Supporting Material

S1 Appendix. Statistical methods details

We used segmented/piecewise linear regression [1] to assess the impact of the change-points on the trends. We repeated the following statistical methods for each of the three outcomes.

Overall trends

To capture the overall trend in each of the outcomes, a two-way interaction between the number of days from 05 January (the first week in the analysis) and the two change-points was fit. This was our 'baseline model'. This fitted an overall temporal trend for each of the three time-periods, which was reported using the estimated intercepts and slopes and their 95% CIs. An intercept of 0 suggested the level on 05 January 2020 was the same as the equivalent week for the 2018-2019 average. A slope of 0 suggested the segmented temporal trend had the same slope as the 2018-2019 average trend.

We were aware that including the two observations seen between the change-points (15 to 22 March) would cause a high amount of uncertainty around estimates. We therefore included these measurements in the modelling for completeness, but focussed more on the interpretation of the before and after time periods. We expected this to have little impact since the high uncertainty around the between time period would suggest it was very unlikely the estimates would be statistically different to the before and/or after time-periods. Therefore, it is highly likely that any statistical significance in the models will be driven by the difference in the before and after time-period estimates.

Trends by the exposures

We then undertook a comparative interrupted time series analysis approach [2] to test whether the levels within the exposures (the three demographics, clinical specialties for hospital admissions and NHS Health Board) exhibited similar trend patterns within the time periods, for each of the three outcomes.

We done this by firstly testing for a three-way interaction between the baseline model (as described above) and the exposure of interest. The three-way interaction captured whether the trends in the time-periods differed between the groups in the exposure [2]. To test whether this three-way interaction was suitable to the data, an Analysis of Variance (ANOVA) was performed. The p-value of the final three-way interaction was tested against a Bonferroni corrected significance level to account for multiple testing. This divided the standard significance level of 0.05 by the number of terms in the model (N=7). These included the three main effects for each of the three variables (N=3), the three two-way interactions between these three variables (N=3) and the three-way interaction between all three variables (N=1). This meant the Bonferroni corrected significance level was $0.05 / 7 \approx 0.007$.

In the case where this three-way interaction p-value was > 0.007 the remaining combinations of the baseline model and the exposure variable were tested. An illustration of these different models are given as follows.

Let A = time, B = change-points and C = exposures, then the baseline model would be defined as:

$$\text{Baseline model} = A{:}B = A + B + A{:}B$$

The full three-way interaction model described would be defined as:

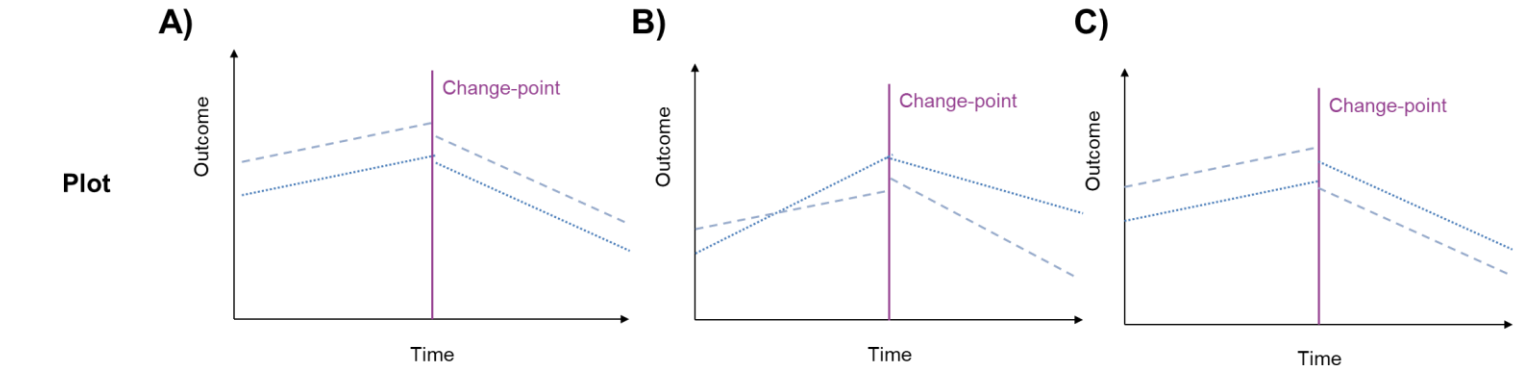
Three-way interaction = A:B:C = A + B + C + A*B + A*C +B*C + A*B*C

The remaining models that were therefore tested are given in **Table 1.**

Table 1. Remaining models tested for the exposures

Model No.	Description	Notation	Interpretation
1	The baseline model plus the main effect for the exposure	A:B + C	Captured the overall difference in the level (intercept) of the outcome between the groups of the additional variable [2]
2	The baseline model plus the two-way interaction between time and the exposure	A*B + A*C	Tested the difference in the slope of the outcome between groups in the exposure [2]
3	The baseline model plus the two-way interaction between the change-points and the exposure	A*B + B*C	Captured the difference between the groups in the exposure in the intercept of the outcome in the time-periods [2]
A = time, B = change-points and C= exposure variable			

To understand what the trend lines for these models may look like, an example is given in **Figure 1**. This assumes the exposure has 2 groups.



Interpretation

	Intercept	Slope
By exposure	Different	Same (parallel)
By time period	Order of exposure groups the same	Different

	Intercept	Slope
By exposure	Different	Different
By time period	Order of exposure groups the same	Order of exposure groups the same
Note order of exposure levels in intercepts can differ from order in slope		

	Intercept	Slope
By exposure	Different for exposure group	Same (parallel)
By time period	Order of exposure groups different	Different

Figure 1. Examples of the alternative models for A) Model 1, B) Model 2 and C) Model 3 Contains examples of plots for each of the types of fitted models (Plots), example linear equations (Equations) and how to interpret the intercept and slope estimates by the exposure groups and time periods (Interpretation).

To select which of these model fit the data best, the model with the lowest Akaike Information Criterion (AIC) and the lowest Bayesian Information Criterion (BIC) [3] was chosen as the final model. In the case where the lowest AICs and BICs were very close, the simplest model was chosen i.e. the model with the lowest degrees of freedom.

All final models were tested against the assumptions of linearity. Residuals were tested for normality using histograms and QQ-Plots. The assumption of constant variance with mean zero was tested by plotting the residuals against the fitted values. To assess whether there was any remaining autocorrelation, autocorrelation plots (ACF) and partial autocorrelation plots (PACF) were used [4].

References

1. Bernal JB., Cummins S., Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial, International Journal of Epidemiology, 46;1, 2017, pp348–355. doi: 10.1093/ije/dyw098
2. Linden A. Conducting interrupted time-series analysis for single- and multiple-group comparisons. The Stata Journal. 15;2. 2015. pp480-500. doi: 10.1177%2F1536867X1501500208
3. Kuha J. AIC and BIC: Comparisons of Assumptions and Performance. Sociological Methods & Research. 33;2. pp188–229. doi: 10.1177/0049124103262065
4. Yaffee RA, McGee M. Introduction to Time Series Analysis and Forecasting. Academic Press. 2000. pp 210. Available from: https://books.google.co.uk/books?id=LSojZBiBZBgC&pg=PA210&lpg=PA210&dq=acf+and+pacf+residuals++google+scholar&source=bl&ots=MqtPJaUVVZ&sig=ACfU3U3pJTALYho1s0QXpG4x7eptfL1p3A&hl=en&sa=X&ved=2ahUKEwjBw7WVpcrqAhV8WhUIHfqVBpsQ6AEwAnoECAkQAQ#v=onepage&q=citation&f=false

S2 Appendix. STROBE and RECORD reporting guideline

Table 1. The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title and Abstract (Pg 1-2)	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Abstract (Pg 2)
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction (Pg 3)		
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction (Pg 3)		

Methods					
Study Design	4	Present key elements of study design early in the paper	Methods, Study design and setting (Pg 3)		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods, Study design and setting (Pg 3)		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching	N/A	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	N/A

		criteria and the number of controls per case			
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Methods, Variables (Pg 4)	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Methods, Variables (Pg 4)
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods, Data sources (Pg 3-4)		
Bias	9	Describe any efforts to address potential sources of bias	Methods, Data sources (Pg 3-4)		
Study size	10	Explain how the study size was arrived at	N/A		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	N/A		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions	Methods, Statistical methods (Pg 4-5) and S1 Appendix		

		(c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses			
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Methods, Data sources (Pg 3-4)
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	N/A
Results					

Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	S4 Appendix	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.*, study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	N/A
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	S3 and S4 Appendix		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure	S3-S5 Appendix		

		Cross-sectional study - Report numbers of outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Results (Pg 6) and S5 Appendix		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Results (Pg 6-7) and S6-S9 Appendix		
Discussion					
Key results	18	Summarise key results with reference to study objectives	Discussion (Pg 7)		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion (Pg 7-8)	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data,	Discussion (Pg 7-8)

				and changing eligibility over time, as they pertain to the study being reported.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion (Pg 8-9)		
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion (Pg 8-9)		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Methods, Ethics, software and dissemination (Pg 5)		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	N/A

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.

S3 Appendix. Temporal trends of percentage change of 2020 counts vs 2018-2019 average of A&E attendances and hospital admissions

Figure 1. Temporal trends of percentage change for A&E attendances and hospital admissions across Scotland
Weekly percentage changes between 2020 and 2018-2019 average for A&E attendances, emergency and planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 Mar) and change-point 2 (UK lockdown on 23 Mar).

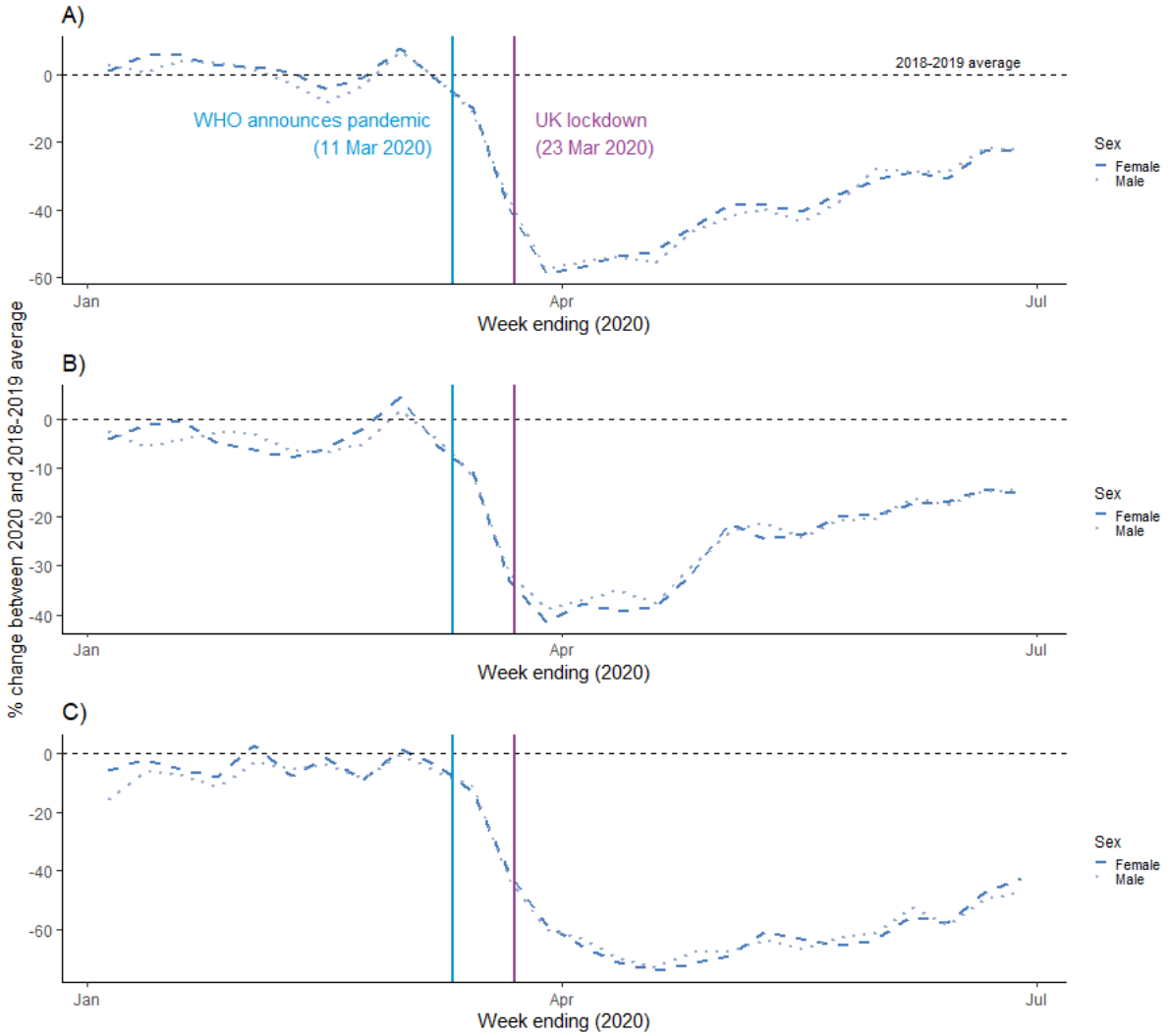


Figure 2. Temporal trends of percentage change in A&E attendances and hospital admissions by sex

Weekly percentage changes between 2020 and 2018-2019 average split by sex for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 Mar) and change-point 2 (UK lockdown on 23 Mar).

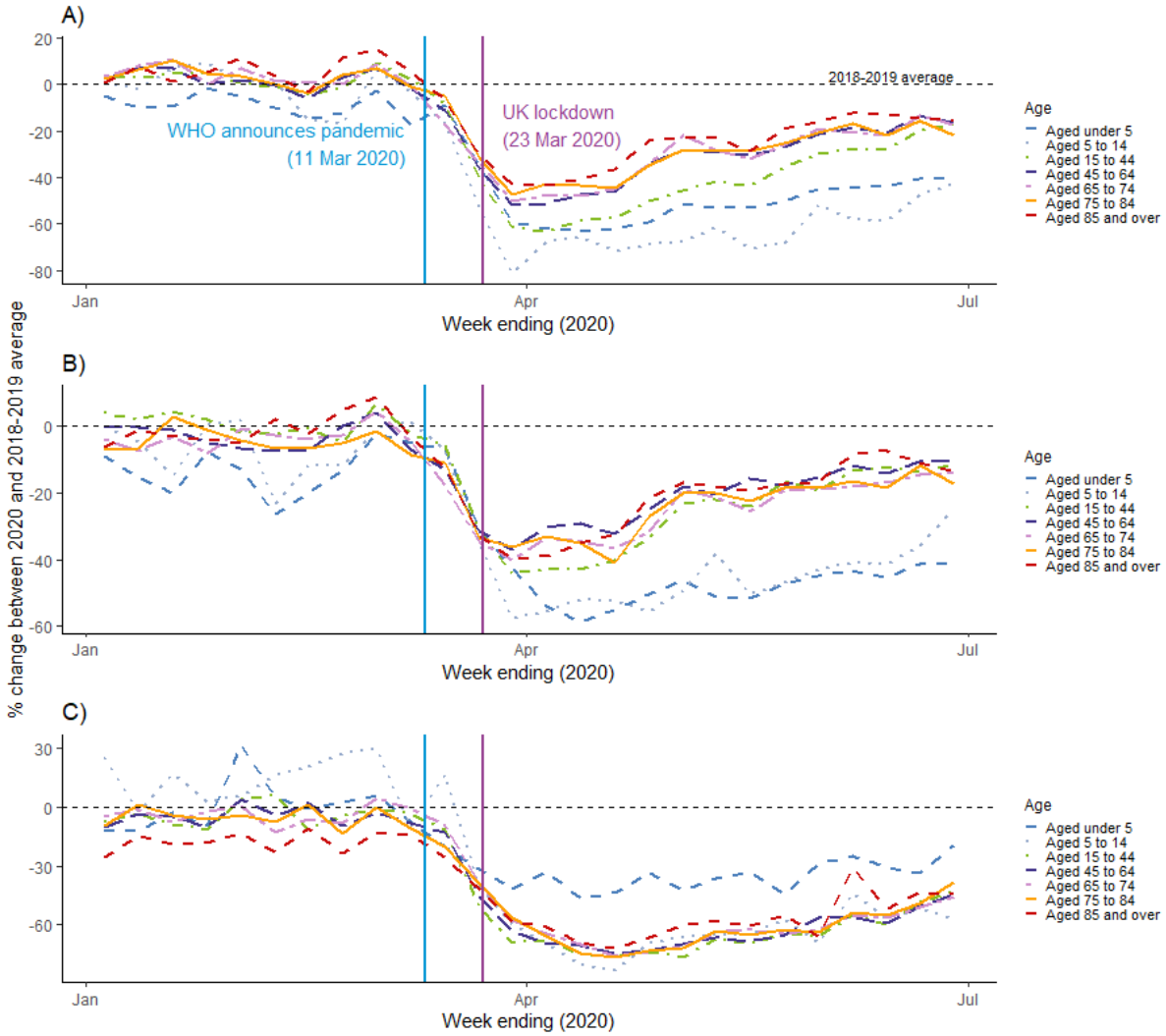


Figure 3. Temporal trends of percentage change in A&E attendances and hospital admissions by age

Weekly percentage changes between 2020 and 2018-2019 average split by Age for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 Mar) and change-point 2 (UK lockdown on 23 Mar).

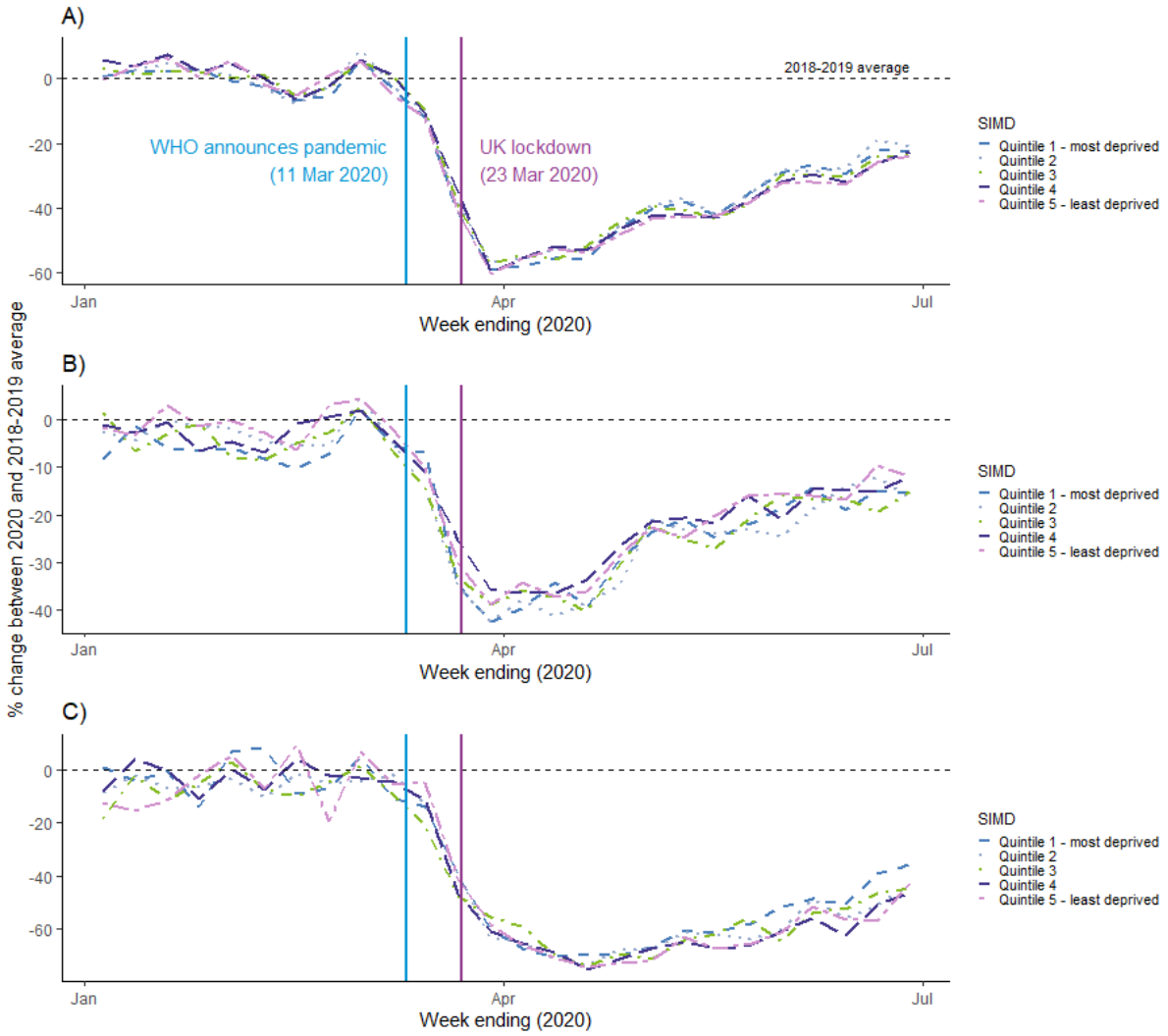


Figure 4. Temporal trends of percentage change in A&E attendances and hospital admissions by SIMD quintile

Weekly percentage changes between 2020 and 2018-2019 average split by SIMD Quintile for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 Mar) and change-point 2 (UK lockdown on 23 Mar).

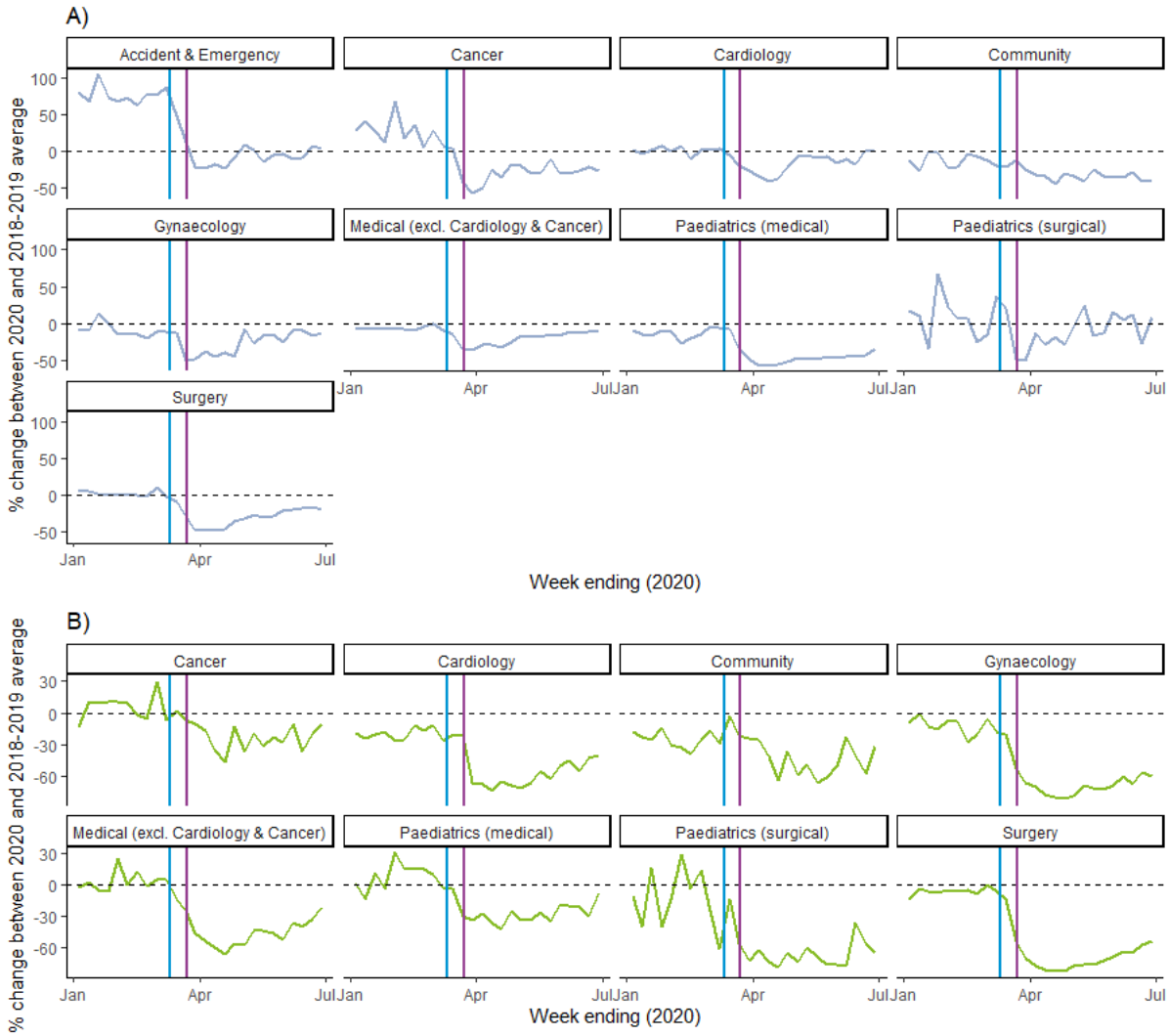


Figure 5. Temporal trends of percentage change in A&E attendances and hospital admissions by specialty

Weekly percentage changes between 2020 and 2018-2019 average split by Speciality for A) emergency and B) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 Mar) and change-point 2 (UK lockdown on 23 Mar). Note: A&E is missing for planned hospital admissions due to small numbers.

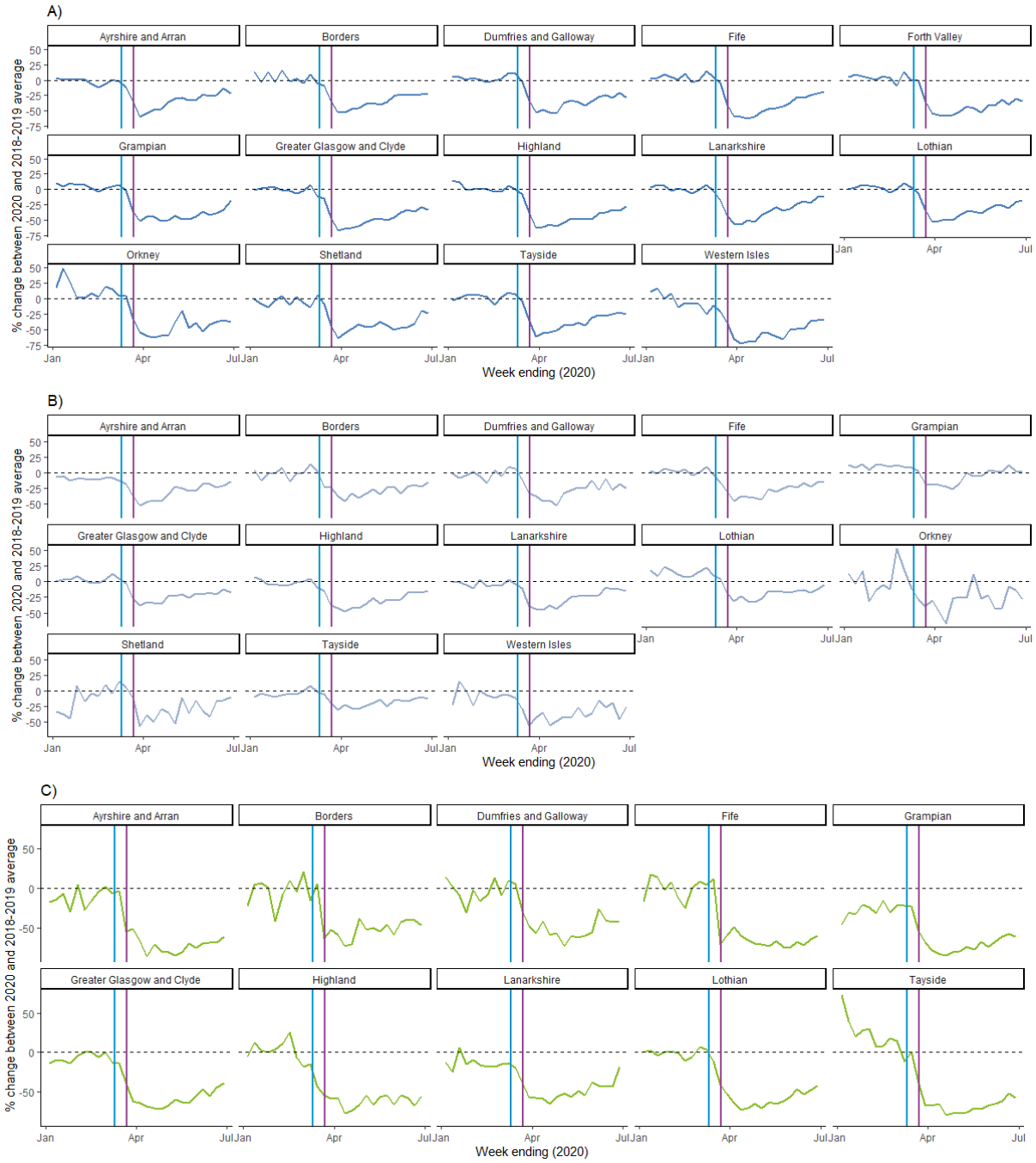


Figure 6. Temporal trends of percentage change in A&E attendances and hospital admissions by NHS Health Board

Weekly percentage changes between 2020 and 2018-2019 average split by NHS Health Board for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 January to 28 June 2020. Includes change-point 1 (WHO announcing pandemic on 11 Mar) and change-point 2 (UK lockdown on 23 Mar). Note: Orkney, Shetland and Western Isles excluded for planned hospital admissions due to small numbers. Forth Valley excluded for emergency and planned hospital admission due to data issues.

S4 Appendix. Temporal trends of counts of A&E attendances and hospital admissions

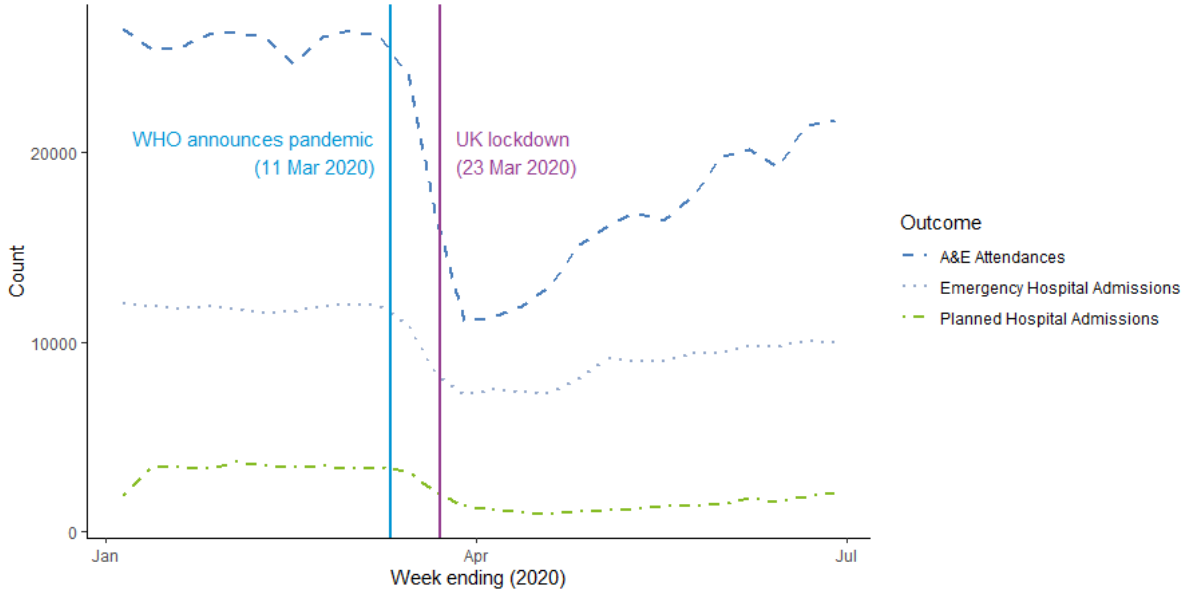


Figure 1. Temporal trends of counts in A&E attendances and hospital admissions across Scotland
Weekly counts of A&E attendances, emergency and planned hospital admissions for weeks ending 5 January to 28 June 2020. Includes change-point 1 (WHO announcing pandemic on 11th March) and change-point 2 (UK lockdown on 23rd March).

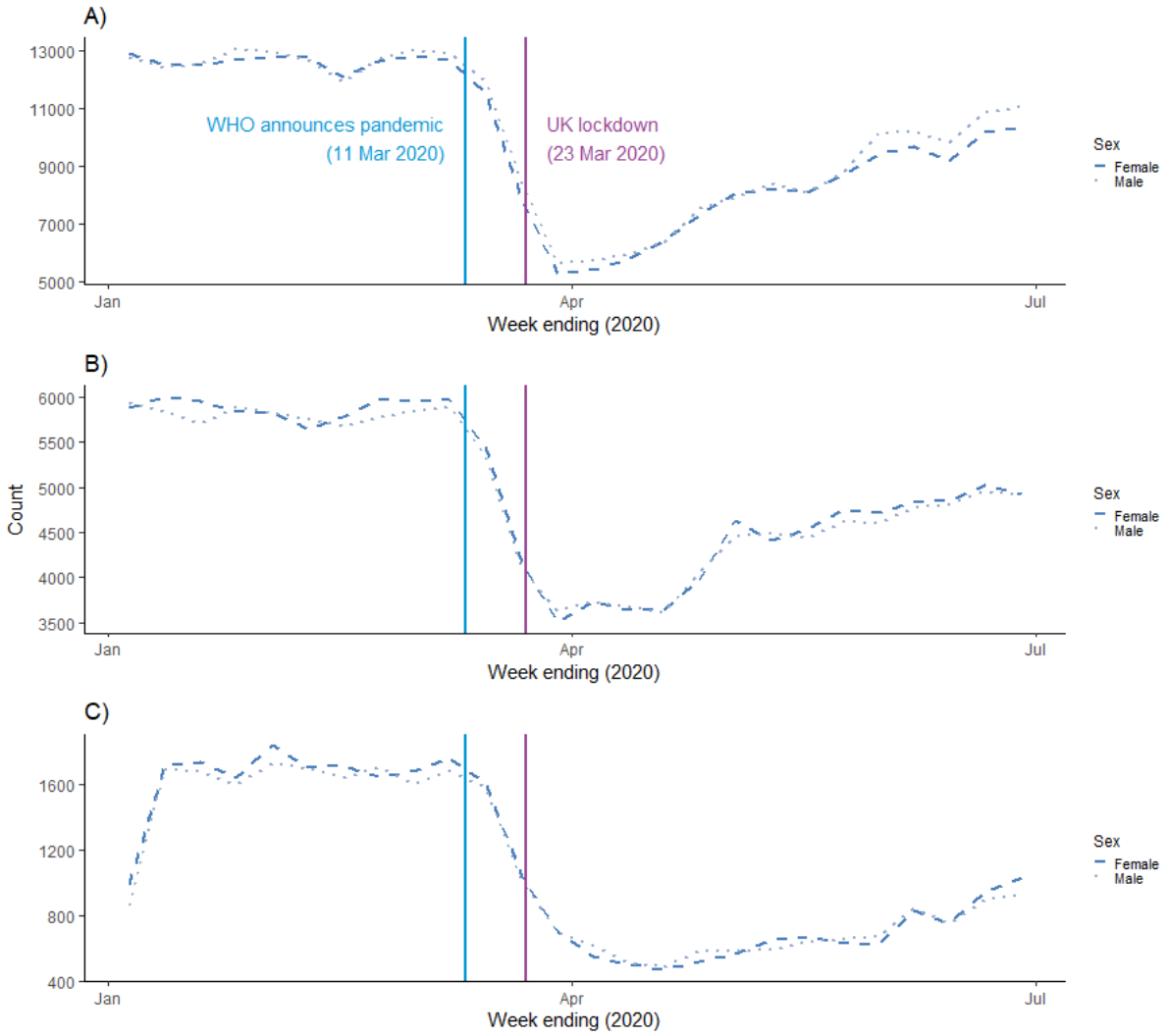


Figure 2. Temporal trends of counts in A&E attendances and hospital admissions by sex

Weekly percentage changes between 2020 and 2018-2019 average split by sex for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 March) and change-point 2 (UK lockdown on 23 March).

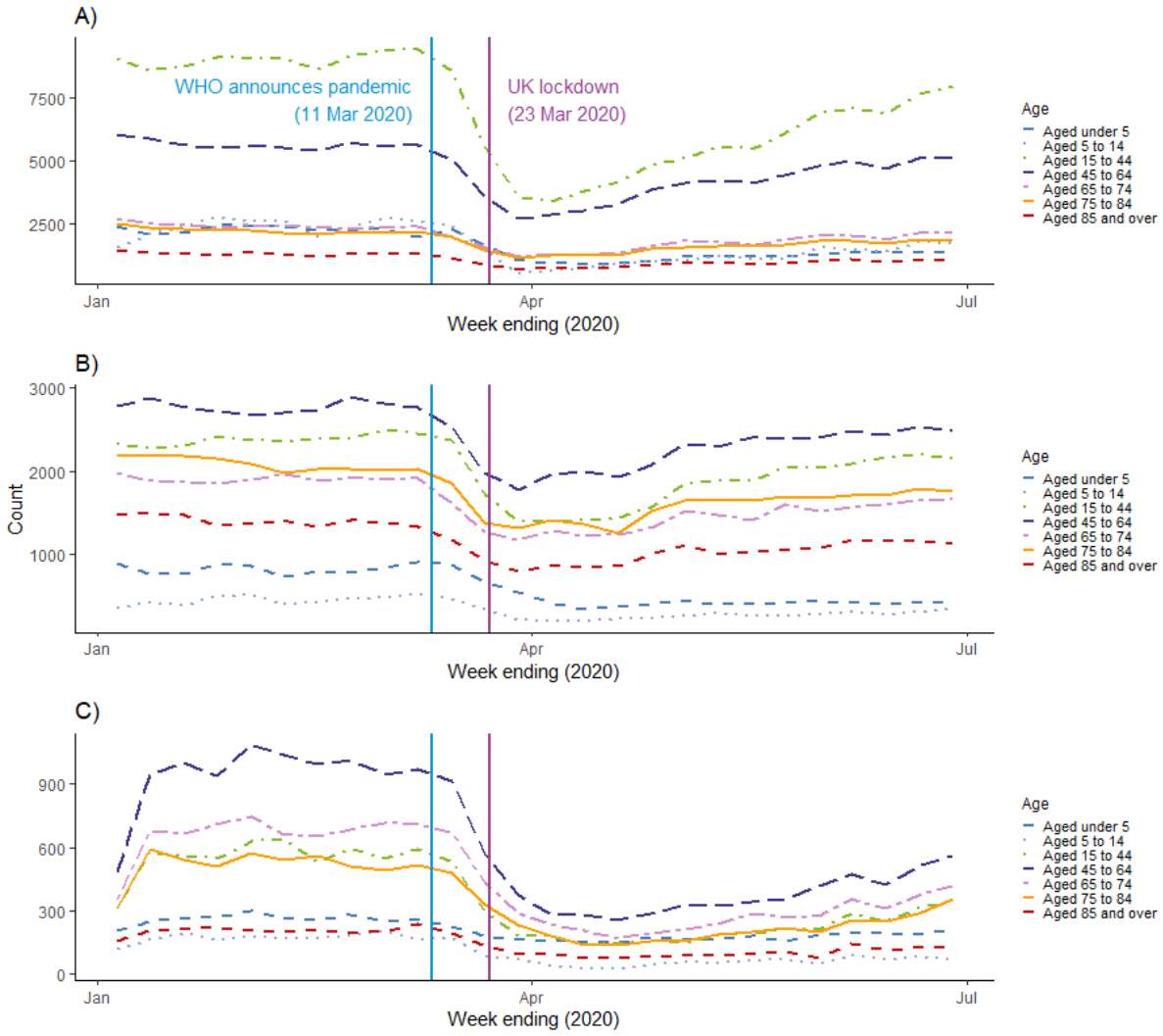


Figure 3. Temporal trends of counts in A&E attendances and hospital admissions by age group

Weekly percentage changes between 2020 and 2018-2019 average split by age for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 March) and change-point 2 (UK lockdown on 23 March).

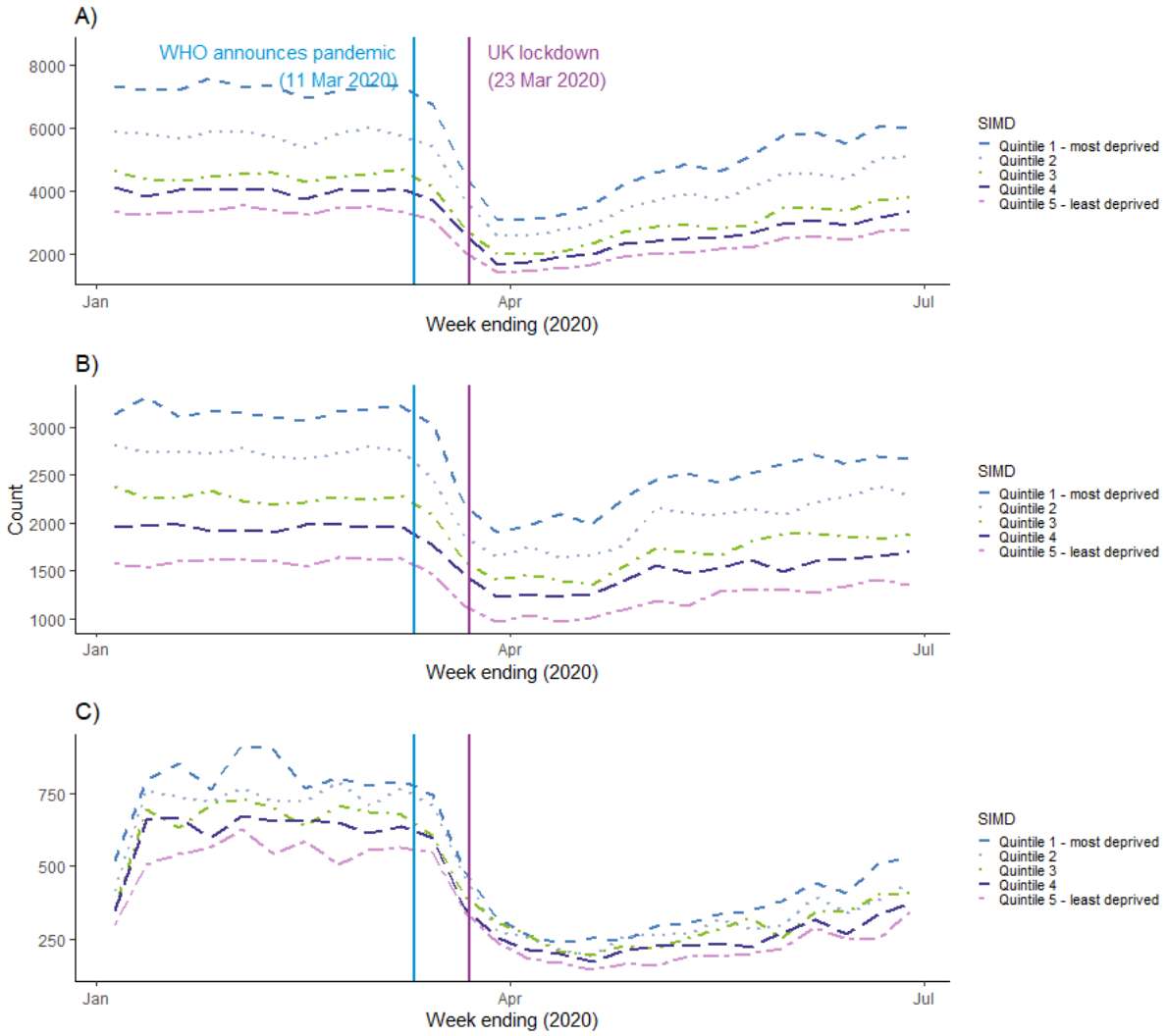


Figure 4. Temporal trends of counts in A&E attendances and hospital admissions by SIMD quintile

Weekly percentage changes between 2020 and 2018-2019 average split by SIMD quintile for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 March) and change-point 2 (UK lockdown on 23 March).

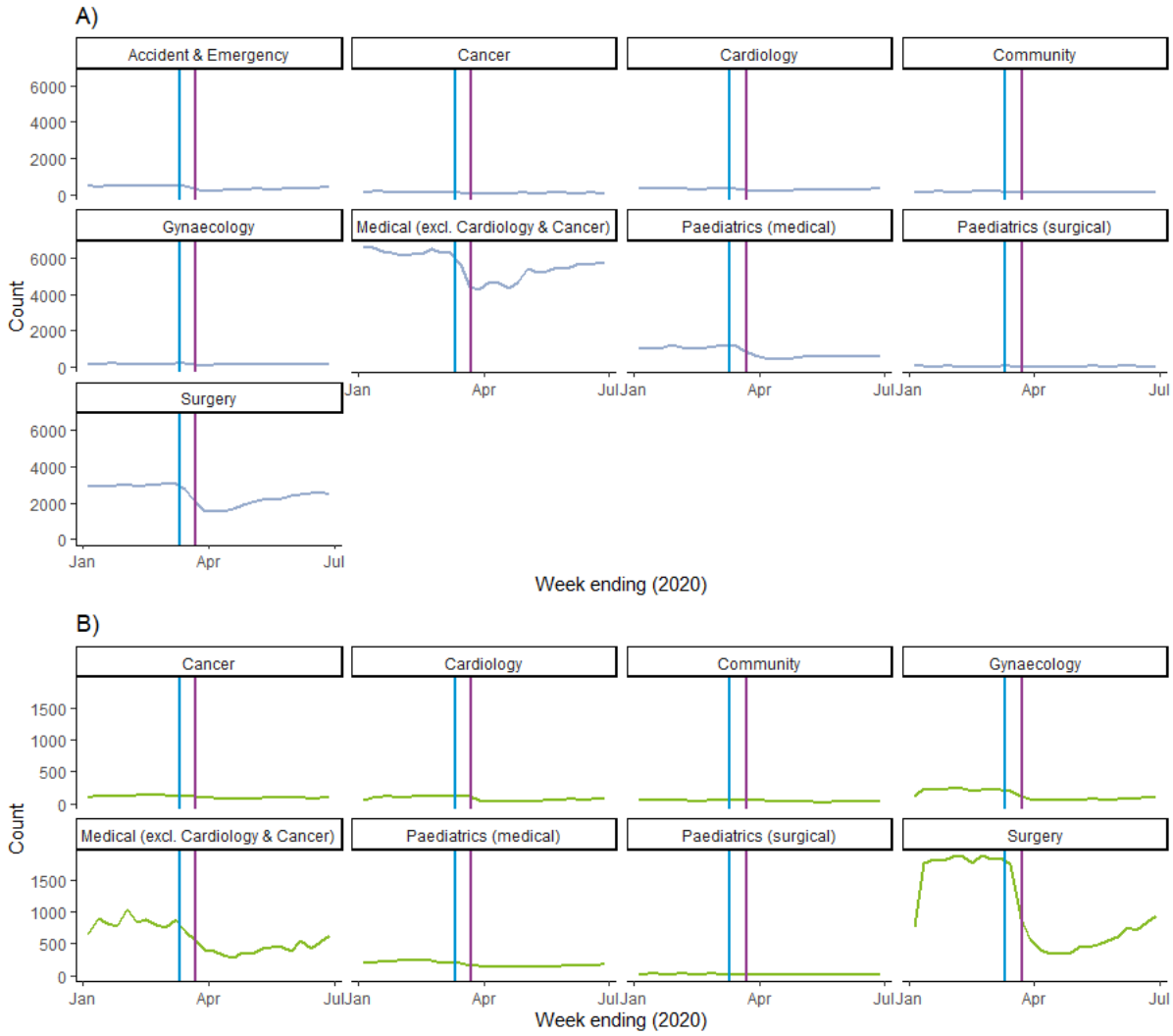


Figure 5. Temporal trends of counts hospital admissions by speciality
Weekly percentage changes between 2020 and 2018-2019 average split by speciality for A) emergency and B) planned hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 March) and change-point 2 (UK lockdown on 23 March).
Note: A&E is missing for planned hospital admissions due to small numbers.

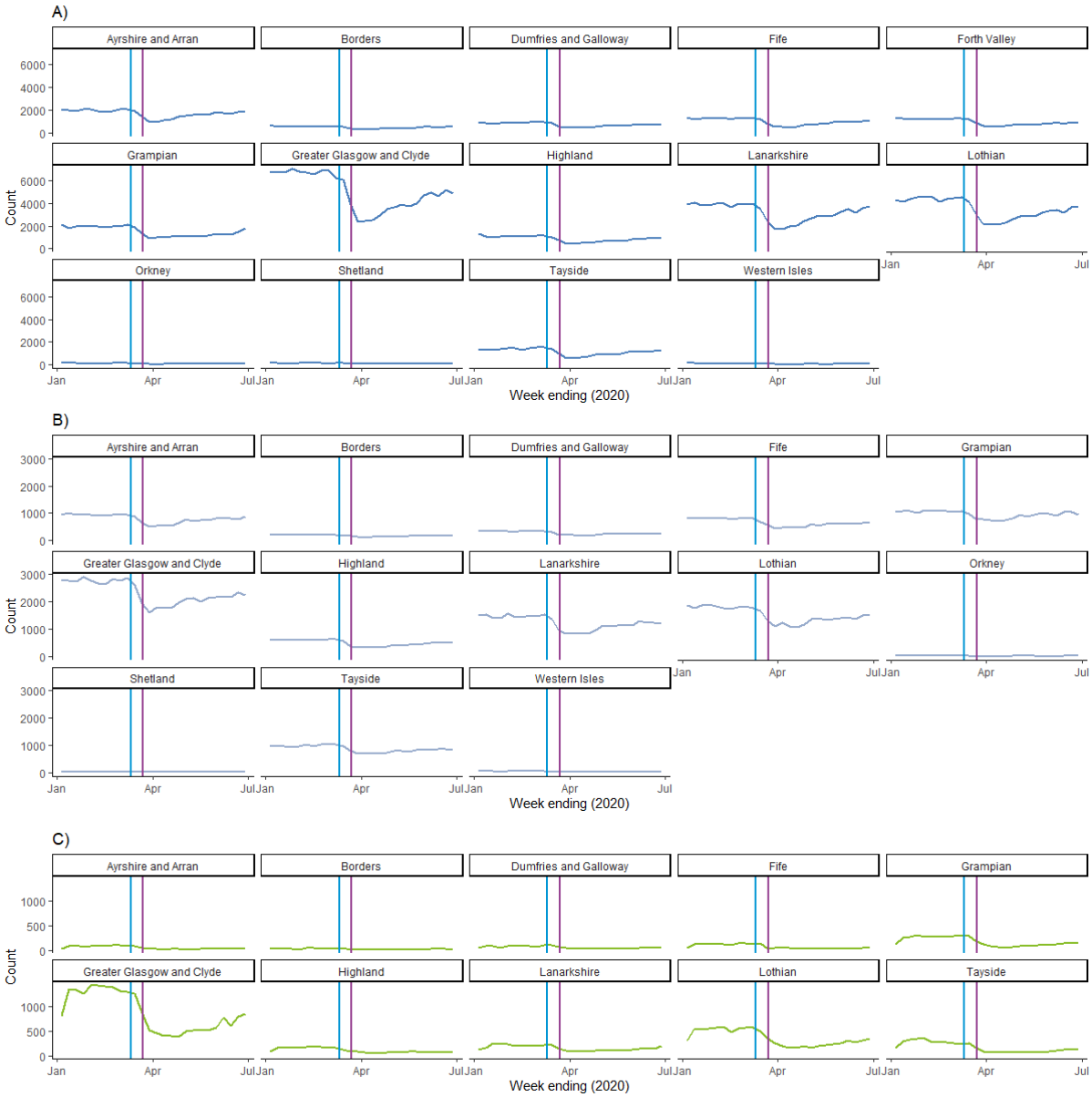


Figure 6. Temporal trends of counts in A&E attendances and hospital admissions by NHS Health Board

Weekly percentage changes between 2020 and 2018-2019 average split by NHS Health Board for A) A&E attendances, B) emergency and C) planned hospital admissions for weeks ending 5 January to 28 June 2020. Includes change-point 1 (WHO announcing pandemic on 11th March) and change-point 2 (UK lockdown on 23rd March).

Note: Orkney, Shetland and Western Isles excluded for planned hospital admissions due to small numbers. Forth Valley excluded for emergency and planned hospital admission due to data issues.

S5 Appendix. Supplementary information on baseline model per outcome

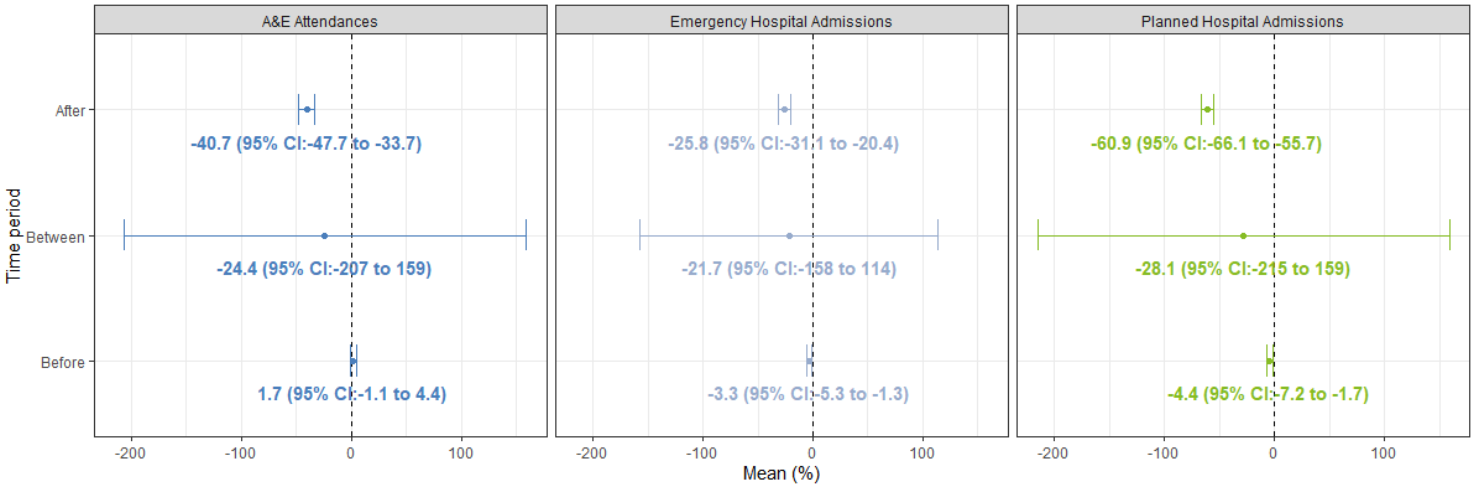


Figure 1. Mean percentage change of 2020 to 2018-2019 average for A&E attendances and hospital admissions

Before indicates weeks before pandemic announcement (weeks ending 05 Jan to 08 Mar 2020); Between indicates weeks between change-points (weeks ending 15 to 22 Mar 2020); After indicates weeks after UK lockdown (weeks ending 29 Mar to 28 Jun 2020). Lines represent 95% confidence intervals.

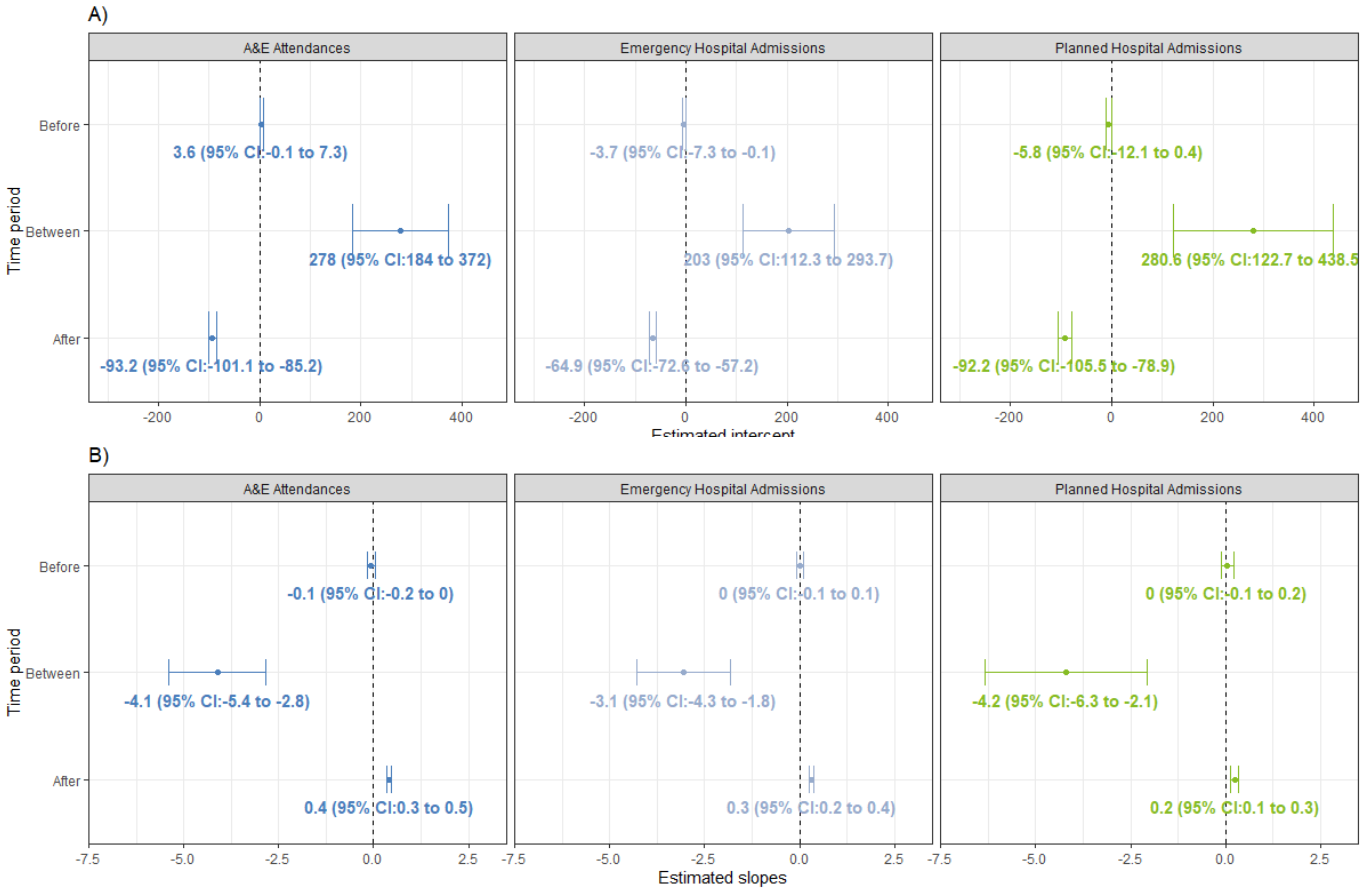


Figure 2. Estimated intercepts and slopes for baseline models for A&E attendances, emergency and planned hospital admissions

Baseline model is the interaction between the number of days since 5th January and the two change-points. Before indicates weeks before pandemic announcement (weeks ending 05 Jan to 08 Mar 2020); Between indicates weeks between change-points (weeks ending 15 to 22 Mar 2020); After indicates weeks after UK lockdown (weeks ending 29 Mar to 28 Jun 2020). Lines represent 95% confidence intervals.

Comparing estimates showed that slopes in the before period were similar across the outcomes, which was also seen in the after time period (Figure 2B). The slopes between the two time-periods were different within the three outcomes (Figure 2B), with slopes in the time-period after the UK lockdown showing evidence of an increasing trend to return to the 2018-2019 average baseline. Accompanying this with the estimated intercepts (Figure 2A) highlighted the drop in the levels before and after.

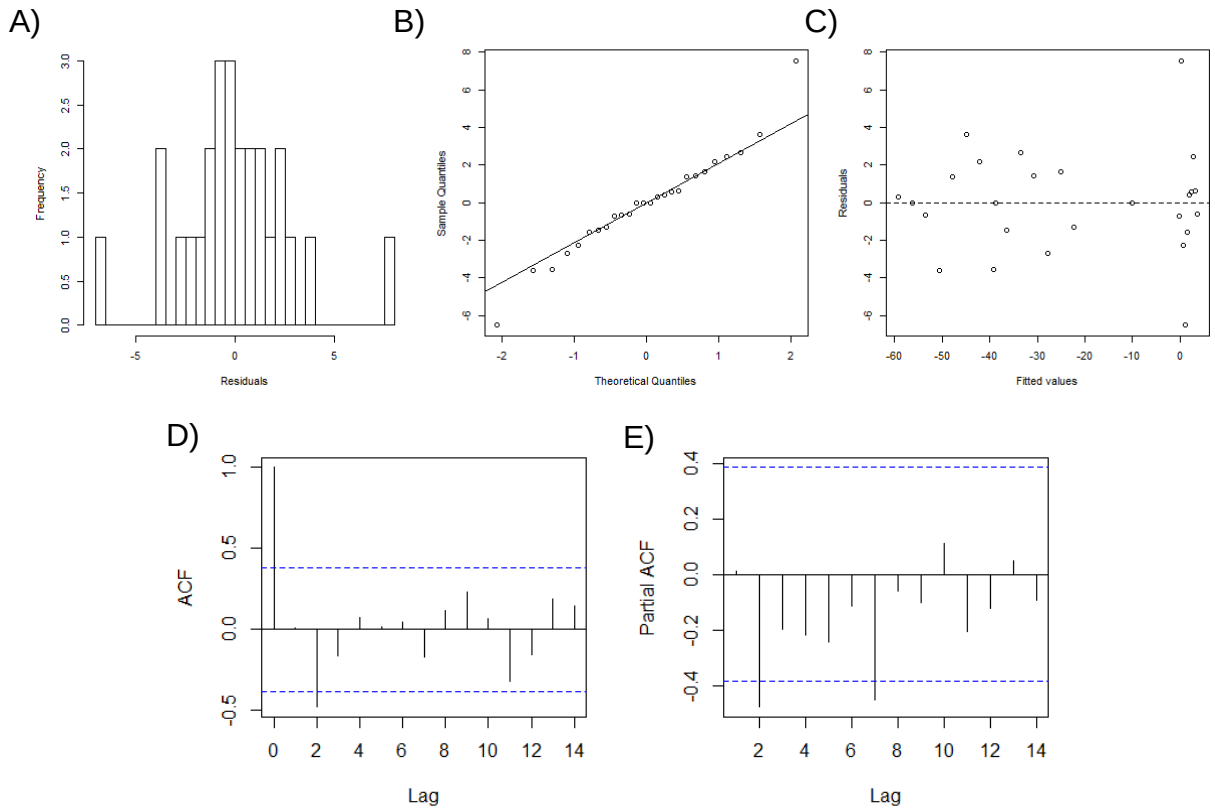


Figure 2. Baseline model diagnostics for A&E attendances
Baseline model of the interaction between the number of days since 05 January and the two change-points for A&E attendances. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals and E) PACF of residuals

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

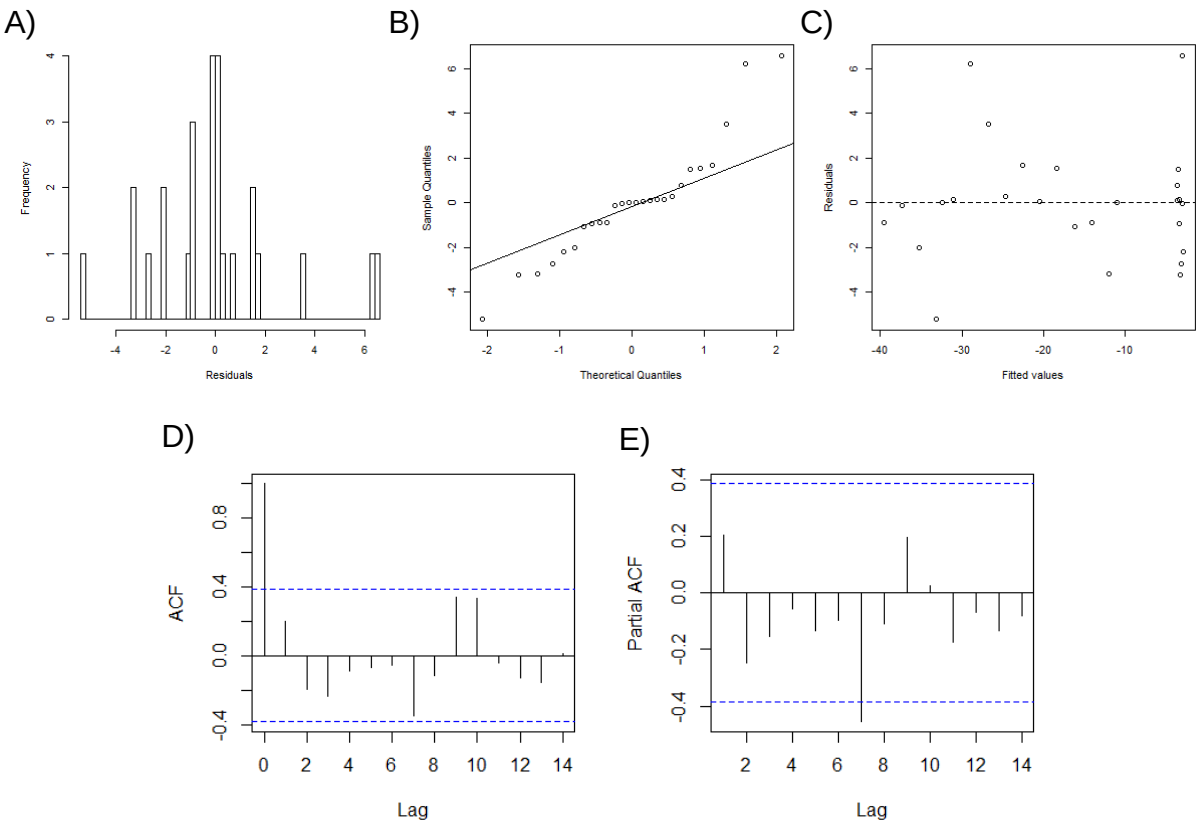


Figure 3. Baseline model diagnostics for emergency hospital admissions
Baseline model of the interaction between the number of days since 05 January and the two change-points for emergency hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals and E) PACF of residuals

Moderate evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

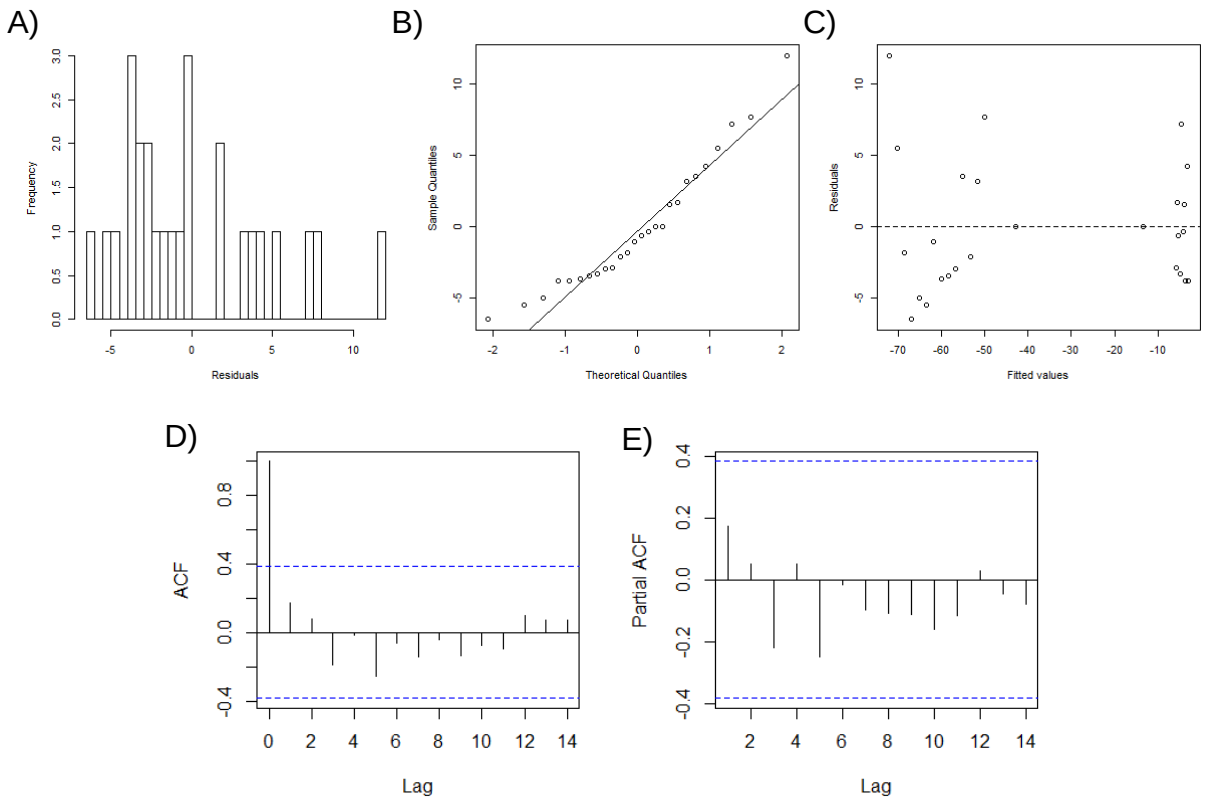


Figure 4. Baseline model diagnostics for planned hospital admissions
Baseline model of the interaction between the number of days since 05 January and the two change-points for planned hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals and E) PACF of residuals.

Moderate to weak evidence that normality can be safely assumed with the lack of a bell-shaped pattern in A) and little linearity in B). Residuals are scattered above and below mean zero line, with skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are within the blue dashed line of the 95% confidence intervals.

S6 Appendix: Supplementary information on interaction with age

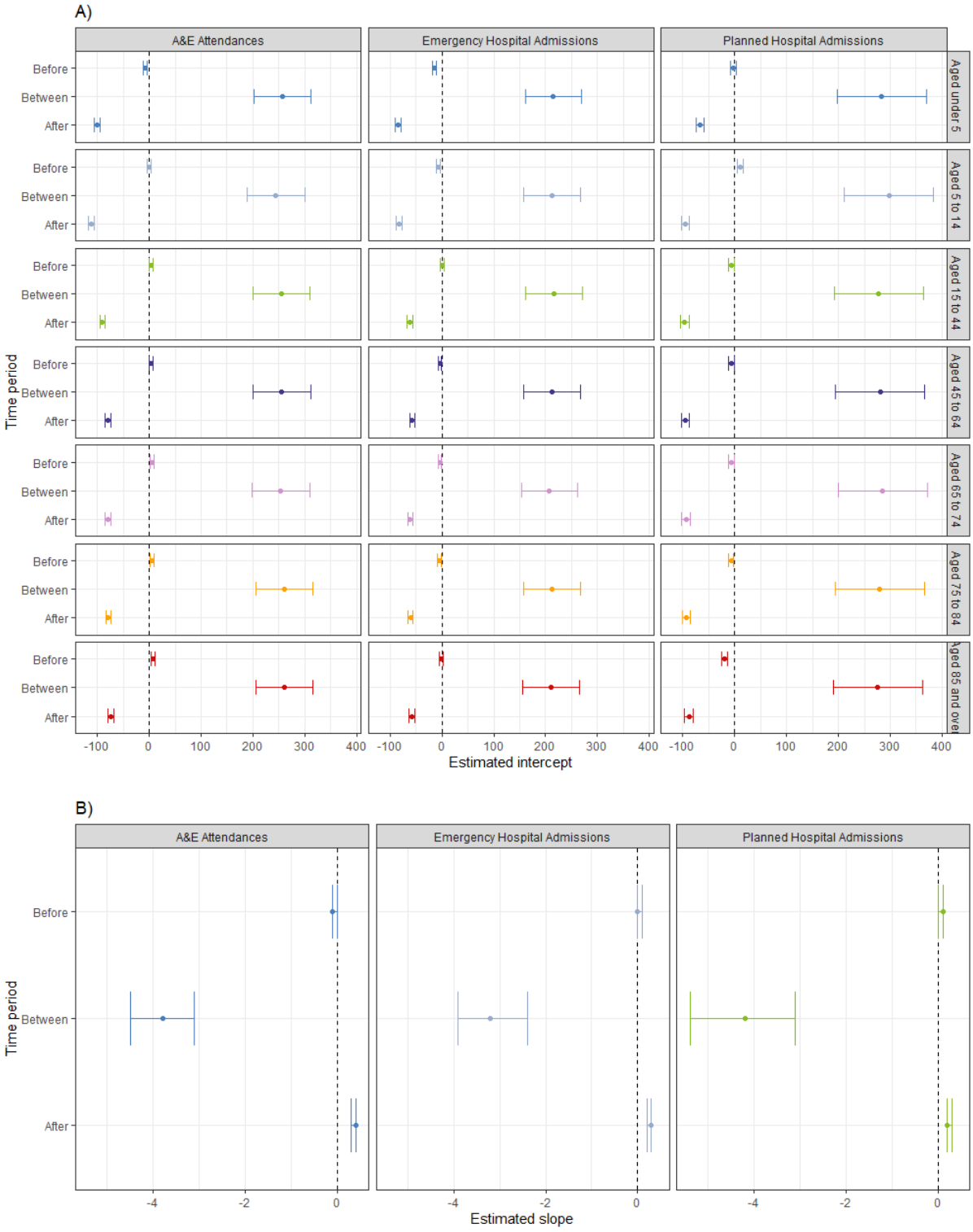


Figure 1. Estimated intercepts (A) and slopes (B) for age model for A&E attendances and hospital admissions

Points represent estimated intercepts (A) and estimated slopes (B) for the fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between age and change-points. Lines represent 95% confidence intervals.

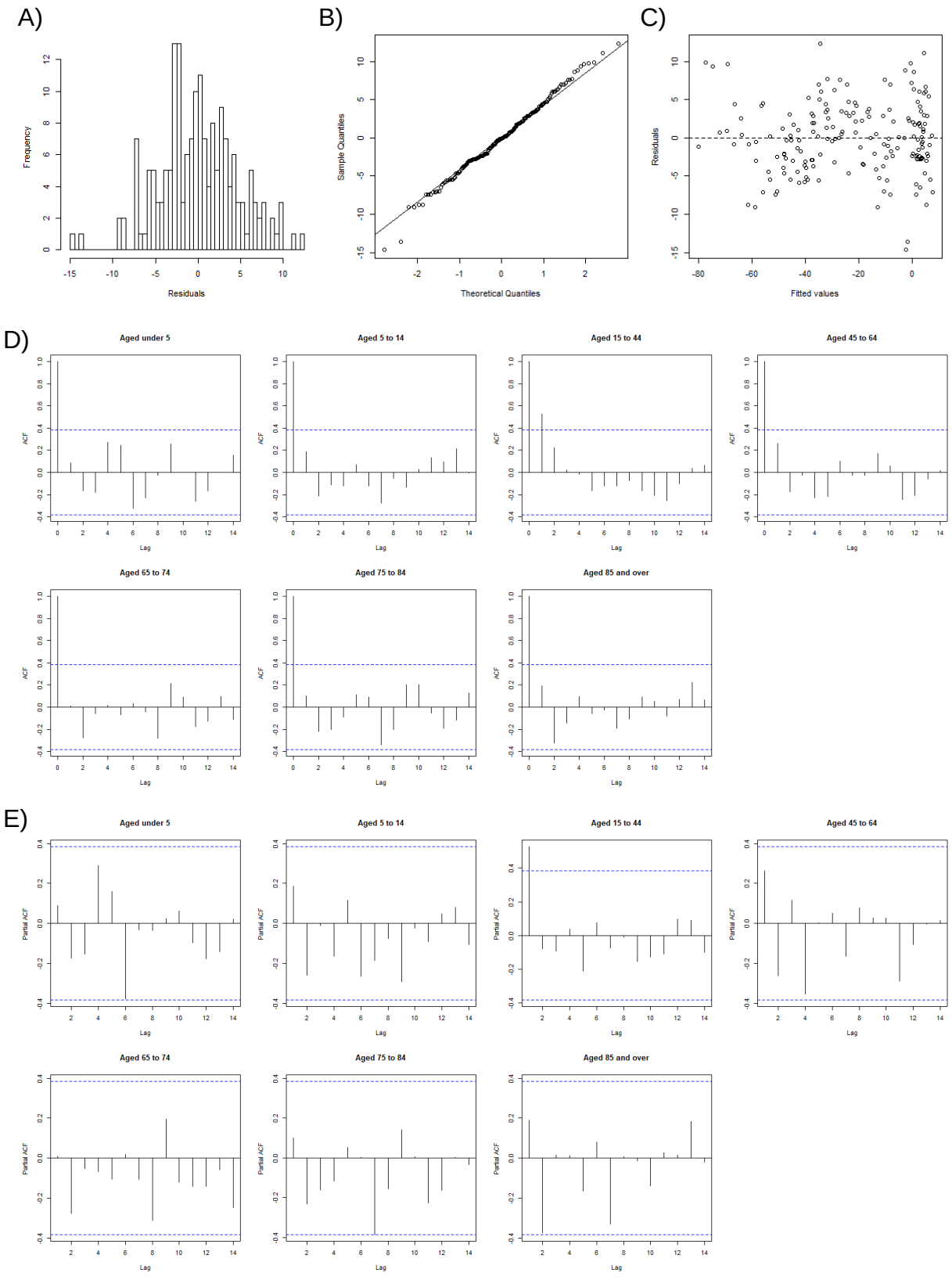


Figure 2. Age model diagnostics for A&E attendances
Fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between age and change-points for A&E attendances. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for age group and E) PACF of residuals for age group.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

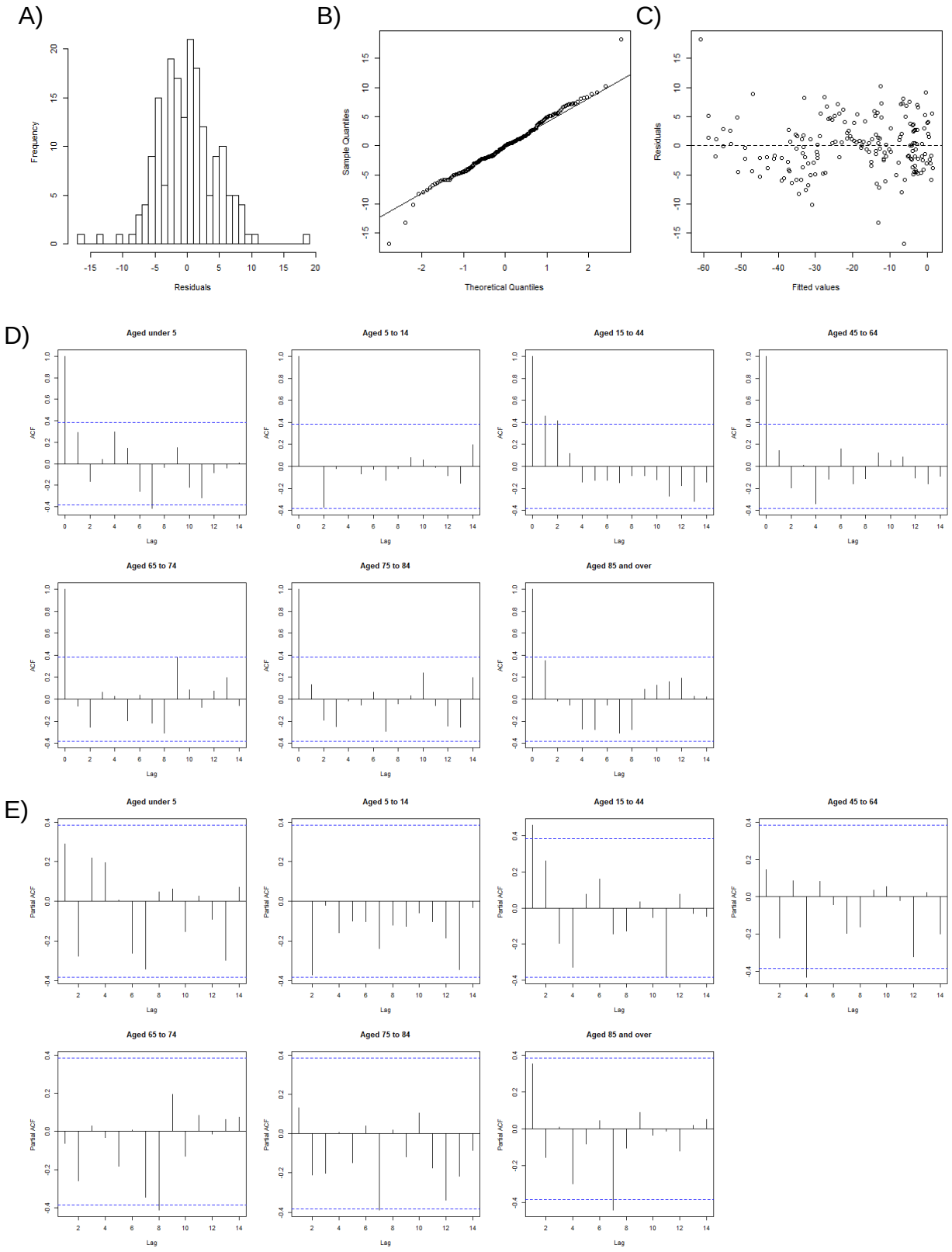


Figure 3. Age model diagnostics for emergency hospital admissions
Fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between age and change-points for emergency hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for age group and E) PACF of residuals for age group.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

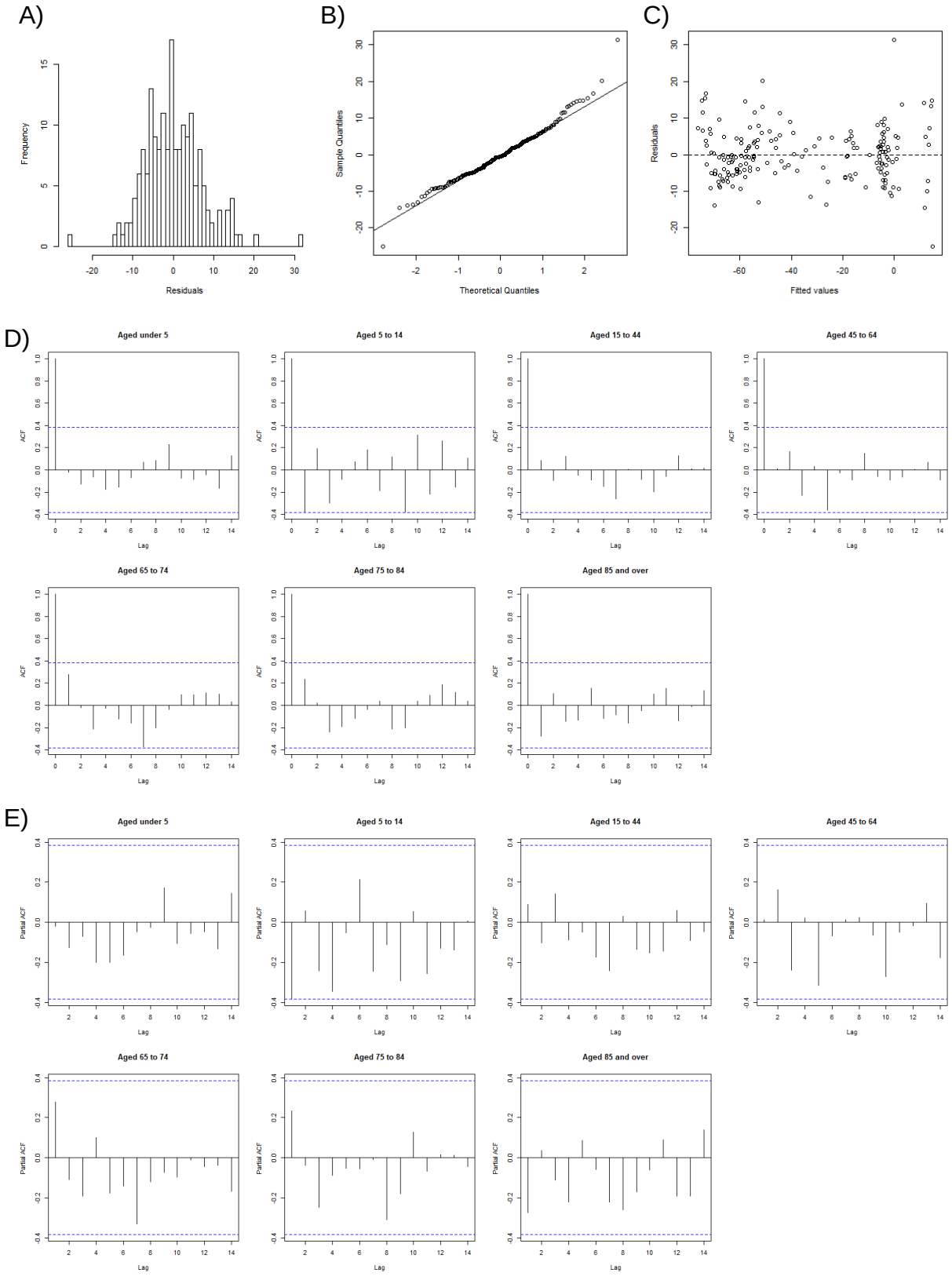


Figure 4. Age model diagnostics for planned hospital admissions
Fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between age and change-points for planned hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for age group and E) PACF of residuals for age group.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

S7 Appendix: Supplementary information on interaction with SIMD

Detailed description

For SIMD, only emergency hospital admissions saw any substantial difference in the groups. The final chosen model fit parallel trend lines for each SIMD quintile, where the slopes differed by the time period. The order of the SIMD quintiles were consistent throughout the time periods (Model 1, S1 Appendix). The plot of the fitted model suggested that those most deprived (Quintiles 1-3) were affected the most, where the trend lines were slightly lower than the most deprived (Figure 1, S7 Appendix). This difference was only slight and it seemed to be driven by differences before the pandemic announcement. This therefore may suggest that, in general, those from deprived areas had lower emergency admissions to previous years for reasons unrelated to COVID-19.

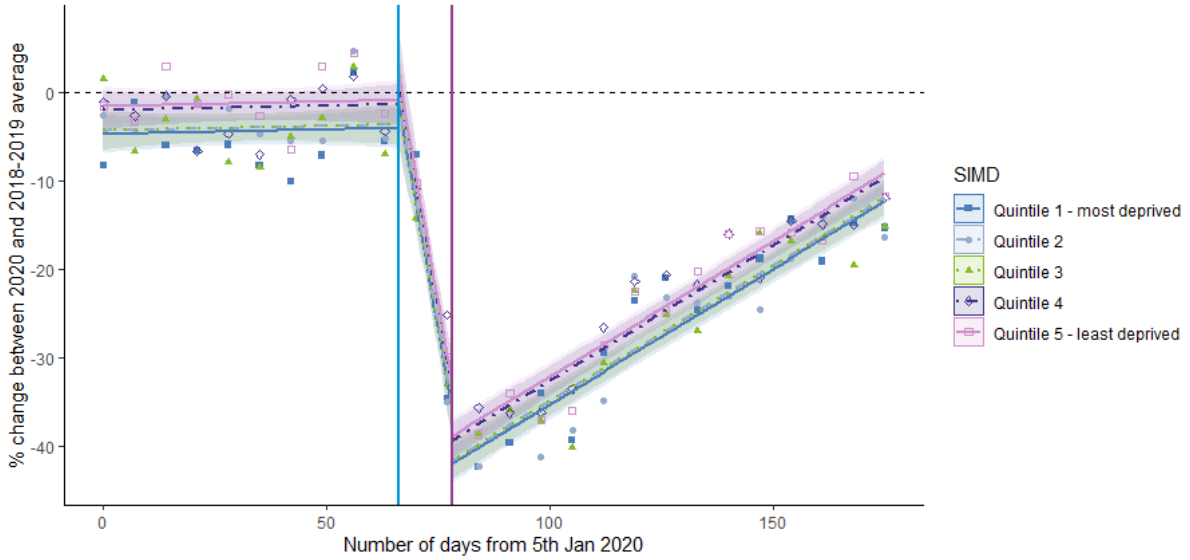


Figure 1. Fitted lines of SIMD model for emergency hospital admissions
Lines represent fitted model of the baseline model (the number of days since 05 January and the two change-points) with adjustment for SIMD Quintile. Shaded areas around lines represent 95% confidence intervals. Points represent weekly percentage changes between 2020 and 2018-2019 average for emergency hospital admissions for weeks ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 March) and change-point 2 (UK lockdown on 23 March).

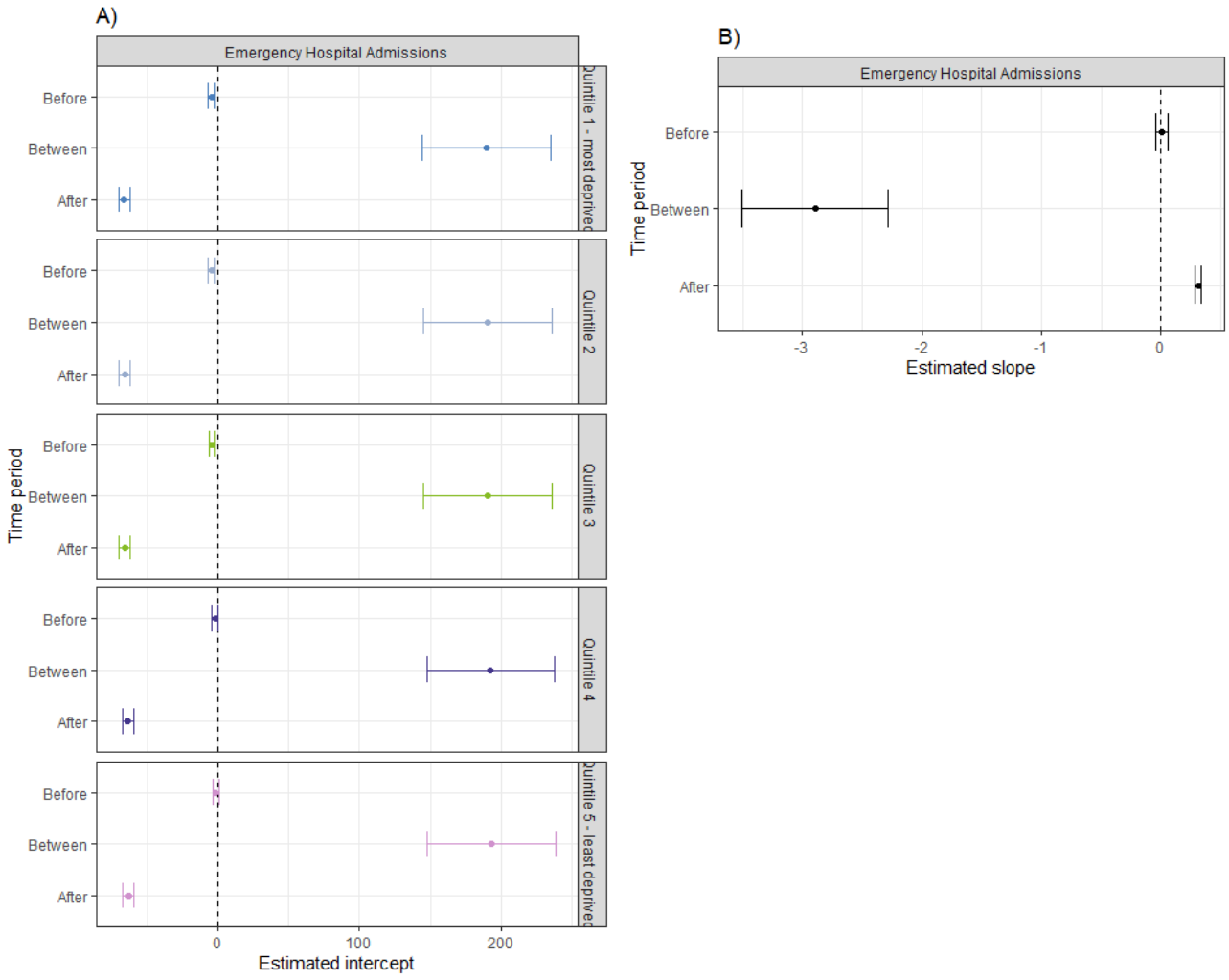


Figure 2. Estimated intercepts (A) and slopes (B) for SIMD model for emergency hospital admissions

Points represent estimated intercepts (A) and estimated slopes (B) for the fitted model of the baseline model (the number of days since 05 January and the two change-points) with adjustment for SIMD Quintile. Lines represent 95% confidence intervals.

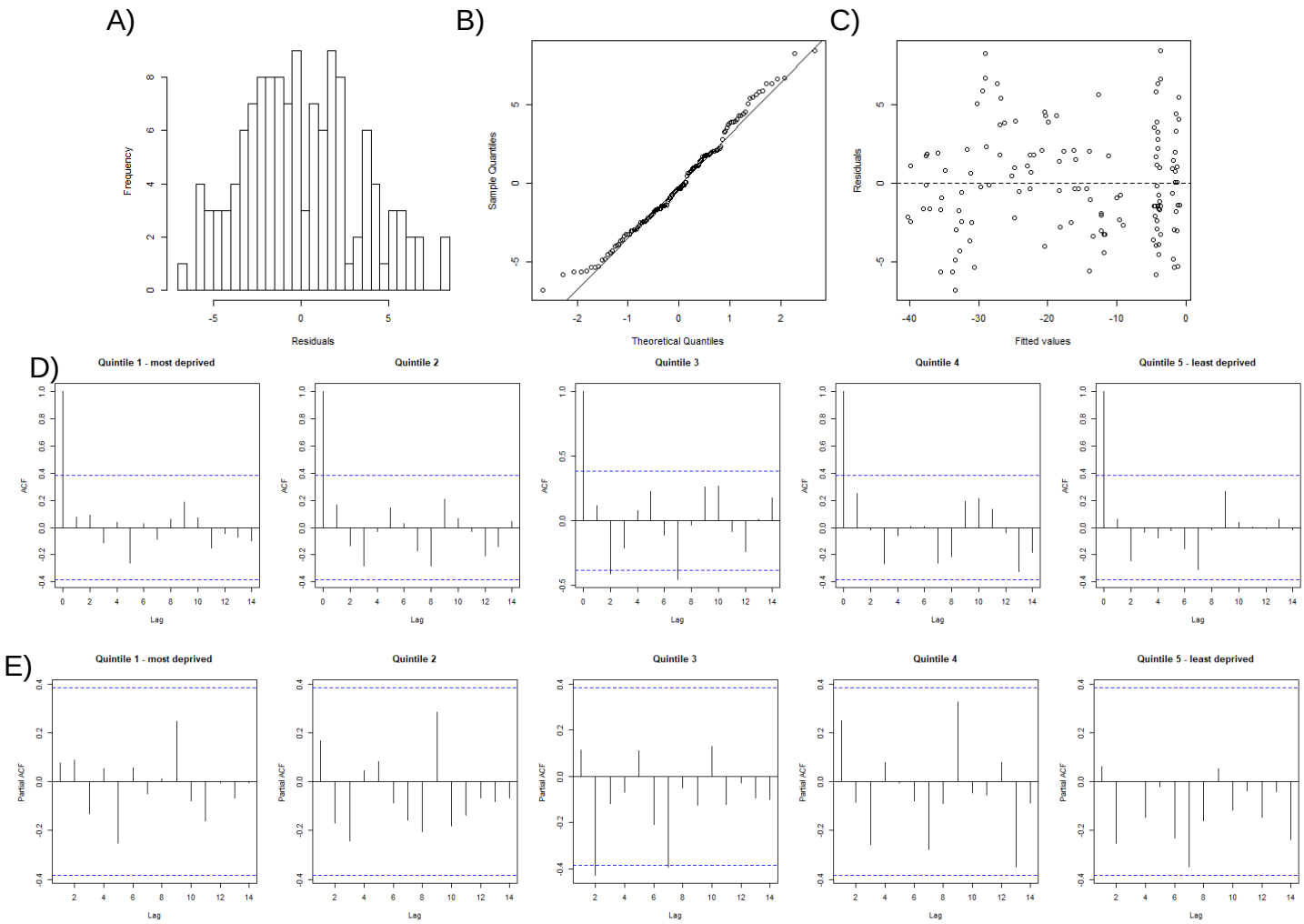


Figure 3. SIMD model diagnostics for planned hospital admissions
Fitted model of the baseline model (the number of days since 05 January and the two change-points) with adjustment for SIMD Quintile. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for SIMD quintile and E) PACF of residuals for SIMD quintile.

Moderate evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

S8 Appendix: Supplementary information on interaction with Speciality

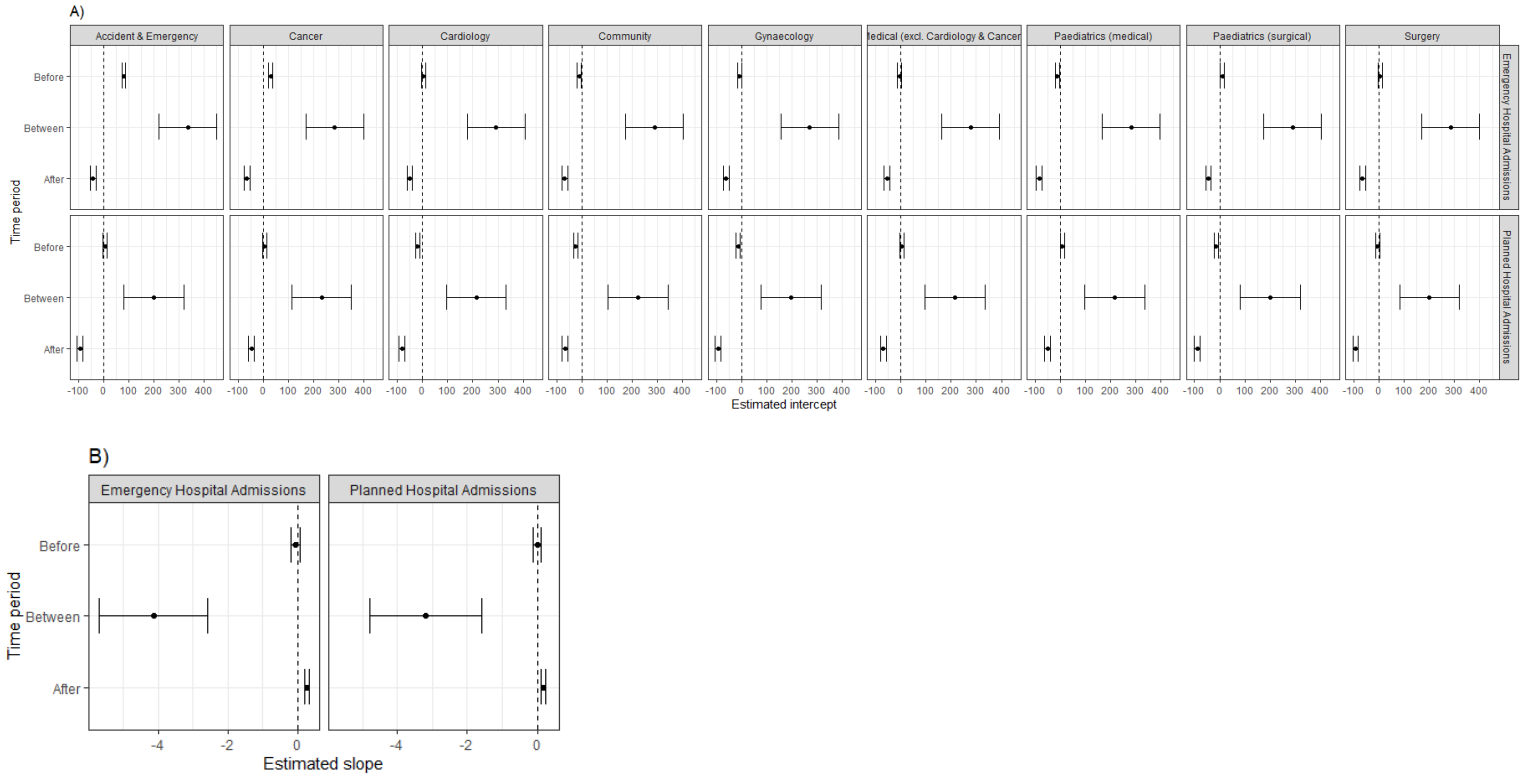


Figure 1. Estimated intercepts (A) and slopes (B) for speciality model for A&E attendances and hospital admissions

Points represent estimated intercepts (A) and estimated slopes (B) for the fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between speciality and change-points. Lines represent 95% confidence intervals.

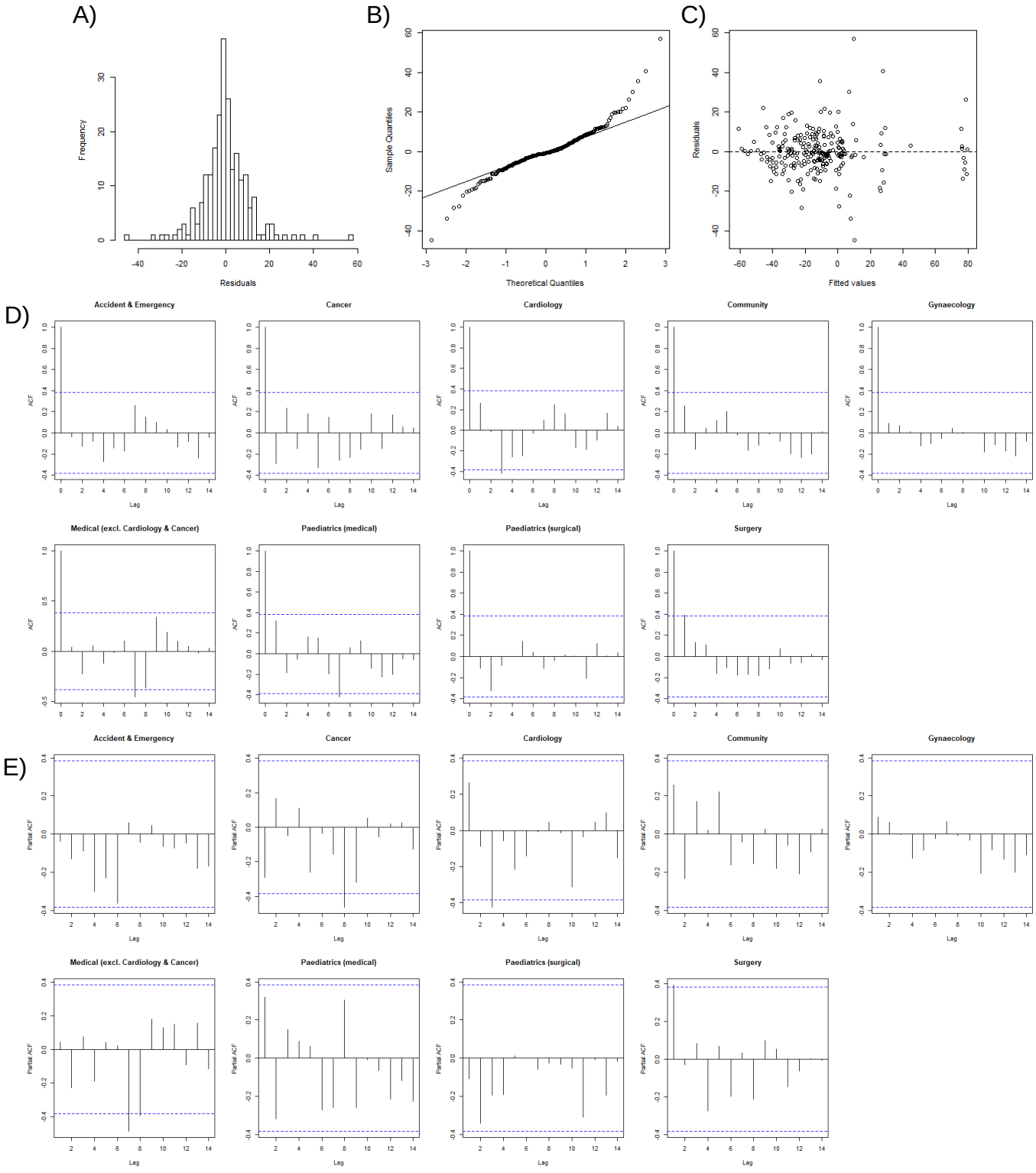


Figure 2. Speciality model diagnostics for emergency hospital admissions
Fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between speciality and change-points for emergency hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for speciality and E) PACF of residuals for speciality.

Moderate to strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B) with fanning of the ends. Residuals are scattered above

and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

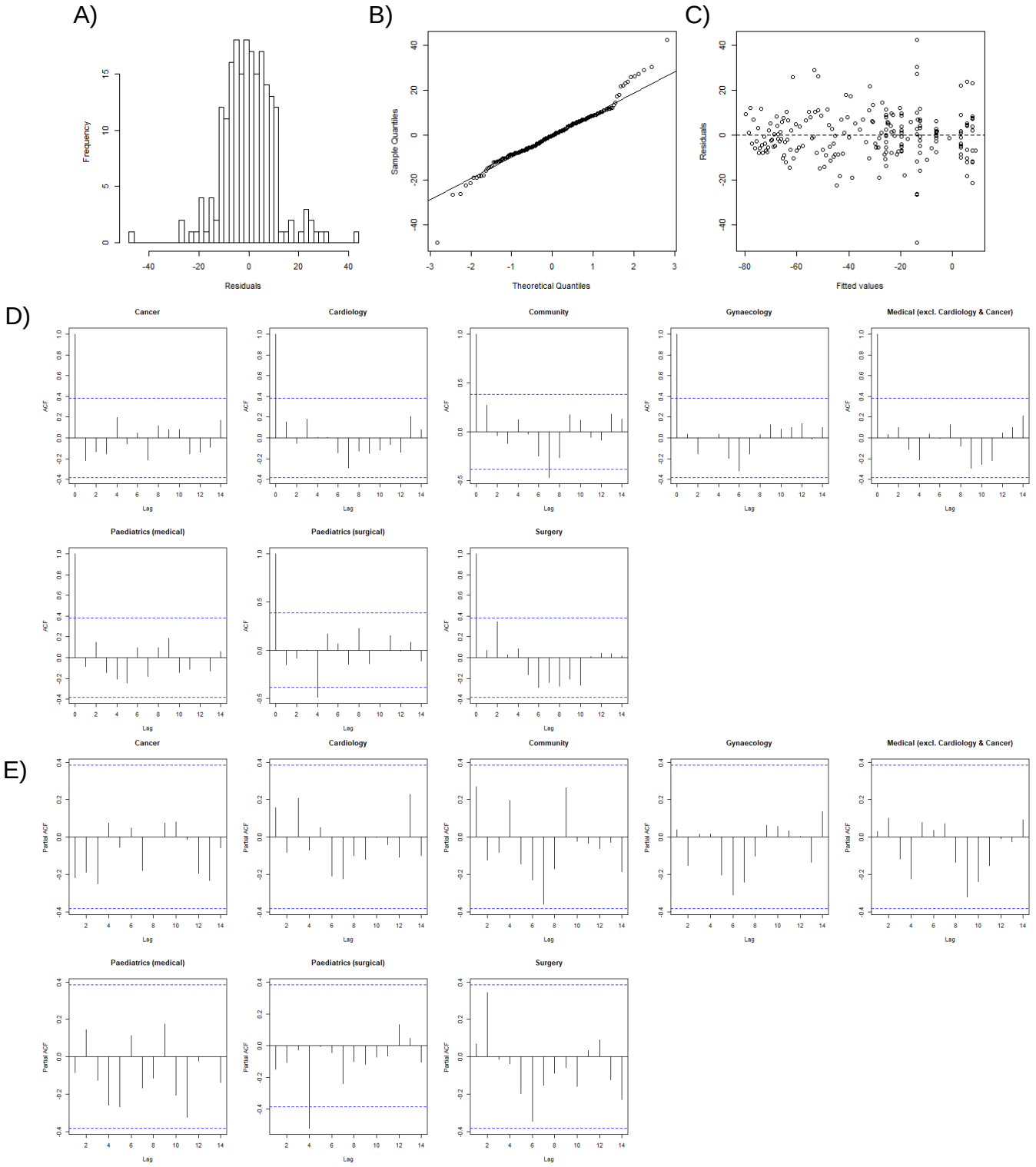


Figure 3. Speciality model diagnostics for planned hospital admissions
Fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between speciality and change-points for planned hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for speciality and E) PACF of residuals for speciality.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

S9 Appendix: Supplementary information on interaction with NHS Health Board

Detailed description

The percentage changes across NHS Health Boards for all outcomes were fairly similar to the overall Scotland changes. This was particularly evident in A&E attendances, where all trends were similar to the 2018-2019 baseline before the 1st change-point, followed by a drop until the 2nd change-point and then followed by a steady incline back to recovery (Figure 6A, S3 Appendix). This consistency is seen in the map of the differences in the mean percentage changes before and after the change-points (Figure. 5A). Using regression to test whether there were differences between NHS Health Boards in A&E attendances, showed that there existed a difference in the slopes between NHS Health Boards (Model 2, S1 Appendix). Plots of the fitted model showed all Health Boards began to increase after the latter change-point at very similar rates with NHS Western Isles having a slightly flatter trend (Figure 1A, S9 Appendix). It also highlighted areas such as NHS Lanarkshire being back at the baseline at the end of the study.

Similar results were shown for emergency hospital admissions, where the trends after lockdown began to increase closer to the 2018-2019 baseline (Figure 6B, S3 Appendix). The smaller Health Boards should be interpreted with caution with high variability due to small numbers; this includes NHS Orkney, NHS Shetland and NHS Western Isles (Figure 6B, S3 Appendix). Spatially visualising the differences shows no major clustering occurring, with the East to South East coast having the biggest decreases (Figure. 5B). A similar model to the A&E attendance outcome was fitted for emergency hospital admissions (Model 2, S1 Appendix), which showed that there was a substantial recovery after lockdown across all NHS Health Boards (S8 Appendix – Figure 1B). Most areas were very close to the baseline at the end of the study, particularly NHS Grampian (Figure 1B, S9 Appendix).

For planned hospital admissions the remaining boards that had all weekly counts >5, displayed fairly consistent trends again, where not many areas saw an increase in planned admissions after the last change-point (Figure 6C, S3 Appendix). The map of these differences show little spatial correlation, with more rural areas such as NHS Borders and NHS Tayside showing larger decreases (Figure. 5C), although noting the unique temporal trend of NHS Tayside (Figure 6C, S3 Appendix). When modelling the differentiating affect across Health Boards for planned hospital admissions, a three-way interaction was proven to be important to the outcome. This captured more variability in the slopes before the 1st change-point, where most were showing increasing trends and others such as NHS Highland and NHS Tayside beginning to show decreasing trends (Figure 1C, S9 Appendix). The drops between these change-points did not seem substantially different from the slopes before and after for areas such as NHS Highland and NHS Lanarkshire. All slopes after the last change-point were very flat, with NHS Ayrshire and Arran and NHS Fife showing no evidence of a return to the baseline (Figure 1C, S9 Appendix).

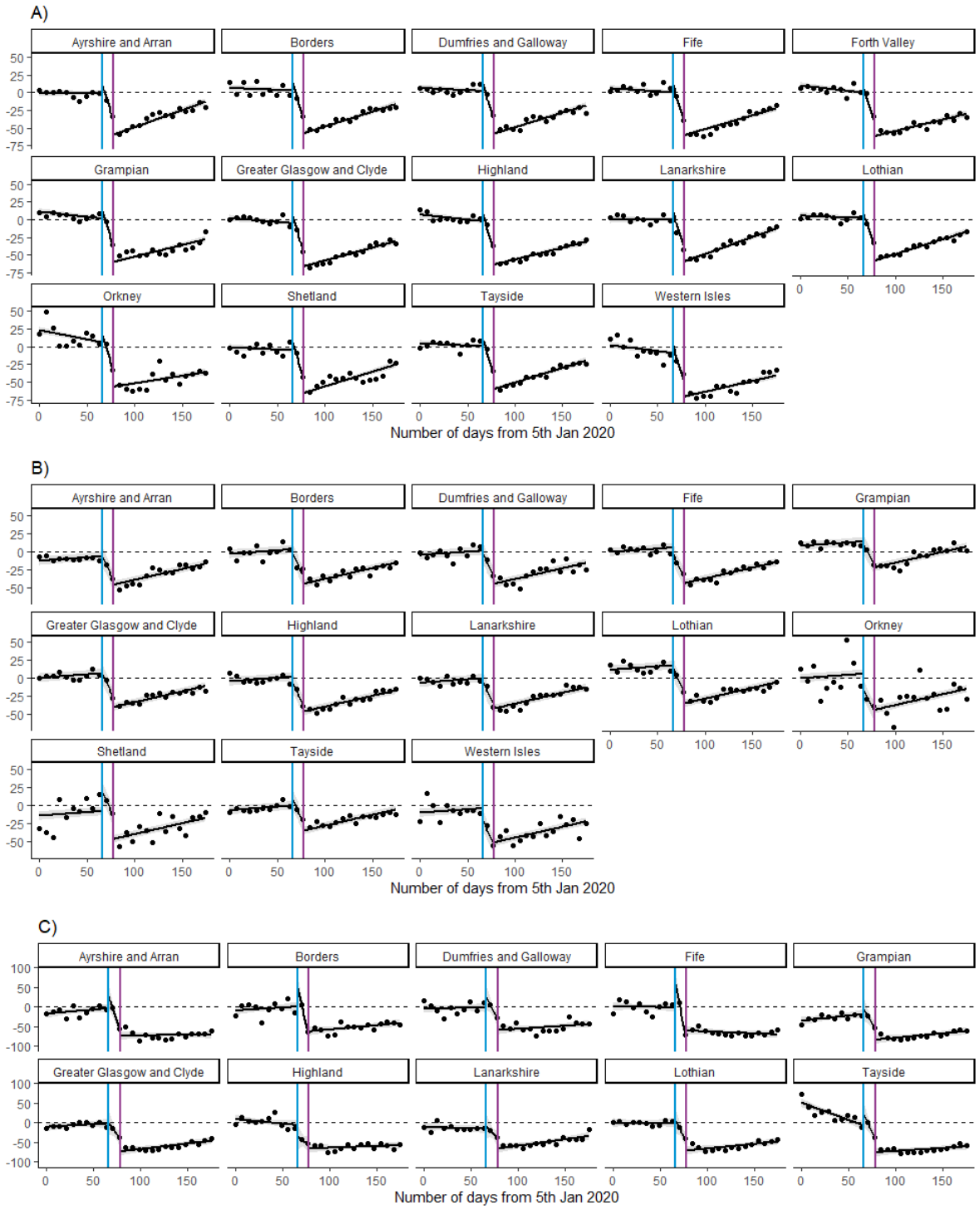


Figure 1. Fitted lines of NHS Health Board model for A&E attendances and hospital admissions

Lines for A&E attendances (A) and emergency hospital admissions (B) represent fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between NHS Health Board and the number of days since 05 January. Lines for planned hospital admissions (C) represent fitted model of the three-way interaction between the baseline model and NHS Health Board. Shaded areas around lines represent 95% confidence intervals. Points represent weekly percentage changes between 2020 and 2018-2019 average for emergency and planned hospital admissions for weeks

ending 05 Jan to 28 Jun 2020. Includes change-point 1 (WHO announcing pandemic on 11 March) and change-point 2 (UK lockdown on 23 March).

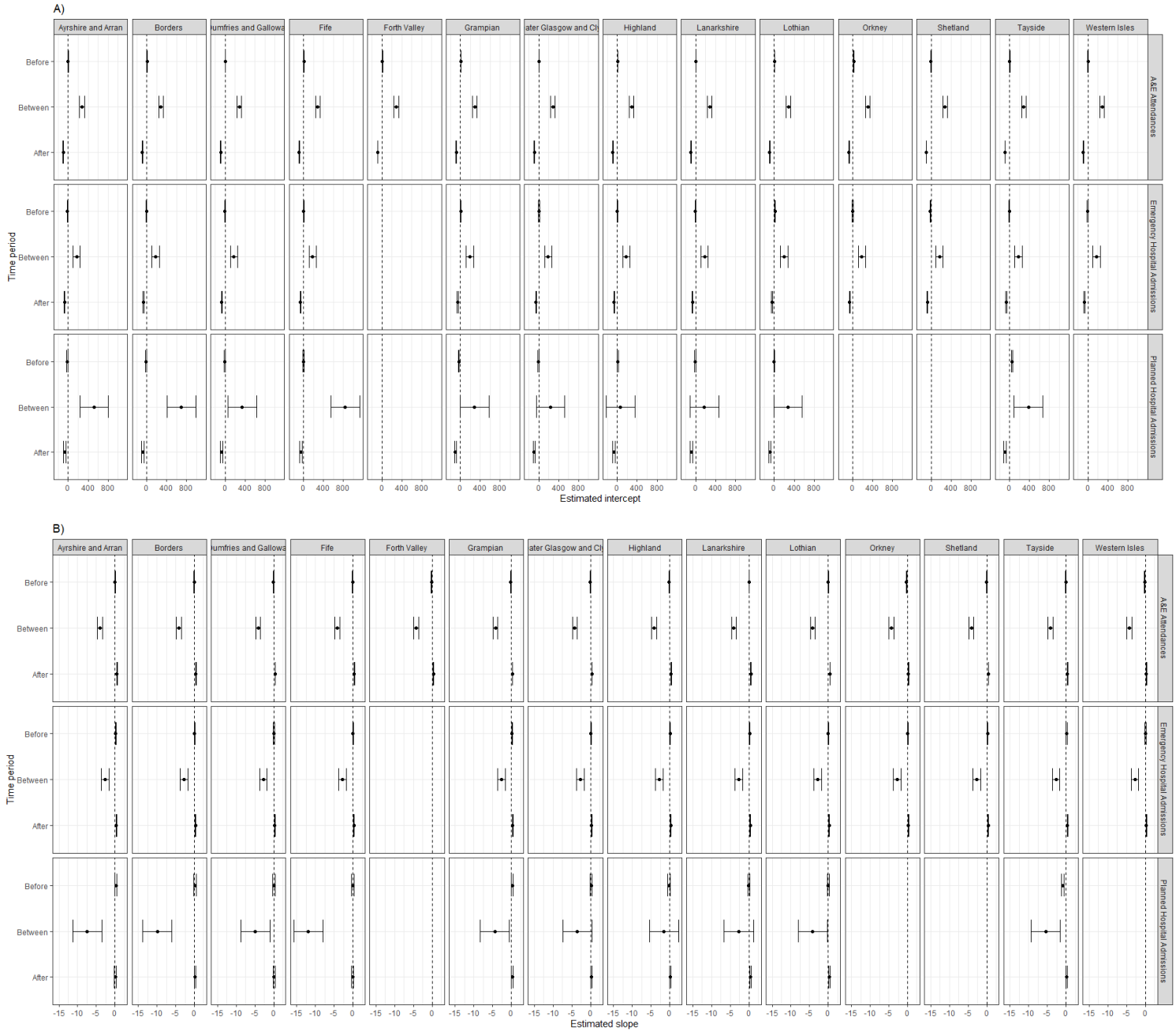


Figure 2. Estimated intercepts (A) and slopes (B) for NHS Health Board model for A&E attendances and hospital admissions

Points represent estimated intercepts (A) and estimated slopes (B) for A&E attendances and emergency hospital admissions fitted model of the baseline model (the number of days since 05 January and the two change-points) and an interaction between NHS Health Board and the number of days since 05 January. Points represent estimated intercepts (A) and estimated slopes (B) for planned hospital admissions represent fitted model of the three-way interaction between the baseline model and NHS Health Board. Lines represent 95% confidence intervals.

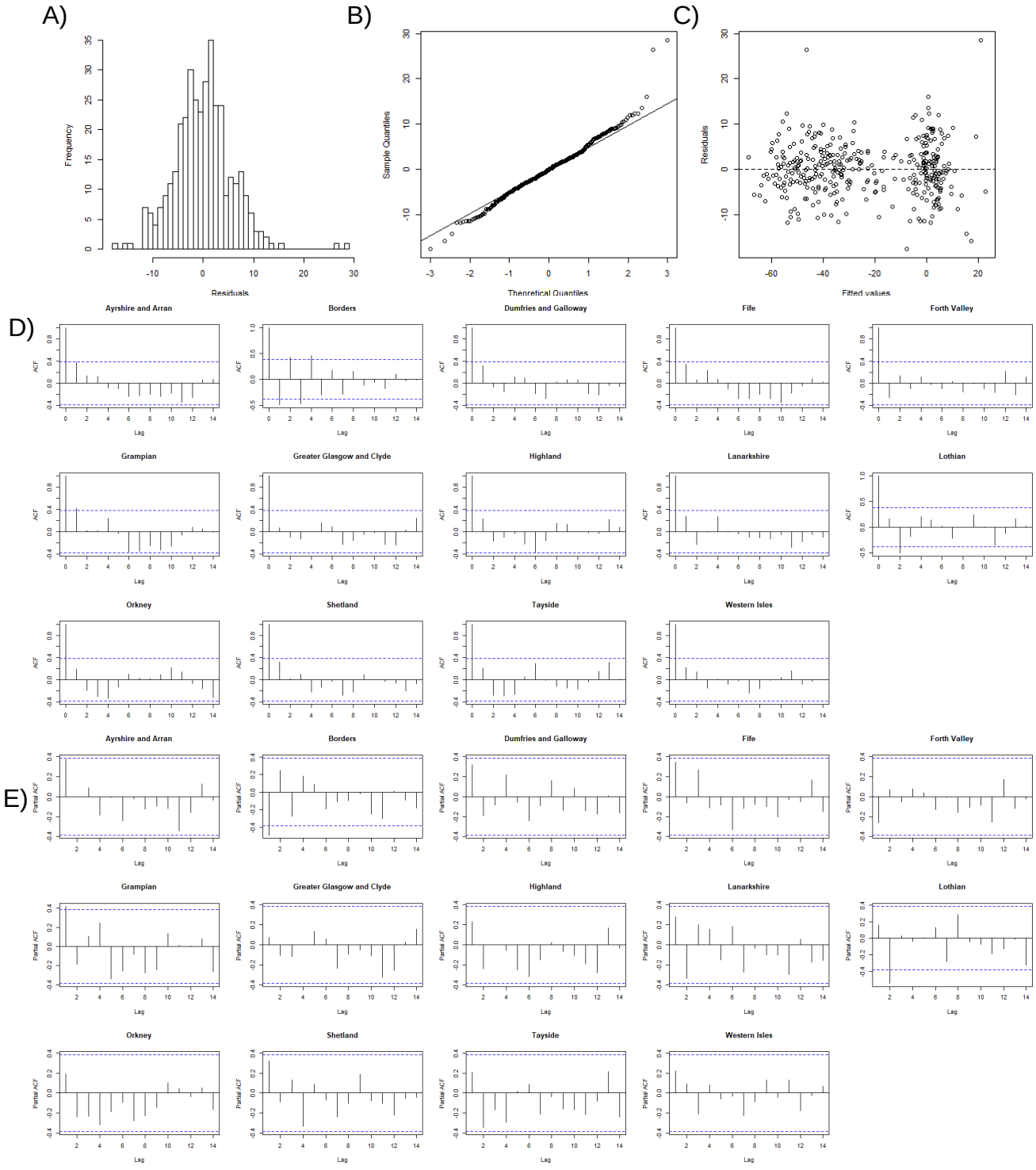


Figure 3. NHS Health Board model diagnostics for A&E Attendances
Fitted model of baseline model (the number of days since 05 January and the two change-points) and an interaction between NHS Health Board and the number of days since 05 January for A&E attendances. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for health boards and E) PACF of residuals for health boards.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B). Residuals are scattered above and below mean zero line, with slight

skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

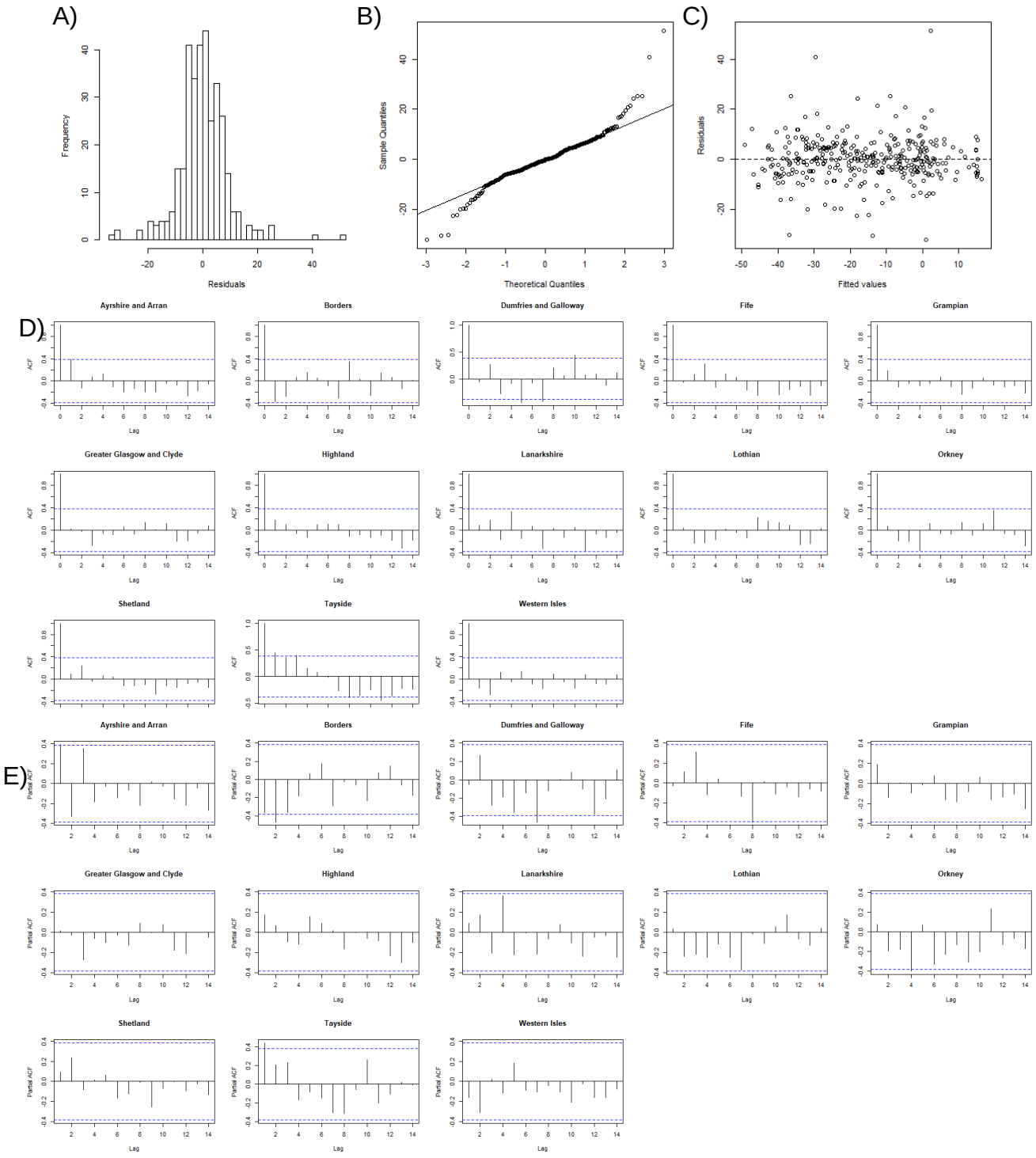


Figure 4. NHS Health Board model diagnostics for emergency hospital admissions
Fitted model of baseline model (the number of days since 05 January and the two change-points) and an interaction between NHS Health Board and the number of days since 05 January for emergency hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for health boards and E) PACF of residuals for health boards.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B) with fanning in the tails. Residuals are scattered above and below mean zero line C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.

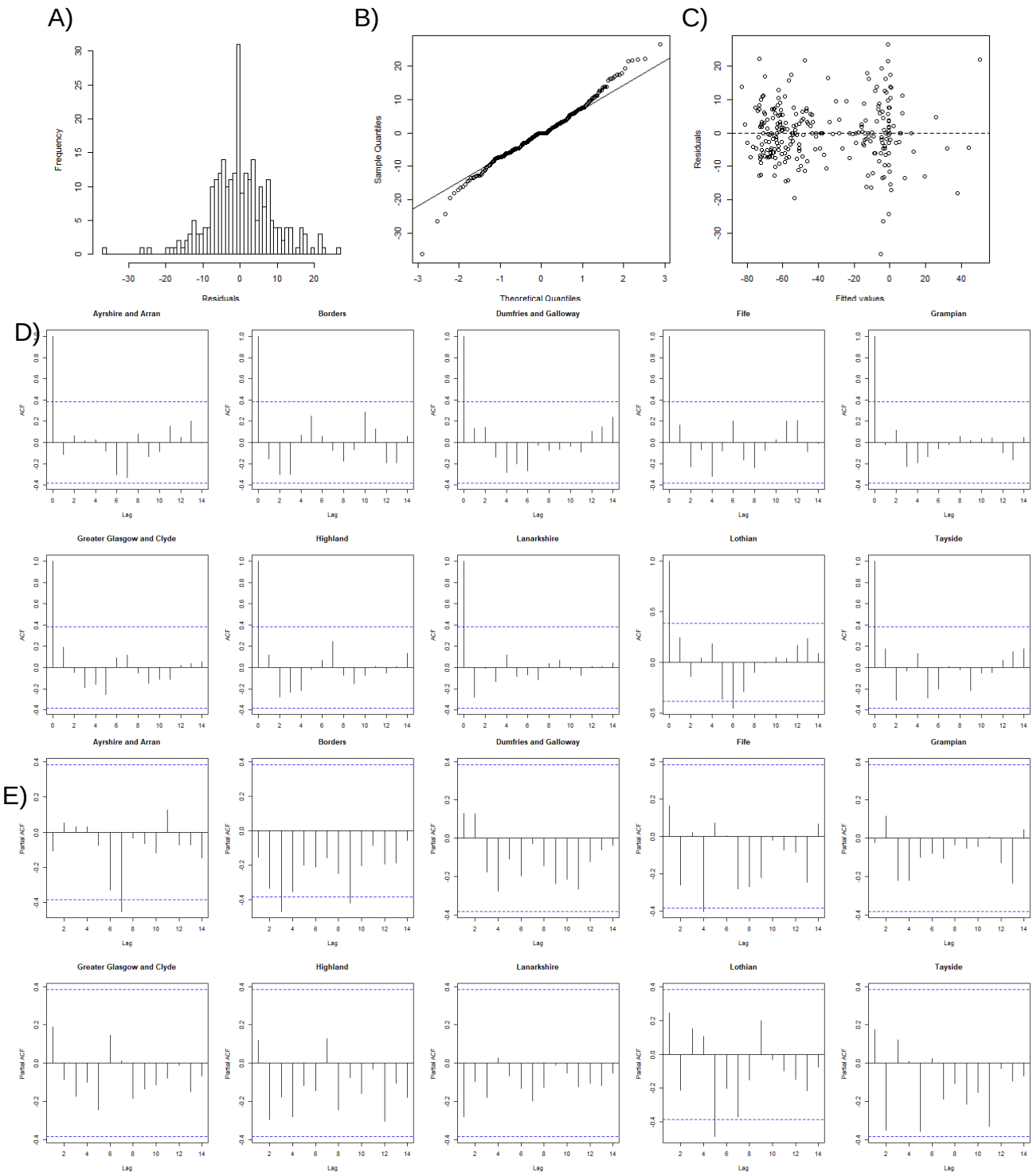


Figure 5. NHS Health Board model diagnostics for planned hospital admissions
Fitted model of the three-way interaction between the baseline model and NHS Health Board for planned hospital admissions. Contains A) histogram of residuals, B) QQ Plot of residuals, C) residuals vs fitted values plot, D) ACF of residuals for health boards and E) PACF of residuals for health boards.

Strong evidence that normality can be safely assumed with the bell-shaped pattern in A) and the linearity in B) with slight fanning of the tails. Residuals are scattered above and below mean zero line, with slight skewing due to the large drop in the fitted values C). No temporal autocorrelation is detected since both D) and E) are mostly within the blue dashed line of the 95% confidence intervals.