


# BMJ Open Consequences of SARS-CoV-2 pandemic on urological surgery in France: a nationwide analysis of the healthcare system database

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## ABSTRACT

The SARS-CoV-2 outbreak overwhelmed the healthcare systems worldwide. Saturation of hospitals and the risk of contagion led to a reduction in the care of other diseases.

**Objective** To determine the impact of SARS-CoV-2 pandemic on urological surgery in France during the year 2020.

**Design, setting and participants** An observational descriptive study was conducted on anonymised data collected from the national healthcare database established each year as part of the Program for the Medicalization of Information Systems in Medicine, Surgery, Obstetrics and Odontology.

**Intervention** None.

**Primary and secondary outcome measures** We gathered the number of urology surgical procedures carried out between 2010 and 2019, and we observed the difference between the forecast and actual number of urological surgeries performed in 2020.

**Results** Urological surgeries decreased by 11.4%, non-oncological surgeries being more affected (−13.1%) than oncological ones (−4.1%). Among the most relevant surgeries, female urinary incontinence (−44.7%) and benign prostatic hyperplasia (−20.8%) were the most impacted ones, followed by kidney cancer (−9%), urolithiasis (−8.7%), radical cystectomy for bladder cancer (−6.1%), prostate cancer (−3.6%) and transurethral resection of bladder tumour (−2%). Public hospitals had a more reduced activity (−17.7%) than private ones (−9.1%). Finally, the distribution of the reduction in urological activities by region did not correspond to the regional burden of SARS-CoV-2.

**Conclusions** Urological care was severely affected during SARS-CoV-2 pandemic. Even if oncological surgeries were prioritised, the longer it takes to receive appropriate care, the greater the risk on survival impact.

**Trial registration** The data collection and analysis was authorised by the French Data Protection Authority (CNIL) under the number1 861 282v2.

## INTRODUCTION

On March 2020, the COVID-19 (SARS-CoV-2) was declared a pandemic by the WHO. Owing to the alarming levels of the disease spread and to the lack of approved medications available

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The database is exhaustive and covers the entire country over a period of 10 years.
- ⇒ Stage at diagnosis and prognosis were not included in the dataset making impossible to evaluate the consequences of delaying medical care.
- ⇒ Descriptive statistical analysis did not provide any insights into the reasons for regional discrepancies between SARS-CoV-2 burden and reduction of surgical activity.

for treatment, authorities of many countries enforced a total lockdown to contain the disease.<sup>1</sup> In France, lockdown was decreed on 17 March 2020. The whole healthcare system was massively impacted ever since. Hospitals struggled to face the high number of admissions in emergency and critical care units due to SARS-CoV-2.<sup>2</sup> Removal of personnel at risk from the workforce together with the high number of casualties due to SARS-CoV-2 infection limited the number of available staff in hospitals.<sup>3 4</sup> Consequently, operating room healthcare workers were redeployed, and facilities were restructured to support the ongoing pandemic response.

To ease pressure on hospitals, the French government requested to cancel elective surgeries. Nevertheless, the lack of medical human resources and services led to reschedule urgent surgical procedures such as oncological interventions, emergencies and organ transplantations.<sup>5</sup> In this context, guidelines were issued by the European and the French Associations of Urology (EAU and Comité de Cancérologie de l'Association Française d'Urologie (CCAFU)) to help clinicians in prioritising urological surgeries and treatments, ensuring adequate care of the patients in the context of the SARS-CoV-2 sanitary crisis.<sup>6 7</sup> Some patients were also afraid of

contamination and delayed consultations with specialists, postponed surgeries or even refused treatments.<sup>8</sup>

During the year 2020, thousands of surgical procedures in the entire country were cancelled, but little is known about the exact number of postponed surgeries during the pandemic period, as well as the long-term consequences, especially on overall survival in patients with cancer.<sup>9</sup>

Our study aimed at describing the impact of SARS-CoV-2 pandemic on urological care provided in the different regions of France during 2020.

## MATERIALS AND METHODS

### Study design

This observational descriptive study is based on anonymised data collected from the national database established each year as part of the Program for the Medicalization of Information Systems in Medicine, Surgery, Obstetrics and Odontology (PMSI). Any stay in general or specialised medicine, general or specialised surgery and gynaecology-obstetrics in a French public or private health institution in metropolitan France or overseas departments is subject to an anonymous discharge summary. This summary includes the main diagnosis and associated diagnoses, coded with the 10th revision of the WHO's International Classification of Diseases (ICD-10), and the procedures performed. The data collection and analysis was authorised by the French Data Protection Authority (Commission Nationale Informatique et Liberté; CNIL) under the number 1 861 282v2.

### Data collection

We gathered all surgeries performed in urology departments in mainland France, from 2010 to 2020 (around 600 000 procedures a year). We also selected seven groups related to the main urological domains, that is, radical prostatectomy for prostate cancer, partial and radical nephrectomy in kidney cancer, transurethral resection in bladder cancer, radical cystectomy, benign prostatic hyperplasia, suburethral slings for female urinary incontinence, and endoscopic and percutaneous procedures for kidney calculus. The ICD-10 codes of the different surgeries for each group are summarised in online supplemental table 1.

Data were provided by the PMSI system as Excel files.

### Statistical analysis

The analyses were purely descriptive. Overall and for each group of surgeries, a forecast of the number of hospitalisations for the year 2020, altogether with its 95% CIs, was calculated based on the number of surgical interventions performed between 2010 and 2019, using the Excel Forecast.Ets and Prevision.Ets.Confint functions. This function uses an exponential smoothing algorithm to predict a future value on a timeline, based on a series of existing values. The simplified Forecast.Ets function

**Table 1** Impact of the SARS-CoV-2 pandemic on the number of urological surgeries

Surgeries	Overall	Oncology	Non-oncology
Performed in 2019	661 389	127 928	533 461
Expected in 2020	673 835	129 828	543 254
95% CIs	660 850 to 686 821	124 299 to 135 356	528 113 to 558 395
Actual in 2020	596 756	124 481	472 275
Δ Expected	-77 079	-5 347	-70 979
% Δ Expected	-11.44	-4.12	-13.07

% Δ Expected, 100\*Δ expected/expected 2020; Δ Expected, difference between actual and expected.

syntax is FORECAST.ETS (target date, values, timeline), where 'target date' is the time/date for which one wants to predict a new value (x value); 'values' is the range of the existing or historical values (y values); and 'timeline' is a range of time/date values that correspond to the historical values (x values).

We calculated the percentage change in the number of hospitalisations as the difference between the forecast and the actual number of hospitalisations in 2020 divided by the forecast for 2020.

Results are presented for the entire country (mainland except Corsica) and by region as the epidemic did not spread homogeneously throughout the country.

### Patient and public involvement

No patient involved.

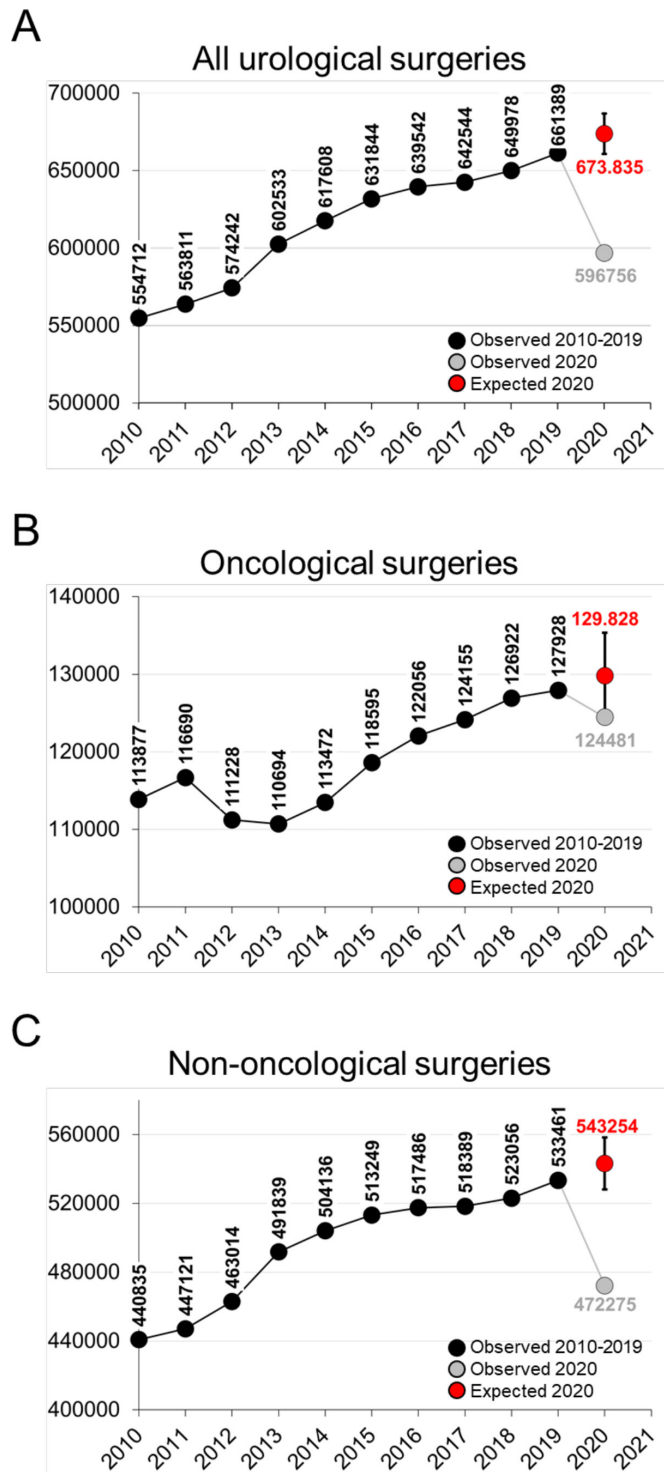
## RESULTS

### Impact of the COVID-19 pandemic on urological care

Table 1 and figure 1 summarise the forecast and actual numbers of surgeries, overall and for oncology and non-oncology reasons. The overall drop in hospitalisations was 11.4%, more pronounced in non-oncology field (13.1% vs 4.1% for oncological surgeries).

Table 2 and figure 2 summarise the forecast and actual numbers of surgeries in seven main urological domains, that is, prostate cancer, kidney cancer, bladder cancer, benign prostatic hyperplasia, female urinary incontinence and calculus of kidney. Overall, 12.7% less surgeries than expected were performed. The most affected surgeries were the suburethral slings for female urinary incontinence (-45%) and those related to prostate hyperplasia (-21%). However, kidney cancer (-9%) and bladder cancer (-6%) care were also impacted.

SARS-CoV-2 pandemic was a matter of public health; hence, all patients with SARS-CoV-2 were sent to public medical centres. Therefore, we analysed the impact of SARS-CoV-2 in the urological services of both public and private establishments (figure 3 describes the impact on prostate hyperplasia care). As shown in table 2, the public health system was more impacted (-17.7% surgical activity) than the private system (-9.1%).



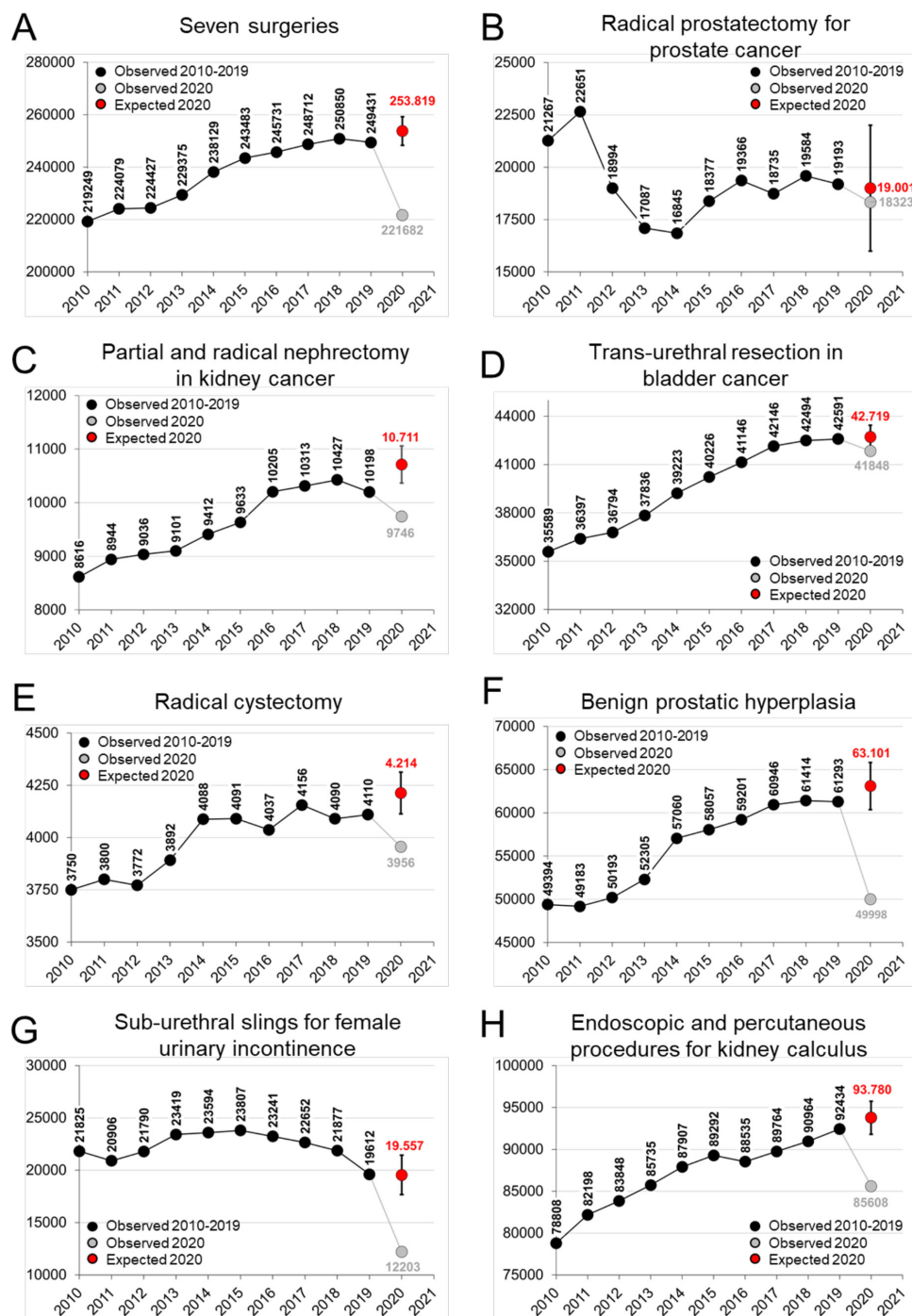
**Figure 1** Changes in the number of urological surgeries between 2010 and 2020. The predicted number of surgeries for 2020 is shown in red. (A) All types of surgeries; (B) oncological surgeries; and (C) non-oncological surgeries.

### Consistency between the distribution of SARS-CoV-2 ICU admissions by region and the deprogramming of surgical procedures

In France, the first wave of the SARS-CoV-2 outbreak was between March and May 2020, followed by a second one between September and November of the same year. However, the disease did not spread homogeneously

**Table 2** Impact of the SARS-CoV-2 pandemic on seven main urological group of surgeries

Surgery	Total	Bladder cancer				
		Prostate cancer	Kidney cancer	Transurethral resection	Radical cystectomy	Benign prostate hyperplasia
Performed in 2019	249 431	19 193	10 198	42 591	4 110	61 293
Expected in 2020	253 819	19 001	10 711	42 719	4 214	63 101
95% CI	248 347 to 259 291	15 995 to 22 007	10 365 to 11 058	41 997 to 43 442	4073 to 4355	60372; 65 831
Actual in 2020	221 682	18 323	9 746	41 848	3 956	49 998
Δ Expected	-32 137	-678	-965	-871	-258	-13 103
% Δ Expected	-12.66	-3.57	-9.01	-2.04	-6.12	-20.77
Private structures	-9.07	+1.24	-8.01	-2.03	-1.14	-16.5
Public structures	-17.73	-10.31	-2.59	-6.93	-11.53	-27.12
% Δ Expected, 100*Δ expected/expected 2020; Δ Expected, difference between actual and expected. .						
		Female urinary incontinence		Kidney calculus		
		19 612		92 434		
		19 557		93 780		
		17673; 21 440		91811; 95748		
		12 203		85 608		
		-8 741		-8 172		
		-44.69		-8.71		
		-33.72		-4.53		
		-43.33		-15.81		

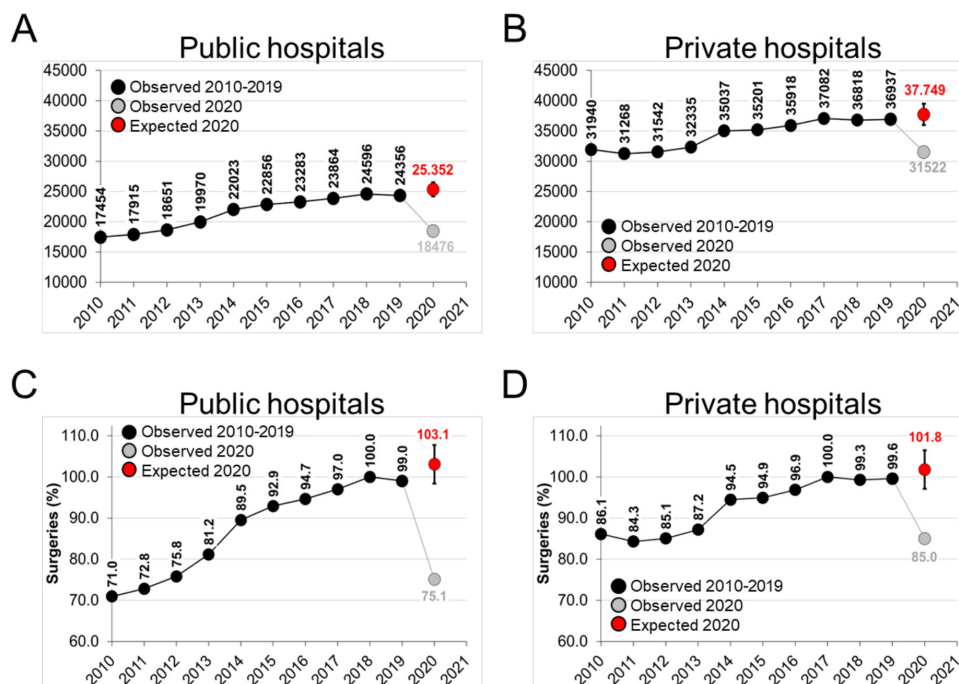


**Figure 2** Changes in the number of elected surgeries between 2010 and 2020 for each of the urological conditions analysed. The predicted number of surgeries for 2020 is shown in red. (A) All seven surgeries; (B) radical prostatectomy for prostate cancer; (C) partial and radical nephrectomy in kidney cancer; (D) transurethral resection in bladder cancer; (E) radical cystectomy; (F) benign prostatic hyperplasia; (G) suburethral slings for female urinary incontinence; and (H) endoscopic and percutaneous procedures for kidney calculus.

throughout the country, as seen by the number of intensive care units (ICUs) admissions/100 000 inhabitants (figure 4A). Thus, the Eastern regions were more affected by the virus, with more than 70 ICU admissions/100 000 inhabitants, than the Western regions (<70). This distribution does not correspond to that of the effect of the pandemic in the global activity of urological services by region (figure 4B).

Nephrectomy for kidney cancer and radical cystectomy for bladder cancer were the most affected procedures in oncological care (table 2). In figure 4C and D, we observed two different patterns that do not correspond to ICU admissions/100 000 inhabitants (figure 4A). Bretagne and Normandie, regions that were barely affected by the pandemic, showed a huge impact in both type of operations (nephrectomy: -14.5% and -11.2%, respectively;





**Figure 3** Changes in the number of surgeries for benign prostate hyperplasia between 2010 and 2020 in public and private hospitals. The predicted number of surgeries for 2020 is shown in red. Changes in public (A) and private hospitals (B) represented as total number of surgeries. Changes in public (C) and private hospitals (D) represented as percentage of number of surgeries.

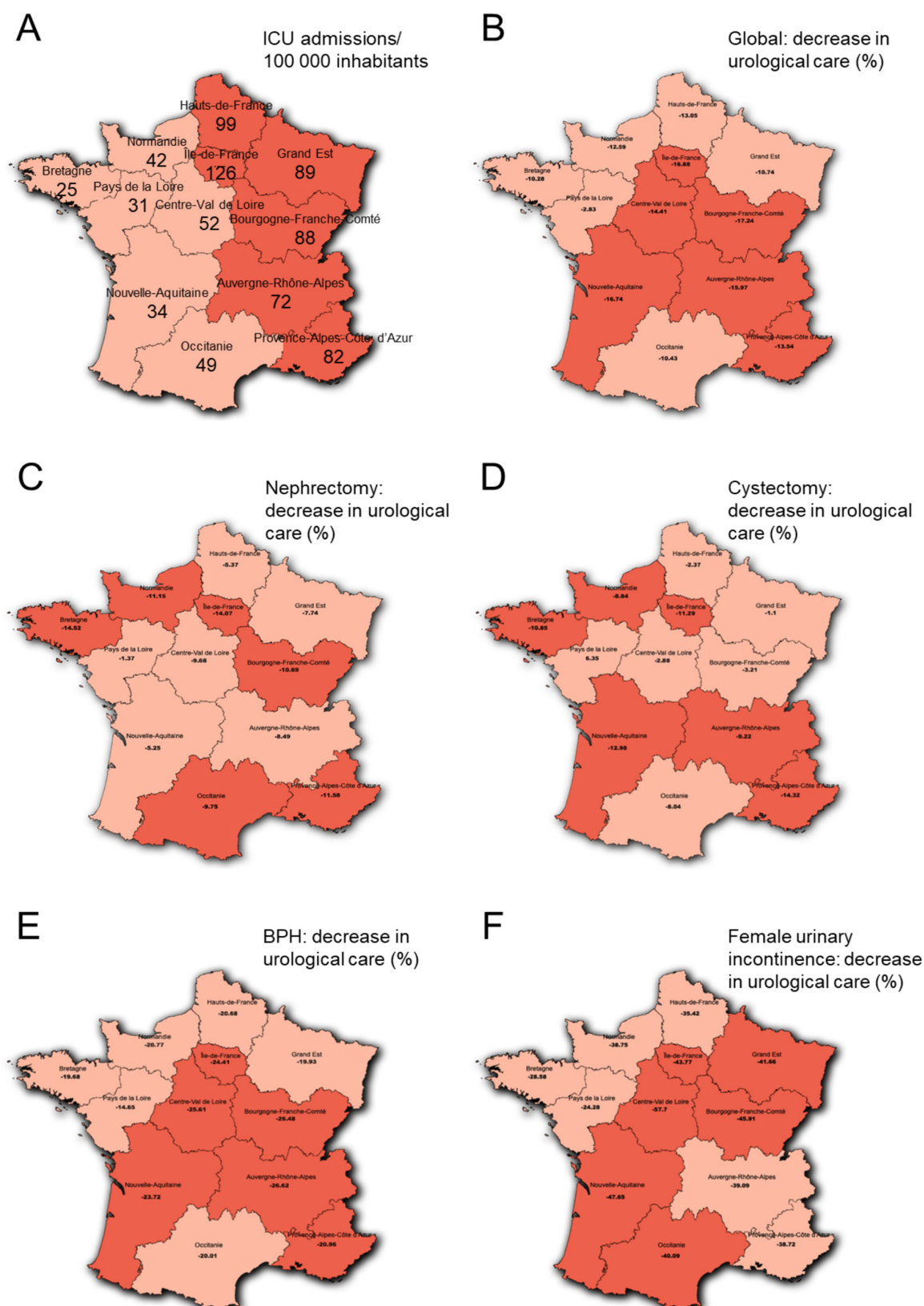
cystectomy:  $-10.9\%$  and  $-8.8\%$ , respectively). On the contrary, Hauts-de-France and Grand Est, where ICUs were saturated with SARS-CoV-2 patients ( $>70$  ICU admissions in ICU/100 000 inhabitants), had a very little impact in both, nephrectomies ( $-5.4\%$  and  $-7.7\%$ , respectively) and cystectomies ( $-2.4\%$  and  $-1.1\%$ , respectively).

Benign prostate hypertrophy (BPH) and female urinary incontinence are the most common surgeries related to the urinary tract. They were the most affected by the pandemic. As previously mentioned, there is a discrepancy between the impact of the pandemic in urological activities by region (figure 4E and F) and the distribution of the disease throughout the country (figure 4A). Grand Est, one of the regions most affected by SARS-CoV-2 cases, saw the number of BPH procedures reduced by  $19.9\%$ , lower than the national average ( $-20.8\%$ ). By contrast, Nouvelle-Aquitaine and Centre-Val de Loire, notably less affected by the pandemic in number of ICU admissions by SARS-CoV-2, had a reduction in BPH procedures of  $23.7\%$  and  $25.6\%$ , respectively, which is highly over the national average. Regarding female urinary incontinence, in Hauts-de-France, Auvergne-Rhône-Alpes and Provence-Alpes-Côte d'Azur, regions with a high number of SARS-CoV-2 patients, surgical services kept the impact of the epidemic at lower levels than the national average ( $-44.7\%$ ), with a drop of  $35.4\%$ ,  $39.1\%$  and  $38.7\%$ , respectively. Meanwhile, in Centre-Val de Loire and Nouvelle-Aquitaine, with much less cases of SARS-CoV-2, the reduction in number of surgical procedures was strikingly high ( $-57.7\%$  and  $-47.7\%$ , respectively).

## DISCUSSION

The SARS-CoV-2 pandemic was a real challenge for all health systems in the world. Due to saturation of hospitals by SARS-CoV-2 patients, and to try to minimise the risk of contagion, many surgeries were postponed or even cancelled with unclear consequences on population health. Aiming to determine the real effect of this outstanding situation in the activity of the urological services, we carried out an objective descriptive analysis of the reduction in the number of surgical procedures during the first year of the pandemic in France. We analysed trends in the entire country and region by region over a 10years period of time to reinforce the validity of the forecast for year 2020. Even if we cannot formally exclude other reasons for a sudden change in urological activity in 2020, there is very little chance that it could be due to other reason than the SARS-CoV-2 pandemic.

Our results are focusing on the French urological activity and cannot be extended to other countries or specialties. Nonetheless, given the exhaustivity of our analysis, our results may help politicians and hospital directors to reconsider the part of surgical deprogramming in the management of similar crisis in the future in order to limit the impact of such decisions on other diseases. Results show an  $11.4\%$  drop in surgical procedures throughout the year 2020, non-oncological surgeries being three times more affected by the pandemic than the oncological ones. These are the consequences of the management recommendations published by the different urological societies, in



**Figure 4** Consistency between the number of SARS-CoV-2 hospitalisations and the decrease in urological surgeries. (A) Map of France showing the number of ICU admissions per 100 000 inhabitants in each region. Pink: <70 ICU admissions/100 000 inhabitants. Orange: >70 ICU admissions/100 000 inhabitants. (B) Region-wide distribution (in percentage) of the impact of SARS-CoV-2 in urological surgeries. (C) Region-wide distribution (in percentage) of the impact of SARS-CoV-2 in nephrectomies for kidney cancer. (D) Region-wide distribution (in percentage) of the impact of SARS-CoV-2 in radical cystectomies for bladder cancer. (E) Region-wide distribution (in percentage) of the impact of SARS-CoV-2 in benign prostatic hyperplasia surgeries. (F) Region-wide distribution (in percentage) of the impact of SARS-CoV-2 in female urinary incontinence surgeries.

that surgeries and treatments should be categorised based on the level of priority, and only urgent, life-saving procedures and oncological surgeries that are associated with worse outcomes if delayed should be performed.<sup>6 7</sup> To prevent further neglect in a sustained pandemic scenario, alternative methods to replace surgical procedures, outpatient interventions and telemedicine were encouraged for non-urgent conditions.<sup>10</sup> In addition, the French Urology Association published new guidelines for the management of functional urology in the pandemic context.<sup>11 12</sup>

Previous studies reported higher rates of reduction in the number of oncological surgeries in hospitals located in Paris, Île-de-France, with a decrease of 31%, between 12 and 27 March 2020, and 49% during the first lockdown (16 March–30 April 2020).<sup>5 13</sup> Considered that Île-de-France was among the most affected regions in France by the SARS-CoV-2 epidemic,<sup>14</sup> these results may not be representative at a national level. The discrepancy between our data and these previous studies would suggest that, after the initial response to deal with the rapid spreading of the virus, activity in hospitals was restored to almost prepandemic levels after the first lockdown, or transferred to other hospitals (eg, private clinics), which helped to mitigate the initial impact in patients' care. Indeed, the current study also shows that the urological care in private clinics was two times less affected than that of the public centres. Despite the implementation of a protocol by the French Federation of Private Hospitalisation to support public hospitals during SARS-CoV-2 era,<sup>15</sup> only 20% of patients with SARS-CoV-2 were hospitalised in private establishments. Furthermore, to limit the massive deprogramming of operations, private services also took care of patients with other pathologies that, in normal circumstances, would have been cared for in public institutions.<sup>16</sup> However, certain delays are still ongoing, particularly for specific surgical procedures.<sup>17</sup>

Oncological surgeries should not be postponed, as minimal delays in patients' care are associated with an elevated risk of disease progression and may lead to fatal outcomes. Hence, we would like to highlight the great impact that the pandemic had on kidney (nephrectomy) and bladder (radical cystectomy) cancer treatments. Our results show that they were the most affected oncological surgeries with a reduction in patients' care of 9% and 6.1%, respectively. Both surgeries have been impacted because they often require intensive postoperative care<sup>10</sup> while ICUs were saturated with patients who developed severe SARS-CoV-2.<sup>18</sup> This is not the case for other oncological procedures, such as prostatectomy, for which most patients go home a few hours or days after surgery.

Of all urogenital cancers, bladder and kidney cancer have the most diverse variety of treatments, resulting in a substantial complexity to clinical decision making during the pandemic added to the high sensibility of these patients to SARS-CoV-2.<sup>19 20</sup> Hence, transurethral resection of bladder tumour is a diagnostic procedure that should not be delayed. Radical cystectomy should not be

delayed and, when possible, neoadjuvant chemotherapy should be considered, as it increases overall survival when waiting time for surgery is extended.<sup>21</sup> On the contrary for patients with intermediate risk or poor-risk prognosis of metastatic kidney cancer, surgical therapy can often be deferred in favour of effective systemic therapy, which does not require hospital admissions.<sup>20</sup> However, in any oncological disease, the diagnosis and timely treatment should not be compromised.<sup>19 22</sup>

Functional urology should also not be neglected since, as reported in a recent study, for 22% of patients whose surgery had been postponed at the first lockdown, the operation was not rescheduled 6 months later. This leads to an accumulated delay that increases hospitals' burden and it may also have a toll in patients' quality of life and health as well as psychological repercussions.<sup>23</sup> We also believe that uncertainty may have played an important role in patients' decision to be treated. Casalino *et al.*<sup>2</sup> showed that patients may have delayed emergency room visits even for conditions that might have required hospitalisation and/or emergency surgery. It has been reported that patients with minor complaints may have opted for self-treatment. Moreover, patients who needed to go to the emergency room may have chosen to avoid attending hospital for fear of being infected with the novel disease.<sup>24</sup> This is particularly the case for elderly patients.<sup>25</sup>

Female urinary incontinence and BPH are the two major conditions managed in urological practice. Both conditions are particularly common in older people and lead to a significant deterioration in patients' quality of life.<sup>26 27</sup> Our results show that they were the most affected procedures with a reduction in patients' care of 44.7% and 20.8%, respectively. Nevertheless, they are not considered a serious threat to health. This could explain that, in times of SARS-CoV-2, treatments for both disorders were minimised for the sake of other diseases such as cancer, as advised by the available recommendations for urological practice during the pandemic.<sup>6 7</sup>

It is noteworthy that consequences of the pandemic on female urinary incontinence surgery were double that of BPH (44.7% vs 20.8%, respectively). This discrepancy in surgery cancellation between male and female does not rely to any medical guideline. One possible explanation is that most of female urinary incontinence surgery is performed in day-case surgical units that were first to close and last to open in most of French hospitals during pandemic. On one hand, closing day-case surgical units may quickly provide operating room healthcare workers with minimal impact on major surgeries, but on the other hand, patients being operated in these units do not represent any additional load on hospital and ICU. As closing day-case surgical units may be achieved without delay, we would suggest to maintain these units as long as possible until healthcare workers are effectively needed in other departments or ICU.

Finally, a discrepancy between the distribution of SARS-CoV-2 across the country and its impact in urological services by region was observed. Most hospitalisations



due to SARS-CoV-2 happened in Eastern France (the three most impacted regions being Grand-Est, Haut de France and Ile de France with respectively 89 99 and 126 ICU admissions/100 000 inhabitants). However, we saw a completely different pattern regarding the consequences of the pandemic in the treatment of female urinary incontinence, BPH and even in the performance of oncological surgeries such as nephrectomy and radical cystectomy. A survey from the EAU reported that 80.2% of doctors followed the internal, modified protocols established by their own hospitals or department instead of the guidelines issued by international organisations.<sup>4</sup> Hence, we hypothesise that differences in the management of the pandemic among hospitals could explain the disparity between SARS-CoV-2 burden in hospitals and its impact on urologic services by region. Given this observation, we would recommend to better stratify the national guidelines for surgical activity reduction on the true local hospital and ICU loads. Elective surgical activity may be cancelled without any delay. As too much anticipation of pandemic hospital burden may lead to unnecessary delays for other conditions, surgical activity may be adapted on a more rational and daily basis. Multidisciplinary boards have to better take into account the negative impact of delaying surgeries on the prognosis of other diseases even for some benign conditions such as female incontinence or BPH that have very few impact on hospital and ICU loads.

Even if the exhaustivity of our database (including 10 years of surgical activity over the entire country) was a real strength, its main limitation was the descriptive analysis and the absence of any data on stage or prognosis of the diseases at the time of surgery. Hence, consequences of delaying medical care could not be assessed with this dataset. Nonetheless, this comprehensive database allowed us to provide real insights into the disruptions in urological care delivery during the first year after the onset of the SARS-CoV-2 outbreak having a full picture of the situation that may help developing a plan that allows the specialty services to recover from the pandemic in a reasonable time.

## CONCLUSIONS

This nationwide descriptive analysis of the healthcare system database showed that the volume of surgical procedures in the urology departments has drastically decreased during the SARS-CoV-2 pandemic in France. Even if clinicians prioritised oncological procedures, the impact was not neglectable on some major oncological surgeries that could affect overall survival. The decision to delay treatment of more benign conditions may have a toll in the quality of life of patients.

We also found that deprogrammed interventions were often not based on real regional needs.

A deep analysis of the long-term consequences of the current approach in a sanitary crisis scenario as well as a

critical study to improve reactivity and decision making in a similar situation in the future are crucial.

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