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Gesundheitsorientierte Führung in virtueller Teamarbeit – Eine multimethodische Analyse von gesundheitsorientierter Selbst- und Mitarbeiterführung aus der Perspektive von Führungskräften und Beschäftigten virtueller Teams

Dissertation

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Zusammenfassung

Hintergrund

Der Trend zu virtueller Teamarbeit im Arbeitskontext, also zeit- und ortsflexibler Zusammenarbeit mittels digitaler Informations- und Kommunikationstechnologien (IKT), wurde durch die COVID-19-Pandemie weltweit verstärkt. Die gesundheitlichen Auswirkungen der folglich veränderten Arbeitsbedingungen wie die Arbeit aus dem Homeoffice und damit zusammenhängende Ressourcen oder Stressoren sind derzeit noch nicht hinreichend untersucht. Im Gegensatz zur umfangreichen Evidenzlage zum Führungseinfluss in traditionellen Teams in Präsenz besteht in virtueller Teamarbeit nur wenig empirische Evidenz, wie Führung in virtueller Teamarbeit auf die Gesundheit von Beschäftigten wirken kann. Das Ziel der vorliegenden Dissertation war es, gesundheitsorientierte Führung (HoL) anhand der gesundheitsorientierten Selbstführung (SelfCare) und Mitarbeiterführung (StaffCare) aus der Perspektive von Führungskräften und Beschäftigten virtueller Teams multimethodisch zu untersuchen.

Methoden

In der vorliegenden Dissertation wurde ein multimethodischer Ansatz gewählt. Zuerst wurde in Publikation 1 ein systematischer Überblick über den aktuellen Stand der internationalen Forschung zum Zusammenhang virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes von Beschäftigten anhand eines Scoping Reviews erfasst. Anschließend wurden in Publikation 2 die Zusammenhänge von HoL und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit längsschnittlich analysiert. Im Rahmen der letzten Studie wurden anhand qualitativer Interviews mit Führungskräften virtueller Teams die Erfahrungen, Herausforderungen, förderlichen Rahmenbedingungen und präventiven Maßnahmen in der Umsetzung von HoL explorativ untersucht (Publikation 3).

Ergebnisse

Im Rahmen des Scoping Reviews konnten übergeordnet positive Zusammenhänge zwischen virtueller Führung und der psychischen Gesundheit sowie der Arbeitszufriedenheit von Beschäftigten festgestellt werden. Hingegen wurde ein negativer Zusammenhang zwischen virtueller Führung und dem arbeitsplatzbezogenen Isolationserleben von Beschäftigten aufgezeigt. Insgesamt konnten zahlreiche Forschungslücken wie der fehlende Einsatz einheitlicher Konstrukte identifiziert werden (Publika-

tion 1). In der quantitativen längsschnittlichen Studie zeigte sich unter anderem, dass SelfCare und StaffCare relevante Einflussfaktoren von arbeitsplatzbezogener Isolation waren (Publikation 2). Zuletzt ergab die explorative qualitative Studie, dass Führungskräfte unabhängig von ihren Vorerfahrungen mit virtueller Führung diversen Herausforderungen bei der Umsetzung von StaffCare begegneten wie die Wahrnehmung psychischer Gesundheit von Beschäftigten über digitale IKT. Ebenso konnte dargestellt werden, dass es förderlicher Rahmenbedingungen und verhaltens- sowie verhältnispräventiver Maßnahmen bedurfte, um HoL in virtueller Teamarbeit wirkungsvoll umsetzen zu können (Publikation 3).

Schlussfolgerungen

Die Ergebnisse liefern erste Hinweise zur Umsetzung und Wirkung von HoL in virtueller Teamarbeit. HoL bedarf bei der Umstellung auf virtuelle Teamarbeit Anpassungen des Führungsverhaltens. Durch die Gestaltung förderlicher Arbeitsbedingungen in virtueller Teamarbeit können Führungskräfte in der Umsetzung von StaffCare unterstützt werden. Auf Basis der gewonnenen Erkenntnisse wird zum einen eine ganzheitliche Forschungsperspektive empfohlen, um die komplexen, kontextuellen Wechselwirkungen von HoL in virtueller Teamarbeit zu verstehen. Zum anderen werden für die Praxis sowohl verhältnispräventive Maßnahmen für eine ganzheitliche Organisationsentwicklung sowie verhaltenspräventive Maßnahmen für die kontinuierliche Personalentwicklung empfohlen.

Abstract

Background

The trend towards virtual teamwork in the workplace, i.e., flexible collaboration in terms of time and location using digital information and communication technologies (ICT), has been reinforced worldwide by the COVID-19 pandemic. The health effects of the resulting changes in working conditions, such as working from home and associated resources or stressors, have not yet been sufficiently studied. In contrast to the extensive evidence on leadership influence in traditional face-to-face teams, there is little empirical evidence on how leadership in virtual teamwork can affect the health of employees. The aim of this dissertation was to examine health-oriented leadership (HoL) based on health-oriented self-leadership (SelfCare) and employee leadership (StaffCare) from the perspective of leaders and employees of virtual teams using a multi-method approach.

Methods

A multi-method approach was chosen for this dissertation. First, publication 1 provided a systematic overview of the current state of international research on the relationship between virtual leadership and work- and health-related outcomes of employees using a scoping review. Subsequently, publication 2 analyzed the relationships between HoL and the health trajectories of employees working in virtual teams using a longitudinal approach. In the final study, qualitative interviews with leaders of virtual teams were used to explore the experiences, challenges, preconditions, and preventive measures involved in implementing HoL (publication 3).

Results

The scoping review revealed an overall positive association between virtual leadership and employees' mental health as well as job satisfaction, while a negative association was found for employees' workplace isolation. Overall, a wide range of research gaps was identified, such as the lack of standardized constructs (publication 1). The quantitative longitudinal study showed, among other results, that SelfCare and StaffCare were relevant factors influencing workplace isolation in virtual teamwork (publication 2). Finally, the exploratory qualitative study found that, regardless of previous experience with virtual leadership, leaders faced diverse challenges in implementing StaffCare, such as the awareness of employees' mental health via digital ICT. It was also shown that conducive preconditions as well as behavioral and struc-

tural preventive measures were needed to effectively implement HoL in virtual teams (publication 3).

Conclusions

The results provide initial insights into the implementation and impact of HoL in virtual teamwork. HoL requires adjustments to leadership behavior when switching to virtual teamwork. By proactively creating conducive working conditions in virtual teamwork, leaders can be supported in implementing StaffCare. Based on the findings, a holistic research perspective is recommended to understand the complex, contextual interdependence of HoL in virtual teamwork. In addition, structural preventive measures for holistic organizational development as well as behavioral preventive measures for continuous personnel development are recommended for practice.

Abbildungsverzeichnis

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Abkürzungsverzeichnis

COR	Conservation of Resources Theory (dt. Theorie der Ressourcenerhaltung)
HoL	Health-oriented Leadership (dt. Gesundheitsorientierte Führung)
IKT	Informations- und Kommunikationstechnologien
JD-R	Job Demands-Resources Model (dt. Arbeitstätigkeit-Anforderungen-Ressourcen-Modell)
SelfCare	Health-oriented self-leadership (dt. Gesundheitsorientierte Selbstführung)
StaffCare	Gesundheitsorientierte Mitarbeiterführung (dt. Gesundheitsorientierte Mitarbeiterführung)
u. a.	unter anderem
z. B.	zum Beispiel

Publikationsliste

Efimov, I., Rohwer, E., Harth, V. & Mache, S. (2022).
Virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation: a scoping review. *Frontiers in Psychology, 13*: 960955. https://doi.org/10.3389/fpsyg.2022.960955

Efimov, I., Harth, V. & Mache, S. (2024).
“That was one of my most difficult and biggest challenges”: experiences, preconditions and preventive measures of health-oriented leadership in virtual teams – a qualitative study with virtual leaders. *BMC Public Health, 24*: 1338. https://doi.org/10.1186/s12889-024-18800-7

Efimov, I., Krick, A., Harth, V., Felfe, J. & Mache, S. (2025).
When do employees feel isolated when working from home? Longitudinal trajectories, antecedents and outcomes of workplace isolation during the COVID-19 pandemic. *Frontiers in Psychology, 16.* https://doi.org/10.3389/fpsyg.2025.1601214

Weitere Publikationen der Doktorandin zum Thema:

Efimov, I., Harth, V. & Mache, S. (2020).
Health-oriented self- and employee leadership in virtual teams: a qualitative study with virtual leaders. *International Journal of Environmental Research and Public Health*, *17*(18): 6519. https://doi.org/10.3390/ijerph17186519

Efimov, I., Harth, V. & Mache, S. (2021).
Gesundheitsförderung in virtueller Teamarbeit durch gesundheitsorientierte Führung. *Prävention & Gesundheitsförderung, 16*: 249-255, https://doi.org/10.1007/s11553-020-00819-4

Efimov, I., Harth, V. & Mache, S. (2024).
Virtuelle Führung in Krisenzeiten: Veränderungen für Führungskräfte und Unterstützungspotentiale. *Zentralblatt für Arbeitsmedizin, Arbeitsschutz und Ergonomie*, *74*: 224–233. https://doi.org/10.1007/s40664-024-00543-2

Synopse

1. Einleitung

Die Flexibilisierung der Arbeitswelt (engl. New Ways of Working) führte in den letzten drei Jahrzehnten zu einer Zunahme der Nutzung von digitalen Informations- und Kommunikationstechnologien (IKT) sowie der Auflösung fester Arbeitszeiten und -orte [1]. Zu den Formen flexibler Arbeit zählt u. a. die virtuelle Teamarbeit: Darunter werden Teams verstanden, die gemeinsame Aufgaben und Ziele verfolgen und mittels digitaler IKT zeit- und ortsflexibel zusammenarbeiten [2]. Dabei bewegen sie sich auf einem Kontinuum der Virtualität, da digitale IKT in unterschiedlicher Intensität verwendet werden können [3]. Neben diversen Chancen, die die Einführung virtueller Teamarbeit für Beschäftigte als auch für Organisationen ermöglichen kann (wie eine erhöhte Effizienz oder die Reduktion von Kosten, Bürofläche und Reisezeiten) [1, 4], können die veränderten Arbeitsbedingungen auch Herausforderungen für die Zusammenarbeit und Führung bergen, z. B. Herausforderungen in der Teamkommunikation oder eine Zunahme des Isolationserlebens [1, 5, 6].

Dieser Trend zu virtueller Zusammenarbeit im Arbeitskontext wurde durch die COVID-19-Pandemie weltweit verstärkt [7]. Die Eindämmung der COVID-19-Pandemie in Deutschland erforderte ab dem Frühjahr 2020 u. a. die Einführung von Maßnahmen zur Beschränkung sozialer Kontakte im öffentlichen und privaten Raum [8]. In Folge wurde eine SARS-CoV-2-Arbeitsschutzverordnung am 21. Januar 2021 vom Bundesministerium für Arbeit und Soziales beschlossen. Diese verpflichtete Arbeitgeber:innen, Beschäftigten im Fall von Büroarbeit oder vergleichbaren Tätigkeiten die Arbeit aus dem Homeoffice anzubieten, soweit keine betriebsbedingten Gründe entgegenstanden [9]. Das führte zu einem deutlichen Anstieg der Nutzung des Homeoffice und somit auch der virtuellen Zusammenarbeit in Deutschland: in dem präpandemischen Jahr 2019 betrug der Anteil an Erwerbstätigen, die Homeoffice zumindest gelegentlich nutzten, 12,80 %, im ersten Jahr der Pandemie (2020) waren es 21,00 % und in den Folgejahren waren es 24,90 % (2021), 24,00 % (2022) und 23,50 % (2023) [10, 11]. Viele Organisationen waren jedoch für diese Ad-hoc-Veränderungen im Zuge der COVID-19-Pandemie technologisch sowie organisatorisch nicht vorbereitet [12].

1.1. Gesundheitliche Auswirkungen der Arbeit aus dem Homeoffice während der COVID-19-Pandemie

Die Einführung der Arbeit aus dem Homeoffice während der COVID-19-Pandemie veränderte die Arbeitsbedingungen von Beschäftigten in vielen Organisationen. Dem aktuellen Stand der Forschung nach zeigt sich, dass die Arbeit aus dem Homeoffice keine einheitlichen Auswirkungen auf die Gesundheit von Beschäftigten hat. Systematische Literaturreviews weisen zum einen auf negative Einflüsse auf die psychische Gesundheit von Beschäftigten durch erhöhte Arbeitsanforderungen (z. B. Vereinbarkeitskonflikte zwischen Arbeit und Privatleben oder erhöhte technologische Anforderungen) hin [13]. Dabei verdeutlichen mehrere Reviews, dass die gesundheitlichen Auswirkungen der Arbeit aus dem Homeoffice abhängig von persönlichen Faktoren (z. B. Wohnbedingungen) und organisationalen Faktoren (z. B. organisationale Unterstützung, Führung) sind [7, 12, 14-16]. Zum anderen identifizierte eine umfassende Meta-Analyse einen übergeordnet positiven, wenngleich kleinen Effekt von Homeoffice-Intensität auf diverse Outcomes von Beschäftigten. Dabei konnte die von Beschäftigten wahrgenommene Autonomie diesen Zusammenhang positiv verstärken, das Isolationserleben diesen jedoch beeinträchtigen [17]. Ebenso verwiesen bereits prä-pandemische Studien auf das Risiko sozialer Isolation in geografisch verteilter Zusammenarbeit [18, 19]. Allgemein ist soziale Isolation ein Risikofaktor für die Gesundheit und kann zu Beeinträchtigungen der kardiovaskulären und psychischen Gesundheit führen [20]. Dennoch basiert der bisherige Forschungsstand zu den gesundheitlichen Auswirkungen der Arbeit aus dem Homeoffice vor und während der COVID-19-Pandemie auf mehrheitlich querschnittlichen Studien, nicht jedoch auf längsschnittlichen Forschungserkenntnissen. Diese sind jedoch erforderlich, um Gesundheitsverläufe sowie Kausalbeziehungen untersuchen zu können.

1.2. Einfluss von Führung in virtueller Teamarbeit

Ein relevanter organisationaler Faktor, der die gesundheitlichen Auswirkungen der Arbeit aus dem Homeoffice beeinflussen kann, ist die Führung [7]. Aus der Führungsforschung in traditionellen Teams besteht bereits eine umfangreiche wissenschaftliche Evidenz, dass Führung in Präsenz sowohl als Ressource als auch als Stressor einen nachweisbaren Einfluss auf die Gesundheit von Beschäftigten haben kann [21-24]. Führungskräfte können sowohl einen direkten Einfluss über ihr Führungsverhalten ausüben als auch indirekt über die Gestaltung von Arbeitsbedingungen, über ihre

Vorbildfunktion sowie über ihren eigenen Gesundheitszustand [25]. Damit können Führungskräfte als Schutzfaktor für Arbeitnehmende bei hoher negativer Arbeitsbelastung fungieren [22, 23, 26].

Im Vergleich dazu besteht bislang noch wenig empirische Evidenz, welchen Einfluss Führung auf die Gesundheit von Beschäftigten in virtueller Teamarbeit haben kann und welche Führungsstile geeignet sind für die virtuelle Teamarbeit [27]. Nach dem aktuellen Stand der Forschung sind Führungskräfte virtueller Teams mit höheren Anforderungen konfrontiert als Führungskräfte traditioneller Teams in Präsenz [27, 28]. Für die Führung in digitaler, ortsflexibler Zusammenarbeit bestehen verschiedene Begriffe, die bislang synonym in der Forschung verwendet werden, wie virtuelle Führung, remote Führung oder „E-Leadership“ [29]. In dieser Dissertation wird der Begriff „virtuelle Führung“ analog zu „virtueller Teamarbeit“ zur Beschreibung einer digitalisierten, globalisierten und flexiblen Arbeitsumgebung verwendet, in welcher Teammitglieder über digitale IKT kommunizieren und Führungskräfte ihre orts- und zeitflexiblen Teams führen [4]. Virtuelle Führung ist dabei nicht als ein Führungsstil, sondern als eine kontextuelle Bedingung von Führung zu verstehen [30].

1.3. Gesundheitsorientierte Führung in virtueller Teamarbeit

Neben den Forschungsarbeiten zum Einfluss etablierter Führungsstile (z. B. transformationale Führung) auf die Gesundheit von Beschäftigten, entwickelten sich in den letzten zwei Jahrzehnten auch theoretische Konzepte zu gesunder Führung [31]. Ein dominantes Konzept gesunder Führung, welches vier Wirkmechanismen von Führung in einem integrativen Ansatz vereint, ist das Modell gesundheitsorientierter Führung (engl. health-oriented leadership, Abk.: HoL) nach Franke und Felfe [31, 32]. Es setzt sich aus drei Komponenten zusammen: der gesundheitsorientierten Selbstführung (engl. health-oriented self-leadership, Abk.: SelfCare) der Führungskraft, der gesundheitsorientierten Mitarbeiterführung (engl., health-oriented employee leadership, Abk.: StaffCare) und der SelfCare der Beschäftigten. Das Modell dient der Dissertation als übergeordnetes theoretisches Modell und wird im theoretischen Hintergrund der vorliegenden Arbeit erläutert.

Nach dem aktuellen Stand der Forschung zeigt sich, dass das HoL-Modell bislang vorrangig im traditionellen Arbeitskontext in Präsenz untersucht wurde. Zahlreiche Studien konnten den positiven Einfluss von HoL auf die Beschäftigtengesundheit darstellen. Für den Kontext virtueller Zusammenarbeit bestehen bislang nur erste

Forschungsarbeiten [33]. Diese deuten ebenfalls auf positive Zusammenhänge zwischen SelfCare bzw. StaffCare und verschiedenen arbeits- und gesundheitsbezogenen Outcomes, auch im Vergleich zur Zusammenarbeit in Präsenz [34-37]. Dabei können Technostressoren (Schwierigkeiten im Umgang mit digitalen IKT) diesen Zusammenhang beeinträchtigen [38]. Qualitative Studien ergaben zudem, dass die Anwendung von HoL in virtueller Zusammenarbeit Anpassungen des Führungsverhaltens erfordert [39] und mit spezifischen Herausforderungen konfrontiert ist, z. B. Kommunikationsschwierigkeiten, eingeschränktem informellen Austausch, Mangel an sozialer Präsenz und gegenseitigem Vertrauen [40].

Gleichzeitig ist Führung eingebettet in einen Kontext und nicht losgelöst von weiteren Einflussfaktoren [41]. Für eine tiefergehende Betrachtung von HoL in virtueller Zusammenarbeit ist daher ein ganzheitlicher Ansatz zur Analyse von förderlichen Rahmenbedingungen erforderlich [42]. Erste empirische Studien zu Rahmenbedingungen von HoL im traditionellen Arbeitskontext in Präsenz identifizierten die SelfCare von Führungskräften [43], die soziale Unterstützung von Kolleg:innen [44], das Gesundheitsklima im Team [45] oder der Organisation [46, 47] sowie gesundheitsorientierte Personalmanagementstrategien der Organisation [48] als förderliche Faktoren von HoL. Eine erste explorative qualitative Studie zu förderlichen Rahmenbedingungen von HoL in virtueller Zusammenarbeit ergab, dass insbesondere organisationale Faktoren (z. B. flexible Arbeitsbedingungen, Unterstützung durch die Geschäftsleitung und eine förderliche Organisationskultur) relevant für die erfolgreiche Umsetzung von HoL sein können [39]. Weiterhin wurden persönliche Einflussfaktoren (z. B. persönliche Eigenschaften oder Einstellungen), technische Einflussfaktoren (z. B. technische Ausfälle) sowie soziale Einflussfaktoren (z. B. gegenseitige Unterstützung im Team oder Kommunikationsschwierigkeiten) identifiziert [39]. In Ergänzung können auch externe Umweltfaktoren wie die COVID-19-Pandemie relevante Kontextbedingungen darstellen, die die Führung in virtueller Teamarbeit beeinflussen. Dadurch dass viele Organisationen für die pandemiebedingten Veränderungen der Arbeitsbedingungen sowohl technisch als auch organisatorisch nicht vorbereitet waren [12], können zudem große Unterschiede hinsichtlich der Rahmenbedingungen für HoL in virtueller Zusammenarbeit während der Pandemie bestanden haben. In diesem Zusammenhang ist noch offen, ob Vorerfahrungen mit regelmäßiger virtueller Teamarbeit vor der COVID-19-Pandemie einen Einfluss auf die Erfahrungen während der COVID-19-Pandemie haben können. Demnach besteht nach aktuellem Stand der

Forschung wenig Evidenz zum Einfluss von HoL in virtueller Zusammenarbeit, insbesondere unter Berücksichtigung der Rahmenbedingungen während der COVID-19-Pandemie.

2. Zielsetzung und übergeordnete Fragestellungen der Dissertation

Auf Basis des aktuellen Forschungsstands sind die zentralen Ziele der vorliegenden kumulativen Dissertation, einen systematischen Überblick über den aktuellen Stand der nationalen und internationalen Forschung zum Zusammenhang virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes zu erfassen sowie sowohl quantitativ als auch qualitativ das HoL-Modell als ein spezifisches gesundheitsförderliches Führungsmodell in virtueller Teamarbeit zu untersuchen. Dabei sollen zum einen die Zusammenhänge von HoL und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit analysiert werden. Zum anderen soll die Perspektive von Führungskräften zu den Erfahrungen, Herausforderungen, förderlichen Rahmenbedingungen und präventiven Maßnahmen in der Umsetzung von HoL explorativ untersucht werden. Daraus abgeleitet ergeben sich folgende übergeordnete Fragestellungen für die Dissertation:

1. Welchen übergeordneten Einfluss hat Führung in virtueller Teamarbeit auf arbeits- und gesundheitsbezogene Outcomes von Beschäftigten?
2. Welche Zusammenhänge bestehen zwischen HoL und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit?
3. Was sind die Erfahrungen und Herausforderungen bei der Umsetzung von HoL in virtueller Teamarbeit?
4. Welche Rahmenbedingungen und präventiven Maßnahmen fördern die Umsetzung von HoL in virtueller Teamarbeit?

In den nachfolgenden Kapiteln sind die spezifischen Zielsetzungen und Fragestellungen der jeweiligen Studien dargestellt.

3. Theoretischer Hintergrund

Für die Bearbeitung der dargestellten Fragestellungen wurden theoretische Modelle der Arbeits- und Gesundheitspsychologie angewandt. Die jeweiligen Originalarbeiten der Dissertation enthalten ausführlichere Erläuterungen der verwendeten Modelle und sind im Folgenden in zusammenfassender Form dargestellt.

Übergeordnet diente allen drei Studien das HoL-Modell nach Franke und Felfe [32] als theoretischer Rahmen (siehe Abbildung 1). Es beschreibt einen integrativen und

ganzheitlichen Ansatz, welcher vier Wirkmechanismen von Führung kombiniert und aus drei Komponenten besteht: der SelfCare der Führungskraft, der StaffCare und der SelfCare der Beschäftigten. Jede dieser drei Komponenten setzt sich aus drei Dimensionen zusammen: Wichtigkeit, Achtsamkeit und Verhalten. Die SelfCare der Führungskraft bildet hierbei die Basis des Modells. Es wird angenommen, dass Führungskräfte, die sich selbst gesundheitsorientiert führen können, ihre Gesundheit als wichtig erachten, die Belastungsfaktoren am Arbeitsplatz wahrnehmen und entsprechend gesundheitsförderliches und präventives Verhalten anwenden können. Folglich wird die StaffCare der Führungskraft sowie die SelfCare der Beschäftigten positiv beeinflusst. Führungskräfte können demnach die Gesundheit der Beschäftigten über ihr Führungsverhalten direkt beeinflussen als auch indirekt über ihre Vorbildfunktion. Insgesamt nimmt das Modell an, dass diese drei Komponenten die Wahrscheinlichkeit positiver Gesundheitsparameter in der Belegschaft erhöhen können [32].

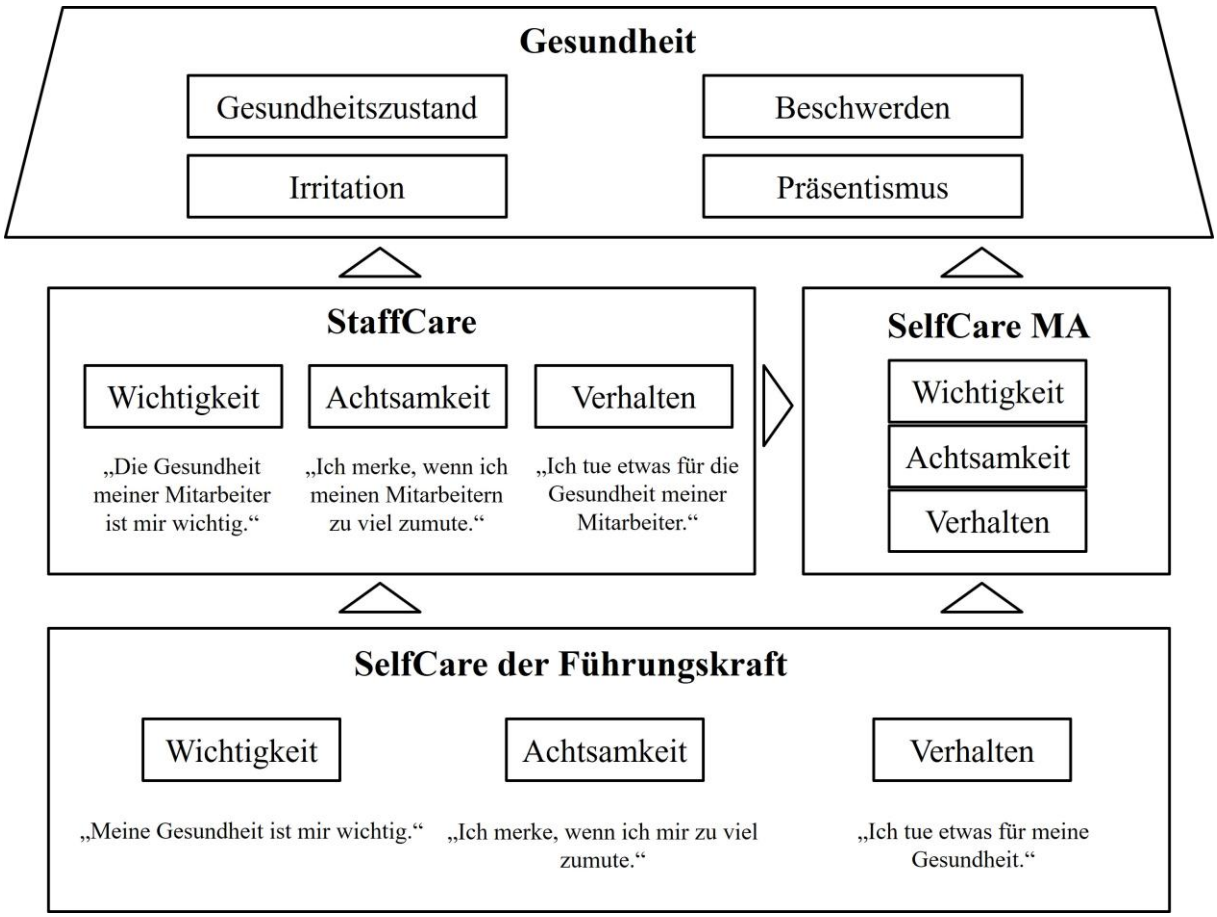

Abbildung 1. Eigene Darstellung des HoL-Modells nach Franke et al. [25]

Um die Wirkbeziehungen von HoL in der quantitativen Längsschnittstudie (Publikation 2) untersuchen zu können, wurden zwei weitere theoretische Modelle verwendet: das Arbeitstätigkeit-Anforderungen-Ressourcen-Modell (engl. Job Demands-

Resources Model, Abk.: JD-R) nach Bakker und Demerouti [49] und die Theorie der Ressourcenerhaltung (engl. Conservation of Resources Theory, Abk.: COR) nach Hobfoll et al. [50]. Das JD-R-Modell nimmt an, dass jede Arbeitstätigkeit spezifische Arbeitsanforderungen und -ressourcen beinhaltet. Hohe Arbeitsanforderungen können die physische und psychische Gesundheit von Beschäftigten beeinträchtigen, Ressourcen können hingegen diese ausgleichen und bei höherer Ausprägung die Gesundheit positiv beeinflussen [49]. Führung kann im JD-R-Modell sowohl als direkter als auch indirekter Einflussfaktor untersucht werden [51]. In Ergänzung nimmt die COR-Theorie an, dass Stresserleben erst dann entsteht, wenn bestehende Ressourcen erschöpft sind und nur noch wenige Ressourcen für den Stressabbau zur Verfügung stehen. Die damit zusammenhängende Ressourcenverlustspirale beschreibt dabei den Prozess der Stressbewältigung, in welcher weitere Ressourcen in jeder Iteration der Stressspirale aufgewendet werden müssen. Umgekehrt können Menschen im Sinne der Ressourcengewinnungsspirale in positiven Gesundheitszuständen weitere Ressourcen gewinnen, wenngleich dieser Prozess im Vergleich langsamer und geringer ausgeprägt ist. Menschen streben danach, in Ressourcen zu investieren, da der Ressourcengewinn unerlässlich ist, um zukünftige Ressourcenverluste zu verhindern [50].

4. Methodik

Das methodische Vorgehen umfasst im Sinne eines multimethodischen Forschungsansatzes eine Kombination aus einer systematischen Literaturrecherche, einer quantitativen und qualitativen Datenerhebung. Anhand eines konvergenten Mixed-Methods-Designs werden die quantitativen und qualitativen Daten verglichen und komplementiert, um eine übergeordnete Interpretation und ein umfassenderes Verständnis für das zu untersuchende Phänomen zu ermöglichen [52]. Die Methodik ist in den drei Originalarbeiten ausführlich dargestellt und wird im Folgenden daher zusammenfassend beschrieben.

4.1. Systematische Literaturrecherche

Um einen systematischen Überblick über den aktuellen Stand der Forschung zum Zusammenhang virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes zu erfassen, wurde eine systematische Literaturrecherche anhand der Joanna Briggs Institut (JBI) Methode für Scoping Reviews durchgeführt [53]. Für die Identifizierung relevanter Studien wurde eine umfangreiche Suche am 09. Februar 2021

sowie ein Update am 28. September 2021 in fünf elektronischen Datenbanken durchgeführt: PubMed, Cochrane Library, PsycINFO, PSYNDEX und Web of Science. Anhand des PEO-Schemas (engl. Population, Exposure, Outcome, Abk.: PEO) wurde die Suchstrategie entwickelt. Die Studienauswahl erfolgte anhand vordefinierter Ein- und Ausschlusskriterien. Es wurden verschiedene Studientypen berücksichtigt, dazu zählten qualitative, quantitative, multimethodische Studien, Fallstudien sowie quasi-experimentelle Forschungsdesigns. Der Zeitraum der Suche beschränkte sich auf Studien ab dem Jahr 2000, da die erste Definition virtueller Führung („E-Leadership“) erst im Jahr 2001 veröffentlicht wurde [54] und ein möglichst zeitgemäßes Arbeitsumfeld erfasst werden sollte. Ausführliche Darstellungen der Suchstrategie sowie der Ein- und Ausschlusskriterien sind in der Originalarbeit dargestellt. Das Titel- und Abstract-Screening erfolgte eigenständig durch die Doktorandin. Das Volltext-Screening und die Bewertung der Studienqualität führten die Doktorandin und ein weiteres Mitglied des Studienteams durch. Wenngleich die Qualitätsbewertung der eingeschlossenen Studien im Rahmen eines Scoping Reviews üblicherweise nicht vorgesehen ist, so kann diese ergänzend durchgeführt werden, um das Risiko möglicher Verzerrungen darstellen zu können. Hierfür wurden die standardisierten JBI-Bewertungsinstrumente verwendet [55, 56]. Der Prozess der Studienauswahl ist in Abbildung 2 anhand des PRISMA-ScR Flow-Diagramms [57] dargestellt. Die Datenextraktion der eingeschlossenen Studien wurde durch die Doktorandin ausgeführt und durch ein weiteres Mitglied des Studienteams geprüft. Die Informationen zu den eingeschlossenen Studien wurden deskriptiv zusammengefasst und analysiert sowie die qualitativen Daten mittels narrativer Synthese in Hauptkategorien klassifiziert [53].

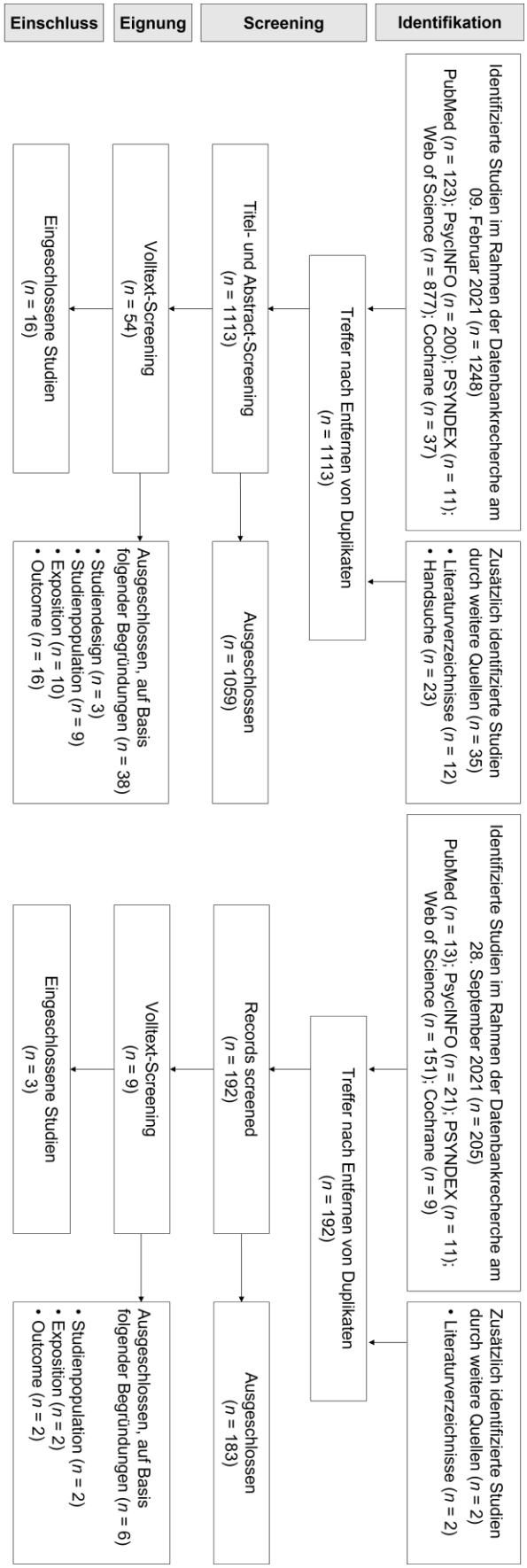

Abbildung 2. Prozess der Studienauswahl im Rahmen des Scoping Reviews, übersetzte Darstellung, basierend auf [58]

4.2. Quantitative Datenerhebung

Zur Untersuchung des HoL-Modells als ein spezifisches gesundheitsförderliches Führungsmodell in virtueller Teamarbeit wurden die Zusammenhänge von HoL und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit anhand einer quantitativen Längsschnittstudie analysiert. Für die Analyse der Gesundheitsverläufe wurde das arbeitsplatzbezogene Isolationserleben der Beschäftigten verwendet. Auf Basis des aktuellen Forschungsstands, des theoretischen Hintergrunds und der Zielstellung der Studie wurden die folgenden Hypothesen aufgestellt. Die theoretische Herleitung der Hypothesen ist in der Originalarbeit ausführlich dargestellt.

- **Hypothese 1 (H1):** Es besteht ein negativer, nichtlinearer Zusammenhang zwischen Zeit und arbeitsplatzbezogener Isolation (H1a). Es gibt einen Interaktionseffekt von Zeit und Homeoffice-Intensität auf die arbeitsplatzbezogene Isolation. Der Verlauf der Homeoffice-Intensität sagt die arbeitsplatzbezogene Isolation über die Zeit voraus (H1b).
- **Hypothese 2 (H2):** Es bestehen quantitativ und qualitativ distinkte Verläufe von arbeitsplatzbezogener Isolation und Homeoffice-Intensität: zwei Verlaufsprofile mit hoher arbeitsplatzbezogener Isolation, dabei eins mit niedriger und eins mit hoher Homeoffice-Intensität (H2a), und zwei Verlaufsprofile mit niedriger arbeitsplatzbezogener Isolation, dabei eins mit niedriger und eins mit hoher Homeoffice-Intensität (H2b).
- **Hypothese 3 (H3):** Persönliche Einflussfaktoren (SelfCare, Extraversion) sagen die Profilzugehörigkeit voraus. SelfCare (H3a) ist positiv und Extraversion (H3b) negativ mit Verlaufsprofilen assoziiert, die eine niedrige arbeitsplatzbezogene Isolation und eine hohe Homeoffice-Intensität aufweisen.
- **Hypothese 4 (H4):** Soziale Einflussfaktoren (soziale Norm, soziale Unterstützung durch Kolleg:innen, StaffCare, Kommunikationsschwierigkeiten) sagen die Profilzugehörigkeit voraus. Soziale Norm, soziale Unterstützung durch Kolleg:innen und StaffCare sind positiv mit Verlaufsprofilen assoziiert, die eine niedrige arbeitsplatzbezogene Isolation und eine hohe Homeoffice-Intensität aufweisen (H4a). Kommunikationsschwierigkeiten sind negativ mit Verlaufsprofilen assoziiert, die eine niedrige arbeitsplatzbezogene Isolation und eine hohe Homeoffice-Intensität aufweisen (H4b).
- **Hypothese 5 (H5):** Die Verlaufsprofile unterscheiden sich in den Ausprägungen der psychischen Belastung, des Commitments und der selbst einge-

schätzten Leistung. Verlaufsprofile, die eine niedrige arbeitsplatzbezogene Isolation und eine hohe Homeoffice-Intensität aufweisen, zeigen ein geringeres Maß an psychischer Belastung (H5a) und ein höheres Maß an Commitment (H5b) und selbst eingeschätzter Leistung (H5c).

In der quantitativen Längsschnittstudie wurde eine Mehrebenenanalyse über fünf Messzeitpunkte (Level 1) genestet in *N* = 512 Personen (Level 2) angewandt. Die Rekrutierung für die Online-Befragung erfolgte in fünf Wellen (T1: April 2021, T2: Juli 2021, T3: September 2021, T4: Juli 2022, T5: Oktober 2022). Die Teilnahme war freiwillig und Studienteilnehmende wurden vorab schriftlich über die Studie informiert und unterschrieben eine Einwilligungserklärung zur Studienteilnahme. Teilnehmen konnten erwachsene Vollzeitbeschäftigte, die grundsätzlich von zuhause arbeiten konnten. Die Stichprobe wurde von 848 Fragebögen auf *N* = 512 Personen reduziert, die zu jedem Messzeitpunkt angaben, mindestens einen Tag pro Woche von zuhause aus zu arbeiten. Die Studienteilnehmenden waren im Durchschnitt 48,6 Jahre alt (Standardabweichung = 11,0) und identifizierten sich fast zur Hälfte als weiblich (49,80 %). Die meisten hatten keine Führungsverantwortung (62,50 %), waren in einem Angestelltenverhältnis (86,50 %) und trugen keine Verantwortung für die Kinderbetreuung in der Zeit, die sie von zuhause arbeiteten (65,20 %). Ungefähr die Hälfte arbeitete an fünf Tagen pro Woche im Homeoffice (46,90 %) und in großen Organisationen mit mehr als 500 Beschäftigten (50,40 %).

Der Fragebogen bestand überwiegend aus validierten Skalen, z. B. der Health-Oriented Leadership Scale [59]. Zum ersten Messzeitpunkt (T1) wurden soziodemographische und arbeitsbezogene Charakteristika erhoben, ebenso wie die Variablen zu den Arbeitsanforderungen und Ressourcen (als potenzielle Prädiktoren). Zum letzten Messzeitpunkt (T5) wurden die arbeits- und gesundheitsbezogenen Outcomes erhoben. Zu allen Messzeitpunkten wurden das arbeitsplatzbezogene Isolationserleben und die Homeoffice-Intensität erfasst. In den statistischen Analysen wurden folgende Kontrollvariablen berücksichtigt: Alter, Geschlecht, Betreuung von (Enkel-) Kindern während der Arbeit im Homeoffice und Freiwilligkeit, im Homeoffice zu arbeiten.

Die Datenauswertung erfolgte in vier Schritten und integrierte den personen- und variablenorientierten Ansatz [60]. Abbildung 3 stellt das konzeptionelle Modell der Studie dar (in Anlehnung an die Struktur des Modells von Kröner und Müller [61]).

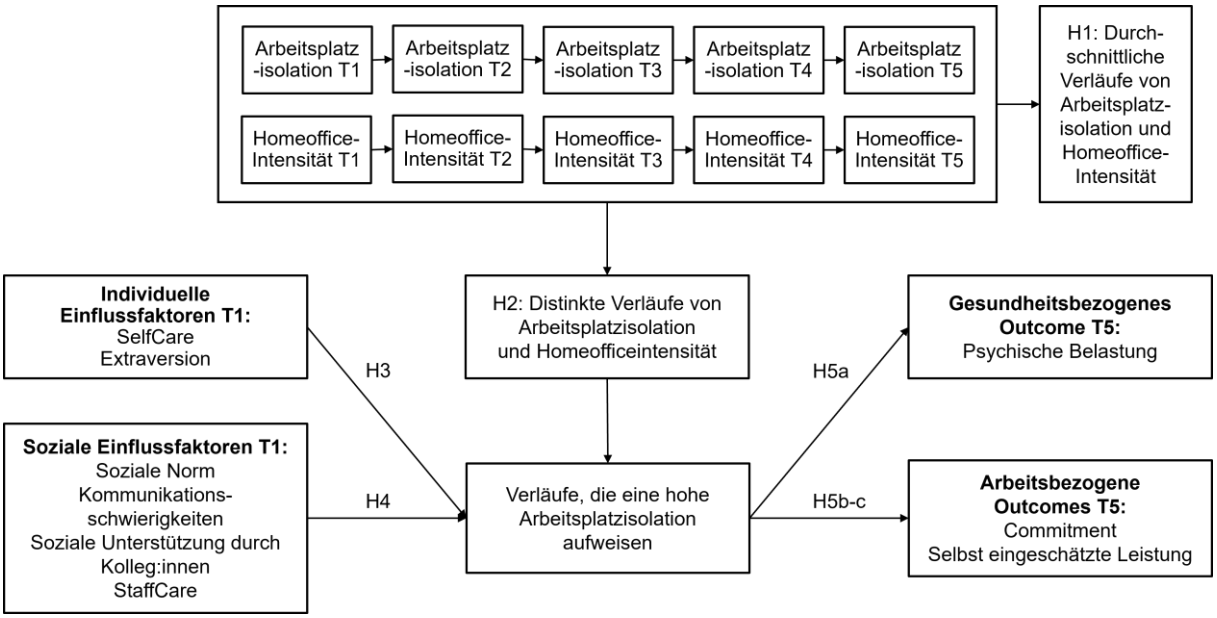

Abbildung 3. Konzeptionelles Modell der Studie, orientiert an [61]

Zuerst wurde anhand einer mehrstufigen Wachstumskurvenanalyse in IBM® SPSS® Statistics die Veränderungen der arbeitsplatzbezogenen Isolation und Homeoffice-Intensität über fünf Messzeitpunkte von N = 512 Beschäftigten analysiert, um einen allgemeinen Trend in der Stichprobe zu identifizieren. Hierfür wurde zunächst eine lineare Beziehung zwischen Zeit (Messzeitpunkte 1-5) und der abhängigen Variable arbeitsplatzbezogene Isolation modelliert und um einen Interaktionsterm zwischen Zeit und Homeoffice-Intensität ergänzt (Modell 1). Im Anschluss wurden quadratische Beziehungen (Modell 2) und kubische Beziehungen (Modell 3) getestet. Es wurde das Modell mit dem kleinsten, signifikanten -2LL Wert gewählt, welches die Daten am besten abbildet [62].

Im nächsten Schritt wurde eine latente Profilanalyse in Mplus 6.12 [63] durchgeführt. Anhand einer latenten Profilanalyse können Profile, d. h. distinkte Gruppen innerhalb der Stichprobe, identifiziert werden, die sich in ihren Verläufen zur arbeitsplatzbezogenen Isolation und Homeoffice-Intensität unterscheiden. Um die am besten passende Profillösung auszuwählen, wurden mehrere statistische Anpassungswerte sowie inhaltliche Entscheidungskriterien berücksichtigt [64]. Beim Vergleich der verschiedenen Profillösungen wurde das Modell gewählt, welches den kleinsten Wert des Bayes'schen Informationskriteriums (BIC), signifikante p-Werte im Lo-Mendell-Rubin-Likelihood-Ratio-Test (LMRT), im Vuong-Lo-Mendell-Rubin-Likelihood-Ratio-Test (VLMRT) und im Bootstrapped-Likelihood-Ratio-Test (BLRT) sowie die höchsten Werte in der Entropie (d.h. Gesamtgenauigkeit der Klassifizierung) und der Average-Latent-Class-Posterior-Wahrscheinlichkeit (AvePP, d.h. die Gewissheit, dass eine

Person einem bestimmten Profil zugeordnet werden kann) aufwies. Ergänzend wurde bei der Wahl der Profillösung die Prävalenzen der Profile berücksichtigt (d.h. mindestens 1 % oder > 25 Personen pro Profil) sowie die Interpretierbarkeit der Profile. Auf Basis einer Wahrscheinlichkeitsberechnung enthält die gewählte Profillösung eine Zuordnung aller Personen in der Stichprobe zu den jeweiligen Profilen (d.h. die wahrscheinlichste Profilzugehörigkeit) [64].

Um die Prädiktoren der Profilzugehörigkeit zu ermitteln, wurde anschließend eine multinomiale logistische Regression mittels IBM® SPSS® Statistics durchgeführt und das Profil 1 „Hohe Homeoffice-Intensität und geringe Isolation“ als Referenzkategorie definiert.

Im letzten Analyseschritt wurden Varianzanalysen mit Post-hoc-Tests in IBM® SPSS® Statistics berechnet, um Unterschiede in den Outcomes zwischen den Profilen zu untersuchen. Ausführlichere Erläuterungen zu allen Analyseschritten sind in der Originalarbeit dargestellt.

4.3. Qualitative Datenerhebung

Für die qualitative Untersuchung des HoL-Modells in virtueller Teamarbeit wurde die Perspektive von Führungskräften zu den Erfahrungen, Herausforderungen, förderlichen Rahmenbedingungen und präventiven Maßnahmen in der Umsetzung von HoL anhand einer qualitativen Interviewstudie durchgeführt. Der phänomenologische Ansatz wurde dabei als methodische Orientierung angewandt, um subjektive Perspektiven explorativ erforschen zu können [65, 66]. Zwischen Mai und Juli 2021 wurden halbstrukturierte, leitfadenbasierte Telefoninterviews mit 16 Führungskräften virtueller Teams aus Deutschland durchgeführt. Die Verwendung von Telefoninterviews erfolgte aus forschungsökonomischen Gründen, aus Gründen der zeitlichen und örtlichen Flexibilität sowie der Möglichkeit, die Stichprobe geografisch ausweiten zu können [67].

Studienteilnehmende wurden anhand des Schneeballsystems über persönliche und berufliche Kontakte, über berufliche Netzwerkplattformen und über Präsentationen auf wissenschaftlichen Konferenzen und einer Veranstaltung für Mitglieder eines Unternehmensverbandes rekrutiert. Führungskräfte konnten an der Interviewstudie teilnehmen, wenn sie (1) mindestens 18 Jahre alt waren, (2) Deutsch sprechen konnten, (3) mindestens 1,5 Jahre Berufserfahrung aufwiesen und (4) in ihrer beruflichen Tätigkeit mehrheitlich digital mit ihrem Team zusammenarbeiteten (z. B. drei Ta-

ge/Woche) und somit praktische Erfahrungen mit virtueller Führung entweder bereits vor oder seit der COVID-19-Pandemie gemacht hatten. Es bestanden zwischen der Doktorandin und den Studienteilnehmenden keine persönlichen Beziehungen. Die Studienteilnahme war freiwillig und die Führungskräfte wurden während der Rekrutierung und zu Interviewbeginn über die Studienziele, das Vorgehen und den geltenden Datenschutz ausführlich informiert und unterschrieben eine Einverständniserklärung vor der Studiendurchführung.

In Anlehnung an Witzels problemzentrierter Interviewmethode (PZI) wurden ein Kurzfragebogen zur Erfassung soziodemografischer Daten, eine Tonbandgeräteaufzeichnung, ein Interviewleitfaden und Postskriptum eingesetzt [68, 69]. Der halbstrukturierte Interviewleitfaden fokussierte die Erfahrungen und Herausforderungen der Führungskräfte bei der (ad hoc) Anwendung von HoL in der virtuellen Teamarbeit während der COVID-19-Pandemie, die hierfür erforderlichen Rahmenbedingungen sowie mögliche Präventionsmaßnahmen zur Förderung der Umsetzung von HoL in virtuellen Teams. Dieser wurde vor der Datenerhebung pilotiert und im Hinblick auf Verständlichkeit und Länge überprüft. Die einzelnen Fragen des Interviewleitfadens sind in der Originalarbeit dargestellt. Die Interviews wurden auf Deutsch durch die Doktorandin durchgeführt, welche zum Erhebungszeitpunkt bereits über Erfahrungen im Bereich qualitativer Forschung verfügte. Keine weiteren Personen waren bei den Interviewdurchführungen anwesend, kein Interview wurde wiederholt oder aus der Auswertung ausgeschlossen. Die Interviews dauerten im Durchschnitt 46 Minuten (Spanne: 35-66 Minuten). Eine theoretische Sättigung wurde im Verlauf der Interviewdurchführungen angenommen, sobald sich Erfahrungsberichte der unterschiedlichen Teilnehmenden mehrfach wiederholten [70].

Anschließend wurden die Audio-Aufnahmen transkribiert [71], anonymisiert und anhand der Qualitativen Inhaltsanalyse nach Mayring [72] induktiv analysiert und interpretiert. Die Kodierung der transkribierten Daten erfolgte mittels der Software MAXQDA Plus für Qualitative Inhaltsanalysen (Version 20.0.6, 2020, VERBI GmbH, Berlin). Ergänzend wurde ein explorativer Vergleich der Erfahrungen und Einschätzungen von Führungskräften mit und ohne prä-pandemischer Vorerfahrung mit regelmäßiger virtueller oder hybrider Zusammenarbeit durchgeführt. Studienteilnehmende wurden in die Datenauswertung nicht involviert.

Von den 16 Studienteilnehmenden war die Mehrheit männlich ($n = 11$, 68,75 %) und zwischen 31 und 40 Jahren oder zwischen 51 und 60 Jahren alt (jeweils: $n = 6$, 37,50

%; Durchschnittsalter: 45,7 Jahre). Die meisten Führungskräfte waren zum Zeitpunkt der Erhebung in der Dienstleistungsbranche (*n* = 11, 68,75 %) und in großen Organisationen beschäftigt (*n* = 12, 75,00 %), waren mehrheitlich auf nationaler Ebene (*n* = 13, 81,25 %) und in regional verteilten Teams tätig (*n* = 10, 62,50 %). Sieben Führungskräfte (43,75 %) arbeiteten schon vor der Pandemie regelmäßig virtuell oder hybrid mit ihrem Team zusammen, wohingegen neun Führungskräfte (56,25 %) angaben, dies erst mit der COVID-19-Pandemie umgesetzt zu haben.

5. Ergebnisse

5.1. Einfluss von Führung auf die Gesundheit von Beschäftigten in virtueller Teamarbeit[1]

Im Rahmen von Publikation 1 wurde anhand einer systematischen Literaturrecherche der aktuelle Stand der Forschung zum Zusammenhang virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes von Beschäftigten erfasst. Insgesamt 19 Studien erfüllten die Einschlusskriterien und konnten daher im Scoping Review eingeschlossen werden. Die meisten der identifizierten Studien waren quantitative Querschnittsstudien (*n* = 14), wurden in Nordamerika (*n* = 9) oder Europa (*n* = 7) durchgeführt und erst in den letzten Jahren (2016-2021; *n* = 9) veröffentlicht. In den Stichproben der Studien wurden unterschiedliche Arbeitsformen digitaler Zusammenarbeit untersucht: Telearbeitskräfte (*n* = 10), virtuelle Teamarbeitskräfte (*n* = 5) und Beschäftigte, die räumlich entfernt zur Führungskraft arbeiteten (*n* = 4). Die meisten der identifizierten Studien ermittelten den Zusammenhang von Führung und der Arbeitszufriedenheit von Beschäftigten (*n* = 12) sowie weitere mit der psychischen Gesundheit (*n* = 5) und dem Isolationserleben (*n* = 5) von Beschäftigten. Führung wurde dabei zum einen als Führungsstil (*n* = 10) erhoben, zum anderen als soziale Unterstützung durch die Führungskraft (*n* = 5) oder als allgemeine Führungsverhaltensweisen und -strategien (*n* = 4).

Die Ergebnisse des Scoping Reviews wiesen auf übergeordnet positive Zusammenhänge zwischen virtueller Führung und der psychischen Gesundheit von Beschäftigten hin. Die Zusammenfassung dieser Studien ergab, dass Führung in einem positiven Zusammenhang mit dem Wohlbefinden der Beschäftigten stand [73, 74] und in

[1] Efimov, I., Rohwer, E., Harth, V. & Mache, S. (2022). Virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation: a scoping review. *Frontiers in Psychology, 13*: 960955. https://doi.org/10.3389/fpsyg.2022.960955

einem negativen Zusammenhang mit psychischen Beanspruchungen [75, 76] und dem Stresserleben der Beschäftigten [77]. Neben direkten Zusammenhängen [75-77] wurden auch indirekte Zusammenhänge in quantitativen Studien untersucht, in welchen Führung als moderierende Variable fungierte [77] sowie mediierende Variablen (wie psychologische Vertragserfüllung, Arbeitsengagement [74] und soziale Isolation [76]) im Zusammenhang von Führung und Wohlbefinden bzw. psychischer Beanspruchung der Beschäftigten identifiziert wurden.

Des Weiteren deuteten die Ergebnisse auf mehrheitlich positive Zusammenhänge zwischen virtueller Führung und der Arbeitszufriedenheit von Beschäftigten hin, wenngleich die Studienergebnisse hier nicht homogen waren. Es konnten zum einen positive direkte positive Zusammenhänge zwischen Führung und der Arbeitszufriedenheit der Beschäftigten festgestellt werden [75, 76, 78-81], zum anderen indirekte Zusammenhänge, in welchen Führung als mediierende Variable [78, 82, 83] untersucht wurde. Andere Studien untersuchten den direkten Zusammenhang zwischen Führung und Arbeitszufriedenheit unter Berücksichtigung moderierender Variablen (wie die Intensität der virtuellen Zusammenarbeit [84], die physische Distanz zur Führungskraft [80] oder den Promotionsfokus der Beschäftigten [85]). Einzelne Studien ergaben keine signifikanten direkten Zusammenhänge zwischen Führung (operationalisiert durch soziale Unterstützung durch die Führungskraft [86, 87] und beziehungsorientierter Führung [79]) und Arbeitszufriedenheit. In den Studien wurden sowohl die allgemeine Arbeitszufriedenheit [75, 76, 78, 79, 82-85] als auch jobspezifische Arbeitszufriedenheit (z. B. Zufriedenheit mit der Telearbeit) [80, 81, 86, 87] untersucht.

Zuletzt ergab das Scoping Review übergeordnet negative Zusammenhänge zwischen virtueller Führung und dem Isolationserleben von Beschäftigten. Das Outcome wurde in den Studien mit professioneller Isolation [88, 89], sozialer Isolation [76, 90] und wahrgenommener Nähe [91] operationalisiert. Wenngleich drei der Studien qualitative Interviewstudien waren, so untersuchten zwei quantitative Studien sowohl den direkten Zusammenhang zwischen Führung und Isolationserleben [76] als auch Führung als moderierende Variable im Zusammenhang von Telearbeit und professioneller Isolation [88].

Übergeordnet deuteten die Ergebnisse des Scoping Reviews auf einen weiterhin bestehenden großen Forschungsbedarf zum Einfluss von Führung, insbesondere HoL,

auf arbeits- und gesundheitsbezogene Outcomes von Beschäftigten in virtueller Teamarbeit hin.

Die Qualitätsbewertung der eingeschlossenen Studien deutete auf eine gute bis sehr gute Übereinstimmung hinsichtlich der Interrater-Reliabilität hin (κ = 0,74 für die erste Suche, κ = 0,89 für das Update) [92]. Insgesamt erfüllten fast alle analytischen Querschnittsstudien (*n* = 12) mindestens 50,00 % der Qualitätskriterien (mit Ausnahme von einer Studie, die nur 37,50 % erreichte). Die qualitativen Studien (*n* = 4) erreichten mindestens 60,00 % der Qualitätskriterien, die Kohortenstudie erfüllte 63,60 % und die quasi-experimentelle Studie 77,80 %. Keine Studie wurde basierend auf der Qualitätsbewertung ausgeschlossen [53]. Eine vollständige Darstellung der Scoping Review Ergebnisse und der Qualitätsbewertung ist in der Originalarbeit aufgeführt.

5.2. Gesundheitsorientierte Führung in virtueller Teamarbeit

Zur empirischen Untersuchung eines spezifischen gesundheitsförderlichen Führungsmodells wurden die Zusammenhänge von HoL und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit quantitativ in Publikation 2 analysiert. Darauf aufbauend wurden aus der Perspektive von Führungskräften die Erfahrungen, Herausforderungen, aber auch förderlichen Rahmenbedingungen und präventiven Maßnahmen in der Umsetzung von HoL explorativ in der qualitativen Interviewstudie in Publikation 3 untersucht.

5.2.1. Zusammenhänge von gesundheitsorientierter Führung und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit[2]

Im Rahmen der quantitativen Längsschnittbefragung (Publikation 2) wurden die Zusammenhänge von HoL und den Gesundheitsverläufen von Beschäftigten in virtueller Teamarbeit analysiert. Hierfür wurden (1) eine mehrstufige Wachstumskurvenanalyse, (2) eine latente Profilanalyse, (3) eine multinomiale logistische Regression und (4) Varianzanalysen mit Post-hoc-Tests durchgeführt. Die Grundlage für diese Berechnung bildete in einem ersten Analyseschritt die Untersuchung von Gesundheitsverläufen von Beschäftigten, die während der COVID-19-Pandemie im Homeoffice gearbeitet haben. Auf Basis des theoretischen und empirischen Hintergrunds wurde die arbeitsplatzbezogene Isolation in Abhängigkeit von der Homeoffice-Intensität für

[2] Efimov, I., Krick, A., Harth, V., Felfe, J. & Mache, S. (2025). When do employees feel isolated when working from home? Longitudinal trajectories, antecedents and outcomes of workplace isolation during the COVID-19 pandemic. *Frontiers in Psychology, 16.* https://doi.org/10.3389/fpsyg.2025.1601214

die Analyse von Gesundheitsverläufen verwendet. Die Operationalisierung der Variablen, die Ergebnistabellen und Analysen sind in der Originalarbeit ausführlich dargestellt.

(1) Allgemeiner Trend im Zeitverlauf

Anhand einer mehrstufigen Wachstumskurvenanalyse wurde im ersten Analyseschritt ein allgemeiner Trend im Zeitverlauf innerhalb der Stichprobe berechnet. Die Ergebnisse zeigten, dass in Modell 1 ein nichtlinearer Zusammenhang zwischen Zeit und arbeitsplatzbezogener Isolation gefunden wurde: $b = -.04$, $SE = .03$, $p = .176$, zudem ein Interaktionseffekt zwischen Zeit und Homeoffice-Intensität auf arbeitsplatzbezogene Isolation: $b = -.02$, $SE = .01$, $p < .01$. Modell 2 ergab, dass sowohl der lineare Term, $b = -.46$, $SE = .12$, $p < .001$, als auch der quadratische Term, $b = .07$, $SE = .02$, $p < .01$, arbeitsplatzbezogene Isolation vorhersagen konnten. Es wurde ebenfalls ein Interaktionseffekt zwischen Zeit und Homeoffice-Intensität auf arbeitsplatzbezogene Isolation identifiziert: $b = -.01$, $SE = .01$, $p < .05$. Modell 3 hingegen ergab, dass keine linearen, quadratischen oder kubischen Terme und keine Interaktionseffekte die arbeitsplatzbezogene Isolation vorhersagten. Der Vergleich der Modelle anhand der Chi-Quadrat-Statistik zeigte, dass Modell 2 zu einem signifikanten Anstieg von -2LL führte, Modell 3 jedoch nicht. Dieses Ergebnis bedeutet, dass Modell 2 die beste Modellanpassung beschreibt. Insgesamt wurde eine negative lineare und eine positive quadratische Beziehung zwischen Zeit und arbeitsplatzbezogener Isolation ermittelt, was demnach auf eine zunächst negative lineare Abnahme der Isolation und dann auf eine Abflachung dieser Kurve hindeutet (siehe Abbildung 4). In Ergänzung beschreibt der gefundene Interaktionseffekt, dass der Effekt der Zeit auf die arbeitsplatzbezogene Isolation in Abhängigkeit von der Homeoffice-Intensität variiert. Homeoffice-Intensität ist somit in Ergänzung zur Zeitvariable ein relevanter Prädiktor für das arbeitsplatzbezogene Isolationserleben. Die Hypothesen 1a und 1b konnten angenommen werden.

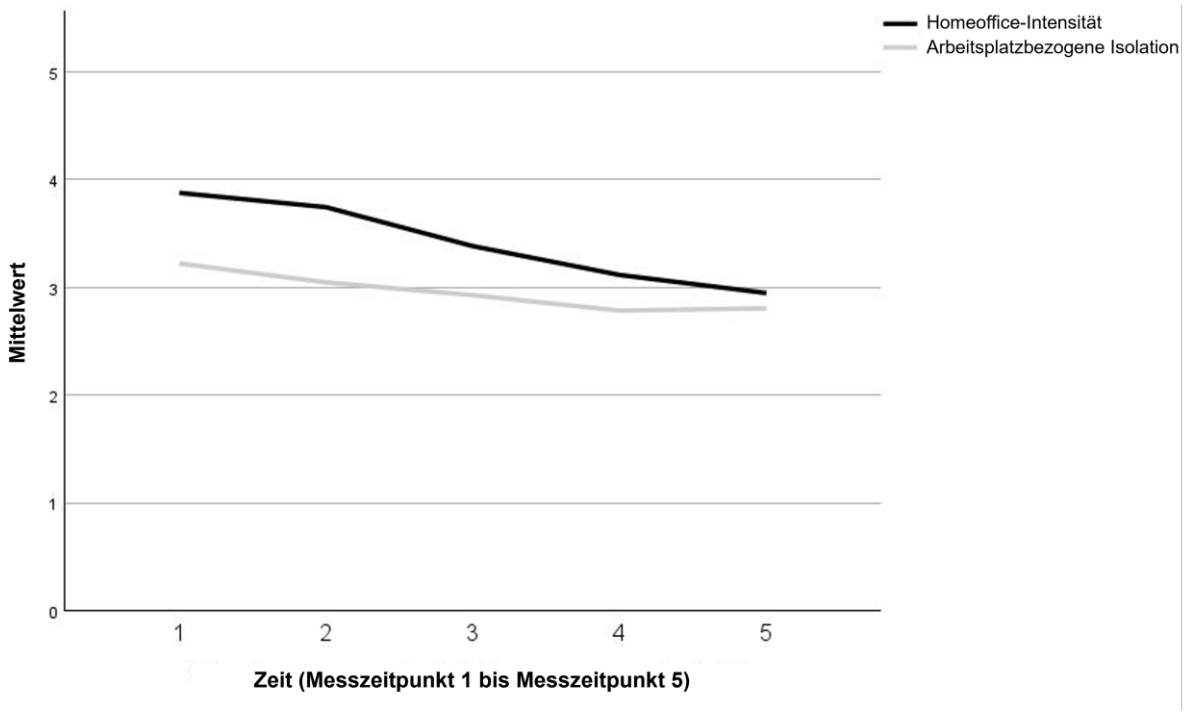

Abbildung 4. Verlauf der arbeitsplatzbezogenen Isolation und der Homeoffice-Intensität im Zeitverlauf (gemittelt über alle Studienteilnehmenden)

(2) Verlaufsprofile

Im zweiten Analyseschritt wurde anhand einer latenten Profilanalyse distinkte Untergruppen ermittelt, die sich in ihren Verläufen signifikant unterscheiden („Verlaufsprofile“). Die Ergebnisse der latenten Profilanalyse ergaben sechs verschiedene Profillösungen (von einem bis sechs Profile), die anhand mehrerer statistischer Anpassungswerte sowie unter Berücksichtigung inhaltlicher Entscheidungskriterien verglichen wurden. Das Drei-Profil-Modell wurde gewählt, da es signifikante *p*-Werte in allen drei Likelihood-Ratio-Tests (LMRT, VLMT und BLRT) als auch sehr hohe Entropie und AvePP-Werte aufwies, die auf eine sehr gute Klassifikationsqualität hinwiesen. Wenngleich der BIC-Wert mit Zunahme der Profile abnahm, wies das Drei-Profil-Modell in allen anderen statistischen Werten die beste Anpassung an die Daten auf. Auch nach inhaltlichen Entscheidungskriterien ergab das Drei-Profil-Modell eine gute Verteilung der Profilprävalenzen und war interpretierbar. Die drei Profile in diesem Modell werden beschrieben durch: (1) „Hohe Homeoffice-Intensität und geringe Isolation“ (*n* = 140, 27,00 %), (2) „Geringe Homeoffice-Intensität und hohe Isolation“ (*n* = 190, 37,00 %) und (3) „Hohe Homeoffice-Intensität und hohe Isolation“ (*n* = 182, 36,00 %). In allen drei Profilen nahmen die Homeoffice-Intensität und arbeitsplatzbezogene Isolation über die Zeit ab. Die Verläufe beider Variablen waren somit in allen

drei Profilen ähnlich, die jeweiligen Achsenabschnitte unterschieden sich jedoch. Die Profile waren damit quantitativ, jedoch nicht qualitativ distinkt voneinander (siehe Abbildung 5). Hypothese 2 konnte demnach nur teilweise angenommen werden.

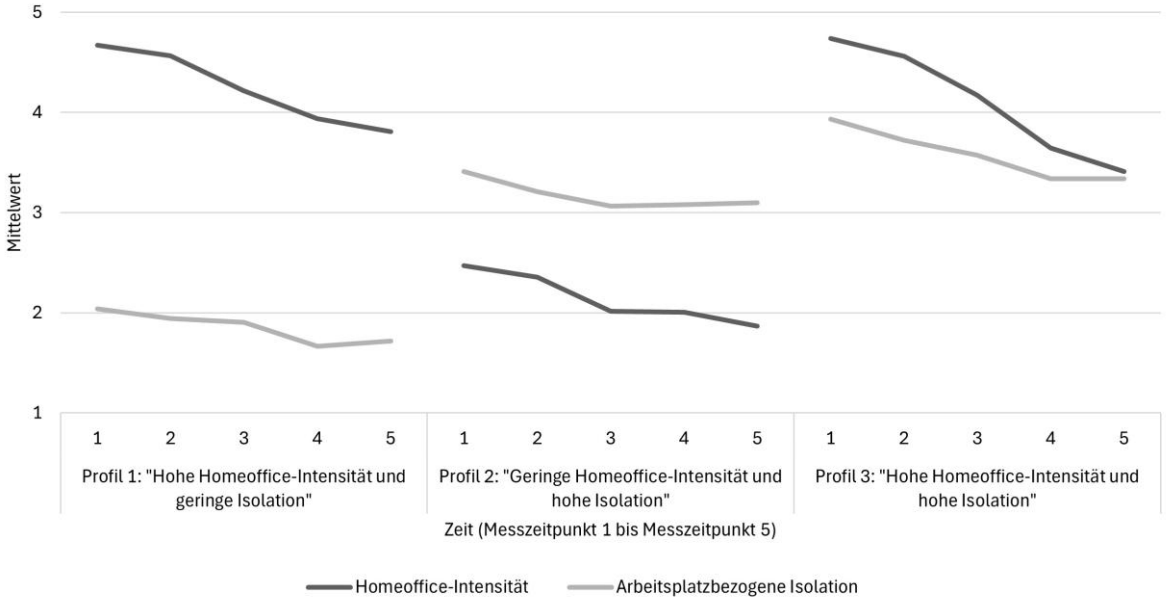

Abbildung 5. Mittelwerte der Arbeitsplatzisolation und der Homeoffice-Intensität im Zeitverlauf bei den verschiedenen Profilen

(3) Analyse von Prädiktoren

In der multinomialen logistischen Regression wurden verschiedene persönliche und soziale Einflussfaktoren als Prädiktoren der Profilzugehörigkeit untersucht. Die Profilzugehörigkeit resultierte als neue kategoriale Variable aus der latenten Profilanalyse und wurde in der Regression entsprechend als abhängige Variable eingesetzt. Die Vergleiche der Profile 2 („Geringe Homeoffice-Intensität und hohe Isolation“) sowie 3 („Hohe Homeoffice-Intensität und hohe Isolation“) mit der Referenzkategorie Profil 1 („Hohe Homeoffice-Intensität und geringe Isolation“) ergaben, dass die folgenden Variablen die Profilzugehörigkeit signifikant vorhersagen konnten: SelfCare, Extraversion, soziale Norm, soziale Unterstützung durch Kolleg:innen, StaffCare und Kommunikationsschwierigkeiten. Demnach konnte die Hypothese 3 angenommen werden, da SelfCare negativ mit der Zugehörigkeit zu Profil 3 assoziiert war (Vergleich Profil 2 und 1: $b = -0{,}61$, Wald $\chi^2[1] = 3{,}02$, $p = 0{,}08$; Vergleich Profil 3 und 1: $b = -0{,}88$, Wald $\chi^2[1] = 8{,}06$, $p < 0{,}01$) und Extraversion positiv mit der Zugehörigkeit zu Profil 2 und 3 assoziiert war (Vergleich Profil 2 und 1: $b = 0{,}46$, Wald $\chi^2[1] = 5{,}25$, $p < 0{,}05$; Vergleich Profil 3 und 1: $b = 0{,}42$, Wald $\chi^2[1] = 5{,}53$, $p < 0{,}05$). Das bedeutet, dass SelfCare positiv mit dem Profil 1 im Vergleich zu Profil 3 assozi-

iert war und Extraversion negativ mit dem Profil 1 im Vergleich zu den Profilen 2 und 3 assoziiert war. Des Weiteren konnte die Hypothese 4a nur teilweise bestätigt werden, da nur soziale Unterstützung durch Kolleg:innen negativ mit der Zugehörigkeit zu Profil 2 assoziiert war (Vergleich Profil 2 und 1: $b = -0{,}36$, Wald $\chi^2[1] = 4{,}73$, $p < 0{,}05$; Vergleich Profil 3 und 1: $b = -0{,}04$, Wald $\chi^2[1] = 0{,}06$, $p = 0{,}81$). Das bedeutet, dass die soziale Unterstützung durch Kolleg:innen wie erwartet positiv mit Profil 1 im Vergleich zu Profil 2 assoziiert war. Die Ergebnisse zu sozialer Norm fielen heterogen aus, denn der Vergleich zwischen Profil 2 und 1 ergab einen negativen Zusammenhang zwischen sozialer Norm und der Zugehörigkeit zu Profil 2 ($b = -0{,}39$, Wald $\chi^2[1] = 7{,}74$, $p < 0{,}01$) – der Vergleich zwischen Profil 3 und 1 hingegen einen positiven Zusammenhang zur Zugehörigkeit zu Profil 3 ($b = 0{,}32$, Wald $\chi^2[1] = 5{,}30$, $p < 0{,}05$). Zudem wurde ein positiver Zusammenhang zwischen StaffCare und der Zugehörigkeit zu den Profilen 2 und 3 identifiziert (Vergleich Profil 2 und 1: $b = 0{,}55$, Wald $\chi^2[1] = 5{,}70$, $p < 0{,}05$; Vergleich Profil 3 und 1: $b = 0{,}53$, Wald $\chi^2[1] = 6{,}80$, $p < 0{,}01$). Demnach war StaffCare im Vergleich zu den Profilen 2 und 3 entgegen der Erwartung negativ mit Profil 1 assoziiert. Zuletzt konnte die Hypothese 4b angenommen werden, da Kommunikationsschwierigkeiten positiv mit der Zugehörigkeit zu den Profilen 2 und 3 assoziiert waren (Vergleich Profil 2 und 1: $b = 0{,}72$, Wald $\chi^2[1] = 10{,}17$, $p < 0{,}01$; Vergleich Profil 3 und 1: $b = 0{,}88$, Wald $\chi^2[1] = 18{,}04$, $p < 0{,}001$). Somit war die Variable Kommunikationsschwierigkeiten negativ mit Profil 1 im Vergleich zu den Profilen 2 und 3 assoziiert.

(4) Analyse von Outcomes

Für die Varianzanalysen mit Post-hoc-Tests wurde die kategoriale Variable der Profilzugehörigkeit als unabhängige Variable in den Analysen aufgenommen, die Outcome Variablen als abhängige Variablen. Die Ergebnisse zeigten, dass keine signifikanten Unterschiede zwischen den Profilen hinsichtlich der psychischen Belastung ermittelt werden konnten. Hypothese H5a konnte daher abgelehnt werden. Signifikante Unterschiede wurden jedoch zwischen den Profilen hinsichtlich der Outcomes Commitment, $F(2, 509) = 6.47$, $p < .01$, $\omega^2 = .021$, und selbst eingeschätzter Leistung, $F(2, 509) = 10.93$, $p < .001$, $\omega^2 = .04$, gefunden. Die Post-hoc-Tests mittels Hochbergs GT2 Post-hoc-Analyse ergaben signifikant geringere Commitment-Werte in Profil 1 im Vergleich zu Profil 2 ($M_{Profil1} = 3.21$ vs. $M_{Profil2} = 3.59$; durchschnittliche Differenz = -0.38, $p < .01$, 95 %-CI [-0.66, -0.10]), jedoch nicht zwischen Profil 1 und 3 ($M_{Profil1} = 3.21$ vs. $M_{Profil3} = 3.27$; durchschnittliche Differenz = -0.06, $p = .929$, 95 %-

CI [-0.35, 0.22]). Hypothese H5b konnte daher abgelehnt werden. Ergänzende Analysen zeigten signifikant höhere Commitment-Werte in Profil 2 im Vergleich zu Profil 3 ($M_{Profil2}$ = 3.59 vs. $M_{Profil3}$ = 3.27; durchschnittliche Differenz = 0.31, $p < .05$, 95 %-CI [0.05, 0.57]), was darauf hindeutet, dass entgegen der Erwartung die höchsten Commitment-Werte Personen mit geringer Homeoffice-Intensität (Profil 2) aufwiesen. Abschließend ergaben die Post-hoc-Tests mittels Hochbergs GT2 Post-hoc-Analyse, dass Personen mit geringem Isolationserleben (Profil 1) die höchsten Werte hinsichtlich der Einschätzung der eigenen Leistung im Vergleich zu Profil 2 ($M_{Profil1}$ = 3.84 vs. $M_{Profil2}$ = 3.45; durchschnittliche Differenz = 0.39, $p < .001$, 95 %-CI [0.17, 0.61]) und zu Profil 3 ($M_{Profil1}$ = 3.84 vs. $M_{Profil3}$ = 3.46; durchschnittliche Differenz = 0.38, $p < .001$, 95 %-CI [0.16, 0.61]) aufwiesen (siehe Abbildung 6). Hypothese 5c konnte demnach angenommen werden. Ausführliche Darstellungen der Ergebnisse inklusive der Ergebnistabellen sind in der Originalarbeit dargestellt.

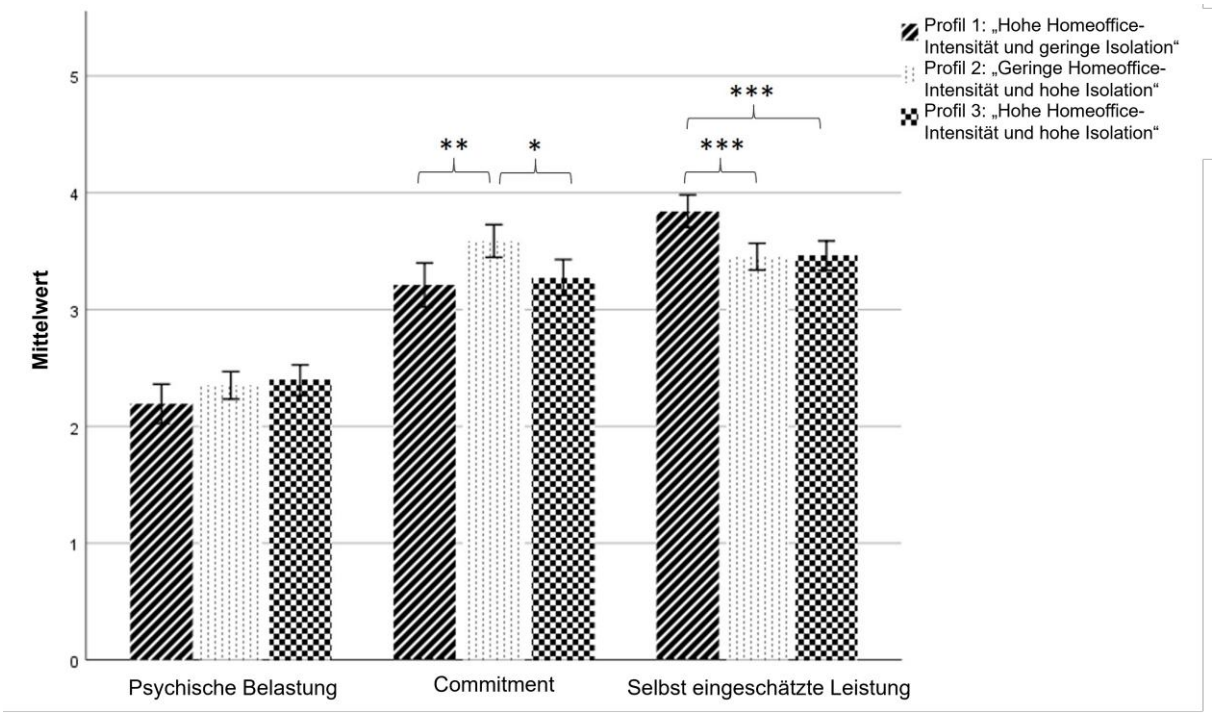

Abbildung 6. Post-hoc Tests zwischen den Profilen[3]

[3] Die Fehlerbalken sind 95 %-Konfidenzintervalle. Verbale Anker für psychische Belastung: 1 (*nie*) bis 5 (*fast immer*), für Commitment: (*trifft überhaupt nicht zu*) bis 5 (*trifft voll und ganz zu*), für Leistung: 1 (*ausreichend*) bis 5 (*ausgezeichnet*). Signifikante Unterschiede zwischen den Profilen: *p < 0,05, **p < 0,01, ***p < 0,001.

5.2.2. Erfahrungen und Herausforderungen gesundheitsorientierter Führung in virtueller Teamarbeit[4]

Im Rahmen der qualitativen Interviewstudie (Publikation 3) berichteten die Führungskräfte (*n* = 16) von ihren Erfahrungen und diversen Herausforderungen hinsichtlich der Implementierung von SelfCare und StaffCare in virtueller Teamarbeit aus dem Homeoffice während der COVID-19-Pandemie. Im Hinblick auf die Implementierung von SelfCare gaben zum einen mehrere Führungskräfte an, dass ihnen die Umsetzung gesundheitsförderlicher Verhaltensweisen auch im Homeoffice gelang und keine Herausforderungen wahrgenommen wurden. Auf der anderen Seite beschrieben mehrere Führungskräfte, dass die Implementierung von SelfCare im Homeoffice stärkere und konstante Selbstreflexion und Selbstdisziplin erforderte angesichts diverser Arbeitsanforderungen (z. B. verlängerte Arbeitszeiten und ständige Erreichbarkeit).

Im Gegensatz dazu berichteten fast alle Führungskräfte, dass sie Herausforderungen bei der Implementierung von StaffCare aus dem Homeoffice während der COVID-19-Pandemie erlebt haben. Dies begründeten sie mit der Herausforderung, die physische und psychische Gesundheit ihrer Teammitglieder über digitale IKT wahrzunehmen, aber auch die subjektiv wahrgenommene Nähe zu bestehenden oder neuen Teammitgliedern über digitale IKT aufrechtzuerhalten bzw. aufzubauen, insbesondere bei einer höheren Anzahl unterstellter Beschäftigter. Ebenso wurden die eingeschränkten Möglichkeiten und Qualität des informellen Austauschs über digitale IKT und die privaten Herausforderungen der Teammitglieder aufgrund der COVID-19-Pandemie (z. B. aufgrund von Kinderbetreuung, begrenztem Wohnraum, sozialer Isolation) als weitere Herausforderungen für die Umsetzung von StaffCare beschrieben. Um mit diesen Herausforderungen umzugehen und StaffCare-Verhalten dennoch umsetzen zu können, gaben alle Führungskräfte an, die Teammeetings und Eins-zu-Eins-Meetings mit ihren Teammitgliedern umgestaltet zu haben, z. B. wurde eine digitale Meeting-Etikette eingeführt, die Häufigkeit von digitalen Meetings erhöht, die Dauer der Meetings reduziert und der informelle Austausch proaktiv organisiert. Ergänzend wurde mehrheitlich erläutert, dass die Berücksichtigung von Bedürfnissen und Kompetenzen der Teammitglieder im Rahmen von StaffCare (z. B. über

[4] Efimov, I., Harth, V. & Mache, S. (2024). “That was one of my most difficult and biggest challenges”: experiences, preconditions and preventive measures of health-oriented leadership in virtual teams – a qualitative study with virtual leaders. *BMC Public Health, 24*: 1338. https://doi.org/10.1186/s12889-024-18800-7

die Förderung von Handlungsspielraum, Partizipation, Reduktion von Hierarchien und klarem Erwartungsmanagement) als auch eine allgemein proaktive Kommunikation in virtueller Teamarbeit erforderlich ist, um gesundheitsorientiert führen zu können.

Im explorativen, qualitativen Vergleich der Führungskräfte mit und ohne präpandemischer Vorerfahrung mit regelmäßiger virtueller oder hybrider Teamarbeit zeigte sich, dass zwar fast alle Führungskräfte mit Vorerfahrung angaben, dass die Implementierung von SelfCare im Homeoffice während der COVID-19-Pandemie möglich für sie war, jedoch fast alle Führungskräfte unabhängig ihrer Vorerfahrung von Herausforderungen bei der Implementierung von StaffCare berichteten.

5.2.3. Rahmenbedingungen und präventive Maßnahmen gesundheitsorientierter Führung in virtueller Teamarbeit[5]

Des Weiteren berichteten die Führungskräfte (*n* = 16) in der qualitativen Interviewstudie (Publikation 3) von ihren Einschätzungen, welche Rahmenbedingungen und präventiven Maßnahmen förderlich für die Umsetzung von HoL in virtueller Teamarbeit seien. Dabei beschrieben die Führungskräfte, dass persönliche, organisationale, soziale und technische Rahmenbedingungen die Umsetzung von HoL in virtueller Teamarbeit ermöglichten. Sie erläuterten zum einen, dass bestimmte Eigenschaften von Führungskräften (z. B. Empathie und Vertrauen), ihre SelfCare und somit Vorbildfunktion als auch Führungserfahrung hilfreich seien, um gesundheitsorientiert führen zu können. Zum anderen gaben alle Führungskräfte organisationale Rahmenbedingungen an. Dazu zählten sie eine unterstützende Geschäftsleitung, eine offene Organisationskultur, gesundheitsförderliche Arbeitsbedingungen, die Bereitstellung struktureller Angebote wie z. B. Weiterbildungsmöglichkeiten und ein arbeitnehmerorientierter Betriebsrat. Zusätzlich führten die Führungskräfte die soziale Unterstützung durch das Team, weiteren Kolleg:innen und der eigenen Führungskraft ebenfalls als förderliche Rahmenbedingung für die Anwendung von HoL auf. Zuletzt verdeutlichten mehrere Führungskräfte, dass technische Rahmenbedingungen wie eine stabile Internetverbindung, eine ausreichende technische Ausstattung

[5] Efimov, I., Harth, V. & Mache, S. (2024). “That was one of my most difficult and biggest challenges”: experiences, preconditions and preventive measures of health-oriented leadership in virtual teams – a qualitative study with virtual leaders. *BMC Public Health, 24*: 1338. https://doi.org/10.1186/s12889-024-18800-7

und adäquater IT-Support erforderlich sind, um HoL in virtueller Teamarbeit anwenden zu können.

Für die Förderung von HoL in virtueller Teamarbeit erachteten die Führungskräfte verschiedene verhaltens- und verhältnispräventive Maßnahmen als geeignet. Zum einen beschrieben sie Weiterbildungsmöglichkeiten für Führungskräfte (z. B. zu HoL oder virtueller Führung) und für Beschäftigte (z. B. zur Selbstfürsorge) als unterstützende Maßnahme. Zum anderen erkannten sie die förderliche Wirkung einer unterstützenden Geschäftsleitung (z. B. über wertschätzende Kommunikation, eine langfristige, präventive Ausrichtung auf die Gesundheit und das Wohlbefinden der Belegschaft) und der Verbesserung der technischen Ausstattung und allgemeiner Digitalisierungsprozesse.

Im explorativen, qualitativen Vergleich der Führungskräfte mit und ohne präpandemischer Vorerfahrung mit regelmäßiger virtueller oder hybrider Teamarbeit zeigte sich hinsichtlich förderlicher Rahmenbedingungen, dass alle Führungskräfte mit Vorerfahrung ihr Team als unterstützend erlebt haben, im Gegensatz zur Hälfte der Führungskräfte ohne Vorerfahrung. Des Weiteren identifizierten fast alle Führungskräfte mit Vorerfahrung einen Bedarf für verhältnispräventive Maßnahmen, wohingegen fast alle Führungskräfte ohne Vorerfahrung angaben, einen Bedarf für verhaltenspräventive Maßnahmen zu haben.

6. Diskussion

Die übergeordneten Ziele der kumulativen Dissertation waren es, einen systematischen Überblick über den aktuellen Stand der Forschung zum Zusammenhang virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes zu erfassen sowie sowohl quantitativ als auch qualitativ das HoL-Modell als ein spezifisches gesundheitsförderliches Führungsmodell in virtueller Teamarbeit zu untersuchen sowie Empfehlungen für die Praxis abzuleiten. Dazu wurden drei Ansätze verfolgt, die eine systematische Literaturrecherche anhand eines Scoping Reviews (Publikation 1), eine quantitative Längsschnittstudie (Publikation 2) und eine qualitative Interviewstudie (Publikation 3) beinhalten. Die vorliegende Dissertation liefert neue wissenschaftliche Erkenntnisse zu HoL in virtueller Teamarbeit. Im Folgenden werden die zentralen Ergebnisse der Dissertation übergreifend diskutiert. Eine ausführliche Diskussion der Ergebnisse ist in den jeweiligen Originalarbeiten aufgeführt.

6.1. Einfluss von Führung in virtueller Teamarbeit

Das Ziel der ersten Studie war es, im Rahmen eines Scoping Reviews den aktuellen Forschungsstand zum Zusammenhang virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes von Beschäftigten systematisch zu erfassen (Publikation 1). Im Vergleich zur umfassenden Evidenzlage zum Führungseinfluss im traditionellen Arbeitskontext in Präsenz [21-24] zeigt sich, dass für den Kontext virtueller Teamarbeit die empirische Studienlage zu gering ist, um Wirkzusammenhänge kausal interpretieren zu können. Die Ergebnisse des Scoping Reviews weisen jedoch auf eine ähnliche Tendenz: Führung in virtueller Teamarbeit scheint ebenso wie Führung in Präsenz sowohl einen direkten Einfluss auf arbeits- und gesundheitsbezogene Outcomes zu haben als auch einen indirekten Einfluss über die Gestaltung von Arbeitsbedingungen [25]. Somit können Führungskräfte auch in virtueller Teamarbeit voraussichtlich eine Arbeitsressource und damit als Schutzfaktor für Beschäftigte bei hoher negativer Arbeitsbelastung dienen [22, 23, 26]. Übergeordnet deuten die Ergebnisse des Scoping Reviews auf positive Zusammenhänge zwischen virtueller Führung und der psychischen Gesundheit sowie der Arbeitszufriedenheit von Beschäftigten hin, und auf einen negativen Zusammenhang zu dem Isolationserleben von Beschäftigten. Dennoch ist die überschaubare Ergebnislage nicht homogen, sodass ein großer Forschungsbedarf bestehen bleibt. Das Scoping Review ermöglichte die Identifizierung zahlreicher Forschungslücken, z. B. welche Führungsstile in den spezifischen Kontextbedingungen virtueller Teamarbeit geeignet sind, welchen Einfluss Führung auf weitere arbeits- und gesundheitsbezogene Outcomes haben kann und wie dieser Führungseinfluss ganzheitlicher auf verschiedenen Wirkebenen untersucht werden kann (beispielsweise im spezifischen gesundheitsförderlichen Führungsmodell HoL anhand einer differenzierten Analyse der StaffCare und der SelfCare, sowohl aus der Perspektive von Beschäftigten als auch von Führungskräften). Zusammenfassend wird zum einen deutlich, dass noch keine einheitliche Definition virtueller Führung oder Teamarbeit besteht, somit auch die Operationalisierung der Konstrukte sowie die Methodik der eingeschlossenen Studien sich unterscheiden und eine zusammenfassende Betrachtung der Ergebnisse limitiert bleibt. Zum anderen ist bei der Interpretation der bisherigen Forschungslage die dynamische Entwicklung in der Praxis sowie Forschung während der COVID-19-Pandemie zu berücksichtigen. Somit bleibt derzeit offen, inwieweit eine Vergleichbarkeit von Studien zu unterschiedlichen Zeitpunkten während der COVID-19-Pandemie gegeben ist, ge-

nauso wie die Vergleichbarkeit zu prä-pandemischen oder post-pandemischen Studien [93].

6.2. Gesundheitsorientierte Führung in virtueller Teamarbeit

Die Ziele der darauffolgenden Studien waren es, HoL als ein spezifisches gesundheitsförderliches Führungsmodell in virtueller Teamarbeit quantitativ und qualitativ zu untersuchen. Zum einen sollten Zusammenhänge von HoL und den Gesundheitsverläufen von Beschäftigten analysiert werden (Publikation 2) und zum anderen aus der Perspektive von Führungskräften die Erfahrungen, Herausforderungen, förderlichen Rahmenbedingungen und präventiven Maßnahmen in der Umsetzung von HoL explorativ ermittelt werden (Publikation 3). Die Forschungsergebnisse aus beiden Publikationen werden im Folgenden gemeinsam betrachtet, übergeordnet interpretiert und unter Berücksichtigung des bisherigen Forschungsstands diskutiert, um ein umfassenderes Verständnis für das zu untersuchende Phänomen zu ermöglichen [52].

6.2.1. SelfCare in virtueller Teamarbeit

Hinsichtlich der längsschnittlichen quantitativen Untersuchung von SelfCare in virtueller Teamarbeit (Publikation 2) zeigte sich, dass eine ausgeprägte SelfCare mit einer erhöhten Wahrscheinlichkeit verbunden war, dem Profil mit niedrigem arbeitsplatzbezogenen Isolationserleben anzugehören. Dieses Ergebnis spricht dafür, dass SelfCare ein relevanter Einflussfaktor für die Ausprägung des Isolationserlebens im Homeoffice sein kann. In den qualitativen Interviews mit den Führungskräften virtueller Teamarbeit (Publikation 3) wurde zudem ersichtlich, dass die Umsetzung der eigenen SelfCare zwar mehreren Führungskräften gelang, wiederum bei einigen Führungskräften mit Herausforderungen einherging, denen sie anhand von Anpassungen ihres gesundheitsförderlichen Verhaltens wie einer konstanten Selbstreflexion und erhöhten Selbstdisziplin begegnen konnten. Der explorative Gruppenvergleich deutete zudem darauf hin, dass fast alle Führungskräfte mit prä-pandemischer Vorerfahrung mit regelmäßiger virtueller oder hybrider Teamarbeit keine Herausforderungen bei der Umsetzung von SelfCare im Homeoffice erlebten. Insgesamt lässt sich aus beiden Studien schließen, dass eine hohe SelfCare förderlich für ein geringes arbeitsplatzbezogenes Isolationserleben im Homeoffice sein kann, jedoch die Umsetzung von SelfCare bei der Umstellung auf virtuelle Zusammenarbeit ohne Vorerfahrungen mit Herausforderungen verbunden sein kann. Diese Ergebnisse stehen im Einklang mit bestehender wissenschaftlicher Fachliteratur, welche auf die erhöhten

Arbeitsanforderungen und Herausforderungen von Führungskräften virtueller und hybrider Teams während der COVID-19-Pandemie verweisen, z. B. längere Arbeitszeiten aufgrund erhöhter Arbeitsmenge oder zusätzlicher Aufgaben im Krisenmanagement [34, 94-96]. Dabei kann eine hohe SelfCare ein gesundheitlicher Schutzfaktor in der Begegnung erhöhter Arbeitsanforderungen sein [33]. Bisherige erste Studien zur SelfCare im Homeoffice deuten ebenfalls auf eine positive Wirkung auf arbeits- und gesundheitsbezogene Outcomes hin [34, 36].

6.2.2. StaffCare in virtueller Teamarbeit

Die quantitative Längsschnittanalyse (Publikation 2) ergab, dass eine ausgeprägte StaffCare entgegen der Erwartung mit einer geringeren Wahrscheinlichkeit verbunden war, dem Profil mit niedrigem arbeitsplatzbezogenen Isolationserleben anzugehören. Auch dieses Ergebnis deutet darauf hin, dass StaffCare ein relevanter Einflussfaktor für die Ausprägung des Isolationserlebens im Homeoffice sein kann, jedoch sich in zukünftiger Forschung noch zeigen wird, in welcher Funktion. In den qualitativen Interviews mit Führungskräften virtueller Teams (Publikation 3) wurde zudem ersichtlich, dass die Umsetzung von StaffCare während der COVID-19-Pandemie für die Mehrheit mit diversen Herausforderungen einherging. Alle Führungskräfte passten demnach in unterschiedlicher Art und Weise ihr StaffCare-Verhalten an, um mit den Herausforderungen umgehen zu können. Der qualitative, explorative Gruppenvergleich deutete zudem darauf hin, dass die Herausforderungen bei der Implementierung von StaffCare unabhängig von der prä-pandemischen Vorerfahrung mit regelmäßiger virtueller oder hybrider Teamarbeit von der überwiegenden Mehrheit der Führungskräfte wahrgenommen wurde. Jedoch scheinen Führungskräfte mit prä-pandemischer Vorerfahrung ihr Team als unterstützend in der Umsetzung von StaffCare zu erleben und mehrheitlich einen Bedarf für verhältnispräventive Maßnahmen zu haben. Im Gegensatz dazu berichteten Führungskräfte ohne prä-pandemische Vorerfahrung mehrheitlich einen Bedarf für verhaltenspräventive Maßnahmen.

Insgesamt bleibt nach aktuellem Kenntnisstand offen, wieso gegenteilige Effekte bei dem Einfluss von StaffCare auf das arbeitsplatzbezogene Isolationserleben im Längsschnitt gefunden wurden. Dieses Ergebnis steht im Gegensatz zu vorherigen Studien, die auf eine ausgleichende Rolle von Führung für das arbeitsplatzbezogene Isolationserleben von Beschäftigten in virtueller Teamarbeit hinweisen [76, 88-91,

97]. Ebenso konstatieren bisherige Studien zur StaffCare in virtueller Teamarbeit positive Einflüsse auf arbeits- und gesundheitsbezogene Outcomes von Beschäftigten [34, 35, 37]. Zum einen kann eine mögliche Interpretation des Ergebnisses der vorliegenden Dissertation sein, dass Beschäftigte, die eine allgemein hohe StaffCare wahrnehmen, diese positive Wirkung insbesondere in virtueller Teamarbeit vermissen und sich dadurch isolierter erleben. Zum anderen lässt die Berücksichtigung der qualitativen Ergebnisse der vorliegenden Dissertation die Annahme zu, dass Führungskräfte insbesondere in disruptiven Zeiten wie der COVID-19-Pandemie diversen Herausforderungen bei der Umsetzung von StaffCare nach der (ad hoc) Umstellung auf virtuelle Teamarbeit begegneten. Auch bisherige Forschungsarbeiten verweisen auf spezifische Herausforderungen für Führungskräfte in dieser Zeit wie u. a. Kommunikationsschwierigkeiten, einen eingeschränkten informellen Austausch, Mangel an sozialer Präsenz und gegenseitigem Vertrauen sowie Technostressoren [34, 38, 40]. Der Umgang mit vielfältigen Herausforderungen bei der Umstellung auf virtuelle Teamarbeit kann demnach Anpassungen im StaffCare-Verhalten erfordern [34, 39], um eine positive Wirkung für Beschäftigte ermöglichen zu können.

6.2.3. Rahmenbedingungen gesundheitsorientierter Führung in virtueller Teamarbeit

Darüber hinaus legen die Ergebnisse aller drei Publikationen die Annahme zugrunde, dass auch virtuelle Führung in einen Kontext eingebettet ist, somit durch weitere Faktoren beeinflusst werden kann und eine ganzheitliche Perspektive erfordert [41]. So gab das Scoping Review in Publikation 1 erste Hinweise auf moderierende und mediierende Variablen im Zusammenhang von virtueller Führung und arbeits- und gesundheitsbezogenen Outcomes von Beschäftigten, z. B. die räumliche Entfernung oder Arbeitsmenge. Die quantitative Längsschnittanalyse in Publikation 2 identifizierte neben SelfCare auch Extraversion als persönliche Einflussfaktoren. Weiterhin zeigte die Analyse, dass neben StaffCare auch soziale Unterstützung durch Kolleg:innen oder Kommunikationsschwierigkeiten relevante soziale Einflussfaktoren auf das arbeitsplatzbezogene Isolationserleben sein können. Zuletzt ergab auch die qualitative Studie in Publikation 3, dass diverse persönliche, technische, soziale und organisationale Einflussfaktoren die Umsetzung von SelfCare und StaffCare in virtueller Teamarbeit fördern können. So berichteten die interviewten Führungskräfte, dass insbesondere vorteilhafte organisationale Rahmenbedingungen wie gesundheitsför-

derliche Arbeitsbedingungen oder eine offene Organisationskultur unterstützend wahrgenommen wurden. Ebenso wurden verschiedene verhaltens- und verhältnispräventive Maßnahmen als geeignet erachtet, um die Umsetzung von Self- und StaffCare in virtueller Teamarbeit präventiv zu fördern. Demnach deuten diese Ergebnisse darauf hin, dass Führungskräfte virtueller Teams in einem förderlichen Arbeitsumfeld arbeiten sollten, um sich selbst und ihre Teammitglieder gesundheitsorientiert führen und bei Bedarf entsprechende organisationale Hilfestellungen erhalten zu können.

Diese Interpretation der Ergebnisse deckt sich mit der wissenschaftlichen Evidenz zur Führung in Präsenz [26, 98]. Auch bisherige Forschung zu virtueller Führung verwies auf förderliche Arbeitsbedingungen als relevante Einflussfaktoren. So wurden u. a. eine organisationale Unterstützung [39, 94, 95, 99, 100], eine nicht zu beanspruchende Arbeitsmenge und strukturierte Prozesse [94], flexible Arbeitsbedingungen [39], eine offene Organisationskultur [39, 100] und strukturelle Angebote (z. B. IT-Support oder Weiterbildungsmöglichkeiten) [39] als förderliche organisationale Rahmenbedingungen identifiziert. Auch technische Faktoren wie technische Ausfälle oder Probleme können virtuelle Führung negativ beeinflussen [39]. Dadurch dass Organisationen unterschiedlich gut auf die pandemiebedingten Veränderungen der Arbeitsbedingungen vorbereitet waren [12], können zudem Unterschiede hinsichtlich der technischen und organisationalen Rahmenbedingungen von Führungskräften virtueller Teams während der COVID-19-Pandemie bestanden haben. Des Weiteren ergab bisherige Forschung, dass soziale Einflussfaktoren wie ein unterstützendes Team (z. B. durch Selbstorganisation, gegenseitige Unterstützung) oder Kolleg:innen außerhalb des Teams (z. B. durch Austausch zu guter Führungspraxis) relevante Einflussfaktoren für virtuelle Führung sein können [39, 95]. Hierbei wurde auch in vorherigen Studien auf die Herausforderungen für virtuelle Führung bei Kommunikationsschwierigkeiten im Team hingewiesen [40, 101]. Zudem verwies bisherige Forschung auf persönliche Eigenschaften oder Einstellungen wie Extraversion als einen weiteren Einflussfaktor [1, 39, 102]. Gleichzeitig stellt die COVID-19-Pandemie einen sehr spezifischen Kontext dar, welcher einen relevanten Einfluss auf die Arbeits- und Gesundheitssituation weltweit hatte und bei der Interpretation berücksichtigt werden sollte. In der Allgemeinbevölkerung konnte eine Verschlechterung der psychischen Gesundheitszustände (u. a. auch eine Zunahme der Einsamkeit), insbesondere in vulnerablen Gruppen, weltweit beobachtet werden [103-106]. Die vorliegenden Er-

gebnisse zum arbeitsplatzbezogenen Isolationserleben im Längsschnitt sind neuartig und verdeutlichen, dass die Arbeit im Homeoffice keine einheitliche Auswirkung auf Beschäftigte und Führungskräfte hatte. So konnte entweder ein niedriges oder ein hohes arbeitsplatzbezogenes Isolationserleben erlebt werden, letzteres sowohl bei niedriger als auch bei hoher Homeoffice-Intensität. Führungskräfte stehen somit vor der Herausforderung, unterschiedlichen Bedürfnisse und Erfahrungen von Beschäftigten in disruptiven Zeiten wie der COVID-19-Pandemie zu begegnen.

6.3. Theoretischer Hintergrund

Zuletzt wurden die Ergebnisse der Publikationen 1, 2 und 3 vor dem Hintergrund der eingesetzten theoretischen Modelle (HoL [32] und JD-R [49]) und Theorien (COR [50]) reflektiert. Die drei Studien der vorliegenden Dissertation zeigen auf, dass SelfCare und StaffCare in virtueller Teamarbeit relevante Prädiktoren für arbeits- und gesundheitsbezogene Outcomes von Beschäftigten und Führungskräften sein können. Unter Berücksichtigung förderlicher Arbeitsbedingungen können sowohl SelfCare als auch StaffCare voraussichtlich als Ressourcen auch im Homeoffice fungieren. Das Scoping Review in Publikation 1 ergab, dass virtuelle Führung in bisheriger Forschung unterschiedlich operationalisiert wurde, sowohl als direkter als auch indirekter Einflussfaktor auf die arbeits- und gesundheitsbezogenen Outcomes. Die quantitative Längsschnittstudie und qualitative Interviewstudie in Publikationen 2 und 3 untersuchten SelfCare und StaffCare als direkte Einflussfaktoren, wobei Publikation 3 förderliche Voraussetzungen von HoL in virtueller Teamarbeit beleuchtete. Diese Ergebnisse stehen im Einklang mit den eingesetzten theoretischen Modellen. Gemäß dem HoL-Modell [32] als auch dem JD-R-Modell [49] kann Führung sowohl als direkter als auch indirekter Einflussfaktor wirken [32, 51]. In Ergänzung verdeutlichen die vorliegenden Ergebnisse in Übereinstimmung zur COR-Theorie, dass Beschäftigte mit ausreichenden Ressourcen (z. B. hohe SelfCare) im Sinne der Ressourcengewinnspirale weitere Ressourcen gewinnen können und widerstandsfähiger gegenüber Ressourcenverlusten in der Zukunft sind (z. B. geringeres arbeitsplatzbezogenes Isolationserleben). Umgekehrt können Beschäftigte, die hohen Arbeitsanforderungen ausgesetzt sind (z. B. Kommunikationsschwierigkeiten im Team), größeren Herausforderungen bei der Stressbewältigung zusätzlicher Arbeitsanforderungen (z. B. durch veränderte Arbeitsbedingungen in der virtuellen Teamarbeit während der

COVID-19-Pandemie) gegenüberstehen, was folglich zu einer negativen Beanspruchung der Beschäftigten (z. B. negative Gesundheitszustände) führen kann [50].

6.4. Implikationen für die Praxis

Die Erforschung virtueller Teamarbeit und Führung hat mit der COVID-19-Pandemie an enormer praktischer Relevanz gewonnen. Die dynamische Entwicklung der Infektionslage im Pandemieverlauf führte dazu, dass Organisationen unterschiedliche Regelungen zur Nutzung von Homeoffice verwendeten [107]. Auch nach der COVID-19-Pandemie wird vielerorts verhandelt, welche Regelungen beibehalten, adaptiert oder aufgehoben werden sollen. So wird in vielen Organisationen auch heute noch u. a. diskutiert, wie Büroflächen genutzt werden sollen, wenn Beschäftigte weiterhin einen Teil ihrer Arbeitszeit im Homeoffice verbringen (z. B. Reduktion von Büroflächen, Umbau von Einzelbüros in Kollaborationsräume und Open Office Konzepte) oder allgemein, ob die Homeoffice-Intensität der Belegschaft wieder reduziert werden sollte [108, 109]. Der derzeitige Forschungsstand weist jedoch darauf hin, dass die Präferenz für flexible Arbeitsmodelle bei Beschäftigten voraussichtlich nicht abnehmen wird [110], die Arbeit aus dem Homeoffice übergeordnet mit positiven Effekten auf die Beschäftigtengesundheit und -zufriedenheit einhergeht [17] und daher auch für die post-pandemische Zeit empfohlen wird [109]. Spezifische Implikationen für die Praxis sind in den Originalarbeiten ausführlich dargestellt.

Übergeordnet wird Organisationen auf Basis der vorliegenden Dissertationsergebnisse empfohlen, eine ganzheitliche Perspektive in der Gestaltung virtueller Teamarbeit und Führung einzunehmen. Beschäftigte erleben nicht in gleicher Weise die Veränderungen von Arbeitsbedingungen wie beispielsweise die Einführung oder Verstärkung virtueller Teamarbeit während der COVID-19-Pandemie. Die Intensität der Homeoffice-Nutzung allein erklärt nicht die Auswirkungen auf arbeits- und gesundheitsbezogene Outcomes der Beschäftigten [17]. Demnach unterscheiden sich auch die arbeits- und gesundheitsbezogenen Outcomes von Beschäftigten in Abhängigkeit von den jeweiligen persönlichen (z. B. Lebens- und Wohnbedingungen, die eigene Selbstfürsorge) und arbeitsplatzbezogenen Faktoren (z. B. soziale Unterstützung im Team) [7, 12, 14-16]. Um Beschäftigte vor Risikofaktoren zu schützen und gleichzeitig Ressourcen fördern zu können, wird Organisationen aufgrund von Synergieeffekten empfohlen, sowohl verhältnis- als auch verhaltenspräventive Maßnahmen, also Interventionen auf verschiedenen Ebenen, zu kombinieren [111].

Auf verhältnispräventiver Ebene sollten Arbeitsbedingungen bei Veränderungen von Arbeitsmodellen ganzheitlich angepasst (z. B. klare Vereinbarungen zu Erreichbarkeitszeiten, die Festlegung einer digitalen Meeting-Etikette oder die Schaffung angemessener technischer Voraussetzungen für die Arbeit aus dem Homeoffice), die Partizipation der Belegschaft in Veränderungsprozessen ermöglicht sowie Veränderungsmaßnahmen stetig evaluiert und bedarfsgerecht adaptiert werden. Aufgrund interindividueller Unterschiede im Erleben von Beschäftigten ist es daher ratsam, die Vielfalt von Präferenzen für unterschiedliche Arbeitsmodelle zu unterstützen und flexible Arbeitsmodelle innerhalb der Teams zu ermöglichen. Im Austausch mit den Teams und Führungskräften sollten bedarfsorientierte Lösungen für die Homeoffice-Nutzung gefunden werden.

Auf verhaltenspräventiver Ebene sollten Organisationen gezielt Maßnahmen zur Förderung der Selbstfürsorge anbieten, sodass Beschäftigte und Führungskräfte dabei unterstützt werden, ihre individuellen Bedarfe und Bedürfnisse in der virtuellen Teamarbeit zu erkennen und zu erfüllen [112, 113]. Ergänzend bedarf es Maßnahmen zur Förderung des Teamzusammenhalts und der Kommunikation, um präventiv möglichem Isolationserleben und Kommunikationsschwierigkeiten in ortsverteilter, digitaler Zusammenarbeit entgegenzusteuern. Da Führung zwar auch in virtueller Teamarbeit als eine wichtige soziale Ressource für Beschäftigte fungieren kann [33, 35], die vorliegende Dissertation jedoch verdeutlicht, dass Führungskräfte sich mit diversen Herausforderungen bei der Umstellung auf virtuelle Führung aus dem Homeoffice konfrontiert sehen, erfordert es ebenso eine gezielte und fortlaufende Unterstützung von Führungskräften. Damit HoL auch in virtueller Teamarbeit angewendet und positiv wirken kann, erfordert es neben der aktiven Gestaltung von förderlichen Arbeitsbedingungen von Führungskräften (z. B. Gewährleistung von Autonomie für die bedarfsorientierte Gestaltung der Homeoffice-Nutzung im Team), auch der Unterstützung für Anpassungen im Führungsverhalten bei der Umstellung auf virtuelle Führung durch gezielte Weiterbildungsangebote. Dabei sollten Führungskräfte lernen, ihr StaffCare-Verhalten in digitaler Kommunikation anzupassen, z. B. die Erörterung individueller Bedürfnisse und Herausforderungen der Teammitglieder und Identifikation von Frühwarnzeichen psychischer Erkrankungen in regelmäßigen persönlichen und/oder digitalen Einzelgesprächen. Zudem sollten Weiterbildungsinhalte die Förderung sozialen Austausches in virtueller Teamarbeit adressieren, ebenso wie die Stärkung der Teamidentität und sozialer Beziehungen.

6.5. Implikationen für zukünftige Forschung

Mit der COVID-19-Pandemie ist die praktische Relevanz gestiegen, die Themenfelder rund um die virtuelle Teamarbeit zu erforschen. In diesem noch jungen Forschungsgebiet ist seitdem weltweit eine dynamische Entwicklung zu beobachten [114]. Bis heute hat diese Relevanz nicht abgenommen, denn es besteht weiterhin noch viel Forschungsbedarf. Die Erkenntnisse der vorliegenden Dissertation tragen einen Teil zum evidenzbasierten Verständnis von HoL in virtueller Teamarbeit bei. Spezifische Forschungsimplikationen sind in den Originalarbeiten ausführlich ausgeführt.

Übergeordnet wurde mit der Dissertation deutlich, dass im Forschungsfeld noch keine standardisierten Definitionen und folglich einheitlichen Messinstrumente zur Erfassung virtueller Führung oder Teamarbeit verwendet werden [58]. Demnach wird für die zukünftige Forschung empfohlen, Studien zur theoretischen Fundierung, Konstruktentwicklung und -validierung durchzuführen [z B., 115]. Auf diese Weise können zukünftig auf Basis klar definierter und abgrenzbarer Konstrukte im Rahmen von systematischen Reviews vergleichbare Forschungsergebnisse erzielt werden.

Aufgrund der noch sehr überschaubaren Studienlage zum Einfluss von HoL auf arbeits- und gesundheitsbezogene Outcomes von Beschäftigten in virtueller Teamarbeit ergeben sich vielfältige Forschungslücken. Für zukünftige Forschung wird daher empfohlen, längsschnittliche Studien zu kausalen Wirkbeziehungen von SelfCare und StaffCare auf unterschiedliche Outcomes, z. B. der mentalen Gesundheit, umzusetzen. Dabei wird es vor allen Dingen interessant sein, wissenschaftlich zu eruieren, welche Rolle Führungskräfte in virtueller Teamarbeit einnehmen können, um möglichst gesundheitsförderlich agieren zu können (z. B. in einer eher begleitenden, dezentralen Funktion [27]). Ergänzend wird empfohlen, die Effekte von SelfCare und StaffCare auf Individual-, Team- und Organisationslevel zu untersuchen. Dabei können intra- und interindividuelle Unterschiede zwischen Beschäftigtengruppen unterschiedlicher Hierarchielevel betrachtet werden. Eine längsschnittliche empirische Analyse von Dyaden (z. B. Führungskraft und ein Teammitglied), Teams oder 360-Grad-Feedbacks von Führungskräften ermöglichen eine differenziertere Untersuchung der Effekte unter Berücksichtigung von Selbst- und Fremdwahrnehmung. Zudem wird empfohlen, zukünftig Implementierungsstudien durchzuführen, in denen die Auswirkungen der Einführung neuer Arbeitsmodelle anhand von Prä-Post-Analysen untersucht werden. Auch weitere Studiendesigns wie experimentelle, Mixed-Methods

oder qualitative Studien werden für zukünftige Studien empfohlen, z. B. bei der vertiefenden Analyse zur Wahrnehmung von Warnsignalen und von StaffCare in virtueller Teamarbeit.

Des Weiteren bleibt ein großer Forschungsbedarf zur Untersuchung förderlicher Rahmenbedingungen von HoL in virtueller Teamarbeit bestehen. Um die Effekte der Charakteristika virtueller Teamarbeit auf Führung [42] analysieren zu können, bedarf es einer differenzierteren Betrachtung von persönlichen, organisationalen, sozialen und technischen Prädiktoren im Zusammenhang zu HoL (z. B. Organisationskultur oder Technostressoren). Dabei sollten zukünftige Studien neben direkten auch indirekte Wirkbeziehungen von HoL auf arbeits- und gesundheitsbezogene Outcomes über die Arbeitsbedingungen in virtueller Teamarbeit untersuchen. Ebenso können zukünftig Unterschiede von Führungseffekten zwischen Organisationen diverser Branchen, Kulturen und Ländern weiterführende Informationen liefern.

Im Allgemeinen wird es für zukünftige Forschung erforderlich sein, die rasante Entwicklung virtueller Teamarbeit in der Praxis zu begleiten. Quaquebeke und Gerpott [116] weisen beispielsweise auf die zukünftigen Entwicklungspotentiale der Nutzung von Künstlicher Intelligenz in der Führung hin. Diese Veränderungen des heutigen Verständnisses von Führung gilt es auch zukünftig aus wissenschaftlicher Perspektive zu beleuchten und ihre Auswirkungen auf Organisationen zu untersuchen.

6.6. Methodische Stärken und Limitationen

Übergeordnet stellt der multimethodische Ansatz der vorliegenden kumulativen Dissertationsarbeit eine besondere methodische Stärke dar [52]. Durch die Kombination einer systematischen Literaturrecherche, quantitativer und qualitativer Methoden im Quer- und Längsschnitt konnten die Stärken verschiedener Forschungsmethoden genutzt und somit die Validität der Forschungsergebnisse erhöht werden. Zudem ermöglichte dieses Vorgehen eine multimethodische Perspektive des Forschungsfelds sowie eine ganzheitliche Interpretation und Diskussion der übergeordneten Ergebnisse. Die Studienergebnisse wurden des Weiteren jeweils vor dem gewählten theoretischen Hintergrund und dem bisherigen empirischen Forschungsstand interpretiert und diskutiert. Ergänzend bieten die Implikationen der Dissertationsarbeit vor dem Hintergrund der COVID-19-Pandemie eine hohe Relevanz für Praxis und zukünftige Forschung. Detaillierte Darstellungen der spezifischen Stärken und Limitationen der kumulativen Dissertationsarbeit sind in den drei Originalarbeiten aufgeführt.

Zu den Stärken der Literaturrecherche zählen die systematische Vorgehensweise nach der Joanna Briggs Institute (JBI) Methode für Scoping Reviews [53] sowie der Einsatz zweier unabhängiger Studienmitarbeiterinnen für die Studienauswahl und -bewertung. Im Sinne eines Scoping Reviews konnte eine erste systematische Übersicht über das Forschungsfeld geschaffen werden [117-119]. Auf Basis der inhaltlichen und methodischen Analyse der eingeschlossenen Studien im Review konnten Forschungslücken identifiziert und Empfehlungen für zukünftige Forschung abgeleitet werden. In Anbetracht des noch jungen Forschungsfeldes bietet die Übersicht wertvolle Ansätze für zukünftige Forschungsrichtungen.

Eine Limitation der systematischen Literaturrecherche ist die bislang eingeschränkte Evidenz aufgrund der heterogenen Ergebnislage der im Review identifizierten Studien. Trotz enger Einschlusskriterien können zum einen Unterschiede in den Bedingungen virtueller Teamarbeit zwischen den Studien bestanden haben. So können in den Stichproben der jeweiligen Studien unterschiedliche Arbeitsplätze untersucht worden sein (wie Homeoffice, mobiles Arbeiten oder die Arbeit an Kundenstandorten), in unterschiedlichem Ausmaß virtuelle Teamarbeit umgesetzt sowie unterschiedliches technisches Equipment genutzt worden sein. Zum anderen bestehen Unterschiede in der methodischen Qualität der eingeschlossenen Studien (z. B. Einsatz validierter Instrumente). Wenngleich die identifizierten Studien nach engen Einschlusskriterien sorgfältig geprüft wurden, so konnten die Studienbedingungen aufgrund teils fehlender Informationen in den Publikationen und teils synonymer Verwendung unterschiedlicher Begrifflichkeiten (z. B. Telearbeit und virtuelle Teamarbeit) [87, 120] nicht vollständig nachvollzogen werden. Eine zentrale Limitation stellt somit die Vergleichbarkeit der identifizierten Studienergebnisse dar.

Eine zentrale Stärke des quantitativen Forschungsansatzes stellt das innovative methodische Vorgehen unter Nutzung eines umfassenden Längsschnittdatensatzes dar. Mit der Kombination von variablen- und personenorientierten Ansätzen konnten erste ganzheitliche Einblicke in Between- und Within-Effekte von arbeitsplatzbezogener Isolation und Homeoffice-Intensität sowie in relevante Voraussetzungen und Konsequenzen von Untergruppen gewonnen werden. Auch die Anwendung einer längsschnittlichen LPA mit zwei Variablen ist ein neues methodisches Verfahren, welches zusätzlichen Informationswert für das Verständnis individueller Unterschiede in der Entwicklung von Isolation am Arbeitsplatz und Homeoffice-Intensität liefern konnte.

Zu den Limitationen des quantitativen Forschungsansatzes zählen nicht einheitliche Zeitabstände zwischen den Messzeitpunkten, wenngleich keine wesentlichen Unterschiede zwischen angrenzenden Messzeitpunkten festgestellt werden konnten. Die Anwendung einer LPA kann zudem (wie viele andere statistische Methoden) nur als eine Annäherung an die Wirklichkeit verstanden werden. Es wurde das Modell gewählt, welches die Daten der Stichprobe am besten beschreiben konnte. Zuletzt sind bei der Interpretation der Ergebnisse mögliche Einflüsse durch die dynamischen Entwicklungen der COVID-19-Pandemie zu berücksichtigen, ebenso wie mögliche Verzerrungen der Ergebnisse durch Selbstselektion der Teilnehmenden sowie sozial erwünschtes Antwortverhalten. Bisherige Forschung hat beispielsweise auf Diskrepanzen von Selbst- und Fremdwahrnehmung von Führung und Leistung hingewiesen [121, 122].

Eine besondere Stärke des qualitativen Forschungsansatzes ist die explorative Erforschung subjektiver Perspektiven in einem neuen Forschungsfeld [65]. Die angewandten qualitativen Methoden waren aufeinander abgestimmt und für das Forschungsthema angemessen ausgewählt: die PZI-Methode ermöglichte offene Erfahrungsberichte der Studienteilnehmenden unter Nutzung eines halbstrukturierten Interviewleitfadens [69], die Durchführung von Telefoninterviews ermöglichte ein forschungsökonomisches sowie orts- und zeitflexibles Vorgehen, angepasst an die persönlichen Bedingungen der Teilnehmenden [67]. Die Wiederholung ähnlicher Erfahrungsberichte im Laufe der Interviewerhebungen ließen auf eine theoretische Sättigung in der Studie schließen [70].

Zu den Limitationen des qualitativen Forschungsansatzes zählen eine eingeschränkte Kontrolle von Störfaktoren während der Durchführung von Telefoninterviews und mögliche Verzerrungen durch Selbstselektion der Teilnehmenden sowie sozial erwünschtes Antwortverhalten. Somit bleibt beispielsweise offen, ob die Aussagen der Studienteilnehmenden mit dem tatsächlichen Führungsverhalten übereinstimmen oder ähnliche Aussagen außerhalb der Interviewsituation gewählt worden wären. Des Weiteren können in der qualitativen Forschung multiple Realitäten (d.h. Einflüsse durch die Perspektive von Forschenden) nicht vollständig vermieden werden [66, 123]. In der qualitativen Studie wurde diese Limitation mittels sorgfältiger Anwendung der qualitativen Datenerhebungs- und Datenanalysemethoden sowie kritischer Reflexion der Postskripte minimiert. Weiterhin repräsentieren die vorliegenden qualitativen Studienergebnisse nur die Perspektive von Führungskräften virtueller Teams. Des

Weiteren muss bei der Interpretation der Ergebnisse der Kontext der Studie berücksichtigt werden, denn zum Zeitpunkt der Studie konnten dynamische Entwicklungen der COVID-19-Pandemie Einfluss auf das Erleben der Studienteilnehmenden genommen haben. Entsprechend des qualitativen Forschungsansatzes war zudem keine Verallgemeinerbarkeit der Forschungsergebnisse, sondern eine Hypothesengenerierung beabsichtigt. In diesem Sinne kann auch der Gruppenvergleich nur explorativ interpretiert werden.

7. Fazit

Die vorliegende kumulative Dissertation liefert neue wissenschaftliche Erkenntnisse zur Umsetzung und Wirkung von SelfCare und StaffCare in virtueller Teamarbeit. Die Studienergebnisse geben Hinweise darauf, dass eine ausgeprägte SelfCare in virtueller Teamarbeit einen positiven Einfluss auf die Gesundheit am Arbeitsplatz nehmen kann. Nach derzeitigem Forschungsstand ist die Rolle von Führungskräften in virtueller Teamarbeit nicht eindeutig geklärt. Voraussichtlich können Führungskräfte in virtueller Teamarbeit ähnlich wie in traditionellen Teams in Präsenz sowohl einen direkten Einfluss über das Führungsverhalten auf Beschäftigte nehmen als auch einen indirekten Einfluss über die Gestaltung von Arbeitsbedingungen. Dennoch weisen die vorliegenden Studienergebnisse, entgegen der Erwartungen, auf einen negativen Einfluss von StaffCare auf die Gesundheit von Beschäftigten hin. Insbesondere in disruptiven Zeiten wie der COVID-19-Pandemie sowie ohne Vorerfahrungen können Beschäftigte wie auch Führungskräfte diversen Herausforderungen bei der (ad hoc) Anwendung von SelfCare und StaffCare nach der Umstellung auf virtuelle Teamarbeit begegnen. Grundlegend sind für eine wirkungsvolle Umsetzung von StaffCare bei der Umstellung auf virtuelle Teamarbeit Anpassungen des Führungsverhaltens erforderlich. Zudem legen die Studienergebnisse die Annahme zugrunde, dass auch virtuelle Führung in einen Kontext eingebettet ist, somit durch weitere persönliche, organisationale, soziale und technische Faktoren beeinflusst werden kann und eine ganzheitliche Perspektive erfordert. Durch die präventive Gestaltung gesundheitsförderlicher Arbeitsbedingungen in virtueller Teamarbeit können Führungskräfte in der Umsetzung von HoL unterstützt werden. Damit Führungskräfte auch in virtueller Teamarbeit als Ressource für Beschäftigte fungieren können, sollten Organisationen zum einen auf verhältnispräventiver Ebene grundlegende technische Bedingungen sicherstellen (z. B. eine ausreichende technische Ausstattung und adäquater IT-

Support), angemessene Arbeitsmengen, strukturierte Prozesse, flexible Arbeitsbedingungen und eine offene Organisationskultur umsetzen und fördern. Zum anderen sollten auf verhaltenspräventiver Ebene insbesondere die sozialen Beziehungen im Team gefördert werden. Aufgrund der noch übersichtlichen, teils heterogenen empirischen Studienlage bleibt ein großer Forschungsbedarf bestehen. Um die komplexen, kontextuellen Wechselwirkungen von HoL in virtueller Teamarbeit untersuchen zu können, wird für zukünftige Forschung grundlegend empfohlen, Studien zur theoretischen Fundierung, Konstruktentwicklung und -validierung durchzuführen. Mithilfe einer ganzheitlichen Forschungsperspektive sollte zukünftig insbesondere untersucht werden, welche Rolle Führungskräfte in virtueller Teamarbeit einnehmen können, um gesundheitsförderlich agieren zu können. Ein Ausblick in die derzeitigen rasanten technischen Entwicklungen von Künstlicher Intelligenz und dem Einsatz in virtueller Zusammenarbeit machen für die zukünftige Forschung deutlich, dass eine evidenzbasierte Erforschung der Veränderungen des heutigen Verständnisses von Führung und der Auswirkungen auf Organisationen unabdingbar sein werden.

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Virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation: A scoping review

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Background: The significant increase of digital collaboration, driven by the current COVID-19 pandemic, is resulting in changes in working conditions and associated changes in the stress-strain perception of employees. Due to the evident leadership influence on employees' health and well-being in traditional work settings, there is a need to investigate leadership in virtual remote work contexts as well. The objective of this scoping review was to assess the extent and type of evidence concerning virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation.

Method: A search was undertaken in five databases, PubMed, Cochrane Library, PsycINFO, PSYNDEX and Web of Science, as well as reference lists of included articles on 9th February 2021 and an update on 28th September 2021. The search strategy was limited to English, German and French language, peer reviewed journal articles published from January 2000 onwards. This scoping review was conducted in accordance with the JBI methodology for scoping reviews. The methodological quality of the included studies was assessed using the JBI critical appraisal tools. A narrative synthesis was conducted.

Results: Nineteen studies met the eligibility criteria for this review. Overarching review findings suggested a positive link between virtual leadership and well-being, job satisfaction, and a negative link to psychological strain, stress and perceptions of isolation of digitally collaborating employees.

Conclusions: By mapping the available evidence on virtual leadership in relation to health and work-related employee outcomes, the review identified many research gaps in terms of content and methodology. Due to limited data, causal relationships were not derived. Future research is needed to examine the complex cause-and-effect relationships of virtual leadership in more detail.

KEYWORDS

leader–employee interaction, virtual leadership, remote work, employee health, virtual collaboration

Introduction

The current global COVID-19 pandemic has had far-reaching impacts on the health and economies of many countries (Chudik et al., 2020; Pfefferbaum and North, 2020). As a result of human mobility restrictions aimed at reducing the incidence of infection, companies have been encouraged to let their employees, mostly white-collar professional workers, work at home if possible (Fadinger and Schymik, 2020; Hernandez and Abigail, 2020). Despite major challenges faced by many companies in adopting digital collaboration from home, a new discussion emerged in society on the distribution of work in the office and at home even for the post-pandemic period (Adams-Prassl et al., 2020; Alipour et al., 2020; Gupta, 2020). Some companies are therefore planning to reduce office space and transform offices into collaborative open workspaces (Alipour et al., 2020) or to redesign the post-pandemic workplace to hybrid ways of working (Fayard et al., 2021; Kane et al., 2021). Yet, the pandemic situation has only intensified an already existing trend. Over the past two decades, a steady increase in the use of digital information and communication technologies (ICTs) and the dissolution of fixed working hours and locations was recorded (Demerouti et al., 2014). From an economic point of view, the rationale for implementing virtual forms of collaboration, namely "New Ways of Working" (NWW) (Demerouti et al., 2014), primarily lies in an increased flexibility and agility of work engagement, an efficient knowledge and information exchange, as well as the reduction of costs, office space, and travel time (Cascio and Shurygailo, 2003; Latniak, 2017; Liao, 2017; Cortellazzo et al., 2019). These benefits can provide a competitive advantage in the globalized market (Hunsaker and Hunsaker, 2008; Kordsmeyer et al., 2019a). On the other hand, these changed working conditions in NWW also pose challenges for virtual collaboration and consequently for leadership. Thus, little or no personal contact due to geographic distance and time differences can lead to social isolation, loss of motivation, difficulties in building trust and team cohesion, and challenges in team coordination or communication (Hunsaker and Hunsaker, 2008; Hertel and Lauer, 2012; Charalampous et al., 2019; Eisenberg et al., 2019; Lengen et al., 2020).

Virtual leadership

Virtual leadership [or remote leadership or e-leadership (Avolio et al., 2014)] has to adapt to new framework conditions in a digitalized, globalized and highly flexible working environment in which team members interact via digital ICTs and leaders manage their teams across spatial distance, either within time zones or across different time zones (Lilian, 2014). Van Wart et al. (2019) add that leaders should effectively use ICTs by "(1) using ICTs when they are advantageous for various reasons, (2) using the best and most appropriate ICTs available relative to value of various resources, (3) using physically present communication channels when most appropriate, and (4) using ICTs with competence" (Van Wart et al., 2019, p. 83). As such, virtual leadership is not a leadership style, but rather a specific contextual condition for leadership. To date, current research indicated that virtual leadership is more challenging compared to face-to-face leadership due to more difficult relationship building and maintenance as well as coordination of work processes (Akin and Rumpf, 2013; Staar et al., 2019). So far, only little empirical evidence exists on which leadership styles are appropriate for virtual teamwork (Staar et al., 2019), e.g., studies on transformational leadership in virtual teams reveal inconsistent results (Kordsmeyer et al., 2019b). Especially in the course of the COVID-19 pandemic, a mixed form of virtual leadership also increasingly took place: hybrid leadership. Depending on individual needs, some team members are being led completely remotely, while others are being led using a combination of remote and face-to-face leadership (Hopkins and Figaro, 2021). In contrast to virtual leadership, digital leadership describes leadership behavior that drives digital transformation processes in companies (Zeike et al., 2019).

According to current research, leadership in traditional, face-to-face work settings has an evident influence on employee's mental health and job satisfaction (e.g., Kuoppala et al., 2008; Skakon et al., 2010; Montano et al., 2017). In this regard, mental health can be defined as "a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community" according to the World Health Organization (WHO) (World Health Organization, 2018, p. 1). This definition involves more than the absence of mental illness [meaning conditions that affect cognition, emotion, and behavior, e.g., depression (Manderscheid et al., 2010)] and constitutes an integral part of a person's health (World Health Organization, 2018). Compared to the significant body of research available on the influence of face-to-face leadership on employees' mental health and job satisfaction, there is still a great need for research on virtual leadership (Avolio et al., 2014; Staar et al., 2019). As virtual collaboration and use of digital ICTs may create psychological stress factors (e.g., acceleration, interruptions or information density) and thereby may have a negative impact on the mental health and job satisfaction of employees (Mache and Harth, 2019), it currently remains unclear which function leaders may have in this context. Reviews conducted hitherto were able to demonstrate for digital, remote collaboration that work environment may play a pivotal role in employees' mental health, job satisfaction, and perceptions of isolation (Charalampous et al., 2019; Oakman et al., 2020). Given the specific contextual conditions of virtual leadership, it seems appropriate to consider also leadership relations to employees' experience of isolation. In the course of COVID-19 related pandemic measures, such as mobility or contact restrictions and consequently a widespread adoption of

home office, social isolation emerged as one of the key negative impact factors on mental health (Giorgi et al., 2020; Lengen et al., 2020; Loades et al., 2020) and is significantly negatively related to job satisfaction (Toscano and Zappal, 2020). Social isolation can be defined by "the absence of support from co-workers and supervisors and the lack of opportunities for social and emotional interactions with the team" (Marshall et al., 2007, p. 198). Especially in remote work, limited opportunities for social interaction may also lead to professional isolation, i.e., the reduced possibility of being promoted or rewarded (De Vries et al., 2019). Evidence links between mental health and social isolation also exist apart from pandemic conditions (Leigh-Hunt et al., 2017; Wang et al., 2017) and specifically in geographically dispersed collaboration (Marshall et al., 2007; Wilson et al., 2008).

Theoretical framework

A recent systematic literature review illustrated that several theoretical concepts and empirical studies on healthy leadership have emerged over the past decade (Rudolph et al., 2020). Thereby, "Health-oriented leadership" (HoL) (Franke et al., 2014) as one dominant concept proved to have a significant impact on employees' mental health (e.g., Kranabetter and Niessen, 2016; Klug et al., 2019; Santa Maria et al., 2019, 2020; Kaluza, 2020; Vonderlin et al., 2021). It represents an integrative and holistic approach that assumes three components influencing the health of the workforce: SelfCare of the leader, StaffCare and SelfCare of the employees. The HoL concept is based on the health-oriented self-leadership of the leader (SelfCare), which consists of three dimensions: value, awareness and behavior. Thus, the leader considers his or her own health to be important, is aware of the stressors in his or her own workplace, and is able to display appropriate health-promoting and preventive behavior. Consequently, the leader's SelfCare influences the health-oriented employee leadership (StaffCare) as well as the employees' SelfCare, all of which also consist of the same three dimensions. According to the HoL model, leaders may influence employees both directly via StaffCare and indirectly in their role model function via their own SelfCare. All three components together (SelfCare of the leader, StaffCare and SelfCare of the employee) enhance the well-being and health of the workforce and consequently reduce perceived stress and health complaints (Franke et al., 2014).

Study aim

The ongoing need for containment of COVID-19 and continued need to undertake remote work requires evidence synthesis to develop policies and guidelines in order to support virtual leaders in taking care of employees' health. So far, a systematic literature review by Nayani et al. (2018) has outlined the impacts of occupational safety and health leadership on the health of distributed workers. Although it can be assumed that distributed leadership and virtual leadership may have similar associations with the health of employees, little is known about the specific relation between virtual leadership and the mental health, job satisfaction and perceived isolation of geographically dispersed team members with computer workstations. A preliminary search of PubMed, the Cochrane Library and APA PsycINFO was conducted and no current or underway systematic reviews or scoping reviews on the topic were identified. Based on this research gap, this study aims to systematically map the available evidence of virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation. Although there are different aspects that can be reviewed with regard to mental health, this systematic review aims to focus on the health-related aspects of mental health as a first step in approaching the subject. Accordingly, due to its scope, performance-related aspects of mental health (e.g., performance, productivity, or engagement) will not be included, as these are distinct areas of research.

Thereby, existing gaps in the literature will be identified and a basis for the development of specific health promotion measurements for digitally collaborating personnel will be created. This scoping review focuses the following research questions:

1. *How is virtual leadership related to employees' mental health, job satisfaction and perceptions of isolation?*
2. *What mediating or moderating variables influence the relation between virtual leadership and employees' mental health, job satisfaction and perceptions of isolation?*

Materials and methods

Study design

A scoping review is particularly appropriate for providing an overview of the evidence and covering a broader scope with a variety of study designs. Therefore a scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews (Peters et al., 2020). The Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist was therefore used as reporting guidelines (Supplementary Table 1) (Tricco et al., 2018).

Search strategy and data sources

Relevant studies were identified through an extensive search on 09th February 2021 in the following five electronic databases: PubMed, Cochrane Library, PsycINFO, PSYNDEX and Web of

Science. An update of the literature search was performed on 28th September 2021. Based on the PEO (population, exposure, outcome) scheme, supplemented by criteria for study design and report characteristics (publication type, date, language), a search string with English search words was developed. The search strategy was initially developed for the PubMed database and was later adapted, including all identified keywords and index terms, for each included database and information source (see Supplementary Table 2 for an example full search strategy in one database). Based on the research questions and PEO scheme our search string combined keywords concerning population (e.g., "personnel", "worker" or "employee"), exposure (e.g., "virtual leadership" or "e-leadership") and outcome (e.g., "mental health", "well-being", "job satisfaction" or "social isolation"). To identify additional relevant studies, searches were further conducted through manual search. Finally, the reference lists of all included sources of evidence were screened for additional studies.

Eligibility criteria

The study selection was based on predetermined eligibility criteria (Table 1). For inclusion in the present scoping review, studies were required to focus on adult white-collar employees and leaders with computer workstations who regularly collaborate digitally via ICTs during business hours due to spatial difference. Furthermore inclusion-eligible studies had to examine leadership behavior [following a behavioral approach to leadership (Schriesheim and Bird, 1979; Liao, 2017)], and outcomes concerning mental health, job satisfaction or perceptions of isolation. Based on health-related aspects of mental health, outcomes were included that related to absence or presence of mental illness (e.g., depression, burnout) or positive or negative states of well-being (e.g., affective well-being, stress). This scoping review considered qualitative, quantitative, mixed methods, case studies as well as quasi-experimental study research designs for inclusion. Full texts had to be published and made available in languages the research team was capable of (English, German and French). Since the first definition of virtual leadership ("e-leadership") was published in 2001 (Avolio et al., 2001) and given the need to capture a contemporary work environment, studies published since 2000 were included.

Studies were excluded that focused on self-employed workers, employees who work during regular working hours in the office, but digitally and remotely from home exclusively after hours or during informal working times, or if they were conducted in school, medical, or military contexts as these represent specific work settings in which team structures and leadership roles differ. Studies in which leadership was assessed by selection of media use or linguistic aspects of communication were also excluded, as these studies represent a distinct area of research. Furthermore, studies were excluded that focused on physical-related health outcomes, performance-related aspects of mental health (e.g., performance, productivity, engagement), work motivation, work-life balance or trust as these constructs are distinct to the outcome variables under consideration. Consequently, studies were excluded, if they did not provide an adequate description of the variables under study. Reviews, letters, editorials, conference papers, dissertation abstracts, commentaries, reflections, policy statements, books as well as experimental study designs, randomized and nonrandomized controlled trials were not considered.

TABLE 1 Eligibility criteria for study selection.

Criteria	Inclusion	Exclusion
Population	Adult white-collar employees and leaders who regularly collaborate digitally via ICTs during business hours due to spatial difference	Self-employed workers, informal working from home or after hours, professionals working in school, medical, or military context
Exposure	Leadership behavior	Selection of media use, linguistic aspects of communication
Outcome	Health-related mental health outcomes, job satisfaction and perceptions of isolation	Physical-related health outcomes, performance, work motivation/engagement, work-life-balance, trust
Study design	Qualitative, quantitative, mixed methods and quasi-experimental study research designs, case studies	Experimental study designs, randomized and nonrandomized controlled trials, reviews
Publication type	Research articles	Reviews, letters, editorials, conference papers, dissertation abstracts, commentaries, reflections, policy statements, books
Publication language	English, German, French	All other languages
Publication date	From 1st January 2000 onwards	Before 1st January 2000

Study selection

Following the search according to the eligibility criteria, all identified citations were collated and uploaded into EndNote 20 (Clarivate Analytics, Boston, USA) and duplicates were removed. Titles and abstracts were then screened by one reviewer (IE) for assessment against the inclusion and exclusion

criteria for this review. Full texts of selected citations were assessed in detail by two independent reviewers (IE and ER). Reasons for exclusion of sources of evidence at full text that did not meet the eligibility criteria were documented and reported in the scoping review. Any assessment difficulties or disagreements that arose between the reviewers at each stage of the selection process were discussed in the research team until consent was reached. The interrater reliability was measured by Cohen's kappa statistics using the guideline values according to Altman (1991): $\kappa = < 0.20$ poor, $\kappa = 0.21$–0.40 fair, $\kappa = 0.41$–0.60 moderate, $\kappa = 0.61$–0.80 good, $\kappa = 0.81$–1.0 very good.

Data extraction and data analysis

Data was extracted from papers included in the scoping review by one reviewer (IE) and verified by a second reviewer (ER) using a standardized data extraction form developed by the reviewers. The data extracted included general information on authors, year of publication, country, publication type, aims and objectives, study design as well as specific details about the participants, concept, context, exposure, outcomes, data collection instruments and key findings relevant to the review questions. The draft data extraction tool was modified and revised as necessary during the process of extracting data from each included evidence source. The characteristics of the studies were analyzed and summarized in a descriptive manner (Table 3). Qualitative data were classified under main categories using narrative synthesis, as suggested by JBI methodology for scoping reviews (Peters et al., 2020) to identify how virtual leadership is related to employees' mental health, job satisfaction and perceptions of isolation. Any disagreements that arose between the reviewers were resolved through discussion in the research team.

Quality assessment

Conducting a quality assessment is typically not intended for scoping reviews, as these are intended to rather map the evidence (Levac et al., 2010; Rumrill et al., 2010; Munn et al., 2018). Under certain requirements, the assessment of the quality of included studies may also be performed in a scoping review (Peters et al., 2020). In order to identify the risk of diverse biases in included studies and its impact on the validity of inferences, a critical appraisal was performed by two independent reviewers (IE, ER) using JBI standardized appraisal tools (Lockwood et al., 2015; Tufanaru et al., 2020). Based on these checklists, it was assessed whether the quality criteria were (partially) met or not, whether it was unclear or not applicable with justification given for judgement. Any disagreements that arose between the reviewers were resolved by consensus or through discussion in the research team.

Results

Included studies and characteristics

Overall, 1,248 records were identified through the database search on 09th February 2021 and 35 additional records were derived through manual search and screening of reference lists. After duplicates were removed, 1,113 titles/abstracts were screened by one author (IE). Conclusively, 54 full-text records were assessed by two authors (IE and ER) according to defined eligibility criteria for study selection (Table 1) resulting in 16 included studies. 38 full-text articles were excluded due to unmet criteria for study design ($n = 3$), study population ($n = 9$), exposure ($n = 10$) or outcome ($n = 16$). Cohen's kappa calculated for two raters (IE and ER) on 54 cases yielded $\kappa = 0.61$, resulting in a good strength of agreement (Altman, 1991). During the update on 28th September 2021, a total of 192 further records were identified, of which 9 full-text articles were assessed for eligibility by two authors (IE and ER) after screening titles / abstracts (IE). During the analysis of these 9 full-text articles, 6 were excluded due to unmet criteria for study population ($n = 2$), exposure ($n = 2$) or outcome ($n = 2$). Cohen's kappa calculated for two raters (IE and ER) on 9 cases yielded $\kappa = 0.73$, resulting again in a good strength of agreement (Altman, 1991). An additional 3 studies were included in the review, resulting in a total of 19 studies. The results of the search and the study selection process are presented in a PRISMA-ScR flow diagram (Tricco et al., 2018) (Figure 1).

Of the 19 included studies, most were conducted in North America ($n = 9$) or Europe ($n = 7$) and were published between 2016 and 2021 ($n = 9$). Almost all studies were cross-sectional ($n = 18$) and conducted as quantitative surveys ($n = 14$). Most studies surveyed teleworkers or telecommuters ($n = 10$) and assessed leadership by means of leadership styles ($n = 10$). Outcome measures were in most studies job satisfaction ($n = 12$) while others examined mental health ($n = 5$) or perceptions of isolation ($n = 5$). Table 2 shows the characteristics of included studies and Table 3 provides an overview of all study characteristics.

Quality assessment

According to Altman (1991), the inter-rater reliability based on Cohen's kappa ($\kappa = 0.74$ for the initial search, $\kappa = 0.89$ for the update) indicated a good to very good strength of agreement. Almost all analytical cross-sectional studies ($n = 12$) achieved at least 50.0% of the criteria, with only one study fulfilling 3 out of 8 quality criteria (37.5%) of the Critical Appraisal checklist. All four included qualitative studies met at least 6 out of 10 quality criteria (60.0%) of the checklist. The cohort study of this review fulfilled 7 out of 11 quality criteria (63.6%) and the quasi-experimental study fulfilled another 7 out of 9 quality

TABLE 2 Characteristics of included studies ($n = 19$).

Characteristic	Category	*n* per category	% per category
Continents	North America	9	47.4
	Europe	7	36.8
	Australia / New Zealand	2	10.5
	South Asia	1	5.3
Year of publication	2000–2005	5	26.3
	2006–2010	3	15.8
	2011–2015	2	10.5
	2016–2021	9	47.4
Study design	Cross-sectional study	18	94.7
	Longitudinal study	1	5.3
	Quantitative survey study	14	73.7
	Qualitative interview study	3	15.8
	Mixed-methods study	1	5.3
	Quasi-experimental study	1	5.3
Sample	Telework/Telecommuting	10	52.6
	Virtual teamwork	5	26.3
	Remote job*	4	21.1
Exposure variables	Leadership styles	10	52.6
	Leadership support	5	26.3
	General leadership behaviors or strategies	4	21.1
Outcome variables	Mental health	5	26.3
	Psychological strain	2	10.5
	Stress perceptions	1	5.3
	Well-being	2	10.5
	Job satisfaction	12	63.2
	Overall job satisfaction	8	42.1
	Occupation-specific job satisfaction	4	21.1
	Perceptions of isolation	5	26.3
	Social isolation	2	10.5
	Perceived proximity	1	5.3
	Professional isolation	2	10.5

*Employees who worked at a different location than their supervisor (e.g., in a different city/state, abroad, or at a customer's site).

criteria (77.8%) of the checklist. Following the objective of a scoping review, the quality assessment of these studies did not result in any exclusion from the review (Peters et al., 2020). Quality assessment results for all included studies are presented in Supplementary Tables 3–6.

Synthesized findings

Virtual leadership in relation to mental health outcomes of employees

Two studies showed positive links between general (Poulsen and Ipsen, 2017) or supportive leadership behaviors (Karani and Mehta, 2021) and employee well-being. Karani and Mehta (2021) displayed that supervisor support of employees who worked from home during the COVID-19 pandemic was positively associated with employees' well-being in an indirect way in that the supervisor support was positively linked to employees' psychological contract fulfillment ($\beta = 0.12$, $p < 0.05$), psychological contract fulfillment was positively linked to work engagement ($\beta = 0.77$, $p < 0.05$), and work engagement was positively linked to psychological ($\beta = 0.66$, $p < 0.05$) and emotional well-being ($\beta = 0.57$, $p < 0.05$) (Karani and Mehta, 2021). Yet again, a qualitative interview study by Poulsen and Ipsen (2017) revealed that inter-organizational distance workers (work at customers' sites) perceived both positive and negative states of well-being. Thus, on the one hand, they experienced flexibility, autonomy, and potential for personal growth in their work; on the other hand, poor physical and social working conditions were reported to be linked to perceptions of social isolation, loneliness, frustration, and unmet basic needs (e.g., physiological needs and safety). A qualitative analysis of leadership behaviors revealed that dialogue, feedback, and strong managerial perceptual skills were experienced as beneficial in relation to positive well-being (Poulsen and Ipsen, 2017).

Furthermore, two other studies investigated negative associations between psychological strain and quality of management by objectives (MBO) (Konradt et al., 2003) or supportive leadership behaviors (Bentley et al., 2016). Therefore, the results of Konradt et al. (2003) indicated in their cross-sectional study that MBO, a delegative management concept, had the highest statistical predictive value [independent of other (non-) job-related stressors] for perceived psychological strain of teleworkers ($\beta = -0.42$, $p < 0.01$). According to this, employees' irritation was negatively associated with perceived quality of their leadership (MBO), with high quality of MBO representing clearer goals, more feedback, and a higher degree of participation (Konradt et al., 2003). Bentley et al. (2016) demonstrated that perceived social support (from leaders) was negatively associated with psychological strain of teleworkers ($\beta = -0.28$, $p < 0.001$). In addition, statistical mediation effects in the cross-section on social isolation due to teleworking at home were demonstrated in this association (Bentley et al., 2016).

And lastly, the study by Bregenzer and Jimenez (2021) revealed that risk factors of digital work (distributed team work, mobile work, constant availability, and inefficient technical support) were positively associated with stress perceptions among employees. Health-promoting leadership was negatively associated with stress perceptions ($\beta = -0.31$, $p < 0.001$). Additionally, statistical moderation effects on health-promoting leadership in the association between stress perceptions and two risk factors (mobile work*health-promoting leadership: $\beta = 0.11$, $p < 0.001$; inefficient technical support*health-promoting leadership: $\beta = 0.07$, $p < 0.03$) were reported (Bregenzer and Jimenez, 2021).

FIGURE 1
PRISMA-ScR flow diagram of the study selection process.

Virtual leadership in relation to job satisfaction of employees

The studies on overall job satisfaction almost exclusively examined positive associations to established leadership styles, namely Leader-Member-Exchange (LMX) (Golden, 2006; Golden and Veiga, 2008; Kuruzovich et al., 2021), task-oriented leadership (Madlock, 2012), transformational leadership (Whitford and Moss, 2009; Kelley and Kelloway, 2012), and MBO (Konradt et al., 2003). Another study on overall job satisfaction examined a positive association to supportive leadership behaviors (Bentley et al., 2016). Following studies on the link between relationship-oriented leadership styles and overall job satisfaction exhibited contrasting results: A cross-sectional survey study by Golden (2006) showed statistical partial mediation effects for relationship quality with the leader (measured by LMX) in the association between extent of telecommuting and employees' job satisfaction ($\beta = -0.16$, $p < 0.01$; $\Delta R^2 = 0.02$, $p < 0.001$). Furthermore, Golden and Veiga's cross-sectional survey study found statistical moderation effects for extent of virtual work in the positive association between LMX and job satisfaction ($\beta = 0.20$, $p < 0.001$) (Golden and Veiga, 2008). Likewise, more recent study results of Kuruzovich et al. (2021) showed a positive link between LMX and job satisfaction ($\beta = 0.24$, $p < 0.01$) and statistical mediation results in the cross-section for LMX in the association between telecommuting system use and employees' job satisfaction. Furthermore, statistical moderation results were reported for telecommuting software quality in this association. Contrasting results were shown by Madlock (2012) in his cross-sectional survey study: relationship-oriented leadership was reported to have no statistical predictive value, but task-oriented leadership to have the highest statistical predictive value for job satisfaction among telecommuters ($\beta = 0.57$, $p < 0.001$). Studies on transformational leadership, a motivational and visionary leadership style, also suggested that this leadership style was positively associated with employees' overall job satisfaction in remote work contexts: Kelley and Kelloway (2012) cross-sectional survey study illustrated statistical mediation effects of transformational leadership style in the positive association between remote work context and employees' job satisfaction. Similarly, Whitford and Moss (2009) cross-sectional survey study of employees working in distributed teams indicated that visionary leadership (subscale of transformational leadership) was positively associated with job satisfaction when employees' promotion focus was sufficiently high. Statistical moderation effects for promotion focus as well as spatial distance were reported for the positive association between visionary leadership and job satisfaction (Whitford and Moss, 2009). Moreover, quasi-experimental study results of Konradt et al. (2003) showed that MBO as a delegating leadership style had the highest statistical predictive value for job satisfaction among teleworkers ($\beta = 0.52$, $p < 0.01$). In comparison to studies on leadership styles, Bentley et al. (2016) quantitative survey indicated that perceived social support (from leaders) was also positively associated with job satisfaction ($\beta = 0.40$, $p < 0.001$).

Additional four studies examined the positive link between LMX leadership style (Mäkelä et al., 2019), internal team leadership (Lurey and Raisinghani, 2001) or supervisor support (Haines et al., 2002; Nakrošiene et al., 2019) and employees' occupation-specific job satisfaction. The scales used assessed satisfaction with the specific occupation (e.g., telecommuter or expatriate). Similar to study results on overall job satisfaction, the cross-sectional survey study conducted by Mäkelä et al. (2019) showed a positive association between LMX quality and job satisfaction with expatriate job ($\beta = 0.22$, $p < 0.05$). Furthermore, statistical interaction effects in the cross-section were reported between LMX quality and physical distance ($\beta = 0.22$, $p = 0.05$), indicating positive associations between LMX quality and job satisfaction with expatriate job when

TABLE 3 Study characteristics ($n = 19$).

Reference, country	Study design	Sample size, population, sex, age	Exposure	Outcome	Main results	Critical appraisal score
Bentley et al. (2016), Australia/New Zealand	Cross-sectional quantitative survey study	804 teleworkers of 28 organizations, 47% female, mean age: 30.9 years	Perceived social support from supervisor	Psychological strain, job satisfaction, social isolation	Negative association between perceived social support (from leaders) and teleworkers' social isolation and psychological strain, positive association with employees' job satisfaction	62.5%
Bregenzer and Jimenez (2021), Austria	Cross-sectional quantitative survey study	1,412 German-speaking employees that face risk factors in digital work (e.g., distributed team work or mobile work), 56.9% female, mean age: 41 years	Health promoting leadership	Employee well-being (perceived stress, work-related resources)	Negative association between health-promoting leadership and employees' stress perceptions, health-promoting leadership moderated the association between risk factors of digital work and stress perceptions of employees	62.5%
De Vries et al. (2019), Netherlands	Longitudinal quantitative diary study	61 teleworkers of a medium-sized Dutch municipality (public servants), 64% female, mean age: 45 years	Daily LMX	Daily professional isolation	High quality LMX moderated the relationship between home-based telework and employees' professional isolation	63.6%
Golden (2006), USA	Cross-sectional quantitative survey study	294 telecommuters of a large telecommunications company, 47% female, mean age: 43 years	LMX quality	Job satisfaction	Statistical partial mediation effects of LMX in the association between extent of telecommuting and employees' job satisfaction	75.0%
Golden and Veiga (2008), USA	Cross-sectional quantitative survey study	375 virtual employees from a large company in the high-tech industry, 45% female, mean age: 42 years	LMX quality	Job satisfaction	Extent of virtual work moderated the positive association between high quality LMX and employees' job satisfaction	62.5%
Haines et al. (2002), Canada	Cross-sectional quantitative survey study	193 telecommuters of 3 companies in the Montreal metropolitan area (federal government agency, a high-tech organization and from one branch of a financial institution), 44% female, mean age: 42.3 years	Supervisor support	Satisfaction with the telecommuting arrangement	Hypothesized positive relationship between supervisor support and satisfaction with telecommuting arrangement not significant	87.5%

(Continued)

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TABLE 3 (Continued)

Reference, country	Study design	Sample size, population, sex, age	Exposure	Outcome	Main results	Critical appraisal score
Karani and Mehta (2021), India	Cross-sectional quantitative survey study	239 employees working from home during COVID-19 pandemic (consumer durable industry), 40% female, mean age: 35 years	Supervisor support	Emotional and psychological well-being, workspace and life well-being	Indirect positive association between supervisor support and employees' well-being	75.0%
Kelley and Kelloway (2012), Canada	Cross-sectional quantitative survey study	402 employees working in a different city or province/state than manager, 51.3% female, 67% between 30 and 50 years	Transformational leadership	Job satisfaction	Statistical mediation effects of transformational leadership in the positive association between remote work context and employees' job satisfaction.	50.0%
Kirkman et al. (2002), USA	Cross-sectional qualitative interview study	58 team members, 11 team leaders and 6 general managers of 18 virtual teams of a company in the travel industry, sex and mean age NR	Supportive leadership behavior	Isolation/Detachment	Negative association between supportive leadership behavior and employees' feelings of isolation and detachment	70.0%
Konradt et al. (2003), Germany	Cross-sectional quasi-experimental study design	54 full- or part-time teleworkers, 18 non-teleworking employees (control group) with comparable working tasks from the same 19 companies (data processing, telecommunications, financial services), 48,6% female, mean age: 37 years	MBO	Psychological strain, job satisfaction	Negative association between quality of MBO and teleworkers' psychological strain, positive association with their job satisfaction	77.8%
Kurland and Cooper (2002), USA	Cross-sectional qualitative interview study	18 supervisors, 24 telecommuters, 12 non-telecommuters of 2 high-technology firms, 40.7% female, mean age NR	Managerial monitoring strategies	Professional isolation	Negative association between managerial control and telecommuters' professional isolation	70.0%
Kuruzovich et al. (2021), USA	Cross-sectional quantitative survey study	184 teleworkers who telecommuted at least part of the week, sex and mean age NR	LMX	Job satisfaction	Positive association between LMX and teleworkers' job satisfaction, statistical mediation effects of LMX in the association between telecommuting system use and employees' job satisfaction	75.0%

(Continued)

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TABLE 3 (Continued)

Reference, country	Study design	Sample size, population, sex, age	Exposure	Outcome	Main results	Critical appraisal score
Lurey and Raisinghani (2001), USA	Cross-sectional quantitative survey study	67 employees of 12 virtual teams from 8 companies in the high technology, agriculture, and professional services industries, sex and mean age NR	Internal team leadership	Team members satisfaction	Positive association between internal team leadership and employees' team members satisfaction	37.5%
Madlock (2012), USA	Cross-sectional quantitative survey study	157 non-management telecommuters from 7 companies in the insurance, healthcare, high-tech and banking/finance industry, 48% female, mean age: 31 years	Leadership style	Job satisfaction	Positive association between task-oriented leadership and telecommuters' job satisfaction	75.0%
Mäkelä et al. (2019), Finland	Cross-sectional quantitative survey study	290 Finnish expatriates working in 51 different host countries, 23.3% female, mean age: 42.3 years	LMX (Functional distance)	Satisfaction with expatriate job	Positive association between LMX quality and employees' satisfaction with expatriate job, statistical interaction effects of physical distance to their supervisor in this association	75.0%
Nakrošiene et al. (2019), Lithuania	Cross-sectional quantitative survey study	128 teleworkers exercising different telework intensity, working in IT, insurance, telecommunication sectors, 56% female, mean age: 37.1 years	Supervisor support	Overall satisfaction with telework	Hypothesized positive association between supervisor support and overall satisfaction with telework not significant	62.5%
Poulsen and Ipsen (2017), Denmark	Cross-sectional qualitative interview study	13 distance workers, 4 managers from 4 companies in the software development, engineering or management consultancy, advanced manufacturing, sex and age mean NR	Distance management practices	Employees' wellbeing in distance work	Positive association between leadership behavior and distance workers' well-being	70.0%

(Continued)

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TABLE 3 (Continued)

Reference, country	Study design	Sample size, population, sex, age	Exposure	Outcome	Main results	Critical appraisal score
Ruiller et al. (2018), France	Cross-sectional qualitative interview study in a mixed methods study design	16 teleworkers, 6 e-leaders from a large company in the telecommunication industry, 40.9% female, mean age NR	E-communicational mode and control management mode (leadership behavior)	Perceived proximity	Positive association between e-communicational mode of leaders (described as high leader-member-exchange behavior) and teleworkers' sense of belonging	60.0%
Whitford and Moss (2009), Australia	Cross-sectional quantitative survey study	165 employees from a broad, random sample of small, medium, and large public and private organizations, 47% working at a different location than supervisor, 45% female, 53% between 25 and 34 years	Transformational leadership	Job satisfaction	Positive association between visionary leadership and employees' job satisfaction, employees' promotion focus and spatial distance moderated the association between visionary leadership and employees' job satisfaction	87.5%

NR, not reported; MBO, Quality of Management by Objectives; LMX, Leader-Member-Exchange.

physical distance to supervisor was low (e.g., by still working in the same time zone or culture despite being sent abroad as an expatriate) (Mäkelä et al., 2019). Another study by Lurey and Raisinghani (2001) illustrated that internal team leadership and team members' satisfaction was positively associated ($r = 0.45$, $p < 0.01$). In contrast, two studies by Haines et al. (2002) and Nakrošiene et al. (2019) found no significant associations between supervisor support and satisfaction with telecommuting arrangement (Haines et al., 2002) or telework (Nakrošiene et al., 2019).

Virtual leadership in relation to perceptions of isolation of employees

Two studies found positive associations between spatial distance in teams and perceptions of professional isolation among employees (Kurland and Cooper, 2002; De Vries et al., 2019) (i.e., reduced possibility of being promoted or rewarded at the workplace). De Vries et al. (2019) conducted a longitudinal quantitative diary study and demonstrated that home-based teleworking resulted in higher levels of professional isolation among public servants and that a high-quality LMX was conducive in reducing this effect. In addition, an interview study with telecommuters from the high-tech industry by Kurland and Cooper (2002) revealed that regular telecommuting was reported to be positively associated with perceptions of professional isolation among employees. The results of qualitative triad analyses indicated that managerial control was linked to employees' professional isolation. Accordingly, study participants' long-term professional development was described to suffer if they were not given regular opportunities to present ideas, to network, or if leaders faced difficulties with remote mentoring or focused only on results in the short term (Kurland and Cooper, 2002).

Furthermore, two other studies evaluated the negative link between supportive leadership behaviors and perceptions of social isolation (Kirkman et al., 2002; Bentley et al., 2016). A cross-sectional survey study by Bentley et al. (2016) indicated that perceived social support (by leaders) was negatively associated with perceptions of social isolation ($\beta = -0.46$, $p < 0.001$). This association was statistically reported to be greater for low-intensity teleworkers (<8 h telework/week; $\beta = -0.39$, $p < 0.001$) than for higher-intensity teleworkers (> 8 hours telework/week; $\beta = -0.60$, $p < 0.001$) (Bentley et al., 2016). Additionally, a qualitative interview study with virtual team members, leaders, and general managers at a U.S. company by Kirkman et al. (2002) elaborated that virtual leaders counteracted team members' feelings of isolation and detachment by proactively and frequently communicating with them (e.g., routine phone calls or e-mails), by building mentor-protégé relationships, and facilitating face-to-face meetings (e.g., via teambuilding or company events, increased client contact by redesigning job assignments, or by encouraging networking

within the company). Especially at the beginning of virtual teamwork, leaders acknowledged that minimal communication was misunderstood as a positive sign and that it took time to realize how to deal with employees' social isolation (Kirkman et al., 2002).

Additionally, interview results with teleworkers and their leaders by Ruiller et al. (2018) illustrated that leadership behavior was linked to perceived proximity in distributed teams and that leaders were experienced to have a responsibility in preventing de-proximity risks. According to these findings, leadership was reported to be positively related to team members' sense of belonging as leaders worked as part of the team in an equally distributed manner and thus shared the same experiences, jointly developed team goals and structures, build a team identity, and established high quality face-to-face and distant communication (Ruiller et al., 2018).

Discussion

The aim of this scoping review was to systematically map the available evidence of virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation and thereby identify existing gaps in the literature. Referring back to the research questions concerning the relations between virtual leadership and employees' mental health, job satisfaction and perceptions of isolation as well as mediating and moderating variables in this relation, overarching review findings suggested a positive link between virtual leadership and mental health, job satisfaction, and a negative link to perceptions of isolation of digitally collaborating employees. Virtual leadership was found to be both directly and indirectly related to employees' mental health, job satisfaction, and perceptions of isolation. To date, the cause-and-effect relationships of virtual leadership are very complex and still remain unclear, especially in relation to employees' mental health and perceptions of isolation. Reflecting upon our theoretical framework, the HoL model (Franke et al., 2014), it can be noted that all of the included studies only examined follower-directed virtual leadership (i.e. "StaffCare") in relation to employee outcomes. So far, no studies have been conducted that holistically examined self- and follower-directed leadership (i.e. "SelfCare leader", "SelfCare followers" and "StaffCare").

Virtual leadership in relation to mental health outcomes of employees

With regard to mental health, five studies indicated that leaders using a high quality MBO, a health-oriented leadership style, or supportive leadership behaviors were negatively associated with psychological strain (Konradt et al., 2003; Bentley et al., 2016) and stress perceptions (Bregenzer and Jimenez, 2021) and were positively associated with well-being of employees (Poulsen and Ipsen, 2017; Karani and Mehta, 2021). The associations of virtual leadership and mental health outcomes examined in these studies suggested social isolation (Bentley et al., 2016) and work engagement (Karani and Mehta, 2021) as potential mediators. According to present review results, there is no evidence on the relation between virtual leadership and mental illnesses. Moreover, it can be further discussed whether virtual leadership may act as a buffer by mitigating the negative relation between digital work and employees' stress perception (see Bregenzer and Jimenez, 2021). More recent findings that were unable to meet our eligibility criteria due to sample composition still yielded interesting aspects for our review. Dolce et al. (2020) study of virtual leadership in relation to mental health showed that destructive leaders in ad hoc telework during the pandemic were positively associated with employees' cognitive demands, a pressing use of technology, a reduction in autonomy, and, consequently, exhaustion and impaired recovery. Similarly, a recent study revealed that intrusive leadership was positively associated with the stress of workaholic employees who telecommuted after hours, and was also linked to decreased happiness, anxiety and depression (Magnavita et al., 2021). A recent systematic review highlighted the risk of negative psychological impacts of NWW on employees (e.g., blurred work-home boundary or fatigue) (Kotera and Correa Vione, 2020), which increases the overall relevance of promoting health protective factors for digitally collaborating employees. Despite limited number of studies in the present review, some similar results to the current state of research on face-to-face leadership were found. Several systematic reviews and meta-analyses demonstrated that face-to-face leadership can act as both a resource and a stressor (Gregersen et al., 2011) and can have a decisive influence on employees mental health (Kuoppala et al., 2008; Skakon et al., 2010; Montano et al., 2017) and leaders themselves (Kaluza et al., 2020). Most notably, these reviews reported transformational or relationship-oriented leadership styles to be positively related to mental health outcomes of employees (Gregersen et al., 2011; Montano et al., 2017).

Virtual leadership in relation to job satisfaction of employees

Furthermore, with regard to job satisfaction, present review findings indicated a positive association between virtual leadership [as surveyed by LMX quality (Golden, 2006; Golden and Veiga, 2008; Mäkelä et al., 2019; Kuruzovich et al., 2021), task-oriented leadership (Madlock, 2012), transformational leadership (Whitford and Moss, 2009; Kelley and Kelloway, 2012), quality of MBO (Konradt et al., 2003)], supportive [(Bentley et al., 2016) or general leadership behaviors

(Lurey and Raisinghani, 2001)] and employees' job satisfaction. Although most identified studies in this review examined employee job satisfaction as an outcome [see Charalampous et al. (2019) for similar results], the direction of this potential link is not clear. Namely, two studies found no significant association (Haines et al., 2002; Nakrošiene et al., 2019). Contrasting results were found between the studies on the positive link between LMX and job satisfaction (Golden, 2006; Golden and Veiga, 2008; Mäkelä et al., 2019; Kuruzovich et al., 2021) and a study that found no significant association between relationship-oriented leadership and job satisfaction (Madlock, 2012). Moreover, it is not clear how virtual leadership may affect employees' job satisfaction, as most studies assumed a direct link to job satisfaction but others indicated virtual leadership to serve as a mediator (Golden, 2006; Kelley and Kelloway, 2012; Kuruzovich et al., 2021) or moderator (Golden and Veiga, 2008) in the association between remote context variables and job satisfaction. In addition, two studies reported spatial distance, employees' promotion focus (i.e. orientation toward potential benefits or gains, rather than potential losses) and extent of digital work to be potential moderators influencing the link between virtual leadership and employees' job satisfaction (Whitford and Moss, 2009; Mäkelä et al., 2019). The relation between virtual leadership and employees' job satisfaction could therefore be dependent on other contextual factors. Yet, there are diverging research results on the impact of remote working conditions on employees' job satisfaction (Golden and Veiga, 2005). For example, it can be discussed whether telecommuting software quality can contribute to an improved telecommuting experience (Kuruzovich et al., 2021). Previous research more specifically discussed a curvilinear relationship between the extent of digital, remote work and job satisfaction (Charalampous et al., 2019). Outside our scope due to sample characteristics, a study of early-career professionals recruited from a Masters of Business Administration program suggested that the extent of electronic communication at work enhanced the positive association between LMX and students' job satisfaction (Hill et al., 2014). Thus, virtual work characteristics may influence the associations between leadership and employee outcomes. While the current state of research supports a significant direct influence of face-to-face leadership on job satisfaction (Kuoppala et al., 2008; Skakon et al., 2010), the present results can only point to a potential link between virtual leadership and employees' job satisfaction, since only quantitative cross-sectional studies have been conducted so far. To some extent, the comparability of these study results remains questionable, as differing (extensive) measurement instruments were used and recent rapid technological developments over the last two decades have changed the context conditions, in some cases considerably. For example, in the study by Lurey and Raisinghani (2001), study participants stated that they had hardly used videoconferencing. Accordingly, it can be concluded from the comparison of the included studies that the technical requirements and possibilities of virtual leadership differed greatly.

Virtual leadership in relation to perceptions of isolation of employees

Lastly, regarding review results on perceptions of isolation, preliminary review results suggested that employees in remote workplaces are more likely to experience isolation (Kurland and Cooper, 2002; De Vries et al., 2019) – as well as leadership behavior may reduce this perception of social and professional isolation of digitally collaborating employees (Kirkman et al., 2002; Kurland and Cooper, 2002; Bentley et al., 2016; Ruiller et al., 2018; De Vries et al., 2019). However, present review results indicated that supportive leadership behavior from a distance may also be experienced as challenging by leaders (Kirkman et al., 2002; Kurland and Cooper, 2002; Ruiller et al., 2018). The available studies did not indicate any moderating or mediating variables in this association. Similar findings, except our scope due to insufficiently defined sample composition, emerged from another two studies with transformational or considerate leadership reporting negative associations with sales peoples' perceptions of isolation (Mulki and Jaramillo, 2011; Munir et al., 2016). Moreover, a study among distributed workers found that workplace inclusion strengthened the positive relation between health-and-safety-specific leadership and self-rated health (Nielsen et al., 2019). The study findings of Golden et al. (2008) also illustrated that teleworkers' working conditions were related to perceptions of isolation. The negative association between teleworkers' professional isolation and their job performance was enhanced by extent of teleworking, whilst face-to-face interactions and access to communication-enhancing technology reduced this effect. A recent review showed that workplace isolation in digital, remote work settings is related to various employee outcomes, including emotional exhaustion, well-being and job satisfaction (Sahai et al., 2020). Sahai et al. (2020) argued in their review that the constructs of social and professional isolation are despite their differences intertwined and therefore combined them in the term workplace isolation.

Overarching discussion of review results

Due to the fact that no causal relationships of virtual leadership can yet be derived, it remains unclear how the influence of various leadership styles on health and work-related employee outcomes differs in virtual collaboration. However, what is apparent from the results is that context is decisive for virtual leadership and requires an adaptation of leadership behavior. In this regard, the working conditions of NWW can vary greatly, e.g., in terms of technical requirements

and equipment, extent of working virtually and remote, organizational support or corporate culture (Kirkman et al., 2002; Bentley et al., 2016; Nakrošiene et al., 2019; Kotera and Correa Vione, 2020; Niebuhr et al., 2022). Thereby, the COVID-19 pandemic poses a special context for virtual, remote collaboration. It has increased employees' experiences of isolation and related negative mental health consequences in ad hoc remote work, for example with negative effects on stress experience, experienced remote work productivity and remote work satisfaction, but also on social relationships at work (Toscano and Zappal, 2020; Carillo et al., 2021; Galanti et al., 2021; Xiao et al., 2021). Of all included studies, only one examined leadership in relation to employee well-being in remote work due to the COVID-19 pandemic (Karani and Mehta, 2021). Another recent interview study by Yarberry and Sims (2021) explored, amongst others, educators' experiences with prompted virtual teamwork during the COVID-19 pandemic. Again, employees reported feelings of depression due to social isolation, lack of human connection or belongingness. Likewise, leaders' support was attributed a key role by demonstrating their care and concern and finding a balance between micro-management and excessive attention (Yarberry and Sims, 2021). Previous studies indicated that the contextual conditions for virtual leaders differed greatly before and during the pandemic (Chamakiotis et al., 2021). Leaders were often challenged to adjust to ad hoc remote leadership (as well as increasingly hybrid forms of work) without prior knowledge (Chamakiotis et al., 2021) and were confronted with increased stress experiences of employees due to the pandemic situation (Evanoff et al., 2020). Additionally, characteristic of virtual teams in the pandemic is that employees often had to switch from traditional face-to-face to virtual collaboration unprepared in both technical (e.g., lack of organizational readiness) and mental terms (e.g., work-family conflicts) (Chamakiotis et al., 2021).

Implications for future research

In general, the review highlights that there are insufficient research findings to draw generalizable conclusions on virtual leadership in relation to health-related aspects of mental health, job satisfaction and perceptions of isolation of employees. As a result of this systematic review, by capturing key findings, broader clusters for future research could be identified and, consequently, recommendations for future research could be mapped. As there is still a great need for research identified in this review, it is recommended for future research to examine which leadership behaviors have the strongest impact on health-related outcomes. In this context, it will be crucial for future research to investigate whether it remains necessary to adapt existing leadership styles to the specific contextual conditions of virtual, remote work or whether a completely new leadership approach is required. Moreover, it should be investigated whether the effect of different leadership styles differs in the context of virtual, remote collaboration (e.g., does it take behaviors of different leadership styles, e.g., both, relationship-oriented and transformational leadership? Or is a specific leadership approach related to health needed, e.g., HoL by Franke et al., 2014?). Especially in the context of virtual leadership in pandemic conditions, it is important to explore whether the conditions and thus leadership behaviors differ (e.g., dealing with alternating virtual and hybrid leadership).

Furthermore, future empirical studies should investigate the impact of virtual leadership on various employee outcomes in relation to mental health (e.g., stress and strain perception, well-being, mental illnesses, but also performance-related aspects of mental health), job satisfaction and perceptions of isolation (e.g., social and professional isolation) using validated instruments (e.g., Cammann et al., 1979; Maslach and Jackson, 1981; Golden et al., 2008). Following the review by Sahai et al. (2020), future studies could also examine workplace isolation as a multi-dimensional construct, assessing both social and professional isolation (Marshall et al., 2007). Given the potential link between the experience of isolation and mental health identified in this review, future research should examine both constructs in relation to virtual leadership (Bentley et al., 2016).

Referring to the theoretical HoL model used in this review (Franke et al., 2014), it is recommended to examine leadership influence in virtual collaboration more holistically: both directly via follower-directed leadership (i.e., StaffCare) and indirectly via self-directed leadership (i.e., SelfCare from both leaders and employees). The exploration of employees' SelfCare is an interesting aspect of future research, especially in the context of virtual collaboration [e.g., in dealing with various stressors, including techno-stressors (Rohwer et al., 2022)], as well as in light of the fact that employees are active participants in a reciprocal leader-follower relationship (Mäkelä et al., 2019). In addition, virtual collaboration is often organized in a decentralized way, changing the role of the leader and making it more difficult for leaders to directly influence all of their followers' stressors. Furthermore, considering increased health risks of leaders (e.g., greater exhaustion or higher professional or quantitative overload) (Pangert and Schüpbach, 2011; Lohmann-Haislah, 2012; Stilijanow, 2012) and a significant association between leaders' health status and leadership behavior (Kaluza et al., 2020), it is recommended to investigate health-oriented self-leadership among leaders as well. Future studies should examine the impact of virtual leadership on leaders' health outcomes (see Efimov et al., 2020) as well as interdependencies between employees' and leaders' health status in virtual collaboration [e.g., by using health-oriented leadership measurement instrument by Franke et al. (2014)]. In this regard, future interventional research or experimental studies should investigate the relationship between health-oriented leadership and e-health literacy skills: What skills do leaders need in order to discuss health-related topics

in virtual communication or to reduce employees' perceived isolation? In general, future research should further focus on cause-effect relationships of virtual leadership and investigate under which conditions and characteristics virtual leadership functions as a resource or stressor.

The studies presented in this review illustrated that the impact of virtual leadership may also depend on different contributing factors (e.g., individual, organizational, social or technical factors). For this purpose, studies on virtual leadership should also examine different working conditions in companies (e.g., with respect to technical equipment, corporate culture, organizational support or social support by coworkers). Thereby, further research should examine the impact of the extent of remote digital work on employees' perceptions of virtual leadership. As the COVID-19 pandemic has strongly driven the digitalization of workplaces, employees' experiences may differ compared to before the pandemic (Niebuhr et al., 2022). Similarly, studies should be conducted in different sectors and countries to identify potential differences. Accordingly, studies should investigate whether the effect of virtual leadership may function more strongly as a buffer for employees in industries with increased job demands. Given that most studies in this review were conducted in North American or European countries, future studies should also be conducted in diverse countries and cultures. Furthermore, on an individual level, employees' individual needs and characteristics should be taken into account in relation to virtual leadership perception and employee outcomes. Considering diverse factors, future studies should analyze which predictors have the greatest impact on employees' health- and work-related outcomes.

Overarching recommendations include different study designs based on qualitative and quantitative methods or mixed-methods designs. Due to the fact that most of the included studies were quantitative, future qualitative research is needed to explore potential influencing factors and relationships to virtual leadership and health-related outcomes. Given that the majority of studies in this review were cross-sectional, there is a great need for longitudinal and intervention studies in order to obtain generalizable results and to identify causalities in the cause-effect relationships of virtual leadership, as well as to be able to interpret mediation effects.

Implications for practice

At an organizational level, organizations in general are recommended to holistically design, carefully and participatory plan, continuously evaluate, adapt and adjust the introduction of NWW (Kirkman et al., 2002; De Vries et al., 2019). Thereby, organizations should recognize that leadership can also be a relevant influencing factor for employees' mental health, their job satisfaction and perceptions of isolation in virtual, remote collaboration. Basically, organizations should be aware that no leadership or merely transferring traditional leadership in virtual, remote collaboration can pose risks (Contreras et al., 2020). Preparing leaders for health-promoting and effective leadership in virtual, remote collaboration requires organizational support at different levels. In this regard, it should be taken into account that more organizational support for leaders and employees is needed in teams with a higher degree of virtual, remote collaboration (Haines et al., 2002; Kurland and Cooper, 2002; Golden, 2006; Bregenzer and Jimenez, 2021). In general, the review results indicate that behavioral interventions for virtual leadership require adaptation to the specific contextual conditions of virtual, remote collaboration. Although research at this stage does not allow evidence-based recommendations on the application of specific leadership styles, the present review results indicate that certain behavioral activities should be promoted. It is recommended that virtual leaders develop and maintain high quality relationships to their dispersed team members by learning socio-emotional and communicative skills in order to build trust and respect in their team, to establish a shared identity, to enable participation, and to communicate effectively and sensitively via ICTs (Golden and Veiga, 2008; Ruiller et al., 2018; De Vries et al., 2019; Mäkelä et al., 2019). This requires leaders to learn how to communicate effectively via digital ICTs and to select the appropriate communication media accordingly. In doing so, it is crucial to engage in both planned and unplanned communication, as well as in formal and informal communication (Kelley and Kelloway, 2012; Ruiller et al., 2018). Organizations are required to offer a good quality and quantity of technical equipment to the workforce to enable effective communication. Social technologies should also be considered for social exchange (Kuruzovich et al., 2021). Adapting leadership behavior to the virtual, remote context takes work and time, as it takes experience for leaders to correctly interpret the different and individual communication cues to recognize, e.g., perceptions of isolation, stress or strain among employees (Kirkman et al., 2002; Ruiller et al., 2018). In view of the fact that leaders in virtual teamwork are attributed a more moderating role (Hertel and Orlikowski, 2018; Staar et al., 2019), it is also recommended by the present review results that leaders apply a leadership style that uses delegation principles (Konradt et al., 2003). Thereby, they can promote task autonomy and contribute to employee well-being (Mäkelä et al., 2019). In addition, the relevance of clear communication of goals, tasks and responsibilities is increasing, especially against the backdrop of various communication difficulties in virtual collaboration (Lurey and Raisinghani, 2001; Madlock, 2012). In order to achieve long-term behavioral changes in organizations, both behavioral interventions and structural measures need to be implemented. On the one hand, virtual teams should be given the opportunity to hold face-to-face meetings at the beginning of a collaboration or at regular intervals (Kelley and Kelloway, 2012; Mäkelä et al., 2019), and to participate in company-wide

networks on best practices (e.g., also platforms for informal exchange) (Kirkman et al., 2002; Kurland and Cooper, 2002). On the other hand, preventive occupational health and safety programs should be offered to employees and leaders in organizations, along with the development of a universal communication culture and etiquette for digital collaboration. Moreover, corporate structures should be adapted, hierarchies reduced and an open and agile corporate culture developed in order to establish an appropriate working environment in which virtual health-promoting leadership may have an impact (Contreras et al., 2020).

At an individual level leaders should be aware of the responsibility and influence they have on employees. Especially in digital communication, leaders should learn to be even more sensitive to the emotions and different needs of their team members and to respond accordingly (Kirkman et al., 2002; Bregenzer and Jimenez, 2021). Of equal importance is that virtual leaders develop an awareness of the challenges associated with the specific working conditions (e.g., time differences, language barriers, communication problems, lack of trust) (Poulsen and Ipsen, 2017; Mäkelä et al., 2019). Overall, it should be noted that successful change processes at the individual or even organizational level take time to develop.

Strengths and limitations

To the best of our knowledge, this is the first review which aims to systematically map the available evidence of virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation. In preparing this review, the JBI methodology for scoping reviews (Peters et al., 2020) and the PRISMA-ScR Checklist (Tricco et al., 2018) were closely followed. Accordingly, the study selection was conducted systematically and conscientiously by two independent researchers, which improved the reliability of the findings. The selection of narrow inclusion criteria ensured that only studies that actually investigated virtual, remote leadership (e.g., in contrast to distributed or digital leadership) were included. For the purpose of a scoping review, the aim of this review was to map the evidence (Levac et al., 2010; Rumrill et al., 2010; Munn et al., 2018). Accordingly, this review was able to systematically provide an overview of the field and, in particular, to derive recommendations for future research based on the content and methodological analysis of the included studies. This resulted in the identification of broader clusters for future research. Considering the still emerging research field, the review offers valuable approaches for future research directions.

Among the limitations of this review, it must be noted that, first, to date there is limited evidence on virtual, remote leadership in relation to employees' mental health, job satisfaction and perceptions of isolation and, second, the available data remains heterogeneous despite narrow inclusion criteria. It remains questionable whether the conditions of virtual, remote work were comparable for all included samples. For example, differences are possible between teleworkers, telecommuters, expatriates, or virtual team members (e.g., does only one team member or do all team members work remotely?), as these terms are often used interchangeably (Bailey and Kurland, 2002; Nakrošiene et al., 2019). There may also be differences in individual working conditions, such as different levels of telework intensity (e.g., full-time or part-time), the remote work location (e.g., home office, customer site or abroad) and different technical equipment. Moreover, it remains unknown whether differences in collaboration existed across national or cultural boundaries. There are also differences in the methodological quality of the included studies. The instruments used to survey outcomes in the included studies vary in quality (e.g., self-developed or validated items). Similarly, it was found that diverse instruments of varying quality were applied to assess leadership in virtual, remote settings (general leadership behaviors, social support by leaders, or established leadership styles), but none of them used instruments specifically adapted to virtual leadership. In some cases, access to the survey items was not provided, ethical considerations were not always listed, or the research was financed by a company. Lastly, despite limited interpretation (O'Laughlin et al., 2018), mediation analysis of cross-sectional data were reported and discussed in the present review.

Conclusions

Given the increased trend toward virtual, remote work due to the COVID-19 pandemic, the aim of this scoping review was to examine the current state of research on virtual leadership in relation to employees' mental health, job satisfaction and perceptions of isolation. A total of nineteen studies were identified, which indicated a positive link between virtual leadership and well-being, job satisfaction, and a negative link to psychological strain, stress and perceptions of isolation of digitally collaborating employees. Due to limited data, causal relationships were not derived. By mapping the current state of research, the review was able to identify numerous research gaps in terms of content and methodology that need to be addressed in the future. Future research is needed to examine the complex cause-and-effect relationships of virtual leadership and its impact on health-related outcomes of employees in more detail. Recommendations for practice in promoting healthy virtual leadership in organizations include supporting leaders via behavioral und structural interventions in order to raise awareness for their responsibilities and impact as well as to enable leaders to implement leadership behavior adapted to the specific contextual conditions of virtual, remote collaboration.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

Conceptualization, writing—review and editing, and project administration: IE, ER, VH, and SM. Methodology and full-text screening: IE and ER. Title and abstract screening, writing—original draft preparation, and visualization: IE. Supervision: VH and SM. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.960955/full#supplementary-material

SUPPLEMENTARY TABLE 1
PRISMA-ScR Checklist.

SUPPLEMENTARY TABLE 2
Search strategy for PubMed.

SUPPLEMENTARY TABLES 3–6
Critical appraisal results.

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When do employees feel isolated when working from home? Longitudinal trajectories, antecedents and outcomes of workplace isolation during the COVID-19 pandemic

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Introduction: Previous longitudinal studies investigated loneliness in general populations during the COVID-19 pandemic. Less is known about workplace isolation among employees working from home (WFH). Based on job demands-resources and conservation-of-resources theories, this study aims to analyze workplace isolation of employees WFH in relation to their WFH intensity.

Methods: This study examined the change in workplace isolation and WFH intensity over 5 measurement points of 512 employees using multilevel growth curve analysis (GCA), identified groups of participants with distinct trajectories of workplace isolation and WFH intensity using latent profile analysis (LPA), and investigated antecedents and consequences of profile membership.

Results: GCA indicated an overall negative linear and quadratic relationship between time and workplace isolation, as well as interaction effects between time and WFH intensity on workplace isolation. LPA identified 3 groups: (1) high WFH intensity and low isolation, (2) low WFH intensity and high isolation, (3) high WFH intensity and high isolation. Subsequent analyses revealed that individuals in profile 1 had high levels of health-oriented self-leadership (SelfCare) and social support by colleagues, and low levels of communication difficulties, health-oriented employee-leadership (StaffCare) and extraversion. Regarding differences, highest commitment was identified among individuals displaying low WFH intensity (profile 2), whereas highest self-rated performance was prevalent among individuals experiencing low workplace isolation (profile 1).

Discussion: Applying GCA and LPA in this line of research is novel and adds to the understanding of both between-and within-effects of workplace isolation and WFH intensity. Knowledge about relevant resources (e.g., SelfCare) and demands (e.g., communication difficulties) may inform organizational practices aimed at preventing isolation in remote and hybrid work settings.

KEYWORDS

health-oriented leadership, person-oriented approach, remote work, social relationships at work, teleworking, workplace isolation

1 Introduction

The COVID-19 pandemic required worldwide containment and mitigation measures, including social distancing measures, to prevent virus spread (OECD, 2020). These measures negatively impacted loneliness and mental health in general populations across countries (Ernst et al., 2022; Robinson et al., 2022) and specific vulnerable subgroups (Varga et al., 2021), such as older and younger people or those with pre-existing mental illnesses (Varga et al., 2021; Su et al., 2023). Research has clearly demonstrated a negative impact of loneliness and social isolation on physical and mental health outcomes, both before (Leigh-Hunt et al., 2017) and during the pandemic (Loades et al., 2020; Xiong et al., 2020).

Social distancing also brought significant changes to workplaces, including the introduction or increase of remote, digital collaboration (Hernandez and Abigail, 2020). This paper uses the term "work from home" (WFH) to focus on employees working from home (De Vincenzi et al., 2022). But not all organizations were technically and organizationally well prepared for this change during the pandemic (Wang et al., 2021; Efimov et al., 2024a). Current research investigates WFH's effects on employee outcomes, as this relationship is far from univocal. A comprehensive meta-analysis found overall small but beneficial effects of remote work intensity on employee outcomes, although perceived autonomy had a reinforcing and isolation perceptions a detrimental effect as mediators in this relationship (Gajendran et al., 2024). Further, a large-scale study identified a nonlinear relationship between WFH intensity and professional isolation, demonstrating a "too much of a good thing" effect (Rudolph and Zacher, 2024). WFH intensity describes "the extent to which individuals work virtually, away from the office" (Golden et al., 2008, p. 1413). Past research on WFH outcomes suggested that the amount of time people WFH may be more relevant than whether or not they actually do WFH (Rudolph and Zacher, 2024). This study (Rudolph and Zacher, 2024) and reviews (Wang et al., 2021; Beckel and Fisher, 2022; De Vincenzi et al., 2022) suggested that personal and organizational factors influence employees' perceptions of remote work, rather than this working arrangement having a homogenous impact on employees (De Vincenzi et al., 2022).

Despite a considerable increase in remote collaboration in recent years, workplace-related isolation remains under-researched (Sahai et al., 2020). Workplace isolation is "a two-dimensional construct that represents individuals' perception of isolation from others at work and includes perceived isolation from both colleagues and from the company's support network" (Marshall et al., 2007, p. 195). The first dimension "colleagues" therefore describes the perceived isolation from colleagues, i.e., when the need for social or emotional interaction or camaraderie at work is not fulfilled. The second dimension "company" describes the perceived isolation from the company, i.e., when employees do not feel part of the team or departmental network (thus do not get help and support in specific work-related needs) and that their achievements are not being acknowledged by the company. The subjective perception of isolation and not necessarily the actual physical proximity is decisive for this construct (Marshall et al., 2007). Accordingly, workplace isolation is a specific construct that only applies to the work context. In this study, the focus will be on the first dimension of this construct: perceived isolation from colleagues at work. Workplace isolation is distinct from loneliness, a broader, emotional construct that can be applied to all population groups (Russell et al., 1984; Marshall et al., 2007). Loneliness refers to "individual's subjective perception of deficiencies in his or her network of social relationships" whereby these deficiencies can be both qualitative and quantitative in nature (Russell et al., 1984, p. 1313).

In summary, while the pandemic exacerbated loneliness in general populations worldwide, little is known about the temporal dynamics of workplace isolation in relation to WFH intensity over time (trajectories over time) as well as about whether and how subgroups of employees in these trajectories differ (trajectory profiles). Overall, this study aims to analyze workplace isolation among employees working from home in relation to their WFH intensity, identifying a general trend over time and subgroups with different trajectories. Furthermore, this study aims to determine antecedents and consequences of these subgroups with different trajectories.

On the one hand, this study provides theoretical contributions by applying a novel methodological approach to research workplace isolation, enhancing the understanding of both between-and within-person effects, thereby highlighting heterogeneity among employees' experiences and responses to WFH. It integrates Job Demands-Resources (JD-R) and Conservation-of-Resources (COR) theories to advance the understanding of how individual and social resources and demands influence workplace isolation, thus providing a more comprehensive theoretical framework for studying WFH dynamics. On the other hand, this study offers practical contributions by informing organizations about distinct employee subgroups that may experience workplace isolation differently when WFH and identifies relevant resources and demands in this relationship. This knowledge enables organizations to tailor more effective and personalized support strategies and develop targeted, long-term interventions to mitigate workplace isolation and enhancing employee outcomes, also for the post-pandemic context.

1.1 A variable-oriented approach: multilevel growth curve analysis for changes in workplace isolation and WFH intensity

Current state of research demonstrated that longitudinal analyses of changes in isolation perceptions during the pandemic have generally focused on loneliness in the adult general population rather than work-related isolation. These studies were conducted at different time points: before and during the pandemic (Bu et al., 2020; Entringer and Kröger, 2020; Hettich et al., 2022), at the beginning (Buecker et al., 2020; Killgore et al., 2020; Luchetti et al., 2020), and in the course of the pandemic (Caro et al., 2022; Benke et al., 2023; Weber et al., 2023). The methodology and results of studies were mixed: most reported an increase in loneliness (e.g., Hettich et al., 2022; Benke et al., 2023), whilst others found both increases and decreases (e.g., Bu et al., 2020; Buecker et al., 2020), and some noted a decrease (Weber et al., 2023) or stable values (Caro et al., 2022). None of those studies examined slopes of trajectories of isolation perceptions or loneliness over time. However, these studies focused on identifying vulnerable groups and risk factors.

To identify a general trend of workplace isolation and WFH intensity over time, a variable-oriented approach was applied (Laursen and Hoff, 2006). It is appropriate for investigating interindividual variation (Bergman and Lundh, 2015). Yet, there are no existing studies on growth curves of employees' workplace

isolation when WFH (e.g., linear, quadratic or cubic) in general nor during pandemic. This study aims to examine an averaged trajectory of workplace isolation in relation to WFH intensity across participants over time. It is conceivable that employees feel less isolated when WFH over time due to improvements in digital communication tools. Organizations have increasingly invested in better and more diverse digital communication platforms, enhancing collaboration and social interaction (Efimov et al., 2024b). These tools might have improved communication effectiveness, reducing feelings of isolation. Furthermore, employees and leaders have adapted to new work practices, fostering routines that promote social interaction and collaboration even in a remote environment (Efimov et al., 2024a). The initial uncertainty and discomfort in handling WFH might have diminished over time, reducing workplace isolation. Organizations have started organizing targeted virtual social activities and team-building events to strengthen the sense of community and combat isolation, encouraging informal exchanges and social interactions (Efimov et al., 2024a). Thus, we assume:

> *H1a*: There is a negative nonlinear relationship between time and workplace isolation.

Many organizations have implemented hybrid work models, combining WFH with office presence. These models offer employees flexibility to WFH while also providing opportunities for in-person interactions at the office. However, increased WFH intensity reduces direct, personal interactions with colleagues, potentially exacerbating workplace isolation. Thus, the loss of spontaneous communication and informal exchanges that occur in the office (Tautz et al., 2022; Krick et al., 2023; Efimov et al., 2024a) can potentially increase feelings of isolation. High WFH intensity may impair team dynamics, as employees have fewer opportunities to build and maintain team relationships and trust (Breuer et al., 2016), further potentially increasing isolation. Despite the availability of digital communication tools, technological issues and the lack of personal proximity can degrade interaction quality (Efimov et al., 2024a; Klebe et al., 2024), enhancing isolation with higher WFH intensity. Given this, it is conceivable that workplace isolation and WFH intensity covary over time (e.g., Gajendran et al., 2024; Rudolph and Zacher, 2024) and that time and WFH intensity interact with each other, which means that the trajectory of WFH intensity predicts how workplace isolation develops over time. However, no studies to date considered WFH intensity as influencing variable in the relationship between time and workplace isolation. Past research so far indicated that WFH intensity may serve as a predictor or moderator of perceptions of isolation in remote collaboration (Golden et al., 2008; Sahai et al., 2020). A recent meta-analysis found a mediating effect of isolation between remote work intensity and employee outcomes (Gajendran et al., 2024). Moreover, a large-scale longitudinal study indicated a nonlinear ("u-shaped") relationship between WFH intensity and professional isolation, indicating a "too much of a good thing" (Rudolph and Zacher, 2024). Thus, we assume:

> *H1b*: There is an interaction effect of time and WFH intensity on workplace isolation. The trajectory of WFH intensity predicts workplace isolation over time.

1.2 A person-oriented approach: distinct trajectories of workplace isolation and WFH intensity development

Since people may differ in their trajectories, a person-oriented approach was applied. This approach is appropriate for studying individual development and identifying subgroups with different trajectories. It is characterized by a pattern focus, an individual focus, and a process focus. Thereby, the person-oriented approach is theoretically and methodologically opposed to the variable-oriented approach (Bergman and Lundh, 2015).

To date, there are only a few longitudinal studies on distinct trajectories of loneliness or isolation perceptions during the pandemic. Three studies on loneliness revealed four subgroups of loneliness trajectories, but heterogenous results on trajectory prevalence, slopes and levels: Each study found at least one subgroup with high, medium and low levels of loneliness (Bu et al., 2020; Laham et al., 2021; Caro et al., 2022). Another study examined distinct trajectories of workplace sense of community of employees WFH and identified two latent classes of high and low trajectories (Graham et al., 2023). However, this construct is distinct from workplace isolation.

No studies have yet explored distinct trajectories of both workplace isolation and WFH intensity. However, existing studies on associations between workplace isolation and WFH intensity (Golden et al., 2008; Sahai et al., 2020; Gajendran et al., 2024; Rudolph and Zacher, 2024) suggest a covariation over time. Further, we assume WFH intensity to be a relevant variable for identifying subgroups regarding workplace isolation perceptions. To date, latent profile analysis (LPA), a method of the person-oriented approach, has been used little in vocational behavior research (Spurk et al., 2020), and even more rarely have two variables been considered in an LPA (e.g., Kinnunen et al., 2019).

Applying a person-oriented approach (Laursen and Hoff, 2006), this study aims to identify subgroups (profiles) with distinct trajectories of workplace isolation in relation to WFH intensity over time. Due to the limited, heterogeneous findings of past research, we expect at least two levels of both workplace isolation and WFH intensity (i.e., high and low), resulting in four groups: (1) high workplace isolation, high WFH intensity, (2) high workplace isolation, low WFH intensity, (3) low workplace isolation, low WFH intensity, (4) low workplace isolation, high WFH intensity. Thus, we expect at least 4 profiles based on these two dimensions (workplace isolation and WFH intensity), which correspond to a four-field scheme. Based on current research, no detailed expectations are set regarding the prevalence or slopes of subgroups. Thus, we assume:

> *H2*: Quantitatively and qualitatively distinct trajectories of workplace isolation and WFH intensity can be identified: two trajectories displaying high workplace isolation, one at low and one at high WFH intensity (H2a), and two trajectories displaying low workplace isolation, one at low and one at high WFH intensity (H2b).

1.3 Antecedents of profile membership: individual and social determinants

To understand the factors affecting profile membership, the JD-R and COR theories were applied as theoretical framework for this study

(Bakker and Demerouti, 2007; Hobfoll et al., 2018). On the one hand, the JD-R theory assumes that each occupation has specific job demands (which, if high, can impair the mental and physical health of employees) and job resources (which, if high, can have positive effects on work-and health-related outcomes and can mitigate the negative effects of job demands; Bakker and Demerouti, 2007). On the other hand, the COR theory assumes that "individuals strive to obtain, retain, foster, and protect those things they centrally value" (Hobfoll et al., 2018, p. 2). Accordingly, this motivational theory posits that people draw on key resources to respond to stress and develop a reservoir of sustaining resources for future needs. The associated resource loss spiral in this theory further assumes that people experience stress when resources are exhausted, and few resources remain to reduce stress. Consequently, further resources are lost in each iteration of the stress spiral to cope with stress. The same applies vice versa for the resource gain spiral, although slower and smaller in magnitude. Yet, gaining resources is essential to prevent future resource losses. People therefore invest in resources in order to protect and gain resources (Hobfoll et al., 2018). There are various approaches for investigating the effects of working conditions on employee outcomes when WFH. Following Wang et al. (2021), this study also considers work characteristics as antecedents in the WFH context. Since the meaning of work characteristics may be shaped by context and WFH became the "new normal", specific work characteristics should be examined. This allows an investigation of which work characteristics act as demands or resources for different subgroups regarding workplace isolation and WFH intensity. With respect to investigating antecedents of profile membership as another aim of our study, we consider facilitating and hindering factors (both demands and resources) on different levels: individual and social determinants at work.

In terms of *individual determinants*, we examine employees' health-oriented self-leadership (SelfCare) and extraversion as predictors of profile membership. According to Health-oriented Leadership (HoL) model (Franke et al., 2014), SelfCare describes how employees manage their own health. In addition to employees' SelfCare, the HoL model comprises two further components: managers' SelfCare and StaffCare (i.e., health-oriented employee-leadership). Each of the components consists of three dimensions: value, awareness, and behavior. In terms of employee SelfCare, these three dimensions imply that employees can lead themselves in a health-oriented manner if they care about their health (value), are aware of changes in their state of health (awareness) and can apply appropriate health-promoting practices (behavior). The model assumes that positive characteristics of all three components improve the well-being and health of the workforce (Franke et al., 2014). A German longitudinal study during pandemic showed that SelfCare was more prevalent among employees when WFH, and that WFH intensity demonstrated a moderating (i.e., intensifying) effect on the effectiveness of SelfCare on employees outcomes (less strain and health complaints as well as more relaxation and performance; Krick et al., 2024a). Thus, it is considered a personal resource that, according to COR theory, can facilitate further resource gain and reduce resource depletion, which in turn may decrease perceptions of workplace isolation when WFH.

In addition, employees' personality traits may influence workplace isolation perceptions when WFH. Extraversion, a Big Five personality trait associated with higher engagement in social activities (Lucas et al., 2008), is a relevant, rather time-stable predictor in this study that may increase perceptions of workplace isolation when WFH. Previous research has pointed to a negative link between extraversion and preference for teleworking (Gavoille and Hazans, 2022). A study with police officers WFH during lockdown found that individuals with higher extraversion scores missed their colleagues more (Langvik et al., 2021). Further, a literature review argued that new ways of working may be stressful for highly extraverted individuals, since they miss face-to-face contact with colleagues more (Demerouti et al., 2014). Thus, we assume:

> *H3*: Individual determinants (SelfCare, extraversion) predict profile membership. SelfCare (H3a) is positively, and extraversion (H3b) is negatively associated with trajectory profiles which indicate low workplace isolation and high WFH intensity.

In terms of *social determinants*, we examine social norm, social support by colleagues, health-oriented employee-leadership (StaffCare; Franke et al., 2014), and communication difficulties as predictors of profile membership. For one, we expect that social norm at work, i.e., the extent of how many colleagues WFH, may mitigate workplace isolation. Past research indicated that social influence affects decision making, e.g., choice to telework, and that teleworking colleagues had a stronger influence on telework adoption than non-teleworking colleagues (Scott et al., 2012). Thus, a high number of colleagues WFH might positively influence WFH experiences, i.e., employees may feel connected in their experience and perceive a strengthened community that is well attuned to remote collaboration.

Moreover, we expect social support by colleagues to decrease perceptions of workplace isolation when WFH (Marshall et al., 2007; Sahai et al., 2020). Social support at work may be crucial in reducing perceived workplace isolation as it fosters a sense of belonging to a team or organization, both face-to-face and when WFH (Marshall et al., 2007; Graham et al., 2023). Knowing that colleagues and supervisors are available for assistance may help mitigate stress and challenges, making employees feel less isolated. Emotional support from colleagues or supervisors can alleviate negative emotions such as loneliness or frustration (Marshall et al., 2007). Social support also provides access to professional resources (e.g., knowledge and feedback; Drageset, 2021; Jolly et al., 2021), enhancing integration and reducing isolation, creating a more inclusive and interconnected work environment where employees feel more engaged (Marshall et al., 2007; Sahai et al., 2020).

Likewise, according to the HoL model (Franke et al., 2014), we also expect StaffCare, i.e., leader's care for followers health, to be another inhibiting factor for workplace isolation when WFH. Past research suggested a negative link between leadership in remote collaboration and perceptions of isolation (Efimov et al., 2022) and identified leadership as antecedent of workplace isolation (Sahai et al., 2020). Although there are currently no studies on the link between StaffCare and employee isolation when WFH, previous studies indicated a beneficial effect of StaffCare on employee outcomes when WFH (Klebe and Felfe, 2023; Krick et al., 2023; Sachse and Schanz, 2023) or in times of crisis (Klebe et al., 2021). Still, its effectiveness may be impaired by information and communication technologies (ICT) hassles (Klebe et al., 2023). Leaders actively taking care of their employees' health in terms of StaffCare should reduce workplace isolation by fostering interaction

and engagement through regular communication (Henke et al., 2022; Efimov et al., 2024a). This emotional support may mitigate loneliness and foster a sense of belonging. Leaders modelling health-oriented behavior create a supportive workplace culture that encourages peer support, reduces stress and depression (Franke et al., 2014), and may diminish isolation. Providing resources for social interaction, such as team-building activities, allows employees to connect with each other, further reducing isolation (Efimov et al., 2024a).

Last, we consider communication difficulties during WFH as a conducive factor for workplace isolation. Previous studies demonstrated that electronic communication may lack richness and social presence (Marshall et al., 2007), and that lack of social presence, limited informal chats and communication difficulties were experienced as challenges by employees in remote setting compared to traditional office setting (Tautz et al., 2022). Further studies illustrated that communication quantity and improved access to ICT were able to reduce isolation perceptions in remote work (Van Zoonen and Sivunen, 2022; Wong et al., 2022) and decrease professional isolation's impact on teleworkers' work outcomes (Golden et al., 2008). Thus, we assume:

> *H4*: Social determinants (social norm, social support by colleagues, StaffCare, communication difficulties) predict profile membership. Social norm, social support by colleagues, and StaffCare are positively associated with trajectory profiles which indicate low workplace isolation and high WFH intensity (H4a). Communication difficulties are negatively associated with trajectory profiles which indicate low workplace isolation and high WFH intensity (H4b).

1.4 Consequences of profile membership: health-and work-related outcomes

Studying consequences of distinct trajectories of workplace isolation and WFH intensity is highly relevant. Following the COR theory (Hobfoll et al., 2018), we assume that employees experiencing lower levels of workplace isolation have more resources and, according to resource gain spiral, that this is linked to positive health-and work-related outcomes. Previous research indicated a positive link between workplace isolation and burnout or emotional exhaustion, and a negative link to affective commitment and job performance (Sahai et al., 2020). Considering WFH intensity, a longitudinal study during the pandemic pointed to an indirect effect of remote work on psychological distress via isolation (Van Zoonen and Sivunen, 2022). Most recently, a meta-analysis found an overall positive relationship between remote work intensity and various employee outcomes (e.g., organizational commitment and supervisor-rated job performance), with isolation perceptions having a detrimental effect as mediator (Gajendran et al., 2024). To date, studies have not used a person-oriented approach to gain differentiated insights into the consequences (health and work-related outcomes) of subgroups with distinct trajectories in terms of workplace isolation perceptions and WFH intensity. This study aims to address this gap by examining differences between identified profiles in terms of one health-related outcome (psychological strain) and two work-related outcomes (commitment, self-rated performance).

> *H5*: Trajectory profiles differ in their levels of psychological strain, commitment, and self-rated performance. Trajectory profiles which indicate low workplace isolation and high WFH intensity display lower levels of psychological strain (H5a), and higher levels of commitment (H5b), and self-rated performance (H5c).

See Figure 1 for our proposed research model (oriented on the structure of model by Kröner and Müller, 2023).

2 Method

2.1 Study design and sample

We applied a multilevel mixed design by analyzing five measurement points (level 1) nested within $N = 512$ individuals (level 2). Data was collected in Germany by a market research institute via an online survey in 5 waves. The T1 survey included measures of sociodemographic and job-related variables, personal resources, job demands and resources (as potential predictors of latent profile membership). All surveys (T1-T5) included measures of workplace isolation and WFH intensity. Outcome variables (i.e., psychological strain, commitment and self-rated performance) were measured at T5. Eligibility criteria for participation was full-time employment, which generally allowed WFH. Part-time employees, self-employed persons (without employees), unemployed persons, pensioners, housewives and-men, full-time students and participants who were on short-time work or temporary work were excluded. Participation was voluntary and all study participants received written information about the study beforehand and signed an informed consent form regarding data collection and analysis. The study was conducted in accordance with the Declaration of Helsinki and adheres to the legal requirements of the study country.

A total of 848 questionnaires were completed at 5 measurement points by participants with varying degrees of WFH intensity (from 0 to 5 days per week WFH). To analyze a sample that worked for at least one day per week from home at all measurement points, the data set was reduced to a final sample size of $n = 512$ participants. Thus, study participants worked either hybrid or fully remote. They were on average 48.56 years old ($SD = 10.96$) and half of them were female (49.8%). At the time of the survey, all participants worked full-time in different sectors. At T1, almost half worked from home 5 days a week (46.9%) and in companies with more than 500 employees (50.4%). Most held no leadership role (62.5%), were in a salaried employment (86.5%) and had no responsibility for childcare while WFH (65.2%). Further information on sample characteristics is presented in Table 1.

2.2 Measures

2.2.1 Main variables

Time of the survey was coded with T1-T5: The first wave started in April 2021 (T1), continued in July 2021 (T2), September 2021 (T3), July 2022 (T4), and ended in October 2022 (T5).

To assess perceived *workplace isolation* when WFH, we adapted three items of the professional isolation scale by Golden et al. (2008): "I miss face-to-face contact with coworkers", "I feel isolated", and "I miss informal interaction with others" with answer options ranging

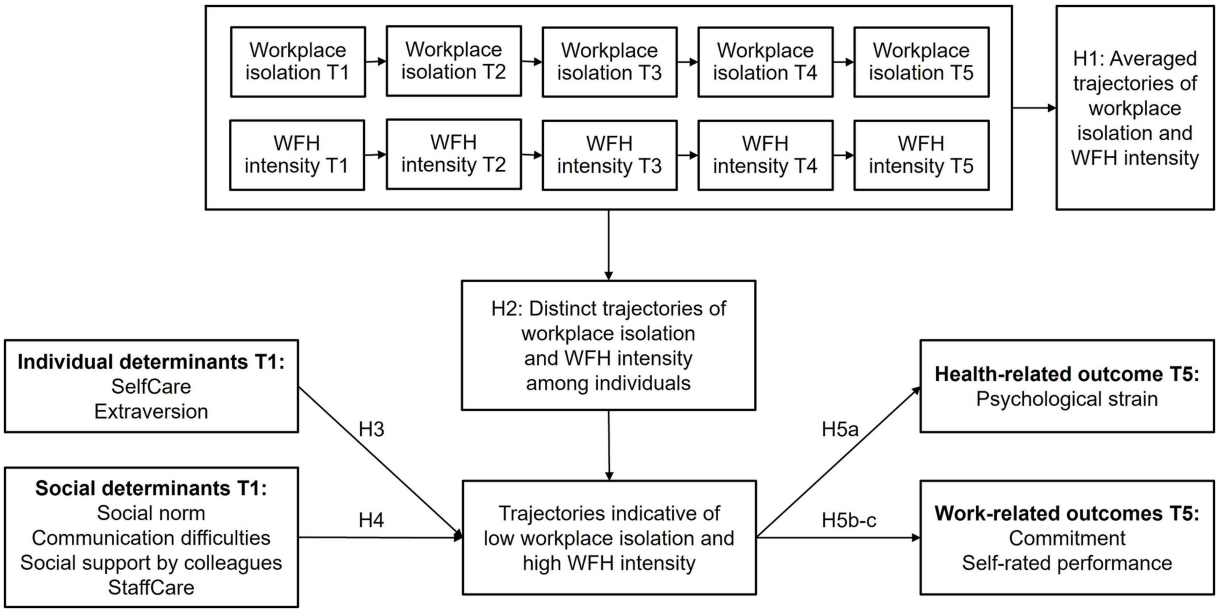

FIGURE 1
Proposed model.

from 1 = *Does not apply at all* to 5 = *Totally applies*. Cronbach's α for T1 was 0.84, T2: $\alpha = 0.85$, T3: $\alpha = 0.82$, T4: $\alpha = 0.83$ and for T5: $\alpha = 0.84$.

WFH intensity was measured at T1 to T5 using a single self-constructed item, oriented on the single item developed by Golden et al. (2008): "On average, how often did you work from home in the last 4 weeks?" on a 5-point scale including: 1 = *maximum 1 day per week*, 2 = *2 days per week*, 3 = *3 days per week*, 4 = *4 days per week* to 5 = *at least 5 days per week*.

2.2.2 Predictors of profile membership

All predictors used in the analyses were measured at T1 with answer options ranging from 1 = *Does not apply at all* to 5 = *Totally applies* (except for items on communication difficulties).

SelfCare (leader's and followers' care for their own health) was measured by using 16 items of the HoL scale by Franke et al. (2014): four items on health awareness, e.g., "I immediately notice when something is wrong with my health." or "I often notice too late when I am expecting too much of myself.", one item on value of health: "My health is my first priority.", and 11 items on health behavior, e.g., "I try to reduce my demands by optimizing my personal work routine (e.g., set priorities, care for undisturbed working, daily planning)." or "When things have been stressful for a longer amount of time, I make sure to slow down afterwards." Cronbach's α was 0.79.

Extraversion was assessed by using three items of the Big Five Inventory-SOEP by Schupp and Gerlitz (2008): "I see myself as someone who is talkative.", "I see myself as someone who is reserved, quiet." (recoded) and "I see myself as someone who is outgoing, sociable." Cronbach's α was 0.74.

Social norm regarding WFH was assessed by using one single self-constructed item: "Most of my colleagues and employees in my department work mainly from home."

Social support by colleagues when WFH was surveyed by using one item of Eurofound's 6th European Working Conditions Survey (Eurofund, 2015): "My colleagues help and support me."

StaffCare (follower-rating of the leader's care for followers health) was assessed by using 19 items of the HoL scale by Franke et al. (2014): four items on health awareness, e.g., "My supervisor immediately notices when something is wrong with my health." or "My supervisor does often not notice when he/she asks too much of me.", one item on value of health: "My health is important to my supervisor.", and 14 items on health behavior, e.g., "When I seem to be stressed, my supervisor responds to it and tries to propose solutions." or "My supervisor tries to reduce my demands by optimizing my work-life balance (e.g., take regular breaks, avoid overtime, avoid the expiration of vacation days)." Cronbach's α was 0.89.

Communication difficulties when WFH were measured by using three self-constructed items: "Communication with others (team members, supervisors, clients) is complicated and inconvenient.", "There are misunderstandings in communication/agreements with others.", "There are uncertainties in communication/agreements." with answer options ranging from 1 = *Never* to 5 = *Almost always*. Cronbach's α was 0.88.

We controlled for age, gender, care for (grand) children while WFH and voluntariness of WFH as these variables may influence analyses on workplace isolation and WFH intensity (Kaduk et al., 2019; Rieth and Hagemann, 2021; Vanderstukken et al., 2022). We assessed care for (grand) children while WFH by using one item: "To what extent do you care for children or grandchildren while working from home?" with answer options ranging from 1 = *Never* to 5 = *Almost always*. Voluntariness of WFH was measured with one item (modified from Kaduk et al., 2019): "I can decide whether and how often I work from home." with answer options ranging from 1 = *Does not apply at all* to 5 = *Totally applies*.

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TABLE 1 Sociodemographic and job-related characteristics of the sample.

Variables	*n*	%
Gender	512	
Female	255	49.8
Male	257	50.2
Age*	512	
18–29 years	33	6.4
30–39 years	75	14.6
40–49 years	133	26.0
50–59 years	169	33.0
60–69 years	102	19.9
Highest level of education	510	
High School	153	29.9
Vocational training	140	27.3
University degree	196	38.3
PhD	21	4.1
Household members	397	
Partner	346	67.6
Children under 5 years of age	39	7.6
Children between 6 and 14 years of age	90	17.6
Children over 14 years of age	102	19.9
(Grand-) Parents	9	1.8
Others (e.g., roommates)	10	2.0
Care for (grand) children while WFH	512	
Never	334	65.2
Rarely	36	7.0
Sometimes	67	13.1
Often	52	10.2
Almost always	23	4.5
Employment	512	
Salaried employment	443	86.5
Civil servant	36	7.0
Self-employed	33	6.4
Company size	512	
≤10 employees	46	9.0
11–49 employees	46	9.0
50–99 employees	43	8.4
100–500 employees	119	23.2
≥ 500 employees	258	50.4
Leadership role	512	
No	320	62.5
Yes	192	37.5
WFH intensity	512	
Up to 1 day per week	21	4.1
2 days per week	73	14.3
3 days per week	94	18.4
4 days per week	84	16.4
5 days per week	240	46.9
Industry	512	
Metal and electrical industry	40	7.8
Chemical and pharmaceutical industry	18	3.5
Energy industry	8	1.6
Construction industry	17	3.3
Craft industry	9	1.8
Logistics, transportation and traffic	25	4.9
Tourism, hotels and restaurants	11	2.1
Banking and insurance industry	57	11.1
Real estate, property & rental industry	9	1.8
Consulting (Management, legal, personnel, tax)	20	3.9
Advertising, communication, marketing, market research, PR	4	0.8
Trade industry	43	8.4
Security	2	0.4
IT, telecommunications	69	13.5
Education, childcare and science	26	5.1
Care, medicine and health	16	3.1
Media, art and culture	7	1.4
Public administration	81	15.8
Other	50	9.8

*M = 48.56, SD = 10.96, range = 19–66 years. All variables were measured at T1.

2.2.3 Outcomes of profile membership

All outcome variables used in the analyses were measured at T5.

Psychological strain was assessed using four items of the irritation scale by Mohr et al. (2005): "I have difficulty relaxing after work.", "I get grumpy when others approach me.", "I anger quickly.", and "I get irritated easily, although I do not want this to happen." with answer options ranging from 1 = *Never* to 5 = *Almost always*. Cronbach's α was 0.89.

Affective organizational commitment was measured using four items of the COMMIT scale by Felfe and Franke (Schilling, 2014): "I feel a strong emotional connection to my organization.", "I am proud to be part of my organization.", "I feel a strong sense of belonging to my organization." and "I think that my values match those of my organization." Items were rated on a 5-point scale: 1 = *Does not apply at all* to 5 = *Totally applies*. Cronbach's α was 0.95.

Self-rated performance when WFH was measured using a self-constructed item: "Based on the last 4 weeks, how would you rate your overall work performance when working from home (in terms of effectiveness and productivity)?" on a 5-point scale: 1 = *sufficient* to 5 = *excellent*.

See Supplementary material 1 for an overview of variables used in this longitudinal study. The questionnaire will be made available on reasonable request by the authors.

2.3 Data analysis

In order to model the rate of changes of workplace isolation over time, we conducted a multilevel growth curve analysis (GCA) in IBM® SPSS® Statistics (version 26, IBM, Armonk, NY, USA) by following recommendations by Field (2013). This analysis method is classified as a multilevel mixed effects model. As a method of the variable-oriented approach, it is appropriate for investigating interindividual variation over time (Bergman and Lundh, 2015). Additionally, we examined whether WFH intensity interacts with time in predicting workplace isolation. Therefore, we restructured our data into long format and checked for outliers, normal distribution of residuals using skewness, kurtosis as well as histograms and Q-Q plots, multicollinearity, and heteroscedasticity using scatterplots. For GCA, we first modelled a linear relationship (model 1) between time (i.e., measurement point 1 to measurement point 5) and our dependent variable workplace isolation and added an interaction term between time and WFH intensity. We then continued with a quadratic model (model 2) and a cubic relationship (model 3). For all analyses we processed with raw data, no centering of predictors. We used "AR(1): Heterogeneous" (i.e., first-order autoregressive structure, meaning that relationship between variances changes in a systematic way; Field, 2013) as covariance structure since we had repeated measures over time, and we assumed that values were less correlated over time and variances were heterogenous, and we identified better model fit indices in comparison to "AR(1)." Further, we used maximum likelihood for model estimation to compare models, and as it also provides more accurate estimates of fixed parameters. For evaluating which model best describes the rate of changes of workplace isolation over time, we tested differences in-2LL (log-likelihood) using chi-square statistics. The model with the smallest, significant -2LL value best describes the data (Field, 2013).

Adopting a person-oriented approach, latent profile analysis (LPA) was used to identify distinct (latent) profiles based on the levels and changes of both workplace isolation and WFH intensity over the course of the pandemic. LPA is a type of finite mixture modelling and combines growth curve modelling and latent class analysis. Thus, it identifies latent classes and calculates parameter estimates for each latent class (Muthén and Muthén, 1998-2015). Latent classes refer to clustering of individuals to latent subgroups. To date, the method LPA has been used little in vocational behavior research (Spurk et al., 2020), and even more rarely were two variables considered in an LPA. We have oriented our research on the study by Kinnunen et al. (2019). Following recommendations of a systematic review on LPA in vocational behavior research (Spurk et al., 2020), we considered our sample size to be sufficient for the calculation of an LPA. By defining explicit hypotheses about the number of profiles, a confirmatory LPA (in contrast to a fully exploratory LPA) was performed in order to identify latent subgroups (Muthén and Muthén, 1998-2015; Spurk et al., 2020). We validated our profiles in subsequent analyses by testing hypotheses on predictors on profile membership as well as on mean differences across profiles in relation to theoretically relevant outcomes (Spurk et al., 2020). We used maximum likelihood with robust standard errors and treated WFH intensity and workplace isolation as continuous variables (Muthén and Muthén, 1998-2015). For selecting the best fitting profile solution, past research recommended using multiple statistical fit values as well as considering content decision criteria (Spurk et al., 2020). When comparing different profile solutions, we chose the model with the smallest Bayesian information criterion (BIC) value, significant p-values in Lo–Mendell–Rubin likelihood ratio test (LMRT), Vuong-Lo–Mendell–Rubin likelihood ratio test (VLMRT), and the bootstrapped likelihood ratio test (BLRT), as well as the classification quality based on entropy (i.e., overall accuracy of classification) and average latent class posterior probabilities (AvePP, i.e., the certainty of sorting a person into a specific class; Spurk et al., 2020). Additionally, we considered the trajectory prevalence (according to rule of thumb: minimum of 1% or > 25 cases per profile; Spurk et al., 2020) and the interpretability of the trajectories for our decision. The analysis was performed using Mplus 6.12 (Muthén and Muthén, 1998-2015).

Once a profile solution was identified, we performed a multinomial logistic regression using IBM® SPSS® Statistics to examine predictors of profile membership. We checked our data for linearity of the logit, independence of errors (overdispersion), multicollinearity, outliers, incomplete separation, and analyzed main effects. Profile 1 "high WFH intensity and low isolation" was defined as reference category.

The last step in the analysis involved performing univariate analyses of variance (ANOVAs) with post hoc tests using IBM® SPSS® Statistics to examine differences between profile trajectories on outcomes. We checked our data for homogeneity of variance, normal distribution, and outliers within groups.

3 Results

Means, standard deviations, and correlations are presented in Table 2.

3.1 Multilevel growth curve analysis for changes in workplace isolation and WFH intensity

The intraclass coefficient for our dependent variable workplace isolation was 0.65, indicating a 35% portion of within-person variance and justifying the use of a multilevel approach. In Hypothesis 1, we expected (1a) a negative nonlinear relationship between time and workplace isolation and (1b) an interaction effect of time and WFH intensity on workplace isolation. To determine the shape and growth parameters of the averaged sample trajectory, we first included a linear term of time as a predictor of workplace isolation and an interaction term of time and WFH intensity (model 1), then progressed with testing a quadratic (model 2) and cubic term of time (model 3). The results are displayed in Table 3. In model 1 no linear relationship between time and workplace isolation was found: $b = -0.04$, $SE = 0.03$, $p = 0.176$, but an interaction effect between time and WFH intensity on workplace isolation: $b = -0.02$, $SE = 0.01$, $p < 0.01$. Model 2 showed that in addition to the linear term, $b = -0.46$, $SE = 0.12$, $p < 0.001$, the quadratic term positively predicted workplace isolation: $b = 0.07$, $SE = 0.02$, $p < 0.01$. Additionally, we found an interaction effect of the quadratic term of time and WFH intensity: $b = -0.01$, $SE = 0.01$, $p < 0.05$. Model 3 revealed that none of the linear, quadratic or cubic terms of time nor any interaction effects predicted workplace isolation. Besides fixed effects, random effects were also tested in each model. For the first-order polynomial (linear trend, relationship between time and workplace isolation), the

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TABLE 2 Means, standard deviations, and correlations.

Variables	*M*	*SD*	1	2	3	4	5	6	7	8
1. Workplace isolation T1	3.22	1.13								
2. Workplace isolation T2	3.05	1.13	0.69**							
3. Workplace isolation T3	2.93	1.06	0.68**	0.70**						
4. Workplace isolation T4	2.78	1.09	0.63**	0.62**	0.66**					
5. Workplace isolation T5	2.81	1.08	0.64**	0.65**	0.64**	0.75**				
6. Gender[a]	/	/	−0.00	−0.01	−0.05	−0.04	−0.09*			
7. Age[a]	48.56	10.96	−0.09	−0.05	−0.07	−0.07	0.00	−0.16**		
8. Care for (grand) children while WFH[a]	1.82	1.25	0.08	0.07	0.11*	0.10*	0.11*	−0.03	−0.20**	
9. Voluntariness of WFH[a]	3.46	1.36	0.03	0.03	0.07	0.07	0.03	−0.09*	0.02	0.07
10. SelfCare[a]	3.45	0.56	−0.19**	−0.11*	−0.11*	−0.16**	−0.14**	−0.01	0.06	−0.10*
11. Extraversion[a]	3.53	0.85	0.17**	0.15**	0.16**	0.09*	0.09	0.10*	0.08	0.09
12. Social norm[a]	3.74	1.24	0.10*	0.09*	0.12**	0.07	0.03	−0.05	−0.06	−0.00
13. Social support by colleagues[a]	3.70	1.02	−0.07	−0.07	−0.06	−0.09*	−0.12**	0.01	−0.02	−0.03
14. StaffCare[a]	2.58	0.79	0.06	0.06	0.08	0.08	0.06	−0.12*	−0.09	−0.00
15. Communication difficulties[a]	2.35	0.88	0.35**	0.29**	0.24**	0.30**	0.30**	−0.06	−0.08	0.22**
16. Psychological strain[b]	2.32	0.90	0.13**	0.12**	0.05	0.15**	0.14**	0.12**	−0.12**	0.05
17. Commitment[b]	3.37	1.06	0.00	0.04	0.03	0.05	0.05	−0.03	0.15**	0.06
18. Self-rated performance[b]	3.56	0.85	−0.21**	−0.17**	−0.19**	−0.24**	−0.26**	0.05	0.10*	−0.04

Variables	9	10	11	12	13	14	15	16	17	18
9. Voluntariness of WFH[a]										
10. SelfCare[a]	0.10*									
11. Extraversion[a]	0.14**	0.16**								
12. Social norm[a]	0.13**	0.05	−0.08							
13. Social support by colleagues[a]	0.16**	0.26**	0.10*	0.07						
14. StaffCare[a]	0.10	0.36**	0.09	−0.01	0.22**					
15. Communication difficulties[a]	−0.10*	−0.29**	−0.11*	0.03	−0.22**	−0.16**				
16. Psychological strain[b]	0.01	−0.42**	−0.16**	−0.02	−0.13**	−0.18**	0.32**			
17. Commitment[b]	0.15**	0.25**	0.21**	−0.10*	0.10*	0.39**	−0.14**	−0.24**		
18. Self-rated performance[b]	0.12**	0.30**	0.05	0.02	0.14**	0.14*	−0.27**	−0.28**	0.25**	

N = 512 (only for StaffCare: *n* = 320, Extraversion: *n* = 510). Two-tailed Pearson correlation coefficients were used. StaffCare = health-oriented employee leadership, SelfCare = health-oriented self-leadership, WFH = work from home. T1-T5 = measurement point 1–5. [a] = control and predictor variables measured at T1; [b] = outcome variables measured at T5. Gender is coded 0 = male and 1 = female. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

variance in intercepts across participants was: $b = 0.73$, $SE = 0.10$, $p < 0.001$, the variance in slopes across participants was: $b = 0.01$, $SE = 0.00$, $p < 0.001$, and a negative covariance of slopes and intercepts was seen: $b = -0.29$, $SE = 0.08$, $p < 0.01$. The comparison of models using chi-square statistics indicated that model 2 showed a relevant increase in -2LL, while model 3 did not, suggesting that model 2 described the best model fit. These statistical fit values (significance of the model comparison using -2LL, significance of fixed and random effects) indicate that both a linear trend (first-order polynomial) and a quadratic trend (second-order polynomial) best describe the data. The GCA found a negative linear and a positive quadratic relationship between time and workplace isolation. Accordingly, after a negative linear decrease, a flattening of the workplace isolation curve can be observed. Furthermore, the interaction between time and WFH intensity on workplace isolation seems to be relevant, suggesting that the effect of time on workplace isolation also varied with WFH intensity. This means that the change in workplace isolation is not only a function of time but is also affected by WFH intensity. H1a and H1b were thus supported. Figure 2 presents the averaged trajectories of workplace isolation and WFH intensity across all participants over 5 measurement points.

3.2 Distinct trajectories of workplace isolation and WFH intensity development

In Hypothesis 2, we expected four distinct trajectories of workplace isolation and WFH intensity development: (2a) two trajectories displaying high workplace isolation, one at low and one at

high WFH intensity, and (2b) two trajectories displaying low workplace isolation, one at low and one at high WFH intensity. Using multiple statistical fit values as well as considering content decision criteria, six different LPA models (ranging from one to six profiles) were compared. We decided on the three-profile model for subsequent analyses due to significant *p*-values ($p < 0.05$) in all three likelihood ratio tests (LMRT, VLMRT and BLRT) as well as very high entropy and AvePP values indicating very good classification quality. Higher entropy or AvePP values indicate better fit. A perfect classification is at value 1, but reported cut-off value for entropy is 0.80 or higher. The same cut-off value is suggested as a result of the review by Spurk et al. (2020). In addition, ideally, the model with the lowest BIC value should be selected, as it represents the best fit (Spurk et al., 2020). Although the BIC value decreased with a higher number of profiles in the models in our analysis, the three-profile model still showed better fit values in all other statistical parameters (see Table 4).

The three-profile model also showed a good distribution in terms of trajectory prevalence and ensured interpretability, as all three profiles were quantitatively distinct from each other (Spurk et al., 2020). Figure 3 displays the overall development of workplace isolation and WFH intensity across five measurement points for each profile. The first profile ($n = 140$, 27%), labelled "high WFH intensity and low isolation", is characterized by high WFH intensity and low workplace isolation over time. Participants in this profile showed slight decreases in WFH intensity (mean T1 = 4.67, mean T5 = 3.81) as well as in workplace isolation over time (mean T1 = 2.04, mean T5 = 1.72). The second profile ($n = 190$, 37%) demonstrated nearly opposite characteristics to profile 1 and is therefore described as "low WFH intensity and high isolation": Participants in profile 2 displayed slight decreases in low WFH intensity means over time (mean T1 = 2.47, mean T5 = 1.87) as well as in high workplace isolation means over time (mean T1 = 3.41, mean T5 = 3.10). The third profile ($n = 182$, 36%), labelled "high WFH intensity and high isolation", is best described by participants working intensively from home over time, but also indicating high workplace isolation. Again, this profile demonstrated slight decreases in both variables over time (WFH intensity: mean T1 = 4.74, mean T5 = 3.41; workplace isolation: mean T1 = 3.93, mean T5 = 3.34).

In summary, there are two profiles characterized by high workplace isolation over time, with one profile displaying a high WFH intensity (profile 3) and the other profile displaying a low WFH intensity (profile 2). In contrast, profile 1 is characterized by low workplace isolation over time along with high WFH intensity. All profiles were similar in slopes of both variables but differed in their intercepts and were therefore quantitatively distinct from each other. Since the expected trajectory of low workplace isolation and low WFH intensity was not found in our data, H2 was partly supported.

3.3 Antecedents of profile membership: individual and social determinants

The LPA resulted in a new categorical variable in which each person was assigned to one of the three extracted trajectories (profile 1: "high WFH intensity and low isolation", profile 2: "low WFH intensity and high isolation" and profile 3: "high WFH intensity and high isolation") based on maximum fit. To examine predictors of profile membership, we conducted a multinomial logistic regression using our new categorial variable as dependent variable and predictor variables as independent variables.

In Hypothesis 3, we expected a positive association between SelfCare (H3a) and trajectory profiles that indicate low workplace isolation and high WFH intensity, and a negative association between extraversion (H3b) and those trajectory profiles. In Hypothesis 4, we expected a positive association between social norm, social support by colleagues, StaffCare and trajectory profiles that indicate low workplace isolation and high WFH intensity (H4a), and a negative association between communication difficulties and those trajectory profiles (H4b). Results are displayed in Table 5.

Our final model explained a significant amount of original variability (χ^2 [20] = 90.64, $p < 0.001$) and showed a good fit to our data according to Pearson test (χ^2 [616] = 627.48, $p = 0.365$). The analysis results of the comparison of profile 2 ("low WFH intensity and high isolation") with our reference category profile 1 ("high WFH intensity and low isolation") indicated that extraversion, social norm, social support by colleagues, StaffCare and communication difficulties significantly predicted profile membership. Thereby, as social norm ($b = -0.39$, Wald $\chi^2[1] = 7.74$, $p < 0.01$) and social support by colleagues ($b = -0.36$, Wald $\chi^2[1] = 4.73$, $p < 0.05$) increased by one unit, the relative probability of belonging to profile 2 (compared to profile 1) decreased (change in the odds was 0.68 and 0.70, respectively). This means that social norm and social support by colleagues were positively associated with profile 1 in comparison to profile 2. Further, as extraversion ($b = 0.46$, Wald $\chi^2[1] = 5.25$, $p < 0.05$), StaffCare ($b = 0.55$, Wald $\chi^2[1] = 5.70$, $p < 0.05$) and communication difficulties ($b = 0.72$, Wald $\chi^2[1] = 10.17$, $p < 0.01$) increased by a unit, the relative probability of belonging to profile 2 (compared to profile 1) increased (change in the odds was 1.58, 1.73, and 2.06 respectively). Extraversion, StaffCare and communication difficulties were therefore negatively related to profile 1 in comparison to profile 2.

The analysis results of the comparison of profile 3 ("high WFH intensity and high isolation") with our reference category profile 1 ("high WFH intensity and low isolation") indicated that SelfCare, extraversion, social norm, StaffCare and communication difficulties significantly predicted profile membership. As Selfcare ($b = -0.88$, Wald $\chi 2[1] = 8.06$, $p < 0.01$) increased by one unit, the relative probability of belonging to profile 3 (compared to profile 1) decreased (change in the odds was 0.41). This means that SelfCare was positively associated with profile 1 in comparison to profile 3. Last, as extraversion ($b = 0.42$, Wald $\chi^2[1] = 5.53$, $p < 0.05$), social norm ($b = 0.32$, Wald $\chi^2[1] = 5.30$, $p < 0.05$), StaffCare ($b = 0.53$, Wald $\chi^2[1] = 6.80$, $p < 0.01$) and communication difficulties ($b = 0.88$, Wald $\chi^2[1] = 18.04$, $p < 0.001$), increased by one unit, the relative probability of belonging to profile 3 (compared to profile 1) increased (change in the odds was 1.52, 1.38, 1.70 and 2.40, respectively). Extraversion, social norm, StaffCare and communication difficulties were therefore negatively related to profile 1 in comparison to profile 3.

H3 was supported as SelfCare was positively and extraversion negatively associated with trajectory profile 1, indicating low workplace isolation and high WFH intensity. H4a was partly supported as only social support by colleagues was positively associated with trajectory profile 1, indicating low workplace isolation and high WFH intensity. Results on social norms were mixed: the comparison between profiles 2 and 1 revealed a positive association with profile 1, while the comparison between profiles 3 and 1 revealed

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TABLE 3 Multilevel growth models for longitudinal change in workplace isolation and WFH intensity.

Effects	Model 1				Model 2				Model 3			
	b	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI	*b*	*SE*	*p*	95% CI
Fixed effects												
Intercept	3.04	0.12	<0.001	2.81, 3.28	3.60	0.20	<0.001	3.21, 3.99	3.60	0.41	<0.001	2.80, 4.39
Time	−0.04	0.03	0.176	−0.09, 0.02	−0.46	0.12	< 0.001	−0.71, −0.21	−0.45	0.50	0.370	−1.42, 0.53
WFH intensity	0.07	0.03	0.026	0.01, 0.13	−0.04	0.05	0.389	−0.14, 0.06	−0.07	0.10	0.506	−0.27, 0.13
Time*WFH intensity	−0.02	0.01	0.008	−0.03, −0.01	0.06	0.03	0.072	−0.01, 0.13	0.10	0.13	0.452	−0.16, 0.35
$Time^2$					0.07	0.02	0.001	0.03, 0.10	0.06	0.18	0.722	−0.29, 0.42
$Time^2$*WFH intensity					−0.01	0.01	0.022	−0.02, −0.00	−0.03	0.05	0.564	−0.12, 0.07
$Time^3$									−0.00	0.02	0.994	−0.04, 0.04
$Time^3$*WFH intensity									0.00	0.01	0.731	−0.01, 0.01
Random effects												
Intercept $\pi 0$	0.73	0.10	<0.001	0.56, 0.97	0.73	0.11	<0.001	0.55, 0.97	0.73	0.11	<0.001	0.55, 0.97
Time	0.01	0.00	<0.001	0.01, 0.02	0.01	0.00	<0.001	0.01, 0.02	0.01	0.00	<0.001	0.01, 0.02
WFH intensity	0.01	0.00	0.030	0.00, 0.03	0.01	0.00	0.032	0.00, 0.03	0.01	0.00	0.031	0.00, 0.03
Residual	0.36	0.01	<0.001	0.34, 0.39	0.36	0.01	<0.001	0.34, 0.39	0.36	0.01	<0.001	0.34,0.39
ARH1, rho	−0.29	0.08	0.001	−0.44, −0.12	−0.29	0.08	<0.001	−0.44, −0.12	−0.29	0.08	<0.001	−0.44, −0.12
Model fit indexes												
Parameters		9				11				13		
-2 log-likelihood		6144.05				6128.84**[a]				6128.00		
χ^2 statistic						15.21				0.85		
Degrees of freedom						2				2		

WFH = work from home. [a] Significant difference from the previous model. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

a negative association with profile 1. Contrary to expectations, StaffCare was negatively associated with trajectory profile 1, indicating low workplace isolation and high WFH intensity. Interpretations of these results are presented in the discussion section. H4b was supported as communication difficulties were negatively associated with trajectory profile 1, indicating low workplace isolation and high WFH intensity.

3.4 Consequences of profile membership: health-and work-related outcomes

To examine differences of profile membership on outcomes, we performed ANOVAs with post hoc tests. We used our categorial variable, profile membership, as independent variable and outcome variables as dependent variables. In Hypothesis 5, we expected lower levels of psychological strain (H5a), and higher levels of commitment (H5b) and self-rated performance (H5c) for trajectory profiles indicating low workplace isolation and high WFH intensity. Since profile 1 in our analysis is characterized by low workplace isolation and high WFH intensity, this profile was compared with both other profiles in the analysis.

Results revealed no significant differences between profiles on levels of psychological strain, $F(2, 509) = 2.15$, $p = 0.117$. H5a was therefore rejected. Possible interpretations of these findings are outlined in the discussion.

Testing H5b, results displayed significant differences between profiles on levels of commitment, $F(2, 509) = 6.47$, $p < 0.01$, $\omega^2 = 0.021$, indicating a small effect size. Due to non-equal group sample sizes and homogeneity of variance, Hochberg's GT2 post hoc analysis was used and revealed a significant difference between commitment levels of profiles 1 ("high WFH intensity and low isolation") and 2 ("low WFH intensity and high isolation"), indicating lower commitment levels in profile 1 ($M_{Profile1} = 3.21$ vs. $M_{Profile2} = 3.59$; mean diff. = − 0.38, $p < 0.01$, 95%-CI [−0.66, −0.10], see Figure 4), but no significant difference between profiles 1 ("high WFH intensity and low isolation") and 3 ("high WFH intensity and high isolation"; $M_{Profile1} = 3.21$ vs. $M_{Profile3} = 3.27$; mean diff. = − 0.06, $p = 0.929$, 95%-CI [−0.35, 0.22]). Since only one of the two group comparisons was tested significantly, H5b was rejected. Supplementary analysis identified a significant

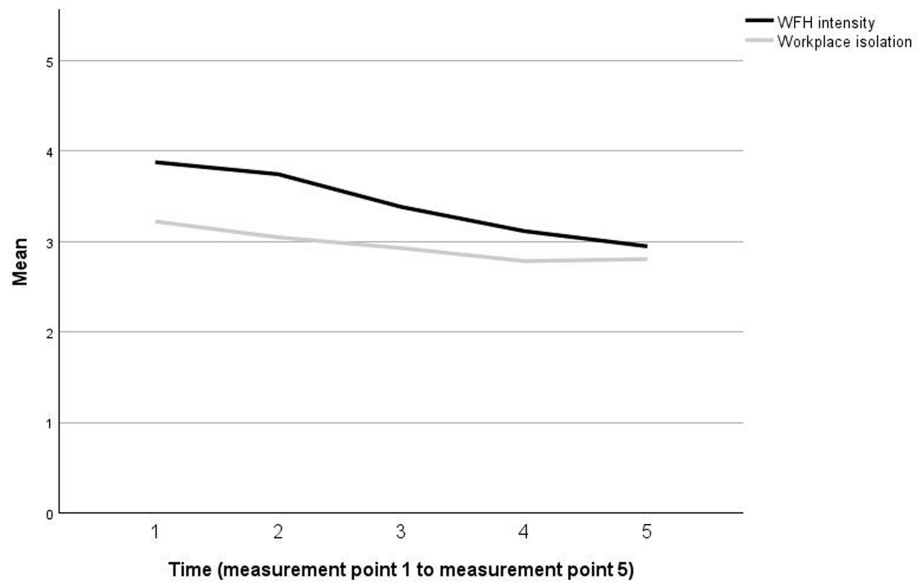

FIGURE 2
Trajectories of workplace isolation and WFH intensity over time (averaged across all participants).

TABLE 4 Latent profile analysis of workplace isolation and WFH intensity from T1 to T5.

No. of profiles	logL	Free parameters	BIC	LMRT	VLMRT	BLRT	Entropy	AvePP	Latent trajectory proportions
1	−8255.82	20	16636.42	—	—	—	—	—	512 (100%)
2	−7590.68	31	15374.74	0.000	0.000	0.000	0.92	0.98–0.98	177 (35%)/335 (65%)
3	−7040.32	42	14342.64	0.000	0.000	0.000	0.92	0.95–0.98	140 (27%)/190 (37%)/182 (36%)
4	−6876.60	53	14083.84	0.129	0.132	0.000	0.91	0.92–0.97	109 (21%)/149 (29%)/130 (25%)/124 (25%)
5	−6801.94	64	14003.13	0.070	0.071	1.000	0.93	0.00–0.97	78 (15%)/146 (29%)/180 (35%)/108 (21%)/0 (0%)
6	−6547.36	75	13562.600	0.166	0.170	0.000	0.92	0.91–0.96	63 (12%) / 103 (20%) / 103 (20%) / 48 (9%) / 79 (15%) / 116 (23%)

N = 512. logL = Log-likelihood. BIC = Bayesian Information Criterion. LMRT = Lo–Mendell–Rubin likelihood ratio test. VLMRT = Vuong-Lo–Mendell–Rubin likelihood ratio test. BLRT = bootstrapped likelihood ratio test. Entropy = Overall accuracy of classification. AvePP = average latent class posterior probabilities.

difference between commitment levels of profiles 2 ("low WFH intensity and high isolation") and 3 ("high WFH intensity and high isolation"); $M_{Profile2} = 3.59$ vs. $M_{Profile3} = 3.27$; mean diff. = 0.31, $p < 0.05$, 95%-CI [0.05, 0.57]), indicating higher commitment levels in profile 2. Contrary to expectations, higher commitment values were not associated with the profile displaying low workplace isolation and high WFH intensity (i.e., profile 1), but instead with the profile displaying high workplace isolation and low WFH intensity (i.e., profile 2).

Last, testing H5c, results revealed significant differences between profiles on levels of self-rated performance, $F(2, 509) = 10.93$, $p < 0.001$, $\omega^2 = 0.04$, also indicating a small effect size. Again, Hochberg's GT2 post hoc analysis revealed significant differences between performance levels of profiles 1 ("high WFH intensity and low isolation") and 2 ("low WFH intensity and high isolation"); $M_{Profile1} = 3.84$ vs. $M_{Profile2} = 3.45$; mean diff. = 0.39, $p < 0.001$, 95%-CI [0.17, 0.61]) and between profiles 1 ("high WFH intensity and low isolation") and 3 ("high WFH intensity and high isolation"); $M_{Profile1} = 3.84$ vs. $M_{Profile3} = 3.46$; mean diff. = 0.38, $p < 0.001$, 95%-CI [0.16, 0.61]), indicating higher self-rated performance levels in profile 1 in comparison to both other profiles 2 and 3. H5c was supported.

4 Discussion

Previous longitudinal studies on isolation perceptions during the pandemic were primarily conducted to analyze loneliness in the general population. Using both a variable-and person-oriented approach, this study was the first to analyze the growth curve of workplace isolation and WFH intensity of employees over the course

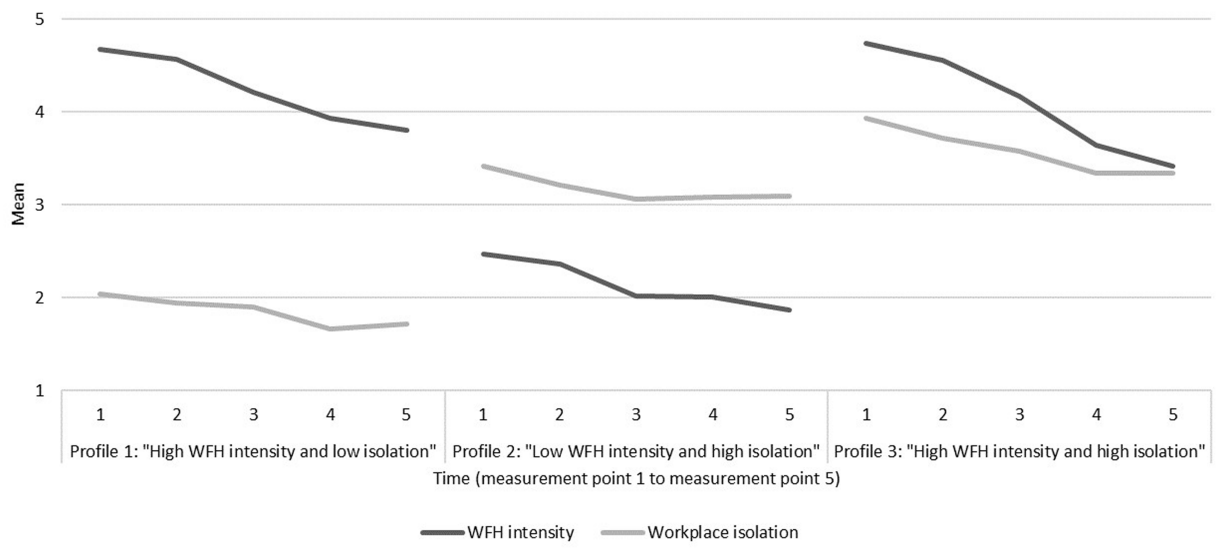

FIGURE 3
Sample means of workplace isolation and WFH intensity over time across profiles.

of the pandemic, to identify distinct trajectories (subgroups) and determine antecedents and consequences of these subgroups with different trajectories.

4.1 Multilevel growth curve analysis for changes in workplace isolation and WFH intensity

Our multilevel GCA found that changes in workplace isolation were best predicted by a linear and quadratic trend, indicating a nonlinear relationship between time and workplace isolation. Accordingly, it was found that participants' workplace isolation first decreased over the course of the pandemic and then plateaued. Given that time predicted the trajectory of workplace isolation and thus a general trend over time was identified in our sample, we may conclude that the changing conditions during the pandemic had an overall impact on the perception of workplace isolation. Although there are no comparable studies on workplace isolation during the pandemic, heterogeneous research on loneliness (Bu et al., 2020; Buecker et al., 2020; Entringer and Kröger, 2020; Killgore et al., 2020; Luchetti et al., 2020; Caro et al., 2022; Hettich et al., 2022; Benke et al., 2023) suggests that other factors might also affect trajectories of workplace isolation. Consistent with literature linking WFH intensity to workplace isolation (Sahai et al., 2020; Gajendran et al., 2024; Rudolph and Zacher, 2024), our findings suggest that the effect of time on workplace isolation varies with WFH intensity. Thus, employees' workplace isolation over time was influenced by their WFH intensity during the pandemic. We may conclude that the trajectory of workplace isolation can be explained by both external pandemic conditions (effect of time) as well as individual variation (interaction effect of WFH intensity). WFH intensity seems to be a relevant variable in analyzing workplace isolation in remote collaboration, also presumably independent of pandemic conditions. In addition, possible explanations for the stabilization of the workplace isolation trajectory may include organizational adjustments or improved remote work practices during the pandemic (De Vincenzi et al., 2022).

4.2 Distinct trajectories of workplace isolation and WFH intensity development

Similar to our expectations, our LPA revealed three distinct trajectories: profile 1 "high WFH intensity and low isolation", profile 2 "low WFH intensity and high isolation", and profile 3 "high WFH intensity and high isolation". Interestingly, a profile with low workplace isolation and WFH intensity was not found. The slopes of both variables were similarly decreasing across all three profiles, indicating quantitative but not qualitative differences. Quantitative differences refer to level differences between profiles, qualitative differences to shape differences between profiles in LPA (Spurk et al., 2020). Our study found that most employees experienced high workplace isolation (profile 2 and 3, about 73%), though half of them worked from home either very frequently or little. This is in contrast to previous studies which have shown lower proportions of high loneliness or low workplace sense of community in general populations: 5.0% (Laham et al., 2021), 14.3% (Bu et al., 2020), 15.8% (Graham et al., 2023), 8.0% (severe) and 28.0% (high; Caro et al., 2022). Additionally, the slopes of these trajectories differed from our results: in two studies, high loneliness levels increased over the course of the pandemic (Bu et al., 2020; Laham et al., 2021); in two other studies, they remained stable (Caro et al., 2022; Graham et al., 2023). This comparison to previous longitudinal studies during the pandemic is limited, since these studies mostly investigated loneliness (i.e., subjective perceptions of qualitative or quantitative deficiencies in social relationships; Russell et al., 1984) in general populations, whereas workplace isolation in our study specifically refers to employees' subjective perception of social isolation from others at work (Marshall et al., 2007; Golden et al., 2008).

TABLE 5 Results of multinomial logistic regression analyses to predict profile membership.

Profile comparison	*b (SE)*	Wald	*p*	OR	95% CI for OR
Profile 2 vs. Profile 1					
Intercept	0.83 (1.70)	0.24	0.625		
Gender	0.07 (0.34)	0.04	0.830	1.08	[0.55, 2.11]
Age	−0.25 (0.02)	2.78	0.095	0.98	[0.95, 1.00]
Care for (grand) children while WFH	0.07 (0.15)	0.22	0.640	1.08	[0.79, 1.45]
Voluntariness of WFH	0.11 (0.13)	0.72	0.397	1.12	[0.87, 1.44]
SelfCare	−0.61 (0.35)	3.02	0.082	0.54	[0.27, 1.08]
Extraversion	0.46 (0.20)	5.25	0.022	1.58	[1.07, 2.33]
Social norm	−0.39 (0.14)	7.74	0.005	0.68	[0.52, 0.89]
Social support by colleagues	−0.36 (0.17)	4.73	0.030	0.70	[0.50, 0.97]
StaffCare	0.55 (0.23)	5.70	0.017	1.73	[1.10, 2.71]
Communication difficulties	0.72 (0.23)	10.17	0.001	2.06	[1.32, 3.21]
Profile 3 vs. Profile 1					
Intercept	−2.24 (1.58)	2.00	0.157		
Gender	0.18 (0.30)	0.34	0.559	1.19	[0.66, 2.17]
Age	−0.01 (0.01)	1.04	0.307	0.99	[0.96, 1.01]
Care for (grand) children while WFH	0.13 (0.14)	0.87	0.350	1.14	[0.87, 1.50]
Voluntariness of WFH	0.04 (0.11)	0.13	0.723	1.04	[0.84, 1.29]
SelfCare	−0.88 (0.31)	8.06	0.005	0.41	[0.22, 0.76]
Extraversion	0.42 (0.18)	5.53	0.019	1.52	[1.07, 2.14]
Social norm	0.32 (0.14)	5.30	0.021	1.38	[1.05, 1.82]
Social support by colleagues	−0.04 (0.16)	0.06	0.807	0.96	[0.71, 1.30]
StaffCare	0.53 (0.20)	6.80	0.009	1.70	[1.14, 2.53]
Communication difficulties	0.88 (0.21)	18.04	0.000	2.40	[1.60, 3.59]

R^2 = 0.25 (Cox & Snell), 0.28 (Nagelkerke), 0.13 (McFadden). Model χ^2 (20) = 90.64, $p < 0.001$. *b* = regression coefficient, *SE* = standard error, OR = odds ratio, 95% CI = 95% confidence interval. StaffCare = health-oriented employee leadership, SelfCare = health-oriented self-leadership, WFH = work from home. All predictors and control variables were measured at T1. Degrees of freedom were 1 for all Wald statistics. Profile 1 = "High WFH intensity and low isolation", profile 2 = "Low WFH intensity and high isolation", profile 3 = "High WFH intensity and high isolation".

Overall, all three profiles displayed decreasing slopes over time (consistent with the averaged trajectory in our GCA). This suggests that contextual conditions influenced WFH intensity (presumably due to a decline in national regulations regarding containment measures and better control of the spread of the virus during the pandemic) and, in turn, affected workplace isolation. Although, to our knowledge, there is hardly any research with LPAs using two variables, our results demonstrate that this methodological approach yields additional informative value. Both our GCA and LPA results indicate that WFH intensity is a relevant covarying variable for identifying distinct subgroups of workplace isolation.

4.3 Antecedents of profile membership: individual and social determinants

In line with our expectations, our results on *individual determinants* showed that SelfCare and extraversion predicted profile membership. Similar to previous research (Krick et al., 2024a), SelfCare was positively associated with profile 1 ("high WFH intensity and low isolation") in comparison to profile 3 ("high WFH intensity and high isolation"). This suggests SelfCare to be a protective factor against high workplace isolation at high WFH intensity. Further, extraversion was negatively associated with profile 1 ("high WFH intensity and low isolation") in comparison to both other profiles, indicating that extraverted people feel more isolated in remote teams irrespective of own WFH intensity. This result is consistent with previous research findings, as this Big Five trait was generally associated with higher engagement in social activities (Lucas et al., 2008). Links between extraversion and preference for teleworking (Gavoille and Hazans, 2022) or higher levels of missing colleagues (Demerouti et al., 2014; Langvik et al., 2021) were also identified in the context of remote working.

Regarding *social determinants*, our study identified social norm, social support by colleagues, StaffCare, and communication difficulties as predictors of profile membership. As expected, communication difficulties were negatively associated with profile 1 ("high WFH intensity and low isolation") in comparison to both other profiles, suggesting that communication difficulties in remote collaboration facilitate workplace isolation regardless of WFH intensity. Similarly, previous studies also referred to communication challenges in remote collaboration (Marshall et al., 2007; Tautz et al., 2022; Tautz et al.,

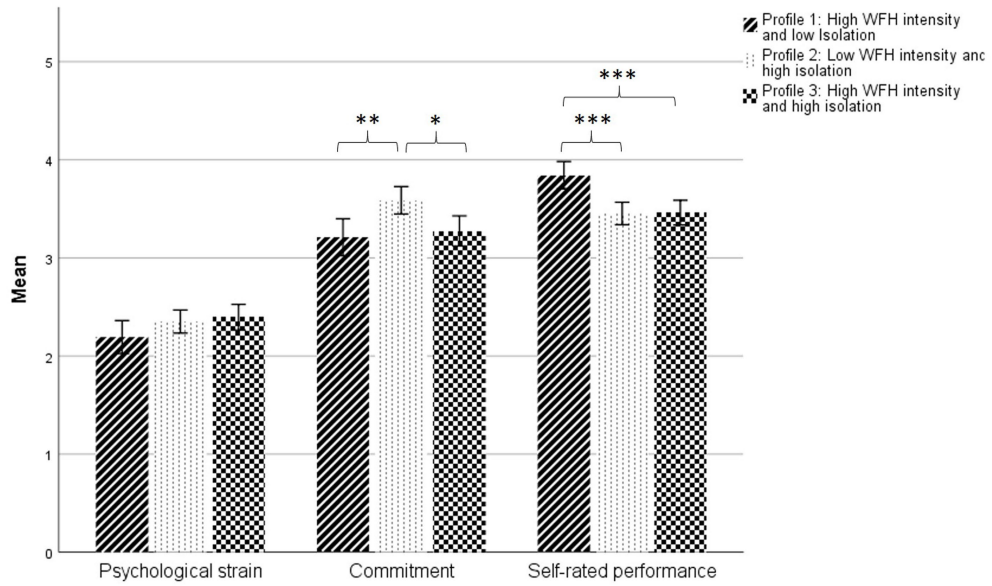

FIGURE 4
Post hoc comparisons between profiles.
Note: Error bars are 95% confidence intervals. Verbal anchors for psychological strain: 1 (*never*) to 5 (*almost always*), for commitment: (*does not apply at all*) to 5 (*totally applies*), for performance: 1 (*sufficient*) to 5 (*excellent*). Significant differences between profiles: $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

2024), as well as conducive impacts of communication quantity on isolation (Golden et al., 2008; Van Zoonen and Sivunen, 2022; Wong et al., 2022). Furthermore, in line with our expectations and previous research (Marshall et al., 2007; Sahai et al., 2020), social support by colleagues was positively associated with profile 1 ("high WFH intensity and low isolation") compared to profile 2 ("low WFH intensity and high isolation"), indicating that it is a job resource that mitigates isolation. Moreover, our results on social norm were mixed. It was negatively associated with profile 1 ("high WFH intensity and low isolation") in comparison to profile 3 ("high WFH intensity and high isolation"), which contrary to our expectations indicates higher isolation when many colleagues frequently WFH. However, social norm was positively associated with profile 1 ("high WFH intensity and low isolation") in comparison to profile 2 ("low WFH intensity and high isolation"), suggesting that employees are more likely to WFH more frequently when the social norm is also high (i.e., a high level of WFH intensity in the team or department). This last result is in line with previous research, as a study found that teleworking colleagues had a stronger influence on telework adoption than non-teleworking colleagues (Scott et al., 2012). Since there may exist other motives for choosing to WFH, e.g., due to job requirements, efficiency or work-life balance reasons (Vanderstukken et al., 2022), the role of social norm on workplace isolation in WFH remains unclear. In addition, other contextual factors such as team cohesion or informal workplace culture may shape the perceived impact of social norms on workplace isolation in remote contexts (Sahai et al., 2020). Surprisingly, StaffCare was negatively associated with profile 1 ("high WFH intensity and low isolation") in comparison to both other profiles. This is in contrast to our expectations and previous research, which pointed to a mitigating role of leadership on employees' isolation perceptions in remote collaboration (Efimov et al., 2022) and to StaffCare's beneficial influence on employee outcomes when WFH (Klebe and Felfe, 2023; Krick et al., 2023; Sachse and Schanz, 2023). It is possible that employees in this study felt more isolated when they perceived an overall high level of StaffCare, as they missed their leader's positive influence when WFH (given that our workplace isolation variable was only measured for WFH context). Another possible explanation for this link may be that StaffCare is more effective in face-to-face settings and its impact is less perceptible in remote contexts (Klebe and Felfe, 2023). Digital communication could dilute the visibility of leadership behaviors, which may explain the weaker effect of StaffCare on perceived isolation when working from home.

Reflecting upon our theoretical framework, the JD-R and COR theories, we may conclude that employees with sufficient resources (e.g., high SelfCare or social support from colleagues) are more likely to gain resources or are more resistant to resource losses in the future, e.g., experience lower workplace isolation in remote collaboration. Conversely, employees facing job demands (such as communication difficulties) may struggle more with additional demands in remote collaboration due to pandemic, leading to higher isolation.

4.4 Consequences of profile membership: health-and work-related outcomes

Contrary to expectations and previous research (Sahai et al., 2020; Van Zoonen and Sivunen, 2022), there were no significant differences in psychological strain levels between profiles. Accordingly, psychological strain was probably independent of workplace isolation perceptions and WFH intensity. Further, contrary to our expectations, our results did not indicate higher commitment levels in profile 1 ("high WFH intensity and low isolation"). Instead, highest commitment levels were found for profile 2 ("low WFH intensity and high isolation"). Significant differences between profile 2 and both other profiles suggest that high WFH intensity may undermine commitment (since profile 2 is the only subgroup to display low WFH intensity over the course of the pandemic).

In contrast, previous research pointed to a negative relationship between workplace isolation and affective commitment (Sahai et al., 2020). A recent meta-analysis referred to a detrimental effect of isolation perceptions as mediator in the relationship between WFH intensity and organizational commitment (Gajendran et al., 2024). In addition, alternative explanations for the findings on psychological strain and commitment are also possible, e.g., other variables such as organizational climate or role clarity may influence these relationships. Finally, in line with expectations, our results found highest levels of self-rated performance in profile 1 ("high WFH intensity and low isolation") in comparison to both other profiles. This suggests that workplace isolation may be more decisive for self-rated performance than WFH intensity, since profile 1 is the only subgroup to display low workplace isolation over the course of the pandemic. Previous research also indicated a negative influence of workplace isolation on the relationship between remote work intensity and performance (Gajendran et al., 2024).

4.5 Strengths and limitations

Our study demonstrates several strengths. It contributes to research and practice by using a comprehensive, longitudinal data set and a novel approach by combining variable- and person-oriented methods. Thereby, we gained initial and holistic insights into between- and within-effects of workplace isolation and WFH intensity as well as into relevant antecedents and consequences of subgroups. Applying a longitudinal LPA with two variables is rather novel, but this methodological approach yielded additional informative value and enhanced our understanding of individual differences in the development of workplace isolation and WFH intensity.

Yet this study has some limitations. First, it was not always possible to ensure equal intervals between measurement times, although no considerable differences were found between adjacent values. Second, there are limitations with respect to the use of self-developed single-item scales. This is a common practice in large-scale surveys for reasons of research economy and for reasons of simpler and more comprehensible responding by study participants. If no validated short or single-item instruments are available in previous research as well as the constructs used are unidimensional, clearly defined and narrow in scope, their use is acceptable. Nevertheless, there is a potential limitation regarding measurement reliability and validity (Allen et al., 2022). For the same reasons of comprehensibility and consistency of the items for study participants, the verbal anchors of the scales used were standardized. Third, like many other methods, the LPA method is an approximation of reality, in which the model that best described the data (based on clear statistical fit values and substantive decision criteria; Spurk et al., 2020) was selected. Nevertheless, it must be pointed out that the identified profiles depend on our theory-driven selection of variables. Therefore, when rerunning an LPA on workplace isolation of remote workers with additional or different variables, other results may be obtained. Fourth, self-selection or self-report biases, e.g., social desirability or misjudgment, cannot be ruled out. Past research demonstrated discrepancies in self-other ratings, e.g., in leadership or performance (Heidemeier and Moser, 2009; Lee and Carpenter, 2018). Fifth, the dynamic course of the pandemic as the context of our study needs to be considered when interpreting the results. It remains open if similar results would emerge in non-pandemic contexts or post-implementation of virtual/hybrid teamwork. Sixth, although a large longitudinal sample was collected, potential limitations remain due to the geographical restriction to Germany. In this regard, the results on workplace isolation perceptions may also be influenced by cultural context (in contrast to non-European countries, for example), potentially limiting generalizability. Last, there is limited research on longitudinal studies of workplace isolation, reducing comparability of present results with previous research.

4.6 Implications for future research

Based on this study's limitations, future research directions were derived. According to current state of research, there are no standardized definitions and thus different measurement instruments for assessing both workplace isolation and WFH intensity (Marshall et al., 2007; Sahai et al., 2020; De Vincenzi et al., 2022). Future research should conduct studies on the theoretical foundation, construct development and validation, e.g., a recent study on the team perceived virtuality scale (Handke et al., 2024). Thus, future efforts should aim for standardization of definitions and instruments or for context-specific operationalizations. Moreover, recommendations include conducting longitudinal GCA and LPA analyses of workplace isolation and WFH intensity outside a pandemic context to determine if these variables remain covarying. Such analyses are also recommended for interventional studies, e.g., to evaluate the implementation of virtual or hybrid teamwork in organizations. Further, research should explore workplace isolation with other potentially covarying variables (like WFH intensity) within longitudinal LPA. More generally, it is recommended for future studies to explore the LPA method with more than one variable or interaction effects. Due to mixed findings on social norm and unexpected results on StaffCare, future research should further explore the role of social norm and leadership in remote work in relation to workplace isolation. In addition to individual and social determinants, other factors at the organizational or workplace level (e.g., organizational climate or ICT demands) may also play a role in the development of workplace isolation when WFH and should therefore be included in future research. Overall, current research highlights the fact that many research gaps still exist on the antecedents and outcomes of workplace isolation, which is gaining relevance in light of past and current trend towards WFH (Sahai et al., 2020). In this regard, future research should investigate whether workplace isolation is a relevant predictor of self-rated performance, as assumed in our study. Future studies should also examine differences between employee groups, e.g., at varying hierarchical levels, and analyze self-other ratings in dyads (leader and employee) or teams (leader and team members), which are currently underexplored but increasingly relevant. Screening for illnesses like depression prior to study participation may also be considered.

4.7 Implications for practice

The results provide important practical implications. When implementing or increasing remote work, organizations should adapt working conditions to mitigate the negative impact of workplace isolation on employee outcomes (see also Gajendran et al., 2024). Especially in times of crisis, such as pandemics, which cause disruptive changes in the workplace, organizations should consider that

employees may differ in their experiences, e.g., isolation perceptions both during high and low WFH intensity. Participatory approaches and regular employee surveys that address diverse needs are essential. This knowledge allows organizations to tailor their support strategies by strengthening relevant resources (e.g., SelfCare, social support by colleagues) and reducing demands (e.g., communication difficulties). In view of the fact that workplace isolation may have a relevant impact on self-perceived performance, organizations should consider prevention in this context.

At the *employee level*, organizations should provide SelfCare trainings, helping employees understand and meet their needs in remote collaboration (e.g., an increased need for social exchange for those with high levels in extraversion). For the HoL model in particular, one such intervention is the GoFüKo training program, which focuses on developing SelfCare and StaffCare competencies (Krick and Felfe, 2024b). Mindfulness-based interventions have also shown to improve SelfCare (Krick et al., 2018; Krick and Felfe, 2020, 2024a).

At the *leadership level*, training for leaders in remote collaboration should cover discussing employees' individual needs and challenges in regular one-on-one meetings, detecting early warning signs of mental illnesses and fostering social exchange (formal and informal meetings, both in person and remotely). Further, leaders should learn how to strengthen social relationships within the team and their team identity and adapt their StaffCare behavior in digital communication. While leadership interventions (e.g., health-oriented leadership interventions) have shown positive effects in traditional, face-to-face work settings (Stuber et al., 2021; Dannheim et al., 2022), there are hardly any such studies for the remote context. When implementing training for leaders in remote work, organizations should pay attention to offering low-threshold and feasible training (e.g., scalable practices or digital tools). An initial tool specifically addressing leaders to overcome specific challenges in remote work is the digital tool DigiLAP (Krick et al., 2024b).

In order for behavioral prevention approaches to be successfully implemented, organizations need to adequately address working conditions at an *organizational level*. Therefore, working conditions in virtual or hybrid collaboration should be established that allow employees to apply SelfCare behavior, e.g., clear agreements on availability times or establishment of digital meeting etiquette. To prevent communication difficulties, teams should be able to receive internal mediators or external experts for team consultation. Further, organizations should promote team collaboration by offering team development activities and facilitating informal exchanges in person. Finally, organizations have to ensure adequate technical preconditions for remote collaboration and offer IT support services (Efimov et al., 2024a).

5 Conclusion

While previous research has primarily focused on studying loneliness in the general population during the pandemic, this study offers a novel contribution by analyzing workplace isolation in relation to WFH intensity over time. By combining variable-and person-oriented approaches, this study identifies a general trend and subgroups with distinct trajectories, their antecedents and consequences. We found that workplace isolation decreased during the pandemic, then plateaued, and covaried with WFH intensity. Three distinct profiles among participants differed in their initial levels of isolation and WFH intensity, though they followed similar downward trends over time, suggesting that pandemic's contextual conditions influenced workplace isolation and WFH intensity development. By identifying relevant resources (e.g., SelfCare, social support by colleagues) and demands (e.g., communication difficulties), important implications for practice for reducing workplace isolation were derived. Recommendations for organizations include behavioral and structural prevention measures for employees and leaders in remote collaboration, e.g., SelfCare and leadership trainings to promote social relationships and prevent communication difficulties. In view of remaining theoretical, methodological and empirical research gaps, future research is encouraged to develop theoretically grounded and psychometrically validated instruments to assess workplace isolation, especially in light of evolving work arrangements such as hybrid and fully remote models.

Data availability statement

The datasets presented in this article are not readily available because of privacy restrictions. Requests to access the datasets should be directed to JF, felfe@hsu-hh.de.

Ethics statement

Ethical approval was not required for the studies involving humans because participation was completely voluntary and anonymous. Answering our questions did not cause any harm and was neither mentally nor psychologically stressful. The questionnaire did not contain any distressing material. The study was conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

IE: Methodology, Writing – review & editing, Writing – original draft, Conceptualization, Project administration, Visualization, Formal analysis. AK: Methodology, Data curation, Investigation, Writing – review & editing, Formal analysis, Conceptualization, Funding acquisition. VH: Writing – review & editing, Supervision. JF: Investigation, Conceptualization, Funding acquisition, Data curation, Writing – review & editing, Methodology. SM: Supervision, Conceptualization, Methodology, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2025.1601214/full#supplementary-material

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Publikation 3 – Qualitative Interviewstudie

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"That was one of my most difficult and biggest challenges": experiences, preconditions and preventive measures of health-oriented leadership in virtual teams – A qualitative study with virtual leaders

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Abstract

Background Health-oriented leadership (HoL) has a positive impact on health- and work-related outcomes of employees in face-to-face settings. Increased digitization during the COVID-19 pandemic has led to many changes and increased job demands. According to current state of research, HoL in virtual teamwork is insufficiently researched. The aim of the study is to examine the experiences of virtual leaders during the COVID-19 pandemic and to identify preconditions and preventive measures for promoting HoL.

Method Using a qualitative study design, semi-structured, guide-based telephone interviews were conducted with 16 German virtual leaders between May and July 2021. The collected data were inductively analyzed and interpreted using qualitative content analysis according to Mayring. Explorative analyses of differences between leaders with and without pre-pandemic experiences with virtual leadership were made.

Results Results indicated that leaders, regardless of pre-pandemic experiences with virtual leadership, faced diverse challenges in implementing HoL in virtual teamwork during the COVID-19 pandemic. Virtual leaders perceived personal preconditions (e.g., leaders' characteristics or behaviors), organizational preconditions (support by management or open-minded corporate culture), social preconditions (e.g., social support by team) and technical preconditions (e.g., sufficient technical equipment) as conducive to implementation of HoL. Almost all leaders with pre-pandemic experience identified a need for structural preventive measures, whereas almost all leaders without pre-pandemic experience reported a need for behavioral preventive measures in order to promote HoL in virtual teams.

Conclusions This study suggests that implementing HoL in virtual teamwork is challenging, complex and requires adjustments in leadership behavior. Thereby, the study provides initial empirical findings for a holistic approach to HoL implementation in virtual teams, considering beneficial multilevel preconditions. Due to a limited generalization

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of present results, longitudinal and interventional studies will be necessary for the analysis of causal relationships in future research. In particular, a holistic research perspective in order to understand the complex, contextual interdependencies of leadership is recommended. In practice, based on a differentiated needs analysis, structural preventive measures for a holistic organizational development as well as behavioral preventive measures for ongoing personnel development are recommended.

Keywords Leadership, Leader–employee interaction, Remote work, Teleworking, Working conditions

Background

The COVID-19 pandemic led to a significant increase worldwide in the use of mobile work such as home offices. In Germany, the percentage of all employees working from home almost doubled compared to the pre-pandemic period: in 2019, the percentage was 12.8% of all employees, increasing to 24.8% in 2021 [1]. The numbers of employees working from home in 2021 varied greatly between sectors, with most employees in IT services (75.9%) and the fewest in health care (5.4%) [1]. In this regard, a study conducted in Germany in 2020 showed that of all surveyed employees who reported working from home permanently or on some days, about 45% had started doing so as recently as the COVID-19 pandemic [2]. The pandemic-related changes in collaboration led to increased job demands and impaired wellbeing for many employees [3], especially in the absence of organizational support [4]. A review further revealed that personal factors (e.g., personal living conditions or personal resources) or organizational factors (e.g., leadership style or job autonomy) influenced perceptions of remote or home office work rather than this working arrangement having intrinsically homogeneous consequences on employees [5]. Fewer studies looked at the impact of the pandemic on leaders. The latter also reported increased job demands (e.g., work intensification) and challenges in virtual or hybrid leadership [6–9]. The Global Leadership Forecast 2021, a global survey among leaders, found that 60% felt exhausted after each workday, 23% did not experience themselves as effective at leading virtual teams, and less than 30% received training in this area and accordingly felt less prepared [10]. The definition of virtual leadership for this study is based on [11].

Yet it is relevant that leaders have a good state of health and are skilled at leading in a healthy and effective way, as they may serve as a protective factor for employees in the face of work strain [12–14]: by means of their leadership behavior (direct influence), design of working conditions, their function as a role model and their own state of health, which in turn may influence leadership behavior (indirect influence) [15]. In contrast to established leadership concepts focusing on leadership behavior (such as transformational leadership) in relation to follower health [16], theoretical concepts of healthy leadership have also been developed over the last two decades [17]. A dominant concept is the "health-oriented leadership" (HoL) approach according to Franke and colleagues [16] which also serves as a theoretical framework for this study. This broader approach integrates leader and follower perspectives and differentiates between follower-directed health-oriented leadership (i.e., StaffCare) and self-directed health-oriented leadership (i.e., SelfCare). Thus, the theoretical model consists of three components: SelfCare of the leader, StaffCare and SelfCare of followers. Each of these components comprises three dimensions: value, awareness and behavior. The SelfCare of the leader forms the basis in this model. Thereby, leaders should consider their own health to be relevant, be able to perceive changes when exposed to stress factors, and lastly be able to apply appropriate health-promoting behaviors towards themselves. Subsequently, the SelfCare of the leader enables StaffCare and can positively influence (in a direct and indirect way) the SelfCare of the employees. In the corresponding instrument, the components can be assessed by both leaders and employees [16]. According to current research, this theoretical model has been predominantly studied in traditional, face-to-face work contexts, indicating a positive impact on follower health [18]. Initial quantitative studies on HoL in digital, remote collaboration during the COVID-19 pandemic indicated that high levels of SelfCare among leaders had a positive impact on, among others, their own health, well-being, and job satisfaction [9], and that high levels of StaffCare had a positive impact on employee (mental) health and wellbeing [19], also when compared to office-based collaboration [9, 20, 21]. Study results by Klebe and colleagues showed that ICT hassles weakened the positive relationship between StaffCare and employees' mental health [19]. Furthermore, a qualitative interview study with virtual leaders before the COVID-19 pandemic found that applying HoL in virtual collaboration was possible, but required adjustments in StaffCare awareness and behavior, e.g., support in boundary management [22]. Another qualitative study on HoL and transformational leadership during the COVID-19 pandemic revealed that lack of social presence, limited informal chats, communication difficulties and lack of mutual trust was experienced by leaders and employees as challenging in the remote setting compared to the traditional office setting [23]. Overall, reviews demonstrated that there is insufficient evidence on leadership influence on followers' mental health outcomes in digital,

remote collaboration [11] and, in particular, in recent years few empirical studies on HoL in this context [18]. Researchers are currently arguing whether pre-pandemic research findings on virtual leadership and teamwork are transferable to the remote work context created by the COVID-19 pandemic [24–26]. In addition, previous studies did not analyze results on (healthy) leadership in digital, remote collaboration during the COVID-19 pandemic between individuals with and without prior experience – besides one study on perceived efficacy of virtual leadership between leaders with and without previous experience of working from home [27]. Therefore, it is currently an open question whether experiences of leaders who regularly worked in virtual teams before the COVID-19 pandemic differ from individuals who were forced to move their work to home offices ad hoc during the pandemic.

Furthermore, reviews have shown that leadership does not function in a vacuum, but rather exists in a context [28], requiring a systematic approach and an analysis of contextual conditions in the cause-effect relationship between virtual leadership and health outcomes [11, 29, 30]. However, many organizations were unprepared for the ad hoc changes in the workplace brought about by the COVID-19 pandemic [26]. Accordingly, different conditions and preconditions may have existed. Initial studies on conducive conditions of virtual leadership during the pandemic revealed the relevance of organizational and social support for leaders [8, 31]. Similarly, there are generally few studies on conducive conditions for HoL [11]. For the traditional, face-to-face work context, leaders' own SelfCare [32], but also job resources related to social relationships (such as social support by colleagues [33], team health climate [34] or organizational health climate [35, 36]) as well as to work organization (such as high-performance work practices or health-oriented human resources management strategies [37]) were found to positively influence HoL. For the digital, remote work context, only one pre-pandemic qualitative explorative study assessed work characteristics influencing the application of HoL in virtual teams [22]. The findings indicated that, besides social, technical and personal factors, organizational factors (e.g., flexible working conditions, structural offers as well as a conducive management board and culture) were particularly relevant [22]. Accordingly, there is little evidence on preconditions of HoL in general, as well as in virtual teamwork or during the COVID-19 pandemic.

Summarizing all above listed research gaps, there is a lack of research on HoL in virtual teamwork in general as well as during the COVID-19 pandemic [18, 22] (also in relation to prior experience with virtual leadership) and on preconditions [36]. Thereby, this study aims to answer the following research questions:

- What are the experiences and challenges for (ad hoc) SelfCare and StaffCare in virtual teams in times of the COVID-19 pandemic?
- Which preconditions enable HoL in virtual teams?
- Which preventive measures may promote the use of HoL in virtual teams?
- How do leaders with and without pre-pandemic experience working in regular virtual or hybrid teams differ in their experiences and opinions?

Materials and methods

Study design

The present explorative interview study followed a qualitative research approach, which was assumed to be most appropriate for gaining initial insight in a new field of research [38]. Thereby, the study is based on the phenomenological approach as methodological orientation for accessing subjective perspectives [38, 39]. Between May and July 2021, a total of 16 semi-structured, guide-based telephone interviews were conducted with German virtual leaders. The use of telephone interviews was based on research economics, flexibility in time and place as well as geographical expansion of the sample [40]. The COREQ checklist (Consolidated criteria for reporting qualitative research) was used to ensure the quality of the methodology report in this study (see supplementary material 1) [41]. The first author (IE), a female psychologist (M.Sc.) and research assistant, conducted the study, from recruitment to data coding and interpretation, as part of her PhD thesis. She had practical experience in qualitative interviewing from previous research projects at the time of the study.

Data collection

Applying the inclusion criteria, leaders were invited to voluntarily participate in this study who (1) worked mostly digitally at a computer workstation (e.g., 3 days/week), and therefore had practical experience with virtual leadership before and/or during the COVID-19 pandemic, (2) had at least 1.5 years of professional experience, (3) were German speaking and (4) at least 18 years old. Recruitment followed the snowball system through personal and professional contacts as well as professional networking platforms. In addition, recruitment took place via presentations at a scientific conference and an unpaid, free presentation for members of a business association. No personal relationship existed with any interviewee beforehand. All interviews were conducted in German. Study participants were informed about interviewer's and study background, objectives, procedure, and data protection before study conduct. They were given the opportunity to take part in the interview flexibly in terms of time and place (from the company office

or home office). Aiming at adopting an emic perspective [42], the problem-centered interview (PCI) method according to Witzel was used to conduct interviews [43]. The PCI method was considered to be particularly suitable as it aims at a joint understanding process between interviewer and interviewee and explores subjective experiences of interviewees (such as specific behavior, reasons, opinions) through dialogue. According to this method, four PCI instruments were employed: a short questionnaire for socio-demographic data, an audio tape recorder, an interview guide, and a postscript [43, 44]. At the beginning of the interview, the participants were also informed about the theoretical model [16] that was used as a framework for this study. In line with our research questions, interview participants were asked about their experiences and challenges of (ad hoc) implementing SelfCare and StaffCare in virtual teamwork during the COVID-19 pandemic, which preconditions affected them in doing so, and which preventive measures they considered supportive in promoting the use of HoL in virtual teams. The interview guide is displayed in supplementary material 2. A pre-test was conducted to evaluate both content related comprehension and time requirement. To the researcher's knowledge, no other people were present during the interviews. Interviews length was 46 min on average (range between 35 and 66 min). No interviews were excluded or repeated. With the repetition of experience narratives by different participants, theoretical saturation was assumed over the course of the study.

Data analysis and presentation

The collected, recorded data were transcribed verbatim (in terms of content and semantics [45]), anonymized, and inductively analyzed and interpreted using Qualitative Content Analysis by Mayring [46]. The characteristics of the sample were summarized in a descriptive manner (see Table 1). The coding of qualitative data was analyzed and classified into main and subcategories. The category structure was discussed in the research team until consensus was reached. The coding tree (see supplementary material 3) corresponds to the process model of summary [46]. In addition to summary analysis, two within-sample groups were created (leaders with and without pre-pandemic experience with regular virtual or hybrid teamwork) and results per categories were compared between these two groups in an exploratory manner. Study participants were not involved in data transcription or analysis. Data collection, transcription and analysis was conducted in German and results (e.g. interview quotes) were translated to English for the manuscript. For both analyses steps the software MAXQDA Plus for Qualitative Data Analysis (Version 20.0.6, 2020, VERBI GmbH, Berlin, Germany) was used.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and approved by the Local Psychological Ethics Committee of the Hamburg Psychosocial Medical Center of the University Medical Center Hamburg-Eppendorf, Germany (LPEK-0240). All study participants received written information about the study beforehand and signed an informed consent form regarding the data collection, transcription and analysis of the interviews.

Results

In the following, descriptive results on study participants' characteristics as well as main results are presented. The main results are outlined based on four main categories: (1) Implementation of SelfCare in home office during COVID-19 pandemic, (2) Implementation of StaffCare in virtual teams during COVID-19 pandemic, (3) preconditions of HoL in virtual teams and (4) preventive measures for promoting HoL in virtual teams. See supplementary material 3 for our corresponding coding tree. Each main category is supplemented by the explorative comparison of two groups (leaders with and without pre-pandemic experience with regular virtual or hybrid teamwork). Participant quotations are presented to illustrate findings. For readability reasons, a selection of quotations is displayed in the manuscript text; further quotations can be found in supplementary material 4.

Study participants' characteristics

In this study sample ($N=16$), most leaders were male ($n=11$, 68.75%) and between 31 and 40 years old or between 51 and 60 years old (respectively: $n=6$, 37.50%; mean age of 45.7 years). The majority was employed in the service industry ($n=11$, 68.75%; of which $n=5$, 31.25% were in IT / software) and in largescale companies ($n=12$, 75.00%; of which $n=5$, 31.25% were in companies with more than 10,000 employees). Almost all participants worked full-time and permanently ($n=15$, 93.75%). About half of the study sample worked between 40 and 50 h per week ($n=9$, 56.25), and 6 leaders reported working often or very often at irregular times, such as late evenings, nights, weekends, or vacations (37.50%). Most participants had leadership responsibility for a team ($n=8$, 50.00%) or a department ($n=5$, 31.25%), with a leadership span of less than 10 employees ($n=6$, 37.50%) or greater than 26 employees ($n=7$, 43.75%). The majority was operating at national level ($n=13$, 81.25%), with team members most commonly located regionally ($n=10$, 62.5%). Moreover, more than half of the participants ($n=9$, 56.25%) indicated that prior to the pandemic, they either solely collaborated face-to-face with their team or, even though home office was occasionally used within some teams, the focus of collaboration was face-to-face. 7 leaders (43.75%), by contrast, were familiar

Table 1 Study participants' characteristics ($N = 16$)

Variable	*n*	%
Gender		
Male	11	68.75
Female	5	31.25
Age		
31–40 years	6	37.50
41–50 years	3	18.75
51–60 years	6	37.50
≥ 61 years	1	6.25
Industry		
Services	11	68.75
Logistics	3	18.75
Manufacturing	2	12.50
Company size		
≤ 49 employees	2	12.50
50–249 employees	2	12.50
≥ 250 employees	12	75.00
Employment		
Full-time (permanent)	15	93.75
Part-time (permanent)	1	6.25
Working hours per week		
30 h per week	1	6.25
40 h per week	3	18.75
40–50 h per week	9	56.25
> 50 h per week	3	18.75
Work at irregular times		
Never	1	6.25
Rarely	6	37.50
Sometimes	3	18.75
Often	5	31.25
Very often	1	6.25
Job tenure		
≤ 5 years	4	25.00
6–10 years	6	37.50
11–15 years	1	6.25
16–20 years	1	6.25
≥ 21 years	4	25.00
Job position		
Management	3	18.75
Head of department	5	31.25
Team lead	8	50.00
Leadership span		
≤ 10 employees	6	37.50
11–20 employees	3	18.75
≥ 26 employees	7	43.75
Geographical team distribution		
National (Germany)	13	81.25
International	3	18.75
Experience with virtual or hybrid teamwork prior to COVID-19 pandemic		
Yes	7	43.75
No	9	56.25

with regular virtual or hybrid collaboration in their teams prior to COVID-19 pandemic (e.g., due to international geographical team distribution). Table 1 displays the characteristics of the sample.

Implementation of SelfCare in home office during COVID-19 pandemic

Overall, in terms of SelfCare in home office during the COVID-19 pandemic, a total of nine leaders reported on feasibility of implementation, but also on associated challenges.

Feasibility of implementing SelfCare

With regard to implementation of SelfCare in home office during the COVID-19 pandemic, a total of four leaders indicated that the implementation was feasible for them and that they had not experienced any challenges in this process. Some explained this by their flexible, autonomous and self-responsible working conditions.

> *"Yes, it is absolutely possible for myself, since no one tells me how to organize my working time, I have full control over it. And everything that did not go well, I have to account for myself. And everything that worked out well, too. So, like everyone else, I'm learning how it can work." [Participant #9, age 51–60 years, head of department].*

Challenges for SelfCare implementation

However, four leaders indicated that SelfCare was feasible but challenging in home office. They reported that they have learned to manage stressful challenges (such as constant availability, limited opportunities to balance work due to longer working hours and fewer breaks) through self-reflection and self-discipline over the course of the pandemic. It was argued that virtual collaboration required more involvement, focus, and preparation.

> *"Practicing self-care for oneself, of course, is a matter of self-discipline, and also partly a matter of organization at home, which is not always easy. I believe it is possible for oneself. [...] So, in fact, I had to readjust and discipline myself when there were long periods at home. [...] I also introduced rituals for myself, in order to consciously transition from professional to private life, so to speak." [Participant #12, age 41–50 years, head of department].*

In addition, one of those four leaders highlighted the need for constant self-reflection, since despite comprehensive knowledge on self-care, implementation remained difficult.

"But then you also realize that you are honestly quite careless about your own person. So, this self-awareness and also perceiving myself when I'm moving in such a downward spiral, so to speak, and actually also exceeding my own limit, [...] although one perceives it. That's the issue of 'interested self-endangerment,' something like that. We can all make a hook on it. We are not consistent enough, because we actually know that it is not okay at some points. And we regularly exceed these limits, and we communicate this to ourselves. It's not even that we all don't talk about it, but it's often said: 'Well, we have to somehow change that now,' but still it doesn't work (laughs). [...] And, it has to be said, we are all managed appropriately. So, we are all, in the areas in which I am predominantly engaged, all senior professionals with corresponding employment contracts, where you are controlled by incentive agreements [...]. And that includes money. Quite a bit, and accordingly you're running on a wheel, so to speak." [Participant #10, age 51–60 years, team lead].

Last, another participant stated that after observing low self-care at home office, switching back to company office was identified as a solution.

"Well, I actually noticed that I have a very bad leadership style towards myself (laughs). Or rather, I don't have any self-discipline. Meaning, in the first two months of the first lockdown, where I had to work in the home office, I didn't really pay attention to myself. I started at eight o'clock, slowly got hungry at 12 o'clock, I'm just not much of a breakfast person, but then I noticed: a) there's nothing at home, b) I can finish this e-mail and the call I just missed, I might as well call back and then another e-mail comes in and in the blink of an eye it's 3 p.m. and I think to myself: 'Okay, then you don't need to prepare lunch anymore,' work anyway until 5 p.m. and only then start to take care of myself. Sometimes even longer. And I noticed that after two or three weeks. So that I was clearly more exhausted, I just [...] had no daily routine. [...] That's why it was a good solution for me to go back to the office later on, where structures were a bit more clearly defined." [Participant #8, age 31–40 years, team lead].

Comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork

A comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork showed that almost all leaders with prior experience stated that SelfCare was also feasible for them in home office during the COVID-19 pandemic, although half of those participants also reported challenges in doing so. In contrast, two out of three leaders without pre-pandemic experience reported facing challenges and difficulties in implementing SelfCare after workplace changes due to the pandemic. However, one participant without pre-pandemic experience shared that practicing SelfCare was independent of work setting and that managing change was job-related and therefore familiar to him. Figure 1 presents the group comparison graphically.

"I'm the head of change department, so change is something that I'm also kind of personally and professionally used to approach somehow." [Participant #9, age 51–60 years, head of department].

Implementation of StaffCare in virtual teams during COVID-19 pandemic

Overall, in terms of StaffCare in virtual teams during the COVID-19 pandemic, leaders reported on feasibility of implementation, but also on many challenges, and outlined their StaffCare behaviors in this context.

Feasibility of implementing StaffCare

With regard to StaffCare in virtual teamwork during the COVID-19 pandemic, a total of eleven leaders indicated that it was feasible for them to implement. Although many leaders emphasized that StaffCare implementation was feasible, but under more difficult conditions, the other half of those eleven leaders rated personal characteristics and behaviors of the leader (such as trust towards the team, openness, communication, and taking time) as more important for the implementation of StaffCare than actual differences between face-to-face and virtual collaboration.

"So, I suppose - in the end - I'd say that it's just as good or just as easy or just as hard as being present in the office environment. Because basically it's about really listening to people. That is, to whatever concerns my colleague. And that's maybe a little bit easier to read, you know, via nonverbal communication when I see the person, that's for sure. But it's actually more about, from my point of view, that the person is willing to be open." [Participant #3, age 41–50 years, management].

Challenges for staffcare implementation

Although many leaders confirmed the feasibility of applying StaffCare in virtual teamwork, almost all participants described various challenges in implementing StaffCare

Fig. 1 Explorative comparison regarding implementation of SelfCare and StaffCare in virtual teams during the COVID-19 pandemic. *Note* An explorative comparison was conducted between leaders with and without pre-pandemic experience with virtual or hybrid teamwork. The number on axes corresponds to the number of leaders who have named feasibility of SelfCare and StaffCare, associated challenges and respective leadership behaviors

in virtual teamwork during the COVID-19 pandemic: fewer cues in virtual communication, limited possibilities and quality of informal exchange, challenges maintaining or building proximity to employees as well as private challenges of employees (see Table 2).

Fewer cues in virtual communication

In total, twelve leaders reported difficulties in perceiving employees' health status, feelings, or mood through digital communications – in comparison to face-to-face leadership before the pandemic. This was mainly attributed to fewer cues in virtual communication, especially when no video conference was possible and only voice was heard but no facial expressions or gestures were seen, also due to employees' free choice to turn off video.

> *"We can't oblige anyone to turn on the camera, and there are colleagues who turn off the camera for a long time and don't show themselves. And then, of course, it's even more difficult when you only have the voice for a while." [Participant #1, age 51–60 years, head of department].*

The challenge was also described by some leaders by the fact that, despite a relationship of trust, most employees did not express problems to their leaders at an early stage.

> *"That was one of my most difficult and biggest challenges. To pay attention to mental health. Because that's even less possible, because the employees, I would argue we already have a great relationship of trust, and yet [...] I don't know everything. So, you can literally feel it. And then I just miss the facial expressions, the gestures, the body language, in order to really be able to better assess the situation." [Participant #8, age 31–40 years, team lead].*

In addition, it was shown that a more holistic perception of employees is limited not only in direct communication with the leader, but also in contact with other colleagues in virtual collaboration.

> *"So basically, being able to lead well is of course also something that suffers, I think, because you obviously can observe employees less at work, for example. So, how does he deal with colleagues? You just don't get to see that anymore. How does he interact with other departments? Usually, colleagues are here in the room and have a question, or other departments, and you can see directly: How does he solve it now? How does he deal with it? How does he react to stress? I don't see all that anymore. I don't see people talking to each other on the phone. That means I notice less and can therefore provide*

Table 2 StaffCare in virtual teams during COVID-19 pandemic

Challenges for StaffCare implementation	StaffCare behaviors to cope with challenges
• more difficult perception of employees' mental or physical health through digital communications due to fewer cues (12)	• consideration of employees' needs and competence (e.g., by promoting autonomy, participation, reduction of hierarchies, communication of expectations regarding availability) (10)
• limited possibilities and quality of informal exchange via digital communications (4)	• proactive communication with employees whether within team or one-on-one (9)
• difficulties maintaining or building proximity with existing or new employees via digital media, in particular with a higher number of subordinate employees (5)	• redesigning team meetings (16): – *formal meetings*: increase in frequency of digital meetings (6), implementation of digital meeting etiquette (e.g., regarding timing, use of communication media) (8), enabling face-to-face team meetings (6) – *informal meetings*: organized rather than spontaneous contact with employees (3), additional meeting formats to encourage informal exchange within the team, e.g., regular digital team meetings, team events or lunch dates (9), encouraging informal exchange in formal meetings, e.g., via check-ins (5), enabling face-to-face meetings for informal exchange (3)
• private challenges of employees (e.g., due to childcare, limited housing, social isolation) (8)	• redesigning one-on-one meetings (16): – implementation of organized one-on-one meetings via digital media, by phone (11) or face-to-face (1) within varying, sometimes increased frequency (annually, every few months or weeks, weekly, in combination within professional exchanges, or on demand) – confidential conversations regarding current state of health and mind (10), work-related problems (2), to maintain contact (2)

Note The number in brackets corresponds to the number of leaders who have named respective leadership behaviors and challenges

> *less information to them: What could you do differently? Instead, I usually only see the work output. So, what has the person worked on? How do I feel about that? And then, of course, you can do that digitally just as well as in the office. […] I believe that mere professional management, which is really about content, can also be done digitally." [Participant #4, age 31–40 years, team lead].*

Besides perception of employees' mental health, perception of their physical health via digital communications was also found to be limited, although easier for prevention. Due to this limited perception, one leader pointed out that virtual teamwork requires employees to be more responsible for their own health than in the office.

> *"I can't assess whether employees in their home office are sitting and eating healthy and are taking breaks from work. So that, but each person is also responsible for his or her own actions and, as with everything else, I rely on my team. As a leader, I also see myself as an enabler. I provide everything that is possible for me and that is necessary […] And I'm only talking about physical health for now. It [StaffCare] is, well, it's possible, but the employees' self-responsibility is of course much more strongly required here than in the office." [Participant #8, age 31–40 years, team lead].*

In addition, two leaders stated that the more difficult perception of employees' health status, feelings, or mood through digital communications was related to the fact that there was generally reduced communication that was more subject-related.

> *"I (…) rarely get to call people and say: 'Hey, I just wanted to chat.' Well, then one calls for a reason, and if one doesn't have a reason, then one doesn't call the people. Then one doesn't know whether they're doing well or badly." [Participant #8, age 31–40 years, team lead].*

Limited possibilities and quality of informal exchange

Overall, four leaders indicated that informal face-to-face contact with employees was much easier to implement before the pandemic. Due to the shift to digital communications as a result of the COVID-19 pandemic, informal contact was considered to be of limited possibilities and quality, e.g., due to insufficient technical equipment or less incentives.

> *"I don't think the informal aspect at the office can be replaced by a virtual coffee break. But it also has to do with the equipment. So, is it a virtual coffee break where people don't see each other? Or do they have the resources to see each other via webcam? That has another quality. How many participants are there? That also plays a role. But basically, I would say it still can't compensate for the classic face-to-face contact." [Participant #9, age 41–50 years, head of department].*

Challenges maintaining or building proximity to employees

Another challenge for five leaders was maintaining or building proximity to existing or new employees.

> *"So, the biggest challenge for me is actually staying close, noticing when employees are not doing well and (…) taking the time to follow up. If you notice that something is wrong, you notice that relatively quickly in meetings, when it somehow becomes qui-*

eter around a person. But taking the time to follow up and ask questions is definitely a challenge, especially in this pandemic period, when we all tend to work more and are very busy with meetings. […] It's good for me to have a lot of private conversations with the team, I would say, and to be close to them. But that's also important to me as a leader. Maybe others are different in that respect. […] I think you have to know about each other, who you are and who you are in private, in order to really work well together. I think it's extremely important to establish this proximity, especially when the team changes and new people join." [Participant #5, age 31–40 years, team lead].

Especially in virtual collaboration, it was described as challenging to build personal relationships via digital media and not to lose employees over a long period of time – in particular with a higher number of subordinate employees.

"Yes, the challenge is indeed to keep in contact, to develop a sensitivity for this. […] You have a completely different feeling about it, of course. There's something wrong or the person is not doing well or whatever, and then you can work on it. That's much more difficult now. So, without video anyway, but even with video. […] That means it's more difficult to develop a feeling, a sense of being close to employees. And the more you have in direct reports, the more difficult it is to meet everyone's needs. You have to be careful not to lose those who perhaps need to be addressed more. […] And then, of course, to what extent do you have insight into privacy?" [Participant #9, age 41–50 years, head of department].

One leader changed to a new company during the pandemic and reported on the challenge of establishing personal relationships via digital communications.

"Well, I have one employee who is younger, but I am one of the youngest of them. We have many who are much older and have been with the company much longer, of course. And when is the right time to switch from "you" [formal, polite pronominal salutation in German] to "you" [informal, confidential pronominal salutation in German]? And I think […] in the non-digital world before Corona, there would have been several natural moments where you would have said, 'Well, this is a good setting, now it's time to do it'. But I haven't found that here with my team yet." [Participant #7, age 41–50 years, management].

Private challenges of employees

Last, eight leaders indicated that their employees' private challenges during the COVID-19 pandemic had a negative impact on employees' mental health and, consequently, posed a challenge to leadership. These ranged from the difficulty of combining childcare or homeschooling and home office, supporting one's own parents, to limited housing (e.g., more difficult separation of work and private life in home office), social isolation, poor work-life balance, breakups, and financial problems.

"But you just feel that there's something and you also know that there are private problems, organizational problems, childcare, financial situation, a construction project that doesn't work out, thousands of things, separation. And of course, all this has an impact on mental health. No one came out of the pandemic in a better mood." [Participant #8, age 31–40 years, team lead].

StaffCare behaviors to cope with challenges

Reflecting on the challenges of StaffCare in virtual teamwork, leaders reported different leadership behaviors used to deal with them: consideration of employees' needs and competence, proactive communication with employees as well as the redesign of team and one-on-one meetings (see Table 2).

Consideration of employees' needs and competence

Overall, ten leaders acknowledged considering the needs and competence of their employees by e.g. promoting autonomy, participation and reduction of hierarchies. Some explained that cultural and organizational changes towards more self-responsibility, agility and eye-to-eye collaboration were implemented in their company.

"I […] have been in leadership responsibility for […] more than 30 years. And things have changed in that respect, too. It used to be different. People used to lead in a different way. And now, it's a change that I had to make and that I'm still involved in. But it's a lot of fun. So, to call on employees to take responsibility for their own actions and to take them on board. […] Nevertheless, it is still disciplinary responsibility in a way that I also put myself in front of the group to provide support. I share responsibility for decisions, I stand in front of the group, and my colleagues also gave me feedback that my leadership behavior has changed in the last two years. […] Two years ago we had a restructuring and we are in the process of separating technical responsibility and disciplinary responsibility a bit." [Participant #1, age 51–60 years, head of department].

One leader emphasized that in times of crisis, such as the COVID-19 pandemic, there is a need for leadership demanded by employees and requires clear and participative leadership behaviors.

> *"This is what human history says, that especially in stressful situations, there is an immediate call for a leader. [...] We no longer live in a time where typical hierarchical top-down decisions are made by one person and followed by others; instead, it's about engagement and participative or coaching leadership. And that means somehow making sure that everyone is going in the same direction and, on the other hand, nurturing or enabling the greatest possible decision-making potential. And that's how it is for us, that's how I try to practice it. So, where it is possible or also wanted or just simply necessary, just to specify, to specify the direction, and on the other hand to enable the highest possible participation. [...] During the weekend, I thought about this very carefully: Okay, what does that mean? And in the first few weeks, I led very closely, much, much more closely than I usually do. Because this was already somehow a crisis situation and, in a crisis, it simply helps people and they also call for [...] 'What does that mean now?' and 'Where are we going?' and so on. And somehow, the clearer someone is, it's like a ship is sinking and everyone looks to the captain and if he can calmly tell you: 'Here are the boats and there's the rope, please pull on it and everything will be fine and that's where we're going out now and that's the direction where we're going now,' then it somehow goes well, I think, metaphorically speaking." [Participant #6, age 51–60 years, head of department].*

It was reported that individual needs of employees were considered and support was offered.

> *"One of my very, very, very first trainings as a project manager, I learned to pay attention to three things when leading people. When distributing tasks, actually as a classic project manager: TPI. Task, Process, Individual. On the one hand, it's about the task, what do you have to do? The other, process, how do we get there? And just as important, all equally weighted, individual, what does the person need to do this? Does she work at night? [...] It doesn't matter at all, but we have to combine these three things somehow, task, process, individual. And I think that's quite important and helpful to remember that. And that's always very easy to say, it's also very easy for me to explain it that way, but to implement it, that's the challenge. Because you have your own strengths, weaknesses and needs." [Participant #7, age 41–50 years, management].*

Furthermore, clear rules were established regarding availability and working hours, and expectations were communicated to support the boundary management between work and private life.

> *"And we have clear rules, including absences. And also, my expectation is not to work in the evening or on the weekend, and I tell them that when that happens, and it does happen. Then someone calls me on vacation or on their vacation or on their day off. And then I'll give them the hint right away, 'Why are you calling me today? You're off today.' [...] I practiced that [before the pandemic], too. But now I'm even stricter, I guess. Because that is more important to me. I notice by myself, this boundary management isn't really easy, what concerns private and business, because it somehow becomes blurred. And I think you have to, I personally think it's important to separate the two." [Participant #10, age 51–60 years, team lead].*

Proactive communication with employees

About nine leaders reported that in the wake of the COVID 19 pandemic, spontaneous informal exchanges with employees had to be replaced with proactive communications. This represented a major change for participants in which new strategies had to be considered and new behaviors learned in order to maintain rapport with each employee and within the team. Leaders described that proactively approaching employees was necessary, i.e., proactively asking questions, carefully listening, and taking more time for informal conversations. It was illustrated that more sensitivity was needed, especially with introverted employees who had become even more withdrawn as a result of virtual collaboration.

> *"If I want to maintain contact, then I have to make sure that I do. So, if I don't make sure that I have non-work-related contact with my colleagues and listen to how things are going, then nothing will happen, unless the other person is similarly active as I am [...], but that was definitely a big change. Learning that you don't just spontaneously meet a colleague in the hallway, but that you really have to make an active effort if you want to keep in touch. Especially with colleagues you don't see at all because you don't have anything to do with them professionally. Regarding your own team, I think you also need a different sensitivity than before, [...] If you're so far away and only meet someone in a team*

meeting and every two weeks in one-on-one meetings […], then I think you need even more sensitivity and in between you simply have to ask again: 'Hey, is everything okay with you right now? Tell me again, how was your day yesterday? I remember you had an assessment center and you weren't very satisfied.' And I think you have to take more time, and that's something I had to learn at the beginning." [Participant #5, age 31–40 years, team lead].

Redesigning team meetings

All leaders described how they redesigned their team meetings for virtual collaboration during the COVID-19 pandemic. Several leaders emphasized that often this involved joint team deliberation and decision-making to address challenges.

First, some leaders outlined how formal team meetings were increased in frequency for virtual collaboration, as it was determined that there was an increased need for conversation. Accordingly, nine leaders reported that a new digital meeting etiquette was implemented. Thus, the timing of digital meetings was restructured. Due to an increased frequency of meetings in virtual collaboration, it was found that the timing of digital meetings was experienced as exhausting. Meeting duration in general, but also whole-day events, were shortened, for example, and meeting-free days were consciously scheduled.

"We have introduced meeting etiquette. That means that no one is disturbed before eight o'clock and after seven o'clock. Except in management groups, where we have allowed it until 8 pm. After every 45 minutes, there's a 15-minute break for digital meetings. There's always an hour for lunch, and if a long meeting is scheduled for a whole day, it can't go longer than four hours, because you're simply more stressed digitally." [Participant #12, age 41–50 years, head of department].

In addition, teams agreed on which communication media should be used for which purpose and how video conferencing systems should be used for verbal communication, e.g. camera on.

"No, actually, in one of our first meetings as a team, where we kind of sat down together and discussed how we wanted to work in the future, especially under these conditions, we looked at which media and which channel we should use for which occasion. In other words, we tried to define […] when do I write an email and when do I post something in our Teams [a video conferencing system] channel, for example. […] But it took a while to get things going and, especially at the beginning, I got the feedback: "Oops, we haven't done it like this for the last six months" and the last six months referred to the pandemic, to the beginning, where I was still on parental leave while my team was already there. And there was less of that, there was less communication simply through these channels. And because I have a great affinity for this, I simply pushed it a bit and used it more, and somehow it became second nature to everyone." [Participant #5, age 31–40 years, team lead].

Face-to-face team meetings but also business trips were drastically reduced: some leaders reported regular (e.g., once per week) or infrequent (e.g., every three months) face-to-face meetings or hybrid team meetings at times, depending on changing policies during the COVID-19 pandemic. These were occasionally implemented for important meetings or to facilitate face-to-face exchanges and trust building.

"I only travel to [large city in Germany] when I meet with a manager or have a very important appointment. I don't think I've had any flights since March 2020, I haven't been on a plane at all. And my business trips were maybe 20 to 30 in total, which is what I usually managed in a month." [Participant #12, age 41–50 years, head of department].

Second, leaders described the redesign of informal team meetings. Overall, three leaders indicated that, compared to face-to-face leadership, informal contact had to be organized rather than emerging spontaneously, and new digital formats had to be considered.

"And of course, you can discuss this much more easily over a cup of coffee than if you have to organize some kind of meeting for it." [Participant #2, age 51–60 years, management].

Nine participants explained that they had implemented additional meeting formats to encourage informal exchange within the team: daily or weekly digital meetings (e.g., daily check-ins, virtual coffee breaks) for exchange and socializing, regular digital team events (e.g., game nights), joint digital sports sessions or healthy breaks, regular digital lunch dates, regular impulse weeks or webinars (e.g., on topics of collaboration and health-promoting work in the home office), as well as exchange between leaders was promoted via leadership workshops.

"So, from my perspective, that totally helped to introduce these things like our daily or just a monthly team evening. We wouldn't do a monthly

team evening if it wasn't for Corona [Covid-19 pandemic]. We never would have done that before. We used to meet maybe once every three months for a team evening. But we noticed that we were missing that and then we said: 'Well, now it will be once a month and we'll bake together, we'll play virtual escape games together or everyone will bring a funny wallpaper for Teams [a video conferencing system] and we'll guess where the person was or what the story is about this picture, just to create a bit of personal proximity and contact. And that definitely had a positive impact on our work." [Participant #5, age 31–40 years, team lead].

Five leaders also referred to encouraging informal exchange in formal meetings, for example, by asking about current state of mind, e.g., during check-ins at the beginning of a meeting.

"We start every meeting with a so-called check-in. It's always about how we're doing, and a few weeks ago there was a noticeable lockdown fatigue in Germany and, of course, in our team as well. And I addressed that too, and everyone just said they were sick of it and wanted to see people again and go out and so on." [Participant #6, age 51–60 years, head of department].

One leader, on the other hand, also discussed the challenge of building trusting relationships only via digital meetings.

"The second is the relationship level, which is actually difficult. Because part of that, especially in recent times, is that you go out to eat together as a team, in the evening as well, and in fact a certain degree of ease only sets in after a while. Not just after five minutes, but perhaps after you've been sitting together for two hours. And that is indeed a bit tricky, so I have tried to figure out how to create an online team event, for example, or to have a regular meeting every two weeks, and every two weeks I have another meeting with each team member, where the focus is not primarily on work content, but also on the other side of the business. And personally, I consider that a bit tough, because I don't think we really get much out of it." [Participant #7, age 41–50 years, management].

Last, three leaders indicated they had the opportunity to implement face-to-face meetings for informal exchanges, e.g., team events. One leader explained that he had learned during the pandemic that virtual collaboration in terms of content worked really well, and that social events should be deliberately planned for face-to-face meetings and separated from content collaboration.

"What you can't do [digitally] is to organize a [...] social event. And we do that very consciously. [...] And this separation is what I want to do now, I have to gather my experience and so far, it's working very well. The employees are also on board and understand it. And they are now acting in the same way, separating content from personal events. [...] And now that's a reason to get together, saying, 'So, we're going to share,' we're looking forward to dinner, so it has become something special, and we're also much more disciplined. When I decide: Now it's about eating and exchange, [...] then it's simply more consequent. We didn't manage that before. Most of the time, it was still about content-related topics at dinner." [Participant #12, age 41–50 years, head of department].

Redesigning one-on-one meetings

Overall, all interviewed leaders reported organizing one-on-one meetings with their employees within varying frequency (annually, every few months or weeks, weekly, in combination within professional exchanges, or on demand). Most leaders described conducting these meetings via digital media or by phone. Thereby, some emphasized the challenge of not always being able to use the camera function or the need to implement personal exchanges in a more organized way.

"So, you just have to exchange in a more planned way and take your time for that. In fact, I have consciously set digital meetings for this purpose, where we can then talk about it." [Participant #15, age 31–40 years, team lead].

Only one leader stated implementing walks in the park for face-to-face communication for increased quality.

"Whenever it was possible, we agreed that those things that are merely practical can also be done quite well online. But really chatting with someone, in quotation marks, is something we've often shifted to a walk over the last few months. So, when I've met with colleagues, I've rarely met to talk about something business-related. But more like: let's meet in the park and go for a walk. [...] Yes, and I think that has a completely different effect than to say: Okay, I'll sit here online in front of the computer and we'll talk for a while. So that's already different." [Participant #3, age 41–50 years, management].

However, two leaders reported implementing personal communication often within professional meetings, resulting in increased levels of communication during the pandemic. It was argued that this supposed relaxed conversational approach enabled many problems to be dealt with at an early stage.

> *"I always started my meetings with personal topics, so that's my conversation style. Always first: 'How are you? Everything okay? I'm dealing with this and that, and what's going on with you?' [...] and then, once it's been discussed, I add: 'Hey, I still have a subject-related issue.' Then it goes off. So that's my way of managing the conversation. Optimally, I also finish with something personal, which has extended phone calls to an enormous length, but I'm firmly convinced that they were necessary. Because if I didn't do that, I think the group would become [...] more dissatisfied in the long run. And by always practicing this communication and not only preaching, but also doing it myself, I promote communication among each other. Often, really frequently, these supposedly relaxed conversations bring up things that are also professional. [...] And I think I was able to eliminate a lot of trouble spots in advance, before they became major problems." [Participant #8, age 31–40 years, team lead].*

Regarding the purpose of holding one-on-one meetings, it was mostly stated that confidential questions were possible to ask about the current state of health and mind, e.g., about workload, stress perception, mental illnesses or particular private challenges during the pandemic. Within these conversations, leaders described how they sought individual solutions together with the respective employees, such as adjustments to work schedules.

> *"Namely through personal conversations, through a lot of time and space. Some have already spoken up and expressed something like this, that it is somehow too much at the moment or this dissatisfaction in general, this insecurity. [...] Sometimes it's enough to somehow reduce the pressure a bit. There are different types of stress. I think some people just have a guilty feeling very quickly and are very conscious of their duties. And those are even the more difficult cases, according to my impression. And to say: 'It's okay if you don't meet a deadline, as long as the company doesn't collapse afterwards.' And to signal that: I've got my eye on you and I'll defend you, if someone has a problem with this. So, there were situations like that." [Participant #16, age 31–40 years, team lead].*

In addition, individual participants stated that they hold confidential meetings in order to discuss work-related problems and to maintain contact with employees.

> *"But I also see it as my job. So, I actually keep a list in which I write in: When was the last time you spoke to a colleague? And if that hasn't happened for two months, I give them a call. So, I do try to keep in touch, because some people naturally drift away when you don't get to see or hear them anymore." [Participant #2, age 51–60 years, management].*

Comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork

A comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork showed that seven leaders with no prior experience reported being able to implement StaffCare in virtual teamwork during the COVID-19 pandemic, compared to four leaders with prior experience. In both groups, about half emphasized that StaffCare implementation was carried out under more difficult conditions. Almost all leaders described various challenges in implementing StaffCare in virtual teamwork during the COVID-19 pandemic and both groups differed little in terms of what they said about the challenges: fewer cues in virtual communication, limited possibilities and quality of informal exchange, challenges maintaining proximity to employees as well as private challenges of employees. Last, the group comparison regarding StaffCare behaviors revealed that all leaders, regardless of prior experience, reported having adjusted team and one-on-one meetings. However, the majority of leaders with no prior experience more often stated using proactive communication with employees, compared to only two leaders with prior experience. Likewise, almost all leaders with prior experience reported considering employees' needs and competencies, compared to only four leaders without prior experience (see Fig. 1).

Preconditions of HoL in virtual teams

Leaders named several personal, organizational, social, and technical preconditions as conducive to the use of HoL in virtual teams (see Table 3).

Personal preconditions

Almost all leaders stated that leaders' specific characteristics and behaviors, self-care, role modeling, and leadership experience are basic preconditions for practicing HoL in virtual teams.

About twelve leaders discussed key characteristics as important preconditions for practicing HoL. Thus, seven of these participants reported that leaders need empathy

Table 3 Preconditions of HoL in virtual teams

Preconditions	Details
Personal preconditions (15)	• characteristics of the leader, e.g. empathy, trust (12)
	• self-care of the leader (9)
	• leader as role model (7)
	• leadership experience (2)
Organizational preconditions (16)	• supportive management (10)
	• supportive, open-minded corporate culture (15)
	• health-promoting working conditions (10)
	• wide range of institutional services (13)
	• employee-oriented, supportive work council (3)
Social preconditions (13)	• social support by team, e.g. through employee ownership (12)
	• social support by colleagues or own supervisor (4)
Technical preconditions (5)	• stable internet connectivity (2)
	• sufficient technical equipment for all employees (4)
	• IT support by organization (1)

Note The number in brackets corresponds to the number of leaders who have named respective preconditions

in order to be able to perceive moods and communicate sensitively, even at a distance and via digital communication. Another seven participants stated that trust is essential, especially to avoid micromanagement in virtual collaboration, and can be built through sincerity, authenticity, transparency, and commitment. Additionally, it was described that leaders should be open (both to employees and in terms of how they work), have a genuine interest in their employees, and have awareness and sensitivity to issues around health.

> *"In any case, you first have to be empathetic, because otherwise you're probably not interested in whether you're helping the other person to develop, whether you're helping the other person to cope with such a situation. And you have to be quite sensitive or attentive in order to notice that. It's just something different than in the office. Even there, I would argue, there are people who wouldn't notice or wouldn't question it. And you have to be critical accordingly, i.e., you have to question whether the employee dares to say that or whether he or she doesn't want to admit it." [Participant #4, age 31–40 years, team lead].*

For this, one leader explained that the leadership task should be considered relevant and time should be devoted to it.

> *"The freedom of leadership or the leader to say that these topics, these team meetings and also these one-on-ones, that they are important and that time is also allocated for them. I think leadership is often seen a bit like that: Yes, you still have a team here, in addition to your actual job. And I think that's often somewhat difficult for many people to understand. How much time do I really have to spend on my team in addition to my actual job?" [Participant #16, age 31–40 years, team lead].*

As a related point, about nine leaders explained that their own SelfCare, the health-oriented way they treat themselves, is relevant to practicing StaffCare. They described that in order to achieve this, first, one's own health and well-being should be considered important; second, awareness should be practiced (e.g., via self-reflection, a positive self-perception, personal attitudes, and knowledge of health-promoting work); and third, health-promoting behaviors should be practiced (e.g., exercise, spiritual rebalancing, spending time in nature, switching off from work, setting boundaries).

> *"Yes, of course you have to prioritize this issue for yourself, otherwise I think it's difficult to implement it well for others. If you didn't care at all about your own health and well-being, I can hardly imagine that I would be able to do this well for others." [Participant #9, age 51–60 years, head of department].*

Four leaders emphasized that high job demands, such as intense deadline pressure or high workloads, or unfavorable personal conditions, such as housing conditions, may cause increased stress and impede one's own self-care.

> *"That also depends on my personal mindset and my constitution at that moment, for sure. I noticed that my daily state, in quotation marks, varies a lot. There are days when I have really good sensors for it and can react well to it. And on other days where I'm just so caught up in my to-dos that I somehow don't have an eye for it. [...] Or I notice it the next day that something happened. But yes, it also depends totally on how I'm feeling myself and I had to learn to take care of my health first, in order to be able to help others from a strengthened position. [...] These are exactly the days when I don't have a free minute and meetings follow meetings." [Participant #5, age 31–40 years, team lead].*

Thereby, one person explained the importance of continuously applying health-promoting lifestyle patterns in order to be able to recall them more easily in stressful situations.

"If I'm not used to balancing myself out in sports or spiritually, if I'm basically rather negative or have difficulty dealing with changes or pay little attention to myself, have a poor relationship to myself [...]. And this is then multiplied by stressful situations or by a pandemic, I think, unfortunately. [...] There is just a special situation in a pandemic and everything that was there before in terms of good habits and life coping strategies can be accessed more easily." [Participant #6, age 51–60 years, head of department].

Furthermore, seven leaders stated that the leader has a duty of care and an important role model function (among other things, for SelfCare, trusting and fun cooperation, as well as proximity, openness and transparent communication).

"Of course, the role model function is very important. As a leader, I have to be healthy myself and have an eye for what that means, what's good for me and what's not good for me. I have to know what I shouldn't do and how I can set an example. For example: I will, and there I am also quite clear, I will always take my vacation leave and I will not take my 30 days over too. I don't have problems like that, because I know for sure that it's extremely important for me to get this time off and just get out and relax on vacation. That is super important to me. Just as a small example. And I will always pass that on to my employees: 'Do that.' I will also set an example, because I think it's extremely important that not everything is about work 365 days a year. That means the role model function is very important, so I believe that as a leader I must have understood what that means and must behave accordingly. Otherwise, I can't expect my employees to behave healthily themselves. That is also the case with various other issues." [Participant #15, age 31–40 years, team lead].

Last, two leaders added that leadership experience, e.g., via intensive leadership training, is conducive to the implementation of HoL.

"However, I also had 15 years of leadership experience at the [name of the company] and there were always very intensive training programs for leaders. How to deal with addictions, so I'm really very sensitized. I'm also very aware of what signals to look at. As a young leader, you are often overwhelmed: 'Oh, you can't talk about that now, if he always smells like alcohol.' You have to find ways to deal with that somehow. But you learn to pay attention to that: When does something change? Or when does an employee's behavior change when he becomes more and more quiet? And then you must also have the courage to ask: 'Are the tasks inappropriate? Or are you feeling bad? Can we do something?'" [Participant #14, age ≥ 61 years, team lead].

Organizational preconditions

All leaders indicated organizational preconditions for using HoL in virtual teams: from a supportive management, to a supportive, open-minded corporate culture, health-promoting working conditions, a wide range of institutional services and to an employee-oriented, supportive work council.

First, a total of ten leaders argued that management takes on a supporting role when it recognizes the relevance of occupational health and anchors it at a structural level, as well as acting as a role model.

"Yes, so our divisional management, with whom I have also worked closely in recent months, it already helps if they also keep an eye on such issues and also clearly communicate to employees that we should pay attention to each other, that if we are not doing well, we should talk openly about it with our supervisor or with other colleagues and that we need to actively communicate. Such calls came more frequently in recent months because this is already an issue and we simply see, especially in the HR department, that employees also face this issue of working so much from home and being in the office so little. And we try to balance that out as much as possible. But it really helps when management emphasizes this again. Every four weeks, there's a letter from the management, another official one, in addition to various other formats, where it's reminded that everyone should take the time to do this. And of course, that helps me as a leader too, in that it gives us even more legitimacy to ask." [Participant #5, age 31–40 years, team lead].

Second, fifteen leaders reported that a supportive corporate culture is another precondition for the implementation of HoL. They described that an open-minded corporate culture is beneficial for employees to discuss problems.

"And I would say that this openness, which is needed, is much more important than whether I meet the person face-to-face on site or not." [Participant #3, age 41–50 years, management].

Furthermore, several leaders explained that a cultural change in their company towards more self-organization or agile collaboration meant better conditions for leadership.

> *"Our management board or advisory board has just launched a project, or is in the process of launching one, where the topic is: culture. Culture in our company. It has been recognized that we need to implement a cultural change so that we can work together successfully in the future. And we are currently in the process of doing so. As I said, we started two years ago with an agile mindset, with agile methods. […] The management board and so on are also for now mostly on a first-name basis. Everyone is addressed by their first name. That wasn't the case with us in the past. […] And the communication channels, open communication and transparent communication. The fact that the management board now also publishes objectives, their own objectives and strategy, and so on, in teams. That was a bit different before. That was always hierarchical. The management board passed this on to its department heads, and they perhaps passed it on to the team leaders. And now it is passed on directly from management to all employees. So, the type of information policy has already changed." [Participant #1, age 51–60 years, head of department].*

In this regard, three participants also explained that there were still challenges in adapting to new working conditions during the COVID-19 pandemic, e.g., due to a change-resistant corporate culture or during cultural change.

> *"One thing is a lack of experience with introducing and implementing change. The organization is not used to this, and perhaps it is not wanted, because it is also somewhat uncomfortable." [Participant #7, age 41–50 years, management].*

Yet two leaders explained that the corporate culture may differ between teams and that good teamwork depends more on leadership and team culture than on corporate culture.

> *"I believe that this always depends on the team. I think you can be in a company that is super open and super cool and new work and so on, but you can have a manager who is just in the numbers and who will miss all empathy and then not even see that other employees just don't find it that cool. And conversely, you can have a company that has been on the market for a relatively long time, perhaps a bit encrusted in some way, which is probably the case with most long-established companies […]. And you can just as well have teams that are just totally cool and agile and strong in sharing. That's more how I would put it." [Participant #16, age 31–40 years, team lead].*

Third, ten leaders suggested that working conditions of employees and leaders in the company can influence leadership. They explained that high workloads, a lack of meaningfulness in the job, an inadequate workplace environment and ergonomics in the office or home office, or non-flexible working hours can impair HoL.

> *"Of course, we have flexible working hours, which certainly adds to that. Especially in the home office, it's possible at any time […]. So, for example, if an employee works for two hours, rides his bike for an hour, takes a shower and then works again for three and a half hours, then in case of doubt goes out with the dog and then works again for three and a half hours, as an example. So, the flexible work schedule is, of course, very convenient at that point. That's certainly helpful for healthy leadership." [Participant #9, age 51–60 years, head of department].*

Fourth, thirteen leaders added that a wide range of institutional services in their companies was perceived supportive for implementing HoL: i.e., a wide range of professional training for leaders and employees, workplace health promotion offers (such as healthy breaks, guided walks, sports and diet offers), regular employee surveys and consequent deduction of actions, communication opportunities with management (such as open-door meetings or digital events), networking offers and monetary offers (such as special leave days or a health budget for every employee).

> *"So, I have to say, I'm totally happy with my position and with my opportunities right now. And, as I said earlier, if the employee wants to, we can discuss everything. […] So I can actually offer my employees everything they need so that they can also work in a healthy way." [Participant #1, age 51–60 years, head of department].*

Last, three leaders argued that an employee-oriented work council is a supportive precondition for implementing HoL, especially in times of changing working conditions. It was described that a restrictive work council hindered the introduction of digital media or flexible working hours.

"The work council sometimes (laughs) has ideas that are not necessarily good for all employees. Because the work council sometimes wants to protect employees, but, for example, what I just said, if someone prefers to work in the evening because the kids are in bed at eight and then he can work well again, but the work council insists on saying: 'Okay, only until 8 p.m., you're not allowed to work any longer.' This would be counterproductive for some employees." [Participant #1, age 51–60 years, head of department].

Social preconditions

Overall, thirteen leaders stated that support by their team, by other colleagues or own supervisors are further conducive preconditions for implementing HoL in virtual teamwork.

First, a total of twelve leaders indicated that employee characteristics such as openness, trust, honesty, engagement, and ownership were experienced as supportive. Thereby, leaders explained that the implementation of HoL also requires the competence and trust of employees to open up in collaboration, to communicate honestly and to engage in this type of leadership, e.g., via mutual care for one another.

"And that the person, the employee, the colleague, that they participate. That they also open up. So, as I said, I can only talk to someone openly and honestly, I would say, if they are also open and honest. Otherwise, I may be on the wrong track and do him no good at all, because he may not give any or not the right feedback or honest feedback. For me, that is always an interplay." [Participant #1, age 51–60 years, head of department].

In addition, leaders described that employees' individual responsibility regarding their physical and mental health is challenged more in virtual than in face-to-face collaboration.

"Yes, that's exactly where it gets difficult, because the fact that you don't see people in person means that everyone works with an incredibly high level of self-discipline. In this case, self-discipline doesn't mean working as long as possible and as much as possible, but knowing where the limits are, where you stop. It may well be the case that someone demands more and more and at some point, you have to say, 'Stop. Here's a limit right now.'" [Participant #11, age 51–60 years, head of department].

According to one of those leaders, knowledge of team members through earlier face-to-face collaboration was conducive to virtual collaboration.

"One influence is certainly how well I know my team, my employees, the environment. I can imagine it being extremely difficult when, as a new leader, you start working for a company on a fully digital basis and have perhaps never seen your colleagues or employees before, or have only seen them digitally. So that is a framework condition that I imagine to be very difficult. […] So given the precondition of saying: […] I know the employees, I know what they can do, what they can achieve. Strengths and weaknesses. You can say that this also works, even digitally to a certain extent. But in the other situation, I think it's much more difficult to first earn this trust." [Participant #14, age ≥ 61 years, team lead].

Second, four leaders added that colleagues (e.g., for exchange on leadership topics) or own supervisors (e.g., no performance pressure, open-mindedness, autonomy) were experienced as supportive for practicing HoL.

"Yes, colleagues. Because I've been with the company for so long, I'm relatively well connected and have one, two, three, four contacts or colleagues who can help me with every topic or question. In this respect, I think I'm also quite well supported. Even beyond the site, i.e. nationwide, yes." [Participant #9, age 51–60 years, head of department].

"Yes, my supervisor. He allows me to lead in this way. He doesn't expect me to deliver fixed numbers that have to be achieved, no matter what. He is open for ideas, for new approaches, for suggestions. He also helps me to keep negative influences away from the team and to protect the group. So, I can only say that my kind of leadership would not be possible without my boss." [Participant #8, age 31–40 years, team lead].

Technical preconditions

Overall, five leaders indicated that a stable internet connectivity, sufficient technical equipment for all employees and IT support by the organization are among the preconditions for implementing HoL in virtual teamwork.

"If there were any problems, we have a good IT department, which serves as a direct point of contact." [Participant #4, age 31–40 years, team lead].

On the one hand, some leaders indicated that their company had fully met technical preconditions, while still

others indicated that challenges still existed, e.g., no uniform technical equipment for all employees, no standardization of digital communication channels and server infrastructure or a stable internet connectivity during international virtual collaboration.

> *"For people who live in regions or countries where the internet connectivity is not quite as reliable, it can happen that when they switch on their video stream, people suddenly become hard to understand or disappear from their meeting completely. So, they usually have to dial in acoustically or even use the telephone." [Participant #11, age 51–60 years, head of department].*

Comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork

A comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork showed that almost all leaders reported personal, organizational, or social preconditions for HoL in virtual teams. In contrast, technical preconditions were reported less frequently. With regard to social preconditions, it was found that all leaders with prior experience perceived their team as supportive, in contrast to half of leaders without prior experience. Figure 2 displays the group comparison graphically.

Preventive measures for promoting HoL in virtual teams

All leaders named existing or needed behavioral and structural preventive measures - which they found or would find helpful - to promote HoL in virtual teamwork (see Table 4).

Behavioral preventive measures

About eight leaders discussed on behavioral preventive measures that are beneficial for leaders themselves: further training on health-oriented, virtual or hybrid leadership, best practice exchange programs or individual coaching offers. Six of them referred to existing offers in their company.

> *"Yes, I would really like to see training on how to manage hybrid employees well, because that will be the next challenge. How can I integrate employees from the home office as well as those who are in the office? We will probably end up with a hybrid version, which is why I think it makes totally sense for us to take a closer look at what that means for us in concrete terms." [Participant #5, age 31–40 years, team lead].*

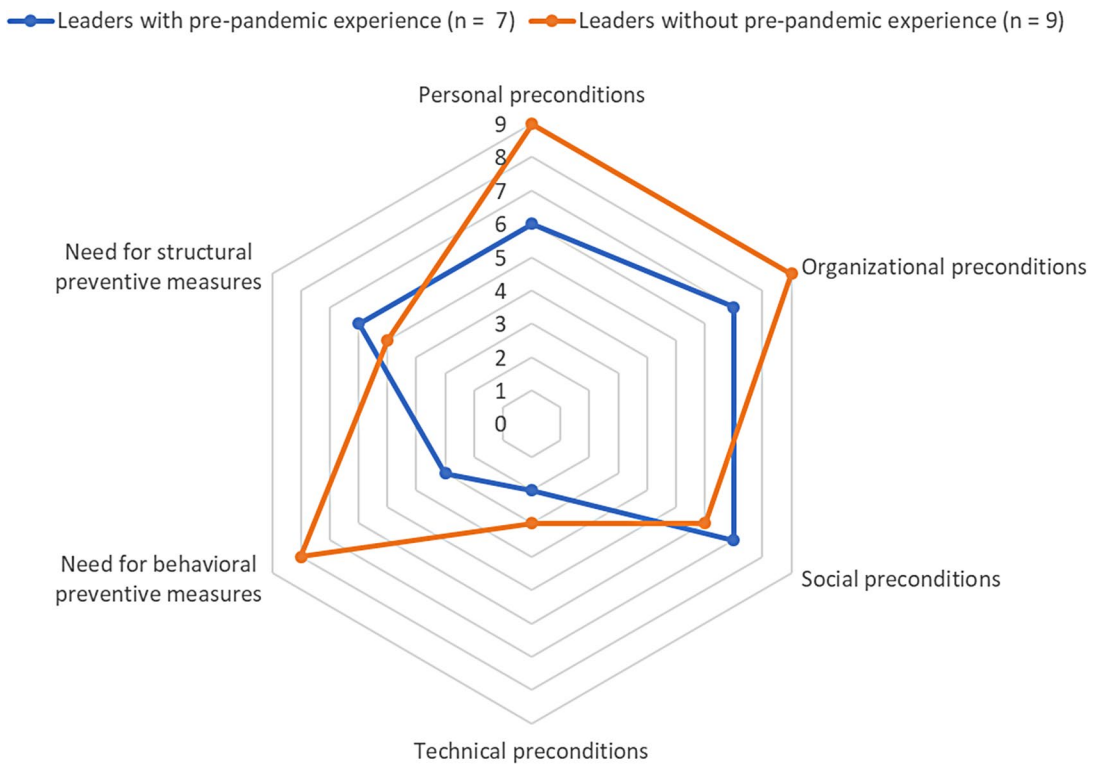

Fig. 2 Explorative comparison regarding preconditions and preventive measures for promoting HoL in virtual teams. *Note* An explorative comparison was conducted between leaders with and without pre-pandemic experience with virtual or hybrid teamwork. The number on axes corresponds to the number of leaders who have named respective preconditions and preventive measures for promoting HoL in virtual teams

Table 4 Summary of preventive measures for promoting HoL in virtual teams

Behavioral preventive measures	Structural preventive measures
Further training for leaders (8):	**Support from management (5):**
• e.g. on health-oriented, virtual or hybrid leadership • best practice exchange programs • coaching	• communication of appreciation • transparent information flow • support for cultural change towards enhanced autonomy • long-term, preventive focus on health and well-being of the workforce
Further training for all employees (5): • e.g. on self-care • more incentives • follow-up regularity	Improvement of technical equipment and general digitization processes (7): • uniform equipment of all employees with necessary technology such as webcams • lean communication channels • new technical solutions for digital, remote team and department development • further digitization, e.g. server, processes

Note The number in brackets corresponds to the number of leaders who have named respective preventive measures

In addition, five leaders outlined that behavioral preventive measures for all employees would be beneficial for developing employees' self-care, such as creating more incentives to increase awareness for health promotion. Two of them referred to existing offers in their company.

> *"Yes, self-responsibility, self-discipline, self-care. So that's what I'm missing and that's what I know one or the other employee was missing, also in the course of 'Now I have to take care of my child and then I have to keep track of my working hours and then there's another person calling me' and that you don't take yourself as important anymore. So, I think that if there were offers to heed alarm signals, [...] this issue - self-care - is quite present at the moment anyway." [Participant #8, age 31–40 years, team lead].*

Thereby, one participant pointed out that rather mandatory and especially regular offers for all employees are needed to promote the implementation of HoL.

> *"I think there are enough offers, I think one should achieve a certain regularity, sensitize again and again. [...] This is nothing new, but what you notice in daily business is that it gradually gets lost again and again. So, if you are not very disciplined or if you don't get an impulse again, then it is increasingly pushed back to the background. [...] That's why I think it would be important and good not only to make offers, but also to simply introduce mandatory seminars in this area." [Participant #9, age 51–60 years, head of department].*

In total, four leaders expressed no further need for behavioral preventive measures as there was already a sufficiently large range of services in their company.

> *"So, I'm not missing anything. I hope that there won't be any more, because then something completely different will happen, then we'll have an overflow of communication." [Participant #11, age 51–60 years, head of department].*

Another participant highlighted the need for both behavioral and structural preventive measures.

> *"I believe that in case of doubt, both are good. So, it basically goes hand in hand." [Participant #3, age 41–50 years, management].*

Structural preventive measures

About five leaders discussed support from management as beneficial for practicing HoL. This included appreciative and transparent communication to employees, especially during times like COVID-19 pandemic, when a great deal of uncertainty and frustration was prevalent among workforce.

> *"And what is left behind [...] I think it has a lot to do with appreciation. [...] that comes first of all from the leader, from the direct one. But I think above all, when the organization becomes larger, then at some point it stops. And at some point, employees start to think that they [management] are only interested in whether the business is running well. [...] Even if they [management] have good intentions, many decisions sometimes come across differently to the broad group of employees. And I think that was one issue. At a time when there is a lot of frustration, combating this frustration efficiently has to be managed by the leader. They have to be given the tools, because if they don't, the same thing will happen that takes place in the office. This, what do you call it? Trash talk? (laughs). That people vent their frustration in an unhealthy way. [...] It [affects communication] from the very top down to the lower leadership levels, where communication needs to be good as well." [Participant #16, age 31–40 years, team lead].*

Leaders explained that hierarchical management is a barrier to the practice of HoL. Management was also called upon to support staff during cultural changes towards enhanced autonomy by providing guidance. In this context, one leader explained that a long-term, preventive focus on health and well-being of the workforce is required from management.

"Well, I think it's very important that even in a medium-sized company like ours, the focus is on [health]. In order to prevent people from getting ill in the long term or quitting or simply not being able to perform at the level they normally would. And I know that from other companies as well. That's just something, yes, there's no focus on it. There is only a focus when you suddenly have a wave of employees quitting or poor quality, so you think: My gosh, what's the reason for that (laughs)? And then to recognize that some colleagues are just completely overworked or underworked, that usually takes a while. Because they run with the team and before you realize that something is wrong, it's often too late." [Participant #14, age ≥ 61 years, team lead].

Furthermore, seven leaders emphasized the need to improve technical equipment and general digitization processes, e.g., uniform hardware and software equipment for all employees with necessary technology such as webcams, lean communication channels, more stable servers or new technical solutions for digital, remote team and department development.

"Enabling even more digitization, perhaps having fewer channels at the same time. The fact that we have both Skype and Teams [two video conferencing systems] at the same time is a bit annoying, to be honest. And I would like to see greater speed in the process of migrating. Skype is supposed to be shut down and we're supposed to use Teams for everything, but that won't be implemented until the end of the year." [Participant #5, age 31–40 years, team lead].

Comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork

A comparison between leaders with and without pre-pandemic experience with virtual or hybrid teamwork showed that almost all leaders with prior experience identified a need for structural preventive measures. Regarding behavioral prevention measures, four leaders expressed no further need, referring to existing services offered by their company that they found helpful. In contrast, almost all leaders without pre-pandemic experience in virtual or hybrid teamwork reported a need for behavioral preventive measures. Moreover, five leaders indicated a need for structural prevention measures (see Fig. 2).

Discussion

The aim of the present study was to conduct qualitative interviews with leaders in order to gain new insights into the experiences and challenges for (ad hoc) SelfCare and StaffCare in virtual teams in times of the COVID-19 pandemic, into preconditions that may enable HoL in virtual teams and into preventive measures that may promote the use of HoL in virtual teams. To our knowledge, this study is the first to provide empirical results on preconditions of HoL in virtual teams during the COVID-19 pandemic and on explorative, qualitative group comparisons between leaders with and without pre-pandemic experience with virtual or hybrid teamwork. Reflecting upon our theoretical framework, the HoL model [16], an extension of the model by a holistic approach to context should be discussed (see chapter on implications for future research).

Implementation of SelfCare in home office during COVID-19 pandemic

Similar to present study results, previous studies indicated that leaders of virtual or hybrid teams also faced increased job demands and challenges during the COVID-19 pandemic, such as additional crisis management tasks [7], longer working hours due to increased workload [8], impaired mental health [9], and increased exhaustion with high appraised e-mail overload [6]. In times of increased job demands, higher levels of SelfCare may be beneficial in order to be able to take care of one's own health [18]. In relation to our research question of what experiences and challenges virtual leaders faced regarding (ad hoc) SelfCare during the COVID-19 pandemic, currently, only two studies exist that have examined SelfCare of leaders working in virtual teams. Thus, a quantitative study with leaders who led remotely from home offices during COVID-19 pandemic showed that leader SelfCare was effective in home office setting and had a positive impact on, amongst others, leader's health, well-being, job satisfaction, engagement, and commitment [9]. Likewise, present qualitative results indicated that leaders who experienced no challenges in implementing SelfCare in their home offices expressed job satisfaction with their flexible and self-responsible working conditions. Another qualitative interview study with virtual team leaders prior to COVID-19 pandemic demonstrated that SelfCare can be applied in virtual teams as well. In this study, leaders reported a high relevance for their own health, a high awareness of changes related to their health, and specific SelfCare behaviors: physical activity, boundary management, healthy nutrition, sleep, recreational activities, social exchange, time management, use of occupational health services and mental handling of stress [22]. Similarly, the leaders of the present study also reported behaviors such as self-reflection

and self-discipline to apply SelfCare. In contrast, however, our study presented challenges that were associated with the implementation of SelfCare during the COVID-19 pandemic, particularly among leaders who had no pre-pandemic experience with virtual or hybrid teamwork. Overall, no other comparable studies exist that analyzed leaders' self-directed leadership by their pre-pandemic experience with remote, digital collaboration.

Implementation of StaffCare in virtual teams during COVID-19 pandemic

Referring to our research question, regarding the experiences and challenges of virtual leaders in terms of (ad hoc) StaffCare during the COVID-19 pandemic, the current state of research on the feasibility of implementing StaffCare, associated challenges and StaffCare behavior is discussed as follows. In terms of subjective perceptions on feasibility of implementing StaffCare in virtual teams, there exists only one other qualitative study with virtual leaders, but from the period just before the COVID-19 pandemic [22]. In comparison to the present study, this previous study showed that all interviewed virtual leaders rated the relevance of employee health as high as their own and the majority stated that they were able to perceive changes in the health status of their employees also in the virtual work context. The sample consisted of leaders who were familiar with virtual leadership and collaboration – unlike the leaders in the present study, half of whom had to make an ad hoc switch to virtual collaboration [22]. Accordingly, results of the previous study are rather comparable to leaders with prior experience from the present results.

Similarly, to how the majority of leaders surveyed in this study mentioned challenges in perceiving employees' mental or physical health through digital communication due to fewer cues, previous studies also demonstrated leaders' challenges in implementing StaffCare. For example, a quantitative study surveying over 1,300 leaders shed light on leadership-specific challenges in the home office during the COVID-19 pandemic, with over 45.7% of leaders reporting that it was difficult to notice when someone needed support and over 41.8% stating that it was difficult to keep track of how much their own employees were actually working [9]. Three qualitative studies with leaders during the COVID-19 pandemic discussed that the transition to home office created difficulties in perceiving their employees (e.g., obtaining a sense of how their employees were managing with their tasks, detecting employees' individual level of motivation or identifying employees' support needs), which was experienced easier in the office before [7, 8, 31]. Another qualitative study with virtual leaders before the COVID-19 pandemic revealed that physical distance and reduced communication quality diminished leaders' awareness of employee health status [22]. And yet, a review on leadership when working from home also referenced several studies that outlined the challenges for leaders to perceive subtle signals or non-verbal communication via digital technologies or online meetings [47]. Independent of remote setting, an experimental vignette study showed that leaders' awareness of warning signals (for early detection of emerging depression and burnout among followers) may be facilitated by clarity of displayed warning signals of employees. In this study, leaders' awareness was highest when they perceived a combination of warning signals: employees' poor performance and socioemotional withdrawal [48]. Furthermore, our study found limited possibilities and quality of informal exchange via digital communications to be challenges of leaders in implementing StaffCare. Similarly, a quantitative study by Krick and colleagues [9] on HoL in home office during COVID-19 pandemic illustrated that as digital communication increased, less informal communication occurred and that 37.7% of leaders reported that it was difficult to exchange ideas spontaneously with employees. Also, a recent quantitative survey by Fraunhofer Institute for Industrial Engineering IAO found that about 35.1% agreed that networking among colleagues had worsened and 23.2% perceived a reduced interest in social exchange and related company offers due to working from home [49]. Other qualitative studies on HoL and transformational leadership during COVID-19 pandemic identified a lack of social presence, limited options for informal conversations, communication difficulties, lack of mutual trust and employees' lower willingness to talk about problems when using electronic forms of communication as challenges for leadership in a remote setting [7, 23]. In line with our results on leaders' difficulties maintaining or building proximity with existing or new employees via digital media, previous studies also demonstrated more intensive relationship design and maintenance as a challenge of virtual leaders [50–53]. Thus, numerous studies on virtual leadership highlighted the relevance of trust building for successful collaboration [22, 54, 55]. Last, our study indicated that leaders perceived their leadership to be impacted by employees' private challenges during the COVID-19 pandemic (e.g., due to childcare, limited housing, social isolation). Likewise, a panel survey in Germany during COVID-19 pandemic indicated an increase in gender and socioeconomic inequalities in parents' psychological well-being, such as higher parenting stress among parents working from home and parents with financial insecurity [56]. Further, a review demonstrated that also personal factors, such as living conditions or perceptions of isolation or loneliness, impacted employees' mental health [57] and their perceptions of remote or home office work [5]. Given the higher risk of experiencing isolation in virtual

teamwork, pre-pandemic studies pointed to a potential mitigating effect of leadership on perceptions of social or professional isolation among digitally collaborating personnel [11].

Moreover, our study discussed StaffCare behaviors of leaders dealing with particular leadership challenges during the COVID-19 pandemic. These included, consideration of employees' needs and competences (e.g., by promoting autonomy, participation and supporting boundary management), replacing spontaneous informal exchanges with proactive, planned communications in virtual collaboration, as well as restructuring their formal as well as informal team and one-to-one meetings. In comparison to our results, a quantitative study on digital StaffCare in home offices during the COVID-19 pandemic illustrated that there were great differences in leaders' self-reports and employees' peer-reports of health-promoting leadership behaviors [9]. Another qualitative study before the COVID-19 pandemic on StaffCare in virtual teams found that leaders reported trust building activities, health-oriented communication, support in boundary management, implementation of face-to-face meetings, and delegation of decision-making authority and responsibility as relevant leadership behaviors in this context [22]. Further, a review on leadership when working from home identified six overarching leadership behaviors that were beneficial for employee well-being and work performance: communicating and informing (e.g., frequent and regular communication), controlling and setting boundaries (e.g., transparent guidelines regarding working hours and breaks, availability requirements, supporting employees with boundary setting), allowing autonomy (e.g., showing trust in employees' performance and responsibility, delegating), supporting and showing empathy (e.g., emotional support, being available), valuing and sanctioning work from home to facilitate well-being (e.g., prioritizing health, leading by example), and balancing individual and collective needs (i.e., flexibly adjusting leadership to employees' individual needs and conditions while fostering a sense of community) [47]. Other studies on (ad hoc) virtual leadership during the COVID-19 pandemic referred to task-related behaviors (such as increases in meeting volume [31], setting a normal work schedule, creating a dedicated workspace, time management [53], setting team-specific rules [49]) and relationship-related behavior (such as setting aside time for building and sustaining relationships [58], being intentional about interactions, checking in with colleagues, engaging in informal team activities [53] and planning them in advance or initiating them strategically [59]).

Overall, according to current research, initial quantitative studies demonstrated the effectiveness of StaffCare also for digital, remote work contexts during the COVID-19 pandemic [9, 19–21]. Three of these studies analyzed StaffCare in comparison between office and home office [9, 20, 21]. Their findings indicated i.e. positive effects of StaffCare on employees' well-being [20] as well as negative effects on employees' mental exhaustion [21] and psychosomatic complaints [20] in both work contexts whereas two studies found lower effectiveness of StaffCare on employees' engagement and job satisfaction in home office in comparison to office [9, 21]. Furthermore, two other studies conducted during the COVID-19 pandemic showed that, one, telework-oriented leadership (including StaffCare) affected teleworkers' happiness well-being via strain by ensuring communication and information exchanges between teleworkers [60] and, two, that the positive relationship between StaffCare and follower health was stronger in times of crisis [61]. Lastly, according to current state of research, there are no comparable studies that have conducted a group comparison between leaders with and without prior experience with digital, remote collaboration in relation to healthy leadership.

Preconditions of HoL in virtual teams

In a literature review on work design and remote working, Wang and colleagues [26] argued that prior to the COVID-19 pandemic, studies often considered work characteristics as moderators or mediators in the relationship between remote work and work experiences. Their third proposed approach, which was described as more appropriate for understanding remote working experiences for the period during the COVID-19 pandemic, no longer considered remote work as an independent variable but as a context, and thus work characteristics as antecedents in that context. The meaning of certain work characteristics such as social support was described as being shaped in the context of virtual work [26]. In addition, a recent review on leadership in virtual work settings outlined that work characteristics may have specific and sometimes diverse impacts on leadership effects and that these opposing mechanisms need to be taken into account [30].

Referring to our research question, regarding the enabling preconditions for HoL in virtual teams, the current state of research on personal, organizational, social and technical preconditions in this respect are discussed as follows. Leaders in the present study identified leaders' characteristics and self-care, role modeling and leadership experience as personal preconditions for using HoL in virtual collaboration. To date, based on current research, only one qualitative study conducted prior to the COVID-19 pandemic exists that identified leader characteristics (leaders' own ambition, too high demands and expectations towards oneself) as aggravating factor for using HoL in virtual collaboration [22]. In comparison

to our results, in another qualitative study with leaders during the COVID-19 pandemic, technology literacy was most frequently reported alongside other relevant remote work skills and behaviors: being independent, communication, strong work ethic, ability to manage distractions, time management, personality (extraversion), supporting coworkers [53].

Similar to how leaders in the present study considered organizational preconditions for applying HoL in virtual collaboration, a qualitative study with virtual leaders from Germany also referred to a supportive management, flexible working conditions, an open-minded corporate culture and structural offers (e.g., occupational health offers or training courses) as supporting factors for leaders of virtual teams [22]. Other studies also indicated the relevance of organizational support for digital, remote leadership during the COVID-19 pandemic [7, 8, 31, 53]. Thus, with regard to management support, an interview study with leaders in Denmark pointed to the positive impact of crisis communication across the organization, although more concrete guidance for remote leadership was desired [8]. In terms of health-promoting working conditions, previous qualitative interview studies during the COVID-19 pandemic reported that high workload and less structured processes were perceived detrimental to remote leadership [7], and that agreements with management on working hours were perceived supportive in facilitating setting boundaries between work and leisure [31]. Additionally, a recent review on virtual leadership proposed a model on leadership in virtual settings illustrating qualifying factors of electronically mediated interaction (such as spatial or temporal dispersion) in the relationship between virtual leadership and employee outcomes [30]. In line with present results, institutional services were considered supportive for virtual leadership in other studies too: reimbursement for use of private electronic devices in home office as well as training on the use of new ways of working and digital communication including help by technical teams and management [31] (although in one study tools, advice and support was experienced more helpful at the beginning of the pandemic, but as it progressed, the support was lacking behind leaders' experiences and not fitting their needs [8]). Further, similarly to our findings, an interview study with leaders from a healthcare organization in Canada found that corporate culture was a relevant enabler of remote work, which included supporting staff, positive perceptions of remote work, a value-focused organization, and embracing geographically dispersed teams [53]. However, independent of remote work context, studies on HoL investigated leaders' job resources [32] and demands [48], organizational health climate [35, 36]), high-performance work practices or health-oriented human resources management strategies [37] as antecedents of HoL.

Consistent with our findings on social preconditions, other qualitative studies regarding virtual leadership before [22] or during the COVID-19 pandemic [7, 8] also identified social support by team, colleagues or own supervisor. On the one hand, self-organized teamwork, mutual support by the entire team [22], and a positive team spirit [8] were experienced as supportive (although one study pointed to a decrease in motivational team climate due to the implementation of virtual teamwork [7]). On the other hand, team members were also experienced as supportive by also paying attention to interpersonal conflicts or communication problems [22], showing commitment, dedication, and enthusiasm for the collaboration, and thus generating well-being through socialization among leaders [8]. Furthermore, social support by colleagues was described in terms of exchanges on good leadership practices and lessons learned (or by observing good leadership practices among colleagues [22]), inspirational and emotional support, and having a broad network in the organization [8]. In contrast, unhealthy leadership behaviors of leaders' own supervisor were reported as another aggravating factor for applying HoL in virtual teams [22]. Previous studies on HoL beyond remote work research also assessed social support by colleagues [33], employees' disclosure [62] and team health climate [34] as antecedents of HoL.

Although few leaders reported technical preconditions as a basis for HoL in virtual teamwork in the present study, other qualitative studies also pointed to technical problems in remote and digital collaboration such as poor internet connection, problems accessing data, inappropriate or inadequate home space and equipment [22, 31, 53]. Thus, it was reported that successful organizations in implementing working from home provided employees with remote data access solutions, upgraded hardware and software, made equipment available for home office use, provided IT support services, and offered ongoing support for leaders, IT professionals and technical teams to keep work running smoothly [31]. In addition, a quantitative study pointed to the impeding impact of ICT hassles on the positive relationship between StaffCare and employees' mental health [19]. Another study suggested higher irritation levels among leaders experiencing more ICT hassles which was further linked to lower levels of StaffCare [63].Finally, while some of the studies referenced included leaders with varying levels of pre-pandemic experience with digital, remote collaboration [8, 31, 53], their findings were not presented or analyzed by prior experience. Accordingly, there are currently no comparable studies on preconditions of HoL that have conducted a group comparison

between leaders with and without prior experience with digital, remote collaboration.

Preventive measures for promoting HoL in virtual teams

Referring to our research question regarding preventive measures for promoting HoL in virtual teams, our results showed that all leaders named a variety of existing or needed behavioral preventive measures (e.g., further training for leaders and all employees) and structural preventive measures (e.g., support by management, improvement of technical equipment or general digitization processes). Similarly, a qualitative study with leaders from a healthcare organization in Canada that had little experience with managing remote work prior to the COVID-19 pandemic found that both behavioral and structural preventive measures were identified to support remote work in the future. On the one hand, the development of individual skills (e.g., managing virtually, maintaining rapport virtually, technology literacy, virtual soft skills, self-management) was suggested, and on the other hand, organizational changes (e.g., organizational culture shifts such as establishing trust in remote workers or "camera-on" culture, clear policies and processes, greater participation of employees, improved IT support and provision of appropriate technology and equipment) were proposed [53]. According to current research, there are hardly any further studies on prevention measures in virtual teamwork and leadership as well as on group comparisons between leaders with and without prior experience with digital, remote collaboration.

Implications for future research

This qualitative study allows for hypothesis generation and yields many implications for future research. Overall, according to current state of research, to date there is no sound evidence on HoL implementation in digital remote collaboration [11, 18]. Therefore, future research should investigate, through experimental or qualitative studies, the StaffCare awareness of virtual leaders and how leaders can detect early warning signals via digital media. Moreover, future qualitative studies should also shed light on the employee perspective and examine how StaffCare is perceived by virtual team members, identifying challenges and differences to face-to-face StaffCare. Furthermore, quantitative longitudinal studies should survey the relationship between HoL and health- and work-related outcomes of virtual leaders and their team members in the future. In this regard, both external and self-reports should be considered, either by surveying dyads (leader and employee), entire teams (leader and team members) or in terms of a 360-degree feedback (e.g., leader, team members, supervisor, colleagues, customers).

Since there is still a great need for research on relevant influencing factors for virtual leadership and employee outcomes in general [11, 30], but also specifically on preconditions of HoL in traditional face-to-face as well as in digital remote work settings [18], it is recommended for future research to investigate diverse personal, organizational, social and technical preconditions in this context. This should include a differentiated and holistic examination of the specific conditions that leaders and employees need in order to effectively implement SelfCare and StaffCare in virtual teams. Further, it should be taken into account that characteristics of virtual teamwork may have partly diverse impacts on leadership effects [30] and that there cannot be a one-size-fits-all approach. Interventional studies are particularly recommended to study leadership effects post improvement of working conditions (e.g., via training programs on HoL or organizational culture change processes, see chapter on practical implications). In addition, future research should reveal how overarching contextual conditions such as the COVID-19 pandemic might differ from the post-pandemic period in their impact on virtual leadership.

Implications for practice

Our findings highlight that in times of crisis such as the COVID-19 pandemic, in which abrupt workplace-related changes are imperative, challenges emerge for leaders in terms of their SelfCare and StaffCare. Moreover, it can be inferred from present exploratory results that prior experience with regular virtual or hybrid teamwork as well as adequate and comprehensive training prior for this activity may facilitate the implementation of HoL in times of crisis. Initial intervention studies on the effectiveness of HoL in traditional, face-to-face work settings indicate positive results of leadership interventions [64, 65] – although no other intervention studies exist yet for the virtual work context [18]. Furthermore, our results suggest that, in addition to enabling leaders and employees for HoL in virtual teams on a personal level, the organization also needs to adapt working conditions at the organizational, social, and technical levels. Thus, for successfully establishing a health-promoting leadership culture in an organization, a holistic perspective is required. For this purpose, a meta-analysis on workplace resources at the individual, the group, the leader, and the organizational levels in relation to employee well-being and organizational performance found that interventions at all of those four levels were effective. Accordingly, it was recommended that while organizations may engage at any level to effectively strengthen resources for employees, multilevel interventions should be preferred due to synergistic effects [66].

Overall, our findings on experiences, preconditions and preventive measures of HoL in virtual teams provide helpful insights for and recommendations for occupational health promotion in virtual teams. Thus, the first

step is to perform a well-founded assessment of the organization through strong employee participation in order to identify the status quo and areas for action according to existing needs. After implementing interventions, a second step should take continuous, evidence-based evaluations into account. In this regard, organizations should note that, especially in times of crisis, ongoing, adapted organizational support is required according to actual and changing needs of employees. A list of possible areas for action are presented in Table 5.

Strengths and limitations

Our study demonstrates several strengths. First, our study provides a valuable contribution to improving our understanding of the implementation of HoL in virtual collaboration – particularly in light of the massive worldwide increase of remote working during the COVID-19 pandemic. Moreover, using a qualitative research approach allowed for initial exploratory research findings in a new field of research [38]. Applied methods coincided and were appropriately selected for the subject. The PCI interview method enabled participants to speak openly about their experiences, combined with a structured interview procedure based on an interview guide. Conducting telephone interviews provided advantages in terms of research economy as well as flexibility in time and place to meet participants' personal conditions. Consequently, anonymity during telephone interviews was perceived to be beneficial in building trust. Last, another strength lies in our sample distribution and size. The roughly equal distribution of the sample into two groups as to pre-pandemic experience with virtual or hybrid

Table 5 Practical implications for promoting HoL in virtual teams

Level of measure implementation	Behavioral preventive measures	Structural preventive measures
Personal	For leaders: • Empowerment of own health literacy: awareness for role model function, self-responsibility and health-oriented self-leadership • Further training and strengthening of leadership skills: e.g. on health-oriented, virtual/hybrid leadership (if applicable, specific further training on detecting early warning signs of mental illness and dealing with highly stressed employees) • Coaching For all employees: • Further training: needs-based qualification and skills reinforcement • Empowerment of own health literacy: self-responsibility and health-oriented self-leadership • Professional support in psychosocial employee counseling	For leaders: • Leadership programs for existing and new leaders • Instruments and leadership guidelines for orientation, e.g. annual employee interviews, 360-degree feedback tool For all employees: • HR development programs: transparent horizontal and vertical career paths
Organizational	• Use of measures for organizational culture development, e.g. training in dealing with failures (for building a culture of learning from failures) • Use of a wide range of institutional services, e.g. workplace health promotion offers	• Strategic alignment for cooperative collaboration between management, work council, human resources and change departments, and occupational health and safety • Support from management: role model function, long-term, preventive focus on health and well-being of the workforce, communication of appreciation and transparency • Establishing flexible, health-promoting working conditions • For organizational culture development: definition of corporate values, integration into corporate strategy • Participation of employees: regular employee surveys
Social	• Joint qualification and awareness measures in the team, team development measures • Formal and informal exchange formats for virtual collaboration among employees and leaders, e.g. best practice exchange programs • For communication problems and for dealing with conflicts: internal mediators or external experts for team consultation	• Promoting informal exchange: releasing budget for face-to-face meetings, enabling virtual teams to come together at regular times for social events
Technical	• Ongoing training for IT support services teams • Training for all employees when introducing new technical tools and workplace changes	• Provision of adequate IT support services • Improvement of general digitization processes, e.g. stable internet connection, lean communication channels, remote data access • Upgraded uniform technological equipment for all employees for offices and home offices • New technical solutions for digital, remote team and department development

teamwork allowed for an exploratory qualitative group comparison. Our 16 conducted interviews were sufficient to achieve theoretical saturation [67].

Yet this study has some limitations. First, due to chosen recruitment strategy (snowball system), participant drop out could not be fully traced. According to qualitative research, no generalizability of research results but hypothesis generation was intended. Nevertheless, it must be mentioned that any external influences during our telephone interviews, e.g. due to technical malfunctions in individual interviews, could not be controlled – although no consequences for the course of the interview were determined. Furthermore, our results only represent a leader perspective. In addition, self-selection bias and socially desirable response behavior could not be entirely avoided. It remains questionable whether the participants also assign the same importance to health apart from the interview situation or whether their self-reports match their actual leadership behavior. When interpreting the explorative group comparison, it is important to note that quantitative data of radar charts are not comparable without limitations. Despite using an interview guide, participants were free to decide what they wanted to report on the questions. Thus, not all participants commented on all categories. In addition, although qualitative data collection and analysis methods were carefully applied as well as critically reflected by the interviewer by means of postscripts, multiple realities (i.e. influences through researcher's perspective) cannot be completely eliminated in qualitative research [39, 42]. Last, it is necessary to consider the context of study conduct when interpreting results. Although it was intended to capture experiences with (ad hoc) leadership during the COVID-19 pandemic, dynamic pandemic trajectories over time must be considered. The data were collected in 2021, a period when a great deal of transition and uncertainty still existed in many organizations regarding virtual or hybrid collaboration and leadership [26, 68]. It can be discussed whether a habituation effect occurred in later stages of the pandemic, so that pre-pandemic experience with virtual or hybrid teamwork no longer made a decisive difference for leaders.

Conclusions

Given the increased digitization and workplace-related changes during the COVID-19 pandemic, the aim of this study was to examine the experiences of virtual leaders during the COVID-19 pandemic and to identify preconditions and preventive measures for promoting HoL. By using a qualitative research approach, we illustrated that leaders, regardless of pre-pandemic experiences with virtual leadership, faced diverse challenges in implementing HoL in (ad hoc) virtual teamwork during the COVID-19 pandemic. Overall, we found that implementing SelfCare and StaffCare in virtual teamwork is very challenging and complex – apart from leaders' own awareness and motivation, they have to consider many external influences to be able to apply appropriate leadership behavior. Thereby, our study presented initial empirical findings for a holistic approach to HoL implementation in virtual teams, considering beneficial preconditions on personal, organizational, social and technical levels. This study provides a basis for future research, including longitudinal and interventional studies to analyze the causal relationships between preconditions, HoL in virtual teams and health-related outcomes. In particular, we recommend a holistic research perspective in order to understand the complex, contextual interdependencies of leadership. In practice, a holistic perspective is also recommended, which requires a differentiated implementation and evaluation of multilevel behavioral and structural preventive measures adapted to the needs of employees and the organization in order to achieve effective change in organizations.

Abbreviations

SelfCare	Health-oriented self-leadership
StaffCare	Health-oriented employee leadership
HoL	Health-oriented leadership

Supplementary Information

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Supplementary Material 1: COREQ checklist

Supplementary Material 2: Interview guide

Supplementary Material 3: Coding tree

Supplementary Material 4: Interview quotes

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Author contributions

Conceptualization, I.E. and S.M.; methodology, I.E. and S.M.; data curation, I.E.; data analysis, I.E.; visualization, I.E.; writing—original draft preparation, I.E.; writing—review and editing, I.E., V.H. and S.M.; supervision, V.H. and S.M.; project administration, I.E., V.H. and S.M. All authors have read and agreed to the published version of the manuscript.

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Data availability

The data analyzed during the current study are not publicly available due to German national data protection regulation. The data used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was conducted in accordance with the Declaration of Helsinki and approved by the Local Psychological Ethics Committee of the Hamburg Psychosocial Medical Center of the University Medical Center Hamburg-Eppendorf, Germany (LPEK-0240). All study participants received written information about the study beforehand and signed an informed consent form regarding the data collection, transcription and analysis of the interviews.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests in this study.

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Erklärung des Eigenanteils an den Publikationen

Publikation 1 – Scoping Review

Die Doktorandin war federführend in der Planung, Konzeption und Projektadministration der ersten Studie beteiligt. Die methodische Umsetzung (das Titel- und Abstract-Screening, das Volltext-Screening, die Datenextraktion der eingeschlossenen Studien, die Datenauswertung, Interpretation und Qualitätsbewertung) erfolgten durch die Doktorandin. Die Visualisierung ebenso wie die Präsentation der Ergebnisse auf nationalen und internationalen Fachkonferenzen führte die Doktorandin durch. Die Erstellung und Überarbeitungen des Manuskripts erfolgten ebenfalls durch die Doktorandin als Erstautorin.

Publikation 2 – Quantitative Längsschnittstudie

Auch bei der Planung, Konzeption und Projektadministration der zweiten Studie war die Doktorandin federführend beteiligt. Da es sich um eine Zusammenarbeit mit der Universitätsprofessur für Arbeits-, Organisations- und Wirtschaftspsychologie der Helmut-Schmidt-Universität Hamburg handelte und zum Zeitpunkt der Zusammenarbeit die Datenerhebung abgeschlossen war, führte die Doktorandin die statistische Datenanalyse der Längsschnittstudie, die Datenvisualisierung sowie die Ergebnisinterpretation durch. Zudem stellte die Doktorandin die Ergebnisse auf einer internationalen Fachkonferenz vor. Die Erstellung und Überarbeitungen des Manuskripts erfolgten ebenfalls durch die Doktorandin als Erstautorin.

Publikation 3 – Qualitative Interviewstudie

Zuletzt war die Doktorandin ebenfalls federführend bei der dritten Studie in der Planung, Konzeption und Projektadministration beteiligt. Für die methodische Umsetzung (Rekrutierung der Stichprobe, Durchführung der Interviews, Datenauswertung und -interpretation) war die Doktorandin verantwortlich. Ebenso oblagen die Visualisierung und Präsentation der Ergebnisse auf nationalen und internationalen Fachkonferenzen der Doktorandin. Sie erstellte das Manuskript und führte etwaige Überarbeitungen als Erstautorin durch.

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Eidesstattliche Versicherung

Ich versichere ausdrücklich, dass ich die Arbeit selbständig und ohne fremde Hilfe, insbesondere ohne entgeltliche Hilfe von Vermittlungs- und Beratungsdiensten, verfasst, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt und die aus den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen einzeln nach Ausgabe (Auflage und Jahr des Erscheinens), Band und Seite des benutzten Werkes kenntlich gemacht habe. Das gilt insbesondere auch für alle Informationen aus Internetquellen. Soweit beim Verfassen der Dissertation KI-basierte Tools („Chatbots“) verwendet wurden, versichere ich ausdrücklich, den daraus generierten Anteil deutlich kenntlich gemacht zu haben. Die „Stellungnahme des Präsidiums der Deutschen Forschungsgemeinschaft (DFG) zum Einfluss generativer Modelle für die Text- und Bilderstellung auf die Wissenschaften und das Förderhandeln der DFG“ aus September 2023 wurde dabei beachtet. Ferner versichere ich, dass ich die Dissertation bisher nicht einem Fachvertreter an einer anderen Hochschule zur Überprüfung vorgelegt oder mich anderweitig um Zulassung zur Promotion beworben habe. Ich erkläre mich damit einverstanden, dass meine Dissertation vom Dekanat der Medizinischen Fakultät mit einer gängigen Software zur Erkennung von Plagiaten überprüft werden kann.

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