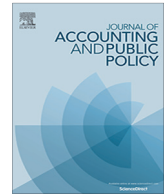




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ABSTRACT

This study examines whether influenza-like illnesses (ILIs), a potential threat to the conduct of public company audits, are associated with audit outcomes. Because the peak months of flu season overlap with audit busy season, audit offices most at risk of ILIs may be adversely affected. The demanding nature of audit busy season and the culture of audit firms may compel employees to go to work sick, a phenomenon known as presenteeism. When auditors go to work with flu-like symptoms, cognitive functioning is impaired, resulting in brain fog. This impairment may influence auditors' ability to exercise judgment and professional skepticism, leading to adverse outcomes. Using data collected from the Centers for Disease Control and Prevention (CDC) we find that the filing of audit reports is delayed and audit quality suffers in audit offices most at risk of influenza-like illnesses. The observed effects of health impairments on company outputs have broad implications for both the audit profession and workplaces as a whole.

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1. Introduction

Influenza (the flu) infects as many as 60.8 million people in the U.S. each year (CDC, 2017), approximately 20 percent of the population. The magnitude of individuals with the flu results in significant productivity loss in the workplace, where employees lose 69 percent of expected working hours while sick (Van Wormer et al., 2017). As auditing requires high cognitive functioning, a capability that is impaired when auditors are sick, we predict that audit firms are highly susceptible to the costly effects of influenza-like illnesses (ILI). Flu season peaks in the months of December through March and therefore directly overlaps with audit busy season.¹ Although the timing of the flu is consistent year-to-year, the severity and distribution of the disease vary over time and across states. This study examines the risk of contracting an influenza-like illness and its impact on auditors' work.²

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¹ The majority of public companies have a December 31st year-end (Lopez and Peters, 2012) and audit reports due either 60, 75, or 90 days following the fiscal year-end (for large accelerated, accelerated, and non-accelerated filers, respectively). Thus, most audited reports are due between February and March, creating an increase in demand for auditors' work during this timeframe. During the last 34 years, flu season peaks have most often occurred between the months of December and March (CDC, 2016), creating an overlap between the audit busy season and flu season. Further, most reported flu hospitalizations are of adults ages 18–64 (CDC, 2018), the same working population that comprises employees of public accounting firms.

² The CDC defines an influenza-like illness (ILI) as one where the patient has a fever (a temperature of 100°F or greater), a cough, and/or a sore throat, without another known cause. Throughout the paper, the term ILI is used to refer to the auditor's risk of contracting an influenza-like illness.

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Employees who have the flu often go to work sick, an act referred to as presenteeism, which limits their productivity on the job (Goetzl et al., 2004; Hempt, 2004; Hansen and Anderson, 2008; Schultz et al., 2009; Petrie et al., 2016). Anecdotal evidence suggests that auditors rarely stay at home when sick. To corroborate this, we conduct an exploratory survey, the results of which identify that 87 percent of auditors go to work while sick.^{3,4} Among other debilitating physical conditions, presenteeism is characterized by an influenza-induced phenomenon commonly referred to as “brain fog,” a symptom that reduces alertness, memory, and accuracy (Smith et al., 2004).⁵ Audit work requires judgment, professional skepticism, and overall high cognitive functioning, and thus, brain fog may negatively influence auditors’ work. If this is the case, impaired cognitive functioning may result in longer audit delays and impaired audit quality. However, auditors consistently work under pressure and may be able to overcome the negative effects of an ILL.⁶ Regardless, we predict that when auditors are at greater risk of an influenza-like illness, audit report lag will be prolonged and audit quality will suffer.

Our investigation is motivated by the human capital and pharma-economics literatures. The capacity of human capital is critical to corporate success (Schultz, 1961; Becker, 1962), and health is a critical component of human capital (Grossman, 1972; Becker, 2007), with health directly influencing the function and effort that drive employee productivity (Bartel and Taubman, 1979). The importance of human capital to firm success extends to the auditing context (Bröcheler et al., 2004), where improvements in [audit] inputs lead to improvements in audit quality (Knechel et al., 2013). Likewise, impairments to employee capacity or capabilities, a key audit input, may lead to impairments in audit quality and other audit outcomes. We are not aware of any prior study that links the physical health of auditors to audit outcomes and aim to contribute to the health and human capital literatures by leveraging influenza-like illnesses as a measure of auditor health.

To test our predictions, we employ a broad sample of firm-year observations from 2008 to 2018. We focus on firms with a December 31st or January 31st year-end to ensure that the busy season of the audit engagement overlaps with flu season. ILL activity is measured using state-level data from the U.S. Centers for Disease Control and Prevention (CDC) in the period that overlaps with audit busy season.⁷ Our test variable is based on a combination of ILL spread and severity, which vary significantly over time and across states. In addition to its time-series and cross-sectional variation, ILL is exogenous to the audit, thereby reducing concerns of reverse causality.

Our first tests examine the association between ILL and audit delay. We document a positive association between ILL and non-timely filings, indicating a greater likelihood of significant delays when auditors are sick. We also identify a positive association between ILL and the time it takes to file the audited annual report, suggesting that when auditors are at greater risk of being sick, it takes a longer amount of time to complete the audit. The economic significance of these estimations yields a 14.9 percent (8.6 percent) increase in the likelihood of a non-timely filing (length of the audit report lag) when moving from the 25th to 75th percentiles of ILL. A falsification test identifies no association between ILL and either measure of audit delay for clients whose audit does not directly overlap with flu season.

We use discretionary accruals and material weakness errors to measure audit quality. These proxies are indicative of auditor judgments that could be impaired by ILL-induced brain fog. We find that ILL is associated with lower audit quality, yielding a 1.9 percent increase in discretionary accruals, 1.6 percent decrease in accruals quality, and 15.4 percent increase in the likelihood of material weakness errors when moving from the 25th to 75th percentiles of ILL activity. This evidence suggests that audit quality suffers when ILL outbreaks impair auditors’ mental capacities.^{8,9} We do not observe a significant association between ILL and audit quality for clients whose audit is completed outside of busy season and does not directly overlap with flu season. This strengthens our inferences of a significant detrimental effect of ILL on the conduct of audits.

In each of our analyses we control for state characteristics that may influence our dependent and independent variables. First we control for general health, a characteristic that, unlike ILL, does not vary drastically from year to year. Results are consistent with our expectations and show no significant association between general health and audit delay or audit quality. This highlights that the risk of illness is a threat to the audit process while general health, a stickier and more predictable measure, is not. We address concerns that state flu vaccination efforts may bias cross-sectional variation in our analyses by controlling for the level of vaccine coverage in each state in our sample period.¹⁰ We find that the association between ILL and our dependent variables is robust to the inclusion of vaccine coverage. Next, as the flu may spread faster in states with higher population density, we control for this variable and find that our results are not sensitive to the inclusion of population density.

³ The most popular drivers of this decision were anxiety about making up work upon return, approaching deadlines, and to avoid judgment by coworkers.

⁴ While the 2019 coronavirus disease (COVID-19) introduced greater cognizance of the threat of flu-like illnesses, this study examines the pre-COVID-19 period, in which auditors were more likely to go to work while sick.

⁵ A comprehensive review of the literature examining the association between influenza and impaired cognitive processing may be found in Smith (2013).

⁶ We do not expect there to be any evidence of a positive (negative) association between the risk of an ILL and audit quality (timing). Rather, the tension in this paper is whether we will observe evidence of a positive or a null association.

⁷ Our data source is one of many novel sources that allow for the study of cognitive processing constraints in accounting processes (Teoh, 2018). Our data source is also consistent with recent papers leveraging data from the U.S. census bureau or similar sources to make inferences about financial reporting and other business outcomes (e.g. McGuire et al., 2012; Call et al., 2017; Caskey and Ozel, 2017; Aobdia et al., 2018; Beck et al., 2018; Christensen et al., 2018; Chhaochharia et al., 2019).

⁸ We do not find a significant association between ILL and restatements, either due to the effects of influenza-like illnesses not being significant enough to result in a misstatement, or perhaps because auditors are able to direct their limited cognitive resources to the areas of highest audit risk. Past research recognizes that a restatement, albeit very important, is only one indicator of audit quality.

⁹ Our results are robust to the use of two alternative measures of audit quality: small profits and qualified opinions.

¹⁰ The ILL data from the CDC is ex-post, and thus already reflects vaccination efforts and efficacy. However, these tests are designed to assuage additional concerns.

Our subsequent tests address the concept that financial reporting quality and audit quality are not independent measures. Rather, the “two processes are interdependent and jointly determine the (observable) outcome.” (Gaynor, Kelton, Mercer, and Yohn 2016, 2). Thus, the quality of the audit depends on the financial reporting quality of the client. We acknowledge that if the client is sick with the flu and financial reporting quality deteriorates, this may also impact the quality of the audit. This concern is common to most archival audit studies that rely on publicly available post-audit outcomes. Nevertheless, we perform multiple tests to rule out the concern that our results are primarily driven by the client’s risk of illness, rather than the auditor’s. We do not find evidence of an association between ILI and audit outcomes when the client’s risk of contracting an ILI is greater than the auditor’s.¹¹ Finally, we examine the association between ILI and the delay in filing of unaudited quarterly reports but do not find evidence of a significant association.¹²

In additional tests we examine whether state, auditor, or client characteristics moderate the association between ILI and observed audit outcomes. Here we find evidence to suggest that good health may mitigate the positive association between ILI and measures of audit timing, but no evidence that vaccine efficacy or population density influence the association between ILI and audit outcomes. We find that larger offices with fewer human resource capacity constraints are able to mitigate some of the effects of ILI on audit delay, but do not find evidence of an influence on audit quality measures. The results of our study hold after execution of multiple robustness tests, including alternative measures of busy season and ILI and alternative sample compositions.

Our findings offer important insights to the audit profession, with broader implications for the role of disease and other health impairments in quality and productivity. Regulators and standard setters have a vested interest in understanding threats, including ILI and brain fog, to auditors’ abilities to exercise strong judgment and decision making. One of the primary focuses of the [Center for Audit Quality](#) is high quality performance of public company auditors. Additionally, Auditing Standard 1015 addresses auditors’ due professional care in the performance of their work, stating that “the matter of due professional care concerns what the independent auditor does and how well he or she does it (PCAOB, 2002).” ILI may directly impair how well an auditor performs an audit, making ILIs a threat to audit quality.

The findings of this study are further informative to audit firms, who dedicate significant resources to manage and improve human capital and audit quality. Our conversations with human resources representatives of five international audit firms reveal that the firms offer flu shots for employees in their local offices.¹³ This practice suggests that audit firms are invested in maintaining employee health.¹⁴ The results of this study suggest that investments in preventative healthcare may not be sufficient to deter the negative consequences of employees going to work when sick. Public accounting firms may consider how challenging cultures (Wyatt, 2004; Tysiac, 2020) and the rigorous nature of busy season (Cohn, 2013; Persellin et al., 2019) influence employees’ decisions to go to work while sick.¹⁵ Further, in the post-COVID era, while employees may not physically go to the office, the effects of influenza and brain fog persist when an individual decides to work from home.

Outside of the auditing context, pharma-economics research has documented the significant macroeconomic cost burden of ILIs (Keech et al., 1998; Stewart et al., 2003; Molinari et al., 2007; Keech and Beardsworth, 2008; Peasah et al., 2013; Petrie et al., 2016). We contribute to the burgeoning line of research examining the impact of ILIs on company-level outputs (Dorner and Haller, 2020; Grinza and Rycx, 2020).¹⁶ While the overlap between flu season and audit busy season makes the audit context an attractive setting in which to examine this association, the implications of this study may extend beyond audit firms to the flu season outputs of all companies.

2. Background and hypothesis development

Human capital serves as a key indicator of firm performance (Schultz, 1961; Becker, 1962). Prior literature has documented the influence of human capital on audit outcomes, with a focus on the education and skill of audit labor pools. For example, Beck et al. (2018) examine local labor characteristics and find that audit quality is positively associated with the education level in the city where the audit office is located. Similarly, Sherwood et al. (2020) document a positive association between the number of non-CPAs and audit quality in a local office. Beyond the scope of audit research, the human capital literature recognizes health as a critical component (Grossman, 1972; Becker, 2007) and identifies that employee productivity is driven by skills and effort, with health directly influencing skills (Bartel and Taubman, 1979). With stronger and

¹¹ This test is performed in a sample of observations where the client and auditor are located in different states.

¹² As these filings are not subject to the same level of assurance as annual filings, delays are thus more attributable to the client than the auditor.

¹³ There are four primary types of influenza virus. Within each type there are additional subtypes, lineages, and strains. While flu vaccines are available annually, they only protect against specific viruses included in the vaccine. As a result, vaccine efficacy is limited to the viruses the vaccine was designed to protect against. In the sample period reviewed in this study, 2008 – 2018, vaccine efficacy ranged from 19 to 60 percent, with an average of 43.8 percent (CDC, 2019c).

¹⁴ Interestingly, four of the five firms that we spoke with (in the pre-COVID era) do not distinguish between sick days and vacation time and therefore have no documentation about the direct impact of the flu on their organization.

¹⁵ Notably, the 2019–2020 flu season is dominated by COVID-19, which is more severe than the typical seasonal flu (Adhanom Ghebreyesus, 2020). With auditors working from home during lockdown, the impact of presenteeism on audit outcomes may be less pronounced in this period, especially because of greater awareness of the need to exercise social distancing and the social acceptance of using masks to reduce the spread of illnesses. While COVID-19 is beyond the scope of the current study, future research may consider how COVID-19 impacts audit work processes and audit quality.

¹⁶ These studies examine the impact of the flu on company outputs in the German and Belgian settings. To the best of our knowledge, no study has examined this in the U.S. context.

healthier human capital, the quality of a firm's outputs should improve. To the best of our knowledge, this has not been examined in the context of audit or accounting. We therefore examine the association between poor health and audit quality by studying the association between ILIs and audit outcomes.

There are two mechanisms by which ILIs may negatively impact auditors' work. It is possible that an ILI may impair auditors' health and force them to miss work, a phenomenon referred to as absenteeism in pharma-economics. The National Institute for Occupational Safety and Health reports that U.S. employees miss 17 million workdays due to the flu (NIOSH, 2018). Keech and Beardsworth (2008) find that individual employees miss up to 5.9 days of work due to the flu. When an auditor is absent during busy season, the quality of the audit team's work may decline if the work is spread across a smaller engagement team. The second means by which an ILI may influence audit outcomes is if auditors continue to work while sick with an ILI, an act referred to as presenteeism. Individuals may be more likely to go to work sick when they have an important deadline on the horizon, such as the audit report of a public company. Supporting this, Hansen and Anderson (2008) find that people are more likely to go to work sick when there is time pressure associated with the job, when they work >45 h per week, and when a high degree of cooperation with coworkers is required. All are characteristic of audit busy season.

Anecdotal evidence based on conversations with current and former auditors suggests that staying home sick during busy season is a rare occurrence. We supplement these conversations with an informal survey of auditors about their experience of being sick during busy season.¹⁷ There were 81 individuals who completed the survey, 67 of whom were auditors.¹⁸ Respondents represented local (6), national (14), large international (12), and Big 4 (35) firms and were geographically dispersed throughout the U.S. 82 percent of auditors (55 respondents) reported being sick during busy season in the past several years. Participants reported the rank they held in the firm when they were sick, ranging from associate (11), senior associate, (27), manager (8), senior manager (4), and partner (5). 87 percent of auditors (48 respondents) went to work while sick with flu symptoms.¹⁹ Based on this exploratory survey evidence, audit firm culture (Wyatt, 2004; Tysiac, 2020), and the rigorous nature of the audit environment during busy season (Cohn, 2013; Persellin et al., 2019), we predict that presenteeism, rather than absenteeism, is the primary channel through which influenza influences the work of auditors. We therefore develop our proceeding predictions based on presenteeism's potential impact on audit outcomes.²⁰

The work of auditors requires significant expertise and professional judgment (DeFond and Zhang, 2014) and therefore, to be most effective, auditors should be of strong mental health. Influenza, a contagious respiratory illness, is a direct threat to auditors' cognitive capabilities. Flu symptoms include headaches and fatigue (CDC, 2019a), which contribute to "brain fog" during times of illness. Further, when a person is sick, the immune system releases cytokines to alert the nervous system that the body is ill. However, cytokines also influence brain chemistry by reducing alertness, memory, and accuracy, and increasing reaction times (see Smith, 2013 for a review), and making people more sensitive to prolonged work (Smith et al., 2004). Studies also document that performance impairments, such as brain fog, persist after other physical symptoms of being sick pass (Smith et al., 2000).

Due to impaired judgments and cognitive capacities while employees are sick, presenteeism is estimated to cost companies more than \$150 billion per year (Stewart et al., 2003). Goetzl et al. (2004) document that respiratory disorders, including the flu, cost employees an average of 1.4 h of productivity loss per day. A 2002 study initiated by Lockheed Martin documented the impact of the company's employees' common medical conditions and illnesses on job performance (Hemp, 2004). The study reported that 17.5 percent of Lockheed Martin employees had the flu in the prior two weeks. The reported average productivity loss was 4.7 percent. Additionally, the symptoms of the flu persist longer if employees work, rather than rest, while sick (Shu, 2013). This may result in prolonged periods of impaired judgments if auditors have to work while sick during busy season.

The timing of flu season is a critical factor that suggests that the significant costs of ILIs, including presenteeism, may extend to audit firms. During the last 34 years, flu season peaks have most often occurred between the months of December and March (CDC, 2016). The Bureau of Labor Statistics (BLS, 2010) documents that illness related absences are 31.2–51.9 percent higher during flu season than other months of the year.²¹ Importantly, this period spans audit busy season. The majority of public companies have a December 31st year-end (Lopez and Peters, 2012) and audit reports due between February and March.²² During this time period, auditors are often expected to work overtime, which leads to increased susceptibility to mental and physical health stresses (Shields, 1999; Harrington, 2001). These pressures are likely to be exacerbated by the timing of flu season.

¹⁷ Prior to administering the survey, we solicited feedback from several academic researchers and audit practitioners. Approval to conduct the survey was provided by the Institutional Review Board of the authors' academic institution prior to distribution. The survey was administered via Qualtrics and made available on LinkedIn, <https://www.goingconcern.com>, and <https://www.reddit.com/r/Accounting>. The survey had a completion rate of 63 percent. The average age of survey participants was 29 years and 57 percent of respondent auditors were female.

¹⁸ We removed 14 observations from respondents who identified "tax" or "other" as their service line.

¹⁹ The survey was used solely to assess the likelihood of auditors going to work while sick. Thus, we did not ask participants to provide assessments of the likelihood of being sick on audit quality or timing.

²⁰ We acknowledge that there is a possibility that absenteeism may also be driving the results. Our predictions remain vastly similar if absenteeism is a significant contributing factor. Longer audit delays are a product of fewer audit personnel (Behn et al., 2006; Abbott et al., 2012). Auditors being sick and absent from work may reduce audit quality as the existing work has to be spread amongst remaining team members. We present presenteeism based on anecdotal and survey evidence to streamline the normative conclusions of the study.

²¹ While the Bureau of Labor Statistics measures absences, this statistic is generally indicative of the prevalence of ILIs during audit busy season. As suggested by anecdotal and survey evidence, auditors are unlikely to stay home while sick and instead may go to work.

²² Audited financial reports are due 60, 75, or 90 days after the fiscal year-end for large accelerated, accelerated, and non-accelerated filers, respectively.

Although the timing of flu season is consistent from year to year, the severity of ILIs varies drastically by year and location. For example, in a given week during the 2008 flu season, ILIs in U.S. states ranged from low (Alabama) to high (Virginia). Examining these same states in 2011, ILI activity in Alabama was high and activity in Virginia was low. This variation is depicted in Fig. 1, presenting the distribution of ILI for each state and year in the sample.

Further illustrating variation, the 2011 flu season was generally mild relative to prior years (CDC, 2014) while the 2012 season brought back high ILI activity and a particularly long flu season (CDC, 2019b). Additionally, threats posed by ILIs are not mitigated over time. The 2018 flu season was of high severity, with an increase in hospitalizations, doctor's office visits, and mortality across the country (PwC, 2018). The season marked the third use of the high severity classification since 2004, and the first season in which the high severity classification applied to all persons, regardless of age (CDC, 2018). With no promise of a guaranteed effective vaccine from the CDC, ILIs remain a continuing threat to the output of public accounting firms.

2.1. Hypotheses development

We first study the association between ILIs and audit delay, an important analysis because the value of financial statement information increases with the timeliness of such information (Ashton et al., 1987). However, delay may be prolonged when auditors lack the abilities and skills required for efficiency (Behn et al., 2006). While brain fog may lead to delays, it is also possible that auditors may push to file the audit report at an earlier date to meet statutory deadlines or satisfy expectations of shareholders and their clients. In this case, we would not find evidence of an association between ILIs and audit delay. However, we predict that when auditors are sick, their daily productivity suffers, and there is a longer delay in the filing of the audit report.

We further predict that when auditors have a greater risk of an ILI the report lag may be prolonged to such an extent that it results in a non-timely filing. Non-timely filings have adverse consequences for companies, including the possibility of being delisted, revocation of registration by the SEC, potential violation of debt covenants, and the signaling of accounting or other issues that may impose additional costs on shareholders. These consequences are evidenced by an increase in information asymmetry and trading costs for investors and negative market reactions to late filings (Bartov and Konchitchki, 2017). Non-timely filings also present risk considerations for auditors, who charge higher fees for accelerated filers with non-timely filings (Wang et al., 2013). Both predictions are formalized in the following hypothesis:

H1: Influenza-like illnesses are positively associated with audit delay.

We next consider the association between ILIs and audit quality, addressing the possibility that attempts to complete a timely audit may lead to sacrifices in quality arising from brain fog and other flu-induced cognitive impairments. Maintaining strong auditor judgment is critical to the success of an audit. Auditing Standard 1015 (AS 1015) defines auditors' responsibilities to exercise due professional care as what the independent auditor does and how well he or she does it (PCAOB, 2002). AS 1015 and PCAOB Staff Audit Practice Alert No. 10 (PCAOB 2012) state that exercising due professional care requires the auditor to exhibit professional skepticism, or "an attitude that includes a questioning mind and a critical assessment of audit evidence." Due to brain fog and other physical and cognitive limitations, an auditor's ability to exercise due professional care and professional skepticism may be threatened when sick.

Recent literature has examined the association between cognitive functions and audit quality. Kallunki et al. (2019) empirically document an association between cognitive abilities and audit quality. Experimental evidence also finds that cognitive limitations can impair professional skepticism (Nelson, 2009). Bonner et al. (2018) examine the sufficiency of auditors' resources for self-control in decision-making and find that poor audit outcomes are exacerbated when auditors have low levels of cognitive resources. Thus, we predict that ILIs will impair audit quality and formulate this expectation in the following hypothesis:

H2: Influenza-like illnesses are inversely associated with audit quality.

3. Research design

3.1. Sample

This study leverages influenza-like illness data collected by the Centers for Disease Control and Prevention (CDC). ILI data is measured in seasons and is available for the 2008–2009 season through the 2018–2019 season. We match each flu season with the corresponding fiscal year-end whose audit would occur during that flu season. For example, flu season 2008–2009 peaks in December 2008 through March 2009. We match this flu season with companies with December 31, 2008 or January 31, 2009 year-ends. This matching process yields a sample including fiscal years 2008 – 2018.²³ We begin with client-year

²³ Because of data requirements, the accrual quality and material weakness error samples exclude observations in 2018. The restatement sample excludes years 2017 – 2018 to provide time for the restatement to be identified (Cheffers et al., 2010).

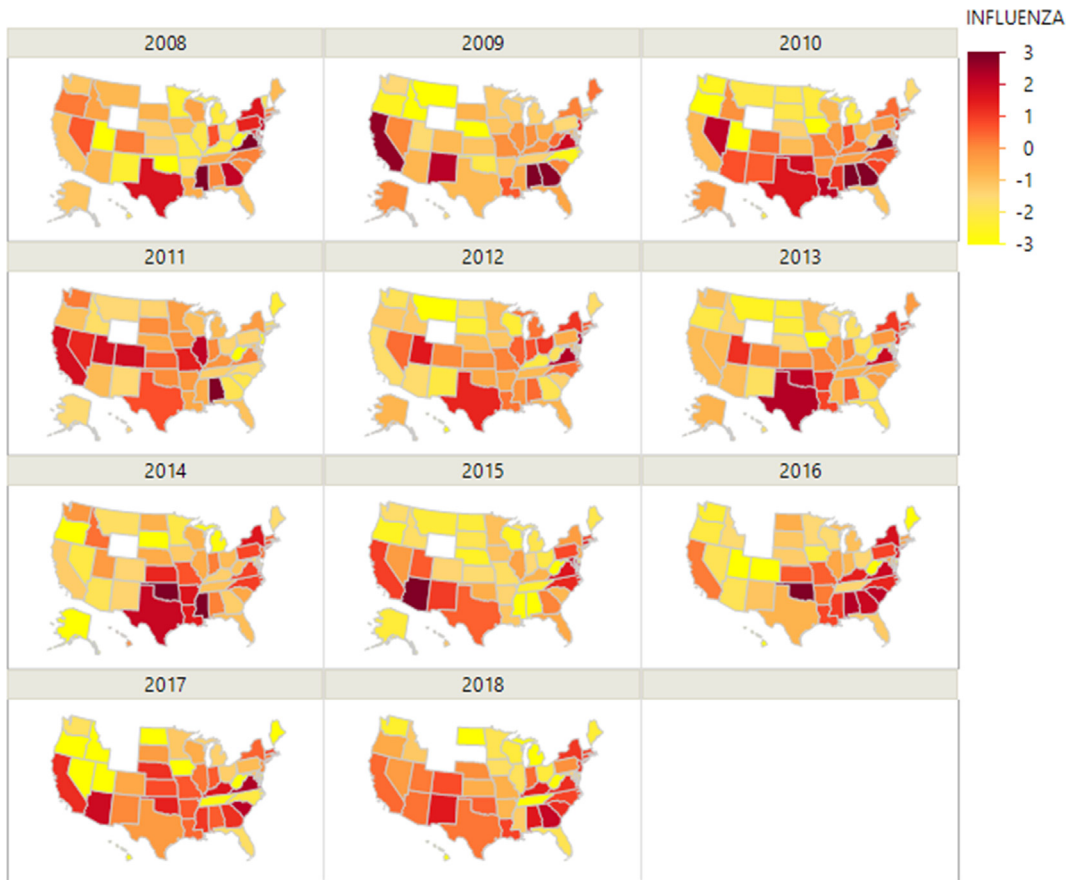


Fig. 1. Map of ILI by state and year. The sample period is from 2008 to 2018. States colored white are omitted from the sample due to lack of audit offices serving as the lead auditor during this period. In this Figure, the risk of influenza-like-illness is depicted with the colors yellow and red and gradients in-between. States in a highly saturated yellow color have a lower risk of influenza-like-illness, while states in a highly saturated red color have the highest risk of influenza-like-illness.

observations with corresponding flu data, audit data from Audit Analytics, and financial data from Compustat. To capture only companies with meaningful economic activity, we limit the sample to companies with over five million dollars in total assets.²⁴ The discretionary accruals and accrual quality samples exclude companies in the financial services industries (SIC 6000–6999). We eliminate client-year observations without December 31st or January 31st year-ends to ensure that the timing of the engagements' busy seasons coincides with the timing of flu season.²⁵ The samples are further limited by the necessary data for dependent and control variables. ²⁶Table 1 describes the sample composition.

3.2. Variable of interest

ILI data is compiled by the CDC at the state-level.²⁷ We rely on CDC categorization of ILI activity to measure our test variable. ILI spread is reported to the CDC by state health departments on a scale of 0–4, with 0 being not widespread and 4 being persistent across the state. ILI severity is measured on a scale of 0–10, with 0 being minimal and 10 being high. We first

²⁴ The results are robust to the inclusion of all companies with available data.

²⁵ The sample of companies without December 31st or January 31st year-ends are utilized in falsification tests for clients whose audit is completed outside of flu season.

²⁶ The number of observations in probit models may differ because observations are dropped when the independent variable perfectly predicts the dependent variable.

²⁷ Our study is one of many recent papers leveraging geographic variation in various constructs, such as the quality of human capital (Call et al., 2017; Beck et al., 2018) or social norms (McGuire et al., 2012; Christensen et al., 2018), to examine audit and accounting outcomes. Other uses of publicly available government data in recent literature include analysis of union membership (Caskey and Ozel, 2017), immigration and human capital (Aobdia et al., 2018) and state-level economic outcomes (Chhaochharia et al., 2019).

Table 1
Sample Composition.

Dependent Variable	NT	LAG	DA	AQ	MWE	RESTATE
Sample period	2008– 2018	2008– 2018	2008– 2018	2008– 2017	2008– 2017	2008– 2016
Company-years with CDC, Compustat, and Audit Analytics data	50,690	50,690	50,690	46,771	46,771	42,429
Less: company-years with assets > \$5 million	1,828	1,828	1,828	1,729	1,729	1,612
Less: company-years for the financial industry	–	–	12,199	11,188	–	–
Less: company-years whose audit is not completed in flu season	9,807	9,807	8,662	8,213	9,290	8,542
Less: company-years without necessary control variables	4,367	5,093	6,355	6,858	7,041	6,087
Final sample	34,688	33,962	21,646	18,783	28,711	26,188

calculate the average spread and severity between December 1st and March 31st, the overlapping weeks of flu season and audit busy season. To synchronize the scales of the two ILI measures, we standardize the spread and severity measures by year.²⁸ We then sum the standardized measures of spread and severity of ILIs during audit busy season for the state in which the audit office is located.²⁹ A higher value of *ILI* indicates higher spread and severity of the illness.

3.3. Multivariate models

The models include industry and year fixed effects to control for variation in the dependent variables by industry and over time that are unrelated to the change in the independent variables. Standard errors are clustered by client and audit-firm to control for potential correlation of error terms.^{30,31} All continuous variables are winsorized at the 1st and 99th percentiles to mitigate the influence of outliers in the data. All variables are defined in detail in the Appendix.

3.3.1. Audit delay

We first test H1, which predicts a positive association between ILIs and audit delay. The dependent variable *NT* is an indicator variable equal to 1 if the delay resulted in the audit report being filed after the SEC filing deadline, as reported to the SEC on Form 12b-25, Notification of Late Filing (Wang et al., 2013; Cao et al., 2016; Czerney et al., 2019). Acknowledging that a non-timely filing may be considered an extreme form of audit delay, our second delay measure is designed to partially alleviate this concern. *LAG* is equal to the number of days between the fiscal year-end date and the filing date of the audit report less the number of days provided by the SEC filing deadline (60, 75, and 90 days for large accelerated, accelerated, and non-accelerated filers, respectively (Hoitash and Hoitash, 2018)).³² H1 predicts a positive association between *ILI* and *NT* and *LAG*.

$$\begin{aligned}
 NT/LAG = & \beta_0 + \beta_1 ILI + \beta_2 SIZE + \beta_3 LOSS + \beta_4 LIT + \beta_5 FOREIGN + \beta_6 BUSSEG + \beta_7 MW + \beta_8 ROA + \beta_9 INVREC \\
 & + \beta_{10} RESTRUCTURE + \beta_{11} LEVERAGE + \beta_{12} MB + \beta_{13} RESTATE + \beta_{14} GC + \beta_{15} BIG4 + \beta_{16} AUDITORCHANGE \\
 & + \beta_{17} AUDITFEES + \beta_{18} OFFICESIZE + \beta_{19} HEALTH + \beta_{20} VACCINE + \beta_{21} POPD_{industry \& year} fixed effects + \varepsilon.
 \end{aligned} \quad (1)$$

Control variables are adapted from prior research on audit timing (Knechel and Sharma, 2012; Cao et al., 2016; Sharma et al., 2017; Hoitash and Hoitash, 2018). In addition, we control for state-level factors that may influence our dependent variables: health, vaccination, and population density. Unlike the flu, health is predictable, as it does not vary drastically from year to year. We therefore do not expect a significant association between general health and audit quality. In addition to tracking flu activity, the CDC performs an ongoing health survey designed to collect data on health-related risk behaviors and conditions in U.S. adults.³³ *HEALTH* represents the average of survey participants' responses to a 1–5 scale where 1 indicates excellent health and 5 indicates poor health.³⁴

²⁸ The standard score for each year of the sample has a distribution with a mean of 0 and a standard deviation of 1. The results are not sensitive to alternative methods of constructing *ILI*, as reported in Part 5.

²⁹ We also examine whether our results are consistent when examining *ILI* spread and severity separately. As expected, we find less consistent results when not aggregating the two measures. These untabulated results support the need to examine the spread and severity of the illness in conjunction.

³⁰ Results are robust to clustering standard errors by client, state, and audit office and to double clustering by client/audit office and state/industry.

³¹ Results are robust to including a time trend variable to address concerns that trends in the variable of interest are leading to false conclusions that changes in flu influence changes in the dependent variables.

³² The results of the *LAG* analysis are robust to the exclusion of companies that had a non-timely filing (*ANNUALNT* = 1). Considering whether the results are driven by smaller audit offices with fewer resources, we examine (untabulated) results illustrating that the results are robust to excluding the smallest decile of audit offices.

³³ Survey data is available at <https://www.cdc.gov/brfss/index.html>.

³⁴ Results are robust to measuring health as the number of days physical health is not good.

ILI data from the CDC is ex-post prevention activities and thus already reflects vaccination efforts by the states. Nevertheless, we control for vaccine efficacy, which compares the frequency of the flu vaccine in patients who had the flu compared to patients who did not have the flu. Vaccine efficacy depends on whether the strain in the vaccine matches the active influenza virus in that year. Thus, vaccination efforts are not equally successful in all years.³⁵ Finally, it is possible that ILIs spread more quickly in states with higher population density. To address this concern, we also control for state-level population density.^{36,37}

3.3.2. Audit quality

H2 predicts a negative association between ILIs and audit quality. We posit that the risk of an ILI will negatively impact auditors' abilities to exercise strong professional judgment and skepticism. We therefore identify discretionary accruals as our first proxy for audit quality that is reflective of auditor judgment.³⁸ We estimate discretionary accruals using two measures. First, the absolute value of the performance adjusted modified Jones model (Kothari et al., 2005) controlling for return on assets (*DA*). Second, we use the Dechow and Dichev (2002) method of accruals quality based on the adjusted recognition of cash flows over a five-year period (*AQ*). We first test H2 using the multivariate model defined below, which controls for auditor- and client-level characteristics documented in prior literature (Francis and Yu, 2009; Reichelt and Wang, 2010), in addition to the state-level factors, described above, that may influence our dependent variables: health, vaccination, and population density.

$$\begin{aligned} DA/AQ = & \beta_0 + \beta_1 ILI + \beta_2 SIZE + \beta_3 LOSS + \beta_4 LIT + \beta_5 FOREIGN + \beta_6 BUSSEG + \beta_7 MW + \beta_8 ROA + \beta_9 INVREC \\ & + \beta_{10} RESTRUCTURE + \beta_{11} LEVERAGE + \beta_{12} MB + \beta_{13} RESTATE + \beta_{14} EXTREMEGROWTH + \beta_{15} STD - CASH + \beta_{16} STD \\ & - SALES + \beta_{17} BIG4 + \beta_{18} AUDITORCHANGE + \beta_{19} AUDITORTENURE + \beta_{20} HEALTH + \beta_{21} VACCINE + \beta_{22} POPD \\ & + industry\&yearfixedeffects + \varepsilon \end{aligned} \quad (2)$$

Measuring the accuracy of audit reports provides incremental information about audit quality (Lennox 1999), and accuracy may be impaired when the risk of an ILI is greater. We therefore further examine the association between ILIs and audit quality via material weakness errors (*MWE*). Material weaknesses offer important information about the efficacy of a company's internal controls over financial reporting, yet only a fraction of companies report their existing weaknesses (Rice and Weber, 2012). We propose that a portion of these omissions may be due to errors by the auditor in completing control testing and identifying a material weakness. The criteria for assessing the likelihood and materiality of internal control classifications are complex to apply due to imprecise definitions and guidance (Bedard and Graham, 2011). Thus, this is an area in which impaired cognitive functions due to the flu may reduce auditors' abilities to accurately identify and classify material weaknesses.

We measure *MWE* as an indicator variable equal to 1 if the auditor failed to identify a material weakness (*MW*) in year *t* and management subsequently identified a *MW* in the first, second, or third quarters of year *t* + 1.³⁹ H2 predicts a positive association between auditors' material weakness errors and influenza. We include restatements as an additional measure of audit quality as restatements are the most egregious indicator of poor audit quality and flu-induced brain fog may influence an auditor's failure to detect and correct a misstatement. *RESTATEMENT* is an indicator variable equal to 1 for the year in which the misstatement occurred. Control variables are consistent with prior research (Ashbaugh-Skaife et al., 2007; Rice and Weber, 2012; DeFond and Lennox, 2017) in addition to the state-level factors, described above, that may influence our dependent variables: health, vaccination, and population density.

$$\begin{aligned} MWE/RESTATEMENT = & \beta_0 + \beta_1 ILI + \beta_2 SIZE + \beta_3 LOSS + \beta_4 LIT + \beta_5 FOREIGN + \beta_6 BUSSEG + \beta_7 MW + \beta_8 ROA \\ & + \beta_9 INVREC + \beta_{10} RESTRUCTURE + \beta_{11} LEVERAGE + \beta_{12} MB + \beta_{13} RESTATE + \beta_{14} EXTREMEGROWTH \\ & + \beta_{15} STD - CASH + \beta_{16} STD - SALES + \beta_{17} BIG4 + \beta_{18} AUDITORCHANGE + \beta_{19} AUDITORTENURE + \beta_{20} HEALTH \\ & + \beta_{21} VACCINE + \beta_{22} POPD + industry\&yearfixedeffects + \varepsilon. \end{aligned} \quad (3)$$

³⁵ It is further possible that the intensity of ILI outbreaks is a function of state government resources. We proxy for state-level resources with state individual tax rates because on average, the majority of state revenues are generated from individual income taxes, but our results are consistent if we consider corporate taxes or the sum of corporate and individual taxes. Individual tax rate data is obtained from The Tax Foundation at <https://taxfoundation.org/>. It is possible that states with higher tax rates have more resources available to support flu vaccinations or treatments. Our results are robust to controlling for these resources.

³⁶ Population density data is obtained from <https://www.census.gov/library/visualizations/interactive/historical-apportionment-data-map.html>. At the time the statistical analysis in this study was performed, the most recent U.S. census data was from 2010. We use the log value of this measure for all sample years, as we do not expect significant variation in population density over the sample period.

³⁷ In additional tests we control for state weather, measured based on the average temperature, maximum temperature, and precipitation over flu season. This data is obtained from <https://www.ncei.noaa.gov/pub/data/cirs/climdiv/>. Our results are consistent when including this control.

³⁸ Discretionary accruals serve as an appropriate proxy because they are associated with PCAOB findings related to complex estimates (Aobdia, 2019), which require significant auditor judgment.

³⁹ Results are robust to limiting management's identification of a *MW* to the first quarter and to the first and second quarters.

Table 2a
Panel A: Descriptive Statistics.

	N	Mean	Median	Std. Dev	p25	p75
<i>ILI</i>	34,688	0.005	0.024	1.404	-1.045	1.059
<i>NT</i>	34,688	0.052	0.000	0.221	0.000	0.000
<i>LAG</i>	33,962	-6.408	-4.000	9.376	-11.000	-1.000
<i>DA</i>	21,646	0.114	0.068	0.138	0.029	0.141
<i>AQ</i>	18,783	0.040	0.029	0.034	0.017	0.050
<i>MWE</i>	28,711	0.029	0.000	0.169	0.000	0.000
<i>RESTATEMENT</i>	26,188	0.081	0.000	0.273	0.000	0.000
<i>SIZE</i>	34,688	6.666	6.757	2.221	5.165	8.148
<i>LOSS</i>	34,688	0.437	0.000	0.496	0.000	1.000
<i>LIT</i>	34,688	0.208	0.000	0.406	0.000	0.000
<i>FOREIGN</i>	34,688	0.239	0.000	0.427	0.000	0.000
<i>BUSSEG</i>	34,688	1.718	1.000	1.428	1.000	2.000
<i>MW</i>	34,688	0.114	0.000	0.317	0.000	0.000
<i>ROA</i>	34,688	-0.056	0.012	0.296	-0.034	0.054
<i>INVREC</i>	34,688	0.277	0.205	0.245	0.070	0.429
<i>RESTRUCTURE</i>	34,688	0.250	0.000	0.433	0.000	1.000
<i>LEVERAGE</i>	34,688	0.254	0.185	0.264	0.042	0.390
<i>MB</i>	34,688	2.739	1.621	5.999	0.938	3.105
<i>RESTATE</i>	34,688	0.076	0.000	0.266	0.000	0.000
<i>GC</i>	34,688	0.052	0.000	0.221	0.000	0.000
<i>EXTREME GROWTH</i>	28,711	1.958	2.000	1.336	1.000	3.000
<i>STD-CASH</i>	21,646	0.076	0.045	0.098	0.024	0.086
<i>STD-SALES</i>	21,646	0.174	0.111	0.193	0.057	0.214
<i>BIG 4</i>	34,688	0.640	1.000	0.480	0.000	1.000
<i>AUDITOR CHANGE</i>	34,688	0.061	0.000	0.240	0.000	0.000
<i>AUDIT FEES (log)</i>	34,688	13.662	13.692	1.328	12.730	14.532
<i>OFFICE SIZE (log)</i>	34,688	16.618	17.102	2.091	15.075	18.283
<i>AUDIT TENURE</i>	21,646	13.780	9.000	16.478	4.000	16.000
<i>HEALTH</i>	34,688	2.567	2.560	0.143	2.487	2.660
<i>VACCINE</i>	34,688	43.355	47.000	11.565	36.000	52.000
<i>POPD (log)</i>	34,688	3.191	3.219	0.609	3.045	3.638
<i>OFFICE GROWTH</i>	34,688	0.039	0.000	0.193	0.000	0.000
<i>CLIENT ILI</i>	7,178	-0.163	-0.231	1.656	-1.140	1.048
<i>CLIENT MORE SICK</i>	8,437	0.543	1.000	0.498	0.000	1.000
<i>ABNORMAL AFEE</i>	34,688	0.019	0.006	0.525	-0.304	0.339
<i>GOOD HEALTH</i>	34,688	0.460	0.000	0.498	0.000	1.000
<i>HIGH VACCINE</i>	34,688	0.552	1.000	0.497	0.000	1.000
<i>HIGH DENSITY</i>	34,688	0.312	0.000	0.463	0.000	1.000
<i>COMPLEX CLIENT</i>	34,688	0.383	0.000	0.486	0.000	1.000
<i>HIGH LEVEL 3</i>	34,688	0.371	0.000	0.483	0.000	1.000
<i>SP</i>	31,698	0.122	0.000	0.327	0.000	0.000
<i>QOP</i>	26,411	0.007	0.000	0.081	0.000	0.000
<i>EDUCATION</i>	31,711	0.268	0.300	0.120	0.263	0.349

Panel A presents descriptive statistics for the sample period 2008 – 2018. The variable of interest, *ILI*, measures the spread and severity of the influenza-like illnesses within each state in our sample period. We define all variables in detail in the Appendix. We winsorize all continuous variables at the 1st and 99th percentiles. *N* is the number of observations based on the sample size in each respective multivariate model, Std. Dev. is the standard deviation, and p25 (p75) is the 25th (75th) percentile of the variable's distribution.

3.4. Descriptive statistics

Table 2 Panel A presents descriptive statistics for all sample variables.⁴⁰ *ILI* ranges from -3.23 to 3.04 with an average of -0.01.⁴¹ The mean audit report lag is negative, indicating that, on average, companies file the audit report 6.4 days ahead of the mandated deadline. We further observe that 5.2 percent of 10-K reports result in non-timely filings with the SEC. Discretionary accruals are, on average, 0.114, accruals quality is 0.040, and 8.1 percent of our sample restate the audited financial statements. Auditors make an error related to material weaknesses in 2.9 percent of the sample. Sample means and other descriptive statistics for our dependent variables are consistent with prior research (e.g. Dechow and Dichev 2002; Doyle, Ge, and McVay 2007; Lawrence, Minutti-Meza, and Zhang 2011; Wang et al. 2013; Beck et al., 2018; Hoitash and Hoitash 2018; Czerney et al. 2019; Lee, Nagy, and Zimmerman 2019). Descriptive statistics for control variables have also been compared to prior literature and are consistent with expectations.

Table 2 Panel B presents the correlation matrix. Offering initial support for our hypotheses, we observe a positive and significant correlation between *ILI* and audit report lag (*LAG*) and non-timely filings (*NT*). Further, the dependent variables *DA*,

⁴⁰ We report the number of observations and corresponding statistics for the largest available sample in our analyses.

⁴¹ We report the minimum and maximum of the *ILI* measure here. Table 2 presents the interquartile range of *ILI*.

Table 2b

Panel B: Pearson Correlation Matrices.

	(1) <i>ILI</i>	<i>NT</i>	<i>LAG</i>	<i>DA</i>	<i>AQ</i>	<i>RESTATEMENT</i>	<i>MWE</i>	<i>AUDIT FEES</i>	<i>SIZE</i>	<i>BIG 4</i>
<i>ILI</i>	1									
<i>NT</i>	0.0450***	1								
<i>LAG</i>	0.0155**	0.366***	1							
<i>DA</i>	0.0293***	0.0805***	0.0841***	1						
<i>AQ</i>	0.0313***	0.0967***	0.103***	0.424***	1					
<i>RESTATEMENT</i>	0.00547	0.0941***	0.186***	0.0484***	0.0403***	1				
<i>MWE</i>	0.0155**	0.0991***	0.185***	0.108***	0.0990***	0.136***	1			
<i>AUDIT FEES</i>	0.0252***	-0.0707***	-0.0751***	-0.256***	-0.399***	0.0100*	-0.106***	1		
<i>SIZE</i>	0.00274	-0.117***	-0.110***	-0.342***	-0.203***	-0.0459***	-0.130***	0.774***	1	
<i>BIG 4</i>	0.00119	-0.131***	-0.0853***	-0.188***	0.0452***	-0.0288***	-0.139***	0.602***	0.464***	1

Panel B presents Pearson correlations for the independent variable of interest, dependent variables, and variables from robustness tests. We define all variables in detail in the Appendix. We denote statistical significant where * = $p < 0.05$, ** = $p < 0.01$, and *** = $p < 0.001$. P-values for all coefficients are conservatively reported as two-tailed.

AQ and *MWE* are positively and significantly correlated with our variable of interest, *ILI*. Inconsistent with our predictions, the correlation between *RESTATEMENT* and *ILI* is insignificant. Additionally, we observe a positive and significant correlation between *AUDIT FEES* and *ILI*. We control for additional factors that may influence these associations in multivariate analyses.

4. Results

4.1. Audit delay

H1 predicts that *ILI* is positively associated with audit delay. Non-timely filings (*NT*) is a binary variable indicative of Form 10-K being filed past the SEC deadline. We present the results of this hypothesis in Table 3. We find evidence of a positive association between *NT* and *ILI* ($p < 0.01$), as reported in Column (1). The area under the receiver operating characteristic (ROC) curve is 0.90, indicating that the model's discrimination between clients with and without non-timely filings is excellent.⁴² To strengthen our findings, we present an alternative measure of audit delay. The dependent variable adjusted audit lag (*LAG*) measures the difference between the SEC filing deadline and the date the Form 10-K was actually filed. We find a positive association, reported in Column (3), between *ILI* and *LAG* ($p < 0.01$), confirming H1.^{43, 44} The coefficients of statistically significant control variables are generally of the expected sign. The results for those clients whose audit is completed during flu season are economically significant. Moving from the 25th to 75th percentiles of *ILI*, holding all other variables at the sample mean, increases the likelihood of non-timely filings (audit report lag) by 14.9 (8.6) percent.⁴⁵ The economic significance is further evidenced by comparing states in the highest and lowest quartiles of *ILI*. Moving from Wisconsin (25th percentile, *ILI* = -1.34) to New York (75th percentile, *ILI* = 0.79) increases the likelihood of non-timely filings (length of audit lag) by 7.3 percent (5.2 days).

Results in Columns (1) and (3) support H1 with a positive association between *ILI* and *NT* (*LAG*) for auditors whose busy season directly overlaps with flu season. In Columns (2) and (4) we perform falsification tests on clients whose audits are not completed during flu season and observe an insignificant association between *ILI* and *NT* (*LAG*) for these firms. Combined, the results indicate that when auditors are more at risk of contracting an *ILI*, they are less efficient or simply unable to complete their work, resulting in a delay in the filing of audited information.

4.2. Audit quality

To test H2, we first examine the association between *ILI* and discretionary accruals. The coefficient of the test variable *ILI* in Table 4 Column (1) is positive and statistically significant ($p < 0.01$), which supports H2 and suggests that an increase in *ILI* spread and severity is associated with an increase in discretionary accruals, or a reduction in audit quality. These results are also economically significant. Holding all other variables at the sample mean, moving from the 25th to 75th percentile of *ILI* increases discretionary accruals by 1.9 percent. Further, moving from a state in the lowest quartile (WI) to the highest quartile of *ILI* outbreaks (NY) increases discretionary accruals by 0.07. Column (2) illustrates an insignificant association between *ILI* and discretionary accruals for those companies whose audit is completed outside of busy season.

⁴² Acceptable values of ROC are at least 0.70, with values between 0.80 and 0.90 being excellent and values exceeding 0.90 being outstanding (Hosmer and Lemeshow, 2000).

⁴³ Our results are robust to measuring report lag as the number of days between the fiscal year-end and filing date of the audit report.

⁴⁴ Both the *LAG* and *NT* estimations are robust to the exclusion of firms with circumstances that could significantly influence the timing of the audit report, such as material weaknesses and going concern opinions.

⁴⁵ Economic significance is calculated by dividing the percentage change in influenza (between the 25th and 75th percentiles) by the mean value of the dependent variable (e.g. Francis and Yu, 2009). The percentile means are calculated using the *margins* command in STATA (Williams, 2012).

Table 3
ILI and Audit Delay.

	(1) <i>Flu Season</i> <i>NT</i>	(2) <i>Non-Flu Season</i> <i>NT</i>	(3) <i>Flu Season</i> <i>Lag</i>	(4) <i>Non-Flu Season</i> <i>Lag</i>
<i>ILI</i>	0.029***	0.025	0.262***	0.086
	(2.62)	(1.00)	(4.79)	(0.84)
<i>SIZE</i>	-0.143***	-0.167***	0.084	-0.405**
	(-5.71)	(-4.81)	(0.83)	(-2.18)
<i>LOSS</i>	0.368***	0.187***	-0.388	-0.868**
	(8.97)	(3.07)	(-1.37)	(-2.43)
<i>LIT</i>	-0.071	-0.047	-0.929*	0.229
	(-1.00)	(-0.29)	(-1.87)	(0.26)
<i>FOREIGN</i>	0.013	-0.076	0.810***	0.244
	(0.31)	(-1.27)	(3.48)	(0.80)
<i>BUSSEG</i>	0.024	0.061*	0.230	0.484**
	(1.49)	(1.91)	(1.64)	(2.20)
<i>MW</i>	1.028***	1.074***	5.698***	6.347***
	(25.82)	(13.07)	(11.38)	(13.61)
<i>ROA</i>	0.070	-0.152	-0.919**	-1.531**
	(1.59)	(-1.46)	(-2.52)	(-2.07)
<i>INVREC</i>	0.356***	0.247	0.645	-1.496
	(2.88)	(1.11)	(1.31)	(-1.24)
<i>RESTRUCTURE</i>	-0.118***	0.010	-0.631***	-0.776*
	(-3.92)	(0.17)	(-3.13)	(-1.83)
<i>LEVERAGE</i>	0.151**	0.289***	0.080	1.548**
	(2.43)	(2.60)	(0.17)	(2.12)
<i>MB</i>	-0.001	-0.002	0.008	0.001
	(-0.43)	(-0.50)	(0.56)	(0.06)
<i>RESTATE</i>	0.204***	0.139	0.627***	0.813**
	(4.18)	(1.55)	(2.92)	(2.09)
<i>GC</i>	0.698***	0.618***	5.660***	5.448***
	(11.52)	(6.34)	(10.08)	(6.94)
<i>BIG 4</i>	-0.122	-0.133	-0.208	-0.023
	(-1.47)	(-1.38)	(-0.39)	(-0.04)
<i>AUDITOR CHANGE</i>	0.336***	0.341***	1.884***	1.105**
	(6.97)	(3.56)	(7.86)	(1.98)
<i>AUDIT FEES</i>	0.180***	0.155**	0.226	0.226
	(3.18)	(2.45)	(1.00)	(0.64)
<i>OFFICE SIZE</i>	-0.065***	-0.087***	-0.289***	-0.375***
	(-4.33)	(-3.08)	(-3.18)	(-2.59)
<i>HEALTH</i>	-0.216	-0.191	0.119	-0.041
	(-1.56)	(-0.64)	(0.21)	(-0.03)
<i>VACCINE</i>	0.001	0.039**	-0.009	0.004
	(0.15)	(2.07)	(-1.58)	(0.47)
<i>POPD</i>	0.002	-0.029	0.165	0.247
	(0.09)	(-0.60)	(0.79)	(0.59)
Constant	-2.916***	-2.850*	-6.670**	0.568
	(-3.46)	(-1.89)	(-2.27)	(0.08)

(continued on next page)

Table 3 (continued)

	(1) Flu Season NT	(2) Non-Flu Season NT	(3) Flu Season Lag	(4) Non-Flu Season Lag
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	34,688	8,883	33,962	8,769
Adjusted/Pseudo R ²	0.304	0.336	0.094	0.166

The table presents the results of the OLS regression of the association between influenza-like illnesses (*ILI*) and audit delay. We measure *ILI* based on the spread and severity within each state in our sample period. *NT* is an indicator variable equal to 1 if the audit report was filed after the SEC deadline. *REPORT LAG* is measured as the number of days between the fiscal year-end date and the filing date of the audit report less the number of days provided by the SEC filing deadline. We present the results of tests for companies whose audit is completed during flu season, those with December 31st or January 31st year-ends, in Columns (1) and (3). The area under the receiver operating characteristic (ROC) curve in Column (1) is 0.90. Columns (2) and (4) present falsification tests for clients whose audit does not directly overlap with flu season (i.e., companies without December or January year-ends). The sample period is from 2008 to 2018. We define all variables in the Appendix. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1 %), ** (5 %), and * (10 %). P-values for all coefficients are conservatively reported as two-tailed.

In Column (3), we offer supplemental evidence of an association between *ILI* and audit quality when measuring discretionary accruals based on Dechow and Dichev (2002). We find a positive and significant ($p < 0.05$) association between *ILI* and *AQ*.⁴⁶ Acknowledging concerns about the use of unsigned discretionary accruals, we separately examine signed accruals. In this untabulated test we observe that our results hold in the negative abnormal accruals sample, but not in the positive. The lack of consistent results are consistent with Aobdia (2019), who finds an association between unsigned accruals and PCAOB inspection findings, but not with signed accruals. We further employ two suggestions from Hribar and Nichols (2007) to address concerns with measures of discretionary accruals. First, our main analysis includes controls (operating volatility and size), designed to reduce bias generated by inherent differences across firms in the volatility of accruals. Second (untabulated), we use the weighted least squares approach and scale all variables by the standard deviation of cash flows. In both cases, our results remain unchanged.

These results are also economically significant. When holding all other variables at the sample mean, a move from the 25th to 75th percentiles of *ILI* increases accrual quality by 1.6 percent. Moving from a state in the lowest quartile (WI) to the highest quartile of *ILI* outbreaks (NY) reduces accrual quality by 0.02. All coefficients of statistically significant control variables are of the expected sign. Column (4) presents results of the robustness test, in which we fail to find a significant association between *ILI* and audit quality when limiting the sample to those companies whose audit is completed outside of flu season.

H2 also predicts a positive association between *ILI* and material weakness errors. We posit that when *ILI* is high, the likelihood of an auditor error increases. The results of this estimation are presented in Column (1) of Table 5. We find further support for H2, where *ILI* is positive and significantly associated with material weakness errors ($p < 0.05$).⁴⁷ This is indicative of a negative association between influenza-like illnesses and audit quality. The area under the receiver operating characteristic (ROC) curve is 0.92, indicating excellent fit. The coefficients of statistically significant control variables are of the expected directions.

To illustrate economic significance, moving from the 25th to 75th percentile of *ILI* (holding other variables at the sample mean) increases the likelihood of a material weakness error by 14.9 percent. Moving from Wisconsin (lowest quartile of *ILI*) to New York (highest quartile of *ILI*) increases the likelihood of a material weakness error by 4.1 percent. Column (2) suggests that there is no evidence of an association between *ILIs* and material weakness errors for companies whose audit is completed outside of busy season.

We do not find evidence of a significant association between *ILI* and the likelihood of restatements in Table 5 Columns (3) or (4). The lack of findings may suggest that the average effect of an *ILI* does not result in a detectable material misstatement, or that auditors are able to direct limited resources to the highest areas of risk and avoid the most severe adverse consequence of poor audit quality, even when their risk of being sick is higher.⁴⁸ Overall, the results presented in Tables 3 and 4 suggest that when auditors are at greater risk of being sick, audit quality declines. This may be due to brain fog or other symptoms that impair auditors' ability to focus on the job.

⁴⁶ The *DA* and *AQ* results are robust to the exclusion of firms with non-timely filings, addressing concerns that quality may inherently be lower for firms that require more time to file the audit report.

⁴⁷ The results are robust to the exclusion of firms with restructures for whom structural changes could significantly influence the identification of material weaknesses.

⁴⁸ We execute additional tests to examine specific types of restatements. We do not find evidence of an association between *ILI* and restatements involving net income, Big R restatements, restatements related to fraud, or restatements requiring SEC review or board involvement. As Rajgopal, Srinivasan and Zheng (2021) find that restatements and the ratio of audit fees to total fees are strong proxies of audit quality, we also utilize this ratio as a measure of audit quality. Like our restatement analysis, we do not find evidence of an association between *ILI* and this quality measure.

Table 4
ILI and Accrual Measures of Audit Quality.

	(1) <i>Flu Season DA</i>	(2) <i>Non-Flu Season DA</i>	(3) <i>Flu Season AQ</i>	(4) <i>Non-Flu Season AQ</i>
<i>ILI</i>	0.102**	0.101	0.030**	0.033
	(2.15)	(0.82)	(2.53)	(1.22)
<i>SIZE</i>	-0.006***	-0.003**	-0.003***	-0.002***
	(-5.14)	(-2.18)	(-8.35)	(-3.56)
<i>LOSS</i>	0.007***	0.014***	0.005***	0.004***
	(3.24)	(4.82)	(6.50)	(4.77)
<i>LIT</i>	-0.004	0.003	-0.002	0.000
	(-1.08)	(0.49)	(-1.53)	(0.02)
<i>FOREIGN</i>	-0.005**	-0.007**	-0.000	-0.001
	(-2.32)	(-2.40)	(-0.58)	(-0.56)
<i>BUSSEG</i>	0.000	0.001	-0.000*	-0.001**
	(0.66)	(0.75)	(-1.67)	(-2.13)
<i>MW</i>	0.008**	0.002	0.002*	0.002
	(2.19)	(0.32)	(1.78)	(1.36)
<i>ROA</i>	-0.100***	-0.066***	-0.002	0.003
	(-19.39)	(-5.55)	(-1.23)	(1.01)
<i>INVREC</i>	-0.012**	0.003	0.007**	0.016***
	(-2.01)	(0.26)	(1.98)	(3.88)
<i>RESTRUCTURE</i>	-0.003***	-0.003	0.001	-0.002**
	(-2.95)	(-0.60)	(0.76)	(-2.23)
<i>LEVERAGE</i>	0.007	0.001	-0.001	0.002
	(1.51)	(0.09)	(-0.52)	(0.79)
<i>MB</i>	0.000*	0.001*	0.000**	0.000*
	(1.85)	(1.95)	(2.50)	(1.70)
<i>RESTATE</i>	0.004*	0.008	-0.000	-0.000
	(1.82)	(1.38)	(-0.42)	(-0.13)
<i>EXTREME GROWTH</i>	0.003***	0.002**	0.000	0.000
	(4.41)	(2.26)	(1.44)	(0.69)
<i>STD-CASH</i>	0.238***	0.354***	0.147***	0.188***
	(12.53)	(6.53)	(13.32)	(15.61)
<i>STD-SALES</i>	0.029***	0.023	0.031***	0.026***
	(4.78)	(1.61)	(13.12)	(6.65)
<i>BIG 4</i>	-0.005	0.005	-0.001	-0.002
	(-1.44)	(0.91)	(-0.44)	(-1.23)
<i>AUDITOR CHANGE</i>	0.004	-0.003	0.002**	-0.002
	(0.99)	(-0.39)	(2.27)	(-1.51)
<i>AUDIT TENURE</i>	0.000**	-0.000	-0.000	-0.000***
	(2.02)	(-0.35)	(-0.38)	(-4.01)
<i>HEALTH</i>	0.002	-0.014	-0.002	0.002
	(0.30)	(-1.50)	(-0.85)	(0.38)
<i>VACCINE</i>	-0.000	-0.000	-0.000	-0.000
	(-1.00)	(-1.49)	(-0.16)	(-0.79)
<i>POPD</i>	-0.000	-0.001	0.000	0.000
	(-0.17)	(-0.51)	(0.99)	(0.21)

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Table 4 (continued)

	(1) Flu Season DA	(2) Non-Flu Season DA	(3) Flu Season AQ	(4) Non-Flu Season AQ
Constant	0.101***	0.094***	0.038***	0.072***
	(4.08)	(3.26)	(6.28)	(5.62)
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	21,646	7,341	18,783	6,741
Adjusted R ²	0.233	0.171	0.532	0.495

The table presents the results of the OLS regression of the association between influenza-like illnesses (*ILI*) and audit quality. We measure *ILI* based on the spread and severity within each state in our sample period. In order to present interpretable coefficients, we scale *INFLUENZA* by 100. *DA* is measured following the performance adjusted modified Jones model (Kothari et al. 2005). *AQ* is measured following Dechow and Dichev (2002) based on the adjusted recognition of cash flows over time. We present the results of tests for companies whose audit is completed during flu season, those with December 31st or January 31st year-ends, in Columns (1) and (3). Columns (2) and (4) present falsification tests for clients whose audit does not directly overlap with flu season (i.e., companies without December or January year-ends). The sample period is from 2008 to 2018. We define all variables in the Appendix. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1 %), ** (5 %), and * (10 %). P-values for all coefficients are conservatively reported as two-tailed.

5. Additional analysis

5.1. Examining client influenza-like illnesses

We acknowledge that all audit deliverables are a product of both the auditor and the client's financial statement preparers. We perform several tests to address the concern that the client's risk of illness, rather than the auditor, is driving the results. First, we limit the sample to observations where two conditions are met: the auditor and client are not located in the same state, and the client is more likely to be at risk of being sick than the auditor. The dependent variable in this analysis is *CLIENT ILI*, calculated using the same method described to measure *ILI*, using the CDC's flu spread and severity measures from the state of the client's headquarters rather than the auditor's.⁴⁹ If the client being sick is not a primary driver of our results, we should not see evidence of an association between *CLIENT ILI* and the dependent variables. The results, presented in Table 6 Panel A, are consistent with our expectations; we do not observe evidence of a significant association (p -value > 0.10) between the client's risk of flu and audit outcomes.

In our next analysis, we limit the sample to observations where the client and auditor are in different states. In this analysis our dependent variable is *CLIENT MORE SICK*, an indicator variable equal to 1 if the client's risk of an influenza-like illness is greater than the auditor's, and 0 otherwise. As presented in Table 6 Panel B, we generally do not find evidence of an association between the *CLIENT MORE SICK* with our dependent variables. Finally, in untabulated analysis, we examine the association between *ILIs* and quarterly reports. In contrast to annual reports, the responsibility over quarterly filings can be more directly attributed to the client because auditors are not required to complete a full audit or issue a formal audit opinion. We expect that if the auditor's risk of illness is driving the results, rather than the client's, we will not observe an association between our measure of *ILIs* and delay of quarterly Forms 10-Q.⁵⁰

The dependent variable *NT 10-Q* is an indicator variable equal to 1 if the delay resulted in the quarterly report being filed after the SEC filing deadline. The dependent variable *10-Q LAG* measures the number of days between the period-end date and the filing date of the quarterly report less the number of days provided by the SEC filing deadline (40 and 45 days for accelerated and non-accelerated filers, respectively). The samples for the *NT 10-Q* and *10-Q LAG* analyses include all companies with quarterly periods 1–3 ending in December or January whose reports must be completed and filed during flu season. Consistent with our expectations, we do not find evidence of an association between *ILI* and the non-timely quarterly reports or delay in quarterly filings. These results suggest that financial statement preparers may be less susceptible to adverse effects of presenteeism and are consistent with the influence of *ILIs* on the work of auditors. Relative to auditors, financial statement preparers may have better work-life balance and may not be expected to work prolonged hours during flu season. Financial statement preparers may thus be more likely to stay at home when sick, rather than go to work.

⁴⁹ We limit the sample based on whether *CLIENT ILI* is greater than *ILI*. If so, we deem that the client is at a greater risk of illness than the auditor (*CLIENT MORE SICK* = 1).

⁵⁰ While the auditor is not responsible for opining on a quarterly filing, the interim financial statements must be reviewed by the independent auditor in accordance with ASC 270. We acknowledge that it is therefore possible for the influence of the auditor's risk of being sick may still influence the timing of the quarterly filings if the client completes the 10-Q in a timely manner but the auditor's review is delayed due to the adverse impacts of an *ILI*.

Table 5
ILI and Other Measures of Audit Quality.

	(1) <i>Flu Season MWE</i>	(2) <i>Non-Flu Season MWE</i>	(3) <i>Flu Season RESTATE</i>	(4) <i>Non-Flu Season RESTATE</i>
<i>ILI</i>	0.026**	-0.006	0.005	-0.029
<i>SIZE</i>	(2.20) -0.063***	(-0.31) -0.109***	(0.54) 0.040***	(-1.35) -0.009
<i>LOSS</i>	(-2.60) 0.218***	(-4.33) 0.143	(3.61) 0.075***	(-0.32) 0.120
<i>LIT</i>	(5.41) 0.114*	(1.56) -0.385**	(2.74) -0.107	(1.60) -0.094
<i>FOREIGN</i>	(1.68) -0.040	(-2.43) -0.016	(-1.26) 0.022	(-0.37) -0.013
<i>BUSSEG</i>	(-0.98) 0.029	(-0.21) 0.141**	(0.60) 0.015	(-0.30) 0.077**
<i>MW</i>	(1.20) 1.401***	(4.97) 1.589***	(1.61) 0.929***	(3.14) 0.896***
<i>ROA</i>	(16.45) -0.075	(13.05) -0.067	(13.14) 0.064	(13.38) 0.018
<i>INVREC</i>	(-1.10) 0.254	(-0.52) -0.066	(1.08) -0.120	(0.15) -0.043
<i>RESTRUCTURE</i>	(1.56) -0.010	(-0.32) -0.106	(-1.09) 0.101***	(-0.23) 0.127
<i>LEVERAGE</i>	(-0.23) 0.114*	(-1.53) -0.159	(5.29) 0.135**	(1.52) 0.102
<i>MB</i>	(1.87) -0.000	(-0.81) -0.006	(2.04) -0.001	(0.77) -0.007
<i>RESTATE</i>	(-0.02) -0.070	(-0.89) -0.186**	(-0.47) 0.699**	(-1.07) 0.697**
<i>EXTREME GROWTH</i>	(-1.09) 0.009	(-2.16) 0.019	(19.38) 0.004	(9.17) 0.031*
<i>STD-CASH</i>	(0.71) 0.055	(0.98) -0.382	(0.46) 0.134	(1.78) 0.205
<i>STD-SALES</i>	(0.27) 0.183*	(-0.81) 0.197	(0.73) -0.084	(0.51) 0.007
<i>BIG 4</i>	(1.89) -0.341***	(0.88) -0.281***	(-1.20) -0.052	(0.02) 0.158
<i>AUDITOR CHANGE</i>	(-5.33) 0.043	(-4.04) 0.199*	(-0.70) -0.061	(1.37) 0.102
<i>AUDIT TENURE</i>	(0.95) -0.003	(1.81) -0.002	(-0.98) -0.005***	(1.30) -0.001
<i>HEALTH</i>	(-1.37) -0.008	(-1.02) 0.550*	(-4.71) -0.227**	(-0.33) 0.232
<i>VACCINE</i>	(-0.05) -0.004	(1.96) 0.055	(-2.23) 0.028***	(1.19) 0.017
<i>POPD</i>	(-0.23) 0.006	(1.29) -0.027	(6.69) -0.019	(1.26) -0.067
	(0.27)	(-0.58)	(-0.73)	(-1.37)

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Table 5 (continued)

	(1) Flu Season MWE	(2) Non-Flu Season MWE	(3) Flu Season RESTATE	(4) Non-Flu Season RESTATE
Constant	-1.351	-9.276***	-3.071***	-2.921***
	(-1.46)	(-4.36)	(-6.44)	(-3.15)
Industry & Year FE	Yes	Yes	Yes	Yes
Observations	28,711	7,605	26,188	7,424
Pseudo R ²	0.330	0.384	0.131	0.154

The table presents the results of the OLS regression of the association between influenza-like illnesses (*ILI*) and audit quality. We measure *ILI* based on the spread and severity within each state in our sample period. Material Weakness errors are identified as those in which the auditor did not identify a MW in year *t* and management identified in the first, second, or third quarters of year *t* + 1. *RESTATEMENT* is an indicator variable equal to 1 if the company restated its financial statements for the fiscal year. We present the results of tests for companies whose audit is completed during flu season, those with December 31st or January 31st year-ends, in Columns (1) and (3). The area under the receiver operating characteristic (ROC) curve in Column (1) is 0.91. Columns (2) and (4) present falsification tests for clients whose audit does not directly overlap with flu season (i.e., companies without December or January year-ends). The sample period is from 2008 to 2018. We define all variables in the Appendix. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1 %), ** (5 %), and * (10 %). P-values for all coefficients are conservatively reported as two-tailed.

Table 6a

Panel A: Client *ILI*.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>CLIENT ILI</i>	-0.058	0.006	-0.000	-0.000	0.037
	(-0.46)	(0.20)	(-0.13)	(-0.24)	(0.74)
<i>SIZE</i>	-0.169	-0.103**	-0.008***	-0.004***	-0.176***
	(-0.79)	(-2.09)	(-3.52)	(-4.28)	(-2.66)
Constant	-10.966	-8.466***	0.229**	0.187***	-2.001
	(-1.27)	(-4.50)	(2.87)	(10.47)	(-0.73)
Controls	Yes	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	3,233	3,239	1,932	1,668	2,427
Adjusted/Pseudo R ²	0.123	0.377	0.274	0.536	0.394

5.2. Cross-sectional analyses

We next perform cross-sectional tests to identify state or auditor characteristics that may influence our findings. We control for the moderating effects of health, vaccine efficacy, and population density in Table 7 Panels A, B, and C, respectively.⁵¹ In each Panel, we measure *GOOD HEALTH* (*HIGH VACCINE*, *HIGH DENSITY*) as an indicator variable equal to 1 if health (vaccine efficacy, population density) is greater than the sample median, and 0 otherwise. As reported in Panel A, we find evidence of a moderating effect of health on the association between *ILIs* and audit timing, suggesting that when health is strong, the negative effect of influenza on audit timing is reduced. We do not observe a moderating effect of health on other audit outcomes. As reported in Panels B and C, we generally do not observe a moderating effect of vaccine efficacy or population density on audit outcomes.

We examine the influence of potential human resource capacity constraints in Table 7 Panels D, E, and F. In Panel D, we report the interaction of office size, measured as the annual sum of audit fees for each unique audit office, with *ILI*. We find evidence to suggest that larger offices that are less resource constrained are able to mitigate some of the effects of influenza on audit delay. We do not find evidence of a moderating effect of office size on measures of audit quality. In additional tests, we examine the moderating effect of reporting complexity, as reported in Panels E and F. Here we use two proxies for complexity, both measures based on the number of complex clients served by an audit office. We identify a complex client based on whether it is 1. Identified as complex by Bills et al. (2015) and 2. If it has reported amounts of Level 3 fair value assets or liabilities that exceed the sample median. For each measure of complexity, we create an indicator variable equal to 1 if the number of complex clients served exceeds the prior year, and 0 otherwise. We do not find evidence to suggest that client complexity moderates the association between *ILI* and audit outcomes.

⁵¹ In these tests we no longer control for these variables. We use linear probability models in analyses with dichotomous dependent variables to allow for a more straightforward interpretation of coefficients and interaction terms (Angrist and Pischke 2009).

Table 6b
Panel B: Stronger Client ILL

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>CLIENT MORE SICK</i>	1.180***	0.021	-0.004	-0.000	0.031
	(4.57)	(0.41)	(-0.93)	(-0.30)	(0.42)
<i>SIZE</i>	0.156	-0.064**	-0.008***	-0.004***	-0.125***
	(0.92)	(-2.01)	(-4.20)	(-4.79)	(-3.22)
Constant	-3.997	-1.792	0.266***	0.047***	-1.048
	(-0.64)	(-1.61)	(5.67)	(3.09)	(-0.67)
Controls	Yes	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	8,103	8,393	4,889	4,111	6,595
Adjusted/Pseudo R ²	0.162	0.316	0.264	0.544	0.374

The table presents the results of the OLS regression of the association between measures of client ILL and audit outcomes. Panel A presents the results of the association between client ILL in a sample of companies where the client and auditor are in different states and the client influenza-like illnesses is greater than the auditor's. Panel B reports the association between an indicator variable equal to 1 if the client is more sick than the auditor and audit outcomes. This analysis is limited to a sample of companies where the auditor and client are in different states. The sample period is from 2008 to 2018. We define all variables in the Appendix. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1 %), ** (5 %), and * (10 %). P-values for all coefficients are conservatively reported as two-tailed.

Table 7a
Panel A: Cross Sectional Test - Health.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILL</i>	0.005***	0.398***	0.001	0.000	0.002
	(3.70)	(6.15)	(1.39)	(0.96)	(1.63)
<i>GOOD HEALTH</i>	-0.007**	0.131	-0.001	-0.001**	-0.000
	(-2.46)	(0.75)	(-0.76)	(-2.03)	(-0.10)
<i>ILL # GOOD HEALTH</i>	-0.005***	-0.273***	-0.000	0.000	-0.001
	(-2.88)	(-3.09)	(-0.26)	(0.81)	(-0.56)
Constant	-0.134***	-13.190***	0.128**	0.022***	0.078**
	(-2.64)	(-5.58)	(7.60)	(2.97)	(1.98)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	34,691	33,965	21,646	18,783	28,714
Adjusted/Pseudo R ²	0.190	0.094	0.233	0.532	0.157

6. Robustness tests

6.1. Entropy balanced samples

We utilize entropy balancing to address endogeneity concerns arising from functional form misspecification between the dependent and independent variables (Hainmueller 2012; Haislip, Myers, Scholz, and Seidel 2017; Wilde 2017; McMullin and Schonberger 2019). The goal of entropy balancing is to achieve covariate balance across treatment and control samples, which is achieved by eliminating differences between observable covariates via a reweighting process. Our treatment and control samples are defined based on *HIGHILL*, an indicator variable equal to one if *ILL* exceeds the annual sample median, and zero otherwise. Each covariate is balanced based on means, variances, and skewness. Inferences from the entropy-balanced sample, as presented in Table 8, support the findings of our main analyses.⁵²

⁵² We implement propensity score matching as an alternative robustness test (Rosenbaum and Rubin 1983). We first estimate propensity scores using logistic regression. The dependent variable in this regression (*HIGHILL*) is an indicator variable equal to one if *ILL* exceeds the annual sample median, and zero otherwise. For each year in our sample, we model the likelihood of selecting a high flu state. We then match, without replacement, clients with audits that overlap with flu season and those whose do not with the closest propensity score within a maximum Caliper distance of 0.01. The covariance balance affirms the success of the matching procedures, as the normalized differences do not exceed 0.25, indicating an acceptable balance between treatment and control groups (Imbens and Rubin, 1997). Regression results within the matched pair samples are robust to estimating our results in this matched sample.

Table 7b

Panel B: Cross Sectional Test – Vaccine Efficacy.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILI</i>	0.002*	0.137**	0.000	0.000**	0.001
	(1.91)	(2.30)	(0.40)	(2.17)	(1.33)
<i>HIGH VACCINE</i>	−0.007***	−0.021	−0.001	−0.000	−0.001
	(−2.46)	(−0.12)	(−0.59)	(−0.61)	(−0.56)
<i>ILI # HIGH VACCINE</i>	0.001	0.240***	0.001	−0.000	−0.000
	(0.36)	(2.76)	(1.10)	(−0.79)	(−0.08)
Constant	0.049	−4.104	0.110***	0.038***	0.067***
	(0.85)	(−1.48)	(5.02)	(5.36)	(2.39)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R ²	0.190	0.094	0.233	0.532	0.329

Table 7c

Panel C: Cross Sectional Test – Population Density.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILI</i>	0.002*	0.207***	0.000	0.000	0.002**
	(1.87)	(3.39)	(0.32)	(0.98)	(1.99)
<i>HIGH DENSITY</i>	−0.009***	0.289	0.002	0.000	0.000
	(−3.05)	(1.49)	(0.82)	(0.64)	(0.17)
<i>ILI # HIGH DENSITY</i>	0.002	0.141	0.002	0.000	−0.002
	(1.13)	(1.37)	(1.40)	(0.87)	(−1.02)
Constant	−0.050	−12.413***	0.123***	0.028***	0.078*
	(−0.83)	(−4.20)	(5.02)	(3.03)	(1.75)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R ²	0.190	0.094	0.234	0.532	0.157

Table 7d

Panel D: Cross Sectional Test – Office Size

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILI</i>	0.016*	1.209***	−0.006	−0.000	−0.000
	(1.82)	(3.14)	(−0.89)	(−0.08)	(−0.02)
<i>OFFICE SIZE</i>	0.003***	−0.058**	0.000	0.000	−0.001
	(5.51)	(−2.53)	(0.00)	(0.59)	(−0.60)
<i>ILI # OFFICE SIZE</i>	−0.001	−13.425***	0.000	0.000	0.000
	(−1.62)	(−4.56)	(1.06)	(0.26)	(0.19)
Constant	−0.069	1.209***	0.121***	0.020*	0.102**
	(−1.15)	(3.14)	(4.12)	(1.85)	(1.98)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	20,982	18,215	27,771
Adjusted/Pseudo R ²	0.190	0.094	0.236	0.532	0.157

Table 7e
Panel E: Cross Sectional Test – Complex Clients.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILI</i>	0.003***	0.295***	0.001	0.000**	0.002*
	(2.90)	(5.57)	(1.53)	(1.97)	(1.89)
<i>COMPLEX CLIENT</i>	0.004	0.103	0.003	0.000	0.007
	(0.59)	(0.97)	(1.48)	(1.17)	(1.27)
<i>ILI # COMPLEX CLIENT</i>	−0.001	−0.117	−0.000	−0.000	−0.001
	(−0.75)	(−1.50)	(−0.35)	(−0.78)	(−0.63)
Constant	−0.072	−13.243***	0.121***	0.024***	0.077*
	(−1.19)	(−4.46)	(4.85)	(2.66)	(1.67)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R^2	0.190	0.094	0.234	0.532	0.157

Table 7f
Panel F: Cross Sectional Test – Complex Clients (Fair Value).

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILI</i>	0.001	0.280***	0.002**	0.000**	0.002*
	(0.55)	(4.79)	(2.00)	(2.14)	(1.8)
<i>HIGH LEVEL 3</i>	0.002	−0.137	0.002	0	0.023*
	(0.17)	(−1.21)	(0.94)	(0.42)	(1.96)
<i>ILI # HIGH LEVEL 3</i>	−0.004	−0.046	−0.001	−0.000	−0.013
	(−0.45)	(−0.65)	(−1.21)	(−1.22)	(−1.15)
Constant	−0.072	−13.484***	0.124***	0.026***	0.183***
	(−0.90)	(−4.52)	(4.94)	(2.74)	(2.94)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R^2	0.179	0.094	0.234	0.532	0.142

The table presents the results of the OLS and LPM regressions of the association between the interaction of influenza-like illnesses (*ILI*) with health, vaccine efficacy, population density, office size, and offices serving complex clients. We measure *ILI* based on the spread and severity within each state in our sample period. The sample period is from 2008 to 2018. We define all variables in the Appendix. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1 %), ** (5 %), and * (10 %). P-values for all coefficients are conservatively reported as two-tailed.

6.2. Alternative measures and sample composition

We consider two alternative measurements of the *ILI* variable to address concerns that results are driven by transformation of CDC data. First, as presented in Table 9 Panel A, we consider a different audit busy season period and measure *ALTILI* starting in the month of January rather than in December. Second, as presented in Table 9 Panel B, we transform the variables by calculating quintiles of spread and severity data, with a value of 1 representing the lowest quintile and a value of 5 representing the highest. We then sum the quintiles of spread and severity to get a composite measure of *ALTILI2*. Our results are robust to both alternative specifications of an influenza-like illness. We next present results for companies whose fiscal year-ends end in the months of November, December, or January. As presented in Table 9 Panel C, the results are robust to this alternative sample composition.

Finally, we present the results using alternative measures of audit quality in Table 9 Panel D. Our first alternative proxy is small profits, measured following Gul et al. (2013). Small profit (*SP*) is an indicator variable equal to 1 if ROA is between 0 and 1 percent, and 0 otherwise. ROA is equal to net income scaled by lagged total assets. The results are robust to making $SP = 1$ if ROA is between 0 and 1.5 percent or between 0 and 2 percent. As presented in Panel D Column (1), we find evidence of an increase in small profits during flu season (p-value < 0.10). We do not find evidence of a change in small profits outside of flu season (p-value > 0.10), as reported in Column (2). In Column (3), we find evidence of a positive and significant association between the risk of flu and the likelihood of the client receiving a qualified opinion (p-value < 0.05).⁵³ *QOP* is an indicator

⁵³ We have omitted the non-flu season sample due to the limited number of qualified opinions during this period.

Table 8
Entropy Balanced Sample.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ILI</i>	0.032***	0.217***	0.001*	0.000*	0.026*
<i>SIZE</i>	(2.76) -0.133***	(4.89) 0.014	(1.82) -0.006***	(1.70) -0.002***	(1.81) -0.081***
Constant	(-6.96) -3.696***	(0.18) -16.512***	(-7.35) 0.106***	(-16.41) 0.022**	(-4.56) -2.210***
Controls	(-6.01) Yes	(-4.27) Yes	(4.14) Yes	(2.54) Yes	(-5.47) Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R^2	0.304	0.105	0.238	0.544	0.183

The table presents the results of the estimation of the association between influenza-like illnesses (*ILI*) and non-timely filings (*NT*), audit report lag (*LAG*), discretionary accruals (*DA/AQ*), and material weakness errors (*MWE*) within an entropy balanced sample. We measure *ILI* based on the spread and severity within each state in our sample period. To present interpretable coefficients in Columns (3) and (4), we scale *INFLUENZA* by 100. We define all other variables in the Appendix. The sample period is from 2008 to 2018. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1%), ** (5%), and * (10%). P-values for all coefficients are conservatively reported as two-tailed.

Table 9a
Panel A: Alternative Measure of Busy Season.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ALTILI</i>	0.021*	0.222***	0.102**	0.030**	0.026**
<i>SIZE</i>	(1.90) -0.143***	(4.66) 0.081	(2.15) -0.006***	(2.53) -0.003***	(2.26) -0.064***
Constant	(-5.74) -3.012***	(0.80) -7.562***	(-5.14) 0.101***	(-8.35) 0.038***	(-2.61) -1.462
Controls	(-3.61) Yes	(-2.58) Yes	(4.08) Yes	(6.28) Yes	(-1.60) Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R^2	0.304	0.094	0.233	0.532	0.330

Table 9b
Panel B: Alternative Measure of *ILI*.

	(1) <i>NT</i>	(2) <i>LAG</i>	(3) <i>DA</i>	(4) <i>AQ</i>	(5) <i>MWE</i>
<i>ALTILI2</i>	0.021*	0.276***	0.114**	0.038**	0.031**
<i>SIZE</i>	(1.66) -0.143***	(4.84) 0.083	(2.22) -0.006***	(2.50) -0.003***	(2.25) -0.063***
Constant	(-5.74) -3.153***	(0.83) -9.547***	(-5.13) 0.090***	(-8.33) 0.035***	(-2.62) -2.186**
Controls	(-3.92) Yes	(-3.42) Yes	(3.74) Yes	(5.28) Yes	(-2.52) Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	34,688	33,962	21,646	18,783	28,711
Adjusted/Pseudo R^2	0.304	0.094	0.234	0.532	0.330

Table 9c

Panel C: Alternative Sample Composition.

	(1) NT	(2) LAG	(3) DA	(4) AQ	(5) MWE
<i>ILI</i>	0.029***	0.258***	0.097**	0.031**	0.026**
	(2.62)	(4.52)	(2.07)	(2.50)	(2.12)
<i>SIZE</i>	-0.141***	0.089	-0.005***	-0.003***	-0.066***
	(-5.56)	(0.92)	(-5.05)	(-8.27)	(-2.67)
Constant	-2.989***	-6.716**	0.102***	0.039***	-1.319
	(-3.53)	(-2.30)	(4.46)	(6.39)	(-1.43)
Controls	Yes	Yes	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
Observations	34,959	34,212	21,837	18,962	28,936
Adjusted/Pseudo R ²	0.304	0.094	0.233	0.531	0.331

Table 9d

Panel D: Alternative Measures of Audit Quality

	(1) <i>Flu Season SP</i>	(2) <i>Non-Flu Season SP</i>	(3) <i>Flu Season QOP</i>
<i>ILI</i>	0.017*	-0.008	0.000**
	(1.94)	(-0.60)	(2.22)
<i>SIZE</i>	0.036***	0.008	0.000
	(2.65)	(0.33)	(1.39)
Constant	-1.117***	-1.177***	0.002
	(-5.21)	(-2.59)	(0.85)
Controls	Yes	Yes	Yes
Industry & Year FE	Yes	Yes	Yes
Observations	31,832	8,258	26,411
Adjusted/Pseudo R ²	0.314	0.295	0.001

The table presents the results of the estimations while varying the *ILI* measure, sample characteristics, and measures of audit quality. In Panel A we measure *ALTILI* based on the spread and severity from January – March within each state in our sample period. In Panel B *ALTILI2* is the sum of the quintiles of the spread and severity measures. In Panel C we include companies with month-ends in November, December, and January. To present interpretable coefficients in Columns (3) and (4) of all Panels, we scale *ILI* (*ALTILI*) by 100. In Panel D we measure audit quality using small profits (*SP*), an indicator variable equal to 1 if ROA is between 0 and 1 percent, and using *QOP*, an indicator variable equal to 1 if the auditor issued a qualified opinion. We define all other variables in the Appendix. The sample period is from 2008 to 2018. We winsorize all continuous variables at the 1st and 99th percentiles. Standard errors are clustered at the client and audit-firm levels to correct for heteroskedasticity. Year fixed effects are based on fiscal year, and industry fixed effects are based on Fama and French 48 industry classifications. The numbers reported in each cell are coefficients (t-statistics), with significance denoted as *** (1 %), ** (5 %), and * (10 %). P-values for all coefficients are conservatively reported as two-tailed.

variable equal to 1 if the auditor issued a qualified opinion, and 0 otherwise. Collectively, the results are consistent with our primary measures of audit quality.

6.3. Additional tests

We complete the following tests in additional untabulated analyses. We recognize that because the CDC provides *ILI* data at the state-level, our results may be influenced by bi- or tri-state areas in which auditors commute to work from multiple states. To address this concern, we exclude from our analysis each of the five largest bi- or tri-state metropolitan areas. With the exception of material weakness errors in one specification, our results remain robust to excluding states commuting to New York City (New York, New Jersey, and Connecticut); Chicago (Illinois and Indiana); Philadelphia (Pennsylvania and New Jersey); Washington DC (DC, Virginia, and Maryland); and Boston (Massachusetts, Rhode Island, and New Hampshire).

We next examine whether the results are driven by other state, office, or company-level factors, as documented in prior research, that may influence audit outcomes. Other research examining human capital in the auditing context documents that audit offices in cities with higher levels of education have higher audit quality (Beck et al., 2018). To test if the impact of the flu is incremental to the education of the workforce, we control for *EDUCATION*, measured as the percentage of the

state population with a Bachelor's degree or higher.⁵⁴ Table 1 Panel A reports that approximately 27 percent of the population of the states within our sample have a bachelor's degree, consistent with Beck et al. (2018). We find that our results are not affected by the inclusion of *EDUCATION* as a control variable in our models.

It is possible that our results are driven by increases in the number of clients served, rather than from auditors being sick. We therefore consider whether our results are driven by limited human resource capacity driven by significant office growth. Bills et al. (2016) document that increases in audit workload reduce audit quality. Our results are robust to controlling for office growth, measured an indicator variable equal to 1 if the office-year falls into the top decile of growth, measured as the percentage change in office size (fees), from year $t-1$ to year t , and 0 otherwise, following Bills et al. (2016). This suggests that the negative association between audit quality and *ILI* is incremental to the association between office growth and audit quality.⁵⁵

Finally, we examine the impact of *ILIs* on overall company performance. If *ILIs* influences company performance, managers may be more likely to engage in earnings management to hide poor performance. Thus, no association between *ILI* and measures of company performance offers evidence that managers' do not have incentives to manage earnings, and thus serves as an additional indicator that the client's risk of illness is not the primary driver of our results. To examine this, we estimate regression models where the dependent variables are return on assets and Tobin's Q. We find no association between *ILI* and return on assets or Tobin's Q and conclude that the risk of an *ILI* does not appear to be associated with company performance and our results are not driven by this alternative explanation.

7. Conclusion

This paper investigates whether influenza-like illnesses, whose peak season directly overlaps with audit busy season, are associated with audit outcomes. We examine the impact of *ILIs* on audit delay and quality and find that audit delay, measured with report lag and the likelihood of non-timely filings, increases when auditors are more likely to be at risk of an *ILI* and *ILI* symptoms induce inefficiencies in the audit. We find that audit quality, measured with discretionary accruals and material weakness errors, declines in states with the worst *ILI* outbreaks. Overall, our results suggest that *ILIs* may impair auditors' judgment and decision-making abilities. To our knowledge, this is the first study to examine the association between auditor health and audit outcomes.

The results of this study are highly informative to audit firms. We propose that the effects of *ILIs* on audit outcomes arise when auditors go to work while sick. The heavy demand of busy season workloads may create environments in which auditors feel like taking a sick day is not an option. In addition, culture and work-life-balance initiatives within a firm or office may influence auditors' decision to work while sick. This issue further extends to inter-firm relationships, where interactions with other engagement team members may drive perceptions of the appropriateness of working while sick. If auditors did not work while sick, firms and offices would have better visibility into the impact of influenza on productivity and be able to assign additional resources to audit tasks, as needed. Our evidence may encourage audit firms to evaluate policies that incentivize working while sick.

Our study is not without limitations. We rely on available proxies of audit quality to measure an unobservable phenomenon. Integral to our reliance on publicly available measures of audit quality is the fact that all studies examining audit quality rely on measures that are a joint effort of the client and the auditor (Gaynor et al. 2016). We acknowledge that the client may also get the flu. However, we do not believe that the potential for the client to be sick limits the contribution of the potential impact of auditor health on audit outcomes. We are also unable to examine the impact of the flu at the individual auditor level and thus cannot directly measure auditors' cognitive states (deHaan et al., 2017). Importantly, this means that our conclusions are rely on the medical sciences literature to support the association between influenza-like-illnesses and reduced cognitive functioning.

While this study examines the consequences of working while sick on engagement-level outputs, future research may consider rewards or consequences for individual auditors who elect to go to work while sick. Research opportunities include examining changes in interactions of audit team members when one or more scheduled personnel are sick with the flu or otherwise unavailable, or how individual health interacts with organizational structures and team practices to jointly influence audit quality (Seckler et al., 2017). While this study does not consider earnings management, future research may consider whether managers take advantage of auditors' poor health to engage in audit management (Luippold et al., 2015). Finally, the effects of COVID-19 may have multiple consequences for audit outcomes. The impact of the flu may be lessened as the practices of wearing masks and social distancing become more prominently accepted. Second, recent flu seasons likely differed in terms of auditors' response to flu-like symptoms. Auditors may have been more likely to work from home or rely on remote technologies. The impact of these changes in work processes on audit outcomes may be considered in future research.

⁵⁴ Education data is obtained from the U.S. Census Bureau's American Community Survey and is available for years 2008 – 2017 of our sample.

⁵⁵ In additional tests (untabulated), we observe that additional tests are robust to the interaction of *ILI* and *OFFICE GROWTH*, as well as to excluding companies with high office growth.

Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix: Variable definitions

<i>NT</i>	An indicator variable equal to 1 if filing date of the audit report was after the SEC filing deadline, 0 otherwise
<i>LAG</i>	The number of days between the fiscal-year end and the filing date of the audit report, less the filing period mandated by the SEC (60, 75, and 90 days for large accelerated, accelerated, and non-accelerated filers, respectively)
<i>DA</i>	Discretionary accruals estimated using the performance-adjusted modified Jones model (Kothari et al. 2005)
<i>AQ</i>	Accruals quality estimated following Dechow and Dichev (2002)
<i>RESTATEMENT</i>	An indicator variable equal to 1 for all companies that subsequently restated their financial statements, 0 otherwise
<i>MWE</i>	An indicator variable equal to 1 if the auditor failed to identify a MW in year <i>t</i> and management subsequently identified in the first, second, or third quarters of year <i>t</i> +1, 0 otherwise
<i>ILI</i>	The sum of the quartiles of flu spread and severity measured from December 1 st of year <i>t</i> -1 to March 31 st of year <i>t</i>
<i>SIZE</i>	The natural log of total assets
<i>LOSS</i>	An indicator variable equal to 1 if the company reported a net loss in year <i>t</i> or year <i>t</i> -1, 0 otherwise
<i>LIT</i>	An indicator variable equal to 1 if the company operates in a highly litigious industry (SIC codes 2833-2836, 3570-3577, 3600-3674, 5200-5961, and 7370), 0 otherwise
<i>FOREIGN</i>	An indicator variable equal to 1 if the company reports an amount other than zero for foreign currency translation, 0 otherwise
<i>BUS-SEG</i>	The sum of reported business segments
<i>MW</i>	An indicator variable equal to 1 if the company reported an internal control material weakness, 0 otherwise
<i>ROA</i>	Return on assets: net income for the current year divided by total assets as of fiscal-year end
<i>INVREC</i>	The sum of total inventory and total receivables scaled by total assets
<i>RESTRUCTURE</i>	An indicator variable equal to 1 if RCP, RCA, RCEPS, or RCD are nonzero, 0 otherwise
<i>LEVERAGE</i>	The ratio of total debt to total assets
<i>MB</i>	Natural log of the market value of equity over book value of equity
<i>RESTATE</i>	An indicator variable equal to 1 if the company announced a restatement during the fiscal year, 0 otherwise
<i>EXTREMEGROWTH</i>	Deciles of the percentage change in sales growth from year <i>t</i> -1 to year <i>t</i>
<i>GC</i>	An indicator variable equal to 1 if the company received a going-concern audit opinion, 0 otherwise
<i>STD-CASH</i>	The rolling five-year window of standard deviation of operating cash flows
<i>STD-SALES</i>	The rolling five-year window of standard deviation of sales revenue
<i>BIG4</i>	An indicator variable equal to 1 if the auditor is one of the Big 4, 0 otherwise
<i>AUDITOR CHANGE</i>	An indicator variable equal to 1 if this is the first year the auditor is engaged by the client, 0 otherwise
<i>FEES</i>	The natural log of audit fees
<i>OFFICE SIZE</i>	The log of the sum of total fees by audit office
<i>AUDIT TENURE</i>	The number of years the audit firm has been engaged by the client
<i>HEALTH</i>	A scale of 1-5, where 1=excellent health and 5=poor health
<i>VACCINE</i>	The percentage vaccine coverage for each state and year in the sample period
<i>POPD</i>	The log of state population density
<i>CLINT ILI</i>	The sum of the quartiles of flu spread and severity (of the state in which the client is located) measured from December 1 st of year <i>t</i> -1 to March 31 st of year <i>t</i>

(continued on next page)

<i>CLIENT MORE SICK ABNORMAL</i>	An indicator variable equal to 1 if <i>CLIENT ILI</i> is greater than <i>ILI</i> , and 0 otherwise
<i>AUDIT FEES</i>	The residual value estimated from Equation (4)
<i>GOOD HEALTH</i>	An indicator variable equal to 1 if average health is greater than the sample median, and 0 otherwise
<i>HIGH VACCINE</i>	An indicator variable equal to 1 if average vaccine efficacy is greater than the sample median, and 0 otherwise
<i>HIGH DENSITY</i>	An indicator variable equal to 1 if average population density is greater than the sample median, and 0 otherwise
<i>COMPLEX CLIENT</i>	An indicator variable equal to 1 if the client's industry is identified as complex by Bills et al. (2015), and 0 otherwise
<i>HIGH LEVEL 3</i>	An indicator variable equal to 1 if the client's reported amounts of Level 3 assets or liabilities exceeds the sample median, and 0 otherwise
<i>ALTILI</i>	The sum of the quartiles of flu spread and severity measured from January 1 st to March 31 st of year t
<i>ALTILI2</i>	The sum of the quintiles of flu spread and severity measured from December 1 st of year t-1 to March 31 st of year t
<i>OFFICE GROWTH</i>	An indicator variable equal to 1 if the audit office growth, measured as the percentage change in office size (fees), falls into the top decile, 0 otherwise
<i>EDUCATION</i>	The percentage of people within the state that have obtained a Bachelor's degree or higher
<i>SP</i>	An indicator variable equal to 1 if ROA is between 0-1 percent, and 0 otherwise
<i>QOP</i>	An indicator variable equal to 1 if the auditor issued a qualified opinion, and 0 otherwise

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