Investigating the secondary care system burden of influenza hospitalisation in clinical risk groups using the HES database

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Introduction and Objectives

- Each year in the UK, influenza infection poses a substantial burden for the healthcare system contributing to severe NHS winter pressures in recent seasons.
- The true secondary care burden of influenza is difficult to measure, since it is the complications of influenza along with exacerbations of existing chronic conditions which result in a large proportion of hospitalisations[1].
- This study will investigate the healthcare burden and resource use associated with influenza hospitalisations for adults across three clinical at-risk groups hospitalised due to influenza, compared to a control group without an influenza diagnosis. The clinical risk groups (CRGs) prioritised for this study were chronic heart disease (CHD), chronic respiratory disease (CRD), and diabetes.
- Additionally, this study will compare the direct impact on secondary care burden post- influenza diagnosis vs. the control group (non-flu cohort) using the Difference in Differences (DiD) method[3], testing the hypothesis that influenza infections might be a significant driver behind an increased burden of care to patients in CRGs.

Methods

Study design and study population

- Five years of HES data (April 2013-March 2018) were used to extract all **inpatient, outpatient, and A&E episodes** of patients coded with an influenza diagnosis and a concurrent CRG diagnosis of either CHD, CRD, or diabetes **(designated as the Flu-CHD, Flu-CRD and Flu-D groups)**; a set of patients without an influenza diagnosis for each CRG were also extracted as a control group (designated as **nFlu-CHD, nFlu-CRD and nFlu-D groups**) (Table 1).

Table 1. Groups used in the study, by cohort and clinical risk group

		Clinical Risk Group (CRG) coding		
		Chronic Heart Disease	Chronic Respiratory Disease	Diabetes
Influenza coding	Present (Flu Cohort)	Flu-CHD	Flu-CRD	Flu-D
	Absent (Non-Flu Cohort)	nFlu-CHD	nFlu-CRD	nFlu-D

- The following ICD10 codes were used to identify patients with an influenza diagnosis: J09X, J100, J101, J108, J110, J111, and J118.
- To define the study population the following ICD10 codes were selected based on the three largest CRGs recommended for influenza vaccination as per Public Health England guidance (including over 65 year olds).[2]
  - CHD: I05-I09,I11-I13,I15,I20-I28,I31,I34-I39,I41-I45,I47-I52,Q24
  - CHR: E84,J40-J47,J60-J65,P27
  - Diabetes: E10-E14
- HES is a data warehouse containing details of all admissions, outpatient appointments, and A&E attendances at NHS hospitals in England.

Analysis

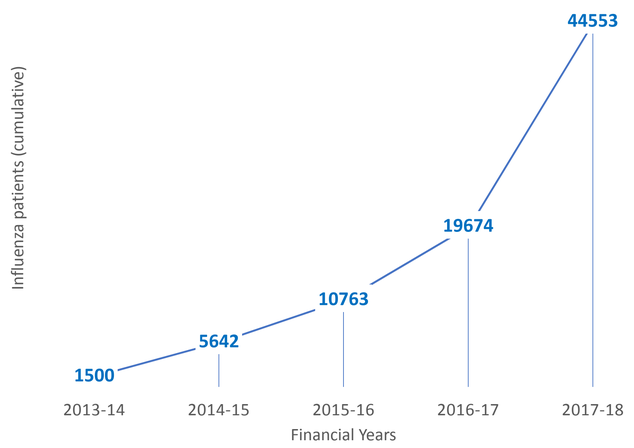
- We extracted HES data for all patients coded with an influenza diagnosis and a concurrent diagnosis of either of the three CRGs of interest over the study time period; CHD, CRD, and diabetes. Non-influenza patients for each CRG were also extracted as a control group. All secondary care events data was bundled and aligned per patient into a single pathway of care so that the data could be analysed on a patient pathway level.
- The following metrics were evaluated between the groups: Total costs per patient, number of care events, average bed days per patient, and hospital readmission rates (%).
- A statistical analysis (Student's T-test, one tail, assuming unequal variance) compared the Flu and non-Flu cohorts for each CRG against the key metrics mentioned above, and represented statistical significance through p-value with a 95% confidence interval.
- Associated costs per episode were derived from HES income tariff based on the Healthcare Resource Groups (the "currency" of care). The cost of care is calculated based on diagnoses and patient procedures. These values were adjusted for inflation and local market prices.
- Sample matching methodologies were used (based on similar age, gender, comorbidity characteristics, and exact CCG area) to minimise confounding issues when comparing results on the two cohort groups.[3]
- DiD was used as a method to statistically assess the cost impact on patients after influenza diagnosis.[4]

Results

Overall influenza impact

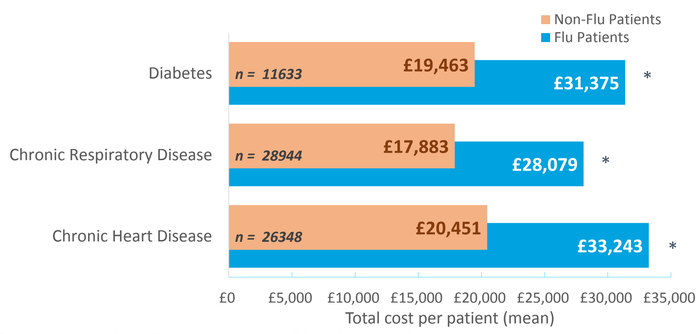
- A total of 44,553 patients were coded with an influenza diagnosis over the five-year period. Of those, about 75% (33,790) of patients were diagnosed since 2015-16 (Figure 1). A total of 133,177 patients were specifically selected for the control group, using the 1 to 3 sample matching methodology.

Figure 1. Total 2013-2018 influenza patients (cumulative)



- After variable adjustment through updated sample matching methodologies total secondary costs were significantly higher (p<0.001) for patients infected with influenza in any of the three CRGs when compared to non-infected control groups (Figure 2).
- In summary, total patient journey costs increased by approximately 50% in all three CRGs when patients were infected with influenza.

Figure 2. Patient cost impact by Clinical Risk Group



** : Results show a significant difference towards Flu (p<0.001). T-test assuming unequal variance. n number shows flu patients*

Post-influenza impact

- A statistically significant difference (p<0.001) was observed in total patient costs following influenza infection (over the expected cost for patients). This was found to be significant across all CRGs.
- Figure 3 shows that after an influenza infection patients incurred an additional £8,280 in secondary care costs through their journey, when compared to the expected cost increases for any patient in their risk groups.
- Figure 4 demonstrates how cumulative month-by-month cost differences between flu vs. non-flu become much more apparent around the time where most of the patients are infected with influenza and thereafter (cost differences become apparent from 1st quartile onwards).

Figure 3. Post-influenza cost impact view

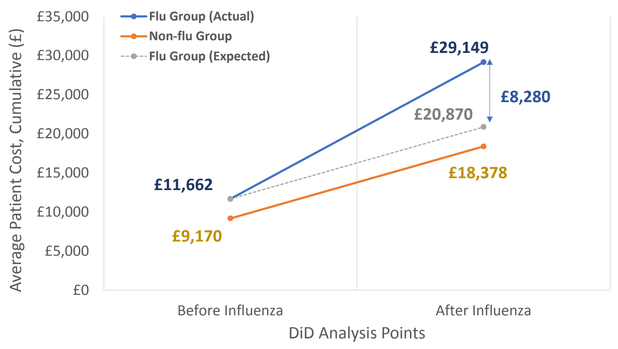
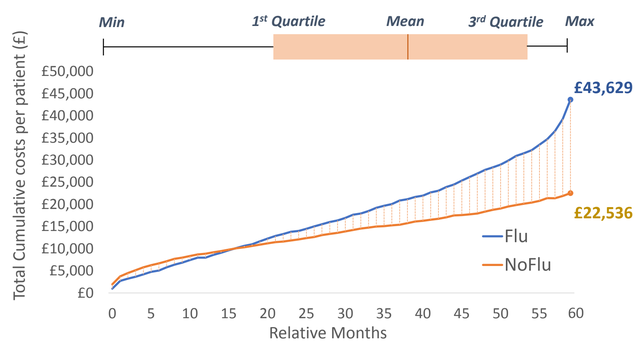


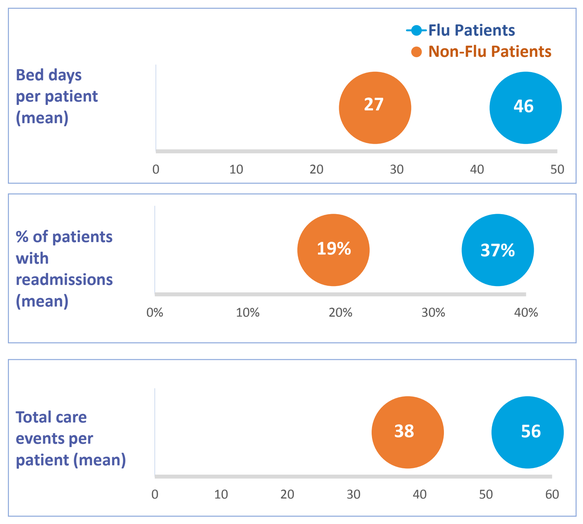
Figure 4. Cumulative differences in patient costs (by month)



Additional burden impact

- As can be seen from Figure 5, after adjusting for variables (age, gender, comorbidity and geography) using sample matching, average bed days per patient, % of patients with readmissions and the total number of healthcare events per patient were significantly higher (p<0.001) for patients infected with influenza when compared to a non-infected control group.
- Healthcare events were assumed to include inpatient, outpatient, and A&E activity

Figure 5. Influenza impact on other hospital metrics



National impact

- The total difference in costs was subsequently extrapolated per CRG and per age band across the five year period (2013-2018). This showed that influenza infections in the populations studied may incur an additional £510 million to the NHS; CHD patients were associated with the highest influenza burden (Figure 6).
- Over half of the national influenza-related burden for patients in the CRGs was attributable to patients aged 65 or above in those CRGs (Figure 7).

Figure 6. National hospital impact of influenza in CRGs

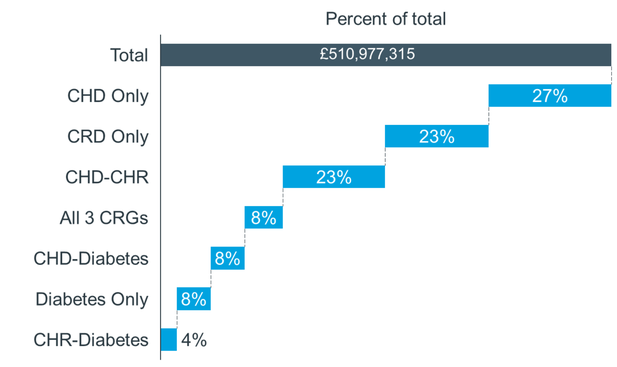
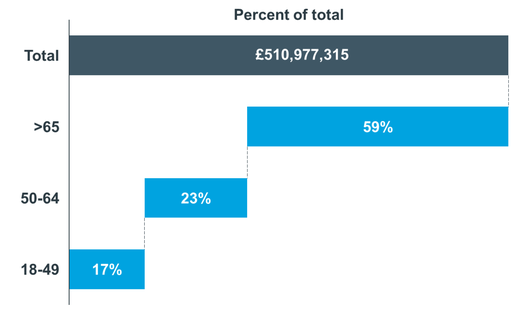


Figure 7. National hospital impact of influenza in CRGs by age



Limitations

- Previous studies have shown the impact of influenza on primary care.[5] This study would not have captured patients diagnosed with influenza solely within the primary care setting, nor those with influenza-attributable disease but coded with a non-influenza diagnosis code; thereby potentially underestimating the total burden of disease.
- It should also be noted that surveillance and coding for influenza diagnosis in secondary care has improved in recent years. Thus, potentially underestimating the number of diagnosed patients from previous years and in turn the recorded burden of disease.

Conclusion and Discussion

- **Total secondary costs per patient were significantly higher post-influenza diagnosis in all CRGs under investigation. Influenza infection also significantly increased burden of care in terms of bed days, readmission rates, and total care events per patient.**
- **Nationally, over a five year period, influenza infections may have incurred an additional system burden of £510 million for the care of patients in CRGs (excluding primary care, indirect, and societal costs), with CHD patients producing the highest burden. Should the recent trend of increasing hospitalisations continue, this reported cost could increase further.**
- **This study highlights the need for further optimisation of the vaccination programme to reduce the secondary care burden of influenza and its complications, and as a primary intervention to help alleviate winter pressures.**

References

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