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NHS sickness absence in England – hidden patterns

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Abstract

Background/Aims: Long-term trends in sickness absence have until now been assumed to be caused by economic cycles, age and gender changes in the workforce, and the success or failure of employers to reduce workplace hazards and other psychological causes of absence. This study aimed to investigate hidden causes of sickness absence and investigated previously unexplained patterns.

Methods: This study used a rolling 12-month average of sickness absence covering the 12 months ending March 2010 through to the 12 months ending October 2019. A rolling average has the advantage of removing the effects of seasonality contained in the monthly data and is a useful tool to reveal the presence of sudden shift up/down behaviour concealed in the time-series.

Results: Time and space (spatiotemporal) patterns of up/down shifts are evident in the regional data across England. Over the 10-year period of the study, these patterns, rather than schemes to reduce sickness absence, appear to dominate the trend, which has shown no evidence of a change in the long-term average.

Conclusions: A seemingly transmissible illness is acting to create up/down shifts in rates of sickness absence.

Key words: Infectious transmission, On/off switching, Sickness absence, Spatiotemporal effects, Time-series

Introduction

Sickness absence is a measure of physical, psychological and social functioning (Marmot et al, 1995). It is costly to employers (Dawson and West, 2017), who use a variety of schemes such as workplace risk assessment, training to avoid injury due to lifting heavy patients, counselling for employees, etc to reduce the causes of absence (NHS England, 2017; Pereira et al, 2017; NHS Employers, 2019). In 2014 NHS staff sickness absence in England was estimated to cost £1.65 billion per annum (NHS Employers, 2014).

Sickness absence rates are known to be affected by factors such as season (Pocock, 1972; Barmby et al, 1997), influenza outbreaks (De Blasio et al, 2012; Gianino et al, 2017), work insecurity (Vahtera et al, 2004), job satisfaction and employee engagement (Marmot et al, 1995; Dawson and West, 2017), socioeconomic status (North et al, 1993; Marmot et al, 1995), economic cycles and related employment rates (Nossen, 2009) and gender (Marmot et al, 1995). NHS staff are annually vaccinated against influenza to avoid higher seasonal absence caused by influenza outbreaks (Pereira et al, 2017).

Most personnel managers will be aware of these factors. However, NHS sickness absences show curious trends which have never been adequately explained (Jones, 2015; 2016; 2019). Because the above factors were widely recognised, no one has looked for more subtle patterns which may act to obscure interpretation of cause and effect, or even lead to incorrect conclusions regarding the success or failure of schemes to reduce sickness absence.

This study uses a calculation of excess winter sickness absence to show time and geographic area (spatiotemporal) patterns regarding the role of winter, as well as a rolling 12-month average of monthly sickness absence among English NHS staff working in 13 different regions, to demonstrate a repeating pattern of curious up/down shifts in staff sickness absence. This is augmented with an analysis of sickness absence at 171 larger NHS organisations to demonstrate more localised spatiotemporal patterns.

Interpreting a rolling 12-month average

Many trends in human health appear to be affected by the season (Jia and Lubetkin, 2009), but this effect can be minimised by applying a rolling 12-month average in order to investigate other trends. In this study, the rolling average started by taking the average of the 12 months ending March 2010, then repeated the calculation with the 12 months starting in April 2010, then May 2010 and so on, with the final average being taken from the 12 months ending October 2019.

A rolling average is especially useful for detecting unexpected, sudden shifts which can lie hidden in a data time series. If there is a shift up in sickness absence rates among NHS staff, the rolling total will at first move from 12 months at the lower rate to 11 months lower plus 1 month higher, through to 12 months of the higher rate. This generates a ramp up in the rolling average in which the slope equals the magnitude of the shift and after 12 months the new higher average is fully revealed. If the shift remains, the rolling average will stay high and if the shift abates the rolling total will show a ramp down. Hence a shift up commences at the foot of a ramp.

Research has shown that these unexpected shifts characterise the trends in diverse aspects of health, including deaths, medical admissions and GP referrals (Jones, 2015b). They originate at a small area level and show a spatial spread like that of an infectious outbreak. This implies that regional and national figures are a result of the shifts occurring in small areas (Jones, 2016a; 2016b).

Methods

Monthly data for NHS staff sickness absence from 2010 to 2019 across 13 English regions and 172 larger NHS organisations were obtained from NHS Digital (2020a). Monthly data were converted into rolling 12-month averages using Microsoft Excel. To determine the largest step increase in sickness absence, the average sickness absence rate was compared between successive 12-month periods. In other words, the average for the 12 months ending March 2011 was compared with that of the 12 months ending March 2010, and so on.

Excess Winter Absence (EWA) was calculated as a rolling difference in the average of the first 8 months versus the average of the next 4 months. Move forward one month and recalculate the difference as a percentage.

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Data for the 172 larger NHS organisations (by number of staff) which had continuous sickness absence data from April 2009 to June 2019 were subject to the same analysis (NHS Digital 2020b). Smaller organisations were excluded because of the higher statistical uncertainty associated with smaller numbers. Differences were calculated as a percentage difference. All data were manipulated using Microsoft Excel.

Results

The unexplained shifts in sickness absence trends are illustrated in *Figure 1*, which shows a rolling 12-month average of sickness absence for NHS staff in England. *Figure 1* begins with a shift down following an earlier shift up which would have started around April 2009. Note the evidence for two further shifts up in February 2012 and May 2014. The 2012 shift up shows a compensating shift down commencing February 2013 while the 2014 shift up shows only a partial shift down commencing July 2015. A further shift up may have commenced around March 2019. These curious patterns are now investigated in more detail with reference to potential factors regulating sub-national trends.

Figure 1. Rolling 12-month average NHS sickness absence rates for England, 12-month period ending March 2010 through to October 2019.

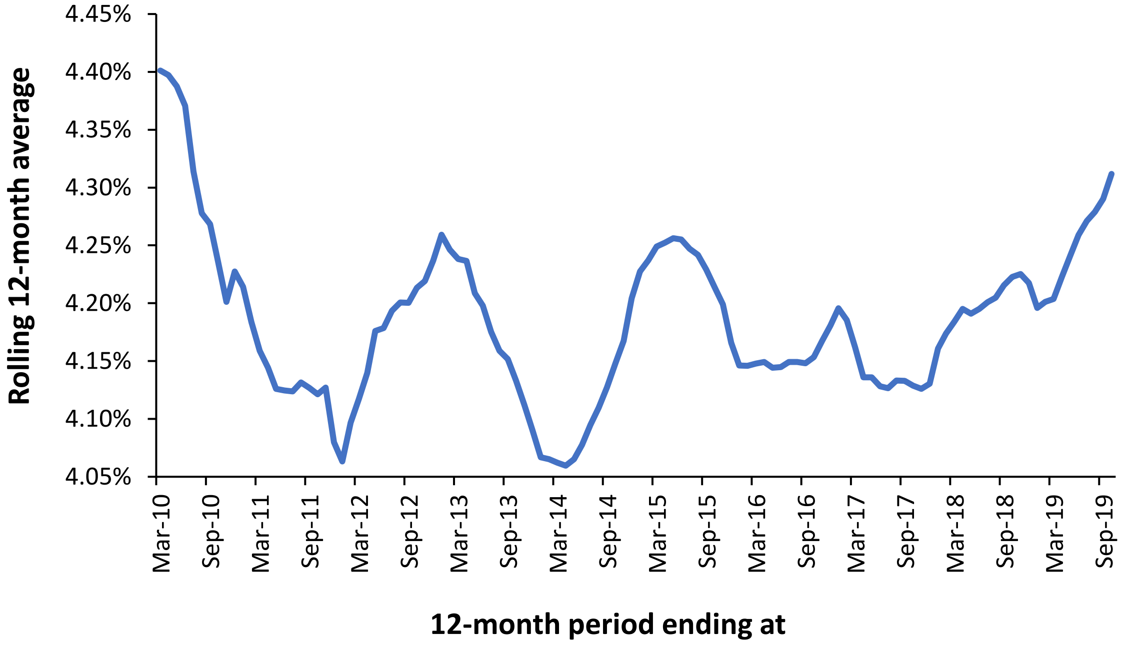

Table 1 demonstrates that average annual sickness absence varies greatly by staff group, from 1% for junior doctors through to 6.2% for ambulance support staff. For organisations, this ranges from 2.6% for clinical commissioning groups (close to the average of 2.2% for managers) through to 5.7% in ambulance trusts. This range may be partly influenced by age, as older staff are likely to take more sickness absences (Marmot et al, 1995). Because of demographic differences, each region or organisation has different mix of staff groups which will influence the absolute rate of sickness absence and potential sensitivity to the curious shift up/down behaviour shown in Figure 1.

A rolling 12-month average, as in *Figure 1*, is highly useful as it largely removes the seasonal cycle in sickness absence, allowing other trends to be seen. However, first it must be established

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whether season differences contribute to regional behaviour and if they are the cause of this shift up/down behaviour.

Table 1. Average sickness absence by staff group and organisation type

Staff group/organisation type	Average
Foundation doctor year 1	1.0%
Foundation doctor year 2	1.0%
Core training	1.1%
Other and unclassified	1.1%
Specialty registrar	1.2%
Consultant	1.2%
Hospital practitioner or clinical assistant	1.7%
Senior managers	1.7%
Specialty doctor	2.1%
Other and local HCHS doctor grades	2.1%
Managers	2.2%
Associate specialist	2.7%
Scientific, therapeutic and technical staff	3.0%
Central functions	3.4%
Staff grade	3.5%
Nurses and health visitors	4.5%
Support to ST&T staff	4.8%
Midwives	4.8%
Ambulance staff	5.3%
Hotel, property and estates	5.6%
Support to doctors, nurses and midwives	5.8%
Support to ambulance staff	6.2%
Clinical commissioning group	2.6%
Commissioning support unit	2.9%
Special health authority	3.3%
Acute trust	4.0%
Community provider	4.6%
Mental health and learning disability	4.9%
Ambulance	5.7%

Footnote:Average absence by staff group is for 2017 and 2018 (top part of table), while by organisation is for 2010–2018 (bottom part of table).

Figure 2 shows the underlying seasonal cycle, with absence rates 17% lower in May than in January. Such seasonal sickness does vary by staff group; most administrative or support staff, nurses and health visitors have the least absences in April and May, while doctors have minimum absences in August and midwives in June. The seasonal profile shown in *Figure 2* is less exaggerated since there will be a high baseline of non-seasonal long-term sickness absence (of approximately 3.9%). These include musculoskeletal problems and injuries at work, which account for 22.2% of days lost (NHS Digital, 2019). Other long-term illnesses are also all contained as a baseline below the seasonal pattern.

Colds, influenza, respiratory conditions and infections account for 8.1% of the annual total days lost. Anxiety, stress, depression and other mental health conditions account for 26% (34% for

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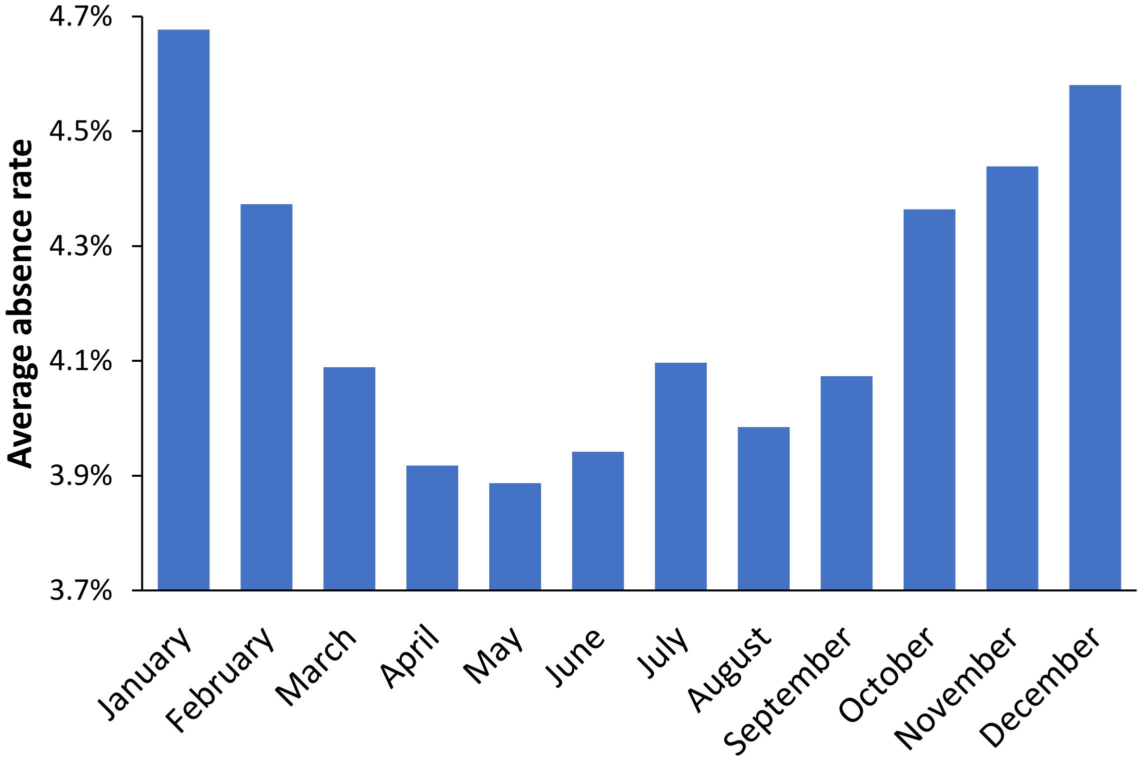
senior managers) of the total (NHS Digital, 2019). Seasonal affective disorder may well provide a basis for seasonality in these major causes of absence.

Figure 2. Seasonal profile of sickness absence of all NHS staff groups (England), monthly average 2009 to 2019.



The issue of seasonal sickness absence by location is further explored in *Table 2* using a rolling excess winter absence (EWA) calculation. This calculation seeks to measure the amount of excess sickness absence in the winter by comparing the four winter months (December to March) with the preceding eight non-winter months (April to November). This is then repeated as a rolling calculation. An example of a rolling excess winter absence calculation is shown in *Figure 3*, in which the winter of 2017–18 experienced the highest excess absence. The excess winter average calculation has the advantage of removing the effect of the different average rates of sickness absence seen by different organisations and regions.

While EWA most often reaches a maximum in February it can sometimes do so in January. Differences in the timing of maximum EWA are usually due to the spatiotemporal effects of the spread of common winter infections. Hence a January maximum for two regions in 2012 compared to February in the other regions, etc.

As can be seen in *Table 2,* the highest excess winter average typically occurs during the 4 months ending January or February (also in *Figure 3*). However, both the extent and the timing varies by region and year. The east of England typically experiences the highest excess winter absence rates with an average of +14.3% over the whole period. The next highest rates occur in the Thames Valley (+13.8%) while the lowest occurs in north west London (+10.3%) and north, central and east London (+11.3%). Clearly location plays a role in both the timing and extent of excess winter absences.

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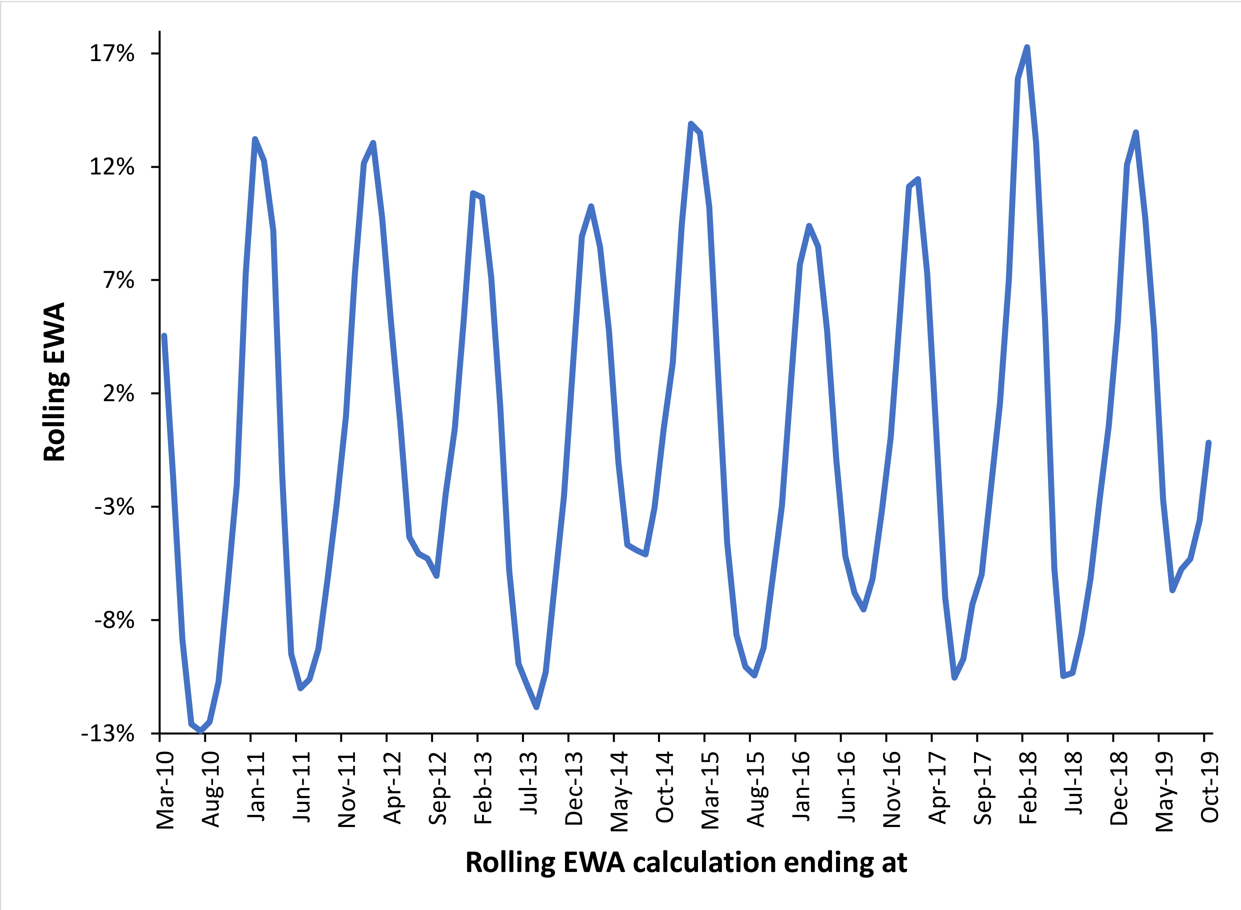
However, to understand the hidden patterns in the data (as in Figure 3), *Figure 4* expands the view of sickness absence to 13 regions across England where further evidence for variable timing and magnitude can be seen. For example, note that N. W. London did not experience the step down in sickness absence seen in all other areas after 2010. Sickness absence in N.W. London were not greatly effected in 2012 compared to other regions, while during 2014 the N.W. England and N.W. London were especially affected while S. London was not, etc. Yorkshire and the Humber saw shift up during the event commencing in 2017. The trend for the whole of England is therefore a composite of the individual parts.

Figure 3. Rolling excess winter sickness absence calculation for England.



The possibility of smaller spatiotemporal trends is investigated in *Figure 5* using data from 172 larger NHS organisations having over 830 full-time equivalent (FTE) staff. *Figure 5* shows the point during the period of March 2011 to June 2019 when each of the 172 organisations reached their maximum successive 12-month difference, e.g. 12-months ending March 2012 versus 12-months ending March 2011, etc. Each organisation experienced multiple shift up events, however on this occasion only the largest shift up event is chosen. As can be seen in *Figure 5* the 12-month periods of highest shift up are clustered around the 12 months ending January 2013, March 2015, January 2017 and October 2018. Recall that because of the nature of the rolling 12-month analysis the point at which sickness absence actually undergoes the shift up (shift up = step-like or sudden increase) occurs 12 months ***before*** the rolling 12-month maximum point shown in *Figure 5*.

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Table 2. Maximum value of excess winter absence (EWA) by region and year (maximum region in bold), winter of 2010–11 to 2018–19

Maximum EWA occurs in the month ending	East Midlands	East of England	Yorkshire and Humber	Wessex	Thames Valley	North west London	South London	North Central and E London	Kent, Surrey and Sussex	North East	North West	West Midlands	South West
Jan-11	10.6%	14.7%	14.4%	10.0%	**15.5%**	13.7%	9.3%	13.1%	13.7%	12.4%	12.9%	13.4%	15.1%
Jan-12	13.8%							9.7%					
Feb-12		**15.5%**	13.3%	13.1%	13.3%	11.6%	12.1%		14.7%	12.4%	13.0%	12.8%	13.3%
Jan-13	10.9%		11.3%					9.1%	11.2%	12.1%		10.6%	11.3%
Feb-13		**13.4%**		12.5%	11.8%	10.2%	11.8%				10.1%		
Jan-14						8.6%		10.4%	8.9%				
Feb-14	9.1%	11.8%	10.3%	10.3%	7.4%		7.7%			**12.1%**	11.4%	11.6%	9.0%
Jan-15	14.9%		13.6%		15.2%	8.7%		15.1%	15.0%		14.8%	14.0%	
Feb-15		14.4%		15.2%			10.2%			**15.4%**			13.2%
Feb-16	10.9%	**11.4%**	10.8%		12.6%	1.6%	11.4%	4.4%	8.9%	10.9%	8.8%	9.4%	9.4%
Mar-16				10.4%									
Jan-17					14.0%						11.4%	10.9%	
Feb-17	10.1%	12.2%	12.6%	**13.6%**		11.9%	13.0%	11.7%	10.4%	10.2%			12.3%
Feb-18	17.7%	**19.8%**	15.1%	15.9%	17.1%	18.2%	16.8%	16.1%	16.6%	19.4%	16.2%	19.8%	17.5%
Feb-19	11.4%	**15.9%**	15.0%	14.4%	17.2%	8.5%	15.5%	10.0%	13.1%	14.4%	12.7%	15.1%	14.5%

Footnote: SHAs=Special Health Authorities and other statutory bodies.

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Figure 4. Trends in rolling 12-month average sickness absence for various regions in England, all relative to the point of minimum absence in each region.

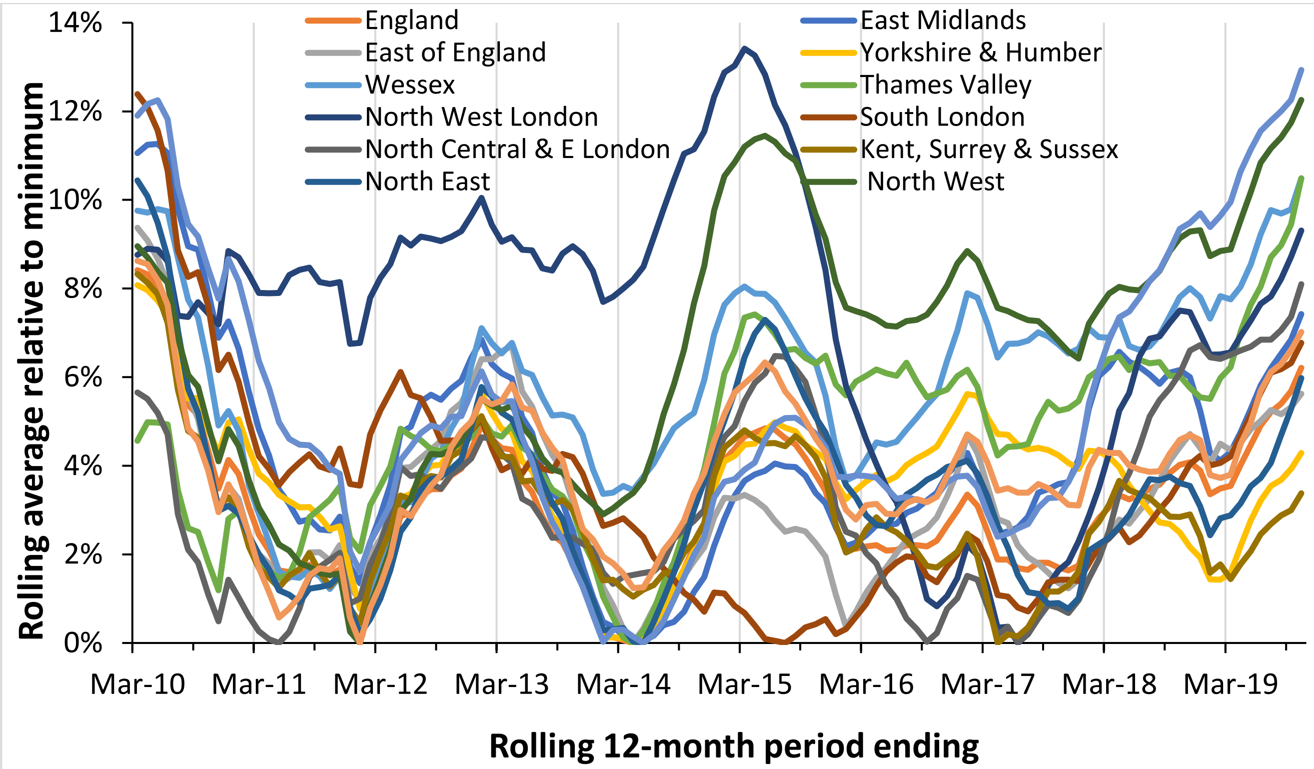
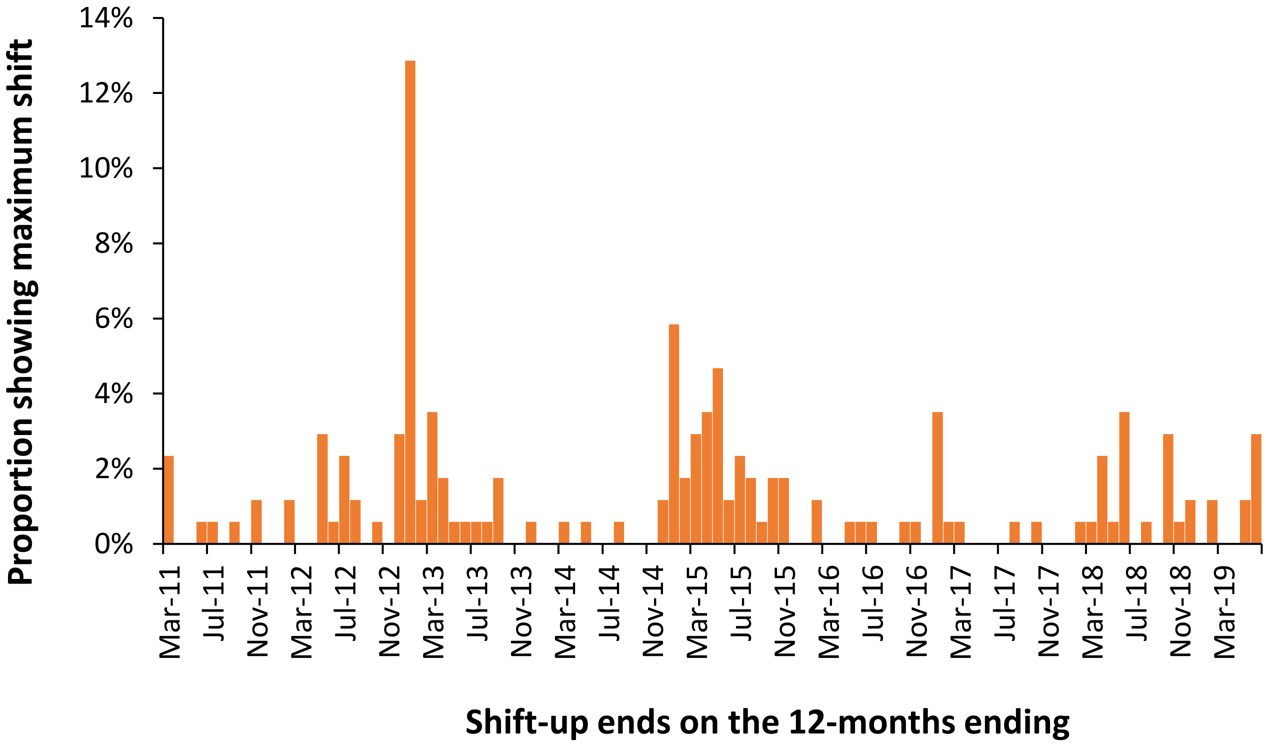


Figure 5. Proportion of 172 larger NHS organisations with continuous absence data showing their maximum step increase in sickness absence at various points in time.



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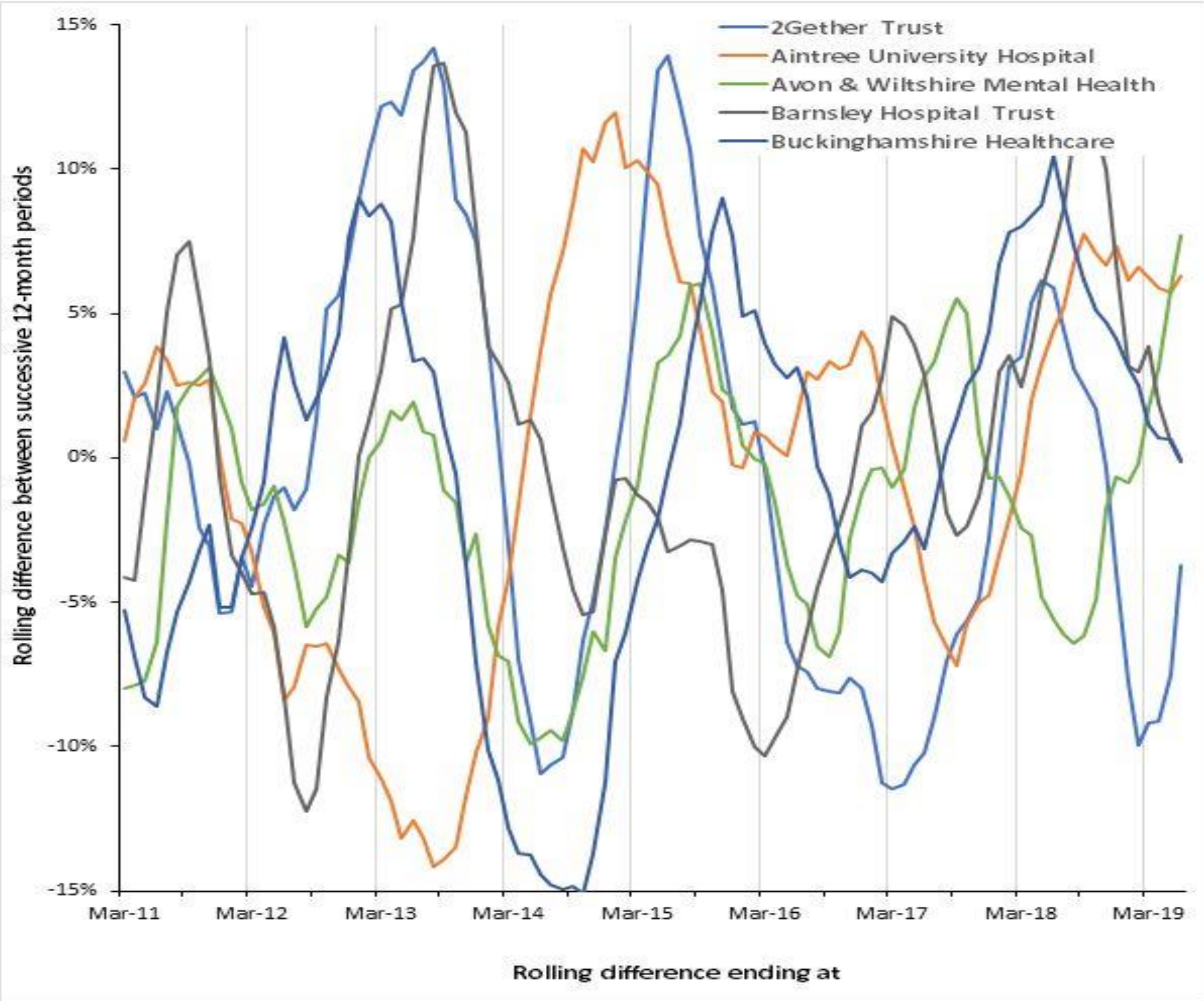
The value of the highest shift up tended to increase as the size of the organisation decreased. Thus smaller organisations with below 1 000 FTE experienced +20% to +30% increase in the average staff absence days per month, while the largest organisations with 10 000 FTE experienced only +5% to +10% increase in the average staff absence days per month (data not shown). These are considerable increases in absence which remain for a 12-month period before shift down.

Finally, *Figure 6* shows a rolling 12-month difference in sickness absence for a random selection of five NHS trusts where multiple shifts up and down can be seen, along with differences in timing and magnitude which depend on location. Most trusts had a minimum of three shift up events, although Barnsley had four.

Figure 6. Timing and magnitude of sudden shifts in sickness absence revealed in a rolling 12-month difference calculation.



Discussion

The effects of seasonality are evident in NHS sickness absence data (*Table 2*, *Figures 2* and *3*). The major causes of days lost are anxiety, stress, depression and other mental health conditions, which account for 26% (34% for senior managers) of total absences in the NHS (NHS Digital, 2019). These are likely to be influenced by the seasons through the effects of seasonal affective disorder.

One study has shown that individuals with seasonal affective disorder experience significantly higher rates of GP consultation during the winter months, especially in February and April (Andrews et al, 2001). Vitamin D levels also vary significantly with the seasons (Bolland et al, 2007) and supplementation or phototherapy can improve symptoms of depression in seasonal affective disorder (Gloth et al, 1999). Meanwhile, heart and circulatory conditions (2.4% of total days lost) are known to be affected by the season (Sher, 2001), as are colds, influenza and other infections, which can account for 8% of days lost. However, seasonal effects are transient and cannot explain how a shift up can endure for 12 months or longer.

In addition, in absolute terms, excess winter absence does not make a major contribution to variations in average annual sickness rates, as the difference between the worst and least affected winters only changes the annual average absence rate by 0.15% percentage points or a 3.5% change in absolute rates between the worst to best winter. *Figure 6* clearly shows that shifts up and down are of the order of ±10% to 15% which is far greater than any effect that can be attributed to excess winter absence. Therefore, while winter is part of a seasonal cycle, the difference between worst and best winters in this time period in terms of annual average absence rates is of minor importance. The difference between the best to worst winter will depend on the frequency of temperature extremes and the wide geographical spread of infectious outbreaks which rely on patterns of human travel and personal proximity to infected persons (Moss et al, 2019). This is an unavoidable consequence of regional weather differences and the wide variety of winter infectious agents which go well beyond just influenza (Stewart, 2016).

However, the curious and large saw-tooth patterns in *Figures 1, 3* and *6* indicate that there is an additional factor which requires explanation.

Research investigating a rolling 12-month total of deaths in England between 2001 to date showed great similarity to *Figure 1* (Jones, 2019b). As with sickness absence, variable timing and magnitude (spatial granularity) were a feature of regional death rates (Jones, 2015a; 2016a). Among the elderly, a period of sickness will often precede death. Using a rolling 12-month total of deaths in England from the Office for National Statistics monthly data (Office for National Statistics, 2019), research has shown that rates of mortality reached a low point in January 2012, going back up to a high point in April 2013, followed by another low point in May 2014. A further high point in death rates then occurred around June 2015 to November 2015. After this, deaths did not return to a low point as they did in 2014, but did drop significantly in February 2016 before rising again. This is a mirror image of the sickness absence trends shown in *Figure 1*.

It is possible that these trends are linked. The author suggests that the simultaneous high points of sickness absence and mortality rates may indicate a transmissible agent which causes typically younger NHS staff to require sickness leave while causing death in older members of the population, hence the data trends exhibited in this study. The average age of NHS staff is 43 years, with the most common age range being 45–54 years (NHS Employers, 2018), while the average and most common ages of death are 78 years and 86 years respectively (Office for National Statistics, 2018).

Is this an infectious illness?

The shift up/down features hidden in the sickness absence trends most commonly endure for 12 months, however both can endure for longer periods. Up to the present no infectious disease outbreak has been identified which has these characteristics. However, what remains to be clarified is whether individuals are affected for the full 12 months, which is unlikely, or if transmission of the agent continues withing the population for the 12 month period, which may be more likely. The other possibility is that infection leads to a period of intermittent poor health. Whichever the scenario the agent must cause a persistent infection, as is the case for all herpes viruses and other similar viruses, and likewise rules out agents such as influenza which cause a temporary illness.

However, similar shift up/down patterns for NHS total costs, hospital bed occupancy, GP referral, emergency department attendance, emergency admission and gender ratio at birth have also been noted in previous studies (Jones, 2015b) – hence the suggestion that we are dealing with a transmissible agent affecting wider human health. Factors such as the weather and temperature do not generate semi-permanent (12-month) shifts in population health as demonstrated in this study.

Of great interest is the observation that the shift up/down patterns in staff sickness absence shown to occur in NHS organisationsin Figures 5 and 6 (variable timing and magnitude) is replicated for in-hospital deaths occurring up to 30 days post discharge (Jones 2018). The agent responsible is able to affect (infect) both staff and patients.

The clearest evidence for an infectious sources comes from the very small area behaviour of both deaths and medical admissions (Jones 2015c,d, Jones 2016b) which show highly variable timing and magnitude. This variable timing and magnitude is important to understanding why N.W. London in Figure 4 seemingly shows little evidence of shift up/down during the interval 2010 to 2013. This is an issue regarding synchrony (the extent to which all small areas initiate shift up within a short space of time). When synchrony is low the shift up/down patterns cancel one another out and generate behaviour similar to that seen for N.W. London between 2010 and 2013 (Jones 2015c). Hence trends in sickness absence in larger regions obeys the same principles demonstrated for both deaths and medical admissions observed within the smaller areas which comprise the larger regions.

Implications for the NHS

The basic pattern of seasonal sickness absence observed in the general workforce (Barmby et al, 1997), which is highest during winter, is replicated among NHS staff. These patterns have changed over the past few decades; a study of British full-time workers between 1971 and 1984 revealed a peak in absence rates during February (Barmby et al, 1997), whereas Figure 2 shows that the peak absence period for NHS staff was in December and January. Changes in the level of pollutants (Department for Environment Food and Rural Affairs 2020) and meteorological parameters influencing absence (Pocock, 1972), arising from global warming since 1984 may be partly responsible for this difference as may wider influenza vaccination among NHS staff (De Blasio et al, 2012; Gianino et al, 2017; Pereira et al, 2017). Winter therefore remains a key target period for genuine reduction in sickness absence rates.

However, despite the plethora of schemes to reduce sickness absence rates among NHS staff (NHS Employers, 2019) we need to ask whether these thus far unexplained shifts up and down actually dominate the trends, rather than absence-reduction schemes which have failed to produce a continuous trend downward, as would be expected. In this respect it is highly likely that the average 12-month sickness absence for England has remained constant for the last decade (since April 2009) at 4.2%±0.3%, where the standard deviation of ±0.3% is merely a reflection of the role of the shifts up and down (*Figure 1 and the analysis of trends at Organisation level as in Figures 5 and 6*).

The 2014 statement that sickness absence was declining (NHS Employers, 2014) merely happened at a time when the rolling average had reached a temporary low point. Likewise, recent alarm at increasing sickness rates in 2019 compared to 2018 (Copeland, 2019) merely reflects another period of more frequent shift-up behaviour. These higher absence rates in 2019 were not unanimous across the country; organisations such as Calderdale and Huddersfield, Ashford and St

Peters, and East Midlands Ambulance (among others) experienced lower rates of sickness absence in this year. For this reason, *Figure 4* includes lines at each financial year to show how using calendar or financial year averages can cause data to be misinterpreted when applied to a process which is dominated by shift up and down behaviour which can occur at any point in the year (Jones, 2019b).

Conclusions

Researchers with a wider interest in sickness absence need to be aware that time and place (spatiotemporal) patterns are concealed in the data. These can be revealed using a rolling 12-month average or more sophisticated methodologies.

It would seem sensible to start looking for whatever agent is triggering this shift up/down behaviour. If the agent can make people fall sick and cause death in others, then it is probably very important.

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