Appendices

Note: the annual datset and core code is available from the Dryad Digital Repository: http://dx.doi.org/[TBC][22]

A: Data Discontinuities

Start date	Type of change	Details	Mortality affected	Analysis Oct-Sept year steps*
1958	ICD & population	Counts included non-civilians ICD-6	ALL	1957 1958
1965	London Boundary	Inner London (similar to London Area County but includes small part of Woolwich)	ALL	1964 1965
1966	London Boundary	Greater London – incorporates Outer London boroughs	ALL	**1965** **1966**
1968	ICD	ICD-8 introduced, cardiovascular category widened	CVD	**1967(CVD-RESP)** **1968(CVD-RESP)**
1976	Data collection	From weekly death registrations to daily death counts	ALL	1974 1975
1984	ICD interpretation	Change in interpretation of rule 3 – fewer deaths attributed to respiratory causes	RESP	**1983(CVD-RESP)** **1984(CVD-RESP)**
1993	ICD interpretation	Reverse of rule 3 interpretation more respiratory deaths	RESP	Bridging adjustment
2001	ICD	ICD-10 introduced: 22% fewer respiratory deaths, especially pneumonia; some respiratory diseases (~5%), assigned to circulatory diseases	RESP CVD	Bridging adjustment

* two analysis years were affected for each Jan 1 change; bolded entries indicate used in main model, otherwise in sensitivity analyses only. ICD bridging correction factors were from Brock 2006[1].

CVD=cardiovascular; Inflpneu=Influenza & Pneumonia; RESP=Respiratory

B: Previously identified cold and heat thresholds for London.

Paper & setting	**Focus: cold or heat?**	**Threshold** (measure of daily temperature used)	Notes regarding methodology used.
Keatinge et al[2] Multicity incl. London 1988 – 1992	**Combined heat and cold**	**19.3 to 22.3 °C (mean)**	Used the 3°C band of minimum mortality. Incorporates 3 day lag for cold.
Carson et al [3] London 1900-1996	**Combined heat and cold**	**15 °C (mean)**	Cold & heat threshold common throughout century of 15.0°C, although 1986-1996 cold threshold was 19.5°C. Incorporates 14 day lag for cold.
Pattenden et al [4] London & Sofia 1993-1996	**Combined heat and cold**	**18 °C (mean)**	Threshold common to London & Sofia. Incorporates 2 day lag for heat; 2 week lag for cold. 10th & 90th percentiles: 5.2°C to 21°C
Hajat et al [5] London, Delhi & Sao Paulo 1991-1994	Heat (but threshold for **both**)	**20 °C (mean)**	Threshold common to London, Delhi & Sao Paulo. Incorporates 2 week lag for cold.
Armstrong et al [6] London 1993-2006	Both – individual thresholds	Cold: 12.1 °C (mean) Heat: 22.3 °C (mean)	Incorporates zero lags.
Eurowinter 1997 [7] Multicity incl. London 1988-1992	Cold	Cold: 18 °C (mean)	Common threshold. Incorporated 3 day lag.
Kovats et al [8] London 1994-2000	Heat	Heat: 12 °C (mean)	All-cause admissions
Hajat et al [9] London 1976-1996	Heat	Heat: 21.5 °C (mean)	Threshold determined by 97th percentile. Increased mortality visible above 19°C
Hajat et al [10] Multicity incl. London **1976-2003**	Heat	Heat: 20.5 °C (mean)	
Baccini et al [11] Multicity incl. London 1992-2000	Heat	Heat: 23.9 °C (max)	Apparent temperature
Ishigami et al [12] London 1993-2003	Heat	Heat: 20.4 °C (mean)	
Armstrong et al [13] England & Wales 1993-2006	Heat	Heat: 24.7 °C (max)	Common threshold at 93rd percentile across England & Wales.

C : Model details

Main model

$E(Y_i)=\exp(\beta_{cold}$ (annual-cold) + β_{heat}(annual-heat) + steps(years 1965,6) + NCS(year,6 knots) + λ(influenza%))

Where, for 52-week years starting i=1949...2005, days j:

- Y_i = annual death count
- $annual\_cold = \frac{\sum \max[(T_C - t_{ij}),0]}{364}$
- $annual\_heat = \frac{\sum \max[(t_{ij} - T_H),0]}{364}$
- steps(years 1965,6): indicator variable for year>=1965 and year>=1966 (boundary change)
- $NCS(year, 6knots)$: $a\ natural\ cubic\ spline\ with\ six\ total\ knots\ (5df)$
- influenza% : proportion of deaths coded as due to influenza; ICD7-8 equivalent
    - for 1949-1974 these were from the London weekly data
    - for 1975-2006 counts of influenza deaths among London residents were obtained directly from the Office of National Statistics.

The year starting Oct 1965 had one 6-day week due to reporting changes. For this year all counts were adjusted by a multiple 364/363.

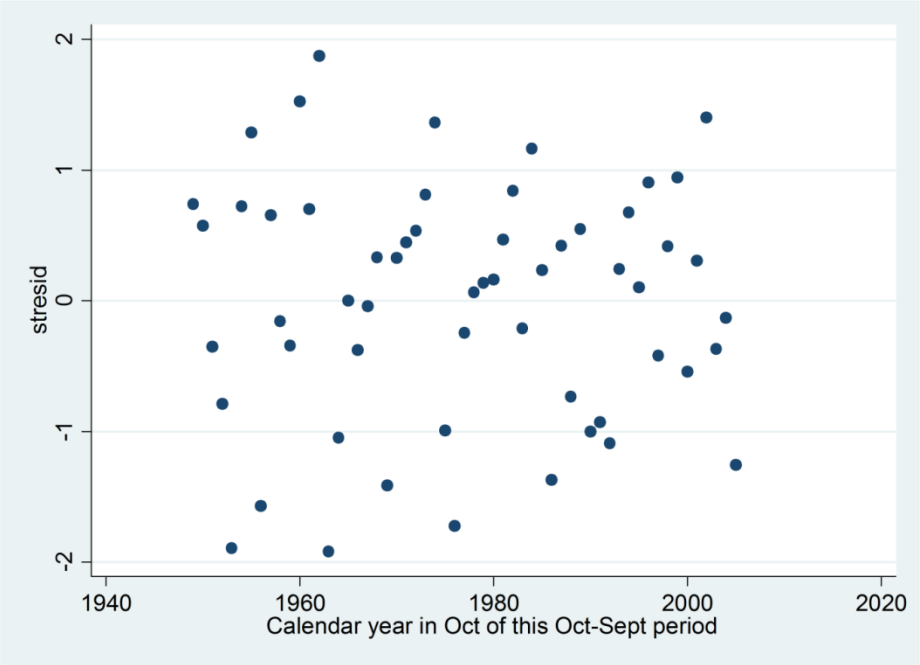
Deaths counts were assumed to follow a Poisson distribution with scale overdispersion

In analyses of deaths due to respiratory and cardiovascular causes, additional steps were included in the model to allow for changes in ICD and coding known to affect one or the other of these categories.

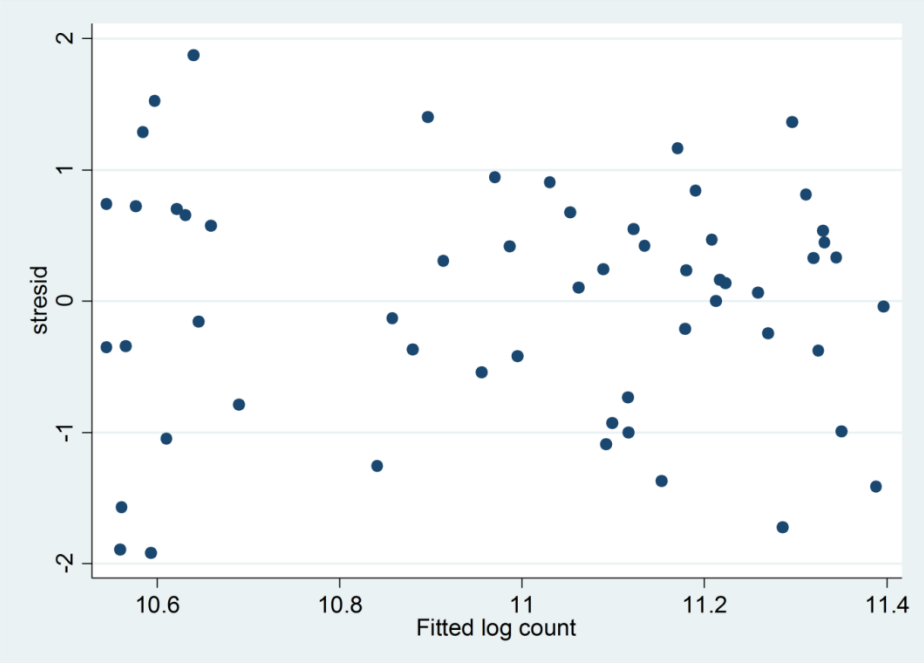
D: Residual analysis

These were carried out with x variables as for the main model but using the simple regression model for simplicity and in view of the similar result in this and the Poisson model. In the plots below stress standard for standardised residual.

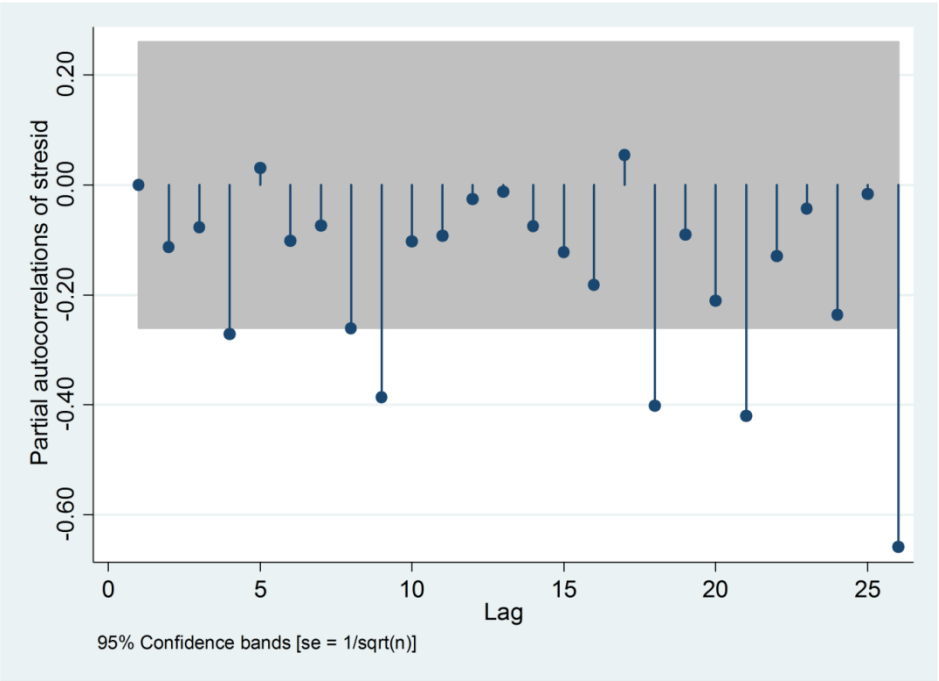
Di: Distribution of residuals by calendar year



Dii: n of residuals by fitted log count



Diii: Partial autocorrelation coefficients



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