

# SARS-CoV-2 pandemic and repercussions for male infertility patients

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**SARS-CoV-2 pandemic and repercussions for male infertility patients: a proposal for the individualized provision of andrological services**

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Specific Topics:	Semen analyses, Spermatozoa, Reproductive tract

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## 1 OPINION

### 2 **SARS-CoV-2** pandemic and repercussions for male infertility patients: a 3 **proposal for the individualized provision of andrological services**

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For Peer Review

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4 105 **Abstract**

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6 106 The prolonged lockdown of health facilities providing non-urgent gamete cryopreservation –  
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8 107 as currently recommended by many reproductive medicine entities and regulatory authorities  
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10 108 due to the SARS-CoV-2 pandemic will be detrimental for subgroups of male infertility  
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12 109 patients. We believe the existing recommendations should be promptly modified and propose  
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14 110 that the same permissive approach for sperm banking granted for men with cancer is  
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16 111 expanded to other groups of vulnerable patients. These groups include male infertility  
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18 112 patients (e.g., azoospermic men and cryptozoospermic) undergoing medical or surgical  
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20 113 treatment to improve sperm quantity and quality, as well as males of reproductive age  
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22 114 affected by inflammatory and systemic auto-immune diseases who are about to start  
23  
24 115 treatment with gonadotoxic drugs or who are under remission. In both scenarios, the ‘fertility  
25  
26 116 window’ may be transitory; postponing diagnostic semen analysis and sperm banking in  
27  
28 117 these men could compromise the prospects of biological parenthood. Moreover, we provide  
29  
30 118 recommendations on how to continue the provision of andrological services in a considered  
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32 119 manner and a safe environment. Our opinion is timely and relevant given the fact that fertility  
33  
34 120 services are currently rated as of low priority in most countries.

35 121 **Keywords:** SARS-CoV-2, Male infertility, Sperm banking, Semen analysis, Azoospermia,  
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37 122 Systemic auto-immune diseases, Opinion.  
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## 123 **Introduction**

124 Severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2) is a novel coronavirus and  
125 causative agent of COVID-19, a disease with potentially dangerous implications for human  
126 health. The remarkable increase in the number of infections by SARS-CoV-2 around the  
127 world raises the prospect of massive hospitalizations that few healthcare systems would be  
128 able to deal with. On this basis, governments around the world have announced the most far-  
129 reaching restrictions on personal freedom in modern history. The urgent need to avoid a  
130 collapse in the healthcare system is the justification for the implemented measures, and  
131 reproductive medicine societies, as well as regulatory authorities, decisively followed by  
132 issuing guidance based on expert best judgment. The key recommendations for practitioners  
133 include suspension of initiation of new fertility treatment and non-urgent gamete  
134 cryopreservation, as well as suspension of elective surgery and non-urgent diagnostic  
135 procedures.<sup>1,2</sup> Sperm banking has been rated as of low priority, indicating that clinical harm  
136 is very unlikely if postponed for six months.<sup>3</sup> Exceptions are oncological patients who require  
137 urgent fertility preservation.

138 Taking the above mentioned into account, we would like to raise a viewpoint hardly voiced  
139 so far. Our concerns are that, first of all, a prolonged lockdown of andrological services will  
140 be detrimental to subgroups of male infertility patients. Secondly, the andrological  
141 community is uneasy about how to provide optimal care to our patients without  
142 compromising safety. We, therefore, propose remedies to mitigate the consequences of a  
143 prolonged cessation of andrological services. The aim is to help authorities and healthcare  
144 providers identify which patients might be prioritized for the continuation of andrological  
145 services in a safe environment.

## 146 **The Pandemic Facts**

147 At the time of writing (April 21), the global deaths caused by SARS-CoV-2 represent  
148 approximately one percent of total deaths expected to occur worldwide over the first three  
149 months of the current year, with a wide variation in the reported death rates per country  
150 ([www.worldometers.info/coronavirus](http://www.worldometers.info/coronavirus)). In total, more than 2.5 million infections by SARS-  
151 CoV-2 have been reported, 95% of which have been defined as mild. Among the severe or  
152 critical cases, the overwhelming majority affects people aged 50 and above. By contrast, the

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4 153 reported death rate among individuals of reproductive age ranges remains low, ranging from  
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6 154 0.2% in China to 0.8% in the United States, with an estimated 1.5:1 male to female ratio,  
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8 155 mainly affecting those individuals with pre-existing conditions, including cardiovascular  
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10 156 disease, diabetes, chronic respiratory disease, hypertension, obesity, and cancer.<sup>4</sup>

### 11 157 **The impact of SARS-CoV-2 for males in need of sperm banking**

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14 158 While it is prudent to advocate temporary social distancing and closure of non-emergency  
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16 159 health services, we do not know how long this pandemic will last. Estimates ranging from 3  
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18 160 to 12 months have been projected, depending on how effective governments implement  
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20 161 quarantine measures and how long it takes to achieve herd immunity. Thus, we would like to  
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22 162 consider what a prolonged lockdown of clinics providing andrological services might mean  
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24 163 for infertility patients. This consideration will focus primarily on priority recommendations  
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26 164 for sperm banking and diagnostic semen analysis for patients seeking fertility rather than  
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28 165 donors.

29 166 The ‘time’ variable is crucial in specific subgroups of infertile males. Besides reproductive-  
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31 167 age oncological patients, loss of time is particularly consequential among patients under  
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33 168 medical treatment aimed at improving sperm quantity or quality and in those with  
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35 169 inflammatory or auto-immune diseases who will either start treatment –with potentially  
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37 170 gonadotoxic drugs– or are under the ‘remission window’ of such treatment, as explained in  
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39 171 more detail below. In both scenarios, the ‘fertility window’ may be transitory and, therefore,  
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41 172 the implications of postponing diagnostic semen analysis and sperm banking in these men  
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43 173 could permanently compromise the prospects of biological parenthood. Hence, the provision  
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45 174 of andrological services cannot be considered a low priority. Our opinion is particularly  
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47 175 important given the fact that healthcare providers are reluctant to recommend assisted  
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49 176 conception in most cases –using either fresh or frozen-thawed sperm– as pregnancy might act  
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51 177 as a comorbidity in women affected by SARS-CoV-2.<sup>5,6</sup>

### 52 178 *Cancer patients*

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55 179 Up to 30% of male cancer survivors lose their fertility potential after anti-cancer therapy.<sup>7</sup>  
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57 180 Chemotherapy, radiotherapy, and radical surgical procedures might irreversibly impair  
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59 181 spermatogenesis and/or ejaculation. Cancer itself can also affect fertility directly (e.g.,  
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4 182 testicular cancer, Hodgkin's lymphoma).<sup>8</sup> Currently, the only reliable method of fertility  
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6 183 preservation in reproductive-aged men with cancer is sperm banking.<sup>9</sup> Sperm banking must  
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8 184 be ideally completed before the start of gonadotoxic therapy. Specimens are usually collected  
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10 185 by masturbation and ejaculated sperm are cryopreserved using slow or rapid freezing  
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12 186 protocols. Before cryopreservation, the semen sample undergoes semen analysis, which is  
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14 187 used to both assess the baseline sperm variables (e.g., count, motility, morphology) and to  
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16 188 plan banking. After thawing, it is inevitable that sperm parameters are overall reduced, and  
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18 189 such samples have to be used with intrauterine insemination (IUI) or assisted reproductive  
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20 190 technology (ART) to allow these patients to have biological children.<sup>10</sup> The costs associated  
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22 191 with sperm banking are relatively low and most cancer patients who banked sperm were  
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24 192 found to be pleased by having taken that decision.<sup>11</sup>

### 25 193 *Azoospermic/cryptozoospermic males*

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27 194 The most vulnerable male infertility patient during the SARS-CoV-2 pandemic is probably  
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29 195 the non-obstructive azoospermic (NOA) or cryptozoospermic patient being medically treated  
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31 196 to restore or improve spermatogenesis. An example is a patient with hypogonadotropic  
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33 197 hypogonadism (HH), in whom azoospermia results from the lack of adequate testicular  
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35 198 stimulation by pituitary gonadotropins.<sup>12</sup> In males with pre-pubertal and post-pubertal HH,  
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37 199 gonadotropin treatment increases testicular size, promotes virilization, and restores  
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39 200 spermatogenesis (to varying degrees) in up to 90% of patients, with reported pregnancy rates  
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41 201 –either by natural intercourse or with the aid of IUI or ART– in up to 65%.<sup>12-14</sup> However, the  
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43 202 treatment duration is long –typically six months or longer– and expensive as well. Moreover,  
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45 203 follow-up during treatment requires monitoring serum levels of pituitary and sexual  
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47 204 hormones, as well as semen analyses. Sperm banking might be considered in men with HH  
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49 205 who responded to therapy, i.e., have viable sperm in the ejaculate, in particular, when the  
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51 206 continuation of gonadotropin therapy is neither possible (e.g., due to economic or logistic  
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53 207 issues), nor desired. In patients who have not responded yet but have economic constraints to  
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55 208 continue therapy (e.g., coexisting female factors), the medication dose and regimen could be  
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57 209 adjusted (e.g., decrease hCG dose, suspend FSH injections) to keep intratesticular as well as  
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59 210 serum testosterone levels within lower normal limits.

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4 211 Another example refers to males with NOA due to spermatogenic failure, including men with  
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6 212 rare numbers of sperm occasionally found in the ejaculate (cryptozoospermia), accounting for  
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8 213 60% of the azoospermia cases.<sup>15</sup> Although the condition is untreatable, medical therapy has  
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10 214 been explored as a way to optimize or induce spermatogenesis and, thus, increase the  
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12 215 likelihood of having sperm retrieved surgically or ejaculated. A few cohort studies have  
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14 216 shown that sperm can be occasionally found in the ejaculate after the use of medication for  
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16 217 boosting intratesticular testosterone production, like hCG injections –alone or combined with  
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18 218 FSH injections–, and estrogen receptor modulators, such as tamoxifen.<sup>16-19</sup> Similar to HH  
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20 219 patients, the continuation of gonadotropin therapy is not always possible nor desired in men  
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22 220 with NOA due to spermatogenic failure who require sperm utilization or banking after the  
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24 221 course of medical therapy. Moreover, immediate ART might not be an option in some  
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26 222 countries with strict lockdown measures during the current SARS-CoV-2 pandemic. Thus,  
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28 223 sperm banking is urged in patients with ejaculated sperm as a way to preserve fertility and  
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30 224 allow future ART with ejaculated sperm. Naturally, semen analyses are required to monitor  
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32 225 treatment results and identify who is eligible for sperm banking. Patients achieving  
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34 226 cryptozoospermia or severe oligozoospermia after treatment may have a short window for  
35  
36 227 sperm cryopreservation as their semen quality might deteriorate.<sup>20</sup> In such events, surgical  
37  
38 228 sperm retrieval will be required, which could inflict both clinical and financial burdens on  
39  
40 229 patients. Nevertheless, sperm retrieval and cryopreservation of testicular sperm should be  
41  
42 230 considered in specific situations when a narrow window of opportunity exists. Sperm  
43  
44 231 retrieval can be performed on an outpatient basis under local/intravenous anesthesia and is  
45  
46 232 associated with minimal postoperative complications.<sup>21</sup>

47 233 Along the same lines, varicocelectomy has been used as an attempt to improve  
48  
49 234 spermatogenesis in NOA men with a coexistent varicocele. Spermatogonia type B, pachytene  
50  
51 235 spermatocytes, and early spermatids are vulnerable to heat stress associated with varicocele.<sup>22</sup>  
52  
53 236 In a systematic review comprising 468 patients with varicocele and NOA, 44% of treated  
54  
55 237 patients had viable ejaculated sperm postoperatively, suitable for ICSI or cryopreservation.<sup>23</sup>  
56  
57 238 These patients should also be monitored with semen analyses, and sperm cryopreservation  
58  
59 239 recommended for those with ejaculate sperm due to the risk of relapse.<sup>24</sup>  
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4 240 Lastly, loss of fertility and late obstruction have been reported in up to 12% and 50% of men  
5  
6 241 with obstructive azoospermia subjected to vasovasostomy and vasoepididymostomy,  
7  
8 242 respectively.<sup>25,26</sup> Similar findings can also occur after the transrectal resection of the  
9  
10 243 ejaculatory ducts. Semen analysis is used to monitor patency status, and sperm banking could  
11  
12 244 be offered to those patients who experience a continuous decrease in sperm count/quality  
13  
14 245 during the follow-up as a way to avoid future sperm retrievals.<sup>26,27</sup>

#### 15 246 *Infertile men of advanced paternal age*

16  
17 247 Infertile men of advanced paternal age (e.g., >50 years) have occasionally used sperm banking  
18  
19 248 for planning of medically assisted reproduction.<sup>28,29</sup> Given that advanced age is a risk factor  
20  
21 249 for SARS-CoV-2 complications, and severe SARS-CoV-2 illness might be treated with non-  
22  
23 250 specific anti-viral drugs with possible gonadotoxic effects<sup>30</sup>, sperm banking could be offered  
24  
25 251 to male infertility patients who are concerned about acquiring the infection.

#### 26 27 252 *Inflammatory and systemic auto-immune diseases*

28  
29 253 At present, the prevailing consensus is to allow gamete cryopreservation to continue for  
30  
31 254 oncological patients. However, males at reproductive age affected by non-oncological  
32  
33 255 conditions (i.e., inflammatory bowel diseases, autoimmune disorders) may also need  
34  
35 256 immediate sperm banking.<sup>31</sup> Gonadotoxic drugs (e.g., cyclophosphamide, methotrexate,  
36  
37 257 mycophenolate mofetil, and mTOR inhibitors) are commonly used to control the  
38  
39 258 inflammatory process in such patients.

40  
41 259 Inflammatory bowel disease (e.g., Crohn's disease, ulcerative colitis) mainly affects young  
42  
43 260 adults, and drugs used for treatment (e.g., sulfasalazine, azathioprine, methotrexate) appear to  
44  
45 261 harm sperm quality.<sup>32</sup> The sulfapyridine metabolite of sulfasalazine impairs semen  
46  
47 262 parameters and increases the production of reactive oxygen species.<sup>32,33</sup> Moreover,  
48  
49 263 pregnancy-related complications and the risk of congenital abnormalities might increase  
50  
51 264 when the father had used azathioprine before conception.<sup>34-36</sup> Also, methotrexate (MTX) is an  
52  
53 265 immunosuppressive agent used to treat inflammatory and auto-immune diseases with known  
54  
55 266 teratogenic effects. The antifolate mechanism of MTX decreases DNA synthesis and inhibits  
56  
57 267 cellular proliferation, possibly resulting in oligozoospermia.<sup>37</sup>

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4 268 Likewise, young men may be affected by systemic autoimmune diseases (SADs) (e.g.,  
5  
6 269 systemic lupus erythematosus, rheumatoid arthritis, systemic sclerosis, ankylosing  
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8 270 spondylitis, dermatomyositis, Behçet disease, psoriasis, among others).<sup>38</sup> In these patients,  
9  
10 271 the chronic inflammation could adversely affect the hypothalamic-pituitary-testicular axis  
11  
12 272 and the testicles directly, causing impairment of semen quality and quantity. However,  
13  
14 273 gonadal dysfunction is primarily related to the effects of immunosuppressive therapy (e.g.,  
15  
16 274 alkylating agents, methotrexate, mycophenolate mofetil).<sup>39</sup>  
17  
18 275 Among patients with inflammatory bowel disease or SAD considering fertility preservation,  
19  
20 276 sperm banking might be conditioned to temporary discontinuation of therapy for at least 3-4  
21  
22 277 months or before initiation of therapy.<sup>35</sup> Several patients might have been planning for this  
23  
24 278 ‘fertility window’ for an extended time, which unfortunately occurred during the SARS-  
25  
26 279 CoV-2 pandemic. Sperm banking is, therefore, an option for patients concerned about  
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28 280 establishing a pregnancy during the SARS-CoV-2 pandemic, in particular, those with semen  
29  
30 281 abnormalities candidates for ART. On this basis, we would argue that the same permissive  
31  
32 282 approach that has been granted for men with cancer to enable gamete preservation should be  
33  
34 283 extended to male patients with inflammatory and autoimmune diseases.

#### 34 284 **What are the possible remedies?**

35  
36 285 We need to consider the health and psychological consequences of not offering the above  
37  
38 286 patients andrological services. The lockdown of andrological services may have a devastating  
39  
40 287 psychological impact on men undergoing fertility-related treatment. Like women, men  
41  
42 288 undergoing fertility treatment may also experience anxiety and stress.<sup>40,41</sup> This psychological  
43  
44 289 distress can aggravate the feeling of fear and uncertainty imposed by the SARS-CoV-2  
45  
46 290 pandemic<sup>42</sup>, which might have negative consequences for the reproductive outcome.  
47  
48 291 The damage to the affected patients is difficult to measure, and it will take months, perhaps  
49  
50 292 years before we can assess the broader implications of the current restrictive measures for  
51  
52 293 patients as well as healthcare providers. While we believe that the various lockdowns will  
53  
54 294 slow the spread of SARS-CoV-2, a strict lockdown is unlikely to last too long due to its  
55  
56 295 practicality and pitfalls on other aspects of society, mainly economical. Thus, a certain level  
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58 296 of risk of infections by SARS-CoV-2 is expected because there will be new cases when  
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4 297 measures are relaxed, and no vaccine is likely to be available soon. Therefore, not only  
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6 298 urgent short-term responses, but also long-term measures are essential.  
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8 299 Hence, in this time of uncertainty, denying andrological services from those who need it most  
9  
10 300 might be even worse than the risks of providing them. We, therefore, propose some remedies  
11  
12 301 that we believe might offer fertility providers and patients alike greater autonomy, and that  
13  
14 302 could be used to alleviate the adverse impact of the coronavirus pandemic in the months to  
15  
16 303 come (**Figure 1**).

17 304 1. Before any service is provided, active SARS-CoV-2 infections and suspected cases should  
18  
19 305 be excluded. Testing patients with the use of polymerase chain reaction (PCR) and/or blood  
20  
21 306 antibody testing is recommended before starting sperm banking. Ideally, only samples from  
22  
23 307 patients with negative results or who have acquired herd immunity should be cryopreserved.  
24  
25 308 2. Andrological services (e.g., diagnostic semen analysis and sperm cryopreservation) should  
26  
27 309 not only be available for oncological patients, but also for the group of patients listed below.  
28  
29 310 i. Men with severe male factor infertility under medical or surgical treatment aiming at  
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31 311 improving sperm quantity or quality (e.g., patients with NOA or cryptozoospermia/severe  
32  
33 312 oligozoospermia, including post-varicocele repair, and those with evidence of loss of patency  
34  
35 313 after successful surgical reconstruction of the reproductive tract).  
36  
37 314 ii. Men at reproductive age affected by inflammatory diseases or SADs, i.e., before initiation  
38  
39 315 of gonadotoxic therapy or if under the ‘fertility window’ achieved after temporary (at least  
40  
41 316 three months) discontinuation of therapy.  
42  
43 317 iii. Infertile men older than 50 years, in particular those with comorbidities who are  
44  
45 318 candidates for IUI or ART and are concerned about the risk of acquiring SARS-CoV-2 and  
46  
47 319 the possibility of anti-viral therapy causing gonadotoxic effects.  
48  
49 320 3. Surgical sperm retrieval and cryopreservation of testicular sperm should be considered in  
50  
51 321 specific situations involving men with NOA undergoing medical therapy to improve  
52  
53 322 spermatogenesis. In this setting, procedures should be performed, if possible, on an outpatient  
54  
55 323 basis under local anesthesia. Moreover, the use of electrocautery should be avoided as the  
56  
57 324 surgical smoke might carry the virus if a patient is infected but asymptomatic. Only essential  
58  
59 325 staff should stay in the operating theater, and personal protection measures should be strictly  
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326 followed as determined by the local healthcare authorities. In closed-controlled air systems,  
327 the airflow might produce an increase in the viral spread from potential asymptomatic

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4 328 patients. Thus, special attention should be given to air quality control, including the use of air  
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6 329 filtration systems, particularly in surgical and laboratory areas.<sup>43</sup>

7  
8 330 4. Encourage telemedicine and phone counseling for providing instructions about testing and  
9  
10 331 sperm banking.

11 332 5. Adherence to infection prevention recommendations is of utmost importance for patients  
12  
13 333 and health practitioners alike. This advice includes the use of appropriate personal protective  
14  
15 334 equipment (PPE) by healthcare staff, adherence to social distancing measures for healthcare  
16  
17 335 staff and patients, and space out appointments so that no patients are waiting together in the  
18  
19 336 clinic waiting area. We stress the importance of training staff (receptionists, nurses,  
20  
21 337 technicians, doctors) on PPE needs and usage (please see

22  
23 338 <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinic-preparedness.html>).

24  
25 339 6. Good laboratory practices should be strictly applied when handling the seminal fluid in the  
26  
27 340 andrology laboratory.<sup>44</sup> This advice includes (i) use of class II safety cabinets<sup>45</sup>, which gives  
28  
29 341 protection to the specimen handled as well as the operator performing the work, (ii) use of  
30  
31 342 high-security straws for sperm cryopreservation, as routinely used in most sperm banks, and  
32  
33 343 (iii) additional measures to protect the specimens from laboratory staff (e.g., use of goggles,  
34  
344 N95 mask, gown/coverall, and gloves) –who might be asymptomatic for SARS-CoV-2.

35  
36 345 7. Technicians/biologists should, ideally, be tested by PCR and/or blood antibody testing  
37  
38 346 before resuming activities, and only staff with negative results or who have acquired herd  
39  
40 347 immunity should perform laboratory duties. If the staff that manipulated specimens get  
41  
42 348 infected, an aliquot of cryopreserved semen samples should be tested (e.g., by PCR) because  
43  
44 349 semen samples, cryopreservation media, straws, and pipette tips could have been  
45  
46 350 contaminated by asymptomatic PCR-positive biologists and technicians.

47 351 8. A thorough discussion between patients and healthcare providers should be made for  
48  
49 352 responsible shared decisions. This advice includes the development and use of dedicated  
50  
51 353 informed consent, detailing the risks of attending the facility and banking of sperm during the  
52  
53 354 SARS-CoV-2 pandemic. Furthermore, psychological support and financial aid might be  
54  
55 355 offered to those in need. The latter might be particularly relevant to patients under economic  
56  
57 356 pressure due to the pandemic who need to afford the costs of semen analysis and sperm  
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59 357 banking.  
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4 358 9. Advanced planning should guide the continuation of andrological services. Working  
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6 359 groups and quality managers should determine which patients to prioritize and how working  
7  
8 360 lists should be filled, including staff scheduling.  
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### 10 361 **Practical considerations**

11 362 During the coming weeks, we should continue to look critically and objectively at the SARS-  
12  
13 363 CoV-2 evidence. Although our recommendations are unlikely to create any further burden to  
14  
15 364 the already overwhelmed medical infrastructure, we acknowledge that patients might be  
16  
17 365 reluctant to use andrological services on the basis of fear of being infected or economic reasons.  
18  
19 366 We also realize that much is unknown about SARS-CoV-2 and its implication on male  
20  
21 367 reproductive health. The existing data indicate that a subject can be infectious 3-5 days before  
22  
23 368 the onset of actual symptoms of the viral infection, and the risk of such cases spreading the  
24  
25 369 infection has not been rigorously researched.<sup>46</sup> While testing patients and staff with the use of  
26  
27 370 PCR and/or antibody kits is recommended, the majority of clinics lack prompt access to these  
28  
29 371 tests. Moreover, some countries face a short supply of test kits, which have been made available  
30  
31 372 for symptomatic patients and frontline health providers only. Besides, the accuracy of these  
32  
33 373 tests has been questioned, with some reports suggesting that many of the SARS-CoV-2 kits in  
34  
35 374 the market have a false negative rate of 30-40%.<sup>47</sup> Thus, it remains to be determined how clinics  
36  
37 375 can screen patients and healthcare providers optimally. Likewise, it remains to be decided who  
38  
39 376 –patients or clinics– will assimilate the testing related-costs, PPE, and reduced patient volume  
40  
41 377 due to extra measures instituted to avoid infections. Along these lines, clinics and hospitals  
42  
43 378 providing andrological services have to determine ways of protecting themselves from  
44  
45 379 potential liability issues. Although the overall mortality rate among men at reproductive age  
46  
47 380 remains low, it should be considered that contamination of patients and staff could occur with  
48  
49 381 SARS-CoV-2 in the context of asymptomatic shedding. For this reason, it seems sound to  
50  
51 382 advise postponing medical therapy in azoospermic men who had planned to initiate medical  
52  
53 383 therapy and who have no pressing concerns (e.g., no maternal factors such as advanced  
54  
55 384 maternal age) until it is deemed safe to obtain regular semen analyses, hormone profiles, and  
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57 385 banking of sperm. The same reasoning applies to semen analysis and sperm banking in men  
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59 386 under therapy who opt to continue on medication till the pandemic ends.  
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4 387 At present, limited data exist about potential routes of SARS-CoV-2 infection in respiratory,  
5  
6 388 cardiovascular, digestive, urinary, and reproductive systems. In this regard, no evidence of  
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8 389 virus load in semen or testicular biopsies of SARS-CoV-2 infected patients has been reported,  
9  
10 390 but data is minimal.<sup>48-50</sup> Nevertheless, angiotensin-converting enzyme 2 (ACE2) receptors,  
11  
12 391 used by the virus to enter host cells, might exist in spermatogonia, Sertoli cells, and Leydig  
13  
14 392 cells<sup>51,52</sup>, as well as sperm cells.<sup>53</sup> Also, previous reports suggested that other coronaviruses,  
15  
16 393 like the SARS coronavirus, could cause orchitis.<sup>54</sup>

17 394 As for pregnancy with the use of banked or fresh ejaculate sperm during the SARS-CoV-2  
18  
19 395 pandemic, it has been suggested that pregnant women might be at a higher risk of developing  
20  
21 396 complications, including miscarriage, preeclampsia, and preterm birth.<sup>5,6</sup> However, the  
22  
23 397 evidence is still limited, and we, therefore, abstain from making recommendations about the  
24  
25 398 use of fresh or banked sperm for assisted conception during the pandemic until more data are  
26  
27 399 available. Naturally, the use of sperm for assisted conception –either fresh or frozen-thawed–  
28  
29 400 would not be recommended in most cases if it is confirmed that pregnancy acts as an important  
30  
31 401 comorbidity factor. Notwithstanding these observations, it should be acknowledged that  
32  
33 402 serology testing, once properly validated and widely available, will be helpful to identify  
34  
35 403 immune patients that could be allowed for treatment.<sup>55</sup> These patients have little risk of either  
36  
37 404 pregnancy complications or propagating the disease when attending fertility clinics.  
38  
39 405 Nevertheless, the provision of andrological services should only be undertaken if the medical  
40  
41 406 infrastructure can support them. We reiterate the above recommendations that care should only  
42  
43 407 be restarted if social distancing can be maintained, areas regularly disinfected, and screening  
44  
45 408 for signs and symptoms of the infection undertaken before allowing patients into the facility in  
46  
47 409 accordance with guidance issued by health regulatory authorities.

## 48 410 **Conclusions**

49 411 We propose remedies to mitigate the consequences of a prolonged cessation of andrological  
50  
51 412 services due to the SARS-CoV-2 pandemic to vulnerable subgroups of male infertility  
52  
53 413 patients. In a moment when the reorganization of healthcare services is focused on supporting  
54  
55 414 SARS-CoV-2 patients who might need critical care, limiting burdens for national health  
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57 415 systems could still represent a relevant issue. We advocate that correct identification of the  
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59 416 more “time-sensitive” cases is crucial for regulating the continuation of andrological services,  
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4 417 including diagnostic semen analysis and sperm banking. Moreover, we provide  
5  
6 418 recommendations on how to most optimally provide care to our patients –without  
7  
8 419 compromising safety– once andrological services are resumed. The aim is to help authorities  
9  
10 420 and healthcare providers identify which patients might be prioritized during the SARS-CoV-2  
11  
12 421 pandemic for the continuation of andrological services in a safe environment.

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17  
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19  
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21  
22 426 contributed to manuscript revision and critical analysis, read and approved the submitted  
23  
24 427 version. The corresponding author takes the final responsibility for the decision to submit the  
25  
26 428 manuscript for publication.

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28  
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32  
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34  
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37 434 declare that the research was conducted in the absence of any commercial or financial  
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586 **Legend to Figure**

587 **Figure 1.** SARS-CoV-2 pandemic and provision of andrological services: proposal for  
588 individualized management.

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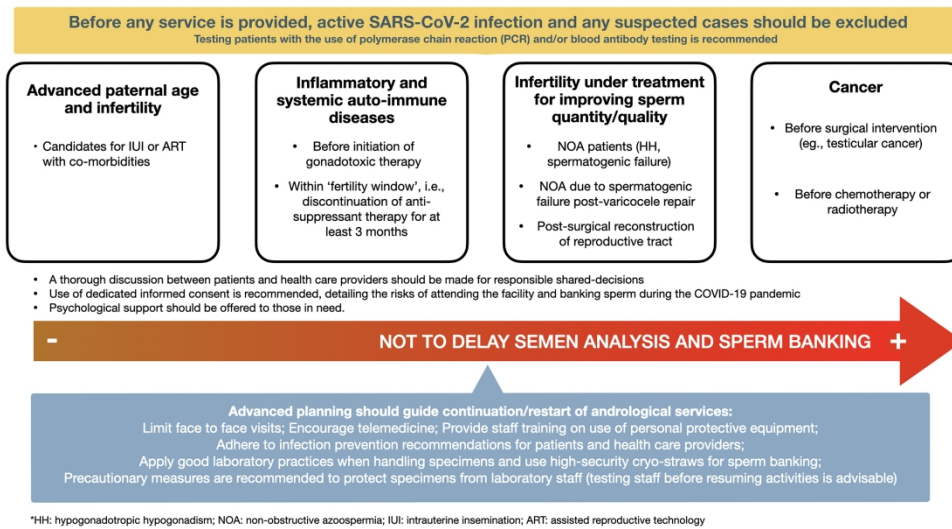


Figure 1. SARS-CoV-2 pandemic and provision of andrological services: proposal for individualized management.

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