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Working from home during COVID-19 in a Danish hospital research setting: Experiences of researchers and healthcare providers, explored by Group Concept Mapping

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ABSTRACT

Objectives: The COVID-19 pandemic has changed the working environment, how we think of it, and how it stands to develop into the future. Knowledge about how people have continued to work onsite and adjusted to working from home during the COVID-19 lockdown will be vital for planning work arrangements in the post-pandemic period. Our primary objective was to investigate experiences of working from home or having colleagues working from home during a late stage of the COVID-19 lockdown among researchers and healthcare providers in a hospital research setting. Secondly, we aimed to investigate researchers' productivity through changes in various proxy measures during lockdown as compared to pre-lockdown.

Design: Mixed-method participatory Group Concept Mapping (GCM).

Setting and participants: GCM, based on a mixed-method participatory approach, was applied involving researchers and healthcare providers online sorting and rating experiences working from home during the COVID-19 pandemic. At a face-to-face meeting, participants achieved consensus on the number and labeling of domains—the basis for developing a conceptual model.

Results: Through the GCM approach, 47 participants generated 125 unique statements of experiences related to working from home, which were organized into seven clusters. Using these clusters, we developed a conceptual model that illustrated the pros and cons of working from home.

Conclusion: The future work setting, the role of the office, and the overall work environment need to respond to workers' increased wish for flexible work arrangements and co-decision.

Keywords: Cluster analysis; Content validity; Corona; Co-decision; Home confinement; Lockdown; Mind map; Multidimensional scaling; Work/Life balance

INTRODUCTION

In the beginning months of 2020, the COVID-19 pandemic began to sweep across the globe(1). To contain and mitigate the spread of COVID-19, many countries ordered a lockdown of public institutions that did not perform critical functions. In the early lockdown, many countries reported high rates of symptoms of anxiety, depression, post-traumatic stress disorder, psychological distress, and stress(2). Studies have shown that such symptoms were particularly acute among healthcare workers(3), and that caregivers with COVID-19 patient contact had a higher prevalence of depression, anxiety, stress, and burnout syndrome compared to caregivers without patient contact(4). Lockdowns also strongly affected economies, resulting in many people losing their jobs or being furloughed until the pandemic was under control(5). Notably, lockdowns exerted a greater negative effect on the well-being of unemployed and furloughed persons than on the employed(6).

Where possible, many public and private organizations remedied the situation by imposing a remote work policy, making it possible for many employees and managers without frontline responsibilities to work from home. People who worked from home often had to care for children who were home due to the closing of childcare and schools. Studies have investigated the early lockdown effect of home confinement and telework on mental well-being and psychological distress and have documented the distress felt by workers with demanding jobs, with a higher educational level, and those who were not sheltering at home(7). Interestingly, physicians working at the hospital as compared to those working from home showed only a higher prevalence of stress, whereas exhaustion, anxiety, and depression remained the same among the two groups(3).

Positive experiences from the coronavirus-induced lockdown also have emerged(8), both on a general level where the initial lockdown was characterized as a time with greater sense of belonging due to an overall societal feeling of togetherness(9), and, more specifically, in relation to working from home. Themes and experiences that have been identified in working from home include a better work-life balance

with more flexibility, increased work-efficiency with less disruption from co-workers, a better work environment, more effective meetings, easier access to co-workers, and a higher sense of work control (10). Thus, the experiences of early stage lockdown among hospital workers—both of physicians and others working from home—were mixed, and the reports do not give a clear picture of when and for whom it was beneficial to work from home. Most of the previous studies investigated the early stage of lockdown, when the situation was new and unknown. It is possible that by later on, when lockdown had become 'the new normal, 'workers' attitudes toward home confinement might have changed.

In order to rethink the future of work by giving people the option of choosing who and what tasks are suitable for remote and onsite work, we should learn from the experiences of employees with mixed job functions working from home or having colleagues working from home at a later stage of lockdown. Knowledge concerning what influences workers' preferences for home and onsite work and what tasks are suitable for the two work environments will be important for optimal planning of work arrangements in the post-pandemic period.

The overarching aim of this study was firstly to investigate experiences of working from home or having colleagues working from home during the of COVID-19 lockdown at a late stage among researchers and healthcare providers in a hospital research setting. Secondly, it aimed to investigate the researchers' productivity during lockdown as compared to pre-lockdown. Knowledge obtained from this study might be used in rethinking the future of work, modifying the role of the office, and creating a more conductive work environment.

METHODS

Study design and procedures

To address the first aim of the study and ascertain broad perspectives on experiences from the COVID-19 late stage lockdown, the authors of this study ('the author group') applied Group Concept Mapping (GCM), a methodology for generating and structuring ideas on a specific topic, based on a mixed-method participatory approach(11 12). The GCM process includes the following phases: 1) preparing, 2) generating ideas (brainstorming), 3) structuring statements (sorting and rating), 4) performing GCM analysis, 5) interpreting the map (validating), and 6) utilizing (developing a conceptual model) (12). The results are illustrated in maps where ideas on the specific topic are organized thematically. Participants in GCM studies are involved in several steps of the research process, including generating ideas, structuring statements and interpreting the map. The GCM process may involve face-to-face group sessions, online participation, or both(11).

In this study, generating ideas and structuring the statements was conducted online between June 1, 2021 and June 21, 2021 using the Concept System® Groupwisdom™ software, designed to support each step in the GCM process (Concept Systems Incorporated, 2019). Interpretation of the map took place at a three-hour face-to-face validation session in June 2021. Members of the author group, except for the last author, were also invited to take part in the study along with the participants. The last author was responsible for conducting the GCM process, including preparation, the GCM analysis and being chair at the validation meeting.

Participants and setting

The study took place at the Parker Institute, a clinical research institute within the hospital system in the Capital Region of Denmark. Potential participants were employees, without tradition for working from home,

at the Parker Institute during the COVID-19 lockdown who were working as researchers, clinicians, research assistants, and technical-administrative staff. While most of the staff was working from home, researchers, clinicians, research assistants involved in ongoing data-collections, and doctors taking part in the COVID-19 emergency response and preparedness all attended physically at work.

GCM: Data Generation

The previously described process of GCM serves as a structure describing the procedures in the study.

Preparing for GCM: Before initiating the data collection, the first and last authors formulated and piloted a seeding question. The final version was: "What experiences have you had in connection with your / your colleagues' working from home during the Corona pandemic?"

Generating ideas (Brainstorming): Potential participants were invited to participate by email with links to online participation using the CS® GroupwisdomTM software. Participants were instructed to think broadly and generate as many answers as possible in response to the seeding question. They were reminded to keep each answer short, with only one meaning.

The statements generated were then consolidated; the first and last authors individually identified redundant statements (i.e., ideas with the same wording or meaning). Next, they met and discussed their findings. Based on consensus, redundant statements were removed, and minor linguistic revisions were made to clarify the meaning. The remaining statements were then imported into CS® Groupwisdom™ in preparation for phases three and four.

Structuring the statements (Sorting and Rating): Again, potential participants were invited to participate by e-mail in the sorting and rating, with a link to online participation using the CS® Groupwisdom™ software. They were presented with the total number of statements and asked to organize all statements into piles, in any way that made sense to them. The only rules were: (A) there must be more than one pile, and (B) there must be fewer piles than the number of statements. Each participant was asked

to label each pile of statements and—based on the seeding question—rate the importance of each statement on a four-point ordinal scale: (1) *"Not at all important,"* (2) *"Somewhat important,"* (3) *"Important,"* and (4) "*Very important.*" Pooled analysis of GCM studies indicated high reliability estimates for sorting and rating processes, as well as high representational validity(13).

Data analyses

GCM analysis (Data analysis): Based on the sorting and ratings, multidimensional scaling and cluster analyses were performed, in which related statements were grouped into clusters (11). To ensure the quality of the overall sorting and rating data, single-participant data from phase three were included in the cluster analysis if more than 75% of the statements were sorted (11) and if fewer than five statements remained unrated.

Within the multidimensional scaling analysis, 'stress value' is the statistic used to indicate congruence between the raw data and the processed data (goodness of fit). A low stress value (considered to be any value <0.39) indicates a good fit. During the cluster analyses, several cluster solutions were generated, and the one that matched the data the best (i.e., the cluster solution representing sufficient details on the topic) was applied, creating the Cluster Rating Map. Based on the labels provided by the participants, cluster labels were suggested by the CS® Groupwisdom™ software. Proximity of clusters on the map indicates how related they are; clusters closer together are more related than those further apart. The height of a cluster signifies its relative importance, with higher clusters (i.e., the number of layers) containing statements being rated as more important.

Interpreting the map (Validating): At the face-to-face validation session, participants met to interpret and validate the results. Based on the Cluster Rating Map and an overview of clusters and statements presented by the last author, participants were instructed by the last author to in small groups (a) determine if each statement was placed in the right cluster, (b) consider the number of clusters, and (c) consider if the

cluster labels illustrated the theme of the cluster. Statements fitting into more than one cluster were to remain in their designated cluster, and only statements clearly misplaced were to be moved. Reflections and suggestions were discussed to obtain consensus.

Utilizing (Developing a conceptual model): Based on the validated Cluster Rating Map, a final conceptual model was developed. To develop the model, the author group met to refine cluster labels and to reach consensus on a final conceptual model.

Demographic data and descriptive statistics

When the GCM process was finalized, the author group send out an anonymized online questionnaire concerning demographic information and work-related functions to all invited participants using the Electronic Data Capture system (REDCap) during late August and early September 2021(14). Three reminders were sent to the invited participants. Characteristics of the study population are presented as count and percentages for categorical data, and median with interquartile ranges (IQRs) for continuous variables using the statistical software SAS/STAT® (release 9.4; SAS Institute, Cary, NC).

Researcher productivity and proxy measures

To investigate researchers' productivity, the number of employees, scientific publications, man years, and funding applications sent were compared in the periods January 1 through December 31, 2019 (i.e., before the pandemic and lockdown) and January 1 through December 31, 2020.

Patient and Public Involvement

Using a GCM approach, the participants were naturally involved early in the research process. The research question (the seeding question) was based on an overall public interest in the area of working from home.

The question was piloted and approved by colleagues not included as authors. The public was not involved in the choice of study design, but the design was chosen due to the participatory design.

Ethical considerations

According to Danish legislation, approval from the Committee on Health Research Ethics and the Danish Data Protection Agency was not required, as no subjects were exposed to medical interventions/devices and no sensitive data were collected. Electronic informed consent was obtained, and all participants were informed about their right to withdraw at any time from the study.

RESULTS

Among 68 invited employees, 43 (63%) responded to the questionnaire. Two respondents did not participate in the online GCM program or the face-to-face validation meeting and were removed from the final sample (n=41, 60%). **Table 1** presents the demographic data of the participants. Of the final 41 participants, 34 (83%) were female, had a median (IQR) age of 45 (39-51) years, and 19 (48%) had children below 15 years of age living at home. The median (IQR) number of individuals in the household was 3 (2-4). Almost a third of the participants had a management function, 16 (39%) had a job function with patient contact, and 28 (68%) reported that they had been working from home during the late stage of lockdown, although only 16 (39%) replied that their work tasks could be handled entirely from home.

Table 1. Demographic information, n=41

	n	%	Median	IQR
Female Gender, no. (%)	34	83		
Age, years	41		45	39 ; 51
Working from home during late stage lockdown, no. (%)	28	68		
Work assignments can be done from home:				
Yes, no. (%)	16	39		
Partly, no. (%)	19	46		
Management responsibility, no. (%)	12	29		
Job function with patient contact, no. (%)	16	39		
Have children <15 years, no. (%)	19	48		
Number of children <15 years	19		2	2 ; 2
Number of individuals in the household	41		3	2 ; 4
Transport time to work (minutes)	41		25	15 ; 40
Would like the opportunity to work from home occasionally, no. (%)	37	90		

IQR: Interquartile Range

Participants were involved in at least one of the GCM phases. In total, 47 (69%) of the invited employees participated in generating ideas, and 32 (47%) took part in structuring (sorting and/or rating) statements. Finally, 48 (71%) participants took part in the face-to-face validation meeting to interpret the cluster rating map.

GCM data

A total of 203 ideas were generated, and after removing redundant ideas and minor linguistic revisions, 125 unique statements remained for sorting and rating. Participants sorted the statements into between four and 17 piles (median=9), except for one participant who sorted all statements into one pile. Also, one participant left a single statement unsorted. When asked to rate the statements' importance, three participants left all and two participants almost all (103 and 116, respectively) of the 125 statements unrated. Moreover, four participants each left one statement unrated. Hence, based on the predefined criteria, sorting of statements was approved for 31 participants, and rating of statements was approved for 27 participants.

The multidimensional scaling analysis involved 16 iterations and revealed a low stress value of 0.19. In the analysis, solutions with 5 to 11 clusters were applied. The cluster solution with seven clusters, generated by the CS® Groupwisdom™ software, was chosen because this solution seemed to provide sufficient details on the topic. The seven clusters, each containing between three and 27 statements, are presented in a cluster rating map (**Figure 1**).

At the face-to-face validation meeting of the study participants, discussions led to consensus about the location of the majority (*n*=123, 98.4%) of statements, and only two statements were moved between clusters. As presented in **Table 2**, each cluster in the revised map now contained between three and 26 statements (Table 2 and Appendix A). Furthermore, the participants suggested changes to all labels, based on the content of each cluster. These suggestions were further discussed among the author group, and this process resulted in the following seven key concept clusters (Table 2).

Table 2. Description of the final seven clusters.

Cluster no. of ideas (%)	Cluster median* (min-max)	Summary of content
1. reduced social contact 26 (20.8)	3 (2-3)	Relationships with colleagues constituted a major part of reduced social contact. Participants throughout the institute experienced losses of: contact, availability, feelings of unity, the camaraderie that develops in the workplace, and perspective on projects. The newly employed found it hard to generate relationships and that the research environment suffered because social contact so necessary to the development of ideas was reduced. The productive and informative informal meetings and the communication that comes with daily physical contact were missed. Similarly, informal problem solving became more difficult due to reduced social contact. Extroverted participants found it hard to work from home; they missed having colleagues to 'unburden themselves' to and found working from home boring.
2 *Online meetings – advantages* 23 (18.4)	3 (2-3)	One of the major advantages of online meetings is that they make it easier to gather people from various places, both locally and internationally, which increases the possibility of brainstorming with a broader, more diverse population of collaborators. Flexibility was also mentioned as an advantage, manifesting as going in and out of meetings when working to solve a problem; doing other things at the same time; and having a walk and talk or linking virtual with physical attendance. Participants claimed online meetings were less time-consuming and more down-to-business and focused. Moreover, they opened the possibility of more people working simultaneously on a document. Participants found that internet teleconferencing were quick to learn and that planning of meetings was easier due to their being no transportation requirements. More meetings could be fit into one day, and online meetings allowed more participants to partake in weekly recurring meetings. Participants came to regard virtual meetings as a natural part of the workday and a convenient alternative to physical meetings.
3 *Advantages working from home* 23 (18.4)	3 (2-4)	Participants claimed the major advantage of working from home was they achieved much more when they could work in a quieter environment. Fewer distractions and interruptions and better concentration were mentioned as important factors, with better concentration regarding both general and specific tasks. Participants found they worked more effectively, were more focused, solved problems with fewer disruptions, were more engaged, and were more productive overall. Working from home and using virtual solutions made it easier for some participants—especially those with part-time or multi-site employment—to juggle different work assignments, appointments, and tasks. Working from home also made it easier to establish a good work rhythm, with participants enjoying the time savings from not having to commute to work.

4 *Disadvantages working from home* 20 (16.0)	3 (2-3)	A major disadvantage of working from home was the increased overlap between worktime and private time. Participants missed the distinction and found it difficult to hold regular breaks and to stop working. Another cited disadvantage was ill-equipped home offices. Participants were less motivated at home, and it was difficult to maintain momentum on projects. Staring at the screen all day made participants more tired, and many found concentrating was difficult. Participants were less effective at home and more inactive, and some missed their bicycle ride to work. Participants mentioned that they preferred to meet up physically at work and to have maximum one day working from home per week.
5 *Flexibility* 19 (15.2)	1 (1-4)	Participants found flexibility between working from home and meeting up physically gave job satisfaction. This job satisfaction included motivation and effectiveness and it made a difference to participants that they could choose work hours that suited them. Working from home gave a better work/life balance and made the workday more flexible. Domestic life benefited from reduced stress, and work schedules could be fit around family life and events. Participants appreciated the trust placed in them to do their work regardless of where they worked from. Savings on transportation—both in terms of commuting time and expenses—and environmental benefits also were mentioned—as were longer workdays. Participants mentioned that their productivity depended on the character of the work and that some tasks were better suited than others to working from home.
6 *Online meetings – disadvantages* 11 (8.8)	2 (2-3)	Online meetings were experienced as tiresome and mentally exhausting, especially if participants had many virtual meetings, if the meetings were back-to-back, or if the participants had to teach virtually for a whole day. During online meetings, participants lost focus, and presenters sometimes failed to respond when communicating and explaining concepts. Participants suggested that the online meetings could work as a supplement. Participants found that they worked better with people they knew before the pandemic; and that they lacked experience using technical equipment such as a WebCam, which is an essential tool for online meetings.
7 *Adequate social contact* 3. (2.4)	3 (2-3)	Only a few participants found social contact during lockdown as adequate. They did not think working together was difficult, and they found it easy to stay in contact as long as colleagues were available via telephone or email during work hours.

**Note*. The cluster median is calculated based on median values of ratings of importance for each statement within each cluster. Min and max represent the lowest and highest median value, respectively, for ideas within a cluster.

Generally, statements were rated as important (*n*=93, 74.4%) or very important (*n*=11, 8.8%) (see Appendix A). These ratings also were reflected by a cluster median value of 4 in cluster 5, and 3 in the remaining six clusters (Table 2). In fact, in cluster 5 (concerning experiences related to flexibility), 10 (52%)

of the cluster statements were rated as very important. In comparison, only one other cluster, cluster 6 concerning the effectiveness related to working from home, contained a statement (n=1, 4.3%) rated as very important.

Conceptual model

The final seven clusters and all the included statements are presented in Supplementary Table 1. Based on these data, a final conceptual model revealing experiences related to working from home or having colleagues working from home was developed (**Figure 2**). The model illustrates the pros and cons of working from home, with three evenly rated clusters in each category balanced by the highest rated cluster, Flexibility, which contained statements related to co-decisions of the work environment. As such, Flexibility counted neither as a pro nor as a con regarding home confinement.

Researchers' productivity

The number of scientific publications and funding applications sent during 2020 increased by 10.0% and 23.9%, respectively, when compared with 2019. At the same time, the number of researchers on staff and man years decreased by 24.5% and 10.2%, respectively.

DISCUSSION

Our study examining working from home during COVID-19 in a Danish hospital research setting clearly revealed an increased interest among researchers and healthcare providers in flexible work arrangements. This interest might be perceived as controversial because many studies on the effects of COVID-19 lockdown

on work conditions have highlighted disadvantages, including lower employee productivity, an inadequate work environment, and psychological challenges(2 6 15).

In the present study, a GCM approach to investigate late stage COVID-19 lockdown was used to synthesise experiences among researchers and healthcare providers, and in the conceptual model seven overall clusters emerged; 1: Reduced social contact, 2: Online meetings advantages, 3: Advantages working from home, 4: Disadvantages working from home, 5: Flexibility, 6: Online meetings – disadvantages, and 7: Adequate social contact. The participants rated statements within the cluster Flexibility as the most important experience of working from home or having colleagues working from home. The study also revealed an increase in the number of funding applications sent and scientific publications, despite a decrease in the number of research staff. However, the increases in the former might be due to researchers' having more time for immersion in other research activities due to clinical trials' being paused during the first half of 2020 and a reduction in patient contact during lockdown.

The results of the present study correspond well to a study of the early stages of COVID-19 lockdown that involved participants from 29 European countries, with the majority from Denmark (23.3 %). In that study, most of the participants—representing knowledge workers—had a more positive rather than negative experience of working from home during COVID-19 lockdown(10). Similar to the present study, the main advantages were work-life-balance, improved work efficiency, and more work control, whereas the disadvantages were home-office constraints, work uncertainties, and inadequate tools. Because that study investigated the early lockdown stage, it highlighted a need for further studies investigating aspects of later stages of the COVID-19 lockdown among knowledge workers(10). The highest rated cluster of the present study of late stage lockdown was Flexibility, with statements like "*The combination of meeting at work and the possibility of working from home is optimal*." In the Danish late stage lockdown, many institutions provided the flexibility of part-time working at the office or at home—hence, home confinement was not as severe as in the early lockdown. Statements like "*Working from home is a good alternative but I want to*

decide, myself, when it is most relevant for me" and "*I appreciate the possibility of changing between working from home and meeting up physically. It gives job satisfaction and makes me more effective*" underlined the importance of flexibility and co-decision of the work environment for a good work-life balance and efficacy. It is important to acknowledge that in the late stage lockdown in Denmark, children below 15 years of age were allowed to go physically to day care and school, which was pointed out in statements like "*It is a lot less stressful working from home under conditions that can be customized to the family*." Approximately half of the participants had children younger than 15 years. Had these children been home confined, the results might have been different, as shown previously(16). In a study investigating preschool, we showed that children were rated more hyperactive and had an overall decrease in child-emotional behavioural function during lockdown as compared to pre-lockdown, potentially due to parental stress in relation to the work-life balance(17 18). Thus, forcing telework and home confinement of the entire family might have negative consequences on well-being and job performance(18 19).

Seven clusters informed our conceptual model, which concretized the experiences in relation to home confinement among researchers and healthcare workers in a hospital research setting. According to the conceptual model, the following clusters were categorized as pro home confinement: Online meetings – advantages; Advantages working from home; and Adequate social contact. However, the model also revealed cons to home confinement, including Reduced social contact; Disadvantages working from home; and Online meetings – disadvantages. The results showed that the participants were neither for nor against working from home, thus showing a more complex picture of the participants' experiences, which the cluster Flexibility highlights by balancing the two sides. The take-home message of our model was that the participants appreciated the possibility of flexibility and co-decision and a well-balanced work-life. This conceptual model provided a nuanced image of working from home; it is therefore well suited to discussing and rethinking the future of work and the overall work environment. Organizations might also use this model to discuss, support, and/or mitigate employees' experiences and perceived challenges from home confinement. Our findings suggest that the previous management paradigms (i.e., those in place prior to the

global COVID19 pandemic) in conventional organizations, large and small, public and private, might yield dissatisfaction if they ignore the apparent wish for flexibility.

Previous studies have shown that productivity during lockdown fell, especially among employees with home-confined toddlers(20). Although the number of research staff decreased during 2020, productivity in 2020, during COVID-19 lockdown, was not affected in relation to the number of scientific publications produced and grants applied for at the department. This finding accords with the work assignments among the participants, where only 14.7 % where not at all able to fulfil their job function from home mainly due to clinical work. Also, many participants reported more time for immersion in their work when working from home, by being less exposed to interruptions. The studies showing reduced productivity might simply be a consequence of job assignments' not being possible to perform from home. The results from the present study provide insights into work experiences among knowledge workers with non-material input and output and with the possibility to work from home(21). The conceptual model is therefore not generalizable across companies and working domains.

This study was possibly limited by selection, as most of the participants were represented by researchers and healthcare providers without patient contact during the lockdown. This selection bias might affect the generalizability of the results in relation to employees with clinical functions. However, the sample size was large, which generated a large number of statements, and the fact that 78 of the statements were redundant indicated that the number of statements was sufficient to reach data saturation. The redundancy was also illustrated in our calculated stress value, which was comfortably below the commonly accepted threshold. Another strength of this study is the high number of participants in the sorting, rating, and validation phases, which assured a valid statistical analysis. Finally, the GCM includes the voice and involvement of the participants; the data are thus not research generated. The method involved the participants in all phases—generation of data, data analysis, and validation of results.

In conclusion, the GCM approach proved to be a relevant method for revealing experiences of working from home or having colleagues working from home during a late stage of COVID-19 lockdown. These experiences indicated a wish for co-decision and interest toward more flexibility, especially when addressing the balance between work and spare time, and the usefulness of the conceptual model for planning of future work arrangements in a hospital research setting.

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Data Sharing: Data are available upon reasonable request by e-amil: bfh-dl-org-parkerinstituttet@regionh.dk.

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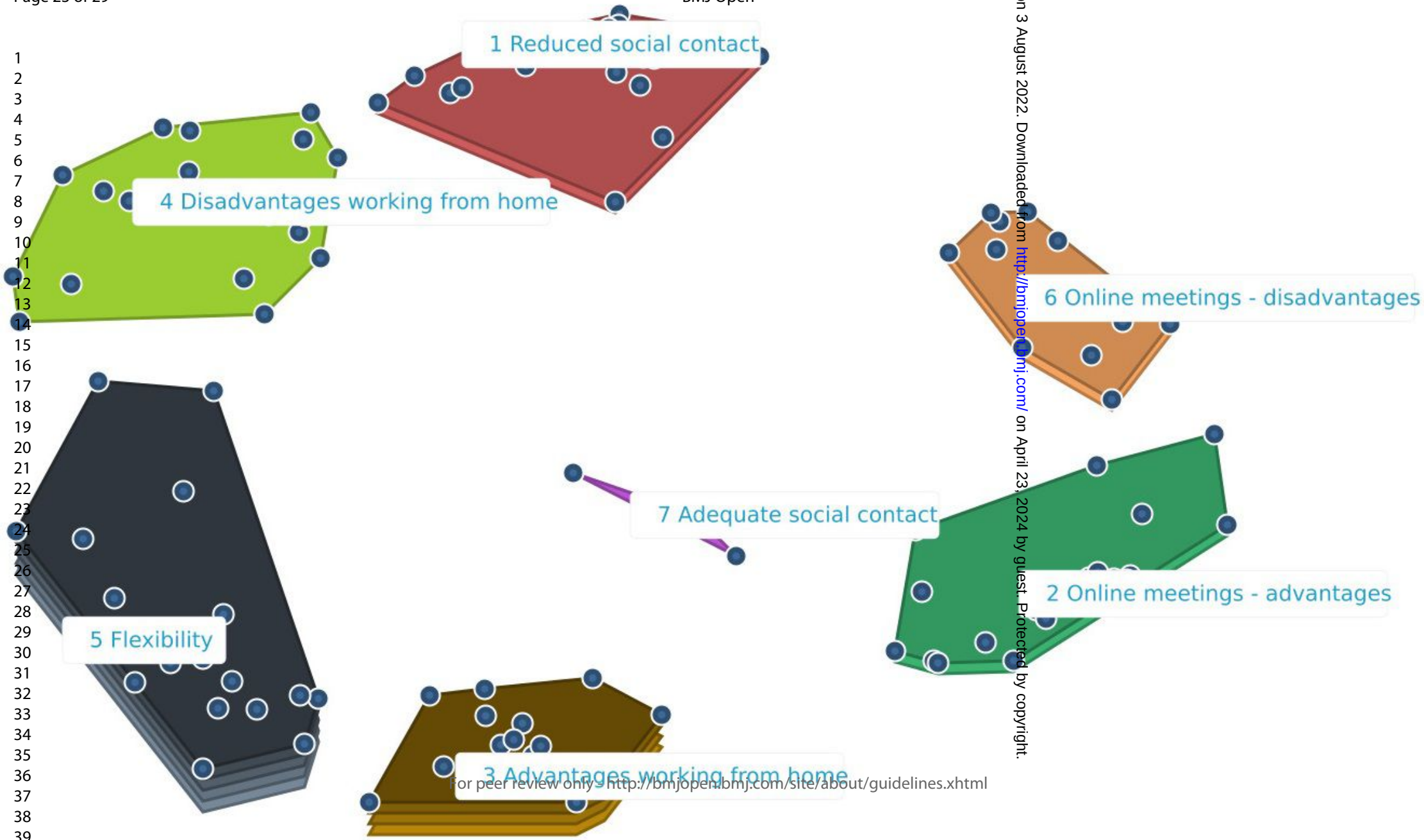
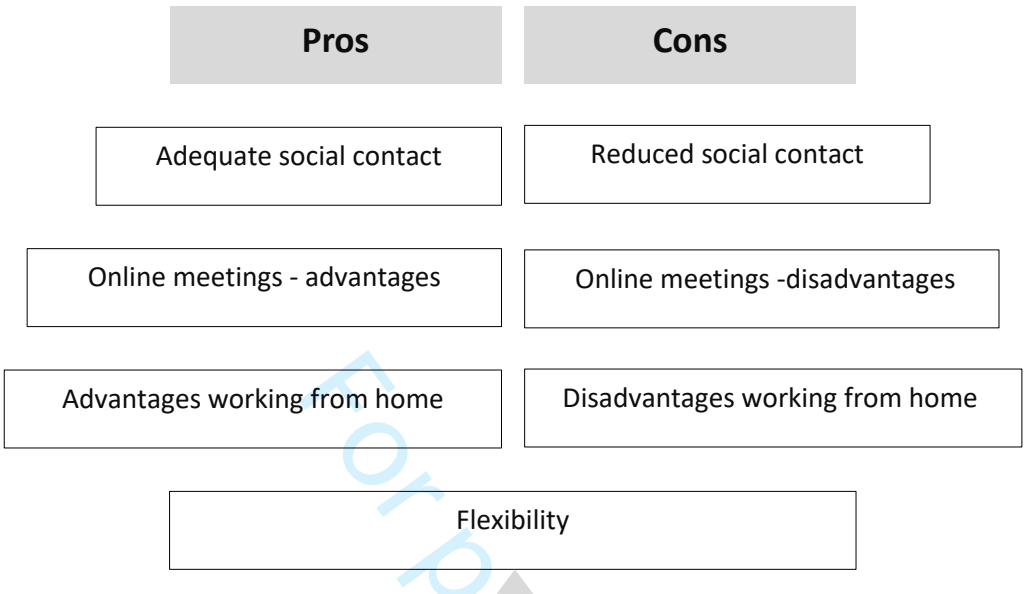
Figure captions

Figure 1. Cluster rating map with seven clusters. Proximity of clusters on the map indicates how related they are. The height of a cluster signifies its relative importance, with higher clusters (i.e., the number of layers) containing statements being rated as more important.

Figure 2. Conceptual model. Pros and cons balancing on the cluster Flexibility





Supplementary Table 1: Statements and Cluster Report

Cluster	Statement #	Statement	Rating of importance (median)
1. Reduced social contact *(n= 26)*	1	I find informal meetings and discussions very productive and I miss them.	3
	2	Small frustrations in a workday – miss colleagues to "unload" to.	3
	3	One easily loses perception of Parker-projects throughout the institute.	3
	6	Ideas are not developed to the same degree.	3
	7	Miss being disturbed while working	2
	8	It has not been possible to get to know people – was relatively, newly employed at lockdown	3
	11	Missed being in a research environment, with the gains that come along the way.	3
	21	Without the daily contact, one has lost the good collegial contact.	3
	23	Daily physical contact is important for good communication.	3
	32	Sometimes a bit lonely to physically meet up, only to find out that pretty much everyone else is at home on that particular day. It may be a help if everyone makes it obvious in Outlook whether they are home or "out".	3
	35	As an extrovert, working from home can be very hard.	2
	36	If people work from home too much, one loses touch with them and the feeling of unity.	3
	46	I have missed meeting up.	3
	48	Colleagues are less available from home.	3
	53	Some stimuli are missing when one only sits at home	3
	58	Working from home can be lonely	3
	86	Hard to generate relationships with new colleagues	3
	88	that I get left out of the very informal communication and information flow if I am not physically present	3
	93	The advantages of having delightful colleagues decrease when one does not have the prospect of meeting face-to -face	3
	101	Meeting in at work and bumping into colleagues at the coffee machine gives an energy boost	3
	103	A strong camaraderie between them who have been present	2
	105	Deadly boring in the long run	2
	107	Some colleagues have not been very available	3

	109	Spontaneous communication/consultation/discussion regarding small challenges is difficult	3
	113	One tends to forget to contact colleagues who have been away all or most of the time	3
	120	In the long term, I think the social relationships with my colleagues will be weakened	3
2. Online meetings – advantages *(n=23)*	4	Starting online Tuesday and Friday meetings has been very positive for the Parker-spirit.	3
	10	That it has been possible to partake in pretty much all Tuesday and Friday meetings	3
	15	Online meetings make it easier to gather people from various places	3
	17	Less chit-chat at virtual meetings	3
	18	Learning to utilize IT-meetings is quick	3
	20	The many online possibilities have increased the possibility of brainstorming with many more relevant people	3
	29	Virtual meetings made it easier to gather people from various places (local and overseas)	3
	31	Virtual meetings are a fine alternative to physical meetings	3
	33	Being able to link virtual access with physical attendance gives meetings more flexibility – but it demands good meeting-discipline from everyone	3
	42	Had more walk and talk meetings, where one takes a walk at the same time one has an online meeting	2
	57	I did not have much experience with online meetings before lockdown, it has opened up for totally new possibilities for collaboration and flexibility.	3
	60	Really great that people have become used to virtual meetings, so there is no longer the same resistance to digital solutions. They have become a natural part of the working day.	3
	64	I have had to find out how the virtual works and I have learnt a lot from that.	2
	68	One can hold really a lot of virtual meetings in one day…	2
	72	Adjusting all meetings and all education to virtual was very demanding but satisfying when it succeeded.	3
	73	Both internal and external meetings have been easier to plan regarding dates, because transport was not a factor that had to be taken into account.	3
	78	Virtual work meetings were very focused because one could work with a document at the same time.	3
	81	Teams are good to go in and out of if one works together with a colleague to solve a problem	3

	89	That some days I see more colleagues online, at various meetings, than I would have done if I had met in physically	2
	90	That more people can partake in Tuesday's education and Friday's meetings, when they are held online	3
	110	Online meetings are less time consuming than physical meetings, but not necessarily more effective.	3
	112	Good to find out that many meetings with international collaborators can easily be taken online.	3
	115	It has been easier to partake in web seminars, for example, than physical seminars, also those that end late, because one can often listen in and, for example, pick up children at the same time.	3
3. Advantages working from home *(n=23)*	19	Working from home is more productive	3
	44	Easier to change between different work assignments	3
	45	Timesaving because there is no transport time	3
	49	Now where the children are away in school, the potential for concentration and engagement is greater	3
	54	Time to focus	3
	55	I find concentrating easier at home	3
	59	Working from home and virtual solutions make it considerably easier to juggle between appointments and tasks, when one has more than one workplace.	3
	62	Peace and quiet to work, fewer distractions, better concentration – work more effectively from home.	3
	63	Lovely being able to rest my head, at home, from the buzz and small sounds.	3
	66	For those of us that are more on the introvert side, it was lovely being able to immerse ourselves, alone at home.	3
	67	Because everything was cancelled in the beginning, there were some good opportunities to create periods for larger work tasks.	2
	69	I experienced that I was more productive at home when it came to articles and reports.	3
	74	Tasks that required peace and quiet and concentration were easier to solve from home.	3
	80	Peace and quiet to concentrate on one's tasks	3
	82	Significantly fewer disruptions during problem solving	3

	87	That I achieve much more, when I get peace and quiet at home, which gives greater daily job satisfaction.	4
	91	That I, as a part-time employee, can be available for both workplaces on the same day, when I work from home. It means, for example, that I can find time in my calendar for a meeting more quickly.	3
	94	Working from home is effective for me in smaller doses	3
	96	Working from home gives better peace and quiet for tasks that require concentration	3
	99	Working from home has made it easier to establish a good working rhythm where one task replaces another.	3
	121	Working from home is a more effective work-form, than I had imagined before lockdown	3
	123	After a few difficult adjustments in the beginning, I have become extremely happy with partially working from home. I get a lot more done (there are less interruptions from colleagues etc. and I am therefore more effective).	3
	124	Effective time without disturbances with peace and quiet to work	3
4. Disadvantages working from home *(n=20)*	13	Time-off and work-life overlap more when you work from home	3
	22	Larger demands are posed on home IT equipment, in order to be just as productive, as at work	3
	25	During the times that several family members were home, due to the pandemic, I was disturbed more – less effective	2
	27	Prefer to meet up at work physically	2
	34	Motivation is lower at home	3
	43	Difficult to remember to hold regular breaks	3
	47	Difficult being effective at home	2
	50	Need bicycle ride, to work, as exercise	2
	51	Some work projects are easiest with large screen	3
	56	On days where motivation is a bit lower than normal – it is better for me to be physically at work	3
	70	Missed separating work-life and private-life during lockdown	3
	71	Became more tired from staring at the screen all day	3
	76	Pain in the back and neck because home is not fitted out, as it is at work	3
	83	Working from home over a long time, demands planning of daily exercise	2
	85	Can be difficult holding momentum up (take care of work)	3
	100	Full time home-office does not work for me because it is too easy to procrastinate	2

	108	I could not imagine having to work from home every day – maximum one day per week	2
	111	I have difficulty concentrating when I work from home	3
	117	In my case, the lack of distinction between work and free time makes it difficult to hold free	3
	118	In my case, it has not been possible to fit out a home-workplace, that is quite the same level as my normal workplace	3
5. Flexibility *(n=19)*	9	I appreciate the possibility of changing between working from home and meeting up physically. It gives job satisfaction and makes me more effective	4
	14	Greater job satisfaction, being able to decide whether one will work from home or at Parker	4
	16	More flexible workday	4
	26	Working from home is a good alternative but I want to decide, myself, when it is most relevant for me	4
	37	Working from home gives more relaxed mornings, where one can start work earlier because one does not need to transport oneself or make small talk with colleagues	3
	40	The combination of meeting at work and the possibility of working from home is optimal	4
	41	The possibility of working from home gives better work/life balance	4
	52	Working from home is wonderful, but it is best when one can self-choose when and for how long	4
	61	Good to save on transport; good for me, good for the dense traffic, good for Denmark, good for the environment.	3
	65	Lovely being able to eat lunch in the garden…	1
	77	Easily came to work longer days – started earlier and finished later because the computer was out and because I saved time on transport.	3
	79	Some tasks are better suited to working from home than others	3
	95	The possibility of working from home gives greater freedom, flexibility, job-satisfaction and motivation	4
	98	Having the possibility of working from home gave a feeling of greater job-satisfaction, less stress and has been very positive on the home front – gave better work-life-balance	4
	102	Lovely with trust from the workplace that one, of course, did one's work – regardless of where one worked from	4
	106	The fitting out of a home office has been a bit of a luxury with a workday from home now and again	3
	116	More flexibility and therefore less stress during the working day, when I have worked from home.	3

	119	The effectiveness of my work from home depends to a large degree on the character of the work	3
	122	It is a lot less stressful working from home under conditions that can be customized to the family.	3
6. Online meetings – disadvantages *(n=11)*	5	As a presenter on a virtual platform, I miss response	3
	12	Online meetings with people I knew before corona, function better than with people I meet online	2.5
	24	Became tired of sitting stuck in front of a screen – when one had many virtual meetings	3
	28	With regard to explaining (presentation or teaching) I clearly prefer physical over virtual meetings	3
	30	One can – at times – quickly lose focus with virtual meetings	3
	38	There is not the same good experience when conveying via screen that there is at a physical meeting	3
	39	Meeting only over a screen is not enough but it is a fine supplement to replace some of the physical meetings	3
	75	If virtual meetings were held back-to-back, or if one should teach virtually a whole day, one became mentally exhausted	3
	84	One needs to have WebCam on for virtual meetings to work	3
	97	Online meetings are ok, but work better face-to-face	2
	114	Online meetings are less personal	2
7. Adequate social contact *(n=3)*	92	That I have less need for the social side of the workplace than many of my colleagues.	2
	104	I do not think working together has been challenging, as long as colleagues are available via telephone/mail during work hours	3
	125	It is easy to stay in contact.	3

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Working from home during COVID-19 in a Danish hospital research setting: Experiences of researchers and healthcare providers, explored by Group Concept Mapping

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ABSTRACT

Objectives: The COVID-19 pandemic has changed the working environment, how we think of it, and how it stands to develop into the future. Knowledge about how people have continued to work onsite and adjusted to working from home during the COVID-19 lockdown will be vital for planning work arrangements in the post-pandemic period. Our primary objective was to investigate experiences of working from home or having colleagues working from home during a late stage of the COVID-19 lockdown among researchers and healthcare providers in a hospital research setting. Secondly, we aimed to investigate researchers' productivity through changes in various proxy measures during lockdown as compared to pre-lockdown.

Design: Mixed-method participatory Group Concept Mapping (GCM).

Setting and participants: GCM, based on a mixed-method participatory approach, was applied involving researchers and healthcare providers online sorting and rating experiences working from home during the COVID-19 pandemic. At a face-to-face meeting, participants achieved consensus on the number and labeling of domains—the basis for developing a conceptual model.

Results: Through the GCM approach, 47 participants generated 125 unique statements of experiences related to working from home, which were organized into seven clusters. Using these clusters, we developed a conceptual model that illustrated the pros and cons of working from home.

Conclusion: The future work setting, the role of the office, and the overall work environment need to respond to workers' increased wish for flexible work arrangements and co-decision.

Strength and limitations of this study

- The GCM includes the voice and involvement of the participants in all phases; the data are thus not research generated.

- The sample size was large which generated a large number of statements, sufficient to reach data saturation.
- The study was possibly limited by selection, as most of the participants were represented by personnel without patient contact during the lockdown.
- This selection bias might affect the generalizability.

Keywords: Cluster analysis; Content validity; Covid; Co-decision; Home confinement; Lockdown; Mind map; Multidimensional scaling; Work/Life balance

INTRODUCTION

In the beginning months of 2020, the COVID-19 pandemic began to sweep across the globe(1). To contain and mitigate the spread of COVID-19, many countries ordered a lockdown of public institutions that did not perform critical functions, in Denmark the first lockdown started on March 13th, 2020. In the early lockdown, many countries reported high rates of symptoms of anxiety, depression, post-traumatic stress disorder, psychological distress, and stress(2). Studies have shown that such symptoms were particularly acute among healthcare workers(3), and that caregivers with COVID-19 patient contact had a higher prevalence of depression, anxiety, stress, and burnout syndrome compared to caregivers without patient contact(4). Lockdowns also strongly affected economies, resulting in many people losing their jobs or being furloughed until the pandemic was under control(5). Notably, lockdowns exerted a greater negative effect on the well-being of unemployed and furloughed persons than on the employed(6).

Where possible, many public and private organizations remedied the situation by imposing a remote work policy, making it possible for many employees and managers without frontline responsibilities to work from home. People who worked from home often had to care for children who were home due to the closing of childcare and schools. Studies have investigated the early lockdown effect of home confinement and telework on mental well-being and psychological distress and have documented the

distress felt by workers with demanding jobs, with a higher educational level, and those who were not sheltering at home(7). Interestingly, physicians working at the hospital as compared to those working from home showed only a higher prevalence of stress, whereas exhaustion, anxiety, and depression remained the same among the two groups(3).

Positive experiences from the coronavirus-induced lockdown also have emerged(8), both on a general level where the initial lockdown was characterized as a time with greater sense of belonging due to an overall societal feeling of togetherness(9), and, more specifically, in relation to working from home. Themes and experiences that have been identified in working from home include a better work-life balance with more flexibility, increased work-efficiency with less disruption from co-workers, a better work environment, more effective meetings, easier access to co-workers, and a higher sense of work control (10). Thus, the experiences of early-stage lockdown among hospital workers—both of physicians and others working from home—were mixed, and the reports do not give a clear picture of when and for whom it was beneficial to work from home. Most of the previous studies investigated the early stage of lockdown, when the situation was new and unknown. It is possible that by later, when lockdown had become 'the new normal', workers' attitudes toward home confinement might have changed.

In order to rethink the future of work by giving people the option of choosing who and what tasks are suitable for remote and onsite work, we should learn from the experiences of employees with mixed job functions working from home or having colleagues working from home at a later stage of lockdown. Knowledge concerning what influences workers' preferences for home and onsite work and what tasks are suitable for the two work environments will be important for optimal planning of work arrangements in the post-pandemic period.

The overarching aim of this study was firstly to investigate experiences of working from home or having colleagues working from home during the of COVID-19 lockdown at a late stage among multidisciplinary researchers and healthcare providers in a hospital research setting. Secondly, it aimed to

investigate the researchers' productivity during lockdown as compared to pre-lockdown. Knowledge obtained from this study might be used in rethinking the future of work, modifying the role of the office, and creating a more conductive work environment.

METHODS

Study design and procedures

To address the first aim of the study and ascertain broad perspectives on experiences from the COVID-19 late stage lockdown in spring and early summer 2021, the authors of this study ('the author group') applied Group Concept Mapping (GCM), a methodology for generating and structuring ideas on a specific topic, based on a mixed-method participatory approach(11 ,12). The GCM process includes the following phases: 1) preparing, 2) generating ideas (brainstorming), 3) structuring statements (sorting and rating), 4) performing GCM analysis, 5) interpreting the map (validating), and 6) utilizing (developing a conceptual model) (12). The results are illustrated in maps where ideas on the specific topic are organized thematically. Participants in GCM studies are involved in several steps of the research process, including generating ideas, structuring statements and interpreting the map. The GCM process may involve face-to-face group sessions, online participation, or both(11).

In this study, generating ideas and structuring the statements was conducted online between June 1, 2021 and June 21, 2021 using the Concept System® Groupwisdom™ software, designed to support each step in the GCM process (Concept Systems Incorporated, 2019). Interpretation of the map took place at a three-hour face-to-face validation session in June 2021. Members of the author group, except for the last author, were also invited to take part in the study along with the participants. The last author was responsible for conducting the GCM process, including preparation, the GCM analysis and being chair at the validation meeting. The study was conducted in Danish and afterwards the statements were translated into English by a native English-speaking employee.

Participants and setting

The study took place at the Parker Institute, Bispebjerg and Frederiksberg Hospital, a clinical research institute working with evidence-based research within rheumatology and disease prevention, within the hospital system in the Capital Region of Denmark. Potential participants were all employees at the Parker Institute, who would not have traditionally worked from home. The invited employees were working as researchers, clinicians including physicians and nurses, research assistants, and technical-administrative staff. The invited participants could freely choose to participate or not. Only the last author had information on who participated through the GCM online system. In Denmark, researchers were allowed to work physically at the hospital from late April 2020 but were encouraged to work from home when possible. While most of the imitated participants were working from home during the COVID-19 lockdown, researchers, clinicians, and research assistants involved in ongoing data-collections, and physicians taking part in the COVID-19 emergency response and preparedness all attended physically at work.

GCM: Data Generation

The previously described process of GCM serves as a structure describing the procedures in the study. *Preparing for GCM:* Before initiating the data collection, the first and last authors formulated and piloted a seeding question. The final version was: "What experiences have you had in connection with your / your colleagues' working from home during the COVID-19 pandemic?"

Generating ideas (Brainstorming): Potential participants were invited to participate by email with links to online participation using the CS® GroupwisdomTM software. Participants were instructed to think broadly and generate as many answers as possible in response to the seeding question. They were reminded to keep each answer short, with only one meaning.

The statements generated were then consolidated; the first and last authors individually identified redundant statements (i.e., ideas with the same wording or meaning). Next, they met and discussed their findings. Based on consensus, redundant statements were removed, and minor linguistic revisions were

made to clarify the meaning. The remaining statements were then imported into CS® Groupwisdom™ in preparation for phases three and four.

Structuring the statements (Sorting and Rating): Again, potential participants were invited to participate by e-mail in the sorting and rating, with a link to online participation using the CS® Groupwisdom™ software. They were presented with the total number of statements and asked to organize all statements into piles, in any way that made sense to them. The only rules were: (A) there must be more than one pile, and (B) there must be fewer piles than the number of statements. Each participant was asked to label each pile of statements and—based on the seeding question—rate the importance of each statement on a four-point ordinal scale: (1) *"Not at all important,"* (2) *"Somewhat important,"* (3) *"Important,"* and (4) "*Very important.*" Pooled analysis of GCM studies indicated high reliability estimates for sorting and rating processes, as well as high representational validity(13).

Data analyses

GCM analysis (Data analysis): Based on the sorting and ratings, multidimensional scaling and cluster analyses were performed, in which related statements were grouped into clusters (11). To ensure the quality of the overall sorting and rating data, single-participant data from phase three were included in the cluster analysis if more than 75% of the statements were sorted (11) and if fewer than five statements remained unrated.

Within the multidimensional scaling analysis, 'stress value' is the statistic used to indicate congruence between the raw data and the processed data (goodness of fit). A low stress value (considered to be any value <0.39) indicates a good fit. During the cluster analyses, several cluster solutions were generated, and the one that matched the data the best (i.e., the cluster solution representing sufficient details on the topic) was applied, creating the Cluster Rating Map. Based on the labels provided by the participants, cluster labels were suggested by the CS® Groupwisdom™ software. Proximity of clusters on the map indicates how related they are; clusters closer together are more related than those further apart. The

height of a cluster signifies its relative importance, with higher clusters (i.e., the number of layers) containing statements being rated as more important.

Interpreting the map (Validating): At the face-to-face validation session, participants met to interpret and validate the results. Based on the Cluster Rating Map and an overview of clusters and statements presented by the last author, participants were instructed by the last author to in small groups (a) determine if each statement was placed in the right cluster, (b) consider the number of clusters, and (c) consider if the cluster labels illustrated the theme of the cluster. Statements fitting into more than one cluster were to remain in their designated cluster, and only statements clearly misplaced were to be moved. Reflections and suggestions were discussed to obtain consensus.

Utilizing (Developing a conceptual model): Based on the validated Cluster Rating Map, a final conceptual model was developed. To develop the model, the author group met to refine cluster labels and to reach consensus on a final conceptual model.

Demographic data and descriptive statistics

When the GCM process was finalized, the author group send out an anonymized online questionnaire concerning demographic information and work-related functions to all invited participants using the Electronic Data Capture system (REDCap) during late August and early September 2021(14). Three reminders were sent to the invited participants. Characteristics of the study population are presented as count and percentages for categorical data, and median with interquartile ranges (IQRs) for continuous variables using the statistical software SAS/STAT® (release 9.4; SAS Institute, Cary, NC).

Researcher productivity and proxy measures

To investigate researchers' productivity, the number of employees, scientific publications, man years, and funding applications sent were compared in the periods January 1 through December 31, 2019 (i.e., before the pandemic and lockdown) and January 1 through December 31, 2020.

Patient and Public Involvement

Using a GCM approach, the participants were naturally involved early in the research process. The research question (the seeding question) was based on an overall public interest in the area of working from home. The question was piloted and approved by colleagues not included as authors. The public was not involved in the choice of study design, but the design was chosen due to the participatory design.

RESULTS

Among 68 invited employees, 43 (63%) responded to the questionnaire. Two respondents did not participate in the online GCM program or the face-to-face validation meeting and were removed from the final sample (n=41, 60%). **Table 1** presents the demographic data of the participants. Of the final 41 participants, 34 (83%) were female, had a median (IQR) age of 45 (39-51) years, and 19 (48%) had children below 15 years of age living at home. The median (IQR) number of individuals in the household was 3 (2-4). Almost a third of the participants had a management function, 16 (39%) had a job function with patient contact, and 28 (68%) reported that they had been working from home during the late stage of lockdown, although only 16 (39%) replied that their work tasks could be handled entirely from home.

Table 1. Demographic information, n=41

	n	%	Median	IQR
Female Gender, no. (%)	34	83		
Age, years	41		45	39 ; 51
Working from home during late-stage lockdown, no. (%)	28	68		
Work assignments can be done from home:				
Yes, no. (%)	16	39		

Partly, no. (%)	19	46		
Management responsibility, no. (%)	12	29		
Job function with patient contact, no. (%)	16	39		
Have children <15 years, no. (%)	19	48		
Number of children <15 years	19		2	2 ; 2
Number of individuals in the household	41		3	2 ; 4
Transport time to work (minutes)	41		25	15 ; 40
Would like the opportunity to work from home occasionally, no. (%)	37	90		

IQR: Interquartile Range

Participants were involved in at least one of the GCM phases. In total, 47 (69%) of the invited employees participated in generating ideas, and 32 (47%) took part in structuring (sorting and/or rating) statements. Finally, 48 (71%) participants took part in the face-to-face validation meeting to interpret the cluster rating map.

GCM data

A total of 203 ideas were generated, and after removing redundant ideas and minor linguistic revisions, 125 unique statements remained for sorting and rating. Participants sorted the statements into between four and 17 piles (median=9), except for one participant who sorted all statements into one pile. Also, one participant left a single statement unsorted. When asked to rate the statements' importance, three participants left all and two participants almost all (103 and 116, respectively) of the 125 statements unrated. Moreover, four participants each left one statement unrated. Hence, based on the predefined criteria, sorting of statements was approved for 31 participants, and rating of statements was approved for 27 participants.

The multidimensional scaling analysis involved 16 iterations and revealed a low stress value of 0.19. In the analysis, solutions with 5 to 11 clusters were applied. The cluster solution with seven clusters, generated by the CS® Groupwisdom™ software, was chosen because this solution seemed to provide sufficient details on the topic. The seven clusters, each containing between three and 27 statements, are presented in a cluster rating map (**Figure 1**).

At the face-to-face validation meeting of the study participants, discussions led to consensus about the location of the majority (*n*=123, 98.4%) of statements, and only two statements were moved between clusters. As presented in **Table 2**, each cluster in the revised map now contained between three and 26 statements (**Table 2** and **Supplementary Table 1**). Furthermore, the participants suggested changes to all labels, based on the content of each cluster. These suggestions were further discussed among the author group, and this process resulted in the following seven key concept clusters (Table 2).

Table 2. Description of the final seven clusters. Statements can be found in Supplementary Table 1.

Cluster no. of ideas (%)	**Cluster median* (min-max)**	**Summary of content**
1. reduced social contact 26 (20.8)	3 (2-3)	Relationships with colleagues constituted a major part of reduced social contact. Participants throughout the institute experienced losses of: contact, availability, feelings of unity, the camaraderie that develops in the workplace, and perspective on projects. The newly employed found it hard to generate relationships and that the research environment suffered because social contact so necessary to the development of ideas was reduced. The productive and informative informal meetings and the communication that comes with daily physical contact were missed. Similarly, informal problem solving became more difficult due to reduced social contact. Extroverted participants found it hard to work from home; they missed having colleagues to 'unburden themselves' to and found working from home boring.
2 *Online meetings – advantages* 23 (18.4)	3 (2-3)	One of the major advantages of online meetings is that they make it easier to gather people from various places, both locally and internationally, which increases the possibility of brainstorming with a broader, more diverse population of collaborators. Flexibility was also mentioned as an advantage, manifesting as going in and out of meetings when working to solve a problem; doing other things at the same time; and having a walk and talk or linking virtual with physical attendance. Participants claimed online meetings were less time-consuming and more down-to-business and focused. Moreover, they opened the possibility of more people working simultaneously on a document. Participants found that internet teleconferencing were quick to learn and that planning of meetings was easier due to their being no transportation requirements. More meetings could be fit into one day, and

		online meetings allowed more participants to partake in weekly recurring meetings. Participants came to regard virtual meetings as a natural part of the workday and a convenient alternative to physical meetings.
3 *Advantages working from home* 23 (18.4)	3 (2-4)	Participants claimed the major advantage of working from home was they achieved much more when they could work in a quieter environment. Fewer distractions and interruptions and better concentration were mentioned as important factors, with better concentration regarding both general and specific tasks. Participants found they worked more effectively, were more focused, solved problems with fewer disruptions, were more engaged, and were more productive overall. Working from home and using virtual solutions made it easier for some participants—especially those with part-time or multi-site employment—to juggle different work assignments, appointments, and tasks. Working from home also made it easier to establish a good work rhythm, with participants enjoying the time savings from not having to commute to work.
4 *Disadvantages working from home* 20 (16.0)	3 (2-3)	A major disadvantage of working from home was the increased overlap between worktime and private time. Participants missed the distinction and found it difficult to hold regular breaks and to stop working. Another cited disadvantage was ill-equipped home offices. Participants were less motivated at home, and it was difficult to maintain momentum on projects. Staring at the screen all day made participants more tired, and many found concentrating was difficult. Participants were less effective at home and more inactive, and some missed their bicycle ride to work. Participants mentioned that they preferred to meet up physically at work and to have maximum one day working from home per week.
5 *Flexibility* 19 (15.2)	1 (1-4)	Participants found flexibility between working from home and meeting up physically gave job satisfaction. This job satisfaction included motivation and effectiveness and it made a difference to participants that they could choose work hours that suited them. Working from home gave a better work/life balance and made the workday more flexible. Domestic life benefited from reduced stress, and work schedules could be fit around family life and events. Participants appreciated the trust placed in them to do their work regardless of where they worked from. Savings on transportation—both in terms of commuting time and expenses—and environmental benefits also were mentioned—as were longer workdays. Participants mentioned that their productivity depended on the character of the work and that some tasks were better suited than others to working from home.
6 *Online meetings – disadvantages* 11 (8.8)	2 (2-3)	Online meetings were experienced as tiresome and mentally exhausting, especially if participants had many virtual meetings, if the meetings were back-to-back, or if the participants had to teach virtually for a whole day. During online meetings, participants lost focus, and presenters sometimes failed to respond when communicating and explaining concepts. Participants suggested that the online meetings could work as a supplement. Participants

		found that they worked better with people they knew before the pandemic; and that they lacked experience using technical equipment such as a WebCam, which is an essential tool for online meetings.
7 *Adequate social contact* 3. (2.4)	3 (2-3)	Only a few participants found social contact during lockdown as adequate. They did not think working together was difficult, and they found it easy to stay in contact as long as colleagues were available via telephone or email during work hours.

**Note*. The cluster median is calculated based on median values of ratings of importance for each statement within each cluster. Min and max represent the lowest and highest median value, respectively, for ideas within a cluster.

Generally, statements were rated as important (*n*=93, 74.4%) or very important (*n*=11, 8.8%) (see **Supplementary Table 1**). These ratings also were reflected by a cluster median value of 4 in cluster 5, and 3 in the remaining six clusters (**Table 2**). In fact, in cluster 5 (concerning experiences related to flexibility), 10 (52%) of the cluster statements were rated as very important. In comparison, only one other cluster, cluster 6 concerning the effectiveness related to working from home, contained a statement (n=1, 4.3%) rated as very important.

Conceptual model

The final seven clusters and all the included statements are presented in Supplementary **Table 1**. Based on these data, a final conceptual model revealing experiences related to working from home or having colleagues working from home was developed (**Figure 2**). The model illustrates the pros and cons of working from home, with three evenly rated clusters in each category balanced by the highest rated cluster, Flexibility, which contained statements related to co-decisions of the work environment. As such, Flexibility counted neither as a pro nor as a con regarding home confinement.

Researchers' productivity

The number of scientific publications and funding applications sent during 2020 increased by 10.0% and 23.9%, respectively, when compared with 2019. At the same time, the number of researchers on staff and man years decreased by 24.5% and 10.2%, respectively.

DISCUSSION

Our study examining working from home during COVID-19 in a Danish hospital research setting clearly revealed an increased interest among researchers and healthcare providers in flexible work arrangements. This interest might be perceived as controversial because many studies on the effects of COVID-19 lockdown on work conditions have highlighted disadvantages, including lower employee productivity, an inadequate work environment, and psychological challenges(2 ,6 ,15).

In the present study, a GCM approach to investigate late stage COVID-19 lockdown was used to synthesise experiences among researchers and healthcare providers, and in the conceptual model seven overall clusters emerged; 1: Reduced social contact, 2: Online meetings advantages, 3: Advantages working from home, 4: Disadvantages working from home, 5: Flexibility, 6: Online meetings – disadvantages, and 7: Adequate social contact. The participants rated statements within the cluster Flexibility as the most important experience of working from home or having colleagues working from home. The study also revealed an increase in the number of funding applications sent and scientific publications, despite a decrease in the number of research staff. However, the increases in the former might be due to researchers' having more time for immersion in other research activities due to clinical trials' being paused during the first half of 2020 and a reduction in patient contact during lockdown.

The results of the present study correspond well to a study of the early stages of COVID-19 lockdown that involved participants from 29 European countries, with the majority from Denmark (23.3 %). In that study, most of the participants—representing knowledge workers—had a more positive rather than negative experience of working from home during COVID-19 lockdown(10). Similar to the present study, the main advantages were work-life-balance, improved work efficiency, and more work control, whereas the disadvantages were home-office constraints, work uncertainties, and inadequate tools. Because that study

investigated the early lockdown stage, it highlighted a need for further studies investigating aspects of later stages of the COVID-19 lockdown among knowledge workers(10). The highest rated cluster of the present study of late-stage lockdown was Flexibility, with statements like "*The combination of meeting at work and the possibility of working from home is optimal*." In the Danish late-stage lockdown, many institutions provided the flexibility of part-time working at the office or at home—hence, home confinement was not as severe as in the early lockdown. Statements like "*Working from home is a good alternative but I want to decide, myself, when it is most relevant for me*" and "*I appreciate the possibility of changing between working from home and meeting up physically. It gives job satisfaction and makes me more effective*" underlined the importance of flexibility and co-decision of the work environment for a good work-life balance and efficacy. It is important to acknowledge that in the late-stage lockdown in Denmark, children below 15 years of age were allowed to go physically to day care and school, which was pointed out in statements like "*It is a lot less stressful working from home under conditions that can be customized to the family*." Approximately half of the participants had children younger than 15 years. Had these children been home confined, the results might have been different, as shown previously(16 ,17) (17). In a study investigating preschool, we showed that children were rated more hyperactive and had an overall decrease in child-emotional behavioural function during lockdown as compared to pre-lockdown, potentially due to parental stress in relation to the work-life balance(18 ,19). Thus, forcing telework and home confinement of the entire family might have negative consequences on well-being and job performance(19 ,20) as shown by a French study investigating anxiety and depressive symptoms pre-COVID-19 lockdown, during the first wave and again during the second wave (21). The study showed a continuing increase in mean scores of anxiety and depressive symptoms(21).

Seven clusters informed our conceptual model, which solidified the experiences in relation to home confinement among researchers and healthcare workers in a hospital research setting. According to the conceptual model, the following clusters were categorized as pro home confinement: Online meetings – advantages; Advantages working from home; and Adequate social contact. However, the model also revealed cons to home confinement, including Reduced social contact; Disadvantages working from home;

and Online meetings – disadvantages. The results showed that the participants were neither for nor against working from home, thus showing a more complex picture of the participants' experiences, which the cluster Flexibility highlights by balancing the two sides. The take-home message of our model was that the participants appreciated the possibility of flexibility and co-decision and a well-balanced work-life. Flexible workplace practices like working from home was slowly increasing in the modern work place culture pre-COVID-19 (22 ,23) (23), however, pre-COVID-19 managerial and executive resistance as well as occupational constrains were major obstructers to these types of working arrangements (24). After organizations have been forced into more flexible working arrangements due to COVID-19 lockdowns, many are considering continuing this practice after the pandemic (24). The conceptual model from our study provided a nuanced image of working from home based on the perspective of the employee. Organizations can use this model to discuss, support, and/or mitigate employees' experiences and perceived challenges from home confinement. Our findings suggest that the previous management paradigms (i.e., those in place prior to the global COVID19 pandemic) in conventional organizations, large and small, public and private, might yield dissatisfaction if they ignore the apparent wish for flexibility.

Previous studies have shown that productivity during lockdown fell, especially among employees with home-confined toddlers(25). Although the number of research staff decreased during 2020, productivity in 2020, during COVID-19 lockdown, was not affected in relation to the number of scientific publications produced and grants applied for at the department. This finding accords with the work assignments among the participants, where only 14.7 % where not at all able to fulfil their job function from home mainly due to clinical work. Also, many participants reported more time for immersion in their work when working from home, by being less exposed to interruptions. The studies showing reduced productivity might simply be a consequence of job assignments' not being possible to perform from home. The results from the present study provide insights into work experiences among knowledge workers with non-material input and output and with the possibility to work from home(26). The conceptual model is therefore not generalizable across companies and working domains.

This study was possibly limited by selection, as most of the participants were represented by researchers and healthcare providers without patient contact during the lockdown. This selection bias might affect the generalizability of the results in relation to employees with clinical functions. Also, we did not stratify by gender although previous studies have shown gender differences in well-being during lockdown with a lower well-being among women (21 ,27). In our study 83% were women, thus a stratification might not have changed the results much. However, the sample size was large, which generated a large number of statements, and the fact that 78 of the statements were redundant indicated that the number of statements was sufficient to reach data saturation. The redundancy was also illustrated in our calculated stress value, which was comfortably below the commonly accepted threshold. Another strength of this study is the high number of participants in the sorting, rating, and validation phases, which assured a valid statistical analysis. Finally, the GCM includes the voice and involvement of the participants; the data are thus not research generated. The method involved the participants in all phases—generation of data, data analysis, and validation of results.

In conclusion, the GCM approach proved to be a relevant method for revealing experiences of working from home or having colleagues working from home during a late stage of COVID-19 lockdown. These experiences indicated a wish for co-decision and interest toward more flexibility, especially when addressing the balance between work and spare time, and the usefulness of the conceptual model for planning of future work arrangements in a hospital research setting.

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Ethical approval

According to Danish legislation, approval from the Committee on Health Research Ethics and the Danish Data Protection Agency was not required, as no subjects were exposed to medical interventions/devices and no sensitive data were collected. Electronic informed consent was obtained, and all participants were informed about their right to withdraw at any time from the study.

Competing of interests: The authors all work at the study setting and have all been working from home during the study period in varies degrees. The authors have no financial or personal interests in the study results.

Contributorship: Substantial contributions to the conception or design of the work and interpretation of data for the work: IOS, KW, RR, RC, CB and EEW; Analyzing the data: IOS, KW and EEW; Drafting the work or revising it critically for important intellectual content: IOS, KW, RR, and EEW; Final approval of the version to be published: IOS, KW, RR, RC, CB and EEW; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: IOS, KW, RR, RC, CB and EEW.

Data Sharing: Data are available upon reasonable request by e-amil: bfh-dl-org-parkerinstituttet@regionh.dk.

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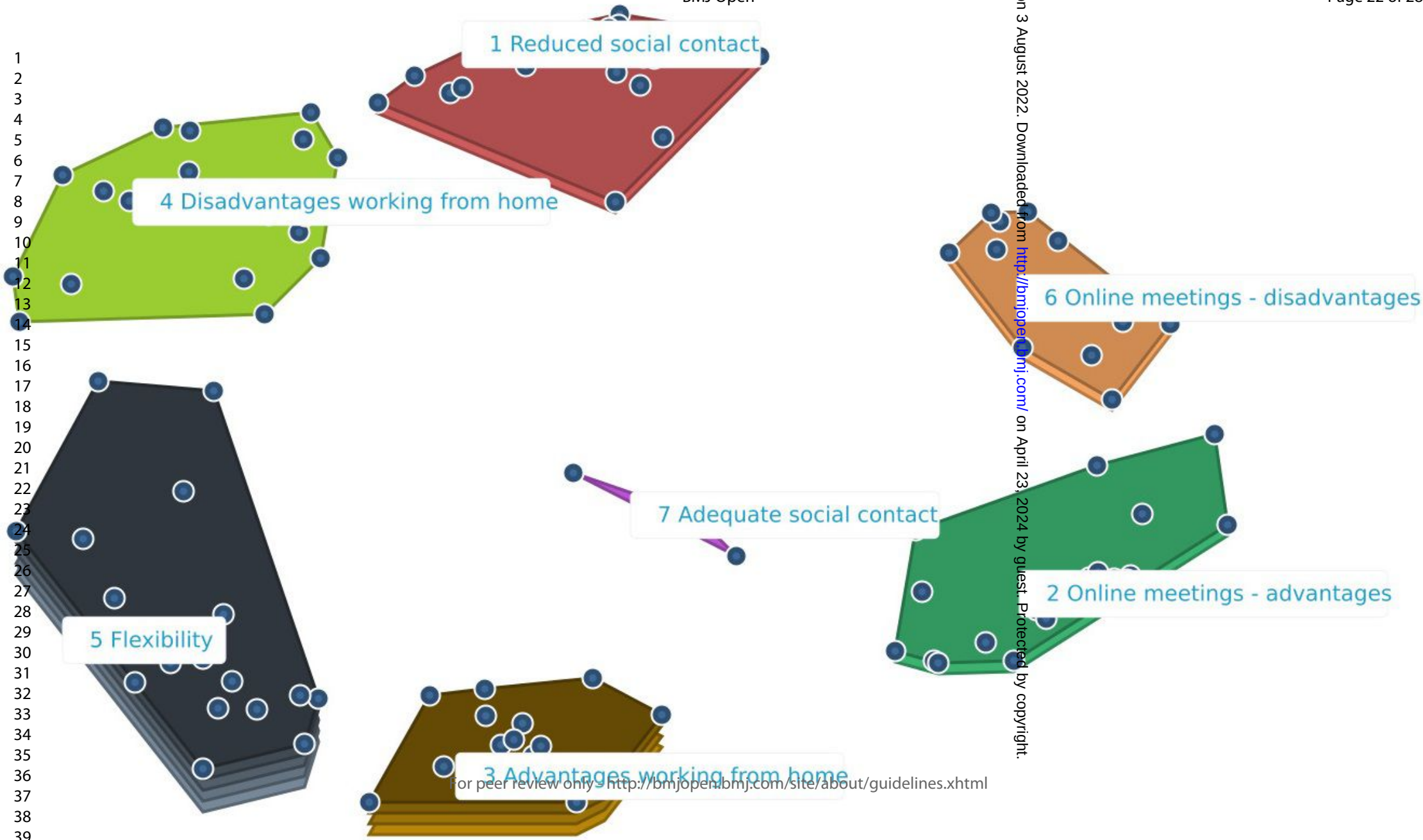
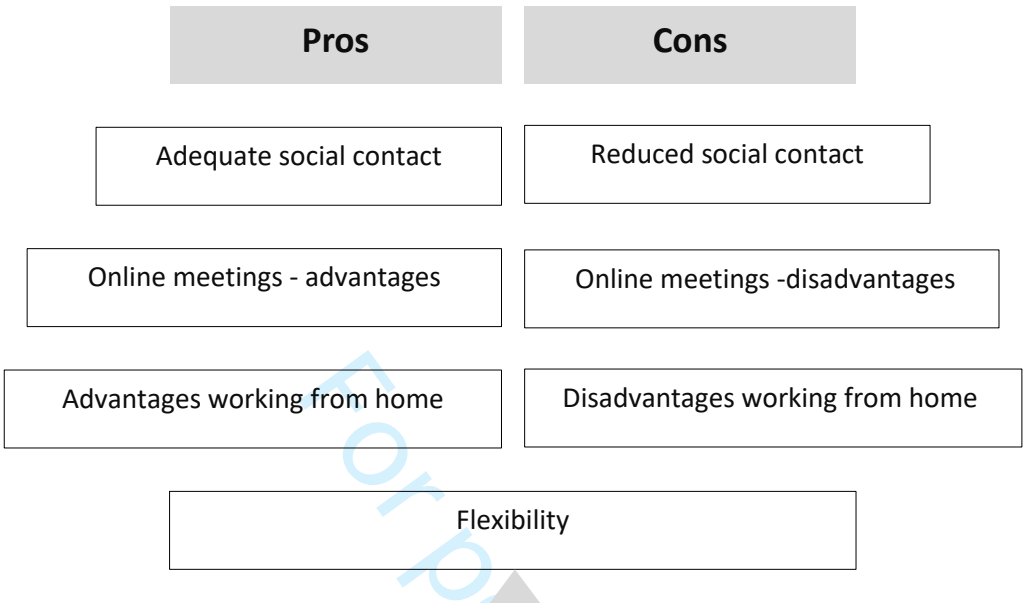
Figure captions

Figure 1. Cluster rating map with seven clusters. Proximity of clusters on the map indicates how related they are. The height of a cluster signifies its relative importance, with higher clusters (i.e., the number of layers) containing statements being rated as more important.

Figure 2. Conceptual model. Pros and cons balancing on the cluster Flexibility





Supplementary Table 1: Statements and Cluster Report

Cluster	Statement #	Statement	Rating of importance (median)
1. Reduced social contact *(n= 26)*	1	I find informal meetings and discussions very productive and I miss them.	3
	2	Small frustrations in a workday – miss colleagues to "unload" to.	3
	3	One easily loses perception of Parker-projects throughout the institute.	3
	6	Ideas are not developed to the same degree.	3
	7	Miss being disturbed while working	2
	8	It has not been possible to get to know people – was relatively, newly employed at lockdown	3
	11	Missed being in a research environment, with the gains that come along the way.	3
	21	Without the daily contact, one has lost the good collegial contact.	3
	23	Daily physical contact is important for good communication.	3
	32	Sometimes a bit lonely to physically meet up, only to find out that pretty much everyone else is at home on that particular day. It may be a help if everyone makes it obvious in Outlook whether they are home or "out".	3
	35	As an extrovert, working from home can be very hard.	2
	36	If people work from home too much, one loses touch with them and the feeling of unity.	3
	46	I have missed meeting up.	3
	48	Colleagues are less available from home.	3
	53	Some stimuli are missing when one only sits at home	3
	58	Working from home can be lonely	3
	86	Hard to generate relationships with new colleagues	3
	88	that I get left out of the very informal communication and information flow if I am not physically present	3
	93	The advantages of having delightful colleagues decrease when one does not have the prospect of meeting face-to -face	3
	101	Meeting in at work and bumping into colleagues at the coffee machine gives an energy boost	3
	103	A strong camaraderie between them who have been present	2
	105	Deadly boring in the long run	2
	107	Some colleagues have not been very available	3

	109	Spontaneous communication/consultation/discussion regarding small challenges is difficult	3
	113	One tends to forget to contact colleagues who have been away all or most of the time	3
	120	In the long term, I think the social relationships with my colleagues will be weakened	3
2. Online meetings – advantages *(n=23)*	4	Starting online Tuesday and Friday meetings has been very positive for the Parker-spirit.	3
	10	That it has been possible to partake in pretty much all Tuesday and Friday meetings	3
	15	Online meetings make it easier to gather people from various places	3
	17	Less chit-chat at virtual meetings	3
	18	Learning to utilize IT-meetings is quick	3
	20	The many online possibilities have increased the possibility of brainstorming with many more relevant people	3
	29	Virtual meetings made it easier to gather people from various places (local and overseas)	3
	31	Virtual meetings are a fine alternative to physical meetings	3
	33	Being able to link virtual access with physical attendance gives meetings more flexibility – but it demands good meeting-discipline from everyone	3
	42	Had more walk and talk meetings, where one takes a walk at the same time one has an online meeting	2
	57	I did not have much experience with online meetings before lockdown, it has opened up for totally new possibilities for collaboration and flexibility.	3
	60	Really great that people have become used to virtual meetings, so there is no longer the same resistance to digital solutions. They have become a natural part of the working day.	3
	64	I have had to find out how the virtual works and I have learnt a lot from that.	2
	68	One can hold really a lot of virtual meetings in one day…	2
	72	Adjusting all meetings and all education to virtual was very demanding but satisfying when it succeeded.	3
	73	Both internal and external meetings have been easier to plan regarding dates, because transport was not a factor that had to be taken into account.	3
	78	Virtual work meetings were very focused because one could work with a document at the same time.	3
	81	Teams are good to go in and out of if one works together with a colleague to solve a problem	3

	89	That some days I see more colleagues online, at various meetings, than I would have done if I had met in physically	2
	90	That more people can partake in Tuesday's education and Friday's meetings, when they are held online	3
	110	Online meetings are less time consuming than physical meetings, but not necessarily more effective.	3
	112	Good to find out that many meetings with international collaborators can easily be taken online.	3
	115	It has been easier to partake in web seminars, for example, than physical seminars, also those that end late, because one can often listen in and, for example, pick up children at the same time.	3
3. Advantages working from home *(n=23)*	19	Working from home is more productive	3
	44	Easier to change between different work assignments	3
	45	Timesaving because there is no transport time	3
	49	Now where the children are away in school, the potential for concentration and engagement is greater	3
	54	Time to focus	3
	55	I find concentrating easier at home	3
	59	Working from home and virtual solutions make it considerably easier to juggle between appointments and tasks, when one has more than one workplace.	3
	62	Peace and quiet to work, fewer distractions, better concentration – work more effectively from home.	3
	63	Lovely being able to rest my head, at home, from the buzz and small sounds.	3
	66	For those of us that are more on the introvert side, it was lovely being able to immerse ourselves, alone at home.	3
	67	Because everything was cancelled in the beginning, there were some good opportunities to create periods for larger work tasks.	2
	69	I experienced that I was more productive at home when it came to articles and reports.	3
	74	Tasks that required peace and quiet and concentration were easier to solve from home.	3
	80	Peace and quiet to concentrate on one's tasks	3
	82	Significantly fewer disruptions during problem solving	3

	87	That I achieve much more, when I get peace and quiet at home, which gives greater daily job satisfaction.	4
	91	That I, as a part-time employee, can be available for both workplaces on the same day, when I work from home. It means, for example, that I can find time in my calendar for a meeting more quickly.	3
	94	Working from home is effective for me in smaller doses	3
	96	Working from home gives better peace and quiet for tasks that require concentration	3
	99	Working from home has made it easier to establish a good working rhythm where one task replaces another.	3
	121	Working from home is a more effective work-form, than I had imagined before lockdown	3
	123	After a few difficult adjustments in the beginning, I have become extremely happy with partially working from home. I get a lot more done (there are less interruptions from colleagues etc. and I am therefore more effective).	3
	124	Effective time without disturbances with peace and quiet to work	3
4. Disadvantages working from home *(n=20)*	13	Time-off and work-life overlap more when you work from home	3
	22	Larger demands are posed on home IT equipment, in order to be just as productive, as at work	3
	25	During the times that several family members were home, due to the pandemic, I was disturbed more – less effective	2
	27	Prefer to meet up at work physically	2
	34	Motivation is lower at home	3
	43	Difficult to remember to hold regular breaks	3
	47	Difficult being effective at home	2
	50	Need bicycle ride, to work, as exercise	2
	51	Some work projects are easiest with large screen	3
	56	On days where motivation is a bit lower than normal – it is better for me to be physically at work	3
	70	Missed separating work-life and private-life during lockdown	3
	71	Became more tired from staring at the screen all day	3
	76	Pain in the back and neck because home is not fitted out, as it is at work	3
	83	Working from home over a long time, demands planning of daily exercise	2
	85	Can be difficult holding momentum up (take care of work)	3
	100	Full time home-office does not work for me because it is too easy to procrastinate	2

	108	I could not imagine having to work from home every day – maximum one day per week	2
	111	I have difficulty concentrating when I work from home	3
	117	In my case, the lack of distinction between work and free time makes it difficult to hold free	3
	118	In my case, it has not been possible to fit out a home-workplace, that is quite the same level as my normal workplace	3
5. Flexibility *(n=19)*	9	I appreciate the possibility of changing between working from home and meeting up physically. It gives job satisfaction and makes me more effective	4
	14	Greater job satisfaction, being able to decide whether one will work from home or at Parker	4
	16	More flexible workday	4
	26	Working from home is a good alternative but I want to decide, myself, when it is most relevant for me	4
	37	Working from home gives more relaxed mornings, where one can start work earlier because one does not need to transport oneself or make small talk with colleagues	3
	40	The combination of meeting at work and the possibility of working from home is optimal	4
	41	The possibility of working from home gives better work/life balance	4
	52	Working from home is wonderful, but it is best when one can self-choose when and for how long	4
	61	Good to save on transport; good for me, good for the dense traffic, good for Denmark, good for the environment.	3
	65	Lovely being able to eat lunch in the garden…	1
	77	Easily came to work longer days – started earlier and finished later because the computer was out and because I saved time on transport.	3
	79	Some tasks are better suited to working from home than others	3
	95	The possibility of working from home gives greater freedom, flexibility, job-satisfaction and motivation	4
	98	Having the possibility of working from home gave a feeling of greater job-satisfaction, less stress and has been very positive on the home front – gave better work-life-balance	4
	102	Lovely with trust from the workplace that one, of course, did one's work – regardless of where one worked from	4
	106	The fitting out of a home office has been a bit of a luxury with a workday from home now and again	3
	116	More flexibility and therefore less stress during the working day, when I have worked from home.	3

	119	The effectiveness of my work from home depends to a large degree on the character of the work	3
	122	It is a lot less stressful working from home under conditions that can be customized to the family.	3
6. Online meetings – disadvantages *(n=11)*	5	As a presenter on a virtual platform, I miss response	3
	12	Online meetings with people I knew before corona, function better than with people I meet online	2.5
	24	Became tired of sitting stuck in front of a screen – when one had many virtual meetings	3
	28	With regard to explaining (presentation or teaching) I clearly prefer physical over virtual meetings	3
	30	One can – at times – quickly lose focus with virtual meetings	3
	38	There is not the same good experience when conveying via screen that there is at a physical meeting	3
	39	Meeting only over a screen is not enough but it is a fine supplement to replace some of the physical meetings	3
	75	If virtual meetings were held back-to-back, or if one should teach virtually a whole day, one became mentally exhausted	3
	84	One needs to have WebCam on for virtual meetings to work	3
	97	Online meetings are ok, but work better face-to-face	2
	114	Online meetings are less personal	2
7. Adequate social contact *(n=3)*	92	That I have less need for the social side of the workplace than many of my colleagues.	2
	104	I do not think working together has been challenging, as long as colleagues are available via telephone/mail during work hours	3
	125	It is easy to stay in contact.	3