Parish Safety Volunteer Visits Evaluation

Summary of findings from quantitative analysis of fire incident, police incident, House Safety Visit and Parish Safety Volunteer Visit data.

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1 Introduction

This document is intended to present to PSV partners (Andrea MacAlister and Kieron Moir) a basic analysis of accidental dwelling fires (ADFs) and burglaries before and after the Parish Safety Volunteer (PSV) programme was implemented in parishes across Essex County.

2 Methods of evaluation

All visits made by Parish Safety Volunteers (PSVs) were recorded and analyzed in light of accidental dwelling fire (ADF) and burglary occurrences (the technical appendix details the way in which the statistical datasets were created and analyzed).

We used the Stata software package to perform all analyses and estimations. The findings presented below rely on two types of tests: the difference-of-means test and linear regression.

2.1 Difference-of-means tests

A difference-of-means test compares the average value of an attribute between two groups. This type of test is useful for determining whether there are differences in the number of ADFs between, say, parishes that received PSV visits and those that did not. This statistical test accounts for not just the mean values, but also the dispersion of observations, when analyzing differences. We are therefore able to tell not just whether means are different from each other in the data sample used, but whether we can believe they are different in the full population of possibilities.

2.2 Linear Regression

Linear regression analyzes the relationship between one outcome of interest (e.g. the number of ADFs) and one or more possible determinants (e.g. PSV visits). This estimation technique utilizes the observations in the data to determine means and dispersion rates for each variable of interest, then uses those means and rates to determine the most likely relationship. We are therefore able to tell not just the

relationships among variables in the data sample used, but also whether we can believe there are relationships in the full population of possibilities.

2.3 Unit of Analysis

When merging the data from different sources (see Appendix), we were forced to aggregate all data to the Local Authority level, rather than a smaller geography such as parishes. We were able to keep the analysis at the monthly level. One observation is therefore a particular LA in a particular month of a particular year (an LA-year-month).

2.4 Comparison Groups

The results we offer are based on comparisons among groups on 2 central dimensions:

Time – comparing the time period before PSV visits began to the time after PSV data ends. This process entails comparing ADF incidence before February 2016 to ADF incidence after December 2016.

Treatment – comparing the LAs that do receive the intervention to those that do not receive the intervention. This process entails comparing LAs that receive PSV visits to those LAs that do not receive visits.

We thus end up with four groups to compare:

- 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
- Post-2016 incidence among LAs that have received visits

2.5 Data Limitations

It is important to note that the data available for analysis has limitations that restrict our ability to make inferences about the success/failure of PSVs and other Home Safety Visits (HSVs).

The PSV programme was implemented in 2016, and we have data on the number of visits to each Local Authority within each month from February-December 2016. This naturally restricts our 'post-PSV' data to only the months after December 2016. For these months, we have ADF data from January-July 2017, and burglary data from January-March 2017. While we report the findings, we caution the reader that there is not enough burglary data to adequately assess differences between before and after the PSV programme, and the ADF data will be greatly enriched by the ability to add more fire incident data in the future.

3 Findings

3.1 Accidental Dwelling Fires

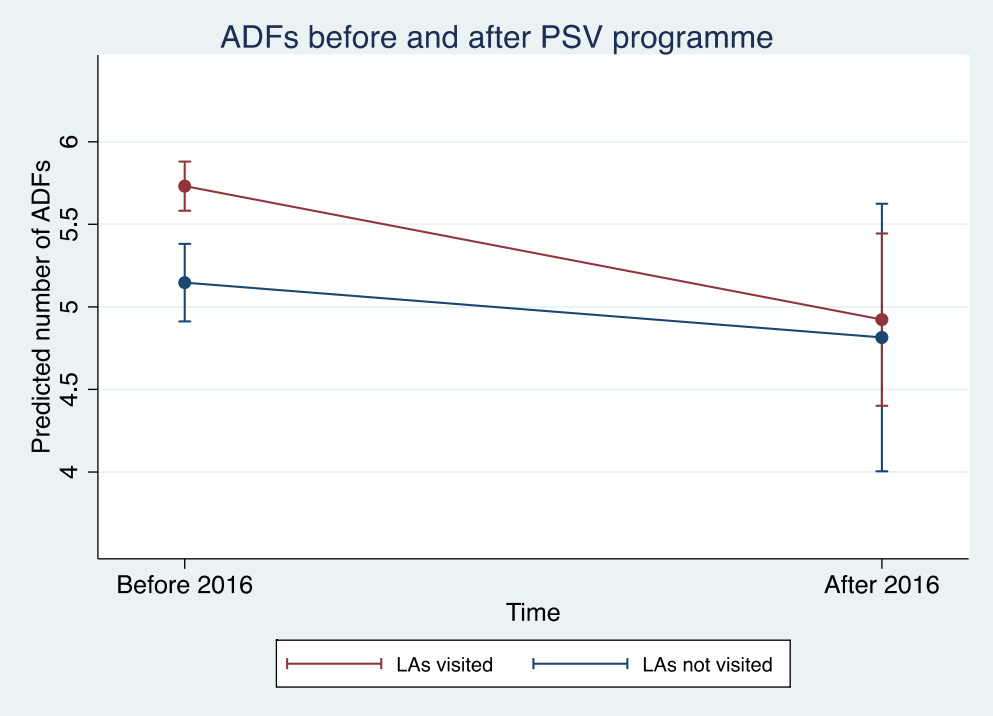
1. **Does the number of fire incidents in a Local Authority decrease after PSV visits take place?**

   Answer: Yes

   Accidental Dwelling Fires went down overall from 2015 to 2017 (before and after the PSV visits). The decrease was an average of 0.7 fewer ADFs per LA per month (3 fewer ADFs per LA per 4-month period).

   This overall reduction was due to a reduction in the number of ADFs for the LAs that received visits. Before PSV visits began (pre-2016), there was a significantly higher number of ADFs in the LAs that would receive visits than there was in the LAs that would not receive visits. After the visit data ends (post-2016), there is no longer a difference between LAs that have received PSV visits and those that have not done.

   Essentially, the difference between LAs that receive visits and those that do not has been eliminated. As you can see in Figure 2.1, before 2016 the two groups of LAs were significantly different in their ADF incidence. After 2016, there is no statistical difference.



2. **Does the number of fire incidents decrease as the number of PSV visits increase for the particular Local Authority?**

   Answer: Unable to discern

   Because of the small number of LA-year-months that have received PSV visits, there is not enough data to determine whether/how increasing visits to an LA decreases ADF incidence rates.

3. **Does the likelihood of having an accidental/deliberate fire in the Local Authority decrease after the PSV visits?**

   Answer: No

   Though the number of ADFs decreases among PSV-visited LAs from pre-2016 to post-2016, we fine no evidence that the likelihood of having a fire at all goes down within an LA. In other words, an LA is just as likely to have at least one fire in any month after 2016 as it was in any month prior to 2016.

3.2 Deliberate Fires or Arsons

The fire incident data differentiated between accidental and deliberate fires. We found no evidence of a difference for the number of deliberate fires over time or when comparing visited vs. unvisited LAs.

The police incident data included a crime category "arson". It was not clear if these were the same as "deliberate" fires, hence they were analyzed separately. We found no evidence of a difference for the number of arsons over time or when comparing visited vs. unvisited LAs.

3.3 Accidental or Deliberate Fires

Some fires were classified as "accidental or deliberate", meaning that at the time of reporting it was uncertain if it was an accidental or deliberate fire.

We found no evidence of a difference for the number of these fire incidents over time, or over visited vs. unvisited LAs.

3.4 Burglaries

1. **Does the number of burglary crime incidents decrease after PSV Visits take place in the Local Authority vicinity?**

   Answer: Unable to discern

   Due to the small amount of burglary data after 2016, there is not sufficient information to tell whether burglary incidents decreased over time.

3.5 Smoke alarms

1. **Does the presence of smoke alarms increase in Essex Local Authorities after a PSV visit takes place?**

   Answer: No

   We find no evidence of a difference for the number of fire incidents where a smoke alarm was present over time, or over visited vs. unvisited LAs (within each group or between them).

3.6 Injured

1. **Does the likelihood of someone getting injured during a fire incident decrease after a PSV visit takes place in the Local Authority?**

   Answer: No

   We find no evidence of a decrease in ADFs where someone is injured. This includes potential decreases over time, or between visited vs. unvisited LAs.

2. **Does the likelihood of someone being evacuated during a fire incident decrease after a PSV visit takes place in the Local Authority?**

   Answer: No

   We find no evidence of a decrease in ADFs where someone is evacuated. This includes potential decreases over time, or between visited vs. unvisited LAs.

3.7 Fires in with Smoke Alarms present

1. What is the relationship between the presence of smoke alarms in ADFs change over time or between LAs that receive visits and those that do not?

   Answer: No

   We find no evidence of a decrease in ADFs with a smoke alarm present. This includes potential decreases over time, or between visited vs. unvisited LAs.

3.8 Fires in Inhabited Dwellings

There was some evidence of a reduction in the number of fire incidents in an inhabited dwelling after the PSV visits, for those LAs where a visit took place.

a. Before 2016, there was a greater number of fires in buildings that were occupied in LAs that would be visited than in those that would not be visited.

b. For LAs which were visited by Parish Safety volunteers, there was a reduction in the number of fire incidents involving a dwelling which was inhabited, comparing rates before the visits took place to after.

4 Technical Appendix

4.1 Datasets included

Data was merged from the following sources:

1. ECFRS Fire Incident data (2009-2017)
2. ECFRS PSV records (2016)
3. ECFRS House Safety Visit data (2003-2017)
4. Essex Police Open Police and crime data (2009-2017)
5. ONS Census 2004 and 2011 Geography mapping data (for England and Wales)
6. Number of Dwellings data from the Department of Communities and Local Government.

4.2 Software used

We used STATA as the preferred software for compiling, preparation and cleaning and analysis of the datasets.

4.3 Resulting Core Datasets for Statistical Analysis

The datasets above were merged and matched, resulting in the following two aggregated datasets:

- *Dataset A2. Fire, Police, PSV and HS visits by LA/yr/mon + Dwelling data LA/yr*
  `(DATASETA2_fire-police-psvvisits-dwellings-hsvisits_byLAyearmon.dta)`

- *Dataset B1. Fire, Police, PSV visits, School visits by LA/yr + Dwelling data LA/yr*
  `(DATASETB1_fire-police-psvvisits-schoolvisits-dwellings_byLAyear.dta)`

Of the two Dataset A2, was used mostly for the analysis; since B1 was on a LA/year level it did not offer itself for analysis appropriate to the level of detail that could help us draw conclusions for the PSV visits programme, as a breakdown by month was needed.

4.3.1 Assumptions

Here is a list of assumptions that were made while creating the core datasets:

a. The date a fire incident was reported is the date of the incident

b. The date a burglary was recorded is the date of the incident

ECFRS call incident year and month are year and month when the fire incident took place, and that the Essex Police data incident reported year and month are the year and month when the police incident happened.

c. "Arsons" in the Essex Police data do not overlap completely with "Deliberate fires" in the Essex County Fire and Rescue Data.

d. ONS Census 2004 geographies and ONS Census 2011 geographies are the same

e. When mapping the Parish Safety Volunteer Visit data from Parish to LA level, some assumptions regarding corresponding mappings were made.

f. When processing the House Safety Visits data, we dropped all records without a date, where all the remaining variables were also missing (8,367 observations in total).

g. In the House Safety Visits data, we assumed that the "due date" in the records prior to 01/04/2016 and the "visit date" for records after 01/04/2016 mean the same thing. Also, for data after that date when the "visit date" was left unspecified in the system, we used the "due date" instead.

4.3.2 Descriptive Statistics

4.3.2.1 Dataset A2 – no of observations, mean, standard deviation, min, max, frequencies

Variable	Obs	Mean	Std. Dev.	Min	Max
la_name	0				
date	1,380	201297.9	241.2902	200904	201707
year	1,380	2012.914	2.417592	2009	2017
month	1,380	6.44058	3.403931	1	12
fires_accidental	1,380	5.526812	3.308855	0	17
fires_delib	1,380	.7978261	1.125418	0	8
fires_accordelib	1,380	.1384058	.3907603	0	3
fires_avg1	1,380	5.526812	2.143488	1	9.53
fires_avg1_delib	1,380	.7978261	.5343392	0	2
fires_avg1_accordelib	1,380	.1384058	.0872409	0	.32
fires_avg2	1,380	5.526812	2.429123	1	10.875
fires_avg2_delib	1,380	.7978261	.5996718	0	2.625
fires_avg2_accordelib	1,380	.1384058	.1435529	0	.625
fires_avg3	1,380	5.559901	2.131506	1	9.382716
fires_avg3_delib	1,380	.8198929	.5824858	0	2.222222
fires_avg3_accordelib	1,380	.1166979	.0935279	0	.3703704
rtfires_accidental	1,380	34.77536	24.75136	0	141
rtfires_delib	1,380	5.080435	6.262338	0	37
rtfires_accordelib	1,380	.8536232	1.579517	0	13
occupied_when_fire	1,380	5.266667	3.385747	0	19
rtoccupied_when_fire	1,380	33.21957	24.90997	0	144
arsons	1,380	5.944928	8.251478	0	49

rtarsons	1,380	36.11014	51.47819	0	320
burglaries	1,380	5.653623	6.563818	0	34
rtburglaries	1,380	35.73043	40.59476	0	224
psvvisits	1,380	.2507246	2.609356	0	56
rtpsvvisits	1,380	2.431884	14.29774	0	163
rtpsvvisits_month	1,380	15.39058	25.46314	0	128
hsvisits	1,380	40.7942	49.28367	0	428
hsvisit_initial	980	28.55102	33.57565	0	212
hsvisit_revisitalarm	980	9.868367	11.49766	0	83
hsvisit_letter	980	.0785714	1.150099	0	32
hsvisit_salarminstall	980	.7632653	1.763052	0	17
hsvisit_1stpartnervisit	980	4.930612	20.01601	0	368
hsvisit_2ndpartnervisit	980	.2867347	2.635196	0	63
visits	1,380	41.04493	49.14603	0	428
rtvisits	1,380	2853.951	1998.173	0	8192
victims	1,380	.7789855	.950398	0	6
rtvictims	1,380	4.92029	4.519335	0	23
persons_evacuated	1,380	.9637681	1.124643	0	7
rtpersons_evacuated	1,380	5.913768	5.374768	0	35
ndwel_la	1,069	3788.04	3796.293	0	11607
ndwel_ha_pp	1,095	3756.891	3189.533	470	12316
ndwel_private	1,069	43458.19	15129.85	23740	66700
ndwel_public_oth	1,083	175.0314	488.1615	0	4513
ndwel_total_la_year	1,095	51114.22	18152.03	26940	78610
ndwel_fraction	1,095	.0838604	.0297658	.0445393	.126022
ndwel_la_fraction	1,069	.0859702	.0862566	0	.2761427
ndwel_happ_fraction	1,095	.0839346	.0713204	.0105832	.2871063
ndwel_private_fraction	1,069	.0860605	.0303746	.0465736	.1435995
ndwel_puboth_fraction	1,083	.0854998	.1811976	0	.7713211
missing_dwelling_data	1,380	.2731884	.5763077	0	2
alarm_present	1,380	3.655072	2.637353	0	15
rtalarm_present	1,380	22.62319	18.77229	0	119
normally_occupied	1,380	6.122464	3.710548	0	20
rtnormally_occupied	1,380	38.55145	28.74646	1	162
la_id	0				

Local Authority (LA) name – ONS Census 2011	Freq.	Percent	Cum.
Babergh	1	0.07	0.07
Basildon	100	7.25	7.32
Braintree	100	7.25	14.57
Brentwood	95	6.88	21.45
Castle Point	97	7.03	28.48
Chelmsford	99	7.17	35.65
Colchester	100	7.25	42.90
Epping Forest	100	7.25	50.14
Harlow	97	7.03	57.17
Maldon	92	6.67	63.84
Redbridge	4	0.29	64.13
Rochford	95	6.88	71.01
South Cambridgeshire	2	0.14	71.16
Southend-on-Sea	100	7.25	78.41
Tendring	100	7.25	85.65
Thurrock	100	7.25	92.90
Uttlesford	98	7.10	100.00
Total	1,380	100.00	

Local Authority (LA) code – ONS Census 2011	Freq.	Percent	Cum.
E06000033	100	7.45	7.45
E06000034	100	7.45	14.89
E07000012	2	0.15	15.04
E07000066	100	7.45	22.49
E07000067	95	7.07	29.56
E07000068	93	6.92	36.49
E07000069	97	7.22	43.71
E07000070	85	6.33	50.04
E07000071	93	6.92	56.96
E07000072	100	7.45	64.41
E07000073	97	7.22	71.63
E07000074	89	6.63	78.26
E07000075	95	7.07	85.33
E07000076	98	7.30	92.63
E07000077	94	7.00	99.63
E07000200	1	0.07	99.70
E09000026	4	0.30	100.00
Total	1,343	100.00	

4.4 Data Preparation and Linkage

4.4.1 Step 1. Preparation of the ECFRS Fire Incident Master file

Two master datasets on Fire incidents across the county were deposited: (a) contained 8,156 observations and 39 variables, whereas (b) contained 7,416 observations and 153 variables (most system variables) including address details of the dwellings to postcode level. These were transformed from an individual fire incident per row to a number of fire incidents by Geography (LSOA), Year and Month.

We included the following measures/indicators from the original files, these are presented by LSOA/Year/Month at this stage:

- No. of accidental fire incidents, i.e. Fire incidents that were reported as of accidental motive;
- No. of deliberate fire incidents i.e. Fire incidents that were reported as of deliberate motive;
- No. of accidental or deliberate fires i.e. Fire incidents where it was unclear if the motive was accidental or deliberate;
- No. of fire incidents where someone involved was injured. This does not include FRS staff, as this is encoded separately;
- No. of fire incidents where someone involved was evacuated;
- No. of fire incidents where a smoke alarm was installed in the premises
- No. of fire incidents where the dwelling was occupied i.e. someone was in the dwelling at the time of fire
- No of fire incidents where dwelling is normally inhabited

Running totals for all of these variables by LSOA/Year/Month, LSOA/Year were generated next.

While compiling the ECFRS Fire Incident Master file, we came up with the following issues that were resolved prior to the final ECFRS Incident Master File being generated:

- Upon import all date variables (e.g. time_of_call) were encoded in a format that STATA would not understand to do date operations with. For this reason, we extracted the month and year (and the day or time where applicable) in separate variables to allow us to operate on them (sort, order, merge etc). In addition, some of the dates from dataset (b) were encoded in a DDmmYYYY format, but upon import this was interpreted as MMDDYYYY. After we identified the pattern, we wrote some code to separate the dates and then copy the month values to the day values and vice versa.

- There were some issues with the way geography information was encoded too: some fire incidents had a textual address but no postcode, some had a postcode but no LSOA code assigned to them. We used the remaining geography variables available to harmonise the dataset as follows:
    - We first filled in the geo_postcode variable with information from the textual address field. This sub-dataset was created manually i.e. By looking up the addresses on the post office website. 130 observations were optimized using this method.
    - All records with no geography information (i.e. no postcode, textual address, LSOA or LA information) were removed (60 observations in total), as there was no way to match the record to any of the rest of the data.
    - For the remaining records, we used the ONS Census 2011 Geography mapping to fill in the LSOA field (code and name). Note that the Fire incident data were using LSOA codes and names from Census 2004, whereas our mapping file was based on ONS Census 2011 LSOA and LA codes and names. This was because the ONS Census 2011 mapping file was the one readily available as open data on the ONS website.
    - Following this step, any observations that we could not generate LSOA information were dropped (12 observations)
    - Finally, all geography variables were dropped, except for the LSOA Code and name variables.

The data were merged by on Lower Super Output Area (LSOA), year, month to arrive at a panel dataset with the unit of analysis being the LSOA-year-month. That is, each observation is one LSOA during a particular year and month, such as 'Basildon-2015-january'. Table A1 describes all variables in this dataset.

The *resulting master Fire Incident data* contained 8,151 observations by LSOA, Year Month, with the running totals of the above measures as follows:

Table 1 Summary of Fire Incidents master file

Variable	Obs	Mean	Min	Max	Label
geo_lsoa04cd	8151	.	.	.	LSOA geography Level code - ONS Census 2004
year	8151	2012.87	2009	2017	Incident Call Calendar Year
month	8151	6.356153	1	12	Incident Call Calendar Month
geo_lsoa04nm	8151	.	.	.	LSOA geography Level name - ONS Census 2004
tn_lsoa_accidental_fire	8151	.9357134	0	3	tot no of fire incidents involving an accidental fire by lsoa\yr\mon
tn_lsoa_victims	8151	.1318857	0	2	tot no of fire incidents involving injured by lsoa\yr\mon
tn_lsoa_persevac	8151	.1631702	0	3	tot no of fire incidents involving evacuated persons by lsoa\yr\mon
tn_lsoa_alarm_present	8151	.6188198	0	5	tot no of fire incidents where a smoke alarm was present by lsoa\yr\mon

tn_lsoa_occupied_when_fire	8151	.8916697	0	5	tot no of fire incidents where dwelling was occupied at time of fire by lsoa\yr\
tn_lsoa_nbuilding_occupied	8151	1.03656	0	5	tot no of fire incidents where dwelling is normally inhabited by lsoa\yr\mon
tn_lsoa_accordelib_fire	8151	.0234327	0	2	tot no of fire incidents - unsure if accidental or deliberate by lsoa\yr\mon
tn_lsoa_delib_fire	8151	.1350755	0	6	tot no of fire incidents involving a deliberate fire by lsoa\yr\mon

4.4.2 Step 2. Preparation of the Essex Police Open data

Open Data on Essex Police Crime Incidents between 2009-Mar 2017 were downloaded from Essex Police Data online repository, by year month, and were appended in a single master file. The police data contained data on various crime types, by year, month and LSOA geography (1,010,707 observations) between Dec 2010 and Mar 2017. Crime types were coded in 16 categories[1] and we selected all records coded as "burglaries" and those coded as "arsons" (about 81,944 observations in total).

4.4.3 Step 3. Merge fire incident and police incident data

The police incident data were then merged with the fire incident data on LSOA level, by year and month – any police incidents that did not match with the fire incidents file were dropped.

4.4.4 Step 4. Prepare Parish Safety Volunteers Data file

The original Parish Safety Volunteer (PSV) Visits data file used included data on the number of PSV visits by parish, month for the year 2016. The original data file was converted to STATA file format and labelled accordingly in preparation for the next steps. We also generated the running totals for visits for the whole LA for all years (`rtvisits`), and by month for all years (`rtvisits_month`).

PSV data were expressed in parish geography level. To map them to the fire-to-police incident data, we mapped parish level geographies to Local Authority level geography. The list of parishes and their corresponding LAs is included below:

[1] The CrimeTypes categories included: Anti-social behavior, Bicycle theft, Burglary, Criminal damage and arson, Drugs, Other crime, Other theft, Possession of weapons, Public disorder and weapons, Public order, Robbery, Shoplifting, Theft from the person, Vehicle crime, Violence and sexual offences, and Violent crime.

Local Authority Name	Parish Name
Tendring	Alresford
Basildon	Benfleet
Braintree	Bocking
Brentwood	Brentwood
Tendring	Brightlingsea
Braintree	Castle Hedingham
Tendring	Clacton on Sea
Colchester	Colchester
Braintree	Colne Engaine
Tendring	Dovercourt
Brentwood	Doddinghurst
Braintree	Earls Colne
Tendring	Elmstead
Uttlesford	Elsenham
Braintree	Finchingfield
Colchester	Fordham
Colchester	Fordham Heath
Braintree	Foxearth
Tendring	Frinton and Walton
Braintree	Greenstead Green
Tendring	Gt. Bentley
Tendring	Gt. Bromley
Uttlesford	Gt. Dunmow
Brentwood	Gt. Warley
Braintree	Gt. Yeldham
Castle Point	Hadleigh
Braintree	Halstead
Tendring	Harwich
Rochford	Hawkwell
Brentwood	Herongate & Ingrave
Chelmsford	Highwoods
Rochford	Hockley
Tendring	Holland on Sea

Local Authority Name	Parish Name
Rochford	Hullbridge
Brentwood	Hutton
Brentwood	Ingatestone
Brentwood	Ingrave
Tendring	Jaywick
Colchester	Langham
Colchester	Layer-de-la-Haye
Tendring	Little Clacton
Colchester	Marks Tey
Brentwood	Mountnessing
Uttlesford	Newport
Rochford	Rayleigh
Rochford	Rochford
Braintree	Shalford
Brentwood	Shenfield
Southend-on-Sea	Shoeburyness
Braintree	Sible Hedingham
Tendring	St. Osyth
Uttlesford	Stansted
Colchester	Stanway
Uttlesford	Thaxted
Tendring	Thorpe le Soken
Tendring	Thorrington
Castle Point	Thundersley
Tendring	Walton on the Naze
Brentwood	Warley
Tendring	Weeley
Colchester	West Bergholt
Brentwood	West Horndon
Southend-on-Sea	Westcliff on Sea
Braintree	Wethersfield
Colchester	Wivenhoe

4.4.5 Step 5. Merge Parish Safety Volunteers data with Fire & Police incident data

With the Parish Safety Volunteer (PSV) data in LA level, the next step was to map the fire-to-police incident data from LSOA to Local Authority (LA) level.

We first created an LSOA to LA geography mapping file from the ONS Census 2011 mapping file.

We then merged that with the fire-to-police incident data and computed any empty geographies from the LSOA name for those records that were not merged (e.g. if the LSOA name was *Braintree 009C* and the LA name had no match, then we replaced the LA name with *Braintree*.

We were now ready to aggregate observations to LA level, and we did that for all the count and totals variables.

The aggregated fire-to-police incident data file, was then merged with the Parish Safety Volunteer visits data file.

The resulting dataset was saved as *Working Master Dataset A: Fire Incident, Police Data, PSV Visit data, by LA, year, month* (`DATASETA_fire-police-psv-incidents-psvvisits_byLAyearMonth.dta`) and contained the following variables by LA, year, month:

Table 2. Variables in Master Dataset A: Fire incidents, Police Incidents, PSV Visits data by LA, year, month

Variable	Obs	Mean	Min	Max	Label
la_name	1380	.	.	.	Local Authority (LA) name - ONS Census 2011
year	1380	2012.914	2009	2017	Year when incident took place
month	1380	6.44058	1	12	Month when incident took place
fires_accidental	1380	5.526812	0	17	tot no of fire incidents involving an accidental fire by la\yr\mon
fires_delib	1380	.7978261	0	8	tot no of fire incidents involving a deliberate fire by la\yr\mon
fires_accordelib	1380	.1384058	0	3	tot no of fire incidents - unsure if accidental or deliberate by la\yr\mon
fires_avg1	1380	5.526812	1	9.53	running average of accidental fire incidents for all years by LA
fires_avg1_delib	1380	.7978261	0	2	running average of deliberate fire incidents for all years by LA
fires_avg1_accordelib	1380	.1384058	0	.32	running average of fire incidents for all years by LA - unsure if accidental or
fires_avg2	1380	5.526812	1	10.875	ave no of fire incidents involving accidental fires (2009-2016) by LA/month
fires_avg2_delib	1380	.7978261	0	2.625	ave no of fire incidents involving deliberate fires (2009-2016) by LA/month
fires_avg2_accordelib	1380	.1384058	0	.625	ave no of fire incidents - unsure if accidental or deliberate (2009-2016) by LA/
fires_avg3	1380	5.563787	1	9.382716	Static overall average, pre-2016, of accidental fire incidents by LA
fires_avg3_delib	1380	.8211963	0	2.222222	Static overall average, pre-2016, of deliberate fire incidents by LA
fires_avg3_accordelib	1380	.1167227	0	.3703704	Static overall average, pre-2016, of deliberate fire incidents by LA
rtfires_accidental	1380	34.77536	0	141	running tot no of fire incidents involving accidental fire by LA/yr
rtfires_delib	1380	5.080435	0	37	running tot no of fire incidents involving deliberate fire by LA/yr
rtfires_accordelib	1380	.8536232	0	13	runtot no of fire incidents - unsure if accidental or deliberate fire by LA/yr
tvisits	1380	.2507246	0	56	tot no of visits by a Parish Safety Volunteer by la/yr/mon
rtvisits	1380	2.431884	0	163	running tot no of PSV visits by LA (2009-2017)
rtvisits_month	1380	15.39058	0	128	running tot no of PSV visits (2009-2017) by month for Essex

burglaries	1380	5.653623	0	34	tot no of police incidents reported as burglaries by la\yr\mon
rtburglaries	1380	35.73043	0	224	running tot no of police incidents reported as burglaries by LA/yr
victims	1380	.7789855	0	6	tot no of fire incidents involving injured persons by la\yr\mon
rtvictims	1380	4.92029	0	23	running tot no of fire incidents involving injured persons by LA/yr
alarm_present	1380	3.655072	0	15	tot no of fire incidents where a smoke alarm was present by la\yr\mon
rtalarm_present	1380	22.62319	0	119	running tot no of fire incidents where a smoke alarm was present by LA/yr
arsons	1380	5.944928	0	49	tot no of police incidents reported as arsons by la\yr\mon
rtarsons	1380	36.11014	0	320	running tot no of police incidents reported as arsons by LA/yr
persons_evacuated	1380	.9637681	0	7	tot no of fire incidents involving evacuated persons by la\yr\mon
rtpersons_evacuated	1380	5.913768	0	35	running tot no of fire incidents involving evacuated persons by LA/yr
occupied_when_fire	1380	5.266667	0	19	tot no of fire incidents where dwelling was occupied by time of fire by la\yr\mo
rtoccupied_when_fire	1380	33.21957	0	144	run tot no of fire incidents where dwelling occupied by the time of fire by LA/y
normally_occupied	1380	6.122464	0	20	tot no of fire incidents where dwelling is normally inhabited by la\yr\mon
rtnormally_occupied	1380	38.55145	1	162	run tot no of fire incidents where dwelling is normally inhabited by LA/yr
la_id	1343	.	.	.	Local Authority (LA) code - ONS Census 2011
date	1380	201297.9	200904	201707	Year + Month

4.4.6 Step 6: Bootstrapping DCLG Dwellings data

For the analysis, we also needed to know the total number of dwellings per LA and year and how the number of dwellings might have increased, to control for effects.

We created a derived dataset for dwelling numbers over the years (2009-2016) for LAs in Essex, based on the "Live tables on dwelling stock - including vacants" statistical dataset, openly available via the Department for Communities and Local Government (DCLG), last updated on 20 April 2017. The dataset is available from https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants. In particular, we used "Table 100 - number of dwellings by tenure and district England" to extract number of dwellings data for Essex.

Here are the variables that were included in the derived dataset:

Variable	Obs	Mean	Min	Max	Label
la_id	96	.	.	.	Current ONS code

year	96	2012.5	2009	2016	Year
la_name	96	.	.	.	Lower and Single Tier Authority Data name
ndwel_la	93	3797.366	0	11607	no Dwellings-Local Authority (incl. owned by other LAs) - including vacant dwell
ndwel_ha_pp	96	3724.823	470	12316	collapsed no. of dwellings (including vacants) Housing association (2009-2011) &
ndwel_private	93	43260.86	23740	66700	collapsed no. of dwellings (including vacants) Private sector (R)1 (2009-2011) &
ndwel_publc_oth	95	183.0316	0	4513	no. of dwellings (including vacants) owned by Other public sector (2009-2016)
ndwel_total_la_year	96	50741.67	26940	78610	Total no of dwellings per LA, per year

The file was then merged with the fire-to-police-to-psv visit data, on LA by year.

Note that:

a. all dwellings data were by LA/year (data was not further broken down by month in the source dataset)

b. There were no dwelling data available for 2017 at the time we put together this report. These are highlighted via the `missing_dwelling_data` variable (with value `2`). There are also some entries (those marked with value `1` as the `missing_dwelling data` variable.

c. No data was included for the following LAs: Babergh, Redbridge, South Cambridgeshire, Southend-on-Sea, Thurrock

4.4.7 Step 7: Preparing the House Safety Visit Data

House Safety Visit data was also provided by ECFRS to be able to compare the effects of the PSV visits with other activities before and after the PSV visits programme.

The House Safety Visit dataset included historic (2004-2016) and current (2016-2017) data on all house safety visits conducted by ECFRS and/or partner organisations between 1st January 2004 to September 2017.

Data prior to 01/04/2016 was extracted from the old Content Records Management (CRM) system and contained slightly different variables/fields compared to the data after that (i.e. the old CRM included a due date (to mean a visit date), whereas data after that date differentiated between a visit date and a due date. Also, the *casetitle* variable/field was originally used to record the type of visit[2], but was then used as a

[2] Values included: Initial HFSV, Revisit for defective alarm, Home Fire Safety Letter, Sensory Alarm Installation, Partnership HFSV, 2nd Visit by Partner, Home Fire Safety Visit

placeholder to record the *case ID number* and later the *Case number ID – Name and surname of person seen – date – AM/PM.*

The data was appended and combined to a single STATA data file for further processing. We then dropped all records if their due date/visit date and the remaining variables were missing (about 8,367 observations deleted).

The data was then mapped to LA geography level, using the ONS Census 2011 mapping file (and the postcode information included in the records). The mapping was improved by manually checking the remaining ~450 unmatched observations and manually mapping their *townpremises* variable to an LA name. The remaining 32 observations that would not be mapped (as they contained no geography information) were dropped and a new set of variables were generated, one for each type of visit, in addition to an overarching one for all HS visits. Totals and running totals by LA/year/month were also generated.

The resulting dataset included the following variables:

Variable	Obs	Unique	Mean	Min	Max	Label
la_name	1772	25	.	.	.	Local Authority Name
year	1772	13	2009.584	2004	2016	Calendar Year when house safety visit took place
month	1772	12	6.511851	1	12	Month of year when house safety visit took place
hsvisits	1772	219	58.88149	1	812	tot no of house safety visits by la\yr\mon
hsvisit_initial	1772	171	36.03781	0	587	tot no of house safety visits which were initial visits (out of the total) by la
hsvisit_revisitalarm	1772	56	5.784424	0	83	tot no of house safety visits which were revisited in order to fit an alarm (out of the total) by la\yr
hsvisit_letter	1772	8	.0434537	0	32	tot no of house safety visits which involved a letter (out of the total) by la\yr
hsvisit_salarminstall	1772	13	.4232506	0	17	tot no of house safety visits which involved a sensory alarm installation (out o
hsvisit_1stpartnervisit	1772	91	7.269752	0	643	tot no of initial house safety visits conducted by a partner(out of the total) by LA/yr
hsvisit_2ndpartnervisit	1772	16	.1822799	0	63	tot no of house safety revisits conducted by a partner(out of the total) by la\y

4.4.8 Step 8: Incorporating the House Safety Visits data to the master dataset

We then merged the House Safety Visits data to the master dataset (fire-to-police-to-PSV visits-to-dwellings) by LA/year/month, dropping all records where the

specific LA year and month were not included in the master dataset (792 observations were deleted).

An additional variable was created summarizing all types of visits (PSV and House Safety) per LA, year and month and its running total was also calculated.

The resulting dataset contained the following variables:

Variable	Obs	Unique	Mean	Min	Max	Label
la_name	1380	17	.	.	.	Local Authority (LA) name - ONS Census 2011
year	1380	9	2012.914	2009	2017	Year when incident took place
month	1380	12	6.44058	1	12	Month when incident took place
fires_accidental	1380	18	5.526812	0	17	tot no of fire incidents involving an accidental fire by la\yr\mon
fires_delib	1380	8	.7978261	0	8	tot no of fire incidents involving a deliberate fire by la\yr\mon
fires_accordelib	1380	4	.1384058	0	3	tot no of fire incidents - unsure if accidental or deliberate by la\yr\mon
fires_avg1	1380	15	5.526812	1	9.53	running average of accidental fire incidents for all years by LA
fires_avg1_delib	1380	15	.7978261	0	2	running average of deliberate fire incidents for all years by LA
fires_avg1_accor delib	1380	14	.1384058	0	.32	running average of fire incidents for all years by LA - unsure if accidental or
fires_avg2	1380	98	5.526812	1	10.875	ave no of fire incidents involving accidental fires (2009-2016) by LA/month
fires_avg2_delib	1380	44	.7978261	0	2.625	ave no of fire incidents involving deliberate fires (2009-2016) by LA/month
fires_avg2_accor delib	1380	12	.1384058	0	.625	ave no of fire incidents - unsure if accidental or deliberate (2009-2016) by LA/
fires_avg3	1380	14	5.559901	1	9.382716	Static overall average, pre-2016, of accidental fire incidents by LA
fires_avg3_delib	1380	15	.8198929	0	2.222222	Static overall average, pre-2016, of deliberate fire incidents by LA
fires_avg3_accor delib	1380	15	.1166979	0	.3703704	Static overall average, pre-2016, of deliberate fire incidents by LA
rtfires_accidental	1380	119	34.77536	0	141	running tot no of fire incidents involving accidental fire by LA/yr
rtfires_delib	1380	37	5.080435	0	37	running tot no of fire incidents involving deliberate fire by LA/yr
rtfires_accordeli b	1380	13	.8536232	0	13	runtot no of fire incidents - unsure if accidental or deliberate fire by LA/yr
psvvisits	1380	16	.2507246	0	56	tot no of visits by a Parish Safety Volunteer by la/yr/mon
rtpsvvisits	1380	26	2.431884	0	163	running tot no of PSV visits by LA (2009-2017)

rtpsvvisits_month	1380	31	15.39058	0	128	running tot no of PSV visits (2009-2017) by month for Essex
burglaries	1380	35	5.653623	0	34	tot no of police incidents reported as burglaries by la\yr\mon
rtburglaries	1380	165	35.73043	0	224	running tot no of police incidents reported as burglaries by LA/yr
victims	1380	7	.7789855	0	6	tot no of fire incidents involving injured persons by la\yr\mon
rtvictims	1380	24	4.92029	0	23	running tot no of fire incidents involving injured persons by LA/yr
alarm_present	1380	16	3.655072	0	15	tot no of fire incidents where a smoke alarm was present by la\yr\mon
rtalarm_present	1380	94	22.62319	0	119	running tot no of fire incidents where a smoke alarm was present by LA/yr
arsons	1380	48	5.944928	0	49	tot no of police incidents reported as arsons by la\yr\mon
rtarsons	1380	194	36.11014	0	320	running tot no of police incidents reported as arsons by LA/yr
persons_evacuated	1380	8	.9637681	0	7	tot no of fire incidents involving evacuated persons by la\yr\mon
rtpersons_evacuated	1380	31	5.913768	0	35	running tot no of fire incidents involving evacuated persons by LA/yr
occupied_when_fire	1380	20	5.266667	0	19	tot no of fire incidents where dwelling was occupied by time of fire by la\yr\mo
rtoccupied_when_fire	1380	119	33.21957	0	144	run tot no of fire incidents where dwelling occupied by the time of fire by LA/y
normally_occupied	1380	21	6.122464	0	20	tot no of fire incidents where dwelling is normally inhabited by la\yr\mon
rtnormally_occupied	1380	133	38.55145	1	162	run tot no of fire incidents where dwelling is normally inhabited by LA/yr
la_id	1343	17	.	.	.	Local Authority (LA) code - ONS Census 2011
date	1380	100	201297.9	200904	201707	Year + Month
ndwel_la	1069	66	3788.04	0	11607	no Dwellings-Local Authority (incl. owned by other LAs) - including vacant dwell
ndwel_ha_pp	1095	87	3756.891	470	12316	collapsed no. of dwellings (including vacants) Housing association (2009-2011) &
ndwel_private	1069	91	43458.19	23740	66700	collapsed no. of dwellings (including vacants) Private sector (R)1 (2009-2011) &
ndwel_public_oth	1083	35	175.0314	0	4513	no. of dwellings (including vacants) owned by Other public sector (2009-2016)
ndwel_total_la_year	1095	94	51114.22	26940	78610	Total no of dwellings per LA, per year
missing_dwelling_data	1380	3	.2731884	0	2	Status of Missing Dwelling data

hsvisits	1380	187	40.7942	0	428	tot no of house safety visits by la\yr\mon
hsvisit_initial	980	127	28.55102	0	212	tot no of house safety visits which were initial visits (out of the total) by la
hsvisit_revisitalarm	980	56	9.868367	0	83	tot no of house safety visits which wererevisits in order to fit an alarm (out o
hsvisit_letter	980	8	.0785714	0	32	tot no of house safety visits which involved a letter (out of the total) by la\y
hsvisit_salarminstall	980	13	.7632653	0	17	tot no of house safety visits which involved a sensory alarm installation (out o
hsvisit_1stpartnervisit	980	64	4.930612	0	368	tot no of initial house safety visits conducted by a partner(out of the total) b
hsvisit_2ndpartnervisit	980	16	.2867347	0	63	tot no of house safety revisits conducted by a partner(out of the total) by la\y
visits	1380	187	41.04493	0	428	Total number of visits (PSV and House Safety) per LA/YR/MON
rtvisits	1380	937	2853.951	0	8192	Run tot no of visits (PSV and House Safety) per LA/YR/MON

4.4.9 Step 9: Merge with the Schools Visit Data

In addition to the house visits data (PSV and HS), school visits data by LA/year were made available for analysis. These did not include a monthly breakdown, hence we had to aggregate the master dataset to be able to link the datasets.

The School Visits data file contained numbers of school visits made by fire service personnel as part of their outreach work by Local Authority each year and included information on how many of these school visits were to different (unique) schools.

The data covered school visits conducted between 2009-2015 and in 2017 – but no data existed for 2016, as due to a CRM system error at the time these were lost.

After aggregating the master file to by LA/year, and generating new running totals, we merged the schools visit data with the master file. The resulting dataset contained the following variables:

Variable	Obs	Unique	Mean	Min	Max	Label
la_name	132	17	.	.	.	Local Authority (LA) name - ONS Census 2011
year	132	9	2012.932	2009	2017	Year when incident took place
fires_avg1	132	15	5.301615	1	9.53	running average of accidental fire incidents for all years by LA
fires_avg1_delib	132	15	.757327	0	2	running average of deliberate fire incidents for all years by LA
fires_avg1_accordelib	132	14	.1314851	0	.32	running average of fire incidents for all years by LA - unsure if accidental or
fires_avg2	132	27	6.12016	1	9.625	ave no of fire incidents involving

						accidental fires (2009-2016) by LA/month
fires_avg2_delib	132	19	.7673611	0	2.625	ave no of fire incidents involving deliberate fires (2009-2016) by LA/month
fires_avg2_accordelib	132	7	.1666667	0	.625	ave no of fire incidents - unsure if accidental or deliberate (2009-2016) by LA/
fires_avg3	132	14	5.252579	1	9.382716	Static overall average, pre-2016, of accidental fire incidents by LA
fires_avg3_delib	132	15	.753648	0	2.222222	Static overall average, pre-2016, of deliberate fire incidents by LA
fires_avg3_accordelib	132	15	.1078741	0	.3703704	Static overall average, pre-2016, of deliberate fire incidents by LA
fires_accidental_y	132	77	57.7803	1	141	tot no of fire incidents involving an accidental fire by LA/yr
fires_delib_y	132	27	8.340909	0	37	tot no of fire incidents involving a deliberate fire by LA/yr
fires_accordelib_y	132	11	1.44697	0	13	tot no of fire incidents - unsure if accidental or deliberate fire by LA/yr
rtfires_accidental	132	15	5.962121	0	14	running tot no of fire incidents involving accidental fire by LA/yr
rtfires_delib	132	7	.6818182	0	6	running tot no of fire incidents involving deliberate fire by LA/yr
rtfires_accordelib	132	3	.1515152	0	2	runtot no of fire incidents - unsure if accidental or deliberate fire by LA/yr
rtfires_accidental_la	132	118	296.7121	1	953	run tot no of fire incidents involving accidental fire by LA
rtfires_delib_la	132	74	43.05303	0	200	run tot no of fire incidents involving a deliberate fire by LA
rtfires_accordelib_la	132	22	4.931818	0	32	run tot no of fire incidents - unsure if accidental or deliberate fire by LA
burglaries_y	132	85	59.10606	0	224	tot no of police incidents reported as burglaries as LA/yr
rtburglaries	132	24	6.234848	0	33	running tot no of police incidents reported as burglaries by LA/yr
rtburglaries_la	132	106	269.7727	0	1160	run tot no of police incidents reported as burglaries by LA
tvisits_y	132	10	2.621212	0	163	tot no of Parish Safety Volunteer visits by LA/yr
rtvisits	132	10	2.621212	0	163	running tot no of PSV visits by LA (2009-2017)
victims_y	132	23	8.143939	0	23	tot no of fire incidents involving injured persons by LA/yr
rtvictims	132	6	.7045455	0	6	running tot no of fire incidents involving injured persons by LA/yr
rtvictims_la	132	75	41.90909	0	140	run tot no of fire incidents involving injured persons by LA
alarm_present_y	132	67	38.21212	0	119	tot no of fire incidents where a smoke alarm was present by LA/yr
arsons_y	132	76	62.15152	0	320	tot no of police incidents reported as arsons by LA/yr
rtalarm_present	132	13	3.568182	0	12	running tot no of fire incidents where a smoke alarm was present by LA/yr
rtarsons	132	25	5.666667	0	32	running tot no of police incidents reported as arsons by LA/yr
rtalarm_present_la	132	110	191.3561	0	664	run tot no of fire incidents where a smoke alarm was present by LA

rtarsons_la	132	91	255.9091	0	1597	run tot no of police incidents reported as arsons by LA
persons_evacuated_y	132	28	10.07576	0	35	tot no of fire incidents involving persons evacuated by LA/yr
rtpersons_evacuated	132	6	.8560606	0	5	running tot no of fire incidents involving evacuated persons by LA/yr
rtpersons_evacuated_la	132	93	53.90909	0	162	run tot no of fire incidents involving evacuated persons by LA
occupied_when_fire_y	132	76	55.06061	1	144	tot no of fire incidents where dwelling was occupied by the time of fire by LA/y
rtoccupied_when_fire	132	16	5.765152	0	15	run tot no of fire incidents where dwelling occupied by the time of fire by LA/y
rtoccupied_when_fire_la	132	114	283.3561	1	983	run tot no of fire incidents where dwelling occupied at the time of fire by LA
normally_occupied_y	132	77	64.00758	1	162	tot no of fire incidents where the dwelling is normally inhabited by LA/yr
rtnormally_occupied	132	16	6.507576	1	16	run tot no of fire incidents where dwelling is normally inhabited by LA/yr
rtnormally_occupied_la	132	115	329.0606	1	1118	run tot no of fire incidents where dwelling is normally inhabited by LA
la_id	130	17	.	.	.	Local Authority (LA) code - ONS Census 2011
date	132	14	201294.7	200904	201701	Year + Month
schoolvisitsmade	112	77	67.53571	0	230	no of school visits made by LA/yr
schoolsseen	112	46	32.3125	0	82	no of different (unique) schools visited by LA/yr
rt_visits_la	132	10	5.242424	0	163	run tot no of Parish Safety Volunteer visits by LA
rtschool_visits_la	132	96	278.9091	0	937	run tot no of school visits made by LA
rtschoolsseen_la	132	95	142.3409	0	433	run tot no of different (unique) schools visited by LA
ndwel_la	93	66	3797.366	0	11607	no Dwellings-Local Authority (incl. owned by other LAs) - including vacant dwell
ndwel_ha_pp	96	87	3724.823	470	12316	collapsed no. of dwellings (including vacants) Housing association (2009-2011) &
ndwel_private	93	91	43260.86	23740	66700	collapsed no. of dwellings (including vacants) Private sector (R)1 (2009-2011) &
ndwel_public_oth	95	35	183.0316	0	4513	no. of dwellings (including vacants) owned by Other public sector (2009-2016)
ndwel_total_la_year	96	94	50741.67	26940	78610	Total no of dwellings per LA, per year
missing_dwelling_data	132	3	.3787879	0	2	Status of Missing Dwelling data

5 Methods of Analysis

In these cases, the item of interest is what we statistically consider to be an *event* -- an accidental dwelling fire (ADF), a burglary, an injury, etc. To analyze events, it is standard to employ *event count models*. Event count models consider that events do not always happen at regular intervals. With event count models, we can determine whether and how much incidence rates of events like accidental dwelling fires have changed, as well as possible causes for the change.

The Poisson Model is appropriate for analyzing event occurrences (counts). The Poisson model has been applied to various events, such as the number of soldiers kicked to death by horses in the Prussian army (von Bortkiewicz, 1898), the number of telephone connections to a wrong number (Thorndike, 1926), or the incidence of a particular disease.

When working with events, it is important to identify two main features:

1. The incidence rate.
   The *incidence rate* is the rate at which events occur over time or space. Examples might be 5 ADFs per year, 7 burglaries per geography, or 1 ADF per 1000 households.
2. The exposure.
   The *exposure* is the number of units of time or space being analyzed. For example,

6 References

Thorndike, F. (1926). Applications of Poisson's Probability Summation. *Bell System Technical Journal*, *5*(4), 604–624. https://doi.org/10.1002/j.1538-7305.1926.tb00126.x

von Bortkiewicz, L. (1898). *Das Gesetz der kleinen Zahlen*. BG Teubner.