

## ORIGINAL ARTICLE

# Assessing the impact of socio-economic determinants on access to care, surgical treatment options and outcomes among patients with renal mass: Insight from the universal healthcare system

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**Abstract**

**Objective:** To assess whether socio-economic disparities exist on access to care, treatment options and outcomes among patients with renal mass amenable of surgical treatment within the universal healthcare system.

**Methods:** Data of consecutive patients submitted to partial nephrectomy (PN) or radical nephrectomy (RN) at our Institution between 2017 and 2020 were retrospectively evaluated. Patients were grouped according to their income level (low, intermediate, and high) based on the Indicator of Equivalent Economic Situation national criterion. Survival analysis was performed. Cox regression models were employed to analyse the impact of socio-economic variables on survival outcomes.

**Results:** One thousand forty-two patients were included (841 PN and 201 RN). Patients at the lowest income level were found more likely symptomatic and with a higher pathological tumour stage in the RN cohort ( $p > 0.05$ ). The guidelines adherence on surgical indication rate as well as the access to minimally invasive surgery did not differ according to patient's income level in both cohorts ( $p > 0.05$ ). Survival curves were comparable among the groups. Cox regression analysis showed that none of the included socio-economic variables was associated with survival outcomes in our series.

**Conclusions:** Universal healthcare system may increase the possibility to ensure egalitarian treatment modalities for patients with renal cancer.

**KEYWORDS**

cancer, minimally invasive surgery, partial nephrectomy, radical nephrectomy socio-economic disparities, universal healthcare

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## 1 | INTRODUCTION

Treatment disparities among patients with cancer owing to sociodemographic inequalities (as measured by race, gender, education, poverty and income level) represent a major public health concern in the early 21st century (Mackenbach et al., 2008). This issue has been recently investigated in those countries in which the health services are reimbursed by private insurances (Trinh et al., 2012; Wu et al., 2012). The American Cancer Society reported that, although the overall cancer mortality rate declined by 27% from 1991 to 2016, socio-economic disparities in this setting have widened with the most striking disparities observed in malignancies most amenable of prevention and early control (Alcaraz et al., 2020). Renal cell carcinoma (RCC) represents an oncological entity whose treatment options are various and rely mainly on tumour's features and diameter. Current International Guidelines strongly recommend partial nephrectomy (PN) in case of renal masses <7 cm (cT1), while radical nephrectomy (RN) still represents the gold-standard treatment for larger tumours (Ljungberg et al., 2020) although a growing body of evidence has recently advocated the use of nephron sparing surgery (NSS) also in selected cT2 tumours, to maximise renal function preservation while maintaining similar oncological outcomes (Bradshaw et al., 2020; Mir et al., 2017). Additionally, guidelines do not specifically recommend a particular surgical approach when renal surgery is performed, despite several studies have shown superior outcomes after robot-assisted PN (RAPN) compared with open and laparoscopic PN, in terms of decreased warm ischaemia time (WIT), complication rate, length of stay (LOS) and overall Trifecta achievement (Bertolo et al., 2018; Bravi et al., 2019; Minervini et al., 2020). Similarly, minimally invasive RN has shown better results compared with open surgery regarding LOS, complication rate and patient's quality of life (QoL) (Althaus et al., 2020; Crocerossa et al., 2021).

In this scenario, it has been suggested that RCC management in daily clinical practice may be influenced by external circumstances other than tumour's features, including patient socio-economic status (Chung et al., 2015; Maurice et al., 2015). In particular, among several investigations, a weak adherence rate to surgical indication (namely, PN for cT1 renal mass) and a potential underutilization of minimally invasive surgery (MIS) have emerged within racial and ethnic minorities, particularly in the setting of private healthcare (Colli et al., 2012; Small et al., 2013; Xia et al., 2019). In this regard, some questions remain unanswered. In particular, the ultimate impact of social determinants on treatment options and outcomes in those countries relying on universal healthcare system has never been assessed.

To address this unmet need, in the present study, we aimed to evaluate access to care and different treatment options among patients presenting with renal masses in our university referral institution, to appraise any possible correlation between surgical management, perioperative outcomes, and patient socio-economic status.

## 2 | METHODS

### 2.1 | Patients and dataset

After the obtainment of institutional review board approval, we retrospectively reviewed the clinical and surgical data of all consecutive patients with diagnosis of renal mass treated with surgical curative intent from January 2017 to March 2020. Only patients with complete preoperative, perioperative and follow-up data were included in the final analysis. Socio-economic features were recorded including gender, nationality, educational and income level. In particular, educational level was clustered based on the highest reached school degree (primary, secondary, high or technical school and academic degree). Patients were then grouped according to their income level (Low: <25,000 euros [group A]; Intermediate: 25,000–50,000 euros [group B]; High: >50,000 euros [group C]) based on the ISEE (Indicator of Equivalent Economic Situation) national criterion that objectively evaluate the family economic situation (<https://www.lavoro.gov.it/strumenti-e-servizi/ISEE/Pagine>, n.d.; Ficarra et al., 2009). All surgical options (namely, open, laparoscopic and robotic surgery) were available at our institution for the treatment of renal masses. Preoperative workup included abdomen and chest contrast enhanced multiphasic computed tomography (CT) or magnetic resonance imaging (MRI) for staging purposes (Ljungberg et al., 2020). Metastatic patients were excluded from the final analysis. Preoperative patient's characteristics were recorded. In particular, symptomatic pattern presentation included the presence of any, localised or systemic, clinical symptoms at the moment of diagnosis. All tumours were scored according to the Preoperative Aspects and Dimensions Used for an Anatomical (PADUA) nephrometric classification of renal masses (<https://www.lavoro.gov.it/strumenti-e-servizi/ISEE/Pagine>, n.d.; Ficarra et al., 2009). Perioperative and postoperative data were thoroughly gathered, including ischaemia strategy (on-clamp vs off-clamp), operative time, WIT and complication rate. Complications were graded according to Clavien-Dindo (CD) classification (Dindo et al., 2004). Tumour stage was classified according to the 2010 TNM criteria (Edge et al., 2009) and nucleolar grading according to the most recent International Society of Urological Pathology (ISUP) grading recommendation (Delahunt et al., 2013).

### 2.2 | Follow-up

Follow-up strategy was tailored according to an individualised, risk-based approach to RCC surveillance, as proposed by the European Guidelines (Ljungberg et al., 2020). Whenever patients were unable to reach our clinic, follow up data were recorded by phone-call or video-based telemedicine tools (Amparore et al., 2020; Campi et al., 2021; Ribal et al., 2020). Renal function was measured as creatinine level and estimated glomerular filtration rate (eGFR) at baseline, first postoperative day and then at scheduled follow-up visits. Chronic kidney disease (CKD) stage was assessed according to the Kidney Disease

Improvement Global Outcomes - KDIGO criteria (Levey et al., 2005). According to European recommendations of RCC management, guidelines adherence was defined as PN for cT1 and RN for  $\geq$ cT2 renal masses.

## 2.3 | Outcomes

The following outcomes were investigated in the present study: (1) whether significant differences in surgical indication (namely, PN or RN) and approach (namely, open, laparoscopic and robotic) exist among patients according to their economic status (i.e. income level). Particularly, robotic and laparoscopic approach were considered together as MIS for RN procedures; (2) whether perioperative outcomes including functional results, as well as perioperative morbidity, diverged in the three patient categories; (3) whether overall survival (OS), cancer-specific survival (CSS) and recurrence-free survival (RFS) were different among patients stratified for their income level. Disease recurrence was defined as any, localised or systemic, recurrence demonstrated by imaging and confirmed at a histopathological examination through a biopsy or surgical removal of the recurrence, according to the pattern of disease.

## 2.4 | Statistical analysis

Independent variables included all patient- and tumour-related data available in our institutional database. First, descriptive statistics were obtained reporting medians (and interquartile ranges, IQR) for continuous variables and frequencies and proportions for categorical variables, as appropriate. Continuous variables were compared using the Student's *t* test or the Mann-Whitney *U* test depending on their normal or not-normal distribution, respectively. Categorical variables were tested with the Pearson's chi-square test. The probability of survival was assessed by the Kaplan-Meier method, with the log-rank test (Mantel-Cox) used to estimate differences among levels of the analysed variables. Univariate and multivariate Cox regression models were used to analyse the impact of socio-economic variables on survival outcomes. For this purpose, educational level was re-categorised into three subgroups where intermediate educational level included secondary and high/technical school. Statistical analyses were performed using SPSS v. 26 (IBM SPSS Statistics for Mac, Armonk, NY, IBM Corp).

All tests were two-sided with a significance set at  $p < 0.05$ .

## 3 | RESULTS

Overall, 1142 patients with renal mass submitted to surgical treatment with curative intent were evaluated. After excluding those cases with incomplete data, 1042 patients were included and analysed. Among these, 841 were PN and 201 RN cases. Both cohorts were

divided into low-income (Group A - 526, 62.5% in PN and 141, 70.1% in RN cohort), intermediate-income (Group B - 205, 24.3% in PN and 37, 18.4% in RN cohort) and high-income (Group C - 110, 13.2% in PN and 23, 11.5% in RN cohort) group (Tables 1 and 2). Low-income patients were found significantly older, with a higher comorbidity burden and showed a lower educational level (all  $ps = 0.001$ ) in both PN and RN cohort, as compared with the remnant groups. With respect to disease clinical presentation, we did not find meaningful differences within the PN cohort. Conversely in the RN population, Group A patients showed to be more likely symptomatic at the diagnosis (16.4%) as compared with their counterparts (10.9% and 4.4% in Groups B and C, respectively) ( $p = 0.02$ ). Moreover, the median clinical tumour diameter at the diagnosis was also statistically higher (7.6 [IQR 5.6-9.0] in Group A vs. 6.3 [IQR 4.5-7.5] and 6.4 [IQR 5.0-7.8] in Groups B and C, respectively). The adherence to surgical indication was high in both cohorts and did not vary according to patients' income level (92.5%, 93.6%, 94.5% in PN cohort and 89.3%, 91.8%, 95.6% in RN for the three groups, respectively [ $p > 0.05$ ]) Time from tumour detection to surgical treatment was similar across the entire cohort.

Perioperative and postoperative surgical outcomes were similar in the three groups of PN cohort, including robotic approach rate, pedicle clamping strategy, median WIT and operative time and complication rate ( $p > 0.05$ ). Moreover, pathological tumour diameter, tumour stage and positive surgical margins rate did not differ according to the income-level in the PN cohort (Table 1).

Within RN patients, perioperative outcomes were also comparable among the three groups with respect to access to MIS (49.3%, 43.2% and 56.6% in Groups A, B and C, respectively), surgical operative time and intraoperative and postoperative complication rate (all  $ps > 0.05$ ). Final histopathological examination revealed a higher pathological stage in patients submitted to RN at lower-income level with a higher percentage of  $\geq$ pT3 tumours (44.1% in Group A), as compared with the counterparts (29.6% and 26.2% in Groups B and C;  $p = 0.03$ ).

## 3.1 | Survival analysis

At the median follow-up of 29 (IQR 18-35) months, OS was 93.1%, 93.4% and 93.3% in low-, intermediate-, and high-income level, respectively ( $p = 0.91$ ), while disease recurrence was recorded in 20 (3.8%), 11 (5.4%) and 5 (4.5%) patients in the PN cohort ( $p = 0.63$ ).

In RN cohort, OS attested at 92.0%, 97.2% and 95.6% in Groups A, B and C, respectively ( $p = 0.37$ ) while cancer-related death was recorded in 1.5%, 0% and 0% in the three groups ( $p = 0.86$ ), at a median follow-up of 26 (IQR 18-36) months (Figure 1).

Univariable (data not shown) and multivariate Cox regression analysis performed separately for RN and PN cases showed that none of the included socio-economic variables (namely, sex, nationality, educational and income level) was independently associated with survival outcomes in both partial and radical nephrectomy cohorts (Tables 3a and 3b).

**TABLE 1** Baseline, perioperative and postoperative outcomes of patients submitted to partial nephrectomy at our institution, stratified according to income level ( $n = 841$ )

Variables		Group A ( $n = 526, 62.5\%$ )	Group B ( $n = 205, 24.3\%$ )	Group C ( $n = 110, 13.2\%$ )	p value
<b>Preoperative features</b>					
Gender, $n$ (%)	Male	323 (61.4)	159 (77.6)	85 (77.3)	0.09
	Female	203 (38.6)	46 (22.4)	25 (22.7)	
Age (years), median (IQR)		66 (59–76)	61 (52–68)	62 (54–68)	<b>0.001</b>
BMI ( $\text{kg}/\text{m}^2$ ), median (IQR)		25 (23–29)	26 (23–26)	25 (24–27)	0.20
ASA score, median (IQR)		2 (2–2)	2 (2–2)	2 (2–2)	0.09
CCI PS score, median (IQR)		4 (3–5)	3 (2–5)	3 (2–4)	<b>0.001</b>
Nationality, $n$ (%)	Local	506 (96.2)	203 (99.0)	108 (98.2)	0.9
	Others	20 (3.8)	2 (1.0)	2 (1.8)	
Educational level, $n$ (%)	Primary school	138 (26.9)	1 (0.5)	3 (2.9)	<b>0.001</b>
	Secondary school	215 (41.9)	25 (12.3)	17 (16.3)	
	High/technical school	150 (29.2)	118 (57.8)	28 (26.9)	
	Academic degree	10 (1.9)	60 (29.4)	56 (53.8)	
Pattern of presentation, $n$ (%)	Incidental	498 (94.6)	197 (96.0)	102 (92.7)	0.32
	Symptomatic	28 (5.4)	8 (4.0)	8 (7.3)	
PADUA risk category, $n$ (%)	Low (6–7)	288 (57.9)	97 (49.7)	52 (50.0)	0.19
	Intermediate (8–9)	150 (30.2)	75 (38.5)	40 (38.5)	
	High ( $\geq 10$ )	50 (11.9)	23 (11.8)	12 (11.5)	
Clinical T stage, $n$ (%)	T1a	366 (68.8)	131 (64.2)	73 (67.0)	0.49
	T1b	124 (23.7)	60 (29.4)	30 (27.5)	
	T2	36 (6.5)	13 (6.4)	6 (5.5)	
	T3a	0 (0)	0 (0)	0 (0)	
	T3b	0 (0)	0 (0)	0 (0)	
Clinical N+ stage, $n$ (%)		0 (0)	0 (0)	0 (0)	-
Clinical tumour diameter (mm), median (IQR)		4 (3–5)	4 (3–5)	4 (2–5)	0.37
Time from detection to treatment (days), median (IQR)		48 (31–56)	46 (31–57)	46 (31–58)	0.11
Haemoglobin blood level (g/dl), median (IQR)		14 (13–15)	14 (13–15)	14 (13–15)	0.76
Creatinine serum level (mg/dl), median (IQR)		0.9 (0.8–1.2)	0.9 (0.8–1.1)	1.0 (0.8–1.1)	0.08
eGFR (ml/min), median (IQR)		81.1 (64.3–91.7)	79.5 (72.1–91.9)	84.1 (72.3–92.7)	0.69
Preoperative CKD stage, $n$ (%)	Stage I	163 (30.9)	53 (25.8)	36 (32.7)	0.65
	Stage II	312 (59.3)	134 (65.3)	67 (60.9)	
	Stage III	49 (9.3)	17 (8.2)	6 (5.4)	
	Stage IV	2 (0.5)	1 (0.7)	1 (1.0)	
<b>Perioperative outcomes</b>					
Surgical indication, $n$ (%)	Elective	479 (91.0)	183 (89.2)	103 (93.6)	0.77
	Imperative	47 (8.9)	22 (10.8)	7 (6.4)	
Guideline adherence, $n$ (%)		490 (92.5)	191 (93.6)	103 (94.5)	0.24
Surgical approach, $n$ (%)	Robotic	524 (99.6)	204 (99.5)	108 (98.2)	0.23
	Laparoscopic	0 (0.0)	1 (0.5)	1 (0.9)	
	Open	2 (0.4)	0 (0.0)	1 (0.9)	
Surgical access, $n$ (%)	Transperitoneal	500 (95.2)	198 (96.6)	103 (93.6)	0.48
	Retroperitoneal	26 (4.8)	7 (3.4)	4 (3.6)	
Pedicle clamping, $n$ (%)	On-clamp	426 (81.1)	166 (80.9)	88 (80.3)	0.20
	Off-clamp	100 (18.9)	39 (19.1)	22 (19.7)	

TABLE 1 (Continued)

Variables		Group A (n = 526, 62.5%)	Group B (n = 205, 24.3%)	Group C (n = 110, 13.2%)	p value
Overall OT (min), median (IQR)		136 (105–173)	140 (116–170)	140 (105–180)	0.64
Ischaemia time (min), median (IQR)		15 (12–20)	15 (11–20)	15 (12–20)	0.51
Estimated blood loss (ml), median (IQR)		100 (95–130)	100 (100–120)	100 (90–125)	0.23
Intraoperative complication, n (%)		15 (2.8)	5 (2.4)	3 (2.7)	0.37
<b>Postoperative outcomes</b>					
1st POD haemoglobin blood level (g/dl), median (IQR)		13 (11–14)	13 (11–13)	13 (12–14)	0.76
1st POD creatinine serum level (mg/dl), median (IQR)		1.3 (1.0–1.4)	1.2 (1.0–1.3)	1.2 (1.0–1.3)	0.25
1st POD eGFR (ml/min), median (IQR)		68 (56–83)	69 (65–74)	140 (105–180)	0.64
Hospitalisation time (days), median (IQR)		5 (4–6)	4 (4–5)	5 (4–3)	0.11
30-days postoperative complication, n (%)	Overall	159 (30.3)	55 (26.8)	25 (22.6)	0.74
	CD 1	94 (17.8)	29 (14.1)	15 (13.6)	
	CD 2	43 (8.1)	18 (8.7)	6 (5.4)	
	CD 3a	6 (1.1)	2 (1.0)	1 (0.9)	
	CD 3b	12 (2.3)	6 (2.9)	3 (2.7)	
Pathological tumour diameter (mm), median (IQR)		3 (2–4)	3 (2–4)	3 (2–5)	0.20
Malignant tumour, n (%)		415 (79)	147 (71.9)	81 (73.6)	0.08
Pathological T stage, n (%)	T1a	360 (68.5)	129 (63.2)	82 (75.0)	0.09
	T1b	99 (18.9)	51 (25.2)	21 (19.0)	
	T2	11 (2.1)	9 (4.5)	0 (0.0)	
	T3a	46 (10.5)	16 (7.1)	7 (6.0)	
Positive surgical margin among malignant tumours, n (%)		22 (5.3)	8 (5.4)	5 (6.1)	0.39
Follow-up (months), median (IQR)		29 (19–36)	27 (17–35)	29 (18–36)	0.06
Last follow-up creatinine serum level (mg/dl), median (IQR)		1.1 (1.0–1.3)	1.1 (1.0–1.2)	1.2 (0.9–1.3)	0.32
Last follow-up eGFR (ml/min), median (IQR)		65.3 (58.6–81.1)	69.5 (59.9–84.1)	68.7 (60.0–83.4)	0.11
Overall survival at median follow-up, n (%)		479 (93.1)	191 (93.4)	103 (93.3)	0.91
Disease recurrence at median follow-up, n (%)		20 (3.8)	11 (5.4)	5 (4.5)	0.63

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; CCI PS, Charlson comorbidity index performance status; CD, Clavien-Dindo; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; IQR, interquartile range; OT, operative time; POD, postoperative day.

## 4 | DISCUSSION

In this retrospective cohort study, based on a large single-Institutional dataset, we evaluated patients undergoing renal surgery with curative intent for localised and locally-advanced renal masses. The aim of the study was to evaluate whether socio-economic disparities exist in the treatment pathways of renal tumour in the setting of universal healthcare.

Our analysis demonstrated that there was a strong guidelines adherence on surgical indication in case of suspected kidney cancer in both patients treated with PN and RN. In particular, 92.5%, 93.6% and 94.5% of patients submitted to PN were diagnosed with cT1 renal mass in Groups A, B and C, respectively ( $p = 0.24$ ) and 89.3%, 91.8% and 95.6% among the three groups of patients treated with a radical intent had a  $\geq$ cT2 renal mass ( $p = 0.19$ ). This meant that the choice for the optimal surgical strategy was not driven by other external factors than tumour's features and patient's health status.

One key point of our study is that patient economic status emerged as possible driver of RCC clinical presentation. Indeed, in the RN cohort the clinical tumour diameter at the diagnosis was statistically higher and the pattern of presentation significantly more likely symptomatic in low-income patients, as compared with their counterparts ( $p = 0.03$ ). Additionally, in this cohort, the final histopathologic examination revealed a higher proportion of locally-advanced tumour stage in the low-income group ( $p = 0.03$ ) (Table 2).

These findings are supported by past investigations. Indeed, several studies highlighted that social determinants may influence timing of cancer diagnosis including RCC. In particular, patient with poorer socio-economic status may experience delay in tumour diagnosis mainly due to a difficult access to referral institutions, as well as a global attitude of underestimating clinical sign and symptoms (Ellis et al., 2018; Schwartz et al., 2016). Nonetheless, in our series, these differences did translate into variables access to care and treatment options offered. In fact, time from tumour detection to surgical

**TABLE 2** Baseline, perioperative and postoperative outcomes of patients submitted to radical nephrectomy at our institution, stratified according to income level ( $n = 201$ )

Variables		Group A ( $n = 141-70.1\%$ )	Group B ( $n = 37-18.4\%$ )	Group C ( $n = 23-11.5\%$ )	<i>p</i> value
<b>Preoperative features</b>					
Gender, <i>n</i> (%)	Male	74 (52.4)	13 (35.1)	7 (30.4)	0.06
	Female	67 (47.6)	24 (64.9)	16 (69.6)	
Age (years), median (IQR)		70 (59–76)	64 (52–68)	62 (54–68)	<b>0.001</b>
BMI ( $\text{kg}/\text{m}^2$ ), median (IQR)		25 (23–29)	26 (23–26)	25 (24–27)	0.20
ASA score, median (IQR)		2 (2–3)	2 (2–2)	2 (2–2)	0.09
CCI PS score, median (IQR)		4 (3–5)	3 (2–5)	3 (2–4)	<b>0.001</b>
Nationality, <i>n</i> (%)	Local	111 (78.7)	29 (78.3)	17 (73.9)	0.19
	Others	30 (21.3)	8 (21.7)	6 (26.1)	
Educational level, <i>n</i> (%)	Primary school	38 (26.9)	5 (13.5)	0 (0)	<b>0.001</b>
	Secondary school	55 (39.0)	2 (5.4)	5 (21.8)	
	High/technical school	52 (36.8)	12 (32.4)	9 (39.1)	
	Academic degree	9 (6.3)	19 (51.2)	9 (39.1)	
Pattern of presentation, <i>n</i> (%)	Incidental	118 (83.6)	33 (89.1)	22 (95.6)	<b>0.02</b>
	Symptomatic	21 (16.4)	4 (10.9)	1 (4.4)	
PADUA risk category, <i>n</i> (%)	LOW (6–7)	16 (11.3)	5 (13.5)	3 (13.0)	0.33
	INTERMEDIATE (8–9)	44 (31.2)	15 (40.5)	8 (34.7)	
	HIGH ( $\geq 10$ )	81 (57.5)	17 (46.0)	12 (52.3)	
Clinical T stage, <i>n</i> (%)	T1a	1 (0.9)	0 (0.0)	0 (0)	0.07
	T1b	14 (9.9)	3 (8.1)	1 (4.3)	
	T2	44 (31.2)	19 (51.3)	8 (34.7)	
	T3a	62 (43.9)	11 (29.7)	11 (47.8)	
	T3b	20 (14.1)	4 (10.9)	3 (13.2)	
Clinical N+ stage, <i>n</i> (%)		20 (14.1)	9 (24.3)	5 (21.7)	0.13
Clinical tumour diameter (mm), median (IQR)		7.6 (5.6–9.0)	6.3 (4.5–7.5)	6.4 (5.0–7.8)	<b>0.02</b>
Time from detection to treatment (days), median (IQR)		38 (21–42)	36 (21–42)	36 (21–42)	0.38
Haemoglobin blood level (g/dl), median (IQR)		14 (12–15)	14 (13–15)	14 (16–15)	0.56
Creatinine serum level (mg/dl), median (IQR)		1.1 (0.8–1.2)	0.9 (0.8–1.1)	1.0 (0.8–1.1)	0.18
eGFR (ml/min), median (IQR)		81.4 (64.3–92.7)	79.6 (72.1–90.9)	84.1 (71.3–92.2)	0.69
Preoperative CKD stage, <i>n</i> (%)	Stage I	45 (31.9)	11 (29.7)	6 (26.0)	0.56
	Stage II	68 (48.2)	18 (48.6)	11 (48.0)	
	Stage III	26 (18.4)	7 (18.9)	6 (26.0)	
	Stage IV	2 (1.5)	1 (2.8)	0 (0.0)	
<b>Perioperative outcomes</b>					
Guideline adherence, <i>n</i> (%)		126 (89.3)	34 (91.8)	22 (95.6)	0.19
Surgical approach, <i>n</i> (%)	Open	71 (50.7)	21 (56.8)	10 (43.4)	0.43
	MIS	70 (49.3)	16 (43.2)	13 (56.6)	
Surgical access, <i>n</i> (%)	Transperitoneal	120 (85.1)	33 (89.1)	20 (86.9)	0.21
	Retroperitoneal	21 (14.9)	4 (10.9)	3 (13.1)	
Overall OT (min), median (IQR)		165 (150–190)	135 (110–193)	140 (110–170)	0.96
Estimated blood loss (ml), median IQR		200 (150–250)	200 (120–200)	180 (180–180)	0.34
Intraoperative complication, <i>n</i> (%)		9 (6.3)	3 (8.1)	1 (4.3)	0.29

TABLE 2 (Continued)

Variables	Group A (n = 141–70.1%)	Group B (n = 37–18.4%)	Group C (n = 23–11.5%)	p value	
<b>Postoperative outcomes</b>					
1st POD haemoglobin blood level (g/dl), median (IQR)	11.6 (10.5–13)	12.5 (11.9–12.9)	12 (11.1–12.7)	0.09	
1st POD creatinine serum level (mg/dl), median (IQR)	1.3 (1.1–1.6)	1.3 (1.1–1.6)	1.3 (1.2–1.7)	0.11	
1st POD eGFR (ml/min), median (IQR)	52 (40–60)	56.4 (45–67)	51 (46–63)	0.07	
Hospitalisation time (days), median (IQR)	5 (4–6)	4 (4–5)	4 (4–6)	0.08	
30-days postoperative complication, n (%)	Overall			0.30	
	CD 1	8 (21.6)	5 (21.7)		
	CD 2	14 (9.9)	1 (4.3)		
	CD 3a	16 (11.3)	4 (17.3)		
	CD 3b	1 (0.7)	0 (0.0)		
		2 (1.4)	0 (0.0)		
Pathological tumour diameter (mm), median (IQR)	6.6 (5–8.3)	6.8 (6–7.5)	7 (5–8)	0.10	
Malignant tumour, n (%)	140 (99.2)	37 (100)	23 (100)	0.82	
Pathological T stage, n (%)	T1b	10 (7)	13 (35.2)	9 (39.1)	<b>0.03</b>
	T2	69 (48.9)	13 (35.2)	8 (34.7)	
	T3a	50 (35.4)	8 (21.6)	5 (21.9)	
	T3b	12 (8.7)	3 (8.0)	1 (4.3)	
Pathological N stage, n (%)	Nx	108 (76.6)	26 (70.2)	18 (78.2)	0.06
	N0	19 (13.4)	9 (24.3)	4 (17.3)	
	N1	14 (10)	2 (5.5)	1 (4.5)	
Follow-up (months), median (IQR)	27 (19–36)	25 (16–34)	27 (16–37)	0.24	
Last follow-up creatinine serum level (mg/dl), median (IQR)	1.4 (1.1–1.6)	1.4 (1.2–1.6)	1.5 (1.1–1.6)	0.76	
Last follow-up eGFR (ml/min), median (IQR)	55.3 (48.6–71.1)	59.5 (49.9–74.1)	58.7 (50.0–73.4)	0.11	
Overall survival at median follow-up, n (%)	130 (92.0)	36 (97.2)	22 (95.6)	0.37	
Cancer specific survival at median follow-up, n (%)	139 (98.5)	37 (100)	23 (100)	0.86	

Abbreviations: ASA, American Society of Anesthesiologists; BMI, body mass index; CCI PS, Charlson comorbidity index performance status; CD, Clavien-Dindo; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; IQR, interquartile range; MIS, minimally invasive surgery; OT, operative time; POD, postoperative day.

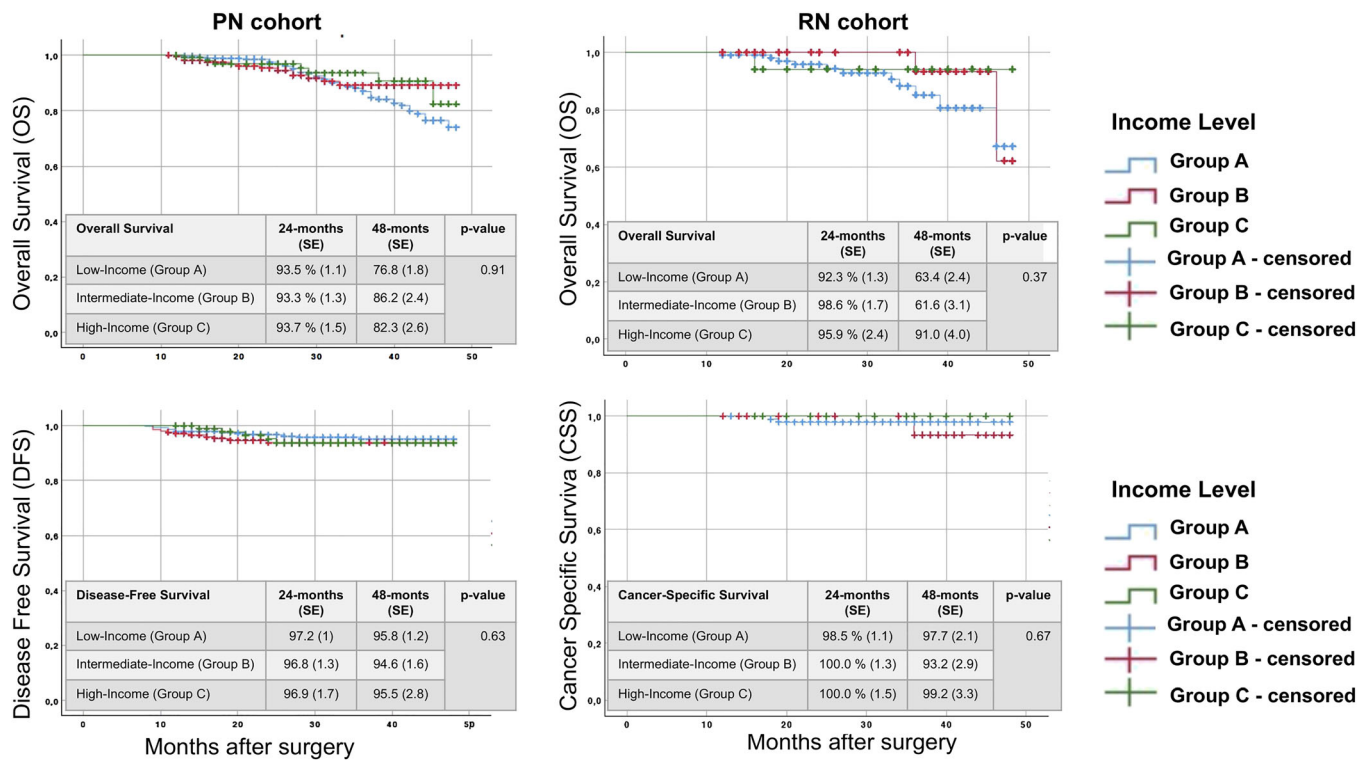
treatment, as well as access to MIS were found comparable in the three groups in both PN and RN cohort.

Despite current International guidelines do not specifically recommend a particular approach for PN while indicating laparoscopic RN as the preferred treatment in case of radical intent (Ljungberg et al., 2020), robotic surgery has largely demonstrated its benefits in terms of perioperative results and oncological efficacy (Bertolo et al., 2018; Bravi et al., 2019; Carbonara et al., 2021; Minervini et al., 2020). Such technology, nevertheless, has remained mainly prerogative of referral Institutions and is burdened by non-negligible costs worldwide (Nabi et al., 2020). A retrospective analysis based on the National Cancer Database evaluating disparities in MIS usage for localised renal cancer in USA found that differences in utilisation of MIS do exist among certain sociodemographic subgroups and in particular racial minorities and people without health insurance were more frequently treated with open approach for both PN and RN (Xia et al., 2019). A similar disproportion in robotic access for patients of lower social classes have noted among different hospital types, namely teaching vs not-teaching hospital or high- vs low-volume

centres (Kiechle et al., 2016; Tatebe et al., 2018). Our study showed that 99.4% of PNs were performed robotically and 50.2% of RNs were carried out with MIS (laparoscopic or robotic) with a comparable distribution across the three groups.

Third, we did not notice any differences in both PN and RN cohorts among patients with distinct income levels with respect to postoperative complications rate, PSM rate, functional data and survival curves. We believe that these results came from the centralisation of kidney cancer services and surgical technology within referral centres, which provide high quality treatment and has shown to have a positive impact on perioperative and postoperative outcomes (Carbonara et al., 2020; Grosso, Di Maida, Mari, & Minervini, 2022; Grosso, Di Maida, Masieri, & Minervini, 2022; Tran et al., 2020). Similarly, univariate and multivariate Cox regression analysis confirmed that none of the socio-economic variables analysed were associated with worse survival outcomes in both cohorts.

Our study was not devoid of limitations. First, the retrospective nature of the study and the relatively small sample of RN cohort may have potentially undermined the reliability of the reported results.



**FIGURE 1** Kaplan–Meier curves depicting overall survival, cancer-specific survival and recurrence-free survival in the partial and radical nephrectomy cohort according to patients' income level

**TABLE 3a** Multivariate Cox regression analyses predicting survival outcomes of patients submitted to partial nephrectomy at our institution (n = 841)

VARIABLES	All-cause mortality		Disease recurrence	
	HR (95% IC)	p value	HR (95% IC)	p value
Female gender (vs. male)	1.53 (0.79–2.92)	0.21	1.30 (0.65–2.629)	0.45
Other nationality (vs. local)	0.97 (0.37–2.51)	0.97	4.45 (0.60–6.59)	0.14
Educational level	Intermediate (vs. primary)	0.43 (0.16–1.11)	0.64 (0.21–1.90)	0.42
	High (vs. primary)	0.71 (0.36–1.76)	0.53 (0.20–1.45)	0.53
Income level	Intermediate (vs. low)	2.13 (0.89–5.52)	0.94 (0.29–3.07)	0.92
	High (vs. low)	1.30 (0.49–3.45)	1.41 (0.47–4.20)	0.63

**TABLE 3b** Multivariate Cox regression analyses predicting survival outcomes of patients submitted to radical nephrectomy at our institution (n = 201)

VARIABLES	All-cause mortality		Cancer-specific mortality	
	HR (95% IC)	p value	HR (95% IC)	p value
Female gender (vs. male)	1.59 (0.79–2.91)	0.21	1.18 (0.84–2.18)	0.19
Other nationality (vs. local)	0.99 (0.34–2.51)	0.97	1.27 (0.69–2.61)	0.66
Educational level	Intermediate (vs. primary)	0.48 (0.13–1.19)	0.66 (0.16–1.58)	0.23
	High (vs. primary)	0.77 (0.30–1.77)	0.83 (0.61–1.94)	0.11
Income level	Intermediate (vs. low)	2.10 (0.89–5.50)	0.71 (0.41–3.86)	0.57
	High (vs. low)	1.37 (0.39–3.41)	0.62 (0.47–2.54)	0.91



Second, the stratification according to patient income-level and the lack of effect size created a disproportion among the sub-groups potentially lowering the study statistical power. Third, we could not be able to perform comparative analysis between our Institution and other district hospitals or private clinics due to the lack of meaningful data.

Despite these limitations reduced the generalizability of the presented results, this is the first study assessing social and economic disparities in the surgical treatment of renal masses in the setting of Universal healthcare system. This study provided key findings to better understand the socio-economic reality of kidney surgery in light of current International guidelines recommendations and the rapidly evolving technology offered in everyday surgical practice.

To conclude, the present study showed a high adherence rate to International recommendations for the surgical treatment of renal masses and outlined no differences in terms of surgical indication, access to MIS, perioperative and postoperative outcomes in patients with renal tumours amenable to surgical curative treatment, according to their economic status. These evidences point out the concepts that the centralisation of cancer services towards referral Institutions and the Universal healthcare system may ensure egalitarian treatment modalities for patients with renal cancer at any clinical localised and locally advanced stage.

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## CONFLICT OF INTEREST

The authors declared no conflict of interest.

## DATA AVAILABILITY STATEMENT

Data are available at the corresponding author.

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## REFERENCES

- Alcaraz, K. I., Wiedt, T. L., Daniels, E. C., Yabroff, K. R., Guerra, C. E., & Wender, R. C. (2020). Understanding and addressing social determinants to advance cancer health equity in the United States: A blueprint for practice, research, and policy. *CA: A Cancer Journal for Clinicians*, 70(1), 31–46. <https://doi.org/10.3322/caac.21586>
- Althaus, A. B., Chang, P., Mao, J., Olugbade, K., Taylor, K., Dewey, L., Percy, A., Crociani, C., McNally, K., & Wagner, A. A. (2020). Patient-reported quality of life and convalescence after minimally invasive kidney Cancer surgery. *Urology*, 144, 123–129. <https://doi.org/10.1016/j.urology.2020.06.020>
- Amparore, D., Campi, R., Checcucci, E., Piana, A., Sica, M., Grosso, A. A., Presutti, M., Barzagli, P., Minervini, A., Serni, S., & Fiori, C. (2020). Patients' perspective on the use of telemedicine for outpatient urological visits: Learning from the COVID-19 outbreak. *Actas Urologicas Espan~ olas*, 44(9), 637–638. <https://doi.org/10.1016/j.acuro.2020.06.008>
- Bertolo, R., Autorino, R., Simone, G., Derweesh, I., Garisto, J. D., Minervini, A., Eun, D., Perdoni, S., Porter, J., Rha, K. H., Mottrie, A., White, W. M., Schips, L., Yang, B., Jacobsohn, K., Uzzo, R. G., Challacombe, B., Ferro, M., Sulek, J., ... Porpiglia, F. (2018). Outcomes of robot-assisted partial nephrectomy for clinical T2 renal tumors: A multicenter analysis (ROSULA collaborative group). *European Urology*, 74(2), 226–232. <https://doi.org/10.1016/j.eururo.2018.05.004>
- Bradshaw, A. W., Autorino, R., Simone, G., Yang, B., Uzzo, R. G., Porpiglia, F., Capitanio, U., Porter, J., Bertolo, R., Minervini, A., Lau, C., Jacobsohn, K., Ashrafi, A., Eun, D., Mottrie, A., White, W. M., Schips, L., Challacombe, B. J., de Cobelli, O., ... Derweesh, I. H. (2020). Robotic partial nephrectomy vs minimally invasive radical nephrectomy for clinical T2a renal mass: A propensity score-matched comparison from the ROSULA (Robotic Surgery for Large Renal Mass) Collaborative Group. *BJU International*, 126(1), 114–123. <https://doi.org/10.1111/bju.15064>
- Bravi, C. A., Larcher, A., Capitanio, U., Mari, A., Antonelli, A., Artibani, W., Barale, M., Bertini, R., Bove, P., Brunocilla, E., da Pozzo, L., di Maida, F., Fiori, C., Gontero, P., Li Marzi, V., Longo, N., Mirone, V., Montanari, E., Porpiglia, F., ... Minervini, A. (2019). Perioperative outcomes of open, laparoscopic, and robotic partial nephrectomy: A prospective multicenter observational study (the RECORd 2 project). *European Urology Focus*, 52405–4569(19), 30335–30339. <https://doi.org/10.1016/j.euf.2019.10.013>
- Campi, R., Tellini, R., Grosso, A. A., Amparore, D., Mari, A., Viola, L., Cocci, A., Polverino, P., Checcucci, E., Alessio, P., Fiori, C., Minervini, A., Carini, M., Porpiglia, F., & Serni, S. (2021). Deferring elective urologic surgery during the COVID-19 pandemic: The patients' perspective. *Urology*, 147, 21–26. <https://doi.org/10.1016/j.urology.2020.09.015>
- Carbonara, U., Lee, J., Crocero, F., Vecchia, A., Hampton, L. J., Eun, D., & Autorino, R. (2021). Single overnight stay after robot-assisted partial nephrectomy: A bi-center experience. *Minerva Urology and Nephrology*, 73(6), 773–780. <https://doi.org/10.23736/S2724-6051.20.04054-0>
- Carbonara, U., Simone, G., Capitanio, U., Minervini, A., Fiori, C., Larcher, A., Checcucci, E., Amparore, D., Crocero, F., Vecchia, A., & Weprin, S. (2020). Robot-assisted partial nephrectomy: 7-year outcomes. *Minerva Urologica e Nefrologica*, 73(4), 540–543. <https://doi.org/10.23736/S0393-2249.20.04151-X>
- Chung, B. I., Leow, J. J., Gelpi-Hammerschmidt, F., Wang, Y., Del Giudice, F., De, S., Chou, E. P., Song, K. H., Almario, L., & Chang, S. L. (2015). Racial disparities in postoperative complications after radical nephrectomy: A population-based analysis. *Urology*, 85(6), 1411–1416. <https://doi.org/10.1016/j.urology.2015.03.001>
- Colli, J., Sartor, O., Grossman, L., & Lee, B. R. (2012). Underutilization of partial nephrectomy for stage T1 renal cell carcinoma in the United States, trends from 2000 to 2008. A long way to go. *Clinical Genitourinary Cancer*, 10(4), 219–224. <https://doi.org/10.1016/j.clgc.2012.05.003>
- Crocero, F., Carbonara, U., Cantiello, F., Marchioni, M., Ditunno, P., Mir, M. C., Porpiglia, F., Derweesh, I., Hampton, L. J., Damiano, R., & Autorino, R. (2021). Robot-assisted radical nephrectomy: A systematic review and meta-analysis of comparative studies. *European Urology*, 80(4), 428–439. <https://doi.org/10.1016/j.eururo.2020.10.034>
- Delahunt, B., Chevillat, J. C., Martignoni, G., Humphrey, P. A., Magi-Galluzzi, C., McKenney, J., Egevad, L., Algaba, F., Moch, H., Grignon, D. J., Montironi, R., Srigley, J. R., & Members of the ISUP Renal Tumor Panel. (2013). The International Society of Urological Pathology (ISUP) grading system for renal cell carcinoma and other prognostic parameters. *The American Journal of Surgical Pathology*, 37(10), 1490–1504. <https://doi.org/10.1097/PAS.0b013e318299f0fb>
- Dindo, D., Demartines, N., & Clavien, P. A. (2004). Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Annals of Surgery*, 240(2), 205–213. <https://doi.org/10.1097/01.sla.0000133083.54934.ae>
- Edge, S. B., Byrd, D. R., Compton, C. C., et al. (2009). *AJCC Staging Manual* (7th ed.). Springer.

- Ellis, L., Canchola, A. J., Spiegel, D., Ladabaum, U., Haile, R., & Gomez, S. L. (2018). Racial and ethnic disparities in cancer survival: The contribution of tumor, sociodemographic, institutional, and neighborhood characteristics. *Journal of Clinical Oncology*, 36(1), 25–33. <https://doi.org/10.1200/JCO.2017.74.2049>
- Ficarra, V., Novara, G., Secco, S., Macchi, V., Porzionato, A., de Caro, R., & Artibani, W. (2009). Preoperative aspects and dimensions used for an anatomical (PADUA) classification of renal tumours in patients who are candidates for nephron sparing surgery. *European Urology*, 56(5), 786–793. <https://doi.org/10.1016/j.eururo.2009.07.040>
- Grosso, A. A., Di Maida, F., Mari, A., & Minervini, A. (2022). The association between income status and treatment selection for prostate cancer in a universal health care system: A population-based analysis. *Letter Journal of Urology*, 207(4), 937–938. <https://doi.org/10.1097/JU.0000000000002418>
- Grosso, A. A., Di Maida, F., Masieri, L., & Minervini, A. (2022). Editorial comment to are there disparities in access to robot-assisted laparoscopic surgery among pediatric urology patients? US institutional experience. *International Journal of Urology*, 29(7), 667. <https://doi.org/10.1111/iju.14897>
- Kiechle, J. E., Abouassaly, R., Gross, C. P., Dong, S., Cherullo, E. E., Zhu, H., Trinh, Q. D., Sun, M., Meropol, N. J., Hoimes, C. J., Ialacci, S., & Kim, S. P. (2016). Racial disparities in partial nephrectomy persist across hospital types: Results from a population-based cohort. *Urology*, 90, 69–74. <https://doi.org/10.1016/j.urology.2015.10.035>
- Levey, A. S., Eckardt, K. U., Tsukamoto, Y., Levin, A., Coresh, J., Rossert, J., Zeeuw, D. D. E., Hostetter, T. H., Lameire, N., & Eknoyan, G. (2005). Definition and classification of chronic kidney disease: A position statement from kidney disease: improving global outcomes (KDIGO). *Kidney International*, 67(6), 2089–2100. <https://doi.org/10.1111/j.1523-1755.2005.00365.x>
- Ljungberg, B., Albiges, L., Bedke, J., Bex, A., Capitanio, U., Giles, R. H., Hora, M., Klatte, T., Lam, T., Marconi, L., Powles, T., & Volpe, A. (2020). EAU Guidelines on Renal Cell Carcinoma. Edn. presented at the EAU Annual Congress Amsterdam.
- Mackenbach, J. P., Stirbu, I., Roskam, A. J., Schaap, M. M., Menvielle, G., Leinsalu, M., Kunst, A. E., & European Union Working Group on Socioeconomic Inequalities in Health. (2008). European union working group on socioeconomic inequalities in health. Socioeconomic inequalities in health in 22 European countries. *The New England Journal of Medicine*, 358(23), 2468–2481. <https://doi.org/10.1056/NEJMs0707519>
- Maurice, M. J., Zhu, H., Kiechle, J. E., Kim, S. P., & Abouassaly, R. (2015). Nonclinical factors predict selection of initial observation for renal cell carcinoma. *Urology*, 86(5), 892–899. <https://doi.org/10.1016/j.urology.2015.06.057>
- Minervini, A., Campi, R., Lane, B. R., de Cobelli, O., Sanguedolce, F., Hatzichristodoulou, G., Antonelli, A., Noyes, S., Mari, A., Rodriguez-Faba, O., Keeley, F. X., Langenhuisen, J., Musi, G., Klatte, T., Roscigno, M., Akdogan, B., Furlan, M., Karakoyunlu, N., Marszalek, M., ... Kutikov, A. (2020). Impact of resection technique on perioperative outcomes and surgical margins after partial nephrectomy for localized renal masses: A prospective multicenter study. *The Journal of Urology*, 203(3), 496–504. <https://doi.org/10.1097/JU.0000000000000591>
- Mir, M. C., Derweesh, I., Porpiglia, F., Zargar, H., Mottrie, A., & Autorino, R. (2017). Partial nephrectomy versus radical nephrectomy for clinical T1b and T2 renal tumors: A systematic review and meta-analysis of comparative studies. *European Urology*, 71(4), 606–617. <https://doi.org/10.1016/j.eururo.2016.08.060>
- Nabi, J., Friedlander, D. F., Chen, X., Cole, A. P., Hu, J. C., Kibel, A. S., Dasgupta, P., & Trinh, Q. D. (2020). Assessment of out-of-pocket costs for robotic cancer surgery in US adults. *JAMA Network Open*, 3(1), e1919185. <https://doi.org/10.1001/jamanetworkopen.2019.19185>
- Ribal, M. J., Cornford, P., Briganti, A., Knoll, T., Gravas, S., Babjuk, M., Harding, C., Breda, A., Bex, A., GORRG Group, Rassweiler, J. J., Gözen, A. S., Pini, G., Liatsikos, E., Giannarini, G., Mottrie, A., Subramaniam, R., Sofikitis, N., Rocco, B. M. C., ... EAU Section Offices and the EAU Guidelines Panels. (2020). EAU section offices and the EAU guidelines panels. European Association of Urology guidelines office rapid reaction group: An organisation-wide collaborative effort to adapt the European Association of Urology guidelines recommendations to the coronavirus disease 2019 era. *European Urology*, 78(1), 21–28. <https://doi.org/10.1016/j.eururo.2020.04.056>
- Schwartz, K., Ruterbusch, J. J., Colt, J. S., Miller, D. C., Chow, W. H., & Purdue, M. P. (2016). Racial disparities in overall survival among renal cell carcinoma patients with young age and small tumors. *Cancer Medicine*, 5(2), 200–208. <https://doi.org/10.1002/cam4.578>
- Small, A. C., Tsao, C. K., Moshier, E. L., Gartrell, B. A., Wisnivesky, J. P., Godbold, J., Sonpavde, G., Palese, M. A., Hall, S. J., Oh, W. K., & Galsky, M. D. (2013). Trends and variations in utilization of nephron-sparing procedures for stage I kidney cancer in the United States. *World Journal of Urology*, 31(5), 1211–1217. <https://doi.org/10.1007/s00345-012-0873-6>
- <https://www.lavoro.gov.it/strumenti-e-servizi/ISEE/Pagine>
- Tatebe, L. H., Gray, R., Tatebe, K., Garcia, F., & Putty, B. (2018). Socioeconomic factors and parity of access to robotic surgery in a county health system. *Journal of Robotic Surgery*, 12(1), 35–41. <https://doi.org/10.1007/s11701-017-0683-3>
- Tran, M. G. B., Aben, K. K. H., Werkhoven, E., Neves, J. B., Fowler, S., Sullivan, M., Stewart, G. D., Challacombe, B., Mahrous, A., Patki, P., Mumtaz, F., Barod, R., Bex, A., & The British Association of Urological Surgeons. (2020). Guideline adherence for the surgical treatment of T1 renal tumours correlates with hospital volume: An analysis from the British Association of Urological Surgeons Nephrectomy Audit. *BJU International*, 125(1), 73–81. <https://doi.org/10.1111/bju.14862>
- Trinh, Q. D., Sun, M., Sammon, J., Bianchi, M., Sukumar, S., Ghani, K. R., Jeong, W., Dabaja, A., Shariat, S. F., Perrotte, P., Agarwal, P. K., Rogers, C. G., Peabody, J. O., Menon, M., & Karakiewicz, P. I. (2012). Disparities in access to care at high-volume institutions for uro-oncologic procedures. *Cancer*, 118(18), 4421–4426. <https://doi.org/10.1002/cncr.27440>
- Wu, X. C., Lund, M. J., Kimmick, G. G., Richardson, L. C., Sabatino, S. A., Chen, V. W., Fleming, S. T., Morris, C. R., Huang, B., Trentham-Dietz, A., & Lipscomb, J. (2012). Influence of race, insurance, socioeconomic status, and hospital type on receipt of guideline-concordant adjuvant systemic therapy for locoregional breast cancers. *Journal of Clinical Oncology*, 30(2), 142–150. <https://doi.org/10.1200/JCO.2011.36.8399>
- Xia, L., Talwar, R., Taylor, B. L., Shin, M. H., Berger, I. B., Sperling, C. D., Chelluri, R. R., Zambrano, I. A., Raman, J. D., & Guzzo, T. J. (2019). National trends and disparities of minimally invasive surgery for localized renal cancer, 2010 to 2015. *Urologic Oncology*, 37(3), 182.e17–182.e27. <https://doi.org/10.1016/j.urolonc.2018.10.028>

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