Manager Characteristics and Early Innovation Adoption during Crises

The Case of COVID-19 Preventive Measures in Danish Eldercare

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Abstract

Reacting rapidly and adequately in the early stages of a crisis is crucial to effective crisis management. This study analyses the relationship between key first-line manager characteristics, early innovation adoption and crisis scenarios in the context of Danish eldercare during the early stages of the COVID-19 crisis. Our findings show that manager characteristics such as education level, eldercare job tenure and previous similar experience are important to early innovation adoption in crises. The study contributes to the crisis management literature by emphasizing the importance of first-line manager characteristics in effective crisis management.

KEYWORDS: COVID-19, crisis management, decision-making, first-line managers, innovation adoption

Introduction

This paper examines the relationship between first-line manager (FLM) characteristics and the early adoption of preventive measures in the first stage of the COVID-19 pandemic. The COVID-19 pandemic has resulted in substantial global problems and has become one of the largest crises of the post-World War II era (Van der Wal 2020). The impact of COVID-19 on some of the most vulnerable communities - residents of nursing homes and other long-term-care facilities – has, furthermore, been particularly critical, COVID-19 affecting the elderly population more than any other group worldwide. Early findings from, for example, Europe indicate that between 37 and 67 % of COVID-19 related deaths were among elderly residents in long-term care facilities (ECDC et al. 2020).

The COVID-19 crisis has also presented leadership, at different levels, with unprecedented challenges. The crisis management literature, however, primarily focusses on national strategies, the responses and actions of political leaders, the response to information asymmetry, the legitimacy of responses and the overall administrative capacity to coordinate and carry out policies during the crisis (Christensen, Lægreid and Rykkja 2016; Ansell, Sørensen and Torfing 2021; Phillips, Roehrich, and Kapletia 2021).

Only a minor proportion of the literature examines the role of public managers as '*the unsung heroes leading us through times of crisis from behind the scenes'* (Van de Wal 2020, 759). This literature draws attention to critical executive crisis management tasks (Boin et al. 2005; Comfort 2007; Boin, Kuipers, and Overdijk 2013), the importance of crisis manager competencies (e.g., Van Wart and Kapucu 2011; Van der Wal 2020), and specific leadership styles that are critical during crises (Yukl 2013).

The amount of research into crisis management is, however, limited (Yukl 2013), the literature furthermore tending to overlook the importance of basic managerial characteristics (Wooten and James 2008). There is therefore an important gap in the crisis management literature, one made even more significant by the decisions and actions of leaders at all levels, in times of crisis, often potentially being a matter of life and death.

In this paper, we contribute to the crisis management literature by examining the importance of managerial characteristics in early innovation adoption, and through integrating and testing arguments from the diffusion of innovation literature to analyse the adoption of new innovations. Focusing on how new ideas, products and organizational practices diffuse within and across members of a social system (Kimberly and Evanisko 1981; Lundblad 2003; Rogers 2003; Damanpour and Schneider 2006, 2009), this literature has also shown that managerial characteristics such as education, tenure and previous similar experience are often of crucial importance to early innovation adoption in different situations. We apply these arguments to advance the crisis management literature, and to examine whether the importance of manager characteristics in early innovation adoption differs between two different crisis scenarios, one in which a manager's organization experiences COVID-19 outbreak and one in which it does not. Figure 1 illustrates the study's theoretical model.

*** FIGURE 1 ***

Two research questions guide the paper: 1) Are managerial characteristics such as education, job tenure and previous similar experience important to early innovation adoption in times of crisis? 2) Does the severity of the crisis make a difference to the importance of managerial characteristics for early innovation adoption?

These research questions are examined in the context of Danish eldercare in the early stages of the COVID-pandemic, a point in time at which some FLMs recognized the signs of an emerging crisis and implemented measures to prevent and mitigate the crisis. FLMs played and still play a critical role in Danish eldercare in the COVID-19 pandemic, through being innovative in the adoption of the measures necessary to prevent COVID-19 infection spreading in their units. This is particularly true in the early phase of the crisis before COVID-19 was declared a global pandemic (on March 11, 2020), when there were no or very few centrally imposed guidelines and instructions that FLMs could apply.

We use survey data collected from FLMs in Danish eldercare in 2020 and apply multiple regression analysis. The analysis provides empirical support for arguments on the importance of previous similar experience of infection prevention and control irrespective of the severity of the crisis, and arguments on the importance of education and eldercare sector tenure being only supported when the crisis is more severe. We find that an academic background is, in the more severe crisis scenario, positively associated with early innovation adoption compared to FLM with vocational and professional backgrounds, and that longer tenure is negatively associated with early innovation adoption.

The remainder of this paper is structured as follows: Firstly, we provide a short overview of key crisis management challenges and tasks and synthesize the existing

literature on the relationship between manager characteristics and diffusion of innovations. The focus in this paper is on the importance of three manager characteristics in two crisis scenarios. We forward eight hypotheses based on this. Secondly, we briefly describe the Danish eldercare system and the impact of the COVID-19 pandemic, as the context of this analysis. Thirdly we describe our data sources and measures, and fourthly present our empirical findings and discuss the implications and limitations and provide suggestions for future research. We finally conclude with answers to our research questions.

Literature and Hypotheses

We understand crisis management, which is defined as the sum of activities aimed at minimizing the impact of a crisis (Boin, Kuipers, and Overdijk 2013), as being organizational leaders' actions that are implemented to reduce the likelihood of a crisis, to minimize the harm of a crisis, and to establish order following a crisis (Boin et al. 2005; Bundy et al. 2017).

The crisis management literature highlights the large number of leadership challenges and strategies that managing a crisis presents (e.g., Boin and t'Hart 2003; Boin et al. 2005; James and Wooten 2005; Comfort 2007; Boin, Kuipers, and Overdijk 2013). For example, Boin, Kuipers, and Overdijk (2013) argue that public leaders face a set of challenges that together constitute the crisis management task. They discuss what they consider to be the ten executive tasks of crisis management, which can also be used to evaluate the performance of a public leader: 1) early recognition, 2) sense making, 3) making critical decisions, 4) orchestrating vertical and horizontal coordination, 5) coupling and decoupling, 6) meaning making, 7) communication, 8) rending accountability (i.e., allocating responsibilities), 9) learning, and 10) enhancing

resilience. Each task is important and requires a different set of skills, organizational strategies, and resources (Boin 2009).

We focus, in this paper, on the initial tasks of early recognition of an emerging risk, sense making, making critical decisions and swift intervention by implementing innovative actions in the early stages of a crisis. Boin et al. (2005, 2013) apply this framework of critical crisis management functions to policy makers and leaders holding high office and strategic positions. We, however, apply this framework to FLMs, i.e., to the operational level in public organizations. In both cases there is a need of swift leadership action, when established formal performance and early warning systems (Hansen 2017) are either too slow or even blind to an emerging crisis.

We integrate, into this, insights from the diffusion of innovations literature, to help understand the importance of basic manager characteristics in early innovation adoption in crisis management, this literature (e.g., Rogers 2003) analysing the factors that influence the adoption of novel ideas, products, and practices by members of a specific social group. Innovation has been defined in several ways (Hansen and Jakobsen 2013). We, however, define it here as being something (an idea, practice or object) that is new or perceived as being new to the individual, or to the unit adopting it (Walker 1969; Damanpour 1991; Rogers 2003; Berry and Berry 2007).

Diffusion studies have examined the impact of different managerial characteristics on public sector innovation (Hansen 2011; de Vries, Bekkers, and Tummers 2016; de Vries, Tummers, and Bekkers 2018; Demircioglu and Van der Wal 2021). Managerial characteristics (e.g.,, Fernandez 2005; Avellaneda 2009), which are often used as proxy measures of managerial capacity, influence manager decisions and strategies, and therefore organizational performance (Avellaneda and Gomes 2015;

Avellaneda, Bello-Gómez, and Olvera 2020). The literature on the diffusion of innovations (e.g., Damanpour and Schneider 2009, Dedehayir et al. 2017) furthermore provides insights into the managerial factors that can influence the adoption of COVID-19 prevention and control measures at an early stage in a crisis. Characteristics of key organizational actors such as gender, age, education, job tenure, political orientation, and attitude to innovation have been shown to influence innovation adoption in several contexts (Kimberly and Evanisko 1981; Greenhalgh et al. 2004; Damanpour and Schneider 2006, 2009; Hansen 2011; Damanpour and Aravind 2012; Wisdom et al. 2014; de Vries, Tummers, and Bekkers 2018).

We focus, however, on the basic characteristics of manager education, job tenure and previous crisis experience as being important antecedents of early innovation adoption. Gender is another variable which was recently found to be important in COVID-19 management at the national strategic level (Park 2021). There is, however, no gender variable variation at the operational level of Danish eldercare (almost all managers being female) in the analysis we conduct here.

The characteristics that are included reflect different knowledge-related dimensions (codified or uncodified), based on expertise or experience. Knowledgeable managers are expected to be more innovative (Avellaneda, Bello-Gómez, and Olvera 2020) than less-knowledgeable managers.

We first hypothesize the direct effects of managerial characteristics on innovation adoption. Then we develop hypotheses for the moderating effects of the crisis scenario on the manager characteristics-early innovation adoption relationship.

Hypotheses

Several studies have found that *education* (i.e., codified knowledge, cf. Lynn [1996]; Avellaneda, Bello-Gómez, and Olvera [2020]) enhances innovation adoption (Kimberly and Evanisko 1981; Rogers 2003; Damanpour and Schneider 2009). The evidence is, however, mixed and varies with context. A recent review of 59 papers published between 1996 and 2015, found 19 papers that studied the impact of education on early innovation adoption. Twelve papers reported a high positive impact, three papers low positive impact and four papers no impact (Dedehayir et al. 2017, Table 2). None of the papers included in this review analysed crisis situations.

Novel idea and solution introduction require the ability to learn. Education is therefore important (Mumford 2000; Damanpour and Schneider 2006, 2009). Educational level, often measured as university level education (e.g., Damanpour and Schneider 2006, 2009; Avellaneda, Bello-Gómez, and Olvera 2020), therefore indicates a higher ability to learn. '*Education brings recognition, leads to better choices and empowers leaders to argue and communicate strategies'* (Avellaneda, Bello-Gómez, and Olvera 2020, 134). Highly educated mangers are more likely to use complex and diverse approaches to problem-solving and decision-making and are more receptive to new ideas. This plays an important role in detecting the need for innovation and in the creation of a favourable environment for its implementation (Kimberly and Evanisko 1981; Damanpour and Schneider 2006, 2009). Our first hypothesis, following these theoretical arguments, therefore is:

H1 – An academic (higher) educational background is positively associated with early innovation adoption

The codified, scientific, and technocratic knowledge acquired through formal education is not the only cognitive resource that is expected to influence managers' decisions and strategies. These decisions and strategies are also influenced by uncodified, intuitive, and context specific manager knowledge (Lynn 1996; Avellaneda 2009). Scientific knowledge is acquired at the university level. Intuitive and context specific knowledge is, however, acquired through work experience (Lynn 1996; Avellaneda 2009). Education endows managers with codified decision-making knowledge, and experience endows managers with uncodified and intuitive knowledge, this type of knowledge (uncodified and intuitive) making managers better equipped to recognize deviations from complex but known processes (Lynn 1996; Boin, Kuipers, and Overdijk 2013).

Managerial work experience is often measured as *job tenure*. Research into this has, however, produced mixed results (see Olvera and Avellaneda [2019] for a discussion on the work experience construct). Researchers furthermore argue that manager tenure could both positively and negatively affect innovation adoption (Kimberly and Evanisko 1981; Damanpour and Schneider 2006, 2009).

Longer-tenured managers hold some advantages in innovation adoption, manager longevity providing greater institutional legitimacy and contextual knowledge of how to accomplish tasks, manage political processes, and obtain desired outcomes (Kimberly and Evanisko 1981; Damanpour and Schneider 2006, 2009; Korac, Saliterer, and Walker 2017), all of which are required when innovating. Managers with short tenures may not, however, be sufficiently familiar with their job and the organization (Damanpour and Schneider 2009), and may lack the legitimacy, knowledge, and skills required to manage innovation adoption.

A negative relationship can, conversely, be expected based on new or short-tenured managers having different perspectives, new ideas and fewer obligations to internal constituencies than longer-tenured managers, which may lead to the more successful introduction of innovation than by the long-tenured (Kimberly and Evanisko 1981; Damanpour 1991). Longer tenure managers have also been socialized into accepting the prevailing organizational conditions and routines, and are therefore less likely to adopt new ways of doing things (Damanpour and Schneider 2006, 2009; Hansen 2011). Tenure could therefore inhibit innovation adoption, as managers' sensitivity to information related to their work responsibilities may potentially negatively bias their inclination to change the status quo and to champion innovation and change (Huber et al. 1993; Hambrick and Mason 1984; Damanpour and Schneider 2006, 2009). Damanpour and Schneider (2009, see also e.g., Miller [1991] and Andrews et al. [2021]) combine the two opposing arguments and propose an inverted U-shaped relationship for job tenure.

Short tenure may negatively affect innovation, due to managers not being familiar enough with their job and the organization. Tenure, over time, will facilitate adoption as managers gain experience, as they become familiar with critical issues during innovation processes, and learn how to resolve them. The impact of job tenure will, however, reverse at the point where long-tenured managers identify fully and accept existing organizational routines and practices, longer-tenured managers becoming therefore more inclined to accept the situation as it has become, to champion fewer innovations and support fewer changes (Damanpour and Schneider, 2006, 2009). We therefore forward the following three competing hypotheses to reflect and test the three lines of argument in the literature:

H2a – Shorter eldercare tenure is positively associated with early innovation adoption

H2b – Longer eldercare tenure is positively associated with early innovation adoption

H2c – The eldercare tenure and early innovation adoption relationship is inversely u-shaped

Job tenure reflects length of service and therefore the level of manager experience of their position, their organization, or their job in the sector. This experience does not, however, necessarily include experience in and knowledge of the innovation in question or of previous, similar innovations. Viable solutions to novel problems do not arise in a vacuum. Research has furthermore found that previous knowledge and experience influences creative problem solving. The ability to generate viable, original solutions to novel problems does not depend solely on a knowledge of an innovation, but also on the expertise, skills and knowledge acquired through experience (Mumford 2000). The diffusion of innovations literature does not, to the best of our knowledge, address individual characteristics in the form of *previous similar experience*. Rogers (2003), however, argues how compatibility, as an attribute of an innovation, affects adoption. An innovation that is more compatible with existing values, past experiences, and the needs of potential adopters is less uncertain to the potential adopter and is more readily adopted. A manager with previous similar experience of an innovation may therefore be more inclined to adopt the innovation in the future (Young, Charns, and Shortell 2001). This means, in this study, that managers implement infection prevention and control measures that were used previously in similar situations, these being adapted if necessary. Managers, through drawing on

experience, know the pros and cons of different strategies, and are therefore better able to put measures into place at a relatively early stage in a crisis than managers who do not have any experience to draw on.

Knowledge gained from experience will, from a crisis management perspective, also promote manager adoption of a more planned and more proactive approach to dealing with a crisis (Wooten and James 2008; Boin and Renaud 2013; Ansell and Boin 2019). For example, Boin, Kuipers, and Overdijk (2013, 82) suggest that *'[e]ffective crisis management begins with a shared recognition that a threat has emerged which requires immediate attention',* and that the early recognition of a potential crisis, which is the first of the ten executive crisis management tasks, is promoted by extensive previous similar experience of crises and the dynamics. This experience makes managers better able to recognize deviations from complex but known processes. Experience from previous events can be usefully applied to similar crises and represents a form of learning from the past (Moynihan 2008; Ansell and Boin 2019), crisis experience also helping give managers insight into the recognition of a new crisis, an ability to react adequately, and a knowledge of how to handle a crisis. We hypothesize, from these arguments, that FLMs who have previous similar experience of infection prevention and control (e.g., from the health care sector and experience of which measures are adequate in preventing and mitigating a virus outbreak) increase the likelihood of early preventive measure adoption. We therefore forward the following hypothesis to test the argument:

H3 – Previous similar experience of infection prevention and control is positively associated with early innovation adoption

Two types of crisis scenario are provided by the eldercare services context during the COVID-19 pandemic, as illustrated in the next section. The first is a general society level scenario in which the COVID-19 pandemic represents a potential organizational crisis that is characterized by outbreaks outside of the FLM's organization but no outbreaks within the FLM's organization. The second is an organizational level scenario in which COVID-19 is a realized organizational crisis that is characterized by outbreaks within an FLM's organization, among staff and/or nursing home residents and home care recipients. Even though COVID-19 cases among nursing home residents and home care recipients increase with the incidence of COVID-19 in a municipality (Rauhala et al. forthcoming), the difference between the first and second scenario for FLMs is, however, critical. An internal crisis scenario represents a more stressful situation than an external crisis scenario. The external crisis can only potentially cause a crisis within the organization. The internal crisis is, however, more critical, COVID-19 outbreaks bringing life-and death-consequences for nursing home residents and home care recipients, both being more vulnerable to COVID-19.

Some leadership studies suggest that the education and experience of managers might, under certain external constraints, not contribute to organizational performance (Fiedler 1986). Other studies (e.g., Riccucci [1995]) conversely suggest previous similar experience has, under stressful conditions, a positive effect on a leader's effectiveness. Experience helps leaders develop technical expertise and allows them to better cope with difficult situations (Fernandez 2005). We therefore expect the relationship between manager characteristics and early adoption to be moderated by crisis scenario. Hypotheses are therefore proposed in which the strength of the associations between

manager characteristics and early innovation adoption is positively moderated where COVID-19 is an organizational crisis characterized by outbreaks within an organization but is not where COVID-19 is a potential organizational crisis characterized by outbreaks outside of the FLM's organization. We therefore forward the following three moderation hypotheses to test the argument of the greater importance of manager characteristics in a more severe crisis scenario.

H4a – The internal crisis scenario moderates positively (increases) the strength of the association between academic educational background and early innovation adoption.
H4b - The internal crisis scenario moderates positively (increases) the strength of the association between eldercare tenure and early innovation adoption
H4c - The internal crisis scenario moderates positively (increases) the strength of the association between previous similar experience with infection prevention and control and early innovation adoption.

Danish Eldercare and the Impact of COVID-19

Eldercare services in Denmark are, as in other Nordic countries, characterized by universal provision. I.e., publicly financed and high quality services provided to all citizens based on their needs (Meagher and Szebehely 2013). Eldercare services are also primarily located at the municipal level, local authorities having primary responsibility for implementing national legislation, for funding care services, and for providing the vast majority of these services. Services include home care, home nursing care, care at nursing homes and nursing home facilities, food services and training and rehabilitation. Provision has declined in the past decade. Denmark still, however, has one of the most comprehensive eldercare systems in the EU (WHO 2019).

The COVID-19 pandemic in Denmark is part of the ongoing global pandemic. The virus was first confirmed to have reached Denmark on 27 February 2020, the first COVID-19 cases in Danish nursing homes being reported in mid-March 2020. The COVID-19 pandemic has, worldwide, had a very major negative impact on the eldercare sector, massive outbreaks being reported in long-term care facilities, and affecting both residents, care workers and relatives.

The Danish national strategy for the COVID-19 crisis response has, since the COVID-19 pandemic outbreak, notably focused on protecting the elderly and other vulnerable persons from COVID-19, particularly the elderly residing in long-term care facilities who, because of age and comorbidity, have a higher risk of developing a more severe form of the disease, and greater mortality (Jordan, Adab, and Cheng 2020). The Danish national strategy in the eldercare sector has, apart from a few mandatory, centrally defined visiting restrictions and prohibitions for nursing homes, mainly consisted of centrally defined instructions and guidelines that provide great local autonomy, but also transfer responsibility for dealing with the crisis to local authorities and local FLMs. The implementation of restrictions, instructions and guidelines therefore became the remit of local governments and in particular FLMs, who also had to develop and adopt new local strategies and specific measures to solve specific problems related to COVID-19 outbreak prevention and management in residential and home care units (Hansen et al. 2020). The Danish health authorities only provided a few guidelines and recommendations to the eldercare sector for infection prevention and control in phase one, the first wave of the pandemic (defined as January to mid-March 2020) (see Rostgaard [2020] for an overview), most centrally defined COVID-19 restrictions, directions, guidelines, and recommendations for the Danish eldercare sector

coming later in phase two (mid-March – April 2020). The adoption of innovative measures to prevent COVID-19 was therefore largely, before mid-March, the responsibility of FLMs.

Data and Methods

Data

Our analysis draws on quantitative data collected in September 2020 through a web-based survey distributed to all FLMs in the Danish eldercare sector. The survey was designed to explore how FLMs in Danish eldercare responded to and experienced the COVID-19 crisis through three distinct phases in 2020. We, to inform the design and content of the survey, conducted 25 explorative interviews with FLMs in different eldercare organizations and contexts. The survey was tested and adjusted using the input from pilot respondents and from Nordic researchers with expertise within eldercare. The survey provides data on a number of widely shared innovations and the time of their adoption in Danish eldercare, which is a focus of our study.

The survey was distributed to all identifiable FLMs employed in the public and private (non-profit and for profit) sector with responsibilities for eldercare in Denmark. The contact information of all FLMs was collected from available official registers, webpages and phone contacts, a total of 1,447 valid contacts being identified. Data collection included an initial invitation and three reminders sent to non-respondent FLMs. We registered 865 responses at the end of data collection, 655 responses being complete and 210 partially complete. The minimum and maximum response rates are, according to common standards for survey research, 44% and 60% respectively. A test for non-respondent bias (Armstrong and Overton 1977) showed only a very few

statistically significant differences in the early and late response data. The test indicates that it is unlikely that our data suffers from non-respondent bias to any substantial degree.

Measures

We included 17 variables in our analysis, based on a larger number of survey items. Appendix A1 provides translated versions of all the survey items included.

Our outcome variable (V1) for 'early adoption' is an index of the number of preventive measures a FLM implemented in their organization in the weeks leading up to the general lockdown in Denmark in mid-March. There were few recommendations on how to deal with COVID-19 in this first phase. FLMs therefore had substantial discretion in how they handled the COVID-19 pandemic. The measures introduced in the first phase were adopted by a larger number of organizations in later phases of the pandemic.

The index for early adoption draws on survey items for seven measures that FLMs had substantial discretion to implement. Examples of these measures include the use of limited movement of citizens, increased attention to contact point cleaning (e.g., door handles), and limitation of services (e.g., cancellation of non-critical services such as practical assistance, physiotherapy or social events). There was also a widespread awareness of a number of other measures among FLMs in this phase. Their adoption, however, depended primarily on external situational factors such as the general availability of COVID-19 test facilities or use of personal protective equipment (not shown).

Our three key explanatory variables for manager characteristics measure the FLMs' educational background, their total tenure in eldercare, and previous similar experience with infection prevention and control (see also appendix A1).

Education (V2–V4) is a categorical variable that measures whether a FLM has a vocational, professional, or academic background, FLM educational background being measured by a set of survey items. We, for analytical purposes, recoded the survey items as three dummy variables, and used academic education as a reference category.

Tenure in eldercare (V5) is an interval-scaled variable that is based on a single survey item that measures FLM total tenure within eldercare. This is irrespective of FLMs has held different (leadership) positions or previously has worked in different eldercare organizations.

Previous similar experience of infection prevention and control (V6) is a dummy variable that is based on a single survey item, which measures whether or not a FLM has previous professional experience of infection prevention and control, e.g., from the health care sector and of measures that are adequate to prevent and mitigate a crisis. The variable is coded as '1' for previous similar experience and '0' for no previous similar experience.

Our moderating variable for the severity of crisis, 'internal COVID-19 outbreak', (V7) measures whether or not there was an internal COVID-19 outbreak among the staff and/or nursing home residents/home care recipients of the FLM's organization. The survey measured the total number of staff and/or residents/recipients who contracted COVID-19 in each phase. Whether a COVID-19 outbreak occurs or not within a FLM's organization is the most critical difference between organizations. We

recoded the variable as a dummy variable, '1' for an internal COVID-19 outbreak and '0' for no outbreak.

We include a set of interaction terms (V8–V12) to address our theoretical interest in the importance of crisis scenario severity (organizational versus general level). The inclusion of interaction terms in the regression models changes the interpretation of coefficients, which become estimated at a value of '0' for the other variable(s) included in the interaction terms. We therefore mean centred the variable for tenure in eldercare (V5) to the grand mean to maintain interpretability as it makes less sense to estimate the importance of 'no tenure' for early adoption in the context of our study. After the mean centring the mean tenure of 20.56 years is represented by the value of '0'. All dummy variables included in interaction terms are also coded so as the value of '0' represents a meaningful subgroup.

We include five control variables (V13–V17) beyond our focal variables and interaction terms. The control variables include measures of gender, FLM primary manager function, the number of staff the FLM is responsible for, the service type, and sector affiliation (see also appendix A1).

Table 1 provides an overview of the descriptive statistics for all our variables, including our interaction terms. We only include cases where valid data for all variables (N=555) is available. Our n is relatively high. It is, however, important to note that the statistical power for significance test in our analysis varies due to the different sizes of the subgroups in the dataset. For example, those with a vocational educational background who reported an internal outbreak (education, vocational × outbreak) account for 2% of the 555 respondents in the dataset. Differences between larger groups are more certain and easier to detect than for smaller groups. We therefore apply a more

liberal p-level of .10 to judging statistical significance, to avoid type II errors (false negatives), even though this increases the chances of type I errors (false positives).

*** TABLE 1 ***

Findings

We analyse our data and test our hypotheses using linear regression with ordinary least square (OLS) estimation. We estimate two main models, to allow the comparison of results without and with interaction terms. All estimations are carried out in the statistical software package IBM SPSS 27.0, including process tool 3.5 (Hayes 2018). Table 2 reports our main results (bivariate correlations are reported in A2 in Appendix).

*** TABLE 2 ***

White's test for heteroscedasticity suggests that a robust estimation of standard errors and p-values is advisable for model 1 (p = .049). The test is insignificant for model 2 (p =. 258), which also suggests an improvement over model 1. We, however, use the more conservative significance tests with robust estimation across the two models to make results comparable.

The explained variance is low in both models (adj. R^2 = .057 and .067). The significant F-tests (p <.001), however, show that the models explain a statistically significant degree of the variance. The insignificant results from the lack of fit test (p= .318 and p = .327) also indicate that the models fit the data relatively well. We, however, also fitted models with additional interaction terms, to check the importance to early adoption of any interaction between tenure and educational background and

COVID-19 outbreak (not shown). The parameter estimates were small and statistically insignificant (b = -.017, p = .618 and .002, p = .941), and their addition caused no substantial changes in other parameter estimates and p-values in the model.

Our results in model 1 (table 2) provide no initial empirical support for the H1 hypothesis of the general importance of educational background (b = -.156, p = .696 and b = -.535, p = .120) or the H2a-c hypotheses of eldercare job tenure (b = .009 p = .366). The results in model 1, however, provide empirical support for the H3 hypothesis that FLMs with previous similar experience of infection prevention and control adapted more measures at an early stage of the crisis than those without experience (b = .494, p = .044). The estimate suggests that those with previous similar experience of infection prevention and control, on average, adapted around .5 more measures than those without previous similar experience.

The inclusion of interaction terms in model 2 (table 2) provides insights into whether the importance of FLM characteristics differs between the critical internal outbreak and the no internal outbreak situation. The two interactions for education × outbreak and tenure × outbreak are statistically significant ($p < .05$) and help improve the model's explained variance (R^2).

Our results in model 2 provide support for the H1 and H2a hypotheses in the case of an internal crisis scenario. The results also provide empirical support for hypothesis H4a and H4b, suggesting FLM educational background and tenure in eldercare make a difference to early adoption of measures in situations of an internal outbreak, when compared with no internal outbreak. The interaction term for previous similar experience × outbreak is insignificant (p = .362) and we find no support for hypothesis (H4c), this hypothesis being that the importance of previous similar

experience of infection control differs between a situation with and without an internal outbreak[i].

Additional probing analysis and plots (Hayes 2018) of the two statistically significant interactions are provided in appendices A3 and A4. A key aspect is that the plots illustrate the very substantial differences in the number of preventive measures adopted by managers with different educational backgrounds under the two crisis scenarios. The plots also illustrate that the negative effect of longer tenure in a more severe crisis scenario is modest, based on a comparison of the number of preventive measures adopted under the two crisis scenarios.

We, in addition to the regression models shown in table 2, estimated models (not shown) using a quadratic term which was included for tenure in eldercare (i.e. tenure × tenure) to test hypothesis H2c, this hypothesis being whether the relationship between tenure and early innovation adoption is U-shaped (inverted) as discussed in the literature. The estimate for the quadratic term was statistically insignificant in models without and with the interaction terms (b = -.001, p = .487 and b = .000, p = .615). The inclusion of the quadratic term caused only small and inconsequential changes in other estimates and their statistical significance. We therefore find no empirical support for the hypothesis of an inverted U-shaped relationship between tenure and early adoption.

Findings for our control variables (model 2) show that differences in early innovation adoption are statistically significant at p-level .05 across service type (b = -433, p = .044) and p-level .10 across the public and private sector (b = -571, p = .061). The findings indicate that early innovation adoption was more frequent in home care than in nursing homes, and more frequent in the private sector than in the public sector.

We therefore find empirical support for service and sector differences that are not explained by other variables in our analysis.

Findings from the hypotheses test are summarized in Table 3, our study overall providing empirical support for three hypotheses. The findings provide empirical support for hypothesis H3, this hypothesis being the importance of previous similar experience of infection prevention and control to early adoption. We also find support for the hypotheses of a positive moderation of the importance of educational background (H4a) and tenure (H4b) in early adoption under a more severe crisis scenario.

*** Around here table 3***

Discussion

The COVID-19 pandemic has had a dramatic impact on the world, and presented unprecedented challenges to all parts of society, not least the eldercare sector. Questions such as '*Could we have done better with COVID-19 in nursing homes?*' (Szczerbińska 2020) and *'Too little, too late?'* (Daly et al. forthcoming) have therefore been raised.

It has been suggested that the causes of the problematic COVID-19 situation, particularly in nursing homes, can be traced to a long term disregard and neglect of the sector (Heudorf et al. 2020; Szczerbińska 2020), to the eldercare sector being abandoned at a time when all health care settings were struggling with a shortage of personal protective equipment and testing, and to the eldercare sector simply not being prepared for the outbreak (Szczerbińska 2020).

COVID-19 will not, as WHO Director-General Tedros Adhanom Ghebreyesus said at the launch of the Global Preparedness Monitoring Board (GPMB) 2020 report (WHO 2020), be the last pandemic nor the last global health emergency. Crisis management will, beyond COVID-19, remain a key core public management task.

Crisis necessitates critical decisions and actions (Boin et al. 2005; Boin, Kuipers, and Overdijk 2013), and FLMs play a critical role in coping with the COVID-19 pandemic. We therefore asked whether certain manager characteristics are particularly important to the way in which FLMs deal with the early phases of a crisis, and whether the severity of the crisis changes the importance of these characteristics.

This study confirms that managerial characteristics play a significant role in predicting early innovation adoption in local crisis management. We find, based on our analysis, empirical support for the hypothesis that previous similar experience of infection prevention and control is a FLM characteristic that is significantly associated with early adoption of COVID-19 prevention and control measures. Previous similar experience of infection prevention and control is, furthermore, a significant factor in early innovation adoption, irrespective of crisis severity.

Our analysis shows that FLMs with previous similar experience of infection prevention and control adopt more prevention and control measures at an early stage of a crisis than FLMs without this experience. An important task in crisis management is the early recognition of an upcoming crisis (Boin et al. 2005; Comfort 2007; Boin, Kuipers, and Overdijk 2013). Our study indicates that previous similar experience increases the likelihood of such early recognition.

We furthermore find that the significance of managerial characteristics varies with crisis severity, which is measured as internal outbreak or no internal outbreak in a FLM's eldercare unit. The study shows that FLM's education and eldercare job tenure, in an internal COVID-19 outbreak in an eldercare unit, increases the likelihood of early adoption of preventive measures. We find that FLMs with an academic educational background adopt more measures at an early stage of an internal outbreak than colleagues with either vocational or professional educational backgrounds. This lends support to the argument that academic education can provide managers with more of the theoretical knowledge and analytical skills required for innovation adoption.

We also find that FLMs with shorter tenure in the eldercare sector, adopt more measures at an early stage of an internal outbreak than FLMs with longer tenure. This finding suggests that managers with short tenures bring new and different perspectives to the organization. Short-tenured FLMs are not able to rely on existing procedures and routines, and therefore analyse the situation and are creative in their response to the new but critical situation. This increases the likelihood of early innovation adoption.

We finally find no empirical support for the theoretical argument of an inverted U-shaped relationship between tenure and early adoption.

Implications

These findings have both theoretical and practical implications. This paper contributes to the crisis management literature in two ways. Firstly, the crisis management literature has paid more attention to the role of public managers and their tasks in times of crises, our knowledge of the importance of their basic characteristics in crisis situations being small. We therefore contribute to the scarce crisis management literature on the importance of basic manager characteristics, by introducing arguments from the

diffusion of innovations literature and analysing the importance of basic manager characteristics in crisis management through the early and timely adoption of infection prevention and control measures.

Secondly, we contribute to this literature by nuancing the understanding of the role of past experience in crisis management, and by analysing the influence of managers' previous similar experience of infection prevention and control on the early adoption of preventive and controlling measures. Previous crisis experience provides managers with insights that help them recognize an upcoming crisis, and with the ability to react rapidly and adequately.

This paper also illustrates some practical implications for crisis management. Managers need to adapt quickly in times of crisis, and to meet the need for action, i.e. by adopting the measures necessary to prevent and mitigate a virus outbreak. Even though leadership in crisis situations can be perceived as being a systemic function, i.e., based on collective action and responsibility, and not solely on leadership exercised by individuals (Comfort and Okada 2013), this paper focuses on three individual managerial antecedents of early adoption. Our findings provide insights into how a more effective future crisis management can be ensured, i.e. through it being ensured that eldercare FLMs are well prepared and equipped with the skillsets and competencies needed to better cope with future pandemics and global health crises such as COVID-19. Crisis necessitates early recognition, critical decisions and actions (Boin et al. 2005; Boin, Kuipers, and Overdijk 2013), and FLMs have played and still play a critical role in coping with the COVID-19 pandemic. One of the key factors of building well-prepared resilient organizations is to ensure that FLMs have the crisis leadership characteristics required (representing different kinds of knowledge) to recognize an

imminent crisis and react rapidly, by adopting the measures and interventions necessary in early crisis stages.

Our findings indicate that academic education, shorter eldercare tenure and previous similar experience of infection prevention and control are important manager characteristics in early innovation adoption in crises. Education and tenure are, however, only important when the crisis is severe, where there are one or more internal outbreaks in the FLM's organization. The majority of FLMs in Denmark's eldercare sector has a vocational or professional educational background (i.e. nursing assistant or nurse). It is therefore important to ensure that the eldercare sector is sufficiently well prepared for future similar crises, through the identification of the skills and competencies managers need to be effective in crisis situations, and the integration of the training of these skills into professional management, based on a recognition that FLMs are responsible for managing both routine and extreme events. It is crucial that FLMs, as first-line *crisis* managers, have sufficient education and previous similar experience to enable them to recognize a crisis and to be able to react rapidly, timely, and sufficiently.

Limitations and Future Research

The data in our analysis, as in numerous diffusion of innovations studies (e.g., Berry and Berry 2007; Bhatti, Olsen, and Pedersen 2011), is recall data collected at one point in time through respondent post-hoc self-reporting. The recall problem is one of a number of diffusion research shortcomings (Rogers 2003), and poses potential limitations on the measurement of the dependent variable. Data obtained from respondents who must remember (far) back in time is not always accurate.

Triangulating self-reporting data with multiple sources of information e.g., reports, minutes from meetings, and other relevant documents, could increase validity.

This paper focuses primarily on the importance of manager characteristics in the adoption of preventive and controlling measures in the early phases of a crisis (preparation and response phases). This research does not, therefore, focus on crisis management tasks and activities in later stages of the crisis. Crises are constantly evolving, and different forms of leadership and executive tasks may be required in different phases of a crisis (Wooten and James 2008; Hannah et al. 2009). We therefore do not know whether the effects of first-mover characteristics on early adoption disappear over time, or whether other managerial characteristics have a greater impact on crisis management in later phases of a crisis. Future research could usefully focus on the time dimension, and examine whether different phases of the crisis require different manager skillsets. Executive crisis manager tasks other than the early recognition and critical decisions examined in this paper, could therefore be investigated.

This study furthermore examines output (the number of preventive measures a FLM has implemented at an early phase of the pandemic) and not the outcome or crisis management performance (e.g., number of confirmed COVID-19 cases and/or COVID-19-related deaths in the FLM's eldercare unit). We cannot therefore, based on our analysis, say whether some managers have been more successful as early adopters at keeping COVID-19 out of their eldercare units. Our recommendation therefore is that future studies analyse the relationship between manager characteristics and crisis outcome.

We find that the severity of a crisis moderates the importance of some manager early adoption characteristics. The study therefore supports and complements arguments

on the importance of manager characteristics in early adoption, by analysing manager characteristics in the context of a crisis. We, however, only find some manager characteristics (education and eldercare job tenure) to be moderated by the severity of the crisis, previous similar experience not being moderated. As a secondary finding we find that private eldercare organizations appear to adopt more innovations in times of crisis than public eldercare organizations. More empirical research is required to validate our findings and to analyse why this could be the case. Our findings are also sector specific, which provides high internal validity for this type of service. Generalizations to other types of services, however, needs to be backed by empirical research.

Conclusion

Reacting rapidly and adequately in early stages of a crisis, through both recognizing an emerging threat, making critical decisions, and initiating actions to mitigate the impact of a crisis, is crucial in effective crisis management (Boin et al., 2005; Boin, Kuipers, and Overdijk 2013). We examine whether managerial characteristics increase the likelihood of managers' rapid reaction and adoption of preventive and controlling measures in the early stages of the COVID-19 crisis.

We integrated insights from the diffusion of innovations literature into a crisis management framework and posed two questions: 1) Are managerial characteristics such as education, job tenure and previous similar experience important to early innovation adoption in times of crisis? 2) Does the severity of the crisis make a difference to the importance of managerial characteristics for early innovation adoption? These questions are central to a broader understanding of the role played by FLMs in crisis management. It is important to understand whether and how basic manager

characteristics make a difference in times of a crisis, such as the COVID-19 pandemic, the decisions and actions of leaders in this crisis being a matter of life and death.

This study yields three main findings: Firstly, we find empirical support for the hypothesis that previous similar experience of infection prevention and control increases the likelihood of preventive measures being adopted in the initial phase of the COVID-19 crisis. FLMs with previous similar experience of infection prevention and control adopt more preventive COVID-19 measures at an early stage of the pandemic, than FLMs without previous similar experience of infection prevention and controlling measures. Our second and third primary finding is that education and tenure are important characteristics *only* when a crisis is critical with one or more internal outbreaks in an eldercare unit. We find that FLMs with an academic education, in an internal outbreak situation, adopt more preventive measures in the early phases of the COVID-19 crisis than FLMs with vocational and professional educational backgrounds. We also find that FLMs with shorter eldercare sector tenure, in an internal outbreak situation, adopt more measures at an early stage than FLMs with longer tenure in eldercare.

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Tables

Table 1. Descriptive Statistics

Variable	M [a]	SD	Min-Max
V1 Early adoption index, 7 items	2.24	2.45	0–7
V2 Education, vocational (no=0, yes=1)	28%	N / A	0–1
V3 Education, profession (no=0, yes=1)	61%	N / A	0–1
V4 Education, academic (no=0, yes=1)	11%	N / A	0–1
V5 Tenure (eldercare, years)	20.56	10.73	0–46
V6 Previous similar experience w/infection control (no=0, yes=1)	83%	N / A	0–1
V7 COVID-19 outbreak, staff/citizen (No=0, Yes=1)	8%	N / A	0–1
V8 Education, vocational × outbreak	2%	N / A	0.00–1.00
V9 Education, professional × outbreak	5%	N / A	0.00–1.00
V10 Education, academic × outbreak	2%	N / A	0.00–1.00
V11Tenure (mean centered) [b] × outbreak	0.04	3.09	-19.56–24.44
V12 Previous similar experience × outbreak	7%	N / A	0.00–1.00
V13 Gender (male=0, female=1)	94%	N / A	0–1
V14 Manager of leaders (0=no, 1=yes)	30%	N / A	0–1
V15 Staff number (LN)	4.06	0.61	0.00–6.35
V16 Service (home care=0, nursing home=1)	66%	N / A	0–1
V17 Sector (private=0, public=1)	86%	N / A	0–1

N = 555

[a] For dummy variables (coded ‘0’ and ‘1’), the percentage for the value of 1 is presented.

[b] Variable for tenure is mean centered (mean = 0) in the analysis for creation of the interaction variable.

Table 2. OLS regressions: Early adoption of COVID-19 preventive measures (7-item measure)

Variables	Model 1			Model 2		
	B [a]	SE [b]	P	B [a]	SE [b]	P
Focal manager characteristics						
Education, vocational	-.156	.386	.686	.122	.408	.765
Education, profession	-.535	.343.	.120	-.250	.371	.500
Education, academic (ref. cat.)	-	-	-	-	-	-
Tenure (eldercare, years, mean centered)	.009	.010	.366	.014	.010	.160
Previous similar experience w/infection control (no=0, yes=1)	**.494**	**.245**	**.044**	**.561**	**.255**	**.028**
Crisis situation (level of crisis)						
COVID-19 outbreak, staff/citizen (No=0, Yes=1)	**1.682**	**.340**	**< .001**	**3.852**	**.792**	**<.001**
Interactions						
Education, vocational × outbreak	-	-	-	**-1.886**	**.919**	**.041**
Education, profession × outbreak	-	-	-	**-2.008**	**.710**	**.005**
Education, academic × outbreak (ref. cat.)	-	-	-	-	-	-
Tenure (mean centered) × outbreak	-	-	-	**-.068**	**.033**	**.042**
Previous similar experience × outbreak	-	-	-	-.658	.721	.362
Controls						
Gender (male=0, female=1)	.017	.418	.982	.015	.417	.971
Manager of leaders (0=no, 1=yes)	.443	.287	.131	.407	.286	.155
Staff number (LN)	-.188	.187	.316	-.173	.186	.353
Service (home care=0, nursing home=1)	**.453**	**.215**	**.035**	**.433**	**.215**	**.044**
Sector (private=0, public=1)	**-.543**	**.304**	**.079**	**-.571**	**.304**	**.061**
Model summary						
Model constant	2.841	.973	.004	2.524	.976	.010
F-test	4.378 (10), p < .001			3.846 (14), p < .001		
R^2 / adj. R^2	.074 / .057			.091 / .067		
Lack of fit test	1.282 (531), p = .318			1.269 (527), p = .327		
White's test for heteroscedasticity	χ^2 (56) = 74.633, p = .049			χ^2 (80) = 87.788, p = .258		

N = 555.

[a] Unstandardized Beta coefficients

[b] Robust standard errors.

Table 3: Summary of hypotheses and findings

Hypothesis		**Finding**
H1:	An academic (higher) educational background is positively associated with early innovation adoption	Partial supported (only in an internal crisis scenario)
H2a:	Shorter eldercare tenure is positively associated with early innovation adoption	Partial supported (only in an internal crisis scenario)
H2b:	Longer eldercare tenure is positively associated with early innovation adoption	Not Supported
H2c:	The association between eldercare tenure and early innovation adoption is inversely u-shaped	Not Supported
H3:	Previous similar experience of infection prevention and control is positively associated with early innovation adoption	Supported
H4a:	The internal crisis scenario moderates positively (increases) the strength of the association between academic educational background and early innovation adoption	Supported
H4b:	The internal crisis scenario moderates positively (increases) the strength of the association between eldercare tenure and early innovation adoption	Supported
H4c	The internal crisis scenario moderates positively (increases) the strength of the association between previous similar experience of infection prevention and control and early innovation adoption	Not supported

Figures

Figure 1. Theoretical model

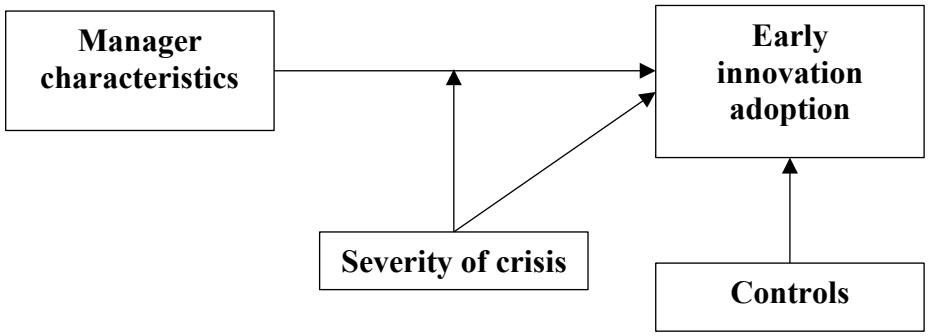


Figure captions:

- Figure 1. Theoretical model

Appendices

Appendix A1: Variables and survey items

Variable	Survey formulations	Notes
V1	Which of the following COVID-19 preventive measures have been implemented in your eldercare unit since March until today? Please indicate for each of the three phases, if you have implemented the preventive measures in the eldercare unit that you are in charge of (e.g.,, nursing home and home care district). Response categories are still organized into three phases. Measures can be prioritized differently from one phase to another (Phase 1: January – mid-March) • Lockdown restrictions (visitors and residents leaving nursing home) • Reduce nursing home residents' freedom of movement (e.g.,, organize zones and closing off areas/facilities) • Reorganize meals, e.g.,, avoid buffet-style dining, single serve portions instead • Organize staff into teams to reduce several different contacts between staff and home care recipients/nursing home residents • Intensified attention to cleaning, especially contact points (e.g.,, door handles) and surfaces that are touched by many people, both at the workplace and in nursing home residents'/ home care recipients' own homes • Cancellation or postponement of services (noncritical services such as practical help, physiotherapy or social events) • Increased requirements for employees' personal protective measures during off-duty hours	Responses (yes/no) recoded to a summative index for early adoption where 0 = none and 7 = all measures.
V2–V4	What is your education? (more answers possible) • Social and healthcare helper • Social and healthcare assistant • Nurse • Physiotherapist • Occupational therapist • Pedagogue • Other medium-term higher education programme • Long-term higher education programme in social sciences • Long-term higher education programme in healthcare • Other long-term higher education programme	Recoded to dummy variables for vocational (items 1–2), professional (3–6) and academic (8–10) educational background
V5	How many years have you worked in the eldercare sector? (years)	Continuous variable
V6	Do you have previous similar experience of infection prevention and control? (yes/no)	Recoded to a dummy variable
V7	How many COVID-19 cases have been reported in the unit that you are in charge of? (Phase 1: January – mid-March) • Among employees and managers • Among home care recipients/nursing home residents	Recoded to yes or no.

	• Among relatives of home care recipients/nursing home residents	
V13	What is your gender? • Female • Male • Other/prefer not to answer	Recoded to dummy variable
V14	Which of the following categories best characterize your current position? (Yes/No) • Manager with responsibility for employees (e.g., manager of eldercare unit with staff responsibility) • Manager with responsibility for leaders (e.g., manager of nursing home or district manager responsible for a nursing home or/and multiple units/home care districts) • Other management position	Recoded to dummy variable
V15	How many employees are you responsible for? (Response option: total number)	Continuous variable
V16–V17	Which of the following categories best characterize the unit that you are in charge of? (Response options: Yes/No) • Public nursing home/assisted living facility • Public home care/home nursing care unit • Private nursing home/assisted living facility (non-profit) • Private nursing home/assisted living facility (for-profit) • Non-profit home care provider • For-profit home care provider	Responses (yes / no recoded to nursing homes or home care (V16) and public or private (V17)

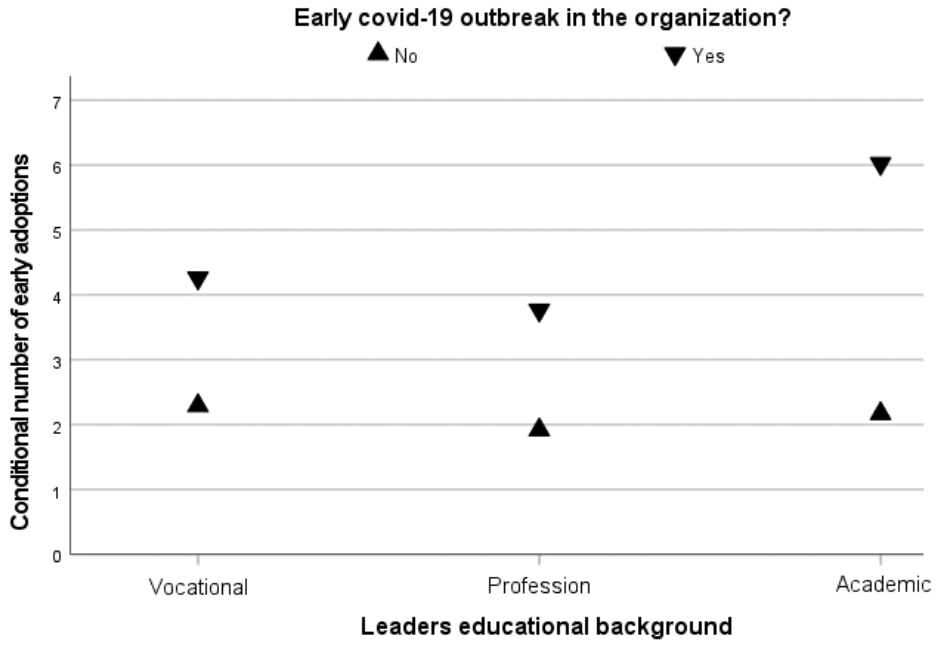
Notes: V8 – V12 are interaction terms based on other variables in the table. (V8: Education, vocational x outbreak. V9: Education, professional x outbreak. V10: Education, academic x outbreak. V11: Tenure (mean centred) x outbreak. V12: Previous similar experience x outbreak)

Appendix A2: Bivariate correlations

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16
V2	0.05															
V3	-0.07	-0.78**														
V4	0.05	-0.22**	-0.44**													
V5	0.06	0.23**	-0.15**	-0.09*												
V6	0.07	-0.05	0.01	0.05	0.03											
V7	0.18**	-0.04	-0.02	0.08	0.01	-0.02										
V8	0.06	0.22**	-0.17**	-0.05	0.08*	-0.05	0.45**									
V9	0.10**	-0.14**	0.18**	-0.08	-0.03	0.01	0.75**	-0.03								
V10	0.15**	-0.08	-0.16**	0.36**	-0.02	-0.02	0.43**	-0.02	-0.03							
V11	-0.06	0.08*	-0.06	-0.02	0.20**	-0.05	0.00	0.28**	-0.14**	-0.05						
V12	0.16**	-0.05	0.01	0.07	-0.01	0.12**	0.89**	0.34**	0.71**	0.37**	-0.07					
V13	-0.01	0.09*	-0.03	-0.08	0.08*	0.09*	-0.06	0.04	-0.05	-0.09*	-0.03	-0.05				
V14	0.10**	-0.21**	0.07	0.18**	-0.02	-0.04	0.15**	-0.03	0.13	0.14**	0.00	0.11**	-0.10*			
V15	0.03	-0.18**	0.02	0.23**	-0.03	-0.03	0.13**	-0.02	0.12	0.10**	-0.02	0.12**	-0.07	0.43**		
V16	0.06	-0.11**	0.11*	-0.01	0.09**	0.11**	-0.04	-0.07	-0.03	0.03	0.01	-0.02	0.01	0.25**	0.02	
V17	-0.07	0.11*	-0.09*	-0.02	0.02	0.04	-0.01	-0.02	-0.01	0.01	-0.02	-0.02	0.05	-0.25**	-0.10**	0.04

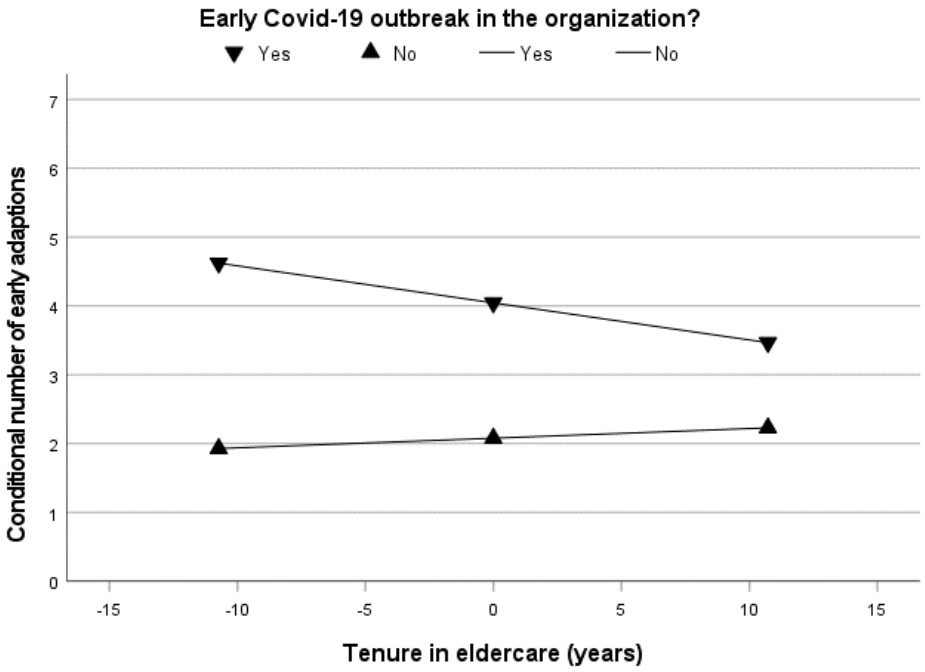
N=555. Correlations estimated using Kendall's tau b.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix A3. Conditional number of early adoptions: Educational background and COVID-19 outbreak



Notes: Test of conditional mean differences: No outbreak: F(2, 540) = 1.182, p = .308. Academic vs. profession: b = -0.250, p = .500. Academic vs. vocational: b = 0.122, p = .765. With outbreak: F(2, 540) = 7.037, p = .001. Academic vs. profession: b = - 2.259, p = <.001. Academic vs. vocational: b = -1.764, p = .035.

Appendix A4. Conditional number of early adoptions: Tenure in eldercare and COVID-19 outbreak



Notes: Tenure in eldercare is mean centred (mean tenure indicated with '0' = 20.56 years) and probed at +/- 1 SD. Significance test of slopes with outbreak: b = -0.054, p = .091 and no outbreak: b = 0.014, p = .160.

[i] It is important to note that the inclusion of interaction terms in model 2 changes the interpretation of the parameter estimates for other variables (in the interaction terms) to 'conditional' effects, as these are estimated when their value is '0'. For example, the estimate for 'experienced w/infection control' (b = .561, p = .028) represents a statistically significant difference between those with and without experience of situations in which there is no internal COVID-19 outbreak (this situation being coded as '0' in the data), when education background is academic (reference category is coded as '0') and when the centred value for tenure is '0'. In model 1, the estimate for prior experience w/infection control (b = .494) represents the 'main' effect as difference, regardless of whether there is an internal outbreak or not.