Prostate cancer diagnosis, staging, and treatment in Sweden during the first phase of the COVID-19 pandemic

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ABSTRACT

Introduction: The first case of COVID-19 in Sweden was diagnosed in late January 2020, the first recommendations against the spread of the virus were released in mid-March, and the peak of the first wave of the pandemic was reached in March-June. The aim of this cross-sectional study was to assess the short-term effects of the first wave of the COVID-19 pandemic on prostate cancer (PCa) diagnosis, staging, and treatment.

Materials and methods: Data in the National Prostate Cancer Register (NPCR) of Sweden on newly diagnosed PCa cases and on the number of diagnostic and therapeutic procedures performed between 18 March 2020 and 2 June 2020 were compared with those in the corresponding time periods in 2017–2019, as reported until January 31 of the year after each study period.

Results: During the study period in 2020, 36% fewer PCa cases were registered in NPCR compared with the corresponding time period in previous years: 1458 cases in 2020 vs a mean of 2285 cases in 2017–2019. The decrease in new PCa registrations was more pronounced in men above age 75 years, down 51%, than in men aged 70–75, down 37%, and in men below age 70, down 28%. There was no decrease in the number of radical prostatectomies and number of radical radiotherapy courses increased by 32%.

Conclusions: During the peak of the first phase of the COVID-19 pandemic, the number of men diagnosed with PCa in Sweden decreased by one third compared with previous years, whereas there was no decrease in the number of curative treatments.

Introduction

A number of recommendations aimed to reduce the transmission of COVID-19 was issued by the Swedish Public Health Agency in mid-March 2020 [1]. While these recommendations were less strict than in many other countries, they included advice on strict hand hygiene, social distancing, no gatherings of more than 500 people (subsequently reduced to 50 people), remote e-teaching in high school and universities, work from home whenever possible, discouraging international and domestic travel, no visits to nursing homes, and strong advice to stay at home in case of respiratory symptoms or fever. However, there were no regional or national formally imposed lockdowns, no mandated quarantine for COVID-19 positive individuals, and no recommendation of wearing facemasks [1]. Overall, almost 90% of Swedish citizen reported to have changed their habits due to the pandemic [2]. In January 2021, almost 12,000 COVID-19 related deaths had been registered in Sweden, according to the World Health Organization. In the neighbouring Scandinavian countries, each with a population of half that of Sweden, substantially fewer deaths were attributed to COVID-19 during the same time period: 2100 in Denmark, 500 in Norway, and 700 in Finland [3].

The Swedish health care system was strongly affected by the pandemic. Specific COVID-19 departments were created with staff from various disciplines, including urology, and the intensive care capacity in Sweden doubled from around 500 available beds before the pandemic to over 1,000 beds at the height of the first wave of the pandemic [1].

The European Association of Urology (EAU) issued recommendations for urological care during the pandemic. Work-up for men with moderately raised PSA values and treatment...
of men with low and intermediate-risk PCa was recommended to be postponed since these cancers are unlikely to cause harm in short-term [4–7].

In Sweden, the national PCa guideline group, as well as the regional guideline groups in the health care regions West and Stockholm, also issued recommendations that included to avoid PSA testing of asymptomatic men, to transfer outpatient clinics to remote consultations (e.g. phone calls or digital meetings), and to postpone non-urgent PCa treatment for men above 70 years and for men with pulmonary or cardiac comorbidities [8].

The impact of the pandemic and its downstream effects on cancer services on a national level is largely unknown. The aim of this cross-sectional study was to assess the short-term impact of the COVID-19 pandemic on prostate cancer (PCa) diagnosis, staging, and treatment.

Material and methods

The National Prostate Cancer Register (NPCR) of Sweden

NPCR captures 98% of all new PCa cases registered in the Swedish Cancer Registry to which reporting is mandated by law [9–11]. About half of new PCa cases are registered in NPCR within 3 months after the date of diagnosis, 80% within 6 months, and 95% within 9 months (Supplementary Figure 1) [12].

Study population and design

In this cross-sectional study, we compared the number of PCa cases registered in NPCR with date of diagnosis from 18 March 2020, when the first recommendations were issued, to 2 June 2020, when the number of deaths from COVID-19 decreased steeply, with the mean of the corresponding number of cases diagnosed in the same time periods in 2017–2019 and reported before January 31 of the year after each study period. We also compared the number of diagnostic and therapeutic procedures during the same time periods. Aggregated data on the number of COVID-19 cases and COVID-19 deaths were retrieved from The Swedish Public Health Authority (Folkhälsomyndigheten) website [13]. Analyses were performed in December 2020.

Results

Number of new prostate cancer cases

During the period with the highest COVID-19 mortality between 18 March and 2 June 2020, 36% fewer men were diagnosed with PCa compared with the corresponding time period in the previous three years, 1458 vs mean 2285 cases (Table 1).

Table 1. Number of prostate cancer cases registered in The National Prostate Cancer Register (NPCR) of Sweden from March 18th to June 2nd in 2017–2020, reported until January 31st of the year after each study period.

| Health care region | 2017 | 2018 | 2019 | Mean 2017–2019 | 2020 | Difference 2020 vs 2017–2019 |
|-------------------|------|------|------|---------------|------|-----------------------------|
| Stockholm-Gotland | 333  | 424  | 486  | 414           | 321  | -93 (23%)                   |
| Uppsala-Orebro    | 521  | 615  | 522  | 553           | 337  | -216 (39%)                  |
| South             | 293  | 311  | 235  | 280           | 187  | -93 (33%)                   |
| West              | 369  | 322  | 382  | 358           | 237  | -121 (34%)                  |
| North             | 466  | 456  | 440  | 454           | 236  | -218 (48%)                  |
| Radical prostatectomy | 247  | 244  | 189  | 227           | 140  | -87 (38%)                   |
| Radical radiotherapy | 1651 | 1626 | 1590 | 1622          | 1574 | -48 (3%)                    |
| Bone imaging      | 1985 | 2099 | 1852 | 1979          | 1570 | -409 (21%)                  |
| Androgen deprivation therapy | 993  | 988  | 856  | 946           | 709  | -237 (25%)                  |

PCa risk categories were defined as low/intermediate-risk = clinical local stage T1-2, Gleason score ≤7 and/or PSA ≤20 ng/ml; high-risk/metastatic = clinical T-stage ≥T3 and/or Gleason score 8–10 and/or PSA >20 ng/ml and/or N1 and/or M1. We assessed the number of bone imaging procedures, including bone scintigraphy, CT, MRI, PET-CT, and plain X ray, as well as the number of radical prostatectomies (RP), radical radiotherapy courses (RRT), and the use of androgen deprivation therapy (ADT) as primary treatment for PCa, including GnRH agonists and antagonists, bicalutamide and bilateral orchiectomy, as registered in NPCR. The study was approved by the Swedish Research Ethics Authority.

Variables

PCa risk categories were defined as low/intermediate-risk = clinical local stage T1-2, Gleason score ≤7 and/or PSA ≤20 ng/ml; high-risk/metastatic = clinical T-stage ≥T3 and/or Gleason score 8–10 and/or PSA >20 ng/ml and/or N1 and/or M1. We assessed the number of bone imaging procedures, including bone scintigraphy, CT, MRI, PET-CT, and plain X ray, as well as the number of radical prostatectomies (RP), radical radiotherapy courses (RRT), and the use of androgen deprivation therapy (ADT) as primary treatment for PCa, including GnRH agonists and antagonists, bicalutamide and bilateral orchiectomy, as registered in NPCR. The study was approved by the Swedish Research Ethics Authority.

Bone imaging includes all imaging used to search for metastasis, i.e. bone scan, CT scan and PET scan and plain X ray.

Androgen deprivation therapy includes GnRH agonists and antagonists, bicalutamide and bilateral orchiectomy as registered in NPCR.
While the number of confirmed COVID-19 cases increased steadily from March and onwards, mortality attributed to COVID-19 decreased after a peak in mid-April (Supplementary Table 1).

**Number of new prostate cancer cases by health care region**

The number of COVID-19 cases and the number of deaths from COVID-19 were highest in the Stockholm-Gotland health care region, whereas the decrease in the number of PCa cases was more pronounced in the healthcare region West, down 48%, and in the Uppsala-Örebro health care region, down 39%, compared with a 23% decrease in Stockholm (Figure 2, Supplementary Table 2).

**Number of new prostate cancer cases by age and risk category**

The numbers of new low/intermediate-risk and high-risk/metastatic PCa were both lower in 2020 than 2017–2019 (Figure 3, Supplementary Table 3). The number of men diagnosed with low/intermediate-risk PCa decreased by 40%, 846 in 2020 vs a mean of 1415 in 2017–2019. The number of men diagnosed with high-risk/metastatic PCa decreased by 36%, 519 in 2020 vs a mean of 805 in 2017–2019. No difference was found in the proportion of men with PSA over 100 ng/ml at diagnosis (data not shown). The decrease was more pronounced for men above age 75 than for men below 75 years. There was a 51% decrease of new PCa cases among men above 75 years, 281 in 2020 vs a mean of 572 in 2017–2019, a decrease of 37% among men aged 70–75, 368 in 2020 vs a mean of 588, in 2017–2019 and a decrease of 28% among men under 70 years, 809 in 2020 vs a mean of 1125 in 2017–2019.

**Patterns of prostate cancer management: staging and treatment**

During the study period the number of radical prostatectomies remained essentially unchanged, 1574 RPs in 2020 vs a mean of 1622 RPs in 2017–2019 (Figure 4, Supplementary Table 4), but there was 32% increase in number of radical radiotherapy courses during the study period: 1547 RRTs in 2020 compared with a mean of 1176 in 2017–2019. The proportions of men with low/intermediate or high-risk/metastatic PCa who underwent RP or RRT remained unchanged, as was their age distribution (Supplementary Figure 2(a,b), Supplementary Table 5). Use of ADT as primary treatment for PCa was 25% lower in 2020 than in previous years: 709 vs 946 men in 2017–2019.
Figure 2. Number of cases of prostate cancer registered in the National Prostate Cancer Register (NPCR) of Sweden per week from 1 January to 30 June 2020, compared with the mean number in the same calendar period in 2017–2019, as reported until January 31 of the year after each study period. Data on number of COVID-19 cases and deaths from COVID-19 are taken from the Public Health Agency of Sweden (https://www.folkhalsomyndigheten.se). Aggregated COVID-19 data for the entire population were only available at health care region level. Part of region Halland belongs to health care region West and part belongs to health care region South, therefore data for Halland was included in both regions.
Figure 3. Number of prostate cancer cases registered in the National Prostate Cancer Register per week according to prostate cancer risk category and age at diagnosis, from 1 January to 30 June 2020, compared with the mean number in 2017–2019, as reported until January 31 of the year after each study period. Prostate cancer risk categories: low/intermediate-risk: clinical local stage T1-2, Gleason score 2–7 and/or PSA 10 to <20 ng/ml; high-risk/metastatic: clinical T-stage ≥pT3 and/or Gleason score 8–10 and/or PSA >20 ng/ml and/or N1 and/or M1.
Fewer men underwent bone imaging in 2020 than in 2017–2019: 1570 vs 1979, a 21% reduction (Figure 4). The proportion of men with high-risk PCa below age 80 who underwent bone imaging remained high: 78% in 2020 compared with 84% in 2017–2019 (Figure 5, Supplementary Table 6).

Discussion

In this population-based study, we found a 36% decrease in the number of men diagnosed with PCa in Sweden during the first wave of the COVID-19 pandemic. There was a slight decrease in the use of bone imaging and androgen deprivation therapy, whereas the number of radical prostatectomies remained unchanged and the number of radical radiotherapy courses increased.

The strengths of our study include the use of comprehensive data with cancer characteristics, diagnostic procedures, and primary treatment from a national clinical cancer register with a virtually complete capture nine months after the date of diagnosis. Nevertheless, it cannot be ruled out that the registration in the National Prostate Cancer Register of Sweden at some units was delayed during the pandemic, e.g. due to shortage of staff for entering data. However, by including cases registered through January of the year after the study period we optimized capture. The fact that the number of radical prostatectomies and radical radiotherapy courses were similar or higher than in previous years indicates that data were timely entered into the NPCR during the study period.

Our analysis cannot discern to what extent the decreased PCa incidence was caused by a reallocation of healthcare resources from that men refrained from PSA testing or seeking medical care for symptoms caused by PCa. The latter explanation is favored by that the number of referrals for a suspicion of PCa dropped during the pandemic, according to the separate registration of referrals for a suspicion of cancer (Swedish: standardiserat vårdförlopp, SVF) [14].

Figure 4. Number of radical prostatectomies, radical radiotherapy courses, bone imagining and start of androgen deprivation therapy as primary treatment per week registered in the National Prostate Cancer Register from 1 January to 30 June 2020, compared with the mean number in 2017–2019, as reported until January 31 of the year after each study period. Androgen deprivation therapy includes GnRH agonist or antagonist, bicalutamide and bilateral orchiectomy as reported in NPCR.
Conclusions

In Sweden, a country with a high incidence of COVID-19 and with substantial reallocations of health care resources, the number of new PCa cases decreased by a third during the peak of the first wave of the pandemic, compared with the same time period in previous years. In contrast, the number of radical prostatectomy remained unchanged whereas the number of radical radiotherapies courses increased. Rapid registration in a clinical cancer register is essential for surveillance of major disruptions of cancer services, such as the one caused by a pandemic.

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Data availability statement

Data on an aggregated level can be made available on a remote server upon request to the corresponding author.

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