

Scotland's Rural College

Impacts of the COVID-19 pandemic on animal behaviour and welfare researchers

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Published in:

Applied Animal Behaviour Science

DOI:

[10.1016/j.applanim.2021.105255](https://doi.org/10.1016/j.applanim.2021.105255)

Print publication: 01/03/2021

Document Version

Peer reviewed version

[Link to publication](#)

Citation for published version (APA):

Camerlink, I., Nielsen, B. L., Windschnurer, I., & Vigors, B. (2021). Impacts of the COVID-19 pandemic on animal behaviour and welfare researchers. *Applied Animal Behaviour Science*, 236, Article 105255. <https://doi.org/10.1016/j.applanim.2021.105255>

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1 Impacts of the COVID-19 pandemic on animal behaviour and welfare researchers**

2

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18

19 ** This paper is part of the Special Issue '*COVID-19: Rethinking confinement*' based on the 2020 ISAE

20 conference

21

22 Declaration of interest: none.

23

24 **Abstract**

25 The COVID-19 pandemic has resulted in many changes in the way research is conducted. Some specific
26 groups (e.g. women) and activities (e.g. teaching) may have been disproportionately affected. Our aim was
27 to assess the impact of the COVID-19 pandemic on animal behaviour and welfare researchers' work
28 experience and productivity, focussing on gender, care role, career stage and teaching load. An online
29 survey asked researchers about childcare, research and teaching load and associated changes due to the
30 pandemic, among others, and included the Perceived Stress Scale (PSS) and the Inventory of Socially
31 Supportive Behaviours (ISSB). From June-July 2020, 117 completed responses were received from 28
32 countries. Time available for writing papers and grants either increased (36%), decreased (31%) or these
33 tasks were halted completely (12%). Perceived productivity was significantly lower for caregivers (P
34 <0.001) and for men as compared to women ($P < 0.001$); and low productivity was associated with more
35 stress (higher PSS: $P <0.001$). Respondents' experience of the pandemic related to the PSS ($b = -0.03 \pm$
36 0.02 ; $P = 0.03$) and to self-assessed personality traits ($P = 0.01$). The average PSS of 21 ± 6.5 was greater
37 than the reference value of 15, and was higher when respondents had low job security ($P <0.001$) and
38 when they more strongly characterised themselves as perfectionists, hard-working, empathetic and
39 worried ($P = 0.02$). Respondents who had an intense care role received most social support ($P = 0.04$).
40 Teaching load increased for 25% of the respondents but did not significantly relate to any of the response
41 variables. Overall, caregivers and early career researchers faced the most difficulties, and personality traits
42 had a major impact on the ability to cope with the changes caused by the pandemic.

43

44 **Keywords.** Gender equality; corona virus; pandemic; care role; psychological stress; research output

45

46 **1. Introduction**

47 It is clear that the COVID-19 pandemic has affected many areas of research, with disciplines that rely on
48 laboratories and time-sensitive experiments being more affected than other disciplines (Myers et al.,
49 2020). Restrictions to control the COVID-19 pandemic have included, in most countries, a complete lock-
50 down including the temporary closure of research facilities. Many researchers have been forced to work
51 from home for two to three months or longer. This has resulted in many changes in work circumstances
52 and research progress, with many facets that go beyond what we can address in just one paper.

53 Researchers faced suspension of animal trials and restrictions on entering laboratory and animal
54 facilities. This affected the planning and execution of many trials and their related funding. Projects that
55 depend on specific timing, for example seasonal data collection such as trials on newborn animals in
56 spring, may have been suspended for a whole year or cancelled completely. At the time of writing, there is
57 still great uncertainty about the feasibility of planning research projects, as waves of COVID-19
58 infections, and thus related restrictions, are foreseen (Kaxiras & Neofotistos, 2020). This will affect nearly
59 all researchers in animal behaviour sciences, and especially those who rely heavily on data collection in a
60 limited time frame, such as PhD students. Consequently, there may be gaps in researchers' curriculum
61 vitae, which may impact their future career progression.

62 It is common for researchers to face high levels of stress (Shin & Jung, 2014) and to have
63 uncertainty about their job position (Castellacci & Viñas-Bardolet, 2020). The pandemic may have
64 resulted in (additional) mental health challenges and reduced life satisfaction (Ammar et al., 2020), in
65 particularly for those who had to stop working (Zhang et al., 2020) and thus had reduced job security.
66 Psychological resilience to stress is an important trait to cope with the situations that arise during the
67 COVID-19 pandemic (Parades et al., 2021), and is related to other personality traits, such as extraversion
68 and conscientiousness (Campbell-Sills et al., 2006). The ability to cope with stressful events can be
69 increased by receiving social support (Ye et al., 2020; Qi et al., 2020). Job security, personality and social
70 support are some of the factors which can affect researchers' response to the situation.

71 Some groups may have been affected more strongly than others. Women particularly may face
72 hardship during the pandemic for multiple reasons, including being more often the primary caregivers,
73 having less financial security and being more often victims of domestic violence than men (e.g. Connor et
74 al., 2020; Fortier, 2020; Gausman & Langer, 2020). The gendered knock-on effects of the pandemic also
75 pervade into academic careers (Gabster et al., 2020; Malisch et al., 2020; Myer et al., 2020). For example,
76 during the first months of the pandemic relatively fewer manuscripts were submitted by female than by
77 male researchers (Gabster et al., 2020). The pandemic may therefore exacerbate gender inequality, which
78 is already an important concern in academia (European Commission, 2019). As our discipline has mostly
79 female researchers (European Commission, 2019; Tang-Martinez, 2020), especially at the level of PhD
80 students and Early Career Researchers (ECR, those up to seven years after obtaining their PhD), there is
81 concern as to how the pandemic will affect our research field in the long term. For parents, the closure of
82 kindergartens and schools during the pandemic led to increased childcare needs, especially for working
83 women (Staniscuaski et al., 2020). Researchers with children or other care duties had to adapt their
84 working schedule to family care. For many, this meant temporary suspension of work duties, as employers
85 requested parents to take up their holidays or take special leave in order to fulfill their care role. During
86 and after the pandemic, ECR may experience increased difficulties in obtaining or keeping a job (Forsythe
87 et al., 2020). Researchers with young children are also more likely to be ECR; which is already a
88 vulnerable group. Lecturers had to move their classes online and alter content and design to a form that
89 was suitable for virtual learning (Crawford et al., 2020). For those with a lot of teaching hours this may
90 have come at the cost of their other professional tasks and their private life (Rapanta et al., 2020). These
91 groups require extra attention in current COVID-19 response strategies and in the development of the
92 post-pandemic research landscape (Corbera et al., 2020; Gibson et al., 2020).

93 The aim of this study was to assess the impact of the pandemic on animal behaviour and welfare
94 researchers' work experience and productivity. For this purpose, we looked at how certain groups
95 perceived the pandemic as compared to others. We hypothesised that especially women, caregivers, ECR
96 and those with a high teaching load would face most challenges during the pandemic. We further

97 predicted that job security, personality and social support would influence the experience of the pandemic
98 as well as work productivity. Although this study is not directly concerning applied (non-human) animal
99 behaviour science, the findings are likely to impact the associated research, and we therefore consider this
100 journal the best place to raise awareness of this subject.

101

102 **2. Methods**

103 *2.1 Survey*

104 A survey was developed to ask animal behaviour and welfare researchers about their experience during
105 the pandemic in relation to their work. The survey was anonymous, and respondents had to agree to give
106 their consent before continuing to the questions. The survey was approved by the Social Science Ethics
107 committee of Scotland's Rural College, where the survey was hosted. The target population was animal
108 behaviour and welfare researchers of any gender. Participants had to be at least 18 years of age and had to
109 be enrolled as a PhD student or holding a PhD degree.

110 An online survey was created using SurveyMonkey. The shareable link to the survey was distributed by
111 email and by advertising the link at various relevant forums, including the Animal Welfare Slack forum,
112 the Animal Welfare Research Network newsletter, the website of the International Society for Applied
113 Ethology (ISAE) and the ISAE newsletter of July 2020. The full survey is provided in the Supplementary
114 Files (**Table S1**). The survey consisted of four parts. The first part included nine questions on
115 demographics, including questions on country of residence, gender, age, children, care roles and a Likert
116 scale of questions related to personality and life satisfaction. The questions on personality were added to
117 get a glimpse of the personality of the respondents without making the online survey unnecessarily long.
118 The questions were chosen from existing questionnaires (Satisfaction with Life Scale: Diener et al., 1985;
119 Big Five Inventory: John et al., 1991; The Toronto Empathy Questionnaire: Spreng et al., 2009) and
120 selected based on traits that are common for researchers, such as conscientiousness (Chamorro-Premuzic
121 & Furnham, 2003; De Feyter et al., 2012) and those related to the pandemic, such as neuroticism
122 (Modersitzki et al., 2020). The second part was related to research work, and included questions on

123 research field, role (i.e. research position), type of institution (e.g. university, research institute, industry,
124 independent, etc.), job security (on a sliding scale corresponding to an 8-point Likert scale), working
125 hours, percentage of time spent on research and education, changes due to the pandemic, and an open
126 question to reflect upon the impact of the pandemic on their career. The third part was the 10-item
127 Perceived Stress Scale (PSS; Cohen, 1983), which is a well-established psychological instrument for
128 measuring the perception of stress (Cohen & Janicki-Deverts, 2012). The PSS contains ten fixed questions
129 that can be answered on a 5-point scale ranging from 0=Never to 4=Very Often. To calculate individual
130 PSS scores, responses to the four positively stated questions (items 4, 5, 7, and 8) were reversed, after
131 which all ten scores were summed. The PSS has an average reference value of 15 to which other groups
132 can be compared (Cohen & Janicki-Deverts, 2012). The fourth part of the survey was optional (i.e. it was
133 not compulsory to answer in order to proceed with the next questions) to decrease dropout rates and
134 included the short form of the Inventory of Socially Supportive Behaviours (ISSB; Barrera et al., 1981;
135 Stokes & Wilson, 1984). The ISSB short form consists of 19 questions related to social support (during
136 the past four weeks) that can be answered on a 5-point scale ranging from 1='Not at all' to 5='About
137 every day' (Supplementary file, Table S4). To obtain the overall score of a respondent, their 19 answers
138 were averaged. The survey concluded with an open question, giving the option to add further comments
139 on personal experiences of the lockdown. Upon submitting the survey, participants were provided with
140 two links to information on mental support during the COVID-19 pandemic. Data from one respondent
141 was removed from the analyses as the person had indicated to be an MSc student. Three surveys were
142 removed mainly due to incomplete answers, resulting in a final sample of 117 responses (out of 121
143 responses received).

144

145 *2.2. Data preparation*

146 In order to facilitate data analyses, four new variables were constructed out of the responses. Three of
147 these variables were 'principal components' (PC) obtained through a Principal Component Analysis
148 (PCA). A PCA reduces the number of variables by combining correlated variables into a few principal

149 components through the use of a matrix (Wold et al., 1987). The PCA's were performed using SAS
150 software (version 9.4, SAS Institute Inc., Cary, NC, USA) without matrix rotation. The subsequent
151 analyses of these new variables are provided in section 2.3.

152 To create the PC variable '*Work productivity*', all responses to questions related to work output during the
153 pandemic were combined in a PCA, after verifying that the questions were significantly correlated.

154 Variables were maintained in the PCA factors irrespective of their loading. One factor had an Eigenvalue
155 of >1 (1.50) and was retained. The factor loaded positively on research output (0.80) and '*Working from*
156 *home has positively influenced my productivity*' (0.61), and loaded negatively on '*My caring commitments*
157 *have made it challenging to complete my workload*' (-0.69). A higher PCA factor score therefore related
158 to a more positive outlook on own productivity. To create the PC variable '*Pandemic experience*',
159 responses to questions on work-related changes and opinions during the pandemic were set to numerical
160 scales and combined in a PCA. One factor best explained the pandemic work experience, with an
161 Eigenvalue of 1.58. All variables loaded moderately positive (0.50 – 0.70) on the factor pattern (change in
162 working hours 0.71; change in time spent on education 0.66; preference to remain working from home
163 0.62; and competence in online tools 0.50), except for 'change in research time' (-0.07). A higher factor
164 score therefore related to increased working and teaching hours combined with a preference to remain
165 working from home.

166 The seven responses to the question '*How would you describe yourself?*' (Supplementary file, Table S1),
167 that were scored on a Likert scale, were combined in a PCA. One factor best explained the combination of
168 variables, with an Eigenvalue of 2.15, and is hereafter called '*Self-description*'. All variables loaded
169 moderately positive (0.50 – 0.70) on the factor pattern except for life satisfaction (-0.16) and multitasking
170 (0.36). A high factor score thus describes researchers who characterise themselves as being perfectionists,
171 hard-working, empathetic and having a tendency to worry a lot.

172 To analyse the effect of care duties, responses related to care roles were combined into the variable '*Care*
173 *role*' with three levels: no (59%), moderately involved (24%), and intensely involved (17%) in caregiving.
174 'No' was when the respondent had no children and was not taking care of a family member. 'Moderately

175 involved' was when the respondent either took care of a family member, or had one or two children but
176 indicated not to be the main caregiver. 'Intensely involved' was when the respondent was either the main
177 caregiver of the child(ren), had more than two children, or took care of a family member alongside
178 childcare.

179

180 *2.3 Quantitative data analysis*

181 Data were analysed using SAS software, version 9.4 (SAS Institute Inc., Cary, NC, USA). Data are
182 presented as percentages of the number of respondents, and as means with standard deviation (SD) unless
183 stated otherwise. Fluctuating sample sizes are due to missing responses as none of the questions were
184 compulsory. Descriptive statistics were assessed by Chi-square tests for categorical variables, t-tests and
185 Pearson correlations.

186 Four response variables were analysed: '*Pandemic experience*', '*Work productivity*', PSS (stress scale)
187 and ISSB (social support). All were continuous variables and were analysed in General Linear Models
188 using the GLMSELECT procedure with automatic 'Stepwise' selection method based on the lowest
189 Corrected Akaike Information Criterion (AICC) statistic, with steps treated competitively, and no
190 constraints on the significance level. The predictor variables were gender (male / female), career stage
191 (PhD student / ECR / established researcher / senior), care role (no / moderate / intense), the interaction
192 between gender and care role, institution (university / other), usual working hours per week (6 levels),
193 working over-hours or overtime (yes / no), job security (8-point Likert scale), percentage of time spent on
194 student education, age and self-description. Mental stress and social support can affect mood and work
195 productivity and vice versa; therefore, for the models on 'pandemic experience' and 'work productivity',
196 the PSS and ISSB were added as covariates, and vice versa for the models on PSS and ISSB.

197

198 *2.4 Qualitative data analysis*

199 Responses to the two open-ended questions, which asked participants to describe their experiences of
200 lockdown, were entered into MaxQDA (version 18.2.4) for analysis. They were analysed thematically

201 following the approach of Braun & Clarke (2006) by one of the authors (BV) and final interpretation of
202 the findings was based on this analysis. This involved reading through the responses and looking for
203 points of meaning and coding (i.e. categorising) them according to their topic or theme. For example, a
204 sentence such as “*Staying home has let me have more time for practicing sports*” would have been coded
205 as ‘more time for activities / hobbies’, and then further grouped according to an overarching theme, in this
206 case, ‘Personal life’ (see Table 4). This was repeated systematically across all responses until a range of
207 codes emerged. These codes were then grouped into super-ordinate (e.g. positive) and sub-ordinate
208 themes (e.g. personal life) resulting in a table of key thematic findings and the codes or ‘meaning units’
209 relating to them (see Table 4). Grouping codes according to overarching or super-ordinate themes helped
210 determine connections between different codes (e.g. ‘more time for activities/hobbies’ and ‘quality time
211 with family’ would connect via a ‘personal life’ theme).

212

213 **3. Results**

214 *3.1 Respondents*

215 The survey was completed by 117 researchers from 28 different countries. Almost 60% of the respondents
216 were based in Europe (34.2%, n = 40) and the United Kingdom (counted separate from Europe: 25.6%, n
217 = 30). North America (21.4%, n = 25) and South America (7.7%, n = 9) accounted for almost 30%, and
218 the remaining 10% of respondents were living in Australia (6.0%, n = 7), Africa (2.6%, n = 3) or south-
219 west Asia (2.6%, n = 3). Most respondents were women (82.5%, n = 94). Respondents predominantly
220 worked at universities on the topic of animal welfare and were doing their PhD studies or were at an early
221 career stage after their PhD (**Table 1**). The average age of respondents was 38.9 ± 9.79 years. Age
222 increased linearly with career stage: PhD students 31 ± 4.8 years of age; ECR 38 ± 6.1 years; established
223 researchers 44 ± 8.2 years; and senior researchers 51 ± 9.6 years. Female respondents occupied relatively
224 fewer senior positions than male respondents, and instead were mostly PhD students or ECR ($\chi = 8.462$; P
225 = 0.04). At the time of completing the survey, 57.7% (n = 64) of the respondents were in lockdown

226 working from home; 4.5% (n = 5) were in lockdown but partly in the office; with the rest not being in
 227 lockdown but working from home (29.7%, n = 33) or in the office (8.1%, n = 9).

228
 229 **Table 1.** Job profile of the respondents (n = 117) in percentage and number of respondents according to
 230 type of research institution, research field and career stage, separately. The column for institution exceeds
 231 100% as some respondents had functions in multiple institutions.

Institution	% (n)	Research field	% (n)	Career stage	% (n)
University	77.8 (91)	Animal welfare	71.6 (83)	PhD student	31.9 (37)
Research institute	15.4 (18)	Animal behaviour	25.0 (29)	ECR	35.3 (41)
Research college	7.7 (9)	Animal production	1.7 (2)	Established ¹	15.5 (18)
NGO	6.8 (8)	Veterinary research	1.7 (2)	Senior ²	17.2 (20)
Government	6.8 (8)				
Independent	2.6 (3)				

232 ¹‘Established researcher’ includes independent researchers, lecturers and assistant professors.

233 ²‘Senior researcher’ includes associate researchers and (university and full) professors.

234
 235 Regarding personality, the large majority agreed that they were good at multi-tasking, perfectionists,
 236 working more than is demanded from them, and tended to worry a lot (**Table 2**). They responded similarly
 237 to the questions related to empathy, indicating to have a strong urge to help others and to get emotionally
 238 affected. Regarding life satisfaction, 43.6% indicated ‘somewhat agree’. Notably, 12.8% indicated
 239 disagreeing with this statement (**Table 2**).

240
 241 **Table 2.** Heat map of the Likert scales on questions related to personality and life satisfaction, showing
 242 the percentage of respondents (out of n = 117) indicating their answer to a 7-point* Likert scale. The
 243 darker the colour the higher the percentage of respondents.

<i>How would you describe yourself?</i>	Likert scale*						
	1	2	3	4	5	6	7
I am good at multi-tasking	0.9	7.7	6.0	6.0	37.6	29.1	12.8
I consider myself a perfectionist	1.7	6.8	6.0	11.1	23.9	26.5	23.9
I tend to work more than what is demanded from me	0.0	6.8	3.4	9.4	29.1	20.5	30.8
I tend to worry a lot	0.9	6.0	4.3	8.6	31.6	21.4	27.4
I get a strong urge to help when I see someone who is upset	1.7	6.0	1.7	5.1	29.1	28.2	28.2
I easily get emotionally affected by others' situation	1.7	10.3	6.0	6.8	31.6	26.5	17.1
I am satisfied with my life	0.0	12.8	4.3	6.8	43.6	21.4	11.1

244 * Likert scale: 1: completely disagree; 2: disagree; 3: somewhat disagree; 4: neither agree nor disagree; 5:
 245 somewhat agree; 6: agree; and 7: completely agree.

246

247 *3.2 Care roles*

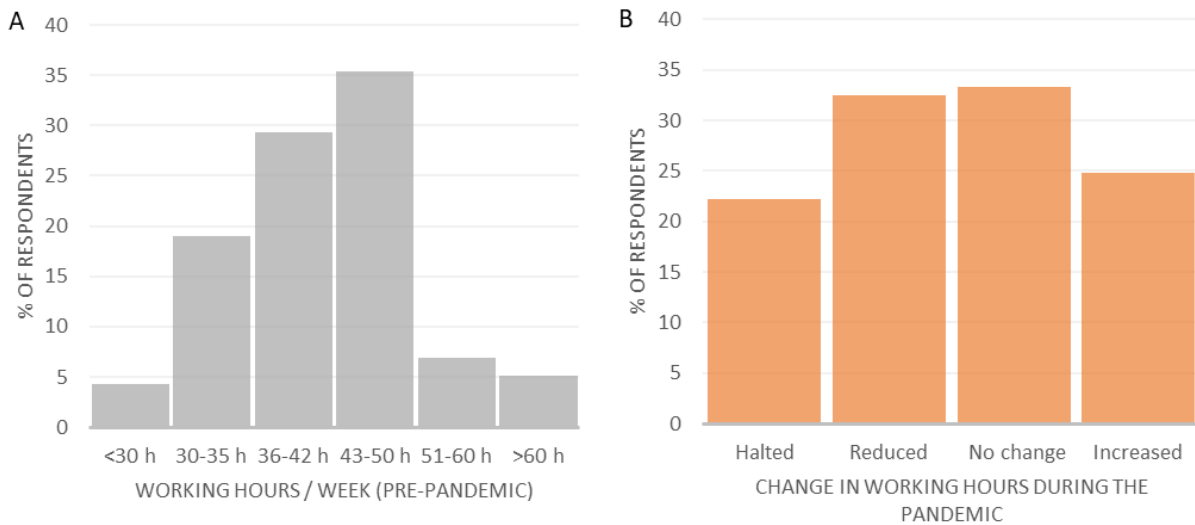
248 The majority of the respondents (61.5%, n = 72) did not take care of children. Most respondents with
 249 child-care responsibilities had two children (21.4 % of all respondents, n = 25), and the most common
 250 child-age category was 1-5 years (17.1% of all respondents, n = 20; Supplementary files, Table S2). A
 251 higher percentage of the male respondents had children (65%, n = 13) as compared to the female
 252 respondents (34.1%, n = 32; $\chi = 12.499$; P = 0.002; Supplementary Files, Table S2). However, when
 253 looking at respondents with care responsibility, none of the men indicated to be the main caregiver,
 254 whereas 14 of the 32 (43.7%) women caregivers did. Men responded that the care was equal between the
 255 two partners (84.6%, n = 11) or the main care was with the partner (n = 1) or family (n = 1). Half of the
 256 women responded that they shared the childcare equally with their partner (50%, n = 16) or that the care
 257 was allocated to a nanny (n = 1). Seven women and three men took care of a family member during the
 258 pandemic. Childcare was increased during the pandemic both for women (for 81.3% of those with
 259 children, n = 26) and men (for 76.9% of those with children, n = 10).

260

261 *3.3 Work pressure*

262 On a scale from 0 to 7, with seven as most secure, respondents rated the financial security of their job as
263 4.6 ± 2.24 (range 0 – 7). Respondents' usual working hours (outside the pandemic) are given in **Figure**
264 **1A**. For the respondents who were halted in their work during the pandemic (**Figure 1B**), 8.6% had to stop
265 temporarily, 8.6% had to take up holiday during the pandemic, 3.4% had to take special leave, and 1.7%
266 were furloughed by their employer. Three-quarters of the respondents (76.7%, $n = 89$) indicated working
267 more hours than they were paid for (i.e. unpaid overtime). Respondents spent on average $27.6\% \pm 24.79$
268 of their working time on education and teaching and $64.6\% \pm 26.34$ on research. The percentage spent on
269 education increased for 25.2% ($n = 28$) of the respondents and decreased for 18.9% ($n = 21$). The
270 percentage spent on research increased for 7.2% ($n = 8$) and decreased for 41.4% ($n = 46$) of the
271 respondents.

272



273

274 **Figure 1.** a) The distribution of the average number of working hours per week prior to the pandemic; and
275 b) the change in working hours during the pandemic.

276

277 *3.4 Work productivity*

278 Of 111 respondents, 29.7% (n = 33) were less able to work on grant proposals and publications during the
 279 pandemic, with 13.5% (n = 15) indicating to have no time at all for it. For 36% (n = 40) the time spent
 280 writing grant proposals and publications increased.

281 Respondents were divided on whether working from home increased their productivity, with 45.9% (n =
 282 43) disagreeing and 35.7% (n = 33) agreeing with the statement (**Table 3**). Similarly, the preference to
 283 remain working from home was divided with 39.1% (n = 35) disagreeing and 50% agreeing (n = 55). For
 284 the majority, care commitments made it challenging to complete work. However, almost all felt competent
 285 in using online tools. The majority (76.4%, n = 69) had the impression that female researchers were more
 286 disadvantaged during the lockdown than male researchers; but it were the female respondents who
 287 indicated this more than the male respondents ($F_{1,107} = 4.24, P = 0.04$).

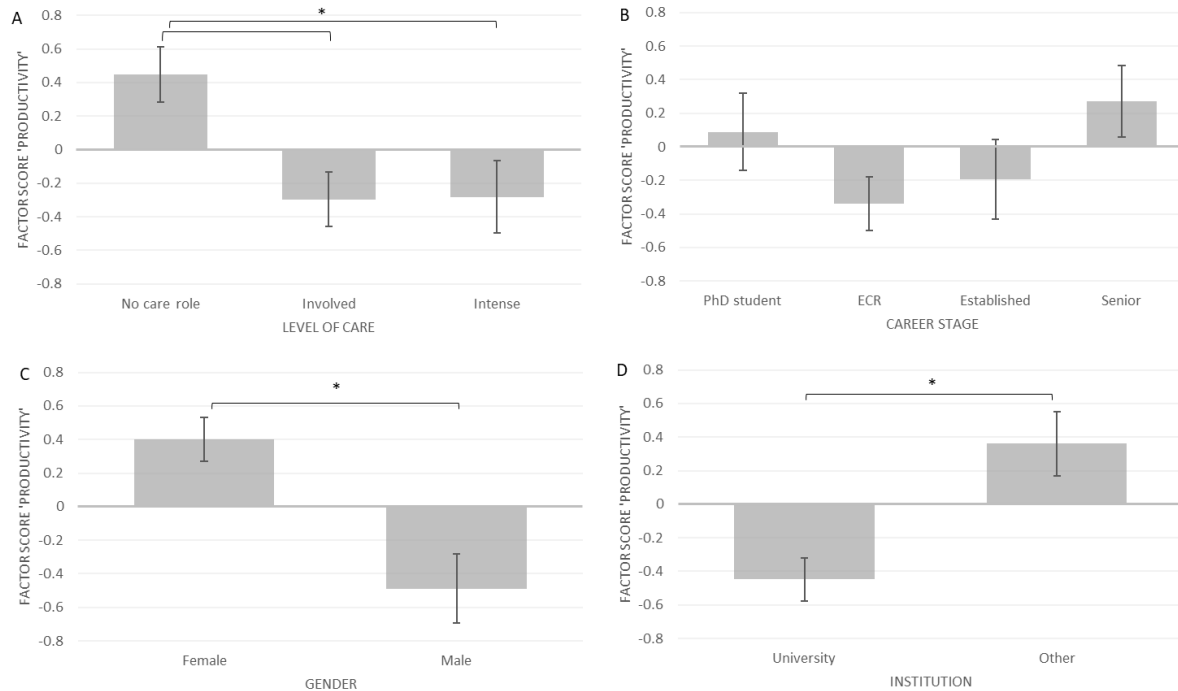
288
 289 **Table 3.** Heat map of the Likert scales on questions related to work during the pandemic. The table shows
 290 the percentage of respondents indicating their answer to an 8-point Likert scale*. The darker the colour the
 291 higher the percentage of respondents.

	Likert scale*							
<i>To what extent do you agree with the following statements?</i>	n/a	1	2	3	4	5	6	7
Working from home has positively influenced my productivity (n = 108)	0.9	18.4	17.4	10.1	17.4	12.8	17.4	5.5
My caring commitments have made it challenging to complete my workload (n = 77)	5.2	9.1	3.9	11.7	18.2	10.4	13.0	28.6
I would prefer to remain working from home (n = 110)	0.9	11.8	11.8	15.5	10.0	16.4	21.8	11.8
I feel competent to use online tools for virtual meetings (n = 109)	0.0	0.9	3.7	0.9	6.4	36.7	17.4	33.9
I have the feeling that female researchers have faced more challenges during the lock-down than male researchers (n = 110)	0.0	5.5	1.8	1.8	14.6	33.6	15.5	27.3

292 * Likert scale: n/a: not applicable; 1: completely disagree; 2: disagree; 3: somewhat disagree; 4: neither
293 agree nor disagree; 5: somewhat agree; 6: agree; and 7: completely agree.

294
295 Perceived work productivity during the pandemic was significantly lower for those who had a care role as
296 compared to those who did not have a care role ($F_{2,73} = 7.87$; $P < 0.001$), irrespective of the level of
297 involvement in the care (Figure 2: no care role vs. involved $P < 0.001$, no care role vs. intense $P = 0.003$,
298 involved vs. intense $P = 0.95$). Perceived work productivity was also lower for men as compared to
299 women ($F_{1,73} = 13.81$; $P < 0.001$); and for those who were working at universities as compared to those
300 working in other types of institutions ($F_{1,73} = 13.99$; $P < 0.001$; **Figure 2**). The higher productivity for
301 women was partly related to a relatively lower percentage of women being caretakers than men in this
302 sample. The highest productivity was seen in women without a care role, with an average factor score of
303 0.67 ± 0.769 (range $-0.77 - 2.03$), while the factor scores for all other groups were negative, i.e. less than
304 zero. The factor scores for productivity tended to be lower depending on career stage ($F_{3,73} = 2.28$; $P =$
305 0.09), with a significant post-hoc difference for ECR as compared to senior researchers (Figure 2). A
306 higher perceived productivity was related to a lower Perceived Stress Scale (PSS, estimate \pm SEM: $b = -$
307 0.05 ± 0.01 ; $F_{1,73} = 12.11$; $P < 0.001$).

308



309

310 **Figure 2.** The effects of a) care role, b) career stage, c) gender, and d) type of work institution on the
 311 perceived work productivity during the pandemic. The axes across the panels are set to the same scale.

312 *indicates a significant difference between the categories.

313

314 3.5 Experience of working (from home) during the pandemic

315 The factor score for ‘pandemic experience’, which loaded positively on increased working and teaching
 316 hours and a preference to remain working from home, was associated with a lower PSS, i.e. less stress as
 317 described in section 3.6 (estimate \pm SEM: $b = -0.03 \pm 0.02$; $F_{1,104} = 4.91$; $P = 0.03$). ‘Pandemic experience’
 318 related positively to the variable ‘self-description’ (estimate \pm SEM: $b = 0.27 \pm 0.11$; $F_{1,104} = 6.47$; $P =$
 319 0.01), thus showing higher factor scores for researchers who described themselves as being perfectionists,
 320 hard-working, empathetic and having a tendency to worry a lot. The factor scores for ‘pandemic
 321 experience’ tended to be higher for women (means \pm SEM: 0.10 ± 0.10) than for men (-0.36 ± 0.23 ; $F_{1,104}$
 322 $= 3.16$; $P = 0.08$).

323

324 3.6 Perceived Stress Scale (PSS)

325 The average score on perceived stress, based on 110 responses, was 21.3 ± 6.33 (SD) (range 7 – 35), with
326 the possible range being 0 to 40. The average of the study population was significantly higher than the
327 reference value of 15 (Cohen & Janicki-Deverts, 2012) ($df = 109$, $t = 10.36$, $P < 0.001$). The separate
328 scores for each of the ten questions of the PSS are provided in the Supplementary files, Table S3. Thirty
329 percent of the variation in the final model of PSS was explained by financial security, work productivity
330 and the respondents' self-description. The PSS was higher when researchers had lower financial job
331 security (estimate \pm SEM: $b = -0.95 \pm 0.27$; $F_{1,74} = 12.45$; $P < 0.001$) and lower productivity (-1.73 ± 0.59 ;
332 $F_{1,74} = 8.36$; $P = 0.005$). Women respondents tended to have lower job security than the male respondents
333 (LSmeans \pm SEM: F 4.42, M 5.35; $t = -1.69$; $P = 0.09$). The PSS was higher when respondents had a
334 higher factor score for self-description, relating to perfectionism, hard work, empathy and worrying (1.40
335 ± 0.59 ; $F_{1,74} = 5.55$; $P = 0.02$). 'Productivity' related significantly to and provided a better model fit than
336 both career stage and working at a university (described in *Section 3.5*). However, it is worth mentioning
337 that PhD students had the highest PSS (means \pm SEM: 26.2 ± 1.35), followed by ECR (21.0 ± 0.96),
338 established researchers (19.3 ± 1.35) and senior researchers (18.3 ± 1.38), showing a decline in PSS with
339 advancement in the research career.

340

341 *3.7 Inventory of Socially Supportive Behaviours (ISSB)*

342 The average score for the ISSB, i.e. how much support the respondent received, was 2.10 ± 0.56 (SD)
343 (range 1.11 – 3.79), with a possible range of 1 to 5. The ISSB did not correlate with the PSS ($n = 109$, $r =$
344 -0.01 , $P = 0.93$). The separate scores for the ISSB questions are provided in the Supplementary files, Table
345 S4. Twenty-one percent of the variation in the ISSB could be explained by the respondent's age, care role,
346 financial security, self-description and productivity. A higher ISSB was associated with a lower age
347 (estimate \pm SEM: $b = -0.02 \pm 0.007$; $F_{1,73} = 4.23$; $P = 0.04$) and a higher factor score on 'self-description'
348 (0.15 ± 0.061 ; $F_{1,73} = 5.92$; $P = 0.02$). Social support was related to care role ($F_{1,73} = 3.42$; $P = 0.04$), with a
349 significantly higher ISSB for respondents who were classified as having an intense care role (mean \pm
350 SEM: 2.28 ± 0.129), as compared to those who did not have a care role (1.93 ± 0.105) or who were

351 moderately involved in caretaking activities (1.87 ± 0.113). The latter two did not significantly differ from
352 each other. Financial security ($P = 0.20$) and productivity ($P = 0.10$) were not significantly related to the
353 ISSB but did contribute to the overall model fit.

354

355 *3.8 Qualitative findings*

356 The qualitative findings provide a deeper insight into participants' experiences of the COVID-19
357 pandemic and what factors may underlie some of the quantitative findings. The outputs of the thematic
358 analysis, as presented in **Table 4**, indicated that participants' experiences of the pandemic and its impact
359 on them could be grouped super-ordinately as being either positive or negative, and sub-ordinately
360 according to how it impacted: a) their personal life; b) their health; c) their home and family-life and; d)
361 their work-life and career. Personal life was separated from home and family-life to enable a distinction
362 between factors relating to 'the self' e.g. personal hobbies and activities, and those relating to 'the others'
363 i.e. the other individuals in the household and the nature of those interactions and relationships.

364 Several participants recounted positive impacts on personal life, including being able to spend
365 more quality time with family or friends and having more time to engage in personal activities (e.g. sports)
366 and hobbies (e.g. gardening). The predominant perception on careers and work-life balance was of the
367 pandemic providing new work-related opportunities, including greater opportunities to write and work on
368 papers, and opportunities to up-skill or develop new skills. Interestingly, many highlighted how the move
369 to more 'online' working offered opportunities to increase international engagement with other
370 researchers and the possibility to attend more conferences as many had moved to a virtual format.
371 Responses concerning working from home related to the time-saving benefit of 'no commute' and the
372 positive impact of home-working on productivity due to 'less distractions' from colleagues or a busy
373 office environment. One participant also described a positive impact on physical health.

374 Despite these positive experiences, the predominant view was that the COVID-19 pandemic had a
375 negative impact on personal life, health, home and family-life, and work-life and career. Negative impacts

376 on personal life included factors such as a lack of routine, and travel restrictions which left individuals
377 feeling isolated due to being unable to visit family or friends. The latter was highlighted by some as being
378 particularly pertinent to the research community where many had moved abroad, away from family and
379 home communities, to pursue their careers. Regarding physical and mental health, participants recounted
380 experiencing increased stress, uncertainty, anxiety, worry, guilt, loneliness and isolation, fatigue and
381 exhaustion, and feelings of being overwhelmed, contributing to poorer mental health. There were several
382 interconnected reasons given, such as having to ‘juggle too many jobs’ (e.g. child-care, home-schooling,
383 increased teaching, having to move teaching online, learning new ways of working), social isolation (e.g.
384 not able to see friends), a lack of social support (primarily from not being able to engage with colleagues),
385 work-related uncertainty (e.g. future funding, whether contract would be renewed, whether PhD could be
386 completed), not switching off from work (due to working from home) and working longer hours (due to
387 increased workload or having to work around caring commitments). In terms of negative impacts on
388 physical health, participants described negative effects of ‘being at the desk all day’ attributed to the
389 working day no longer being broken up when working from home and a ‘lack of exercise’.

390 The negative impact of the pandemic on home and family-life was primarily due to more people
391 having to work and live in the home simultaneously, which resulted in issues such as increased
392 ‘interpersonal conflict’ and ‘more distractions’. In line with the quantitative results, participants with
393 children reported the most negative impacts within this theme, describing numerous challenges related to
394 home-schooling as an ‘extra job’. Some recounted how home-schooling had directly impacted their career
395 prospects, where they had to take time off work or post-pone looking for a new job role until they could be
396 sure their children could return to school.

397 The negative impact of the pandemic on participants’ work-life and career was the most widely
398 mentioned and common theme within participants’ qualitative responses. Specifically, the negative impact
399 lockdown had on planned research, whereby experiments and field-work had to be indefinitely postponed
400 and the potential knock-on effects of this on funding, was most commonly mentioned. PhD students and

401 ECR highlighted this as being particularly detrimental, with PhD students experiencing uncertainty
402 regarding completion of planned PhD work and ECR highlighting the potential negative effects on career
403 progression. Other themes were reduced productivity, motivation and focus. Many stated this was due to
404 the negative impacts of the lockdown on their mental health, the aforementioned challenges of home-
405 working and reduced interaction with colleagues to help motivate or ‘problem-solve’. Several participants
406 (n=11) also described an increase in employment uncertainty. Many had work contracts which would end
407 soon, and they were unsure whether contracts would be extended or whether they would be able to find a
408 new job. Respondents also described how the lockdown had resulted in increased work-related demands,
409 including increased teaching, more meetings and the need to provide more student support. Several
410 mentioned difficulties with creating ‘boundaries’ between work and personal time, a lack of proper
411 equipment (e.g. desk, chair) and difficulties in transitioning to working online. Five participants raised
412 concerns over how the lockdown had impacted their students (e.g. PhD and MSc level) and a perceived
413 need to try to provide them with more support but an uncertainty about what they could feasibly do. In
414 sum, it is evident that respondents had wide-ranging and varied experiences of the lockdown, describing
415 numerous different ways in which it had both positively and negatively impacted their personal, home and
416 family life, work-life and career as well as their health

417

418 **4. Discussion**

419 The quantitative and qualitative study of the experience of animal behaviour and welfare (ABW)
420 researchers during the COVID-19 pandemic shows that many have been, mainly negatively, affected by
421 the changes. Although around one-third of the respondents saw opportunities to focus on research work
422 and increase their productivity, for the majority of respondents research tasks competed with an increased
423 teaching load and increased child care. In this study, extra emphasis was given to women, caregivers, PhD
424 students, ECR and those with a high teaching load. The negative impact of the pandemic especially hit
425 PhD students and ECR, as well as researchers who had an intense care role in their family. Gender

426 differences were present, but overall female ABW researchers were not more disadvantaged than male
427 researchers in the current results.

428

429 *4.1 Changes in work during the pandemic*

430 Half of the respondents indicated that they would prefer to remain working from home, which is also
431 found across occupations (Beck et al., 2020), and most felt that it increased their work productivity. Some
432 indicated reduced productivity but still preferred to remain working from home, which may be related to
433 an improved work-life balance (Crosbie & Moore, 2004; Chung & van der Lippe, 2020). Universities and
434 companies have now had to make the necessary adjustments to facilitate home working, and this may
435 open up new opportunities for more workplace flexibility in the future (Kramer & Kramer, 2020). At the
436 start of the lockdown, however, difficulties such as having no desk space, suitable computer or an
437 ergonomic set-up, may have been common issues, as was indeed found for 47% of the respondents in the
438 survey by Kappel and colleagues (*this Special Issue*). Additional issues existed with limited or no access
439 to folders, servers, hardcopy files and books; and problems with internet access and broadband speed at
440 home. Internet access may have been especially problematic in developing countries, thereby contributing
441 to increased inequality (Niner et al., 2020). Although it was not addressed here, we should be considerate
442 of the consequences of the pandemic on BAME (Black, Asian, and minority ethnic) communities
443 (Bentley, 2020; Kirby, 2020).

444

445 *4.2 Work productivity*

446 Time required for teaching and student supervision mostly increased during the pandemic, and researchers
447 indicated they had less time for research. Myers et al. (2020), in their sample of 4535 respondents,
448 reported a 24% reduction in research time across disciplines, and a decline between 30-40% for biological
449 and agricultural sciences. Indeed, over 43% of our respondents were less able, or not able at all, to work
450 on manuscripts and grant proposals. Perceived work productivity appeared to be partly determined by
451 whether or not the respondent had students (and thus lectures and supervision), rather than the number of

452 hours spent on student education. The reduced productivity at universities may also be in part explained
453 by the reduced productivity of PhD students, who were one of the most affected groups during the
454 pandemic and typically are employed at a university. A low perceived work productivity (i.e. job
455 performance) was associated with more stress (i.e. a higher Perceived Stress Scale score, PSS). However,
456 stress and job performance are not always related (Topic et al., 2016), and not necessarily linear
457 (AbuAlRub, 2004).

458 Perceived productivity was lower for researchers with children, as also found by Myer et al. (2020), which
459 is a natural consequence of the immensely increased unpaid worktime and attention needed from parents
460 to home-school and take care of their children during the pandemic (Craig & Churchill, 2020). Those who
461 had an intense care role received more social support from their surroundings (in the month prior to the
462 survey) than those without care roles or those who were not a main caregiver. For those without children,
463 productivity may have increased as the self-isolation during lockdown reduced social activities, and thus
464 freed up time to complete work tasks. Perceived productivity was highest for women without children, and
465 higher for women than for men, which is in contrast to Myer et al. (2020). The lower productivity for men
466 in our survey might be related to a relatively greater proportion of men having children although none of
467 them was a main child caregiver. Women are still the main child-caregivers in industrialised countries,
468 even when both parents are working (Power, 2020).

469

470 *4.3 Gender differences*

471 The majority of the respondents were women, which is in line with the gender distribution in this
472 discipline (Tang-Martínez, 2020) and its main scientific society (ISAE; Supplementary file Figure S1).
473 Most respondents believed that female researchers may have suffered more from the pandemic than male
474 researchers, although this was mostly indicated by women themselves. This mirrors the global concerns
475 on the disproportional burden on women during the pandemic (Fortier, 2020; Gausman & Langer, 2020),
476 including in academia (Malisch et al., 2020; Myer et al., 2020). This survey and the one from Kappel et al.
477 (2021) from within biological sciences show, however, no significant gender effects on the main

478 parameters, suggesting that in ABW research there is less gender inequality when it comes to dealing with
479 the pandemic. Europe has set strong goals to reduce gender inequality in research (European Commission,
480 2019), but for most other parts of the world gender inequality is a prominent and persistent problem in
481 academia (Conesa Carpintero & González Ramos, 2018; Malisch et al., 2020). In the current data, where
482 more than 80% of the respondents were from industrialised countries, women did have fewer senior
483 positions and tended to perceive their job as less secure than did men.

484

485 *4.4 Difficulties for early career researchers (ECR)*

486 PhD students and ECR (those up to seven years after obtaining their PhD degree), had a lower perceived
487 productivity than senior researchers and the highest levels of perceived stress. The high PSS scores
488 emphasize the vulnerability of this group to stress-related mental and physical problems (Gibson et al.,
489 2020). However, younger researchers did receive more social support, which is an important factor in
490 reducing the risk of a burnout (Jacobs & Dodd 2003). With the COVID-19 recession, it may be harder to
491 find a job for those who are, or soon would be, on the job market (Forsythe et al., 2020). This is especially
492 problematic for those who graduate during a recession (Oreopoulos et al., 2012). A larger gap may appear
493 between young staff members with children and those without (i.e. the “family gap”, Antecol et al., 2018;
494 Conesa Carpintero & González Ramos, 2018), whereby those with children may see a more drastic impact
495 on their work productivity (Malisch et al., 2020). The current results indeed support this hypothesis. This
496 may leave a gap in the CV of ECR with children, thus increasing inequality unless funders and employers
497 adjust to such an involuntary ‘career-break’, or assess research output relative to the actual opportunity to
498 work (Klocker & Drozdowski, 2012). Respondents did mention, as a positive aspect of the pandemic, the
499 increased networking opportunities due to the surge in online meetings and conferences. Virtual
500 conferences provided new opportunities for networking, especially for PhD students and ECR who often
501 have limited financial capacity (Niner et al., 2020).

502

503 *4.5 The typical personality of researchers*

504 Respondents quite uniformly indicated their agreement with the statements on working more than is
505 expected from them, being a perfectionist, being good at multi-tasking, having a tendency to worry a lot,
506 and scoring high on empathy. Higher empathy is associated with a positive attitude towards animals
507 (Furnham et al., 2003; Taylor & Signal, 2005; Apostol et al., 2013) and is higher in self-reports of women
508 as compared to men (Baez et al., 2017). The responses show that the sample population scored high on
509 conscientiousness, which is positively related to academic achievement (Chamorro-Premuzic & Furnham,
510 2003; MacCann et al., 2009; De Feyter et al., 2012). High conscientiousness however also makes
511 scientific staff more vulnerable to a burn-out (Ghorpade et al., 2007). The combined PCA score for these
512 selected traits was indicative of how respondents perceived the pandemic, including their perceived stress.
513 It is thus relevant to include questions on personality in surveys that aim to address researchers'
514 perception. The small selection of questions here does, however, not cover the full spectrum of
515 personality, and including more questions, for example using the full Big Five inventory (De Feyter et al.,
516 2012), would be worthwhile in future surveys.

517

518 *4.6 Increased workload and a high perceived stress*

519 Prior to the pandemic, respondents already worked many hours per week, as is characteristic for
520 academics (Sang et al., 2015). The pandemic contributed to many participants working longer hours, often
521 in their own personal time, as indicated in the open answers. This is in contrast to the survey of Myers and
522 collaborators (2020), who reported a reduction in working hours from 61h pre-pandemic to 54h per week
523 in April 2020. The average PSS in the present study was higher than the reference values provided for the
524 PSS (on average 15), which are based on 4387 US respondents (Cohen & Janicki-Deverts, 2012). The
525 moderately high PSS found here (21) is in accordance with studies addressing the high work pressure and
526 competitiveness in academia (Sang et al., 2015) and may be higher than normal due to the pandemic.
527 Academics should therefore be attentive to a potential need for (professional) organisational and mental
528 health support among employees, colleagues and students (Cao et al., 2020; Malisch et al., 2020).

529

530 *4.7 Future perspective*

531 Research institutes, departments and groups will have to consider how to deal with the multitude of
532 changes due to the COVID-19 pandemic that are either happening now (e.g. mental distress, teaching
533 load) or that are expected to appear in the future (e.g. career gaps; Corbera et al., 2020; Gibson et al.,
534 2020). For example, a substantial part of the curriculum is now adapted to online teaching which makes it
535 likely that online teaching will be more widespread in future (Corbera et al., 2020), although this will vary
536 widely among countries (Crawford et al., 2020). Malisch and co-authors (2020) provide a diagram laying
537 out required changes in teaching, research and services related to the pandemic in order to facilitate a
538 structured evaluation of research staff. Such schemes can be instrumental in, for example, reassessing
539 performance. Corbera and collaborators (2020) emphasize that post-COVID-19 academia should foster a
540 culture of care to make academia more sustainable. The main findings from the current and related
541 surveys (Kappel et al., 2021; Myer et al., 2020) indicate that the experiences of individual researchers vary
542 widely. We thus urge funders, supervisors, colleagues and heads of faculty to be considerate of the stark
543 contrast in experiences, and to take into account that many researchers may need (professional) support.
544 Therefore, adjust research targets to what is feasible for the personal circumstances of individuals,
545 especially those with care roles. This study addressed just a few of the major initial issues that are related
546 to the COVID-19 pandemic within the field of animal behaviour and welfare research. This survey was
547 conducted within half a year of the start of the pandemic, and we strongly encourage more work on this
548 topic to be carried out as the pandemic unfolds and – hopefully – recedes.

549

550 **Acknowledgements**

551 We would like to thank all researchers who took the time to share their responses in the survey. We are
552 grateful to the organisers of the ISAE congresses in 2016-2019 for their help in collating the gender data.

553

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696 **Table 4.** Qualitative thematic analysis of participants' experiences of the COVID-19 pandemic and lockdown.

Themes and sub-themes	Codes	Illustrative quote
Positive		
<i>Personal life</i>	Quality time with friends/family	<i>"It was great to spend so much time with my family which I am truly grateful for"</i>
	More time for activities / hobbies	<i>"Staying home has let me have more time for practicing sports, which I enjoy"</i>
<i>Work-life and Career</i>	Opportunity to write	<i>"Inability to carry out practical work...gave me extra time to refocus my attention on writing publications, which allowed me to catch up on this aspect to a great extent"</i>
	Opportunity to develop skills	<i>"I could focus more on my working and I increased my competence on my research field"</i>
	Opportunities from moving online	<i>"I enjoyed that many events [... became available online. This meant that in some ways I felt more connected to other researchers"</i>
	Working from home	<i>"Less time spent commuting has meant more time for work"</i>
<i>Health</i>	Physical health benefits	<i>"I haven't had any respiratory diseases compared to other autumn semesters"</i>
Negative		
<i>Personal life</i>	Lack of routine	<i>"Working from home affected daily routine"</i>
	Travel restrictions	<i>"[...] the embassy is closed, so I'm stuck in a country that is not my home country"</i>
<i>Physical health</i>	At desk all day	<i>"I'm at my desk exclusively all day which I feel is negatively affecting my health."</i>
	Lack of exercise	<i>"Insufficient exercise"</i>
<i>Mental health</i>	Stress	<i>"Increased workload in terms of teaching, PT support, getting course, exams, assessments, etc online has been very stressful"</i>
	Uncertainty	<i>"Not knowing when I might go back to my lab/office (if am not fired before) is frightening...I am highly afraid of the future"</i>
	Anxiety / Worry	<i>"General anxiety about the situation and loved ones has made it difficult to concentrate at times, and lockdown in general has not been good for my mental health"</i>
	Guilt	<i>"I feel guilty that my daughter is not learning at the level she should be"</i>
	Loneliness / isolation	<i>"I didn't expect to feel lonely as well"</i>
	Fatigue / exhaustion	<i>"My mental health has suffered, never switching off from work, having to make up time in the evenings when the kids are asleep and feeling torn between helping them and working in the day"</i>
	Overwhelm	<i>"Lack of childcare and need to do home schooling has meant I have been meeting myself coming backwards and feeling exhausted and overwhelmed with all the different aspects of life until my children returned to school"</i>

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699 **Table 4 continued.** Qualitative thematic analysis of participants’ experiences of the COVID-19 pandemic and lockdown.

Themes and sub-themes	Codes	Illustrative quote
Negative		
<i>Home and family-life</i>	Interpersonal conflict	<i>“Working from home all the time has increased interpersonal conflict with my family members”</i>
	Impact on productivity	<i>“More traffic/noise in the house (at times it feels like there is constantly someone video-chatting out loud with family members who are in lockdown elsewhere)”</i>
<i>Child-care responsibilities</i>	Impact on career	<i>“Childcare duties put me behind my PhD colleagues without children, to a much greater extent than during normal times”</i>
	Home-schooling	<i>“I do not like having to simultaneously work, care for children and ensure home schooling happens. That is 3 jobs at once, and I can't think straight or do any of them well under these conditions”</i>
<i>Work-life and career</i>	Impact on planned research	<i>“The effects of not being able to be in the office have pushed back my trial dates which has greatly impacted my overall plans for this year and next year as well as creating an uncertainty with respects to the pay-out of my funding”</i>
	Reduced productivity, motivation, focus	<i>“Isolation from my peers has definitely affected my productivity negatively”</i>
	Employment uncertainty	<i>“My current position ends July 31. The uncertainty related to the next school year for my two primary school children mean I cannot search for a 'traditional' job. I will have gaps in my CV as a result and fear the long term negative implications”</i>
	Increased demands	<i>“Remote teaching has required me to take on more hours with not a comparable amount of pay”</i>
	Challenges of home working	<i>“I did notice that it was/is difficult to set work-home boundaries. Often I would work until quite late”</i>
	Concern for students	<i>“I worry about my international students who are separated from family, it has put more stress on them which has reduced their efforts/outputs”</i>
	Impact on industry relationships	<i>“Perception amongst producers, who pay the levy which pays my wages, that I am not doing anything for them”</i>

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