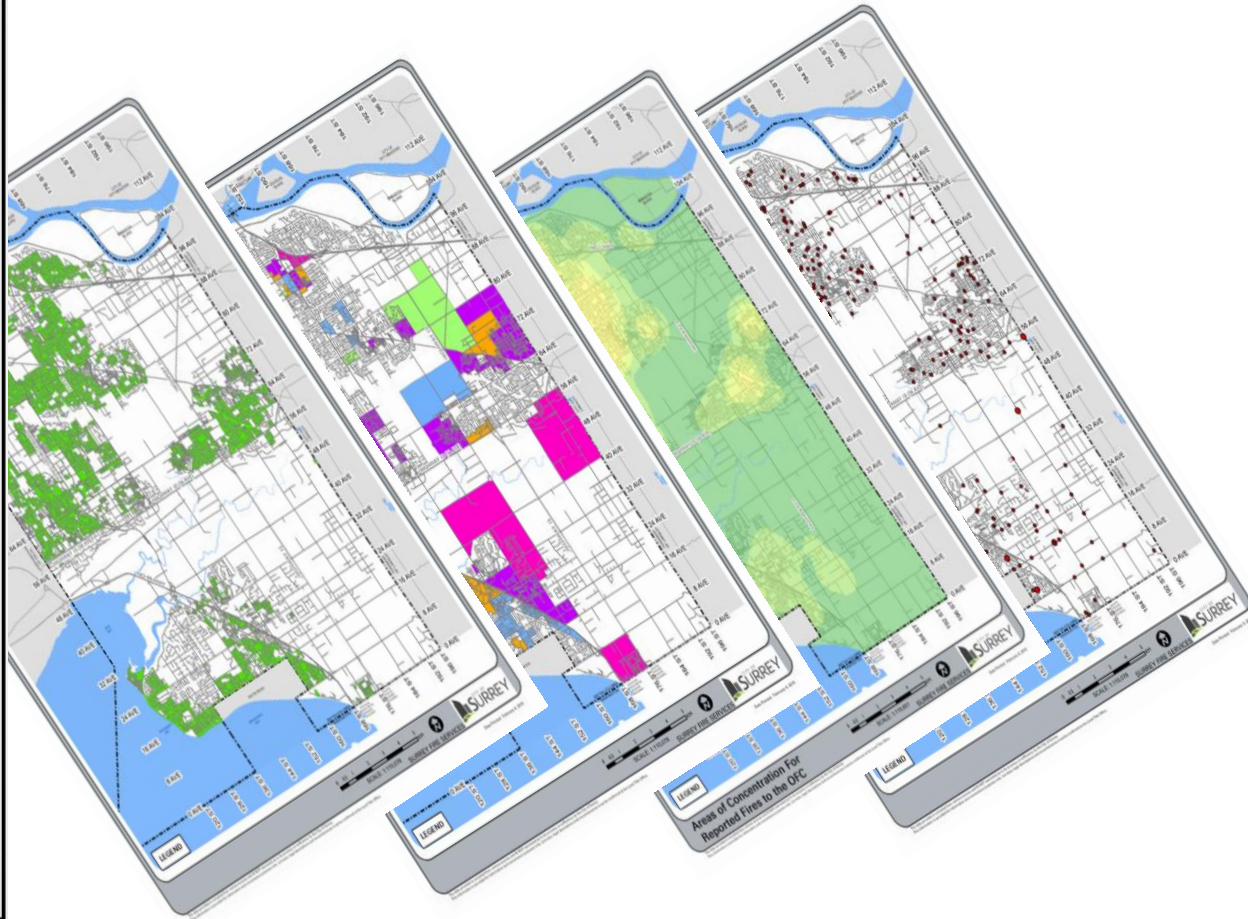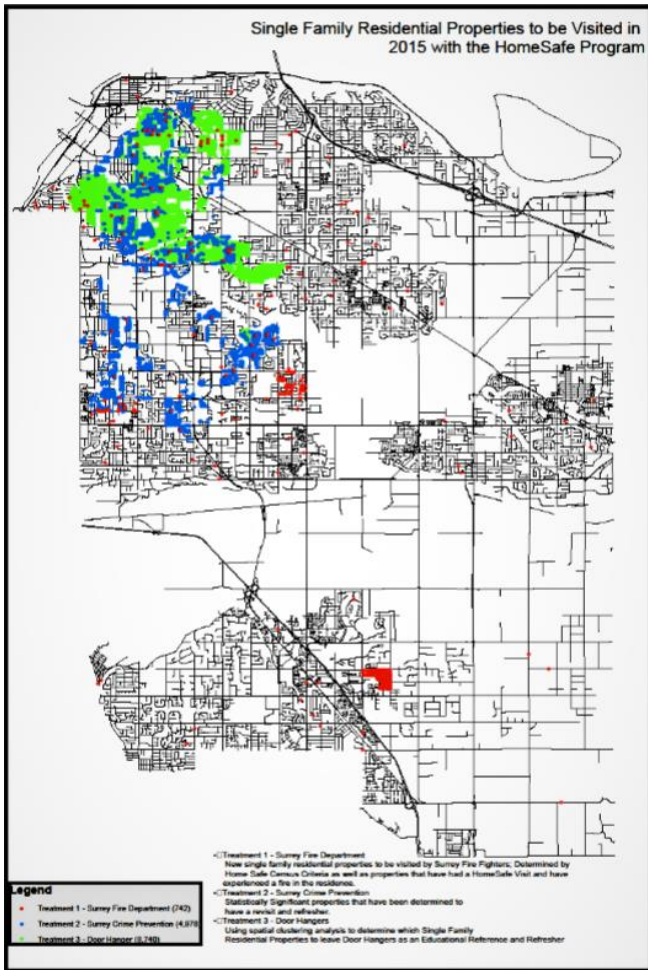
Retreatment 2018
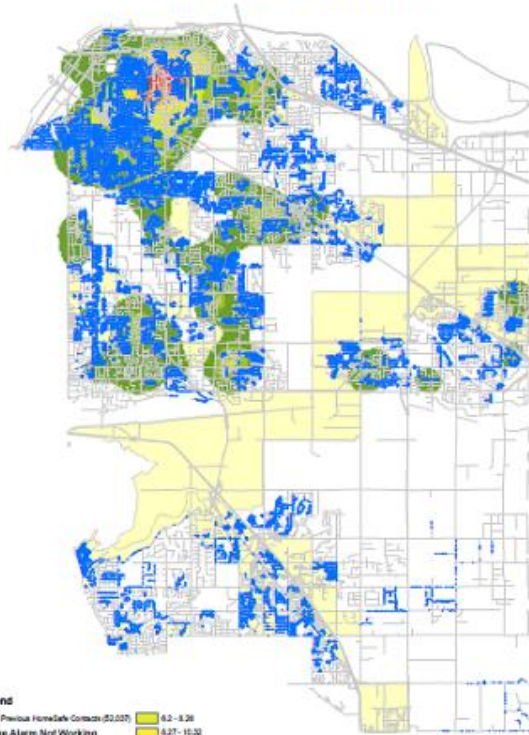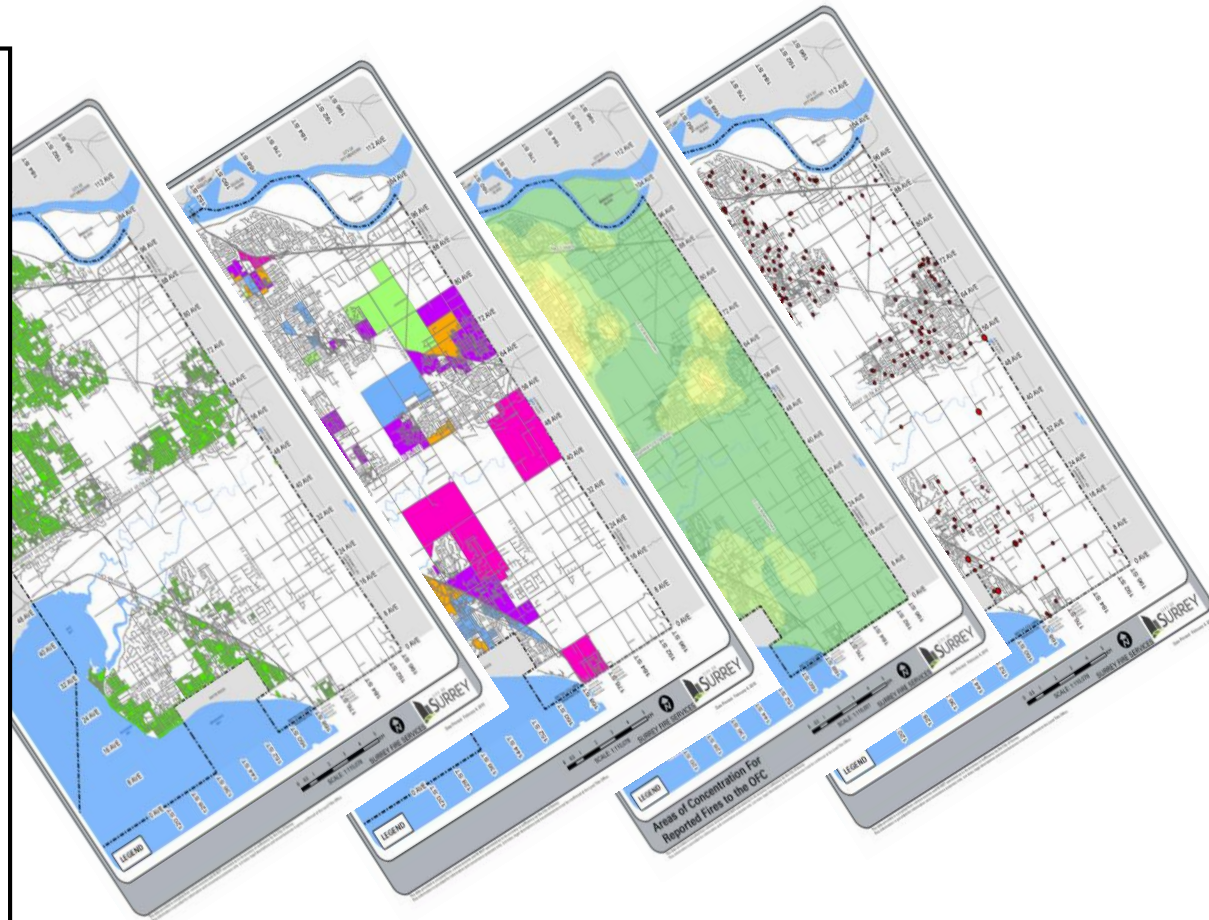
BC – Residential Structure Fires % of Working Smoke Alarm

BC Residential Structure Fires: Working Smoke Alarm (%)
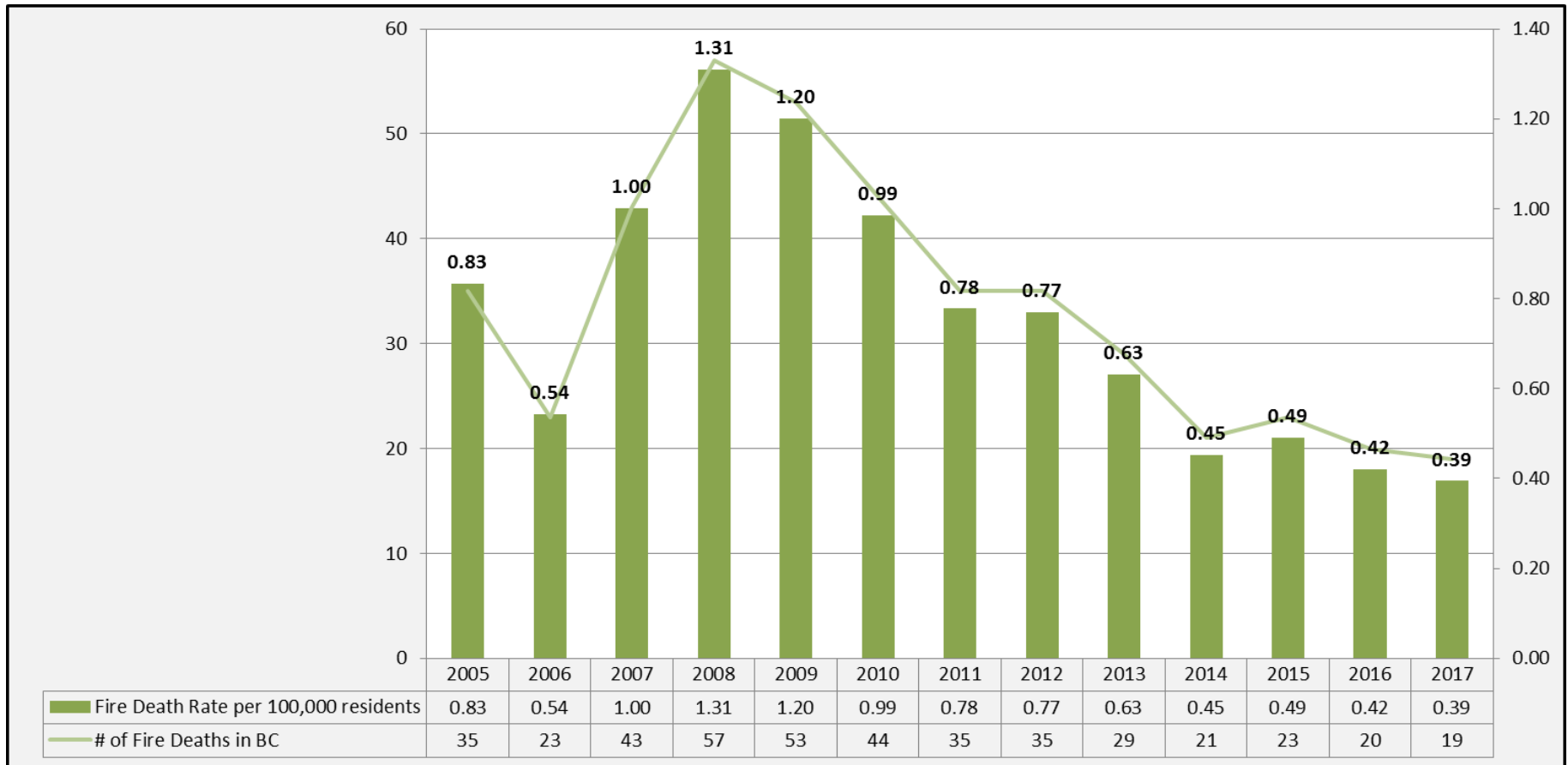
Legend: — Smoke Alarms Working

Year	%
2007	29%
2008	29%
2009	32%
2010	30%
2011	36%
2012	37%
2013	40%
2014	41%
2015	44%
2016	44%
2017	45%

BC Declining Deaths from Fire

BC Residential Structure Fires: Total Deaths 2007-2017

BC Declining Deaths from Fire

Fire Death Rate per 100,000 residents in British Columbia: 2005-2017

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fire Death Rate per 100,000 residents	0.83	0.54	1.00	1.31	1.20	0.99	0.78	0.77	0.63	0.45	0.49	0.42	0.39
# of Fire Deaths in BC	35	23	43	57	53	44	35	35	29	21	23	20	19

Proxy For a Safe Community
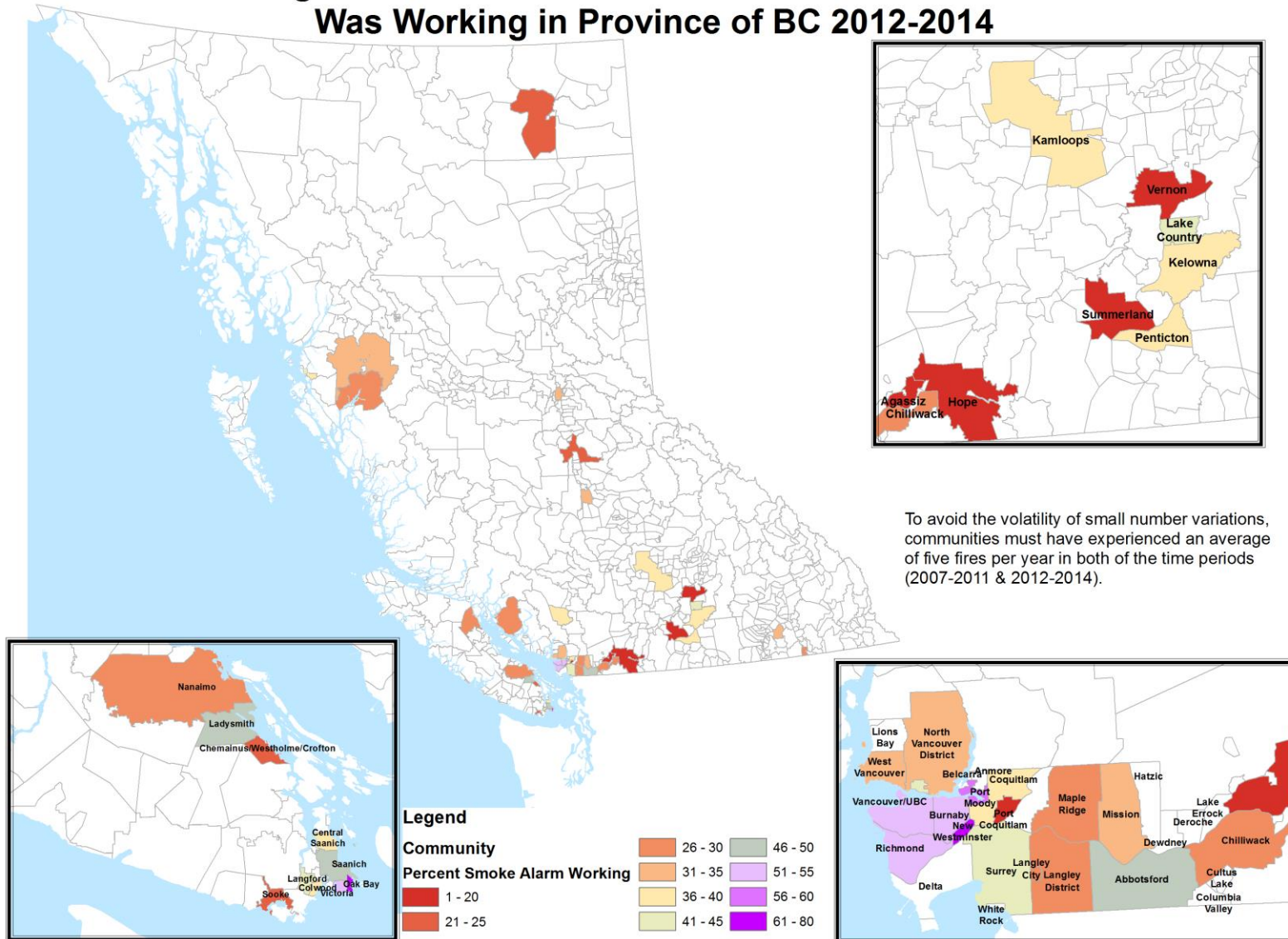# Might be a working smoke alarm

SUCCESS

Percentage of Residential Structure Fires where Smoke Alarm Was Working in Province of BC 2007-2011
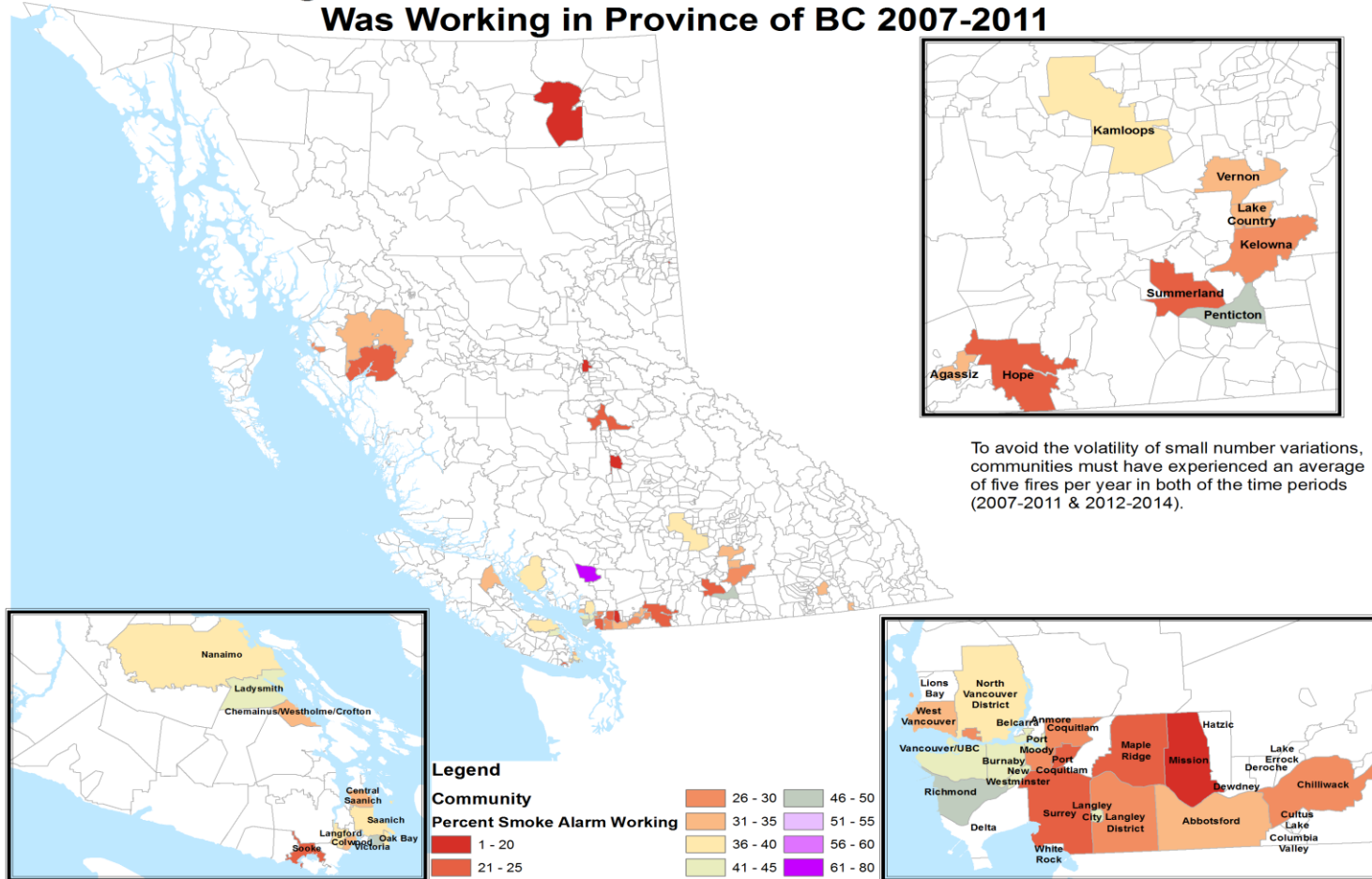
To avoid the volatility of small number variations, communities must have experienced an average of five fires per year in both of the time periods (2007-2011 & 2012-2014).

Legend

Community

Percent Smoke Alarm Working

1 - 20	26 - 30
21 - 25	31 - 35
	36 - 40
	41 - 45
	46 - 50
	51 - 55
	56 - 60
	61 - 80

Percentage of Residential Structure Fires where Smoke Alarm Was Working in Province of BC 2012-2014

To avoid the volatility of small number variations, communities must have experienced an average of five fires per year in both of the time periods (2007-2011 & 2012-2014).

Legend

Community

Percent Smoke Alarm Working

Color	Range	Color	Range
	1 - 20		26 - 30	46 - 50
	21 - 25		31 - 35	51 - 55
			36 - 40	56 - 60
			41 - 45	61 - 80

39

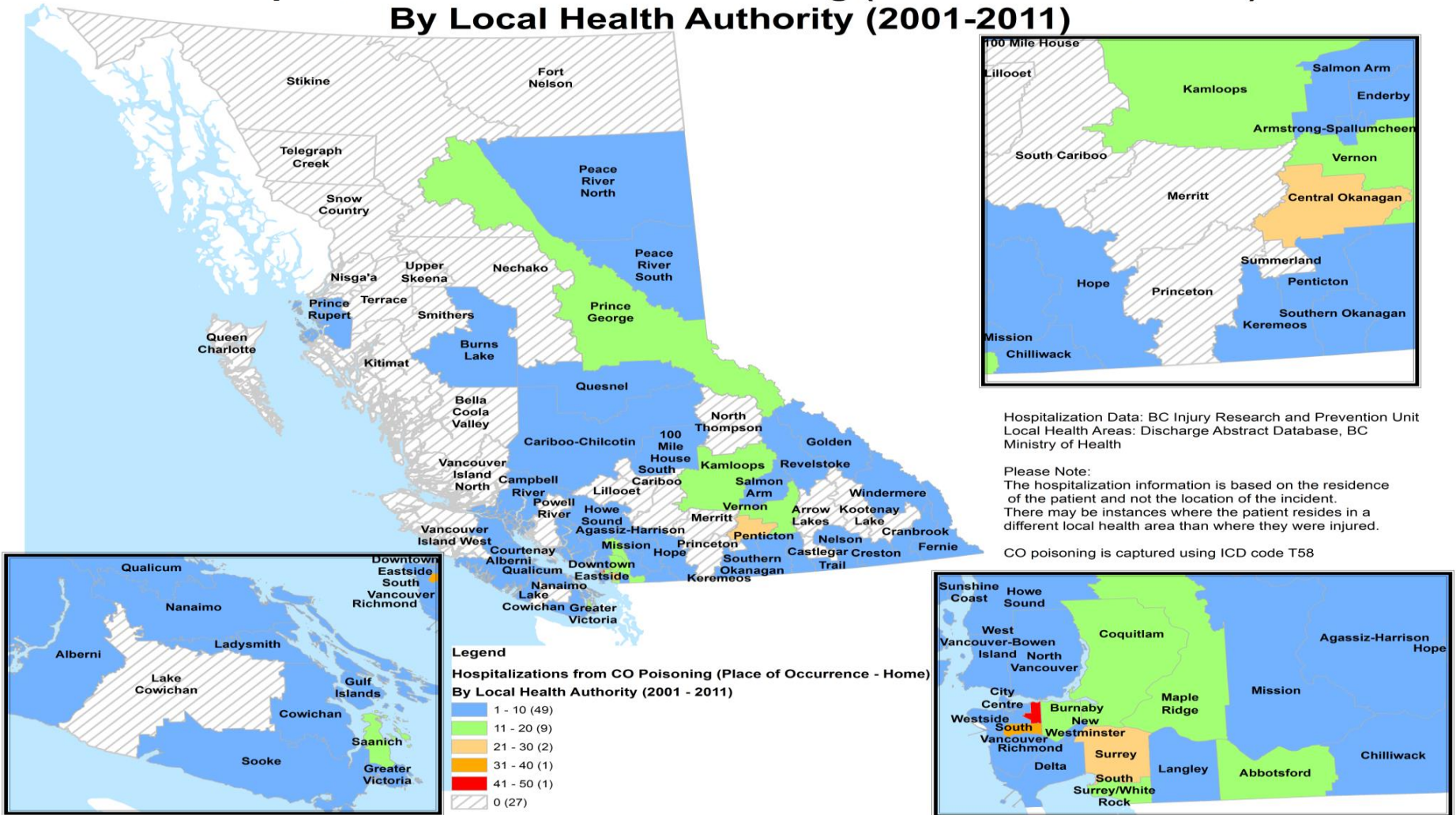# Regional variation over time

Percent Difference Between 2007-2011 & 2012-2014 in Residential Structure Fires where the Smoke Alarm was Working
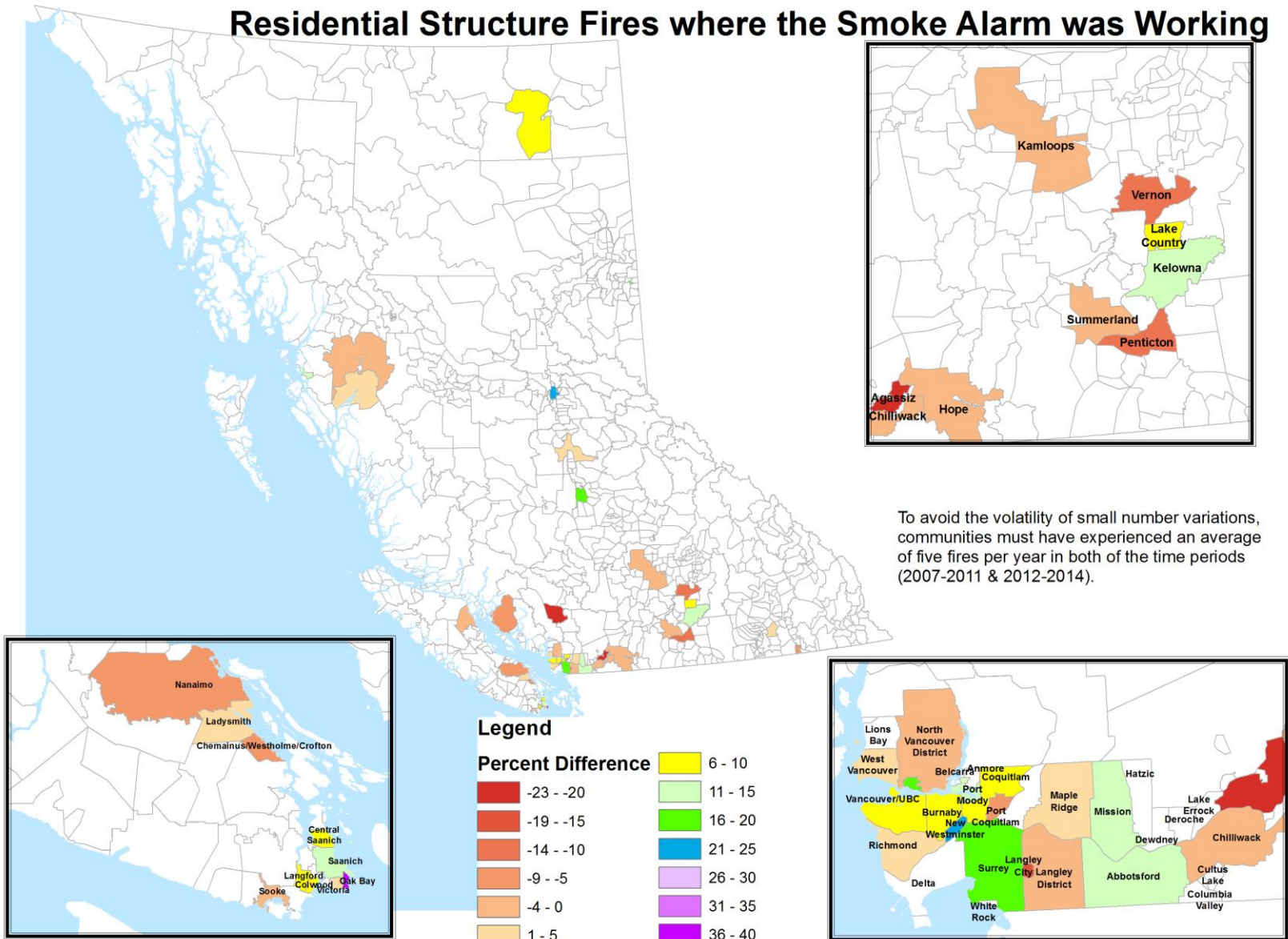
To avoid the volatility of small number variations, communities must have experienced an average of five fires per year in both of the time periods (2007-2011 & 2012-2014).

Legend

Percent Difference

Color	Range
	-23 - -20
	-19 - -15
	-14 - -10
	-9 - -5
	-4 - 0
	1 - 5
	6 - 10
	11 - 15
	16 - 20
	21 - 25
	26 - 30
	31 - 35
	36 - 40

40

There's a new opportunity to add value in Co Detection

Hospitalizations from CO Poisoning (Occurrence at Home)
**By Local Health Authority (2001-2011)**

Hospitalization Data: BC Injury Research and Prevention Unit
Local Health Areas: Discharge Abstract Database, BC
Ministry of Health

Please Note:
The hospitalization information is based on the residence
of the patient and not the location of the incident.
There may be instances where the patient resides in a
different local health area than where they were injured.

CO poisoning is captured using ICD code T58

Legend
Hospitalizations from CO Poisoning (Place of Occurrence - Home)
By Local Health Authority (2001 - 2011)
- 1 - 10 (49)
- 11 - 20 (9)
- 21 - 30 (2)
- 31 - 40 (1)
- 41 - 50 (1)
- 0 (27)

There's a new opportunity to add value in Co Detection

Mortality from CO Poisoning (Occurrence at Home)
**By Local Health Authority (2001-2011)**
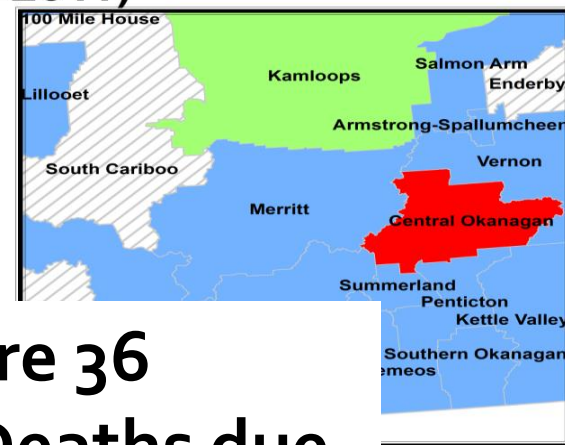
On Average there are 36 Hospitalizations and 11 Deaths due to Co Poisoning in BC per year

...nd Prevention Unit
...s Agency

...n the residence of the patient and not the location of the incident.

CO poisoning is captured using ICD code T58

Legend
Mortality From CO Poisoning (Place of Occurrence - Home)
By Local Health Authority (2001-2011)
1 - 5 (46)
6 - 10 (12)
11 - 15 (3)
16 - 20 (3)
0 (25)
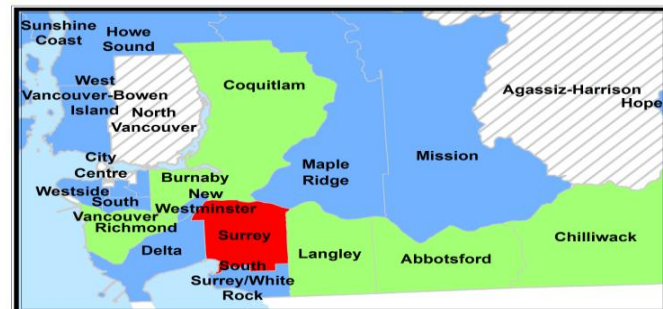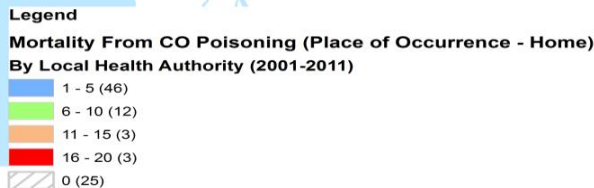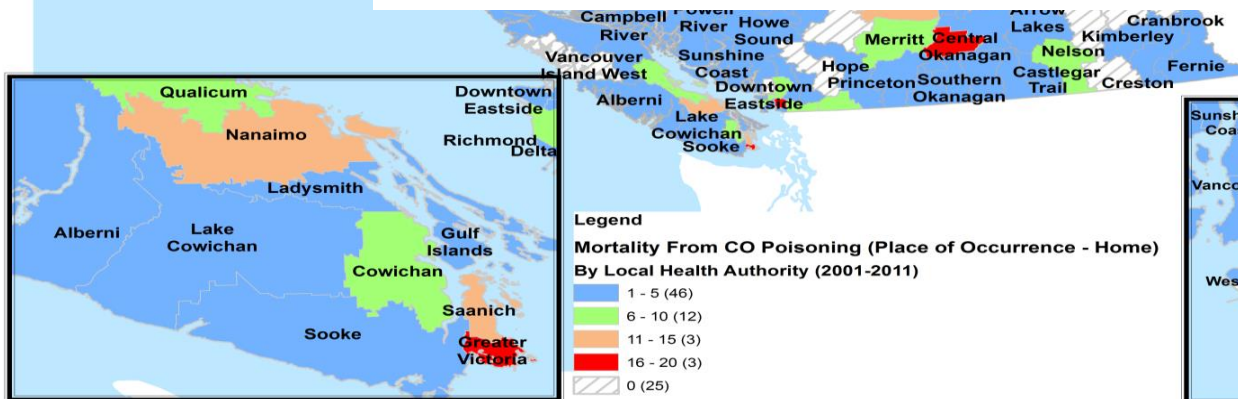
There's still room for improvement

- **Plenty of room for improvement in smoke alarm coverage**

- **Fundamental to ensuring ongoing reductions in fire-related fatalities**
  - Data-driven, targeted interventions
- **Target risk**
  - Individuals, communities
  - Risky areas in houses
  - Risky areas in Cities

Measuring Outcomes ?

Predictive Analysis

- Analytical tools are widely used in the fire services to assist with deployment decisions
- Techniques range from probabilistic models to systems analysis and simulations
- The *Deccan* suite of products is a predictive toolkit used to move units up to fill existing and/or expected gaps in coverage

DECCAN INTERNATIONAL
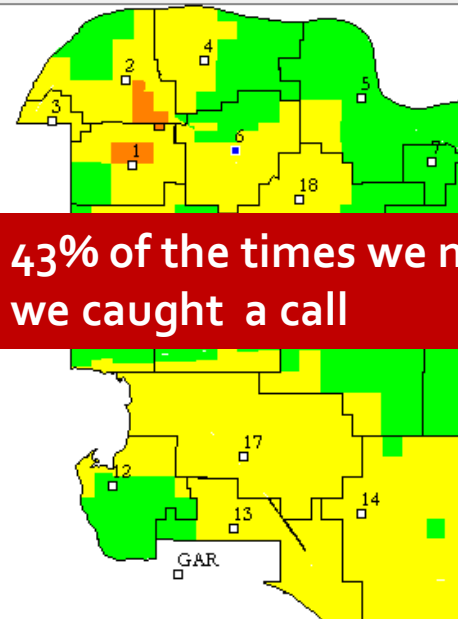*Decision Support Software for Fire and EMS*

Predictive Analysis

Predictive Analysis

Business Rule = Must be a 25% chance another call will occur
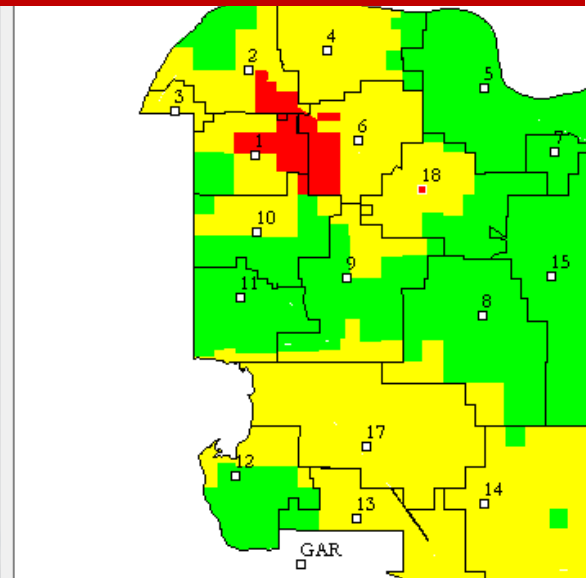
With Move-Ups: 100%

43% of the times we moved we caught a call

We are in the business of being in the right place at the right time as opposed to trying to be every where at once

LiveMUM Rec...

ETBAv	
0	

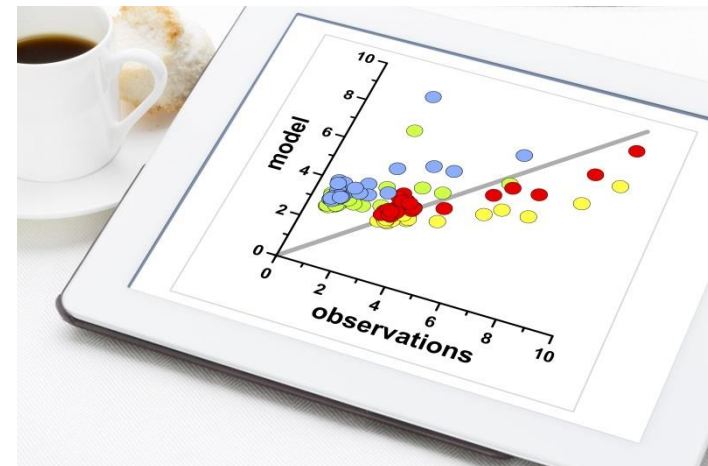| Tick To Evaluate	Move-up Travel Time
✔	2

1

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Statistical Modelling

- What is the relative impact of various components of the model on the outcome?

- Are those impacts large enough to be meaningful from a policy perspective?

- How do the various components in the model interact with one another?

Costing Analysis: Steps to Consider

- Conducting a financial (cost-benefit or cost-effectiveness) analysis of the options under consideration

- Preparing an accounting statement summarizing the results

Cost-Benefit Analysis

- Define the problem

- Identify any constraints or limiting factors

- List the alternatives

- List the benefits

- How are the costs and benefits to be quantified?

Finally Making The Right Decision

- Using Evidence

- Identify and Frame the Question

- Gather the Evidence

- Organize the Evidence

- Review the Decision-making Process

THE RIGHT DECISION

Evidence-based Decision Making for Government Professionals

Paul S. Maxim, Len Garis, Darryl Plecas and Mona Davies