



COVID-19-related uncertainty: fertility staff experiences of its sources, processing, responses, and consequences

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STUDY QUESTION: What are fertility staff experiences of managing COVID-19-related uncertainty after fertility clinics re-opened?

SUMMARY ANSWER: Staff identified many COVID-19-related uncertainty sources, the main being the COVID-19 health threat, to which most clinics and staff responded effectively by implementing safety protocols and building strong collaborative environments that facilitated the acquisition and application of information to guide organizational responses during a rapidly changing situation, but with costs for staff and patients.

WHAT IS KNOWN ALREADY: COVID-19 created significant disruption in fertility care delivery, including temporary clinic closure and treatment delay. Patients experienced significant distress, including concerns regarding the impact of COVID-19 and its vaccine on fertility and pregnancy. Multiple studies show that COVID-19-related uncertainty is a major threat and burden for healthcare staff, but this has not been investigated in reproductive medicine.

STUDY DESIGN, SIZE, DURATION: A cross-sectional, online mixed-method bilingual (English, Spanish) survey (active 25 January–23 May 2021) was distributed to fertility staff across the UK, Latin America, and Africa.

PARTICIPANTS/MATERIALS, SETTING, METHODS: Eligibility criteria were being a healthcare worker at a fertility clinic that had re-opened since its COVID-19-related closure, 18 years of age or older and ability to respond in English or Spanish. The survey was created in English, translated to Spanish, made available using Qualtrics, and consisted of four parts: (i) background and physical and mental wellbeing, (ii) open-ended questions regarding COVID-19 uncertainty, (iii) appraisal items regarding perceptions and impact of uncertainty, and (iv) changes in the workplace. The British Fertility Society and the African Network and Registry of Assisted Reproduction circulated the survey across the UK and Africa via email hyperlinks and social media platforms. The Argentinian Society of Reproductive Medicine and the Latin American Network of Assisted Reproduction distributed the survey across Latin America in the same manner. Thematic analysis was performed on responses from open-ended question to produce basic codes. Deductive coding grouped sub-themes across questions into themes related to the theory of uncertainty management. Descriptive statistics and repeated measures analysis of variance were used on the quantitative data.

MAIN RESULTS AND THE ROLE OF CHANCE: In total, 382 staff consented to the survey, 107 did not complete (28% attrition), and 275 completed. Sixty-three percent were women, 69% were physicians, and 79% worked at private clinics. Thematic analysis produced 727 codes, organized in 92 sub-themes, and abstracted into 18 themes and one meta-theme reflecting that uncertainty is stressful but manageable. The types of uncertainties related to the threat of COVID-19 (20.6%), unpredictability of the future (19.5%), failure of communication (11.4%), and change in the workplace (8.4%). Staff appraisals of negative and positive impact of uncertainty were significantly lower ($P < 0.001$) than appraisals of stress, controllability, and having what it takes to cope with uncertainty. To process uncertainty, clinics focused on information dissemination (30.8%) and building a collaborative work environment (5.8%), while staff employed proactive coping (41.8%) and emotional and cognitive processing (9.6%). Main organizational responses consisted on work restructuring (41.3%, e.g. safety protocols), adapting to adversity

(9.5%, e.g. supplies, preparation), and welfare support (13.8%), though staff perceived lack of support (17.5%). Negative consequences of uncertainty were worse self- and patient welfare (12.1%) and worse communication due to virtual medicine and use of mask (9.6%). Positive consequences were work improvements (8.3%), organizational adaptation (8.3%), improved relationships (5.6%), and individual adaptation (3.2%). Ninety-two percent of participants thought changes experienced in the workplace due to COVID-19 were negative, 9.1% nor negative nor positive, and 14.9% positive. Most staff thought that their physical (92.4%) and mental health (89.5%) were good to excellent.

LIMITATIONS, REASONS FOR CAUTION: Participants were self-selected, and most were physicians and embryologists working at private clinics based in Latin America. The study did not account for how variability in national and regional COVID-19 policy shaped staff experiences of uncertainty.

WIDER IMPLICATIONS OF THE FINDINGS: To address COVID-19 uncertainty, clinics need to promote collaborative (clinic, staff, patients) processing of uncertainty, clear team coordination and communication, organizational flexibility, and provision of support to staff and patients, with an emphasis on cognitive coping to decrease threat of and increase tolerance to uncertainty. Uncertainty management interventions bespoke to fertility care that integrate these components may increase clinics resilience to COVID-19-related and other types of uncertainty.

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Key words: uncertainty management / COVID-19 / fertility staff / stress / experiences

Introduction

The impact of COVID-19 in fertility care has been the subject of numerous studies. Early studies found significant distress among patients (Ben-Kimhy et al., 2020) especially those who experienced clinic closure (Boivin et al., 2020) and treatment delay (Gurtin et al., 2022). Risk factors for high distress are related to COVID-19 exposure, inequalities, and individual circumstances such as longer time trying to conceive (Wang et al., 2020; Kirubarajan et al., 2021). Modifiable factors are hyper-vigilance, uncertainty in illness, contagion anxiety, lack of social support, and low sense of mastery (high helplessness) (Ben-Kimhy et al., 2020). COVID-19 has also had an impact on the delivery of healthcare and patient healthcare behaviour (Requena et al., 2020). For instance, Assisted Reproductive treatment was delayed in 28 countries, with delays ranging from 14 to 160 days, and cycles that continued shifted to frozen embryo-transfer (Cutting et al., 2021). Fear that COVID-19 can impact fertility and pregnancy was evident (Requena et al., 2020; Tur-Kaspa et al., 2021) and concerns about infertility and pregnancy problems from vaccination contributed to reduced uptake in women (Hsu et al., 2022).

Given impacts on patients and care delivery, it is of interest to examine COVID-19 impact on staff working at fertility clinics. Multiple studies undertaken during the pandemic showed that COVID-19-related uncertainty is a major threat and burden for staff (Rutter et al., 2020). People can experience uncertainty when something is not known or definite and is unpredictable or ambiguous. Uncertainty can relate to characteristics of a context (e.g. procedures and regulations), one's own or others' beliefs, values, and abilities, or to important future outcomes (Cranley et al., 2012). Fertility staff report uncertainty around viral aggressiveness, efficacy of patient triage, accelerated turnaround times, reduced teams, and COVID-19 transmission to themselves and family (Group et al., 2020). Multiple COVID-19 guidance has been produced for staff in fertility care, but these focus mostly on

risk mitigation (e.g. American Society for Reproductive Medicine, European Society for Human Reproduction and Embryology) and other uncertainties remain, of which many directly concern patients (e.g. COVID-19 impact on embryo). Important is that COVID-19 uncertainty is experienced in addition to other forms of uncertainty that are and will remain pervasive in fertility clinics, for instance, appropriate diagnosis, likelihood of pregnancy, and efficacy of add-ons.

Uncertainty is often perceived as aversive, motivating people to reduce it. Unavoidable uncertainty can threaten wellbeing and paralyze effective coping. Systematic review shows that low uncertainty tolerance is associated with more risk averse diagnostic performance (inducing higher costs), higher staff burnout, less shared decision-making with patients, higher patient emotional distress, and (in some groups) poorer health outcomes in healthcare professionals (Alam et al., 2017; Kuang and Wilson, 2017). The Theory Recognizing and Responding to Uncertainty (Cranley et al., 2012) highlights that effective management of uncertainty requires identifying triggers of uncertainty, for instance, in patients or healthcare setting. Uncertainty is then processed, which involves assessing inability to predict outcomes and reflecting on own knowledge and experience. Adequate responses are triggered to resolve, decrease, or manage uncertainty. When uncertainty cannot be resolved or reduced, acceptance of the 'probabilistic worldview' and development of coping strategies specific to uncertainty are adaptive (Han et al., 2019). While resolving uncertainty is the expected outcome, this may not be possible, resulting in lingering doubt. Other (positive, negative) consequences can also be experienced. Also, relevant is that uncertainty can be used as a source of hope (Babrow and Kline, 2000), for example believing oneself to be the 'lucky one' despite a poor prognosis. How this translates in fertility care is still not known. Therefore, understanding how fertility staff are impacted by and manage uncertainty is critical in fertility care and will provide know-how that will be useful during and beyond the pandemic period.

In this study, we used an online mixed-format survey (quantitative–qualitative) to examine staff experiences of COVID-19-related uncertainty, its perceived impact, and coping strategies adopted to manage this uncertainty.

Materials and methods

Participants

Eligibility criteria were being a healthcare worker at a fertility clinic that had re-opened since its COVID-19-related closure, 18 years of age or older, and ability to respond in English or Spanish. In total, 382 people consented to the survey, but 107 did not submit their answers. Power calculations were not performed due to the lack of knowledge about any quantitative effects. Previous survey experience suggested that around 200 participants are needed to reach saturation in qualitative responses. The final sample included 275 participants. The mean age was 45 years (SD = 12.26, range 26–65). Most participants were female (63%) working in private clinics (79%). Most were physicians (69%) and a minority were embryologists (27%), psychologists (4%), nurses (2%), or other (9%, e.g. researcher, technician, student). Participants responded from a total of 27 countries. The majority were from Argentina (56%), Brazil (16%), Mexico (8%), and Colombia (5%). A minority were from other countries in Latin America (8%) and elsewhere in the world (4%), including 4 (1.5%) participants from South Africa. There were no participants from the UK.

Materials

A quantitative–qualitative bilingual (English, Spanish) online, anonymous survey was created using Qualtrics (Qualtrics, Provo UT). The survey consisted of four sections. Section 1 assessed participants' age, gender, country of work, type of clinic, professional role, and self-rated physical and mental health on a scale of 1 (poor) to 5 (excellent) according to the 36-item Short Form Suvery health questionnaire (Ware, 2000). Section 2 included five open-text questions about the greatest uncertainties staff experienced in the workplace since the re-opening of clinics, how staff coped with these uncertainties, how clinics supported them in managing uncertainties, other useful sources of support that helped them manage uncertainty, and any benefits that arose from staff experiences of uncertainty. Section 3 included five single appraisal items adapted from the fertility treatment daily record-keeping form (Boivin and Lancaster, 2010). These assessed whether COVID-19-related uncertainty could have a positive or negative impact, whether it was perceived as controllable, and as stressful, and whether respondents believed they could cope with uncertainty. The appraisal response scale extended from 1 (not at all) to 5 (extremely). Part 4 involved one open-text question that asked about COVID-19-related changes in the workplace and one quantitative question asking participants to rate the changes on a scale from 1 (very positive change) to 5 (very negative change). A technical issue with the survey prevented rating of this latter item by participants accessing the English form.

Procedure

The survey was developed in English and translated to Spanish. The British Fertility Society, African Network and Registry for Assisted

Reproductive Technology, Argentinian Society of Reproductive Medicine, and the Latin American Network of Assisted Reproduction were contacted and agreed to disseminate the survey among their membership in the UK, Africa, and South America via email, newsletters, and social media (Facebook, Instagram, and Twitter). The survey was active from 25 January to 23 May 2021. Upon clicking the survey hyperlink, participants were presented with an information sheet and consent form. No time limit was imposed for survey completion. After submission, participants were thanked, debriefed, and provided with support information in case they experienced any distress from participating. Spanish responses were translated to English and all data were analysed in English. All translations were done by Wolfestone Translation Services (Swansea, UK) and reviewed by GB and SG (reproductive psychologists fluent in Spanish and English).

Data analysis

Textual data were analysed by K.A. and N.C. using the (Braun and Clarke, 2006) method of thematic analysis. This involved a series of steps, beginning with data familiarization, inductive coding (whereby meaningful labels were assigned to segments of text), and review within the research team. Subsequently, codes were combined into sub-themes and themes that reflected broader concepts frequently mentioned in the data. Meta-themes were then deduced from all the themes generated based on the Theory Recognizing and Responding to Uncertainty (Cranley et al., 2012). Coding was performed by K.A. and N.C. Peer debriefing occurred on multiple occasions throughout the coding process, after which the two coders reviewed the themes arising from the data and cross-checked them against the original data extracts. Discussions about the coding process continued until consensus was reached. Textual data analysis was presented as a summary accompanied by a thematic map (Fig. 1) and illustrative verbatim quotations from participants (P), with [...] indicating that part of the quotation was not presented and text with □ being added by authors for clarification. Grammatical errors were corrected. Individual participant number was indicated with P. Quantitative data were presented and analysed using descriptive and inferential statistics, respectively. A within-subject ANOVA was used to compare appraisals of uncertainty rated by the same person. Bonferroni-adjusted paired *t*-tests were used to follow-up significant main effects. Statistical significance was defined as $P < 0.05$.

Ethics

Ethical review and approval were provided by the Cardiff University School of Psychology Research Ethics Committee (EC.20.11.10.6130R_KA).

Results

Themes

Thematic analysis produced 727 codes, organized in 92 sub-themes, and abstracted into 18 themes. Figure 1 shows the thematic map relating themes generated, based on the Theory Recognizing and Responding to Uncertainty (Cranley et al., 2012). The overarching theme resulting from our analysis was COVID-19 uncertainty that is

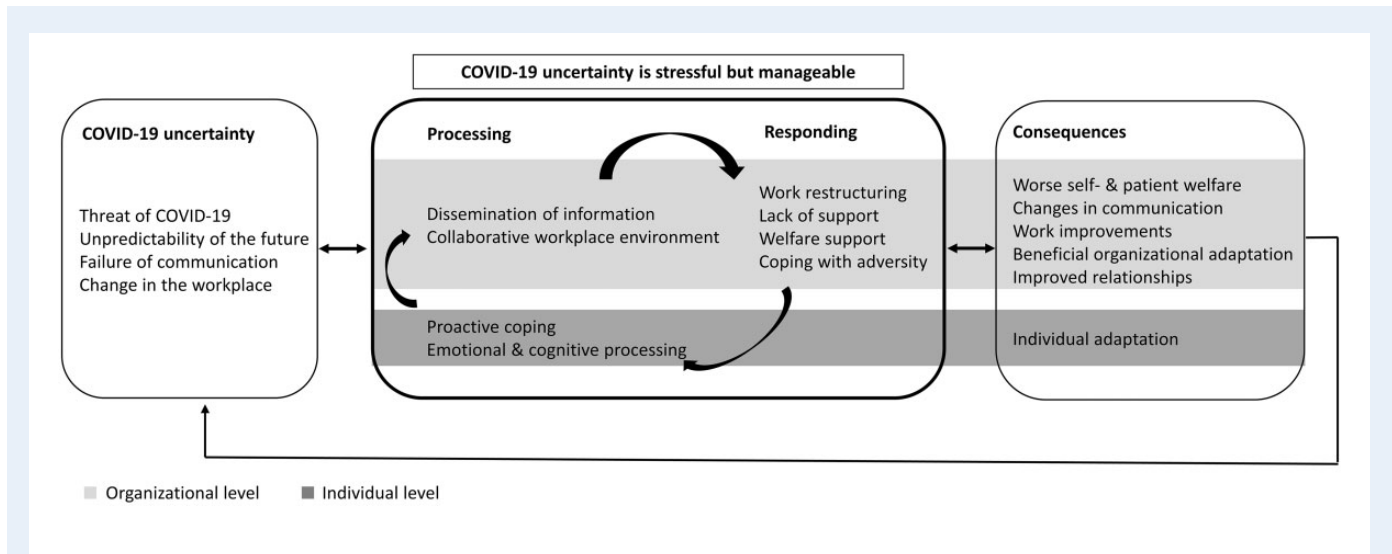


Figure 1. Meta-themes generated from cross-question themes, mapped onto key components of the Theory Recognizing and Responding to Uncertainty (Cranley et al., 2012).

stressful but manageable, with meta-themes capturing types of uncertainties experienced, how staff processed and responded to uncertainty, and its outcomes. Despite uncertainty being manageable, staff perceived gaps in support.

Experiences and appraisals of COVID-19 uncertainty

Supplementary Table S1 presents themes and sub-themes relating to the greatest uncertainties experienced by staff. The greatest uncertainty was the threat of COVID, reported by more than half of respondents and conveyed through reports of uncertainties regarding COVID-19 transmission ('the possibility of contagion and transmitting to family and co-workers', P66) and the inadequacy of safety protocols (e.g. 'lack of a clear protocol in the clinic', P42; 'limited safety supplies', P73). When combined with uncertainties about the risks and complication of COVID-19 and its vaccine ('risks related to infection and the vaccine', P7; 'the risk of complications', P181), these uncertainties generated a sense of jeopardized wellbeing, ranging from social to physical wellbeing ('worry for my health and safety', P69), with death as the most severe uncertainty.

More than half of respondents referred to the unpredictability of the future. The dominant sub-themes were the unknown future ('not knowing what is going to happen', P90), concerns about financial instability ('job uncertainty due to the drop in monthly income', P8; 'continuity of employment in view of the adverse economic situation', P66), and fear of infection to oneself, patients or family ('scared of infecting myself or my family', P196). All these were experienced alongside other negative emotions, with anxiety and stress being the most reported ('more stress at work', P66). In some cases, emotional strain was due to distrust in the safety measures available ('fear of getting infected knowing that the only barriers were the use of [personal protective equipment] PPE and distancing', P196).

A third of respondents cited failure of communication that informs practice as another major uncertainty. These respondents considered the insufficient understanding of the virus as their greatest uncertainty ('lack of knowledge about the way COVID-19 works', P5; 'what effect does COVID-19 have on patients', P31). This was often due to the perception of information being inadequate, changing constantly, and often in contradictory ways ('with no scientific grounds', P16; 'changes almost from week to week, being frequently contrary to what was previously informed', P37). Unsurprisingly, a few respondents also encountered difficulties regarding how to counsel and support patients as they were unsure 'how to advise patients on the risks of COVID-19' (P22).

Uncertainties regarding changes in the workplace were least commonly reported. Work restructuring due to COVID-19 ('new roles and ways of working', P15) and new safety protocols resulted in increasing staff responsibility and workload ('the leaves of vulnerable work personnel [...] as the responsibility lay with fewer people', P66) and changes in working schedules and procedures ('permanent changes to both schedules and ways of working', P15). The change to virtual consultations increased 'the difficulties of evaluating a couple with fertility problems who were not face-to-face' (P37), while face masks for in-person meetings made 'communication more tiring' (P115). The need to adapt 'to technological and health changes' (P33) was a further cause of uncertainty.

Cognitive appraisals of COVID-19-related uncertainty

Figure 2 shows descriptive (mean, SE) data for appraisals. The main effect of appraisal in within-subject ANOVA was statistically significant and moderate ($F(55.038, 582.162) = 14.37$, mean standard error = 20.27, $P < 0.001$, $\eta^2_p = 0.086$, Greenhouse–Geisser-adjusted degrees of freedom). Bonferroni-adjusted paired *t*-tests showed appraisal of negative and positive impact of uncertainty were significantly

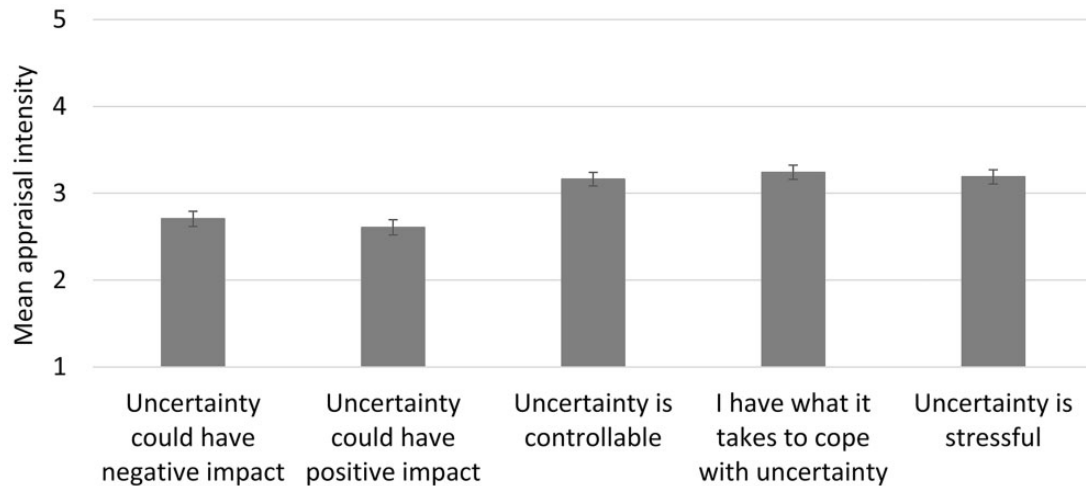


Figure 2. Mean intensity of cognitive appraisals about COVID-19-related uncertainty (N = 275). Higher scores = more of the attribute. Mean and standard errors of the mean represented. Main effect of appraisal using analysis of variance ($P < 0.001$), moderate effect size. Bonferroni-adjusted paired *t*-tests showed perceived negative and positive impact were significantly lower ($P < 0.001$) than perceived controllability, ability to cope and stress of uncertainty.

lower than appraisals of stress, controllability, and having what it takes to cope with uncertainty ($P < 0.001$).

Processing COVID-19 uncertainty

Supplementary Table SII presents themes and sub-themes relating to the ways staff and clinics processed uncertainty. At the organizational level, uncertainty was mainly managed by the promotion of information dissemination and a collaborative work environment. Dissemination of information by clinics helped participants to manage uncertainty, especially when information was readily available ('new information regarding the pandemic was distributed in a timely manner', P191; 'clear governmental information and policies', P29). The role of national and governmental bodies and national and international scientific fertility societies in timely dissemination of trustworthy information was mentioned multiples times ('scientific information from societies through webinars', P36; 'email information from scientific societies [Red Latinoamericana de Reproducción Asistida] REDLARA, [Sociedad Argentina de Medicina Reproductiva] SAMeR', P43; 'national government', P46). This was helped by open communication ('consulting with medical team, consulting geneticists and embryologist from other centres', P240), training opportunities for staff and patients ('webinars providing [...] the best advice', P5; 'awareness and care campaigns [...] for employees and patients', P66), teamwork ('teams are much more mature and prepared', P82), and integration of virtual communication, which was positively evaluated by staff ('optimised times and allowed (staff) to spend more time at home', P182). Nonetheless, the need for more and better-quality information and training made it clear that information provision was not meeting current needs, as 'unclear guidelines' (P42) or information were 'not sufficient to come to any conclusions' (P31). Participants considered wider collaborative networks for 'clinics, centres, and hospitals to share their

experiences and advice' (P72) were crucial to address the lack of information. A collaborative approach to coping in the workplace was mentioned, but to a lesser extent, and mainly referred to clear communication strategies within the team and with patients ('speaking sincerely, enquiring and explaining the scope of the published information', P7; 'exchanging ideas with other professionals', P96; 'involving patient in the decision', P3).

Most participants contributed proactively to control the level of uncertainty within clinics by following safety protocols ('strict compliance with the quarantine protocols', P46) and seeking solutions, for example seeking information ('trying to gain accurate knowledge about the characteristics of the infection', P4) and problem solving ('I foresee the worst that can happen, and I look for future solutions', P188). Other proactive coping included self-care ('taking care of [...] physical and mental health', P90) and remaining vigilant to the aspects of the situation that could be controlled ('taking care of all the details so that no one gets infected', P28; 'controlling what is possible inside the lab', P16). Participants also cited employing emotional and cognitive processing as individual coping strategies. These mostly involved perseverance ('working as hard as possible regardless of the risks', P29) and positive reappraisals of the period of uncertainty as a time to value and enjoy the 'good things' in life ('taking advantage of family life', P11) as 'there could be no tomorrow', P176; or an opportunity to change lifestyle ('think about living outside the city [...] thus, reducing the risks of contagion and improving quality of life', P22). The need to regulate negative emotions (for instance by 'mentally controlling fears and uncertainty', P71; 'meditating to calm the mind', P188; accepting the lack of control and that they 'did not have all the answers', P181) was mentioned to a lesser extent. A small minority stated they were not coping ('still struggling with many difficulties', P16).

Responding to COVID-19 uncertainty

Supplementary Table SIII presents themes and sub-themes relating to the ways staff and clinics responded to uncertainty. The main response involved significant work restructuring, in particular the introduction and strict adherence to new safety protocols and measures ('strict implementation of biosafety protocols', P12). A less-mentioned change was the move to virtual medicine, enabling 'more medical appointments online' (P113). Changes were positively evaluated but triggered additional changes in working loads and patterns ('changes to both schedules and ways of working', P15). Work complications arose due to safety regulations 'that did not exist before' (P8), with staff perceiving they became 'more in demand and made more important decisions on a daily basis' (P12).

Another big organizational focus was on ensuring the welfare of staff ('deep positive changes in the management of care for patients and health personnel', P173), primarily by creating a safe work environment. Other methods included social, financial, and mental health support ('support from colleagues with similar experiences', P114; 'mindfulness workshops', P119; 'job posts were preserved', P56). Despite clinics efforts, perception of lack or insufficient support was common. These related mostly to poor wellbeing and financial support, insufficient health, and safety measures (e.g. lack of 'mass vaccination'), which made participants feel unsafe in the workplace ('did not feel safe', P16). Not surprisingly, requests for support focused on these gaps, the most common being support for general and mental wellbeing, both from management (e.g. 'showing concern for wellbeing', P90; 'psychologists [...]', P86) and among colleagues ('team support', P4). Other requests addressed implementing changes necessary to ensure safety at clinics, from acquiring more safety equipment to keeping social distance and testing patients coming in for appointments ('safety equipment and materials provided', P81; 'providing safety measures', P71; 'protocols for swabbing patients', P35). Financial support was also requested ('wages up to date', P11; 'small financial support', P30; 'jobs preserved', P56). In addition, staff perceive that dissemination of information could be improved through better communication (e.g. 'zoom virtual meetings to stay connected in isolation', P27), more professional collaboration ('teamwork', P4), and wider networks for 'clinics, centres, and hospitals to share their experiences and advice' (P72).

Other organizational responses implemented related to adapting to adversity by managing the workplace changes ('supporting with more workers for some critical areas', P246) in a flexible way ('enable protocol change according to COVID-19 cases and patient demand', P219; 'protocols developed by all of us', P186) and providing supplies to ensure staff and patient safety ('supplying materials to be able to comply with the protocols established as safe', P221).

Consequences of COVID-19 uncertainty

Supplementary Table SIV presents themes and sub-themes relating to perceived consequences of uncertainty. Staff perceived many consequences of COVID-19 and the uncertainty it created. Emerging themes do not reflect that uncertainty was resolved. Instead, they show that responses to address uncertainty had cascading effects at the organizational and individual level. Worse self- and patient welfare was the most prevalent theme. This reflected in perceptions of less empathy and affection towards patients, as staff were 'not able to support patients as they used to' (P51), in emotional strain, namely fear

('afraid for vulnerable colleagues', P14), stress, concern, and insecurity, chronic fatigue, and poor self-care ('people not caring for themselves', P58). Changes in communication were reported. Virtual interactions and use of face masks in in-person meetings made 'communication more tiring' (P115) and negatively affected interactions between staff ('no hug greetings', P29; 'co-existence with work team lost', P56) and with patients ('greet patients differently', P67), as they imposed greater distance and reduced staff empathy for patients ('a phone call is not the same as a hug', P81).

Despite these challenges, work improvements were also reported. Examples were increased experience ('more prepared for problems', P82), resilience and patience, 'building professional networks' (P1), and increased efficiency and awareness (e.g. of the environment, scientific information, and safety). Other organizational adaptations were also perceived as beneficial, for instance at the technological (e.g. virtual working, more social media activity, and 'more online creativity', P14), organizational ('better business management', P230), and financial levels (e.g. improved budgeting skills resulting in respondents having 'money set aside for emergency', P226).

Less prevalent themes were improved interpersonal relationships and individual adaptation. Collaboration and teamwork resulted in stronger, more mature teams that made better decisions and were 'ready to face challenges' (P82). Better communication among staff (e.g. faster information sharing across countries) and patients ('open and honest dialogue with patients', P191) and more trusting teams with a sense of solidarity between colleagues ('more support and back-up from the team despite everything', P36) were also reported. Meanwhile relationships with family and friends were strengthened. At the individual level, respondents talked about hope for a vaccine, gratitude for their work, family, and the simple things in life, and realization that 'life goes on despite what happens to people' (P188).

Staff perceptions of change in the workplace

When rating the COVID-19-related changes experienced at the workplace, 92 (33.5%) participants stated that these were negative or very negative, 25 (9.1%), neither negative nor positive, with 41 (14.9%) reporting these as positive or very positive. One hundred and seventeen participants (42.5%) did not answer this question.

Staff perceptions of physical and mental health

Most respondents reported their current physical health as good, very good, or excellent (92.4%, $n = 254$), with 21 participants (7.7%) rating it as fair. The mean ratings of physical health were 4.05 ($SD = 0.78$, range 2–5). Similarly, most respondents rated their current mental health as good, very good, or excellent (89.5% $n = 246$), with 9.5% ($n = 26$) rating it as fair and 1.1% ($n = 3$) as poor. The mean ratings of mental health were 3.83 ($SD = 0.88$, range 1–5).

Discussion

The COVID-19 pandemic proved distressing for staff, even if most were able to cope. COVID-19-related uncertainty resulted from

perceived threats to health and pressure to respond quickly when lacking necessary experience or reliable applicable evidence. At the core of effective uncertainty management were physical and psychological welfare checks and high-quality communication strategies to allow precise assessment and resolution of uncertainty. Most strategic responses were triggered at the organizational level but staff played a critical role in the implementation and mediation of effects for themselves and patients. Effective responses contributed to a sense of organizational improvement and resilience, but with costs for staff and patients due to changes in work practices. Managing COVID-19 uncertainty will require clinics to deploy strategies that are multi-faceted (identifying, processing, responding) and multi-level (clinic, staff). We advance suggestions on how to achieve this, which we believe apply to other types of uncertainty experienced when providing fertility care. Future research should support the development and evaluation of uncertainty management interventions bespoke to fertility care.

The core issue at the centre of COVID-19 uncertainty in fertility care was threat to own and others' (colleagues, family, patients) welfare, primarily regarding physical health (Requena *et al.*, 2020), but also psychological wellbeing and financial security. Reducing COVID-19 threat required significant and fast organizational changes that had cascading effects for staff (e.g. increased responsibility and ethical dilemmas) and patients (e.g. clinic closure and treatment postponement; Boivin *et al.*, 2020), therefore creating additional uncertainty. Most staff were not overwhelmed, felt able to cope and control uncertainty, and reported overall good physical and mental wellbeing. These reassuring results contrast with meta-analysis showing high incidence of anxiety (37%) and depression (36%) in healthcare workers from November 2019 to September 2020, in particular in women, nurses, and frontline workers (Sun *et al.*, 2021). Results may reflect the fact that most participants worked at private clinics, which were less exposed to service-restructuring and high prevalence of COVID infections. They may also reflect the specificities of fertility care (not life threatening, coping by closure, and delay), time of assessment (>1 year after first COVID-19 case, practice guidelines' available, and confidence in effective vaccination), and focus of questions (i.e. coping and not impact). However, fertility staff shared commonalities with other healthcare workers' in reporting emotional strain due to fear of infection to self and significant others, pervasive uncertainty, need to adapt to daily changes, and extreme concern for patient welfare (Newman *et al.*, 2022).

Processing of COVID-19 uncertainty involved decreasing it by building strong collaborative environments within and between clinics, and with other stakeholders, including patients. These facilitated the acquisition and application of reliable information, which was many times collated, developed, and disseminated by governmental bodies and scientific societies. Such collaborative scrutiny of emerging evidence, reflection, and decision-making are good strategies to use when decisions cannot be based on evidence beyond reasonable doubt, as they are more likely to lead to multi-informed solutions that account for a wider range of stakeholders' welfare (Rutter *et al.*, 2020). These strategies are aligned with evidence-based practice, which advocates for and provides guidance on how to integrate available evidence with clinical expertise and patients' preferences. Nonetheless, while useful, it was clear that many staff found this process challenging due to the speed at which 'new' information was imparted, the limits to supporting evidence, and at times, the need to make sense of what was perceived as contradictory evidence. Overall results suggested that

admitting uncertainty and processing it collaboratively, including with patients, were beneficial. Staff proactively tried to accommodate uncertainty, mainly by reducing personal relevance of uncertainty (e.g. by following protocols) and managing cognitively threat appraisals (e.g. vigilance and positive reappraisal) and the emotions these triggered (e.g. self-care, emotional regulation, and acceptance resignation). The same type of proactive coping responses towards COVID-19 were reported to be beneficial by patients (Boivin *et al.*, 2020). These results align with research showing that promoting uncertainty tolerance is conducive to better staff and patient health outcomes (Alam *et al.*, 2017) and suggest that this can be achieved via education on cognitive coping strategies fit for uncertainty situations.

Responses to COVID-19 were mostly triggered at the organizational level. The most effective measures addressed uncertainty (i.e. safety concerns) while minimizing cascading effects for staff (e.g. welfare and financial security) and patients (e.g. communication). Indeed, when staff expressed dissatisfaction with support, it more often concerned the impact of changes implemented than safety concerns. This evidence shows that uncertainty interventions need to acknowledge bi-directional links in fertility care and their impact on quality of life (of staff and patients; Boivin *et al.*, 2012). Holistic and flexible responses to uncertainty that better ensured everyone's welfare reflected in perceptions of higher personal work efficiency (skills, time management), organizational improvements (technological, financial), and strengthened teams (more collaboration, better communication), suggesting that clinics, as ecosystems, can build up their resilience.

Uncertainty is present in fertility care as a consequence of COVID, but also due to the relatively low success rate of reproductive technologies in relation to the high costs (especially in low- and middle-income countries where treatment is out of pocket funded), diagnosis, and rapidly emerging new technologies and approaches. Developing uncertainty interventions for staff can support them with all these challenges. There is meta-analytical evidence from randomized controlled and quasi-experimental trials in support of the efficacy of interventions to manage on patients and their family member's wellbeing (Zhang *et al.*, 2020) and there is no immediate reason to think similar results could not be obtained with fertility staff. Results from this study informed on how such interventions could be developed. First, interventions should promote collaborative processing of uncertainty. Fertility staff are likely to be skilled in effective communication (within team, with patients) and in evidence-based practice, but further training may be needed with an emphasis on acknowledging, communicating, and making shared decisions in uncertain circumstances. Preliminary evidence from intervention development and evaluation studies suggest that these skills can be improved with brief online training (Hoffmann *et al.*, 2021) and that digital training resources can be rapidly developed (Blake *et al.*, 2020), but bespoke training in fertility care does not exist despite being needed. For example, one of the most common decisions made in fertility care is whether to do another treatment cycle. Nonetheless, there is high heterogeneity on how success rates are discussed in individual consultations (Harrison *et al.*, 2022), information available on clinic websites is mostly low quality (Hammarberg *et al.*, 2017), and just telling patients their success rates does not seem to reduce their overly optimistic view of treatment (Devroe *et al.*, 2022).

Second, education in cognitive coping strategies for uncertainty should promote uncertainty tolerance and adaptive responses in staff. A multi-country study with individuals from the general population

showed that those who focus on accepting, self-encouraging, and finding positives in their COVID-19 circumstances report lower perceived stress (Kirby et al., 2021). Furthermore, those who focus on solving the problems created by COVID-19, self-encourage, and keep a positive outlook through their adverse circumstances, while mentally disengaging from the pandemic (for instance by avoiding news and social media), report better physical and mental health. Our participants reported using most of these coping strategies and that may (at least partially) explain their overall self-reported good mental and physical wellbeing. This is consistent with data from a cross-sectional study showing that uncertainty tolerance was associated with lower risk for burnout in healthcare professionals working during the pandemic (Di Trani et al., 2021). Uncertainty interventions should support healthcare staff in tailoring coping strategies to the uncertainties experienced. More specifically, in using problem solving to address issues they can control (e.g. protocol changes, team building, coordination procedures, and training), in decreasing feelings of helplessness via disengagement from uncontrollable aspects (e.g. transmission rates) and increasing tolerance to the lack of control and adversity by sustaining positive reappraisal (e.g. personal, professional, and organizational growth) and self-encouragement (e.g. resignation and hope in mass vaccination).

Finally, at the organizational level, management should enable well-defined lines of coordination and communication, so that there is clarity about which and how responses will be implemented, their rationale, expected positive and negative consequences, and support mechanisms for staff and patients affected by change. Staff also valued organizational flexibility in adapting responses to a rapidly changing situation. Such an approach, which balances a clear working structure with enough flexibility and autonomy in how teams collectively understand and respond to uncertainty, has been shown as critical to enable healthcare systems to respond effectively to 'low-chance, high-impact' events such as COVID-19 (Lloyd-Smith, 2020).

Strengths and limitations

A strength was the novel focus of the study, given lack of knowledge about how fertility healthcare professionals experienced and coped with COVID-19 generated uncertainty. The mixed-methods and theory-driven approach used in the survey allowed participants to voice their experiences of COVID-19-related uncertainty and explore their fit with theory on healthcare professionals' experiences of uncertainty. Risk of bias in qualitative analysis was addressed via ensuring saturation, code checking, consistency across coders, discussion within team, and triangulation with quantitative data. The sample was big enough to ensure data saturation but mostly represents experiences of physicians and embryologists working at private clinics based in Latin America. Comparisons across continents were not possible. Self-selection whereby the most badly affected staff did not answer the survey cannot be excluded from consideration. Nonetheless, experiences reported are similar to those of a heterogeneous group of healthcare professionals working in the UK (Newman et al., 2022), for instance, and express common themes related with uncertainty management (Cranley et al., 2012). Furthermore, self-selection may result in underestimating the impact of experiences reported, but it is unlikely that it would result in a misrepresentation of the nature of experiences reported. Comparisons across professional roles were also not possible and other healthcare professionals (e.g. nurses and

psychologists) may face different challenges. The 28% attrition rate (i.e. uncompleted surveys) was within the range observed in a systematic review of healthcare staff experiences of COVID-19 (Sun et al., 2021). Finally, the study did not account for variability in national and regional COVID-19 policy that most likely shaped experiences of uncertainty.

Conclusion

The specificities of COVID-19 uncertainty include it being shared by most, triggering high perceived susceptibility and severity threats, and requiring organizational responses supported by effective communication, teamwork, and flexibility. COVID-19 generated uncertainty is not quickly resolvable and, therefore, requires high tolerance and accommodative efforts. Key components identified for uncertainty management interventions in fertility healthcare are, at the organizational level, collaborative (clinic, staff, patients) processing of uncertainty via evidence-based practice (which can be supported by timely dissemination of the best available evidence by governmental bodies and scientific societies), clear team coordination and communication, and organizational flexibility (the latter may be less relevant to manage routine uncertainty). At the individual level, interventions should address provision of support throughout change, with an emphasis on cognitive coping (targeting appraisals and uncertainty tolerance). Research priorities are to develop and evaluate interventions bespoke to fertility care that integrate these components and are adequate in the COVID-19 situation and beyond.

Supplementary data

Supplementary data are available at *Human Reproduction* online.

Data availability

The assessment survey will be made available in the Open Science Framework website (<https://www.osf.io>). We would prefer not to make the data available as it is most qualitative and there is a risk of some being identifiable.

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Authors' roles

S.G., J.B., K.A., and N.C. conceptualized, designed, and executed all aspects of the study. S.G., J.B., and K.A. drafted and revised the article with input from all authors. G.B. and F.Z.-H. contributed to the design of study materials, recruitment of participants, review, and final approval of article and advised (respectively) on medical and support aspects.

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Conflict of interest

S.G. reports consultancy fees from Ferring Pharmaceuticals A/S, speaker fees from Access Fertility, SONA-Pharm LLC, Meridiano Congress International and Gedeon Richter, and grants from Merck Serono Ltd. F.Z.-H. reports speaker fees from Ferring Pharmaceuticals A/S and that he is a chair of the Latin American Registry of ART, Committee of Ethic and Public Policies, and Chilean Society of Obstetrics and Gynecology and a vice chair of the International Committee for monitoring ART. K.A., N.C., G.B., and J.B. report no conflict in relation to this work.

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