CANADIAN JOURNAL OF UROLOGY

Tech Science Press

Doi:10.32604/cju.2026.069461
ARTICLE

Specialist consultation improves underdiagnosis of surgical adrenal incidentaloma: a TriNetX database investigation

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HOCHBERG AR, SHIRODKAR M, IM BH, DENG X, HAILEMARIAM FT, SHAH SS, THOMPSON RAM, AGUIRRE F, GOMELLA PT, SHAH MS, LALLAS CD, METWALLI AR. Specialist consultation improves underdiagnosis of surgical adrenal incidentaloma: a trinetx database investigation. *Can J Urol* 2025;33(4):931–941.

Objectives: *Despite practice guidelines recommending hormonal testing for all cases of incidentally discovered adrenal adenomas (incidentalomas), only 30% of patients receive laboratory workup. This study sought to evaluate hormonal testing and adrenal surgery rates in incidentaloma patients seen by a specialist (endocrinologist, nephrologist, urologist, or general surgeon), compared to those not seen by a specialist.*

Methods: *We identified incidentaloma cases by querying the TriNetX Research Network for all adult patients with an unspecified adrenal mass occurring within 1 month following abdominal imaging. We compared those seen by a specialist against those not following an incidentaloma diagnosis. Primary outcomes were rates of hormonal testing and adrenal gland surgery.*

Results: *Of 132,217 incidentaloma patients, 1054 (0.7%) received a specialist consultation. Referral to a specialist was associated with increased hormonal testing (49.5% vs. 28.0%, $p < 0.0001$) and adrenal surgery (6.3% vs. 3.6%, $p < 0.0001$). Surgery rates were similar among those who received hormonal testing, regardless of specialist consultation (12.6% vs. 13.3%, $p = 0.8445$). Of all incidentaloma patients, 6765 (5.2%) proceeded to adrenal surgery.*

Conclusions: *Patients receiving specialist services experienced more hormonal testing and treatment with surgery. Surgery rates did not differ among those undergoing any hormonal evaluation, regardless of specialist status, indicating that about 13% of incidentaloma patients will require adrenal surgery. Applying this rate suggests that nearly 14,000 incidentaloma patients in TriNetX did not receive surgery despite likely meeting criteria, a significant failure in treatment. Further, prospective studies are needed to investigate practice patterns and expose reasons for the lack of progression to evaluation or treatment.*

Key Words: Adrenal tumors, incidentaloma, endocrinology, cortisol, aldosterone, adrenalectomy

Introduction

Incidentally discovered adrenal adenomas (incidentalomas) are defined as largely asymptomatic adrenal nodules that are detected on abdominal imaging performed for unrelated reasons.[1,2] They are reported to be present in 4–8% of adults[3–5] but this number may approach 15% among adults

Received date 24 June 2025
Accepted for publication 22 February 2026
Published online 21 August 2026

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with hypertension.[6,7] The vast majority of incidentalomas identified are benign and hormonally inactive; thus no treatment is needed.[8] However, approximately 8–15% of incidentalomas are hormonally active and will ultimately require further treatment.[3,8–10] Multiple variants of hormone hypersecreting incidentalomas can develop: 5–30% are cortisol-releasing tumors (i.e., Cushing syndrome),[4,8,11,12] 1.5–14% are pheochromocytomas, and 1–4% are aldosteronomas.[3,8,11] Incidentally discovered sex steroid-releasing tumors are exceedingly rare, as they typically present with overt clinical features such as virilization.[11] Given the ongoing metabolic risks of an untreated hormonally active tumor,[4,13] professional societies such as the American Society of Clinical Endocrinology and the American Association of Endocrine Surgeons recommend hormonal testing for all cases of incidentalomas, both annually and up to 5 years.[5,8,14,15]

Despite these recommendations, a mere 30% of patients with incidentalomas are found to have undergone any adrenal-specific laboratory testing.[4,7,12,14] Several studies have proposed measures to improve adherence to the guidelines, such as including specific recommendations in the radiology report[8,16] and recommendations for referral to an endocrinologist.[15] While some have established that incidentaloma patients seen by an endocrinologist were more likely to be hormonally evaluated,[8,17,18] few studies have continued this investigation through the treatment pathway to investigate rates of adrenal gland surgery. In the present study, we aim to evaluate and characterize a large cohort of patients with incidentalomas in the multi-institutional TriNetX database. We hypothesize that patients who were referred to a medical subspecialty, endocrinology, nephrology, urology, or general surgery, will have higher rates of hormonal testing compared to those not referred to a specialist. We further hypothesize that these higher rates of hormonal testing will lead to higher rates of adrenal gland surgery in patients referred to a specialist.

Materials and Methods

Data source

Data were collected from the TriNetX Research Network (https://trinetx.com/, accessed on 11 February 2026), a large, collaborative enterprise containing data from electronic health records (EHRs) of over 120 million patients across 85 healthcare organizations located in 47 countries. This study did not involve the collection and/or use of individually identifiable data, only using de-identified aggregate patient records; as such, this study was exempt from Institutional Review Board approval. TriNetX only reports data coded into a patient's EHR from up to 20 years prior to the date of analysis and excludes patient data entered prior to this date. Our analysis was performed in November 2025. Cohorts were established using Current Procedural Terminology (CPT), International Classification of Diseases-10 (ICD-10), International Classification of Diseases for Oncology (ICD-O), and SNOMED Clinical Terms.

Study population and cohorts

Our initial cohort consisted of all adult (≥18 years old) patients with an unspecified adrenal mass, defined as having one of the ICD-10 codes found in Table A1. We defined incidentaloma as any diagnosis of adrenal mass occurring within 1 month following abdominal imaging by either computer tomography (CT) or magnetic resonance imaging (MRI). (Table A1) No exclusion criteria were specified. We defined receiving a specialist consultation as having the diagnosis of an incidentaloma and one of the endocrinology, nephrology, urology, or general surgery service codes listed in Table A1 within 1 month to 1 year following abdominal imaging. For hormonal testing, we focused on laboratory tests for cortisol, aldosterone/renin, dehydroepiandrosterone (DHEA), and metanephrines/catecholamines (Table A2). We defined receiving hormonal testing as having an incidentaloma and any code for the laboratory tests following abdominal imaging. Finally, we defined adrenal gland surgery as having any code for surgery performed on the adrenal gland at any time following diagnosis of incidentaloma (Table A1). Of note, the TriNetX database does not provide the size of the lesions. Additionally, the data is aggregate, providing an *average* of values as opposed to matching a specific value to a specific outcome. Therefore, we are unable to directly attribute the effects of mass size on patient outcomes.

Demographic data on patient age at the time of incidentaloma diagnosis, sex, and ethnic group were also collected. Among patients who underwent adrenal gland surgery, we analyzed any available histological information using ICD-O-3 codes. A complete list of codes used to query TriNetX is available in the supplemental materials (Table A1).

We further investigated the timing of patients receiving laboratory testing by analyzing the number of incidentaloma patients receiving hormonal testing between 0 and 6, 6 and 24, and 24 and 60 months after diagnosis. We similarly investigated the timing

of adrenal gland surgery. We analyzed the number of patients receiving adrenal gland surgery between 0 and 6, 6 and 24, and 24 and 60 months after the first instance of hormonal testing or diagnosis of incidentaloma, respectively. Patients on presumed surveillance are typically managed with clinical and hormonal testing annually for up to four years, with sporadic radiographic testing during the first two years of surveillance, though no official guidelines exist to date.[8,19] To account for patients who may have been managed with surveillance, we investigated the number of patients who received follow-up abdominal imaging. We defined follow-up imaging as abdominal imaging received between 6 and 24 months, and 24 and 60 months following the initial abdominal CT or MRI.

Outcomes and statistical analysis

The primary outcomes were differences in the rate of hormonal testing and adrenal gland surgery between those receiving specialist consultations and those not. We also compared the rates of adrenal surgery based on hormonal evaluation, the timing of hormonal testing after diagnosis based on receiving a specialist consultation, the timing of surgery after both hormonal testing and diagnosis based on receiving a specialist consultation, as well as undergoing follow-up imaging based on receiving hormonal testing. Data analysis was conducted using GraphPad Prism 10.1.1 (*GraphPad Prism version 10.1.1 GraphPad Software, La Jolla, CA, USA)*. Analyses included descriptive statistics to characterize cohorts and a two-tailed Fisher's Exact test with calculation of Odds Ratios (ORs) to determine differences between cohorts. 95% confidence intervals (CI) were calculated using the Wilson score interval. Additionally, based on the surgery rate among hormonally evaluated patients, we calculated the number of patients without testing who could need adrenal surgery.

Results

From 2005 to 2025, there were 132,600 patients who met our definition for adrenal incidentaloma. Baseline demographic data for all patients, as well as for both surgery groups, are shown in Table 1. 1054 (0.7%) patients were coded as receiving a specialist consultation while 131,546 (99.3%) were not. Only 37,309 (28.0%) of all incidentaloma patients received any form of hormonal testing. The majority of patients who underwent hormonal laboratory testing were tested for cortisol (71.9%) or metanephrine/catecholamine (61.2%) levels. Fewer were tested for DHEA levels (29.2%) and fewer still were tested for aldosterone/renin levels (7.7%). The management pathway for these patients is shown in Figure 1. Available histological data for patients who underwent adrenal surgery is unexpectedly

TABLE 1. **Baseline patient demographics**

Patient demographics	**Incidentaloma total N = 132,600**	**Specialist services + Surgery N = 66**	**No specialist services + surgery N = 4900**
Age at diagnosis, Mean +/− SD (y)	61.7 +/− 14.1	56.4 +/− 13.6	54.9 +/− 14.9
Sex, N (%)			
Female	75,582 (57.0%)	35 (53.0%)	2842 (58.0%)
Male	54,366 (41.0%)	28 (42.4%)	2009 (41.0%)
Unknown sex	2644 (2.0%)	3 (4.5%)	98 (2.0%)
Ethnic group, (N, %)			
White	92,820 (70.0%)	49 (74.2%)	3479 (71.0%)
Black or African American	18,564 (14.0%)	10*(15.1%)	686 (14.0%)
Asian	3978 (3.0%)	10* (15.1%)	196 (4.0%)
Native hawaiian or other pacific Islander	530 (0.4%)	10* (15.1%)	15 (0.3%)
American Indian or alaska native	397 (0.3%)	0	10 (0.2%)
Unknown ethnic group	13,260 (10.0%)	10* (15.1%)	441 (9.0%)

Note. *Denotes ≤10 instances; instances of cohorts with fewer than 10 patients are reported as 10 by the TriNetX database to better preserve patient confidentiality.

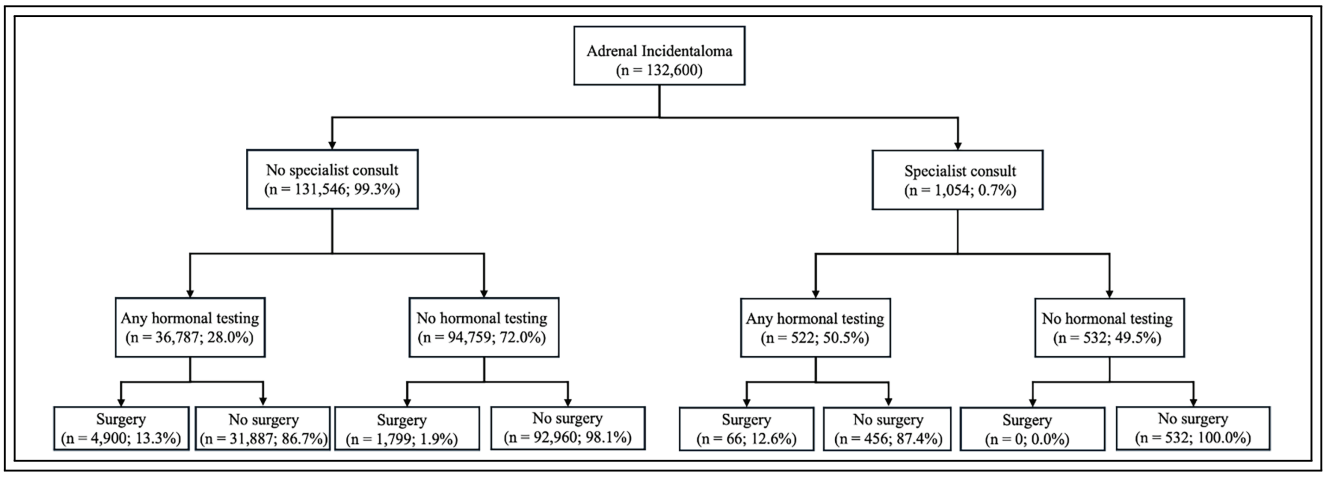

FIGURE 1. Consort diagram showing workup and treatment pathway for patients with adrenal incidentaloma in TriNetX. Percentages shown are relative to the group one level above in the diagram

sparse in TriNetX and largely uninformative. These data can be found in Table A3.

Those who referred to a specialist experienced a significantly higher rate of hormonal testing (49.5% vs. 28.0%, $p < 0.0001$) compared to those not receiving endocrinological evaluation from a specialty service (Table 2). Further, patients referred to a specialist experienced higher rates of surgery (6.3% vs. 5.0%, $p < 0.0001$) compared to those not receiving specialist services. Surgery rates were similar among those who received hormonal testing, regardless of specialist consultation status (12.6% vs. 13.3%, $p = 0.8445$). However, among those who did not receive hormonal testing, patients with specialist consultation status underwent surgery at significantly lower rates (0% vs. 1.9%, $p > 0.05$). Of all incidentaloma patients who underwent hormonal testing, 4900 (13.3%) proceeded to adrenal surgery. Applying this rate to all incidentaloma patients, a total of 19,272 patients (95% CI: 18,648–19,914) would be expected to require adrenal surgery.

Timing of hormonal testing

Overall, the majority (90.2%) of patients who underwent hormonal testing did so within 6 months of their incidentaloma diagnosis. However, those receiving a specialist consultation were significantly less likely (86.6% vs. 90.3%, $p = 0.0075$) to receive hormonal testing during this time period (Table 3). Hormonal testing rates were significantly increased for those receiving a specialist consultation between 6 and 24 months (61.5% vs. 40.3%, $p < 0.0001$) and 24 and 60 months (38.3% vs. 24.0%, $p < 0.0001$) after the initial diagnosis of incidentaloma.

Timing of surgery

Surgery rates were similar, regardless of specialist services, between 0 and 6 months (53.0% vs. 62.2%, $p = 0.1276$) and 6 and 24 months (19.7% vs. 15.3%, $p = 0.3055$) after hormonal testing (Table 4). However, patients receiving specialist services experienced significantly higher rates of surgery (15.2% vs. 6.0%, $p = 0.0062$) between 24 and 60 months after hormonal testing. Of note, there were fewer than or equal to 10 patients who received a specialist consultation and underwent adrenal gland surgery between 24 and 60 months after hormonal testing. However, TriNetX reported the number of patients in this cohort as 10 as part of a patient privacy protection mechanism.

Surgery rates were similar for patients irrespective of a specialist consultation between 0 and 6 months (59.1% vs. 67.9%, $p = 0.1445$) as well as between 6 and 24 months (25.8% vs. 19.9%, $p = 0.2765$) after diagnosis of incidentaloma (Table 4). Patients receiving specialist services experienced higher rates of surgery (15.2% vs. 7.5%, $p = 0.0313$) between 24 and 60 months after diagnosis of incidentaloma compared to those who did not receive specialist services. Similar to the abovementioned cohort, there were fewer than or equal to 10 patients who received a specialist consultation and underwent adrenal gland surgery between 24 and 60 months after diagnosis of incidentaloma.

Timing of Follow up Imaging Relative to Hormonal Testing Patients who underwent hormonal testing experienced significantly higher rates of additional abdominal imaging between 6 and 24 months (52.8% vs. 29.9%, $p < 0.0001$) as well as between

TABLE 2. **Difference in hormonal testing or adrenal surgery based on specialist consultation**

Cohort comparison	Outcome	% of cohort	OR [95% CI]	*p*-value
Specialist consultation vs. no specialist consultation	Hormonal testing	49.5% vs. 28.0%	2.57 [2.28, 2.90]	$p < 0.0001$
Specialist consultation vs. no specialist consultation	Adrenal surgery	6.3% vs. 5.0%	1.26 [1.13, 1.39]	$p < 0.0001$
Specialist consultation + Hormonal testing vs. No specialist consultation + Hormonal testing	Adrenal surgery	12.6% vs. 13.3%	0.97 [0.74, 1.25]	$p = 0.8445$

Note. OR, Odds Ratio; CI, Confidence Interval.

TABLE 3. **Timing of hormonal testing after diagnosis of incidentaloma**

Cohort comparison	Statistical parameters	0–6 months	6–24 months	24–60 months
Specialist consultation vs. no specialist consultation	% of Cohort	86.6% vs. 90.3%	61.5% vs. 40.3%	38.3% vs. 24.0%
	OR [95% CI]	0.70 [0.54, 0.90]	2.37 [1.99, 2.83]	1.97 [1.65, 2.35]
	p-value	$p = 0.0075$	$p < 0.0001$	$p < 0.0001$

Note. OR, Odds Ratio; CI, Confidence Interval.

TABLE 4. **A comparison between the cohort given specialist consultation with those who did not with respect to the timing of hormonal workup and interventions relative to diagnosis and testing**

Cohort comparisons	Statistical parameters	0–6 months	6–24 months	24–60 months
Timing of surgery to initial hormonal testing				
Specialist consultation vs. no specialist consultation	% of Cohort	53.0% vs. 62.2%	19.7% vs. 15.3%	15.2%* vs. 6.0%
	OR [95% CI]	0.69 [0.42, 1.11]	1.36 [0.75, 2.51]	2.80 [1.36, 5.53]
	p-value	$p = 0.1276$	$p = 0.3055$	$p = 0.0062$
Timing of surgery to initial diagnosis of incidentaloma				
Specialist consultation vs. no specialist consultation	% of Cohort	59.1% vs. 67.9%	25.8% vs. 19.9%	15.2%* vs. 7.5%
	OR [95% CI]	0.68 [0.42, 1.11]	1.40 [0.79, 2.39]	2.20 [1.07, 4.33]
	p-value	$p = 0.1445$	$p = 0.2765$	$p = 0.0313$
Timing of follow-up imaging relative to hormonal testing				
Specialist consultation vs. no specialist consultation	% of Cohort	52.8% vs. 29.9%		33.8% vs. 18.4%
	OR [95% CI]	2.61 [2.55, 2.68]		2.26 [2.20, 2.32]
	p-value	$p < 0.0001$		$p < 0.0001$

Note. *Denotes ≤10 instances; instances of cohorts with fewer than 10 patients are reported as 10 by the TriNetX database to better preserve patient confidentiality. OR, Odds Ratio; CI, Confidence Interval.

24 and 60 months (33.8% vs. 18.4%, $p < 0.0001$) compared to those who did not receive hormonal testing (Table 4).

Discussion

Patients receiving specialist services are more likely to receive an initial adequate evaluation with hormonal testing as well as longer laboratory and radiologic follow-up compared to those not referred to a specialist, thus supporting our initial hypothesis. Likely as a result, the patients receiving specialist services were also more likely to receive surgical treatment of their incidentalomas, supporting our second hypothesis as well. The overall hormonal testing rate in our cohort was 28%, which falls well short of societal recommendations and is comparable to previous studies.[1,2,16] Surgery rates are comparable among those undergoing any hormonal evaluation, regardless of specialist status, at about 13%. Given the massive size of this patient cohort, these data suggest that 13% of all adrenal incidentaloma patients will require adrenal gland surgery for treatment. Extrapolating the 13% rate to the unevaluated patients in the cohort, we found that over 19,000 incidentaloma patients in TriNetX probably had laboratory criteria for surgical intervention and yet did not receive it, suggesting a significant failure in the treatment of these patients.

Of those undergoing hormonal evaluation, the most common testing was for cortisol and metanephrines, whereas far fewer patients were tested for DHEA and aldosterone. Strangely, DHEA testing was substantially greater than for aldosterone, despite hypersecretion of the latter being much more common.[20,21] Nevertheless, the clear inconsistencies in clinical practice seen here may be rectified by publicizing and reinforcing standardized testing guidelines such as those proposed by the European Society of Endocrinology (ESE), whose guidelines recommend that all patients with incidentaloma receive testing for cortisol-releasing tumors and pheochromocytomas.[1] Our data align with these recommendations as the vast majority of patients received cortisol and metanephrine/catecholamine testing. The guidelines stipulate that aldosteronoma testing should be reserved for those with accompanying hypertension or otherwise unexplained hypokalemia. Despite this, our data regarding aldosterone testing was still surprisingly low. This fits in with other studies that have demonstrated the rampant underdiagnosis of primary hyperaldosteronism, even when high-risk criteria are met.[22–24]

There are no societal guidelines regarding the timing of adrenal surgery in incidentaloma patients who require this intervention. However, studies have shown the beneficial effect of prompt surgical management in these cases.[25] Our data showed that patients referred to a specialist trended towards a lower rate of surgery, particularly in the absence of hormonal testing. A reason for this may be that a specialist is more likely to recommend additional or repeat hormonal testing and/or imaging prior to recommending surgery, especially if the initial hormonal testing is ordered by the patient's primary care provider or the inpatient team is equivocal. A specialist may also determine that hormonal testing may not be necessary, thereby foregoing surgery in these patients. Patients seen by a specialist had higher rates of surgery between 24 and 60 months after both hormonal testing and diagnosis of incidentaloma, respectively. Though this may be the effect of low sample size, it is also possible that these patients are having their condition more closely monitored due to being seen by a specialist and are therefore more likely to receive surgery in this time should they require it.

When adrenal surgery is not performed, recommendations for follow-up imaging vary based on the features of the incidentaloma. The ESE and the European Network for the Study of Adrenal Tumors recommend that for smaller incidentalomas with benign radiographical features, no additional imaging is required due to the low risk of malignant transformation.[1] For indeterminate lesions, it is suggested that follow-up imaging be obtained around 6 to 12 months after diagnosis to assess for growth.[1,11] Accordingly, our data show that referral to a specialist was associated with more follow-up abdominal imaging up to 60 months after diagnosis.

Only 27.8% of all incidentaloma patients underwent hormonal testing in our series which is substantially lower than the 48% testing rate reported in a UC Davis study done in 2020.[8] Additionally, a survey of abdominal radiologists also performed at UC Davis showed 43.4% of physicians rarely recommended hormonal evaluation and 35.2% of physicians never recommended patients for hormonal evaluation.[26] These observed differences demonstrate the variability amongst physicians in the clinical management of adrenal incidentalomas. Our findings also showed higher surgery rates when compared to data from the UC Davis survey. Clearly, our data and previously published studies indicate that most adrenal incidentalomas are not adequately evaluated; in fact, our large-scale data seem to suggest lack of testing may be common

than the other studies report. The low rates of specialist referral and appropriate hormonal evaluation may be attributable to both the lack of true guidelines for incidentaloma workup and potential lack of experience and/or expertise in managing incidentalomas. This may be repaired by promoting physician awareness of the underdiagnosis and underevaluation of incidentalomas.

There are several notable limitations to this study. The TriNetX database is based on diagnostic and procedural codes obtained from a patient's EHR. While information entered into an EHR has been shown to be accurate in various studies of validation,[26,27] we cannot guarantee the completeness of the data. Importantly, this may be why our specialist referral cohort represented such a small portion of incidentaloma patients. Furthering this issue, TriNetX did not contain a SNOMED code for endocrine surgery services. It is also worth noting that there is no single diagnostic code for adrenal incidentaloma, which led us to use a combination of codes as a proxy. An additional limitation is that TriNetX does not allow for assessment of individual patients, meaning we could not assess individual factors that may have prevented a patient from undergoing adrenal gland surgery, where they would otherwise have met criteria. Most notably, we were unable to determine the size of a patient's incidentaloma or any specific descriptions from their radiology reports. This would have a profound impact on management choices.

Nonetheless, our study was able to investigate and characterize a large group of patients with adrenal incidentalomas. Further, the findings of this study are significant as they confirm a low rate of referral to specialists as well as a profoundly low rate of appropriate hormonal evaluation of patients with incidentalomas and suggest that a sizeable proportion of patients are undertreated. Between these new data and existing single institutional data showing similar results, perhaps primary care physicians' awareness of the under-evaluation and treatment of adrenal incidentalomas will increase in response.

Conclusion

In patients with adrenal incidentaloma, referral to endocrinology or nephrology led to higher rates of hormonal testing and treatment with adrenal gland surgery. Additionally, we found that patients referred to a specialist may have more attention paid to their disease with additional laboratory testing and follow-up abdominal imaging. While many methods have been suggested to improve adherence to established guidelines, it is apparent that much work remains to be done. These data highlight the need for concerted efforts among primary care physicians to establish practice-wide testing and referral algorithms for patients with incidentaloma. With the epidemic of obesity and prevalence of difficult-to-manage hypertension, efforts to ensure adequate testing, follow-up and treatment for the subset of incidentaloma patients who require intervention should have a significant positive impact. Additional evaluation of practice-specific referral patterns is warranted to better understand the reasons that patients may not receive adequate evaluation or treatment for their disease.

Acknowledgement

Not applicable.

Funding Statement

This research received no external funding.

Author Contributions

Conceptualization: Adam R. Metwalli, Aaron R. Hochberg, Sohan S. Shah, Brian H. Im; Methodology: Adam R. Metwalli, Aaron R. Hochberg, Sohan S. Shah, Brian H. Im; Software: Aaron R. Hochberg, Sohan S. Shah, Brian H. Im; Formal analysis: Aaron R. Hochberg; Writing—original draft: Aaron R. Hochberg, Rasheed A. M. Thompson, Monika Shirodkar, Xiaoying Deng, Fitsum T. Hailemariam, Adam R. Metwalli; Writing—review & editing, Aaron R. Hochberg, Monika Shirodkar, Brian H. Im, Sohan S. Shah, Rasheed A. M. Thompson, Francisco Aguirre, Xiaoying Deng, Fitsum T. Hailemariam, Patrick T. Gomella, Mihir S. Shah, Costas D. Lallas, Adam R. Metwalli; Supervision: Monika Shirodkar, Xiaoying Deng, Fitsum T. Hailemariam, Adam R. Metwalli. All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials

Data proprietary to TriNetX (https://trinetx.com/).

Ethics Approval

This secondary analysis of de-identified data was deemed not to constitute human subjects research as per the policies of our institution (Sidney Kimmel Medical College at Thomas Jefferson University Hospital) and was therefore exempt from IRB approval.

Conflicts of Interest

The authors declare no conflict of interest.

Appendix A

TABLE A1. **Codes used to identify and characterize the management of Adrenal Incidentalomas in the TriNetX Database**

Diagnosis and management	Terms of code	Code
Adrenal adenoma	Other specified disorder of adrenal gland	ICD-10-CM E27.8
	Disorder of adrenal gland, unspecified	ICD-10-CM E27.9
	Benign neoplasm of unspecified adrenal gland	ICD-10-CM D35.00
	Neoplasm of uncertain behavior of unspecified adrenal gland	ICD-10-CM D44.10
Abdominal imaging	Computer tomography, abdomen	CPT 1010526
	Magnetic resonance (e.g., proton) imaging, abdomen	CPT 1010531
	Computer tomography, abdomen and pelvis	CPT 1020544
	CT of abdomen	SNOMED 169070004
	MRI of the abdomen	SNOMED 241621009
Endocrinology consult	Endocrinology services	CPT 1013306
	Referral to endocrinologist	SNOMED 306279007
	Endocrinologist review of results	LOINC 69053-7
Nephrology consult	Referral to nephrologist	SNOMED 3062860007
	Referral to nephrology service	SNOMED 306125004
	Nephrology service	SNOMED 310056007
Urology consult	Referral to urologist	SNOMED 306318004
	Referral to urology service	SNOMED 306201000
General surgery consult	Referral to general surgical service	SNOMED 183542009
Adrenal gland surgery	Anesthesia for extraperitoneal procedures in lower abdomen, including urinary tract; adrenalectomy	CPT 00866
	Adrenalectomy, partial or complete, pr exploration of adrenal gland with or without biopsy, transabdominal, lumbar or dorsal (separate procedure)	CPT 50540
	Laparoscopy, surgical; radical nephrectomy (includes removal of Gerota's fascia and surrounding fatty tissue, removal or regional lymph nodes, and adrenalectomy)	CPT 60545
	Adrenalectomy, partial or complete, or exploration of adrenal gland with or without biopsy, transabdominal, lumbar or dorsal (separate procedure); with excision of adjacent retroperitoneal tumor	CPT 60545
	Laparoscopy, surgical, with adrenalectomy, partial or complete, or exploration of adrenal gland with or without biopsy, transabdominal, lumbar or dorsal	CPT 60650

(Continued)

TABLE A1. **(Continued)**

Diagnosis and management	Terms of code	Code
	Adrenalectomy, partial or complete, or exploration of adrenal gland with or without biopsy, transabdominal, lumbar or dorsal (separate procedure)	CPT 1014228
	Endocrine System/Excision/Adrenal Gland, Left	ICD-10-PCS 0GB2
	Endocrine System/Excision/Adrenal Gland, Right	ICD-10-PCS 0GB3
	Endocrine System/Excision/Adrenal Glands, Bilateral	ICD-10-PCS 0GB4
	Endocrine System/Resection/Adrenal Gland, Left	ICD-10-PCS 0GT2
	Endocrine System/Resection/Adrenal Gland, Right	ICD-10-PCS 0GT3
	Endocrine System/Resection/Adrenal Gland, Bilateral	ICD-10-PCS 0GT4
	Radical nephrectomy AND ipsilateral adrenalectomy	SNOMED 116166009
	Adrenalectomy	SNOMED 31904001
	Total adrenalectomy	SNOMED 367531007
	Laparoscopic adrenalectomy	SNOMED 42843004
Adrenal histology	Secondary malignant neoplasm of adrenal gland	C79.7
	Adrenal gland, NOS	ICD-O C74.9
	Pheochromocytoma	ICD-O 8700/3
	Cortex of adrenal gland	ICD-O C74.0
	Medulla of adrenal gland	ICD-O C74.1
	Adrenal cortical carcinoma	ICD-O 8370/3
	Neuroendocrine carcinoma	ICD-O 8246/3
	Neuroendocrine tumor, NOS	ICD-O 8240/3
	Adenoma, NOS	ICD-O 8140/0

Note. CT, Computer Tomography; **MRI,** Magnetic Resonance Imaging; **NOS**, Not Otherwise Specified; **ICD,** International Classification of Diseases; **CPT,** Current Procedural Terminology; **SNOMED,** Systematized Nomenclature of Medicine; **LOINC,** Logical Observation Identifiers Names and Codes; **ICD-O,** International Classification of Diseases of Oncology.

TABLE A2. **Codes used for hormonal testing**

Hormone	Laboratory value	Code
Cortisol	Cortisol [Mass/volume] in serum or plasma	TNX Curated 9035
	Cortisol [mass/volume] in serum or plasma—AM peak specimen	LOINC 9813-7
	Cortisol [Mass or Moles/volume] in serum or plasma—AM peak specimen	LOINC 66735-2
	Cortisol [Mass/volume] in Serum or Plasma—9 h post 1 mg dexamethasone PO overnight	LOINC 1440-7
	Cortisol [Mass/volume] in serum or plasma—8 h post 1 mg dexamethasone PO overnight	LOINC 1434-0
Aldosterone/Renin	Aldosterone/Renin [Ratio] in plasma	LOINC 30894-0
	Aldosterone and renin activity panel—plasma	LOINC 55151-5
DHEA-oma	Dehydroepiandrosterone (DHEA)	CPT 82626
	Dehydroepiandrosterone-sulfate (DHEA-S)	CPT 82627
	Dehydroepiandrosterone-sulfate (DHEA-S) [Mass/volume] in Serum or Plasma	LOINC 2191-5
	Dehydroepiandrosterone (DHEA) [Mass/volume] in Serum or Plasma	LOINC 2193-1
	Dehydroepiandrosterone (DHEA).unconjugated [Mass/volume] in Serum or Plasma	LOINC 2196-4
Metanephrines/ Catecholamines	Metanephrines [Moles/volume] in serum or plasma	LOINC 25474-8
	Metanephrine/Creatinine [Molar ratio] in urine	LOINC 14831-2
	Metanephrine [Moles/volume] in urine	LOINC 34339-2
	Metanephrines [Mass/volume] in Serum or Plasma	LOINC 29142-7
	Metanephrine free [moles/volume] in serum or plasma	LOINC 49700-8
	Metanephrine [mass/time] in 24 h urine	LOINC 19049-6
	Metanephrines [mass/time] in 24 h urine	LOINC 2609-6
	Metanephrine free [mass/volume] in serum or plasma	LOINC 38494-1

(Continued)

TABLE A2. **(Continued)**

Hormone	Laboratory value	Code
	Metanephrine [mass/volume] in 24 h urine	LOINC 21019-5
	Metanephrine/Creatinine [Mass ratio] in 24 h urine	LOINC 35644-4
	Metanephrine [Moles/volume] in serum or plasma	LOINC 25473-0
	Metanephrine [mass/volume] in serum or plasma	LOINC 29141-9
	Metanephrines [mass/volume] in 24 h urine	LOINC 19050-4
	Metanephrine/Creatinine [mass ratio] in urine	LOINC 9645-3
	Metanephrines [mass/volume] in urine	LOINC 2608-8
	Metanephrine and normetanephrine [interpretation] in urine narrative	LOINC 49283-5
	Metanephrine and normetanephrine [interpretation] in serum or plasm	LOINC 45021-3
	Metanephrine [mass/volume] in urine	LOINC 11139-3
	Metanephrines/creatinine [mass ratio] in urine	LOINC 13771-1
	Metanephrines	CPT 83835
	Catecholamines [Mass/Volume] in Plasma	LOINC 2056-0
	Catecholamines [Interpretation] in Plasma Narrative	LOINC 49257-9
	Catecholamines [Interpretation] in Urine Narrative	LOINC 49256-1
	Catecholamines [Mass/Volume] in Blood	LOINC 2055-2
	Catecholamines	CPT 1011327
	Catecholamines fractionated	CPT 82384

Note. **DHEA,** Dehydroepiandrosterone; **DHEA-S,** Dehydroepiandrosterone-Sulfate; **AM**, *Ante meridiem;* **PO**, *Per os;* **TNX**, TriNetX; **LOINC,** Logical Observation Identifiers Names and Codes; **CPT,** Current Procedural Terminology.

TABLE A3. **Histological characteristics of tumors in patients who underwent adrenal surgery—limited available data on histology is available through the TriNetX database**

Adrenal mass type	Specialist consult + Surgery (N, %)	No specialist consult + Surgery (N, %)
Secondary malignancy	12, 18.2%	692, 13.1%
Adrenal gland, NOS	0	58, 1.1%
Adrenal cortical carcinoma	0	44, 0.8%
Pheochromocytoma	0	33, 0.6%
Cortex of the adrenal gland	0	22, 0.4%
Medulla of the adrenal gland	0	10*, 0.2%
Neuroendocrine carcinoma	0	10*, 0.2%
Neuroendocrine tumor, NOS	0	10*, 0.2%
Adenoma, NOS	0	0

Note. *Denotes ≤10 instances; NOS, Not otherwise specified.

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