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Short report

Sick leave due to COVID-19 during the first pandemic wave in France, 2020

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ABSTRACT

Objectives To quantify the burden of COVID-19-related sick leave during the first pandemic wave in France, accounting for sick leaves due to symptomatic COVID-19 ('symptomatic sick leaves') and those due to close contact with COVID-19 cases ('contact sick leaves').

Methods We combined data from a national demographic database, an occupational health survey, a social behaviour survey and a dynamic SARS-CoV-2 transmission model. Sick leave incidence from 1 March 2020 to 31 May 2020 was estimated by summing daily probabilities of symptomatic and contact sick leaves, stratified by age and administrative region.

Results There were an estimated 1.70M COVID-19-related sick leaves among France's 40M working-age adults during the first pandemic wave, including 0.42M due to COVID-19 symptoms and 1.28M due to COVID-19 contacts. There was great geographical variation, with peak daily sick leave incidence ranging from 230 in Corse (Corsica) to 33 000 in Île-de-France (the greater Paris region), and greatest overall burden in regions of north-eastern France. Regional sick leave burden was generally proportional to local COVID-19 prevalence, but age-adjusted employment rates and contact behaviours also contributed. For instance, 37% of symptomatic infections occurred in Île-de-France, but 45% of sick leaves. Middle-aged workers bore disproportionately high sick leave burden, owing predominantly to greater incidence of contact sick leaves.

Conclusions France was heavily impacted by sick leave during the first pandemic wave, with COVID-19 contacts accounting for approximately three-quarters of COVID-19-related sick leaves. In the absence of representative sick leave registry data, local demography, employment patterns, epidemiological trends and contact behaviours can be synthesised to quantify sick leave burden and, in turn, predict economic consequences of infectious disease epidemics.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Sick leave due to COVID-19 has imposed a significant toll on governments, insurers and employers worldwide.

WHAT THIS STUDY ADDS

⇒ This is the first national assessment of the burden of COVID-19-related sick leave in France, and perhaps the first study to quantify the relative contribution of sick leave due to symptomatic infection versus close contact with COVID-19 cases.

⇒ Substantial geographical variation was revealed: regions of north-eastern France, and in particular the greater Paris region, had disproportionately high burden both in absolute terms and relative to the working population size.

⇒ Although not infected at higher rates, middle-aged employees overall accounted for a greater share of sick leaves than other age groups, even after adjusting for their higher rates of employment; yet in some regions youngest workers were most likely to take sick leave.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ In the absence of sick leave registry data, the burden of sick leave caused by infectious disease outbreaks can be estimated by accounting for local population structure, employment patterns, epidemiological trends and contact behaviours.

⇒ Based on the data-driven modelling framework proposed here, tools could be developed to help employers and insurers anticipate and prepare for the economic burden imposed by epidemic waves.

INTRODUCTION

France, like most countries in Europe, was hit by an epidemic of COVID-19 during spring 2020, resulting in an estimated 100 000 hospitalisations and 29 000 deaths between 1 March and 2 June.[1] This first wave of the COVID-19 pandemic was accompanied by a heavy economic toll, partly due to the national lockdown instituted from 17 March to 11 May, in which many businesses were forced to close or reduce activity. Challenges for employers were exacerbated by increased workplace absence coinciding with temporary strengthening of sick

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leave policies. In France, national social security typically only provides sick leave pay from the fourth day of leave. However, as of 4 March, all suspected and confirmed COVID-19 cases, as well as all individuals identified as close contacts of confirmed cases, were ordered to stay home from work and were provided government-paid sick leave effective from the first day of leave. This temporary strengthening of sick leave coverage ensured that all French employees impacted by COVID-19 could receive compensation while absent from work, regardless of their employment sector and pre-existing insurance coverage. Such policies likely help to contain transmission—uncompensated workers are more likely to go to work while sick, potentially spreading infection to colleagues and/or clients—but also pose significant economic challenges.[2 3]

A survey by Malakoff Humanis, a private health insurance company, estimated that 26% of all sick leave episodes among French employees in April 2020 were due to COVID-19 infection or contacts thereof.[4] This suggests that French employers were heavily impacted by COVID-19-related sick leaves during this period. Yet while several international studies have evaluated the burden of COVID-19-related sick leave in particular cohorts and/or employment sectors,[5–8] none have been conducted in France: as in many countries and epidemiological contexts, comprehensive sick leave registry data are unavailable.

The aim of this study was to quantify the burden of COVID-19-related sick leave in France during the first wave of COVID-19, including sick leaves among employees with symptomatic COVID-19 and those due to close contact with infected individuals.

METHODS

Data description

We combined multiple data sources to obtain the necessary inputs to quantify COVID-19-related sick leaves during the first pandemic wave in metropolitan France.

Demography

Demographic characteristics of the population were obtained from the National Institute of Statistics and Economic Studies (INSEE 2017). We calculated the proportion of the working population by 5 years age groups, from 20 to 64 years old.

Symptomatic COVID-19

Daily prevalence of symptomatic COVID-19 infection was estimated using simulations from a previously described dynamic, age-structured, compartmental model of SARS-CoV-2 transmission in France by Massonnaud *et al*.[9] The cumulative estimated 1.6M symptomatic SARS-CoV-2 infections is consistent with 3.5M infections, with and without symptoms, estimated over the same period by Salje *et al*.[10] We extracted the daily incidence of symptomatic COVID-19 and stratified by age- group and region from 1 March 2020 to 31 May 2020. We multiplied by the average duration of symptoms to estimate symptomatic COVID-19 prevalence (online supplemental table S1).

Sick leave

Data on COVID-19-related sick leaves were obtained from an occupational health survey administered by the market research firm IFOP among French private-sector employees working for companies insured by Malakoff Humanis.[4] Individuals were sampled to ensure representativeness of the French working population in terms of age, sex, administrative region, socioeconomic status, employment sector and company size. The survey queried employees about sick leave and impacts of COVID-19 on their health during March 2020. Data comprising n=2975 participants aged ≥18 years (53.8% women) were collected during the survey period (23 April 2020 to 7 May 2020) and analysed to estimate the mean frequency and duration of sick leave, and the probability and duration of COVID-19 symptoms among those taking sick leave (online supplemental table S1).

Contact behaviour

Data on contact behaviour were obtained from SocialCov, a national online survey conducted by Institut Pasteur regarding social behaviours during the pandemic.[11] We extracted data comprising n=42 036 participants aged ≥18 years (68.5% women) across France between 10 April 2020 and 28 April 2020. We used these data to estimate the mean daily number of close contacts per employed person by age group and region during the first wave of the pandemic.

Computing the burden of COVID-19-related sick leave

We estimated daily incidence of COVID-19-related sick leaves by calculating probabilities of taking sick leave due to being a symptomatic COVID-19 case (hereafter, 'symptomatic sick leave') and due to close contact with a symptomatic COVID-19 case ('contact sick leave'). Using the data described above, the daily probability of taking symptomatic sick leave for individuals in a given age group a, region of residence r and calendar date t was calculated as,

$$\begin{aligned} P_{a,r,t}(\text{symptomatic sick leave}) &= p_{a,r}(\text{employed}) \\ &\times p_{a,r,t}(\text{symptomatic COVID-19} \mid \text{employed}) \\ &\times P_{a,r}(\text{taking sick leave} \mid \text{symptomatic COVID-19}) \end{aligned}$$

and for contact sick leave as,

$$\begin{aligned} P_{a,r,t}(\text{contact sick leave}) &= p_{a,r}(\text{employed}) \\ &\times p_{a,r,t}(\text{COVID-19 contact} \mid \text{employed}) \\ &\times P_{a,r}(\text{taking sick leave} \mid \text{COVID-19 contact}) \end{aligned}$$

Together, the total cumulative incidence of COVID-19-related sick leave over the study period was calculated as,

$$Inc_{SL} = \sum_{a,r,t} \left(P_{a,r,t}\ (\text{symptomatic sick leave}) \times N_{a,r} + P_{a,r,t}\ (\text{contact sick leave}) \times N_{a,r}\right)$$

All calculations were performed in R V.3.6.0. Code is available online at https://github.com/MESuRS-Lab/Covid-sick-leave and further methodological details are provided in the online supplemental appendix.

RESULTS

Between 1 March 2020 and 31 May 2020, France experienced a high burden of symptomatic COVID-19 infection among its 67M citizens, translating to a high burden of COVID-19-related sick leave among its 40M working-age adults (summarised in figure 1). In the context of a cumulative 1.62M symptomatic COVID-19 cases nationwide over this period (1.01M among working-age adults), we estimated a cumulative incidence of 1.70M sick leaves, with 1.28M (75%) due to COVID-19 contacts and 0.42M (25%) due to symptomatic infection. Coincident with the peak of the epidemic at the end of March, we estimated a maximum daily prevalence of 645 000 active sick leaves, of which the majority (497 000; 77%) were due to contact with COVID-19 cases. This compares to a peak prevalence of 574 000 active symptomatic cases (356 000 among working-age adults). Contact sick leaves were largely driven by contact with symptomatic individuals within the same household (online supplemental figure S1). In sensitivity analyses, the cumulative number of sick leaves varied from 0.83M when assuming that

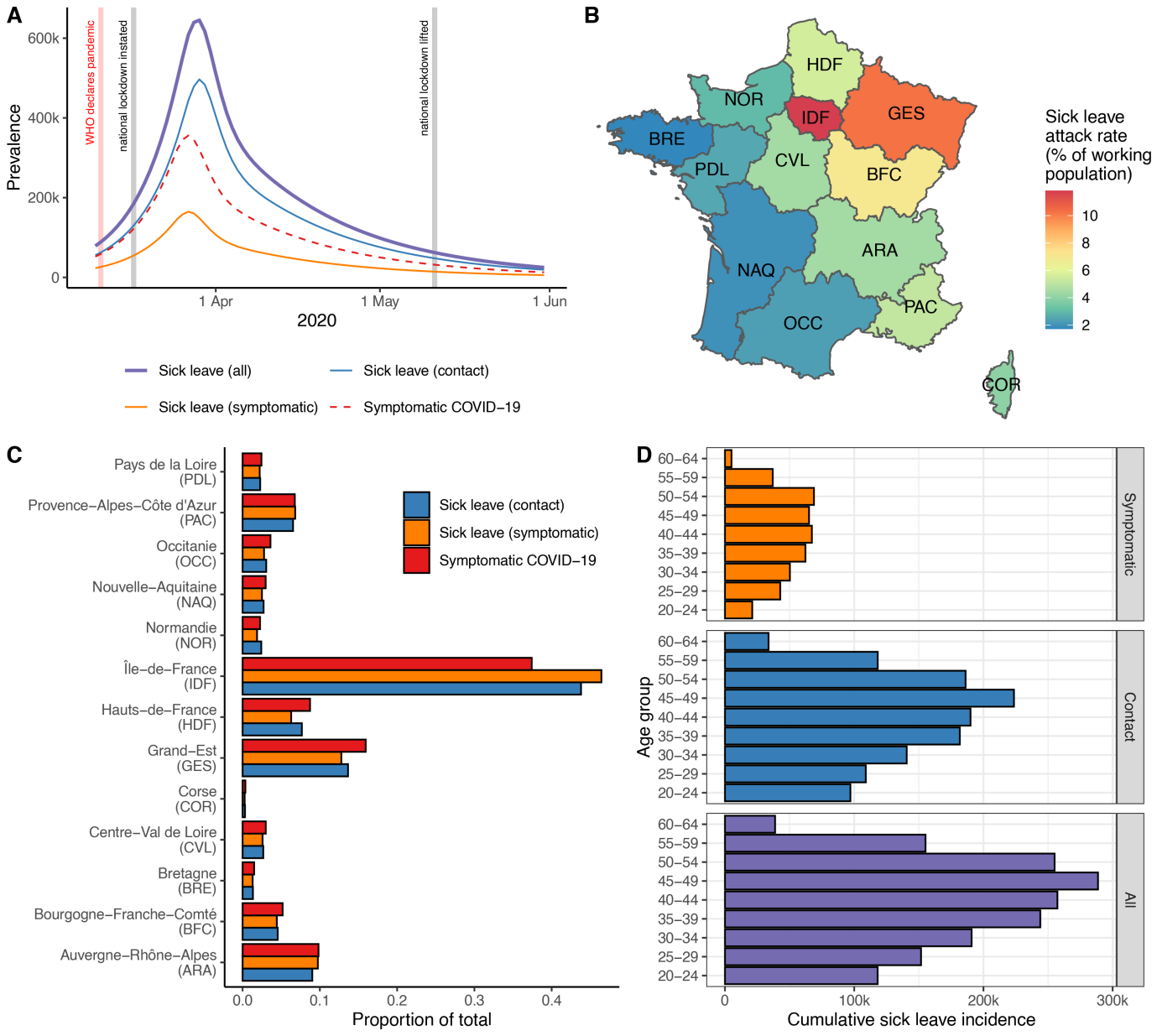

Figure 1 Summary of estimated COVID-19-related sick leave burden in metropolitan France from 1 March 2020 to 31 May 2020. (A) The total daily prevalence of COVID-19-related sick leave (purple) is the sum of the prevalence of contact sick leave (blue) and symptomatic sick leave (orange), and greatly exceeds the estimated prevalence of symptomatic COVID-19 infection among working-age adults (20–64 years, dashed red line). (B) A map of France colour-coded to show regional variation in the attack rate of COVID-19-related sick leave among the working population. (C) The regional distribution of symptomatic COVID-19, symptomatic COVID-19 sick leave and COVID-19 contact sick leave, represented for each region as the proportion of the national total. (D) The age distribution of COVID-19-related sick leaves (top, symptomatic sick leave; middle, contact sick leave; bottom, total).

25% of individuals with COVID-19 symptoms informed their close contacts, to 1.24M given 50%, 1.64M given 75% or 2.05M given 100%.

There was substantial geographical variation in COVID-19-related sick leave, with north-eastern regions facing the greatest burden in both absolute terms and relative to the size of the working population (figure 1B,C). Peaks in daily incidence ranged from 230 in Corse (23 March) to 33 000 in the greater Paris region (Île-de-France; 29 March), and in all regions contact sick leaves outnumbered symptomatic sick leaves (online supplemental figures S2, S3). Yet sick leave burden at the regional level was not directly proportional to the local epidemiological burden of symptomatic COVID-19 (figure 1C). The greatest-hit region, Île-de-France, was over-represented by sick leaves (37.4% of cases among working-age adults, 44.5% of all sick leaves), while the second greatest-hit region, Grand-Est, was under-represented (15.9% of cases, 13.4% of sick leaves).

COVID-19-related sick leaves depended significantly on age (figure 1D). The greatest cumulative sick leave incidence was among individuals aged 45–49, and the lowest among those aged 60–64. This peak at middle-age was largely driven by the age distribution of contact-related sick leaves, and corresponds with age-specific employment rates (online supplemental figure S4). By contrast, the number of symptomatic sick leaves was similar among individuals aged 30–54. When controlling for the working population size, sick leave burden was still generally greatest among the middle-aged, although age distributions varied greatly by region (online supplemental figure S5). In Normandie and Centre-Val de Loire, for

instance, the youngest age group (20–24) had the greatest share of its working population taking sick leave.

DISCUSSION

In this study, we estimated the burden of COVID-19-related sick leave among workers in France during the first pandemic wave. Approximately three-quarters of sick leaves were due to COVID-19 contacts rather than symptomatic disease, and regions of north-eastern France were most severely affected in both absolute and relative terms. Substantial regional variation only partially reflected local infection burden, due to age-adjusted employment rates and contact behaviours. Consequently, groups with relatively high rates of infection, employment and contact, such as the middle-aged in Île-de-France, were disproportionately affected by COVID-19-related sick leave.

Regional variation in sick leave burden was driven in part by regional variation in self-reported contact behaviours, which may vary due to differences in geography, sociocultural norms, COVID-19 burden and other factors. In France during the first wave, higher contact rates outside the home have been reported previously in departments with higher population densities.[11] To our knowledge, ours is the first study to quantify the burden of sick leave resulting from contact with COVID-19 cases, a major driver of workplace absence throughout the pandemic. We aimed to fill this gap using early pandemic data, during a period when most cases were identified only using symptoms due to limited testing capacity. This makes the link between symptom onset, contact notification and sick leave declaration relatively straightforward. We, thus, did not take asymptomatic infection into account, which may be particularly relevant for subsequent epidemic waves with more widely accessible community-based testing. Future studies may also consider long COVID: in Sweden, the mean duration of sick leave for workers experiencing long COVID was estimated at 35 days, with 9% of participants still on sick leave after 4 months.[7] A range of other factors—including evolution of governmental and corporate sick leave policies, behavioural change in response to new variants and waning adherence to contact notification in contexts of vaccination and pandemic fatigue—may influence the rates at which workers take sick leave, and require further study.

Our work should be considered in the context of several limitations. Data on COVID-19-related sick leave were representative of private- but not public-sector employees, who may differ in occupational COVID-19 exposure and associated risks of infection and sick leave. The probability of symptomatic COVID-19 was further assumed independent of employment status, yet front-line and healthcare workers, for instance, face particularly high infection risk.[12] Data limitations also precluded accounting for gender despite its potential relevance, in particular due to gender differences in employment and contact behaviour. Finally, the self-reported nature of contact and sick leave data may introduce bias, although survey respondents were asked to recall only their contacts from the previous 24 hours and sick leaves taken during the first wave of COVID-19 approximately 1 month prior, limiting potential impacts of recall or recency bias.

In conclusion, our results suggest that COVID-19 resulted in a significant sick leave burden in France in early 2020, mostly resulting from individuals in contact with symptomatic cases. To facilitate preparedness in the face of future epidemics of COVID-19 and other infectious diseases, employers and insurers can account for local demography, employment patterns, epidemiological trends and contact behaviours to predict the burden of sick leave they may face, and its downstream economic impacts.

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