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Communication media as mediators of telework frequency and knowledge sharing in Japan under COVID-19

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Abstract: This paper examines how telework frequency has affected the usage of major communication media, and subsequently knowledge sharing, among a large sample of full-time Japanese employees with no prior telework experience during the country's fourth COVID-19 state of emergency. Results suggest that mandatory telework resulted in lower use of face-to-face meetings and phone calls; in higher use of instant messaging and virtual meetings, and that it had no effect on e-mail use. Moreover, phone call, instant messaging, and virtual meeting frequencies were found to mediate the relationship between telework frequency and knowledge sharing. These findings highlight the importance of both existing and newer communication media in offsetting the loss of face-to-face meeting opportunities. Government-mandated telework may have accelerated the adoption of new communication tools such as instant messaging and virtual meeting, which had not yet gained full acceptance before the pandemic.

Keywords: telework; COVID-19; knowledge sharing; communication media; Japan.

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1 Introduction

As of January 2022, COVID-19 has developed into a significant epidemic with excess mortality of at least 5.5 million deaths (WHO, 2022). It immediately led to extraordinary precautionary measures, like the forced confinement of several million individuals. From July 12 to September 28, 2021, Tokyo and neighbouring prefectures in Japan declared a fourth state of emergency, forcing many office workers to work from home. Legally, the central government of Japan only has a limited authority to declare a state of emergency, and it is up to each prefecture and municipality to enforce it. Large corporations were asked by the government and prefectures to support the stay-at-home directive by instructing their staff to transition to home-based telework whenever it was practical. In April 2020, a significant portion of employees in Japan made the switch to 100% telework, with the service sector accounting for the largest share. Until just a few weeks prior, teleworking had been restricted by firm management to one or two days per week, making such a turnaround unthinkable.

Teleworking from home can be done anywhere between a few days a month to several days a week, according to the Japanese Ministry of Health, Labor, and Welfare (MHLW, 2020). It cautions that working from home might cause personal and professional lives to become intermingled and it encourages employers to talk with their staff about how to assess and manage their job to maintain peace of mind. A poll of 1,100 persons conducted in July 2021 revealed that, compared to 19% in April 2021, about 20% of respondents were teleworking every day, and about 12% were doing so at least occasionally in the previous week (Japan Times, 2021). According to the same survey, 13% of respondents thought that telework had increased their efficiency, down from 16% previously.

Although telework is not a new concept, most people who use it nowadays are forced into it without any choice. Millions of people have participated in this extensive experiment by working from home to deliver services, create content, plan meetings, instruct courses, and more. Without any prior experience or training, improvised telework might be more time-consuming than working in an office since interactions must be planned and launched via unfamiliar tools rather than brief, ad-hoc face-to-face (F2F) conversations. In May 2020, a study of about 1,000 adults aged 18 and older revealed that 36% of participants had trouble interacting with their managers and co-workers (Japan Times, 2020).

Once COVID-19 is under control, some businesses have already stated they will make flexible work permanent. Yahoo Japan said in January 2022 that it would permit its 8,000 employees to work from anywhere in the nation and would even give them a monthly commuting budget of up to $1,300 each, taking into account the value of in-person contact (Nonomiya, 2022). Additionally, the government is pressuring more companies to support telework in an effort to stop the virus from spreading (Japan Times, 2022). Therefore, it can be claimed that the pandemic has expedited changes in work practices in Japan. As a result, it is crucial to anticipate issues and suggest solutions, especially when it comes to communication at work and knowledge sharing.

To do so, this paper examines the relationships between telework frequency and the usage of major communication media, and subsequently knowledge sharing, among Japanese employees who were forced to work from home during COVID-19. It contributes to extending both research and practice in the area of telework and media

richness theory. This research clarifies which types of communication media are influenced by telework frequency, and then how knowledge sharing is affected by those communication media. It will help firms develop specific countermeasures, such as training programs or infrastructure, to strengthen specific media and eventually improve the sharing of knowledge. Results show that mandatory telework has accelerated the use of new communication tools such as IM and virtual meeting, and that e-mail was unaffected by telework frequency. Synchronous and richer media such as phone, IM and virtual meeting, proved the most important for knowledge sharing, suggesting that means of communication which allow the exchange of complex messages with interactivity and unequivocality are key for untrained teleworkers.

2 Literature review and hypotheses development

2.1 Telework from home

Telework is the act of regularly working from a location other than one's employer, most often from home or another location. Specifically, Caillier (2012, p.462) states that telework is a "flexible work arrangement that affords employees the ability to periodically, regularly, or exclusively perform work for their employers from home or another remote location that is equipped with the appropriate computer-based technology to transfer work to the central organization". Regular salaried employment performed at the employee's home is referred to as telework from or at home, which is the focus of this paper. It is also known as home-based teleworking or home-working. Leaving aside less frequent instances, its frequency can range from 1 day to 5 days or more each week (Aguilera et al., 2016). Numerous studies have been conducted on the factors influencing the acceptance of home-based telework, which are mainly concerned with the nature of work, its perceived advantages and disadvantages, and fit with the company or country cultures (Peters and Batenburg, 2015; Aguilera et al., 2016). Therefore, telework from home is better suited for highly trained and independent individuals who see it as beneficial to their professional and personal lives. It is also more appropriate in societies and organisations where it has achieved widespread acceptability (De Graaff and Rietveld, 2007). Employee satisfaction, performance, interpersonal relationships, and outcomes for those employees who do not telework have all been proven to be significantly impacted by the frequency of telework (Allen et al., 2015).

In Japan, the Ministry of Health, Labor, and Welfare first released public recommendations for telework in 2004. In 2008, they were modified to include the benefits and drawbacks of this type of work arrangement (MHLW, 2008). Business operations can continue in the event of a natural disaster, in accordance with a business continuity plan; talent can be attracted and retained by allowing flexible working styles; work-life balance and corporate social responsibility are promoted; and office space and commuting costs are reduced (in Japan, the employer bears the totality of the commuting cost between home and office for regular employees). Additionally, there are benefits for employees, such as being able to work while taking care of children or elderly parents, having more free time because they do not have to commute, expanding employment opportunities for the elderly and disabled who have trouble travelling, and being able to work in a more peaceful environment that promotes concentration and productivity. According to employee data, the guidelines also list the drawbacks of telework, such as

separating work and personal time, evaluating one's work, accessing documents that are scattered throughout the office, managing one's health, communicating with superiors, improving one's skills, and earning less money (MHLW, 2008).

We refer to remote work done by employees from their homes as 'mandatory' telework because their employer required it in order to abide by the COVID-19 emergency declaration orders issued by the prefectures where their offices are located. This environment allowed for home-based telework to be deployed without consideration for suitability as long as tasks could be completed remotely using a computer and a phone. The distinction between voluntary and involuntary telework has been made in the past by examining whether an employee's own preferences determined their particular work arrangement (Lapierre et al., 2016).

2.2 Communication media

The media richness theory was put forth by Daft and Lengel (1984, 1986), just as electronic communication was beginning to take off. According to their theory, a communication channel or medium is effective if it can match the richness of the source medium. Richness depends on immediate feedback, multiple cues, language variety, and personal focus. When choosing a communication channel for a particular message or meeting, the key consideration should be to reduce ambiguity or equivocality, the chance of misinterpretations, or multiple interpretations of a message. Multiple cues and more information are needed to fully understand a message when it is challenging to understand and interpret. More cues and data will be required to accurately understand a message that is difficult to decode and comprehend. According to Suh (1999, p.296), "a lean medium, (e.g., a memo) is sufficient to exchange an unequivocal message, (e.g., a routine communication), while a rich medium, (e.g., a face to-face meeting) is recommended to resolve an equivocal situation (e.g., negotiation)". Carlson and Zmud (1999) expanded the four original criteria of richness by including social influence and experience (with a particular channel, topic, communicator, and organisational context).

The most valuable medium is considered to be F2F, followed by the telephone, written addressed materials, and unaddressed documents (bulk e-mails, flyers). Instant messaging (IM), sometimes referred to as chat or texting, and virtual meetings have been developed and broadly accepted since the theory was first proposed approximately 40 years ago. As long as video is on, virtual meetings (such as those held through Zoom, Microsoft Teams, or Webex) have been classified as rich media, one step below F2F interaction because they still prevent manipulating objects, making physical contact, and more generally understanding non-verbal cues (Reed and Allen, 2021). Despite being a suitable alternative method for real-time communication, IM is more difficult and is viewed as considerably leaner because to its lack of support for non-verbal cues (Tang and Bradshaw, 2020). Briefly stated, media richness theory asserts that when compared to richer media, leaner communication channels like phone, text, and e-mail are less successful in conveying complex ideas. In particular, Reed and Allen (2021, p.108) contend that "scheduling a meeting is typically fairly straightforward and can be done via e-mail, a lean form of media […] but a detailed message about a person's work performance on a recent project probably needs a richer medium, such as a face-to-face meeting".

2.3 Knowledge sharing

Knowledge sharing is the most frequent knowledge management process studied, followed by knowledge acquisition and knowledge application (Al-Emran et al., 2018). Knowledge sharing can be formal or informal and is defined as the movement of knowledge between organisational agents (Kianto et al., 2018). Knowledge collection is the act of acquiring knowledge from another actor or unit, as opposed to knowledge donation, which refers to sharing one's knowledge with others. Once information has been freely offered and received, knowledge sharing is regarded to have taken place (Van Den Hooff and De Ridder, 2004).

Trust, intrinsic and extrinsic motivation, job satisfaction, organisational norms and values, and leadership support are all necessary for knowledge sharing (Van Den Hooff and De Ridder, 2004). Polanyi (1966) divided knowledge into tacit and explicit knowledge, since not all knowledge can be easily expressed verbally. Tacit knowledge, which includes attitudes, points of view, technical abilities, and know-how, is cognitive knowledge that is extremely individual and challenging to explain with language or numbers. Contrarily, explicit knowledge is factual and logical knowledge that may be communicated in texts, equations, specifications, and manuals using either words or numbers. Therefore, identifying, storing, and retrieving it is fairly simple (Wellman, 2009). According to the unique requirements of each circumstance, knowledge sharing therefore requires the exchange of both tacit and explicit knowledge among organisational actors.

Knowledge sharing can occur through either through F2F or technology-mediated communication. While F2F communication had been considered of higher value for knowledge sharing, recent research has found that technology-mediated communication allowed the interactions of employees with more diverse backgrounds and stronger competence (Qureshi et al., 2018). Based on their results, they recommend frequent technology-mediated social interactions, i.e., several times a week, in order to maximise knowledge sharing, and they specifically mention e-mail and IM.

2.4 Hypotheses and research model

2.4.1 Telework and communication media

In Japan, Hosoda (2021) has looked into how COVID-19 affects the utilisation of telework. While the pandemic played a significant role in the country's acceptance of telework, he discovered that it has been slower than anticipated. The limited adoption of telework among small and medium-sized businesses has been attributed to communication, particularly frequent and F2F communication, as well as technological problems (Mori and Hayashi, 2020). Those have since been resolved following the successive waves of the virus and the subsequent states of emergency forcing employees to work from home.

Working from home, especially when unprepared, untrained, and unwilling, brings about many changes to doing one's job. Take for instance the workspace an employee is able to claim at home; in Japan, during the first wave of COVID-19 in 2020, women, relative to men, reported much lower satisfaction with their workspace at home (Magnier-Watanabe et al., 2022). As for communication, mandatorily working from home means that employees are prevented from going to the office, at least for a certain

number of days a week, if not every day in some companies or cities under a state of emergency. In turn, most F2F interactions have to be substituted with technology-mediated connections. We therefore hypothesise:

H1a Higher telework frequency is related to lower F2F frequency.

Phone is considered to be a relatively rich media, just below virtual meeting. Phone calls allow for immediate feedback and therefore minimise ambiguity as both sender and receiver can use natural language to clarify intended meaning. However, while it is also synchronous, the initiation of a phone call starts on one end without certainty about the situation or availability on the other end. In short, the caller makes a phone call when he/she feels a need to do so, running the risk of disturbing the receiver. This issue is compounded when the receiver is at home as in the present case, as extensive research on telework and work-family conflict has highlighted (Haddad et al., 2009; Kazekami, 2020). What's more, in the context of unplanned telework, many employees will not have a company-issued phone and they may not have shared their private home phone number. Employees may therefore be reluctant to use the phone to communicate with their telecommuting colleagues, especially since it might open the door to themselves being called at home the next time around. We therefore hypothesise:

H1b Higher telework frequency is related to lower phone call frequency.

E-mail is considered to be of a rather lean medium, enabling the asynchronous exchange of large amounts of explicit information (Lee et al., 2007). E-mail has been around since the late 1960s and a fixture of corporate life since the 1990s (Turville, 2019). It is the cornerstone of office communication, whereby new employees receive their own e-mail address but not necessarily their own office phone number. E-mail crossed over the private sphere long ago and most individuals are very comfortable with it. As the corporate world's most ubiquitous means of communication, we expect e-mail usage to increase with telework frequency in order to make up for the drop in F2F and phone communication. Therefore, we hypothesise:

H1c Higher telework frequency is related to higher e-mail frequency.

IM ranks just below phone communication in terms of media richness since it allows synchronicity but precludes the transmission of natural language (Kuyath and Winter, 2006). Corporate IM is part of a communication suite integrated to the employee computer or smartphone environment. In the context of forced telework, employees lost the possibility to interact directly with co-workers in the office, whether those interactions were planned or serendipitous. IM can bring a quick answer to most questions, and even clarify complex problems through interactive and achievable discussions. We therefore hypothesise:

H1d Higher telework frequency is related to higher IM frequency.

There is consensus that virtual meeting is the second richest type of medium after F2F. Virtual meetings were already commonplace before the pandemic, offering both audio and video and cutting drastically on travel expenses. While dedicated systems had been necessary previously (such as Polycom video-conferencing systems), the advent of Skype first and then Zoom, Webex and Teams usable on any platform contributed to the rapid spread and acceptance of virtual meeting (Vargo et al., 2021). Moreover, synchronous

video and audio have been complemented by the addition of synchronous and asynchronous file sharing and archiving, giving virtual meeting an edge over F2F which is devoid of such features in its purest form. We therefore expect:

H1e Higher telework frequency is related to higher virtual meeting frequency.

2.4.2 Communication media and knowledge sharing

The link between communication medium and knowledge sharing has already been established. For instance, it has been discovered that collaborative technology affects communication patterns, leading to a rise in explicit knowledge sharing and a decline in tacit knowledge sharing (Bélanger and Allport, 2008). And according to media richness theory, the choice of an acceptable communication medium depends on the kind of knowledge that needs to be transmitted. Indeed, previous research has shown that explicit knowledge is more effectively transmitted using leaner media, but tacit knowledge is best communicated utilising richer media (Murray and Peyrefitte, 2007). Richer media (F2F, virtual meetings with video, phone) allow for both tacit and explicit knowledge to be shared, whereas leaner media (IM, e-mail) transmit only explicit knowledge. Additionally, organisational actors choose communication media based on richness and the type of knowledge being disseminated. So, in order to cover the full spectrum of knowledge sharing needs, employees will use all communication media, both lean and rich, depending on requirements and availability.

F2F communication will inevitably decline as a result of telework and be replaced by other forms of communication. Therefore, we anticipate a substitution effect in which other forms of communication replace in-person interactions. Finally, we assume that higher frequencies of communication means are associated with higher knowledge sharing since firms are rational actors incurring costs solely for value-adding activities, such as knowledge sharing. Therefore, we predict the five following hypotheses linking media usage in the course of their work with knowledge sharing (Figure 1):

H2a Higher F2F frequency is related to higher knowledge sharing.

H2b Higher phone call frequency is related to higher knowledge sharing.

H2c Higher e-mail frequency is related to higher knowledge sharing.

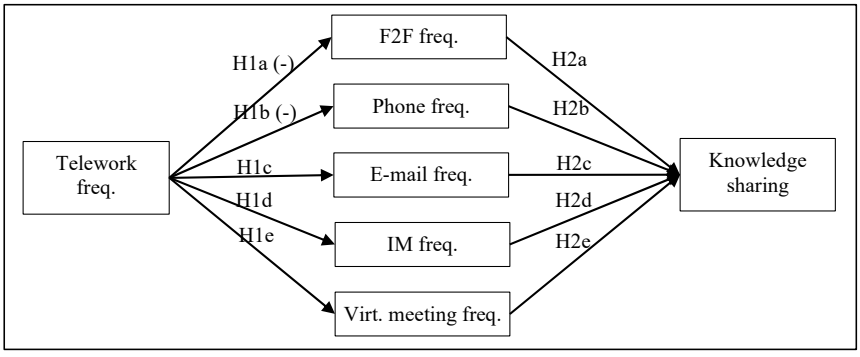
H2d Higher IM frequency is related to higher knowledge sharing.

H2e Higher virtual meeting frequency is related to higher knowledge sharing.

We anticipate that the relationship between the frequency of telework and knowledge sharing will be fully mediated by communication media. It should be understood that the frequency of telework does not directly influence knowledge sharing; rather, the five communication media mentioned above mediate this relationship. The effects of the COVID-19 epidemic on knowledge management have been examined in some recent study. For instance, Ammirato et al. (2021) have compiled a list of problems such the inclusion of emergency knowledge management systems or knowledge integration for contact tracing. The study by Taskin and Bridoux (2010) examined how telework hinders organisational knowledge transfer. They reviewed the literature on the cognitive and relational components of organisational socialisation in their role as facilitators of knowledge transfer. Based on frequency, location, and perception, they demonstrated that

telework may have a negative impact on several of these cognitive and relational components, indicating indirect rather than direct relationships.

Figure 1 Research model



While many other factors have been found to affect knowledge sharing, such as knowledge sharing intention, organisational commitment, and attitude towards knowledge sharing, to name just a few (Witherspoon et al., 2013), we assume within reason that telework and those other factors are independent. The goal of this paper is not to revisit the antecedents of knowledge sharing, but instead to examine the interplay of telework frequency and communication media, and subsequently knowledge sharing.

3 Methodology

3.1 Survey and sample

A sample of full-time Japanese employees living and working in the Tokyo area took part in the study, which was carried out in December 2021 by an online survey company. The respondents all participated in some degree of telework throughout the study period, but they had no prior experience with working remotely from home. This was done on purpose to eliminate bias. The questionnaire asked respondents how frequently they engaged in F2F, telephone, e-mail, IM, and virtual meetings during the fourth state of emergency order (between July 12 and September 28, 2021). This retrospective approach enables the study of a particular unanticipated occurrence, such as COVID-19, and the state of emergency decrees and required home-based work that followed, precluding the use of prospective instruments (Pratt et al., 2000).

In this sample of 575 respondents, men make up the majority of employees (76%), a majority have college degrees (73%), have subordinates (59%), work as general employees (55%) in very large companies with more than 500 employees (56%) for more than ten years (64%), reside (57%) and work (82%) in Tokyo, and have a 30-to 60-minute commute on average one-way (51%), among other characteristics (Table 1).

3.2 Survey and measures

Three questions were used to assess knowledge sharing, based on Kianto et al. (2018) on a seven-point scale; those asked for the respondents' level of agreement with the following: 'we have systems to capture new ideas and experiences'; 'the management motivates us to share our knowledge'; 'we spend time to share ideas and experiences with each other'. For telework frequency: 1: none; 2: 1–3 times a month; 3: one day a week; 4: two days a week; 5: three days a week; 6: six days a week; 7: five days a week. And for communication frequency, the questions were specifically about the use of those media in the course of one's work: 1: never; 2: once a year; 3: once a month; 4: once a week; 5: 2–3 times a week; 6: once a day; 7: several times a day.

Table 1 Sample demographics

Indicator	*N*	*%*	*Indicator*	*N*	*%*
Gender			Company size		
Men	437	76.0	< 10	22	3.8
Women	138	24.0	10–49	48	8.3
Age			50–249	115	20.0
20–24	10	1.7	250–499	67	11.7
25–29	51	8.9	500+	323	56.2
30–34	37	6.4	Tenure		
35–39	51	8.9	2–5 yrs	102	17.7
40–44	62	10.8	5–10 yrs	106	18.4
45–49	108	18.8	10 yrs+	367	63.8
50–54	80	13.9	Domicile		
55–59	69	12.0	Tokyo	326	56.7
60–64	107	18.6	Kanagawa	123	21.4
Education			Saitama	76	13.2
High school	39	6.8	Chiba	50	8.7
Professional school	34	5.9	Workplace		
Associate degree	18	3.1	Tokyo	471	81.9
University degree	419	72.9	Kanagawa	58	10.1
Master degree	53	9.2	Saitama	28	4.9
PhD degree	10	1.7	Chiba	18	3.1
Other	2	0.3	Commute (one-way)		
Function			0–30 mn	89	15.5
Gen. employee	314	54.6	31–60 mn	294	51.1
Section chief	122	21.2	61–90 mn	147	25.6
Manager	68	11.8	91–120 mn	36	6.3
Senior manager	15	2.6	120 mn+	9	1.6
Top management	22	3.8	Telework frequency		
CEO	7	1.2	One day a week	55	9.6

Table 1 Sample demographics (continued)

Indicator	*N*	*%*	*Indicator*	*N*	*%*
Other	27	4.7	Two days a week	116	20.2
Subordinates			Three days a week	150	26.1
0	233	40.5	Four days a week	92	16.0
1–5	168	29.2	Five days a week	162	28.2
6–10	58	10.1			
11–30	63	11.0			
31+	53	9.2			

For the three questions on knowledge sharing, Cronbach's alpha was 0.899 thus denoting internal consistency. A factor analysis (not shown) of those same three questions yielded a single factor explaining 83% of the variance with factor loadings above 0.9, thus confirming convergent validity. The other variables in the survey use only a single survey item each, and therefore making tests of validity and consistency unsuitable.

4 Results

The following statistical tests use SPSS and PROCESS, a computational tool for SPSS that specifically addresses mediation, moderation, or conditional process analyses (Hayes, 2018). The results are depicted in Tables 2, 3 and Figure 2. Based on the hypotheses stated previously, it is expected that telework frequency affects communication media usage, which in turn influence knowledge sharing.

4.1 Descriptive results

During the fourth state of emergency, on average, respondents teleworked between 3 and 4 days a week, and used F2F communication between once and 2–3 times a week, phone 2–3 times a week, e-mail between once and several times a day, IM between 2–3 times a week and once a day, and virtual meetings between once and 2–3 times a week. Correlations, all below 0.5, reveal no issues with collinearity (Table 2).

When considering demographic factors and media usage, there was only a mild negative correlation between age range and IM frequency ($R = –0.251$, $p < 0.001$), and a mild positive correlation between company size and virtual meeting frequency ($R = 0.248$, $p < 0.001$). These suggest that younger employees used IM more and that larger companies relied on virtual meetings more frequently.

Number of subordinates and company size showed mild correlations with knowledge sharing ($R = 0.241$, $p < 0.001$ and $R = 0.132$, $p < 0.001$, respectively), indicating that respondents reported higher knowledge sharing when having more subordinates and when working in larger companies. This finding is somewhat expected as managers with many subordinates are required to communicate with their direct reports and employees of larger companies are part of organisations where knowledge sharing takes place among many more individuals.

Table 2 Means, standard deviations and correlations of survey variables

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1	Gender	1.2	0.4	1												
2	Age range	7	2.3	–0.373**	1											
3	Education	3.8	1	–0.106*	0.02	1										
4	Tenure	4.5	0.8	–0.244**	0.457**	0.031	1									
5	Subordinates	2.2	1.3	–0.128**	0.088*	0.108**	0.172**	1								
6	Company size	4.1	1.2	–0.109**	0.072	0.171**	0.170**	0.131**	1							
7	Commute one-way	2.3	0.9	–0.123**	0.135**	0.04	0.017	–0.042	0.059	1						
8	Telework freq.	5.3	1.3	–0.023	–0.02	0.039	–0.067	–0.090*	0.04	0.025	1					
9	F2F freq.	4.3	1.6	0.001	0.02	0.046	0.035	0.112**	0.077	–0.011	–0.412**	1				
10	Phone freq.	5.3	1.8	0.022	–0.098*	0.075	0.009	0.190**	–0.025	–0.009	–0.161**	0.270**	1			
1.	E-mail freq.	6.5	1	–0.002	0.035	0.172**	0.019	0.094*	0.151**	–0.039	0.07	0.130**	0.369**	1		
1.	IM freq.	5.5	2.2	0.068	–0.251**	0.05	–0.164**	0.081	0.149**	0.009	0.239**	–0.029	0.135**	0.220**	1	
1.	Virt. meet. freq.	4.3	2.1	–0.037	–0.160**	0.158**	–0.051	0.145**	0.248**	–0.046	0.262**	0.007	0.155**	0.255**	0.392**	1
14	Know. sharing	4.5	1.4	0.001	–0.079	0.035	–0.040	0.241**	0.132**	0.029	0.049	0.052	0.217**	0.161**	0.216**	0.230** 1

Notes: Gender: 1 = male; 2 = female.
Age range: 2 = 20–24; 3 = 25–29; 4 = 30–34; 5 = 35–39; 7 = 40–44; 7 = 45–49; 8 = 50–54; 9 = 55–59; 10 = 60–64.
Education: 1 = High school; 2 = Prof. school; 3 = Associate degree; 4 = University; 5 = Master degree; 6 = PhD; 7 = Other.
Tenure: 3 = 2–5 yrs; 4 = 5–10 yrs; 5 = 10yrs+.
Subordinates: 1 = 0; 2 = 1–5; 3 = 6–10; 4 = 11–30; 5 = 31+.
Company size: 1 = < 10; 2 = 10–49; 3 = 50–249; 4 = 250–499; 5 = 500+.
Commute once-way: 1 = 0–30 mn; 2 = 31–60 mn; 3 = 61–90 mn; 4 = 91–120 mn; 5 = 120 mn+.
Telework freq.: 1 = never; 2 = 1–3 times a month; 3 = One day a week; 4 = Two days a week; 5 = Three days a week; 6 = Four days a week; 7 = Seven days a week.
Comm. freq.: 1 = never; 2 = once a year; 3 = once a month; 4 = once a week; 5 = 2–3 times a week; 6 = once a day; 7 = several times a day.

Another notable finding is the absence of a negative correlation between F2F communication and other communication media. This suggests that F2F communication is not directly replaced by other means; furthermore, weak correlations between F2F and phone (R = 0.270, p < 0.001) and e-mail (R = 0.130, p < 0.001) indicate that these communication media are used concurrently as complements.

Last, the lack of significant correlation scores between F2F and IM, and between F2F and virtual meeting, imply that there is no relationship between those communication media, neither as complements nor as substitutes, as could have been expected.

4.2 Hypotheses testing

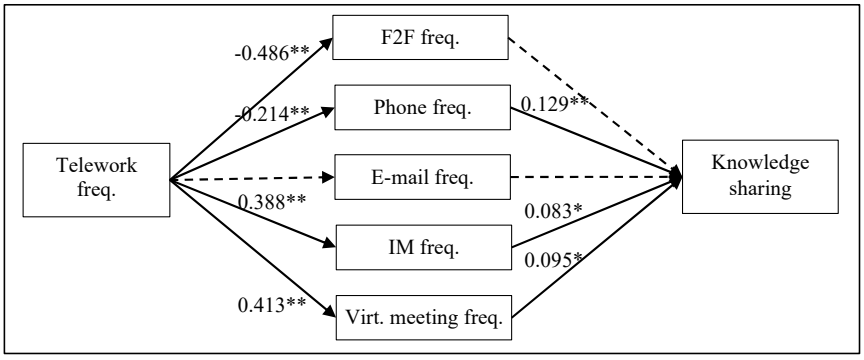
H1a and H1b, whereby higher telework frequency is related to lower F2F frequency (–0.486, p = 0.000) and to lower phone call frequency (–0.241, p = 0.000) are supported. H1d and H1e, whereby higher telework frequency is related to higher IM frequency (0.388, p = 0.000) and to higher virtual meeting frequency (0.413, p = 0.000) are supported as well. However, H1c, about the relationship between telework and e-mail frequency, is not supported (0.054, p = 0.092) (Table 3, Figure 2).

Table 3 Regression coefficients, standard errors, and model summary information

	Consequent					
	M1 (F2F)			*M2 (Phone)*		
Antecedent	*Coeff.*	*SE*	*P*	*Coeff.*	*SE*	*P*
X (Telework freq.)	–0.486	0.045	*0.000*	–0.241	0.055	*0.000*
Constant	6.857	0.246	*0.000*	6.399	0.302	*0.000*
	R^2 = 0.170			R^2 = 0.026		
	F(1,573) = 117.384, p = 0.000			F(1,573) = 15.156, p = 0.000		
	M3 (E-mail)			*M4 (IM)*		
Antecedent	*Coeff.*	*SE*	*P*	*Coeff.*	*SE*	*P*
X (Telework freq.)	0.054	0.032	0.092	0.388	0.066	*0.000*
Constant	6.235	0.177	*0.000*	3.382	0.361	*0.000*
	R^2 = 0.005			R^2 = 0.057		
	F(1,573) = 2.852, p = 0.092			F(1,573) = 34.699, p = 0.000		
	M5 (Virt. meet.)			*Y (Knowledge sharing)*		
Antecedent	*Coeff.*	*SE*	*P*	*Coeff.*	*SE*	*P*
X (Telework freq.)	0.413	0.064	*0.000*	0.009	0.049	0.852
M1 (F2F)				0.009	0.040	0.832
M2 (Phone)				0.129	0.035	*0.000*
M3 (E-mail)				0.046	0.060	0.440
M4 (IM)				0.083	0.029	*0.004*
M5 (Virt. meet.)				0.095	0.030	*0.002*
Constant	2.103	0.349	*0.000*	2.592	0.464	*0.000*
	R^2 = 0.069			R^2 = 0.103		
	F(1,573) = 42.271, p = 0.000			F(6,568) = 10.844, p = 0.000		

As for H2 hypotheses, H2b phone call frequency (0.129, $p = 0.000$), H2d IM frequency (0.083, $p = 0.004$), and H2e virtual meeting frequency (0.095, $p = 0.002$) are positively and significantly related to knowledge sharing, and are therefore supported. H2a F2F frequency and H2c e-mail frequency were not supported (Table 3, Figure 2).

Figure 2 Empirical model



In the model, neither the total effect (0.052, $t(573) = 1.180$, $p = 0.238$) nor the direct effect are significant (0.009, $t(573) = 0.187$, $p = 0.852$). However, several indirect effects are significant, as indicated by the asymmetric bootstrap confidence intervals which do not contain zero (Hayes, 2018): through phone call frequency (–0.028, bootstrap confidence interval between –0.051 and –0.009), through IM frequency (0.032, bootstrap confidence interval between 0.008 and 0.060), and through virtual meeting frequency (0.039, bootstrap confidence interval between 0.010 and 0.070). These findings indicate that there is no direct link between telework frequency and knowledge sharing, and that instead, any effect is mediated through phone, IM, and virtual meeting frequencies.

5 Discussion and conclusions

As expected, telework has resulted in lower use of F2F and of phone communication during the fourth state of emergency in the Tokyo area. This signifies that employees forced to work from home are reluctant to using phone communication with their colleagues for several reasons. First, most people usually working in an office probably do not have a company-issued phone, and they may therefore be unwilling to use their personal line for business dealings, especially if their firm has not expressly agreed to cover related costs. Second, using a personal line and a personal number can be seen as encroaching on their personal space, which is usually separated from their professional sphere, and in which their spouse can expect to be consulted; 76% of the sample was male and decisions related to the household, such as housework and childcare, are usually in the hands of women in Japan, even today (Kato, 2018). Third, phone communication appears to be a complement of F2F communication, implying that less of one means less of the other as well; this points to one used to schedule the other or both having the same requirements such as closeness or an existing basis of trust. Fourth, when working unexpectedly from home, speaking on the phone may be easily replaced by other means

of communication, be they synchronous or asynchronous, such as e-mail, IM, or virtual meetings.

This research has found that higher telework frequency has resulted in higher use of IM and virtual meetings during mandatory telework. IM had become immensely popular for private applications in Japan since the launch of smartphones 15 years ago. Companies have been quick at introducing corporate IM systems (Hassard and Morris, 2022) and employees have been eager to embrace them while working from home. IM offers features associated with both synchronous and asynchronous media since it allows to communicate in real-time or on one own's schedule, to archive conversations, and files, and to store and share large amounts of information. Another major change has been the widespread use of virtual meeting applications, such as Zoom. They have allowed employees to exchange live audio and video on a set schedule, thus preventing possible intrusions into their private sphere; moreover, the possibility to turn off one's video and sound has probably helped its acceptance.

Only e-mail communication has remained immune to telework frequency, hinting that it has not been affected by forced telework and that employees rely on e-mail to the same degree whether working from the office or from home. F2F communication and phone communication, which naturally dropped because of telework, cannot easily be replaced by e-mail which does not offer the same immediate feedback or unequivocality. So, while e-mail has been one of the communication backbones at work, it has not been affected by forced telework, which instead has had a stronger effect on the use of IM and virtual meeting. E-mail's institutionalisation and stability of use had been touched upon in past research on telework in Japan, which had found that e-mail is used much whether working from home or from the office (Lee et al., 2007). This paper further corroborates the permanence and resilience of e-mail, even under conditions of mandatory telework for those with no prior telework experience. It suggests that companies should not disregard e-mail's versatility, especially in times of uncertainty.

As for the predictors of knowledge sharing, the data confirmed the role of phone calls, IM, and virtual meetings, but not of F2F or e-mail. Although telework resulted in lower F2F, it is unexpected that F2F communication of any kind was not related to knowledge sharing. On average during that time, respondents in our sample worked three days per week from home, and two days per week from the office. However, telework was implemented in conjunction with staggered shifts to limit the number of employees in the office at any given time. Indeed, the government is still recommending firms to 'take steps to reduce human contact, such as working from home or teleworking, staggered work hours, and bicycle commuting' (Cabinet Office of Japan, 2022). This arrangement is making finding and talking to the right person F2F all the more difficult. However, our results about e-mail are contradicting past research which had established that e-mail was used while teleworking for knowledge sharing, such as locating domain expertise (Lee et al., 2007). The discrepancy may lie in the mandatory nature of telework in our research, as opposed to the planned character of telework in past studies, whereby training and specific tools can help with the transition to remote work. Office depopulation because of telework had already been documented before the pandemic (Rockmann and Pratt, 2015). In short, the results of this study suggest that teleworkers resort to asynchronous means of communication or mobile communication (IM, virtual meeting) to ensure they can reach their intended target regardless of location or colocation.

To conclude, telework resulted in lower use of F2F and phone communication, higher use of IM and virtual meeting, and had no effect on e-mail usage. These findings should help firms develop specific training programs and/or countermeasures, depending on each company's specific goals and their employees' situation. Mandatory telework may have accelerated the adoption of new communication tools such as IM and virtual meeting, which had not yet gained full acceptance before the pandemic. E-mail seems to have remained unaffected by telework frequency, confirming its status as ordinary but stable communication medium. One important factor explaining the predominance of virtual meetings is that they have to be scheduled, so are less intrusive than unscheduled phone calls in case of mandatory telework. Last, when it comes to knowledge sharing, phone, IM and virtual meeting came out on top under forced telework, putting emphasis on synchronous and richer media. This may suggest that employees working from home unprepared feel a need to use means of communication which allow the exchange of complex messages with interactivity and unequivocality. Firms should therefore invest in tools and training to speed up the adoption of IM and virtual meeting, especially if some employees continue working remotely.

This research has a few limitations, which can inform future research directions. First, this research considers other antecedents of communication media usage and knowledge sharing to be independent of mandatory telework, and therefore tests the focal model ceteris paribus (all other things being equal). Future research could include some of those individual and organisational level antecedents and explore how they affect media usage and ultimately knowledge sharing under mandatory telework. Second, while the present analysis included demographic characteristics but only found few very mild correlations with media usage and knowledge sharing, future research could concentrate on potential demographic moderators with a large enough sample to further investigate the effect of telework frequency.

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