

1 **Impact of SARS-CoV-2 on Training and Mental Well-being of Surgical Gynaecological Oncology**

2 **Trainees**

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49 **ABSTRACT**

50 **Introduction:** The SARS-CoV-2 global-pandemic has caused a crisis disrupting health-systems
51 worldwide. Whilst efforts are afoot to determine the extent of disruption, impact on gynaecological
52 oncology trainees/training has not been explored. We conducted an international survey on impact
53 of SARS-CoV-2 on clinical practice, medical education, and mental well-being of surgical
54 gynaecological-oncology trainees.

55 **Methods:** In our cross-sectional-survey, a customised web-based-survey was circulated to surgical
56 gynaecological oncology trainees from national/international-organisations (May-November 2020).
57 Validated questionnaires assessed mental well-being. Wilcoxon rank-sum test and Fisher's exact-test
58 tested hypothesis about differences in means and proportions. Multiple linear-regression evaluated
59 effect of variables on psychological/mental-wellbeing outcomes. Outcomes included clinical practice,
60 medical education, anxiety-&-depression, distress, mental well-being.

61 **Results:** A total of 127 trainees from 34 countries responded. Of these, 52% (66/127) were from
62 countries with national-training-programmes (UK/USA/Netherlands/Canada/Australia) and 48%
63 (61/127) from no-national-training-programme countries. Altogether, 28% (35/125) had
64 suspected/confirmed COVID19; 28% (35/125) experienced drop in household income; 20% (18/90)
65 self-isolated from households; 45% (57/126) had to re-use personal-protective-equipment and 22%
66 (28/126) purchased their own. In total, 32.3% (41/127) of trainees (national-training-programme-
67 trainees=16.6%(11/66); no-national-training-programme-trainees=49.1%(30/61), $p=0.02$) perceived
68 they would require additional time to complete their training-fellowship. The additional training-
69 time anticipated did not differ between trainees from countries with/without national-training-
70 programmes ($p=0.11$) or trainees at the beginning/end of their fellowship ($p=0.12$). Surgical
71 exposure was reduced for 50% of trainees. Departmental teaching continued throughout the
72 pandemic for 69% (87/126) of trainees, albeit at reduced frequency for 16.1% (14/87), and virtually
73 for 88.5% (77/87). Trainees reporting adequate pastoral-support (defined as allocation of a

74 dedicated mentor/access to occupational health support services) had better mental well-being with
75 lower levels of anxiety/depression ($p=0.02$) and distress ($p<0.001$). National-training-programme-
76 trainees experienced higher levels of distress ($p=0.01$). Mean mental well-being scores were
77 significantly higher pre-pandemic (8.3 (SD=1.6) versus post-pandemic (7 (SD=1.8); $p<0.01$).

78 **Discussion:** SARS-CoV-2 has negatively impacted surgical training, household income and
79 psychological/mental well-being of surgical gynaecologic oncology trainees. Overall clinical impact
80 was worse for no-national-training-programme versus national-training-programme-trainees,
81 though national-training-programme-trainees reported greater distress. COVID19 sickness increased
82 anxiety/depression. The recovery phase must focus on improving mental well-being and addressing
83 lost training opportunities.

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86

87 **HIGHLIGHTS**

88 1. COVID19 has negatively impacted training, income, mental well-being of gynaecologic
89 oncology trainees.

90 2. COVID19 sickness increased anxiety/depression amongst trainees.

91 3. The recovery phase must focus on improving mental well-being and addressing lost training
92 opportunities.

93

94 **INTRODUCTION**

95 On March 11, 2020 the World-Health-Organization (WHO) declared the outbreak of Coronavirus-
96 disease-2019 (COVID-19) a pandemic given its spread and severity. The cause was identified to be a
97 novel coronavirus named severe-acute-respiratory-syndrome-coronavirus-2 (SARS-CoV-2). SARS-
98 CoV-2 has swept the world infecting 164 million individuals and causing 3.4 million deaths worldwide
99 (as of May 2021).¹

100 Globally an array of guidelines have been produced and implemented to restrict/modify elective-
101 surgical and oncology practice during the pandemic.² These guidelines are intended to reduce
102 pressure on healthcare-systems, intensive-care-units, ventilator usage, and minimise risk of
103 nosocomial SARS-CoV-2 infection and the postoperative sequelae that may ensue. Many
104 recommendations are pragmatic deviations from standard of care management, aiming to balance
105 risk of treatment and available resources during this pandemic. It remains to be seen how short and
106 long-term oncological-outcomes will be affected.^{3,4}

107 Whilst data are emerging on impact of the pandemic on surgical-outcomes following cancer-surgery
108 and its impact on healthcare-systems, there is a paucity of data on impact on trainees and no data
109 on the impact specifically on gynaecological-oncology trainees. We present data from an
110 international survey on impact of SARS-CoV-2 pandemic on: 1) clinical-practice, 2) medical-
111 education, and 3) mental well-being of surgical gynaecological-oncology-trainees.

112 **METHODS**

113 We sent an anonymised web-based, voluntary, open-survey to trainee surgical gynaecological-
114 oncology members of the European-Network-of-Young-Gynae-Oncologists (ENYGO), Society-of-
115 Gynecologic-Oncology (SGO), and British-Gynaecological-Cancer-Society (BGCS) between May-
116 November 2020. A survey link was circulated via social-media and email to ENYGO/BGCS/SGO

117 members and included in society newsletters. The survey was in English. Participants were informed
118 of the length of time of survey, how data were stored, investigator names and study purpose.

119

120 Adaptive questioning was incorporated to reduce number/complexity of questions. Respondents
121 had the option to review/amend answers through the use of a “back” button prior to submission. IP
122 (internet-protocol) address of the client computer was used to identify potential duplicate entries
123 from the same user. Duplicates were excluded for data-analysis, with the first entry included. All
124 incomplete questionnaires were included in the analysis irrespective of the number of questions
125 completed. The eighty-one item questionnaire (Appendix-1) included a customised section covering
126 baseline characteristics regarding the respondent’s training post, practice setting, postgraduate
127 experience and socio-demographics. Additional questionnaire-items covered: changes in clinical and
128 research activities/tumour board functioning/workload since pandemic onset; access to personal-
129 protective-equipment and rest-facilities whilst on shift; redeployment; COVID-19 sickness;
130 departmental teaching; medical rotations; mental well-being. For questions pertaining to mental
131 well-being, in addition to a customised ten-point linear scale, the validated fourteen-item Hospital-
132 Anxiety-and-Depression-Scale⁵ to assess anxiety and depression and fifteen-item Impact-of-Events-
133 Scale)⁶ to assess distress were used.

134 **Questionnaire-development**

135 An initial hard-copy draft was developed following a literature-review. Each question was
136 systematically discussed and reviewed by gynaecological-oncology clinicians (five-trainees/five-
137 trainers from UK/US/India/Sweden) in an initial consensus meeting held face-to-face virtually. Each
138 item was given a relevance score from 1 (least-relevant) to 4 (most-relevant) based on
139 knowledge/experience; and identified additional questions. A second face-to-face virtual consensus
140 meeting was held with the same ten gynaecological-oncology clinicians to review initial
141 questionnaire responses, delete low-relevance items, optimise questionnaire length and facilitate

142 compliance. A pilot of the electronic-survey was undertaken for usability/technical
143 functionality/layout. For the pilot, twenty ENYGO/BGCS/SGO members reviewed the electronic-
144 survey.

145

146 **Statistical-analysis**

147 Descriptive-statistics calculated for baseline-characteristics, clinical activities/pathways, personal-
148 protective-equipment, COVID-19 sickness, medical education. Wilcoxon rank-sum test and Fisher's
149 exact test were used for testing differences in means and proportions respectively.

150 Multiple linear-regression was used to model the effect of variables on HADS, IES, mental wellbeing
151 scales. Multiple-analyses were adjusted for gender, ethnicity, income, marital-status, religion,
152 income, age and postgraduate experience. Two-sided p-values are reported for all statistical tests.
153 Statistical analysis was performed using R version 3.5.1. In accordance with the journal's guidelines,
154 we will provide our data for the reproducibility of this study in other centres if such is requested.

155

156 **RESULTS**

157 A total of 127 participants from 34 countries responded. Using the human-development-index
158 classification (a composite index of life expectancy, education, per capita income indicators, used to
159 rank countries into four tiers of human development: very-high, high, medium, low),⁷ 100
160 respondents were from very-high human-development-index countries (Australia-1, Austria-2,
161 Belgium-2, Canada-2, France-2, Germany-2, Hungary-2, Ireland-1, Italy-3, Kazakhstan-1, Netherlands-
162 2, Poland-1, Portugal-1, Romania-1, Russia-2, Singapore-4, Slovenia-2, Spain-2, Switzerland-1,
163 Turkey-5, UK-24, USA-37); 10 from high- human-development-index countries (Azerbaijan-2, Brazil-
164 1, Colombia-1, Indonesia-1, Philippines-1, Serbia-2, Sri Lanka-1, Ukraine-1); 17 from medium-HDI
165 countries (Guatemala-1, India-15, Nepal-1). Baseline characteristics are displayed in Table 1. In total,

166 52% (66/127) of respondents were from countries with national-training-programmes
167 (UK/USA/Netherlands/Canada/Australia) and 48% (61/127) from countries without national-
168 training-programmes. National-training-programme-trainees versus no-national-training-
169 programme-trainees, were earlier on in their fellowship ($p<0.01$), but mean total length of
170 fellowships ($p=0.27$) and mean years of postgraduate experience ($p=0.14$) were similar. The
171 pandemic caused a negative impact on household income for 28% (35/125) of respondents, more so
172 for no-national-training-programme (47.5%(28/59)) than national-training-programme (10.6%(7/66))
173 trainees ($p<0.01$). Almost a quarter (31/127) reported to be shielding (Table 1). Shielding was
174 defined as “staying at home at all times and avoiding any face-to-face contact if you or someone in
175 your household are clinically extremely vulnerable”. This was more common for no-national-
176 training-programme than national-training-programme trainees ($p<0.01$). Whilst shielding, 83.9%
177 (26/31) of respondents were performing research activities, 35.5% (11/31) audits, 41.9% (13/31)
178 telephone clinics, and 9.7% (3/31) no work-related activities.

179

180 Overall, 28% (35/125) of trainees (national-training-programme=28.8%(19/66); no-national-training-
181 programme=27.1%(16/59)) had been off work with suspected/confirmed COVID-19. Only 82.9%
182 (29/35) reported access to SARS-CoV-2 testing. Since the onset of the pandemic, 20% (18/90) of
183 trainees (national-training-programme=10.4% (5/48) versus no-national-training-programme=31%
184 (13/42), $p=0.02$) chose to self-isolate from their household.

185

186 In total, 52% (66/127) of respondents administered chemotherapy, with 32% (21/65) reporting an
187 increase in administration. The mean proportion increase was similar for trainees from both
188 countries with/without national-training-programmes (20.9% (SD=11.6, range=10-50) versus 28.3%
189 (SD=14.6, range=10-50), $p=0.19$). A total of 85%(108/127) of trainees stated multidisciplinary-
190 team/tumour-board meeting logistics had changed with no statistically-significant differences

191 between national-training-programme and no-national-training-programme-trainees ($p=0.71$).
192 Overall, 80.6% (87/108) of trainees stated that meetings became virtual (instead of face-to-face),
193 16.7% (18/108) reported shorter face-to-face meetings, and 18.5% (20/108) had less frequent
194 meetings. When evaluating recruitment to gynaecological-oncology-studies, 74.4% (93/125) stated
195 that this had completely-stopped/somewhat-reduced, 23.2% (29/125) reported no change, and 2.4%
196 (3/125) reported it had somewhat-increased/increased.

197 Table-S1 summarises access, re-use and personal purchase of personal-protective-equipment.
198 Overall, 67% (85/126) of respondents reported adequate personal-protective-equipment “all-of-the
199 time” and 30% (38/126) reported “some-of-the time”. In total, 45% (57/126) of respondents had to
200 re-use and 22% (28/126) had to purchase their own personal-protective-equipment. Personal-
201 protective-equipment access was worse for no-national-training-programme trainees ($p=0.003$). As
202 an example, 80% (53/66) of national-training-programme-trainees compared to 53% (32/60) of no-
203 national-training-programme trainees had personal-protective-equipment access “all-of-the-time”.
204 Only 5% (3/60) of no-national-training-programme-trainees lacked personal-protective-equipment
205 access “most of the time”. National-training-programme-trainees were more-likely to re-use
206 personal-protective-equipment (53% (35/66) versus 36.7% (22/60)). More no-national-training-
207 programme-trainees needed to purchase their own personal-protective-equipment (31.7% (19/60)
208 versus 13.6% (9/66), $p=0.019$). Fewer no-national-training-programme (79.7% (47/59)) versus
209 national-training-programme-trainees (90.8% (59/65), $p<0.005$) had adequate on shift access to rest
210 facilities “all/some-of-the time”.

211

212 In total 13.5% (17/126) of trainees were redeployed, with majority redeployed to Obstetrics-&-
213 Gynaecology (64.7%, 11/17). National-training-programme-trainees were redeployed for shorter
214 times (mean=35.1 (SD=30.3; range=3-80 days) than no-national-training-programme-trainees
215 (mean=49.6 (SD=52.8; range=1-120) days, $p=0.88$). Overall, 88.2% (15/17) of trainees had adequate

216 supervision during redeployment, while 29.4% (5/17) felt/were asked to work beyond their level of
217 clinical competence (more likely for no-national-training-programme-trainees ($p=0.03$, Table-S2).
218 Overall adequate pastoral support (defined as allocation of a dedicated mentor/access to
219 occupational health support services) during the pandemic was reported by 62/125 (49.6%) all-of-
220 the time and 40/125 (32%) some-of-the time (Table-S3). This was greater for national-training-
221 programme (87.5% (56/64)) than no-national-training-programme (75.4% (46/61)) trainees.

222

223 Pre-pandemic training involved rotation to different hospitals for 56.1% (37/66) of national-training-
224 programme and 33.3% (20/60) of no-national-training-programme-trainees ($p=0.01$). Rotations were
225 suspended due to SARS-CoV-2 for 36.8% (20/57) of respondents, more-likely for no-national-
226 training-programme (75% (15/20)) than national-training-programme (16.2% (6/37)) trainees
227 ($p<0.01$). Departmental teaching continued throughout the pandemic for 69% (87/126) of trainees,
228 albeit predominantly virtually for 88.5% (77/87), at reduced frequency for 16.1% (14/87), and
229 without practical hands-on teaching for 21.8% (19/87) (Table-S4). In total, 70.1% (61/87) and 62.9%
230 (78/124) were “very-satisfied/satisfied” with departmental-teaching during and pre-pandemic
231 respectively (Table-S5). The majority, 88% (110/125) accessed e-learning resources during the
232 pandemic (Table-S6). National-training-programme-trainees were more likely to access BGCS/SGO e-
233 learning and no-national-training-programme trainees preferred ESGO/IGCS (International
234 Gynecologic Cancer Society) e-learning. The mean satisfaction with quality of e-learning provided by
235 ESGO/IGCS/BGCS/SGO was overall high, ranging from 7.1-8.6 (1=not-at-all satisfied, 10=very
236 satisfied) (Table-S7).

237

238 Half (63/126) of the trainees reported reduced surgical exposure (“yes” respondents). Table 2
239 summarises the mean (%) reduced exposure according to surgical modality/procedure. Greater
240 levels of reductions were seen in no-national-training-programme versus national-training-

241 programme-trainees. Table-S8 summarises the reasons for reduced exposure with the commonest
242 reasons being postponement of cases (76.2%, 48/63) and referral reduction (57.1%, 36/63).

243

244 Overall, 68.5% (87/127) reported a decrease in outpatient workload with the mean decrease similar
245 for trainees from countries with/without national-training-programmes (46.6% (SD=24.3, range=12-
246 100) versus 47.5% (SD=19.8, range=10-100), $p=0.59$). Reasons reported for reduced outpatient
247 workload included reduced referrals from primary-care/community-practitioners (44.9% (57/127)
248 cases), and patients not attending scheduled outpatient-appointments (41.7% (53/127)
249 respondents). Just 15.2% (19/125) of trainees stated their overall workload had increased and 84.8%
250 (106/125) reported decreased overall workload. Degree of workload reduction for national-training-
251 programme-trainees (27.5% (SD=13.1% (SD=13.1; range=10-50) was lower than no-national-training-
252 programme-trainees (41.2% (SD=18.6; range=15-100), $p=0.04$).

253

254 Overall, 32.3% (41/127) (16.6%(11/66) national-training-programme; 49.1%(30/61) no-national-
255 training-programme; $p=0.02$) believed they would need additional time (those who responded
256 “definitely/probably”) to complete their training-fellowship (Table-S9). The duration of additional
257 training time anticipated did not significantly differ between trainees from countries with/without
258 national-training-programmes (5.1 (SD=2.8, range=3-12) versus 7.8 (SD=5.6, range=1-24) months,
259 $p=0.11$) or trainees at the beginning/end of their fellowship (6.2 (SD=3.1, range=2-13) versus 6.8 (SD
260 2.9), range=2-15), $p=0.12$).

261

262 Mean Hospital-Anxiety-and-Depression-Scale-total (combined anxiety-and-depression scores),
263 Hospital-Anxiety-and-Depression-Scale-anxiety, Hospital-Anxiety-and-Depression-Scale-depression,
264 and Impact-of-Events-Scale scores were 10 (SD=6.7; range=0-29); 6.62 (SD=3.8; range=0-17); 4

265 (SD=3.6; range=0-13) and 18.72 (SD=16; range=0-73); respectively. Higher scores indicate greater-
266 levels of anxiety/depression/distress. Multiple-linear-regression-models explored association of
267 covariates with HADS and IES mean-scores (Tables 3, 4 and S10). Trainees with higher household
268 income (>\$150,000 versus <\$50,000) and adequate pastoral support (all/some-of-the-time versus
269 no-most-of-the-time/not-at-all) had lower levels of anxiety&depression (p=0.02) (Table-2). However,
270 being off work from COVID-19 sickness was associated with higher levels of anxiety&depression
271 (p=0.02). Trainees from very-high/high versus medium HDI-countries (p=0.02) and those who
272 received adequate pastoral-support (p<0.01) had lower levels of distress. However, distress levels
273 were higher in national-training-programme versus no-national-training-programme-trainees
274 (p=0.01). The mean mental wellbeing score pre-pandemic was higher (p<0.01) in comparison to
275 post-pandemic (8.3, (SD=1.6, range=2-10) versus 7, (SD=1.8, range=2-10)). Mental well-being mean
276 scores were not significantly associated with any covariates of interest on multiple linear regression
277 (Table-5).

278 **DISCUSSION**

279 **Summary of main results**

280 The SARS-CoV-2 pandemic has negatively impacted surgical-training and overall well-being of
281 gynaecological-oncology-trainees. Overall, 28% of trainees had suspected/confirmed COVID-19; 28%
282 experienced drop in household income; 24% were shielding; 20% self-isolating from their
283 households; 13.5% redeployed; 45% re-using personal protective equipment, and 22% purchasing
284 their own. Half reported reduction in surgical exposure and one third felt they required additional
285 time to complete their training fellowship. This negative impact on surgical training was worse for
286 no-national-training-programme versus national-training-programme-trainees and seen across most
287 surgical procedures. For 69% of trainees departmental teaching continued and 88% had accessed e-
288 learning resources. Trainees with adequate pastoral-support had significantly lower anxiety-and-
289 depression (p=0.02) and lower distress levels (p<0.001). National-training-programme-trainees had

290 higher-levels of distress than no-national-training-programme-trainees ($p=0.01$). Mean mental well-
291 being scores were higher pre-pandemic versus post-pandemic ($p<0.01$).

292

293 **Results in the context of published literature**

294 Our data demonstrate a profound detrimental impact from the pandemic on surgical training, the
295 training environment and well-being of gynaecologic oncology trainees. The fact that 50% of trainees
296 experienced reduced surgical training and 13.5% were redeployed, supports existing data that
297 elective surgery across hospitals was reduced/stopped to increase critical care bed capacity for
298 patients with SARS-CoV-2 and release staff to support wider hospital responses.^{8-10 11} This was
299 compounded by staff shortages and sickness, reduced theatre availability and supply chain scarcities.
300 National/international guidelines were developed to provide a framework for continuing
301 gynaecological cancer care and aid difficult management decisions.^{12, 13} This identified groups of
302 patients where therapy may be 'delayed' for a period of time until the SARS-CoV-2 pandemic was
303 controlled. Rapid guidance was produced for principles of delivering radiotherapy¹⁴ and systemic
304 anti-cancer treatment.¹⁵ Mitigation strategies resulted in changes to surgical and systemic
305 chemotherapy plans, treatment delays, introduction of regimens requiring less frequent treatment
306 administration. The 37.2-80% mean reduction in surgical training opportunities for trainees observed
307 across surgical modalities, is consistent with the overall reduction in surgical cases resulting from
308 above strategies and findings from a global modelling analysis suggesting 38% cancer and 82%
309 benign surgeries may be postponed during the pandemic.¹⁶ This is also in keeping with data from
310 other surgical specialities where trainees reported a reduction (50-90%) in surgical-training
311 opportunities.¹⁷⁻¹⁹ These effects are corroborated by our data which report increased chemotherapy
312 administration, postponement of surgical cases, reduced referrals, treatment pathway modification
313 and reprioritisation as key reasons for reduced surgical exposure.

314

315 National-training-programme-trainees were less likely to believe they would need additional time to
316 complete their training-fellowship versus no-national-training-programme-trainees ($p=0.02$). This
317 may be because they were earlier in their fellowship (mean 1.6 versus 2.3 years). It also reflects
318 benefits of structured accredited training programmes in gynaecologic oncology which are
319 associated with better educational climates along with better quality/higher training satisfaction.^{10,}
320 ^{20, 21} Such programmes are more likely to adapt and implement changes to ensure timely progression
321 and completion of training. It is encouraging that despite the increased pressure on global
322 healthcare systems, delivery of departmental teaching continued for 69% and consistent with the
323 move towards remote/virtual working practices, was predominantly delivered via virtual platforms
324 in 89% cases. However, there was no practical hands-on teaching for 21.8% of trainees. Simulation
325 training has long been used in general surgery as a supplement to clinical surgical training as part of
326 a balanced curriculum and has been shown to flatten the learning curve of complex surgical
327 procedures and enhance patient safety.²²⁻²⁵ It is a teaching method often underutilised in
328 gynaecologic oncology that warrants greater attention to enable the continued development of
329 surgical skills in times of reduced exposure. The majority of trainees, 88% had accessed e-learning
330 resources during the pandemic with high levels of satisfaction (mean satisfaction 7.1-8.6). Access to
331 ESGO/IGCS e-learning was lower amongst national-training-programme-trainees (predominantly
332 UK/USA trainees) potentially because a larger proportion were accessing national teaching resources
333 produced by national organisations (BGCS–UK/SGO-USA).

334

335 Three in ten trainees had COVID19 and this was associated with increased anxiety&depression.
336 These results are in keeping with published literature confirming a negative impact on the mental
337 well-being of general obstetrics and gynaecology trainees.²⁶ Trainees with adequate pastoral-
338 support had lower-levels of anxiety-and-depression and distress. This is in keeping with published
339 data supporting the positive impact of pastoral support on the mental well-being of medical

340 practitioners.^{27, 28} The reasons for higher levels of distress observed in national-training-programme-
341 trainees versus no- national-training-programme-trainees are likely multifactorial and warrant
342 further research. Potential reasons may include greater need to re-use personal protective
343 equipment (53% versus 36.7%); and needing to cope with greater levels of gynaecologic oncology
344 workloads (p=0.04). Additionally, 92.4% of national-training-programme-trainees were from the
345 UK/USA, and the considerably higher mortality rates seen in the UK/USA populations may have
346 detrimentally affected mental well-being. Data have suggested that country specific mortality rates
347 have been detrimentally impacted by high levels of national obesity, low levels of national
348 preparedness, insufficient scale of testing/track-and-trace facilities, delayed national lockdowns and
349 delays in border closures.^{29, 30} Data also indicate that prolonged and recurrent lockdowns have
350 adversely affected mental well-being.³¹ The limitations of access to personal protective equipment
351 are unfortunate and consistent with media and literature reports.¹⁰ Trainees have had to cope with
352 other stresses like reduction in household income (potentially explained by increased expenditure
353 from purchasing personal protective equipment, additional childcare costs secondary to school
354 closures, additional accommodation costs incurred due to self-isolation; or income reduction due to
355 shielding, COVID19 related sickness, and job loss amongst non-medical partners. It is possible that
356 deterioration of mental well-being was confounded by aforementioned factors external to the work
357 environment and in keeping with general population data.^{31, 32}

358 **Strengths-and-weaknesses**

359 Strengths include that this is the first study internationally reporting impact of SARS-CoV-2 on
360 surgical gynaecologic oncology-trainees. Validated questionnaires were used to evaluate
361 psychological/mental well-being and changes in pre-and post-pandemic mental well-being were
362 quantified through comparison of a customised mental well-being scale. Risk of recall bias was
363 minimised by circulating the survey during the first pandemic wave. Limitations include that because
364 the survey was circulated during the first SARS-CoV-2 wave and a large proportion of countries have

365 subsequently experienced multiple waves with sustained pressure on healthcare systems, the
366 responses demonstrate short-term impact and long-term impact has not been evaluated. Results
367 may not be completely generalizable to trainees globally as a number of countries are not well
368 represented, the survey was available in English only excluding non-English speakers, there may
369 have been an element of selection bias due to the use of social media platforms to circulate the
370 survey link and because the majority of respondents were members of BGCS/SGO/ENYGO and likely
371 to be motivated by career development. Responses received for subjective questionnaire items may
372 have been influenced by the current mental state of respondents.

373

374 **Implications for practice and future research**

375 It must be the responsibility of employers in tandem with government agencies to ensure adequate
376 supply of personal protective equipment and put in place provisions to ensure income protection.
377 This may include the provision of free staff accommodation for individuals requiring to self-isolate or
378 subsidised childcare costs. Training programme directors and societies have a responsibility to
379 ensure continuation of development of surgical skills through the provision of virtual learning
380 (webinars/surgical-videos) and simulation training. Study budgets could be used to purchase
381 simulation equipment with simulation training included in national/international curriculums as a
382 method for achieving surgical competencies. Pastoral support should be governed by codes of
383 conduct with training programme directors, educational offices responsible for producing clear
384 guidelines on how this may be accessed. The onus must be on trainees to access this support when
385 needed. A future cohort study evaluating the long-term impact of the SARS-CoV-2 pandemic on
386 clinical training, education, mental well-being of trainees would help guide the recovery phase.

387

388 **Conclusion**

389 Data show the SARS-CoV-2 pandemic has negatively impacted surgical training and mental well-
390 being of surgical gynaecologic oncology trainees. Recognising medical practitioners are exposed to
391 additional unique work-related stressors as well as shared common stressors experienced by the
392 general population secondary to the pandemic is vital. In addition to lost training opportunities,
393 focusing on improving the mental well-being of trainees is vital for the recovery phase.

394

395 **Contribution to authorship**

396 Conception: FG

397 Design & Development: FG, RM

398 Questionnaire development: FG, JD, LW, RM

399 Data collection: FG, IR, JD, LW, ZR, AS, KZ, TN, IS, NB, CT, ML, AP, MG, RM

400 Data analysis: FG, OB

401 Preparation of tables: FG, OB

402 Initial draft of manuscript: FG, RM

403 Manuscript writing, review and approval: All authors

404

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417 The study has been approved and registered with the Quality Improvement & Assurance Team
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426

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510 effects of the COVID-19 pandemic on physical and mental health in the UK: a population-based
511 study. *The Lancet Digital Health.*

512

513

514 **Table 1. Baseline characteristics of cohort**
515

	Trainees from a country with a national training programme		P value
	Yes n=66, 52%	No n=61, 48%	
Human development Index (HDI)			
Very high	66/66, 100	34/61, 55.7	<0.001
High	0	10/61, 16.3	
Medium	0	17/61, 27.9	
Mean current year of fellowship (SD, range)	1.6 (0.7, 1-4)	2.3 (1.3, 1-8)	<0.001
Mean total years of fellowship (SD, range)	2.8 (0.7, 1-4)	2.9 (1.3, 1-8)	0.274
Mean years of postgraduate experience (SD, range)	7.2 (4.3, 1-16)	6 (3.6, 0-13)	0.140
Healthcare sector of work*			
Government/state funded	61/66, 92.4	55/61, 90.2	0.360
Private	15/66, 22.7	8/61, 13.1	
Both (government and private)	10/66, 15.2	2/61, 3.3	
Mean age (SD, range)	34.5, (3.4, 30-42)	34 (4.2, 23-45)	0.622
Gender			
Male respondents	21/66, 31.8	24/59, 40.7	0.353
Female respondents	45/66, 68.2	35/59, 59.3	
Ethnicity			
White	49/66, 74.2	34/59, 57.6	0.070
Asian	10/66, 15.2	20/59, 33.9	
Black	1/66, 1.5	2/59, 3.4	
Mixed	5/66, 7.6	3/59, 5.1	
Other	1/66, 1.5	0/59, 0	
Religion			
Muslim	2/65, 3.1	10/59, 16.9	<0.001
Christian	23/65, 35.4	23/59, 39	
Jewish	6/65, 9.2	0/59, 0	
Hindu	3/65, 4.6	15/59, 25.4	
Buddhist	0/65, 0	1/59, 1.7	
None	31/65, 47.7	10/59, 16.9	
Marital status			
Married	47/66, 71.2	33/59, 55.9	0.090
Cohabiting/living with partner	9/66, 13.6	9/59, 15.3	
Single	10/66, 15.2	13/59, 22	
Divorced/separated	0/66, 0	4/59, 6.8	
Household income in last 12 months (USD)			
<\$50,000	0/65, 0	35/58, 60.3	<0.001
\$50,000-\$100,000	24/65, 36.9	16/58, 27.6	
\$100,000-\$150,000	19/65, 29.2	3/58, 5.2	
≥\$150,000	22/65, 33.8	4/58, 6.9	
Shielding**			
Yes	7/66, 10.6	25/61, 41	<0.001
No	59/66, 89.4	36/61, 59	

516 Denominator for each demographic questionnaire item represents total number of respondents for
517 that particular question. Incomplete questionnaires were included in the analysis resulting in varying
518 denominators per item.

519

520 *Respondents working at “both” are also counted in the individual categories of “government” and
521 “private”.

522

523 **Shielding defined as staying at home at all times and avoiding any face-to-face contact if you or
524 someone in your household are clinically extremely vulnerable.

525

526 **Table 2. Mean reduction in surgical exposure for trainees according to surgical modality and**
 527 **procedure from countries with and without a national training programme during the SARS-CoV-2**
 528 **pandemic**

529

	National training programme		P value
	Yes	No	
Surgical modality/procedure	Mean (SD, range)	Mean (SD, range)	
Robotic	46.7 (41, 0-100)	80 (30.9, 0-100)	0.041
Laparoscopic	47.2 (38.4, 0-100)	66.5 (26.1, 0-100)	0.058
Open surgical procedures	37.2 (27.5, 0-100)	48.9 (20, 0-100)	0.027
Ovarian cancer cytoreductive surgery	44 (29.4, 0-100)	45.5 (29.4, 0-100)	0.799
Exenteration procedures	34.4 (41.6, 0-100)	61.7 (41.4, 0-100)	0.036
Surgery for recurrent disease	54.2 (39.5, 0-100)	52.1 (30.2, 0-100)	0.814
Radical vulval surgery	26.3 (35, 0-100)	47.6 (32.6, 0-100)	0.016
Radical hysterectomy	20.8 (33.8, 0-100)	42.1 (31, 0-100)	0.007
Pelvic lymphadenectomy	28.4 (36.8, 0-100)	40.7 (29.6, 0-100)	0.078
Para-aortic lymphadenectomy	35.3 (40.9, 0-100)	46.6 (29.5, 0-100)	0.121
Trachelectomy	15 (31.2, 0-100)	58.3 (37.9, 0-100)	0.001

530

531

532 **Table 3. Factors affecting HADS total mean scores**

533 HADS – Hospital Anxiety and Depression Scale questionnaire; HDI – Human Development Index; PPE
 534 – Personal Protective Equipment.

535

Model and variable	Coef.	Std. Err	P> z	95% CI
HADS model (total), n=90				
Gender	-2.024	1.401	0.154	-4.828 to 0.781
Ethnicity	1.545	1.775	0.388	-2.007 to 5.098
Income	-6.765	2.768	0.018	-12.306 to -1.225
Marital status	-0.641	2.146	0.766	-4.936 to 3.654
Religion	-1.737	1.525	0.259	-4.79 to 1.316
Age	-0.451	0.27	0.101	-0.992 to 0.09
Healthcare sector (both vs private)	2.081	3.533	0.558	-4.99 to 9.153
Healthcare sector (government vs private)	1.348	2.9	0.644	-4.456 to 7.153
Postgraduate experience	-0.075	0.231	0.748	-0.538 to 0.389
Total years of fellowship	-1.193	0.704	0.096	-2.603 to 0.216
HDI	-0.798	3.183	0.803	-7.169 to 5.573
National training programme	1.374	1.863	0.464	-2.355 to 5.103
Shielding	-1.193	1.951	0.543	-5.098 to 2.713
Additional training time	1.879	1.819	0.306	-1.763 to 5.52
Overall increase in clinical workload	0.631	2.386	0.793	-4.145 to 5.406
PPE access	-6.52	4.36	0.14	-15.247 to 2.206
COVID-19 sickness	3.754	1.493	0.015	0.766 to 6.742
Redeployment	1.064	2.17	0.626	-3.279 to 5.408
Adequate pastoral support	-5.543	1.752	0.002	-9.051 to -2.036

536

537 Multiple linear regression models evaluating the association of covariates with HADS mean scores.
 538 Models adjusted for gender, ethnicity, income, marital status, religion, income, age and
 539 postgraduate experience.

540

541 HADS is a 14 item validated questionnaire with 7 items pertaining to anxiety and 7 to depression.
 542 Each item scored on a four point Likert-scale from 0-3 and total scores ranging from 0-42. Higher
 543 scores indicate greater levels of anxiety/depression.

544

545 Gender: male versus female

546 Ethnicity: white (reference category) versus non-white

547 Income: >\$150,000 (reference category) versus <\$50,000

548 Marital status: married/cohabiting (reference category) versus single/divorced

549 Religion: Muslim/Christian/Jewish/Hindu/Buddhist (reference category) versus none

- 550 Age: age in years (continuous variable)
- 551 Healthcare sector: trainees working in both government and private healthcare settings versus
552 private only (reference category)
- 553 Healthcare sector: trainees working in government only healthcare settings versus private only
554 (reference category)
- 555 Postgraduate experience: number of years (continuous variable)
- 556 Total years of fellowship: number of years (continuous variable)
- 557 HDI: very high/high (reference category) versus medium
- 558 National training programme: yes (reference category) versus no
- 559 Shielding: yes (reference category) versus no
- 560 Additional training time: definitely/probably/don't know (reference category) versus probably
561 not/definitely not
- 562 Overall increase in clinical workload: yes (reference category) versus no
- 563 PPE access: yes all the time/yes some of the time (reference category) versus no most of the
564 time/not at all
- 565 COVID-19 sickness: yes (reference category) versus no
- 566 Redeployment: yes (reference category) versus no
- 567 Adequate pastoral support: yes all the time/yes some of the time (reference category) versus no
568 most of the time/not at all
- 569

570 **Table 4. Factors affecting IES mean scores**

571 IES – Impact of Event Scale questionnaire; HDI – Human Development Index; PPE – Personal
 572 Protective Equipment.

573

Model and variable	Coef.	Std. Err	P> z	95% CI
IES model, n=118				
Gender	-4.765	2.951	0.11	-10.636 to 1.106
Ethnicity	-1.743	3.776	0.646	-9.256 to 5.77
Income	-8.123	5.964	0.177	-19.989 to 3.743
Marital status	-5.201	4.042	0.202	-13.244 to 2.842
Religion	-4.414	3.249	0.178	-10.879 to 2.051
Age	-0.117	0.501	0.815	-1.113 to 0.879
Healthcare sector (both vs private)	0.741	6.986	0.916	-13.159 to 14.64
Healthcare sector (government vs private)	1.727	5.454	0.752	-9.125 to 12.578
Postgraduate experience	-0.099	0.445	0.825	-0.984 to 0.786
Total years of fellowship	-1.358	1.669	0.418	-4.678 to 1.962
HDI	-14.951	6.177	0.018	-27.241 to -2.66
National training programme	10.344	4.007	0.012	2.371 to 18.316
Shielding	0.719	4.015	0.858	-7.269 to 8.708
Additional training time	5.712	3.641	0.121	-1.534 to 12.957
Overall increase in clinical workload	-1.614	4.664	0.73	-10.894 to 7.666
PPE access	-18.193	10.273	0.08	-38.633 to 2.246
COVID19 sickness	1.163	3.106	0.709	-5.017 to 7.342
Redeployment	-3.614	4.651	0.439	-12.868 to 5.641
Adequate pastoral support	-14.718	4.016	<0.001	-22.71 to -6.727

574

575 Multiple linear regression model evaluating the association of covariates with IES mean scores.
 576 Model adjusted for gender, ethnicity, income, marital status, religion, income, age and postgraduate
 577 experience.

578

579 IES is a 15 item validated questionnaire. Each item scored on a four point Likert-scale from 0-5 with
 580 total scores ranging from 0-75. Higher scores indicate higher distress levels.

581

582 Gender: male versus female

583 Ethnicity: white (reference category) versus non-white

584 Income: >\$150,000 (reference category) versus <\$50,000

585 Marital status: married/cohabiting (reference category) versus single/divorced

586 Religion: Muslim/Christian/Jewish/Hindu/Buddhist (reference category) versus none

587 Age: age in years (continuous variable)

588 Healthcare sector: trainees working in both government and private healthcare settings versus
589 private only (reference category)

590 Healthcare sector: trainees working in government only healthcare settings versus private only
591 (reference category)

592 Postgraduate experience: number of years (continuous variable)

593 Total years of fellowship: number of years (continuous variable)

594 HDI: very high/high (reference category) versus medium

595 National training programme: yes (reference category) versus no

596 Shielding: yes (reference category) versus no

597 Additional training time: definitely/probably/don't know (reference category) versus probably
598 not/definitely not

599 Overall increase in clinical workload: yes (reference category) versus no

600 PPE access: yes all the time/yes some of the time (reference category) versus no most of the
601 time/not at all

602 COVID-19 sickness: yes (reference category) versus no

603 Redeployment: yes (reference category) versus no

604 Adequate pastoral support: yes all the time/yes some of the time (reference category) versus no
605 most of the time/not at all

606

607 **Table 5. Factors affecting mental wellbeing mean scores since the onset of the SARS-CoV-2**
 608 **pandemic**

609 HDI – Human Development Index; PPE – Personal Protective Equipment.

610

Model and variable	Coef.	Std. Err	P> z	95% CI
Mental wellbeing, n=126				
Gender	0.069	0.374	0.855	-0.674 to 0.811
Ethnicity	-0.002	0.485	0.997	-0.966 to 0.962
Income	1.034	0.741	0.167	-0.439 to 2.507
Marital status	0.292	0.511	0.569	-0.724 to 1.309
Religion	0.104	0.426	0.808	-0.743 to 0.95
Age	0.096	0.061	0.118	-0.025 to 0.218
Healthcare sector (both vs private)	-0.451	0.896	0.616	-2.231 to 1.329
Healthcare sector (government vs private)	-0.23	0.689	0.739	-1.599 to 1.138
Postgraduate experience	-0.006	0.057	0.923	-0.119 to 0.108
Total years of fellowship	0.097	0.194	0.62	-0.289 to 0.483
HDI	0.281	0.75	0.709	-1.209 to 1.771
National training programme	-0.689	0.519	0.188	-1.72 to 0.343
Shielding	0.201	0.5	0.688	-0.792 to 1.195
Additional training time	-0.8	0.465	0.089	-1.724 to 0.124
Overall increase in clinical workload	-0.224	0.598	0.708	-1.413 to 0.964
PPE access	-0.766	1.14	0.504	-3.032 to 1.501
COVID19 sickness	-0.011	0.396	0.977	-0.798 to 0.776
Redeployment	-0.59	0.545	0.282	-1.674 to 0.494
Adequate pastoral support	0.717	0.501	0.156	-0.279 to 1.714

611

612 A multiple linear regression model exploring the association of covariates with mental wellbeing
 613 mean scores since the onset of the pandemic. Model adjusted for gender, ethnicity, income, marital
 614 status, religion, income, age and postgraduate experience.

615

616 Linear customised scale where 1=extremely poor mental wellbeing, 10=excellent mental wellbeing.

617

618 Gender: male versus female

619 Ethnicity: white (reference category) versus non-white

620 Income: >\$150,000 (reference category) versus <\$50,000

621 Marital status: married/cohabiting (reference category) versus single/divorced

622 Religion: Muslim/Christian/Jewish/Hindu/Buddhist (reference category) versus none

623 Age: age in years (continuous variable)

624 Healthcare sector: trainees working in both government and private healthcare settings versus
 625 private only (reference category)

626 Healthcare sector: trainees working in government only healthcare settings versus private only
627 (reference category)

628 Postgraduate experience: number of years (continuous variable)

629 Total years of fellowship: number of years (continuous variable)

630 HDI: very high/high (reference category) versus medium

631 National training programme: yes (reference category) versus no

632 Shielding: yes (reference category) versus no

633 Additional training time: definitely/probably/don't know (reference category) versus probably
634 not/definitely not

635 Overall increase in clinical workload: yes (reference category) versus no

636 PPE access: yes all the time/yes some of the time (reference category) versus no most of the
637 time/not at all

638 COVID-19 sickness: yes (reference category) versus no

639 Redeployment: yes (reference category) versus no

640 Adequate pastoral support: yes all the time/yes some of the time (reference category) versus no
641 most of the time/not at all

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