

## ORIGINAL RESEARCH

# Trends in resource utilization for new-onset psychosis hospitalizations at children's hospitals

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## Abstract

**Background:** Children with new-onset psychosis often require hospitalization for medical evaluation.

**Objectives:** The goal of this study was to assess variations in the management of children with new-onset psychosis and characterize trends in resource utilization.

**Methods:** The study included index hospitalizations for children ages 7–18 admitted to children's hospitals with a primary diagnosis of psychosis from 2011 to 2022 using the Pediatric Health Information System (PHIS) database. Children with a complex chronic condition were excluded. Resource utilization categories included medication, imaging, laboratory, and other clinical resources. Variability in resource utilization was assessed using covariance tests for random intercepts with generalized linear models after adjusting for age, sex, payor, and severity. Trends in resource utilization were examined using generalized estimating equations adjusting for the same factors and accounting for hospital clustering.

**Results:** Our data set included 7126 new-onset psychosis hospitalizations from 37 children's hospitals. Teenage males and non-Hispanic Whites were most likely to be hospitalized. There was a significant variation in resource utilization across hospitals in all categories ( $p < .001$ ). The most frequently utilized resources were antipsychotic medications (76%), serum chemistry (77%), toxicology labs (72%), and brain magnetic resonance imaging (22%). The most notable increases in utilization were in the performance of laboratory tests, brain imaging, anesthetic use, and intravenous immunoglobulin use.

**Conclusion:** Study findings suggest that there has been a stable rate of hospitalization for children with new-onset psychosis, yet a significant variation in the medical evaluation exists. Significant increases and variations in resource utilization across all categories suggest an emerging need for robust evidence and consensus-based practice guidelines.

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## INTRODUCTION

Psychosis, defined as impaired reality with disruptions in thinking, perceptions, and behavior<sup>1</sup>, is one of the most frequent and costly pediatric mental health diagnoses requiring hospitalization.<sup>2</sup> Symptoms can include hallucinations, delusions, disorganized speech, and other abnormal psychomotor behaviors.<sup>3</sup> Each year, 100,000 young adults experience new-onset psychosis in the United States, with peak onset between ages 15 and 25.<sup>1,4</sup> Recent data suggest that the prevalence of psychosis symptoms in pediatric patients is approximately 17% for children between 9 and 12 years of age and 7.5% among children between 13 and 18 years of age.<sup>5</sup>

Despite its incidence, managing psychosis in an inpatient setting remains a clinical challenge. Most patients with new-onset psychosis do not go on to develop a primary psychotic disorder, and the differential diagnosis for secondary psychosis is broad.<sup>1,6</sup> Secondary psychosis can be the presenting feature of multiple medical conditions such as neurologic disorders, endocrine disorders, drug or toxin-mediated syndromes, and others.<sup>7</sup> Expert opinions vary on the extent of medical evaluation that patients should undergo during an index hospitalization.<sup>8-10</sup> Crucially, a delay in or nontreatment of secondary psychosis in pediatric inpatients can lead to significant morbidity and even mortality.<sup>7</sup>

Not enough is known about how to evaluate a child presenting with new-onset psychosis in the hospital setting. Thus, the objectives of this study were to assess variations in the evaluation and management of children hospitalized with a new-onset psychosis across US children's hospitals and to characterize trends in resource utilization over time.

## METHODS

This was a retrospective, cross-sectional study of the Pediatric Health Information System (PHIS; Children's Hospital Association) database, which contains data from 49 tertiary care children's hospitals. Of the 49 hospitals, 37 consistently participated in PHIS during the study period and were included in the study. All submitted data are de-identified. Data quality and reliability are assured through a joint effort between the Children's Hospital Association and the respective hospitals. This study was approved for exemption by the institutional review board of the University of Texas Southwestern.

### Study population

Children 7–18 years of age with a primary discharge diagnosis of psychosis between January 2011 and December 2022 were included. Patient-level variables included age (stratified as 7–10, 11–14, and 15–18), gender, race and ethnicity, payor (government, private, or other), discharge disposition (home, skilled facility, or other), and year (stratified as 2011–2013, 2014–2016, 2017–2019, and 2020–2022). Only index encounters were included to capture new-onset psychosis. Children with complex chronic conditions were

excluded as they may have underlying conditions affecting their evaluation and management.<sup>11</sup> The Childhood and Adolescent Mental Health Disorders Classification System (CAMHD-CS) was used to identify diagnoses that met the criteria for inclusion.<sup>12</sup> Diagnoses were manually identified under categories of bipolar disorders, schizophrenia, and other psychotic disorders to best define a patient with psychosis symptoms (Appendix A).

### Measures of resource utilization

Utilization was identified from billing data and categorized as medication, imaging, laboratory, and other clinical resources<sup>10</sup> (Appendix B). Medications included anesthetics, antidepressants, antiemetics, antiepileptics, antipsychotics, anxiolytics, intravenous immunoglobulin (IVIG), mood stabilizers, and steroids. Imaging included brain magnetic resonance imaging (MRI), head computer tomography (CT), head ultrasound, abdominal imaging, reproductive imaging, and spinal imaging. Laboratory studies evaluated blood, urine, and cerebrospinal fluid samples and were categorized as autoimmune, chemistry, cerebrospinal (CSF) studies, endocrine, thyroid labs, hematology, infectious disease, toxicology, and urine studies. Other clinical resources included electroencephalogram (EEG), electrocardiogram (EKG), and therapy services such as physical (PT), occupational (OT), and speech therapy (ST). The tests and treatments were included based on existing literature, our local experience, availability at most children's hospitals, and data from the PHIS database.

### Statistical analysis

Categorical variables were summarized using frequencies and percentages. Variability in resource use across hospitals was assessed using covariance tests for random intercepts with generalized linear models with binomial distributions after adjusting for age, sex, payor, and severity. Trends in resource utilization across years were examined using generalized estimating equations adjusting for age, sex, payor, severity, and accounting for hospital clustering. All statistical analyses were performed using SAS version 9.4 (SAS Institute), and  $p < .05$  was considered statistically significant.

## RESULTS

This study included 7126 new-onset psychosis hospitalizations from 37 hospitals. About half of them were male and had government payors, and a large proportion (80.6%) were discharged home following hospitalization (Table 1).

### Variations in resource utilization

There was a statistically significant variation in resource use across all hospitals. This variation was significant in all categories of

**TABLE 1** Demographic and clinical characteristics of children hospitalized with new-onset psychosis.

		N (%)
Age (years)	7–10	883 (12.4)
	11–14	2080 (29.2)
	15–18	4163 (58.4)
Gender	Male	4138 (58.1)
	Female	2986 (41.9)
Race and ethnicity	Non-Hispanic White	2958 (41.5)
	Non-Hispanic Black	2129 (29.9)
	Hispanic	1256 (17.6)
	Asian	162 (2.3)
	Other	621 (8.7)
Payor	Government	3716 (57.5)
	Private	2346 (36.3)
	Other	401 (6.2)
Discharge disposition	Home	5215 (80.7)
	Skilled Facility	132 (1.9)
	Other <sup>a</sup>	1116 (17.3)
Year	2011–2013	1704 (23.9)
	2014–2016	1863 (26.1)
	2017–2019	1674 (23.5)
	2020–2022	1885 (26.5)

<sup>a</sup>Other Discharge Disposition includes transfer to a Psychiatric Hospital (67.8%) Designated Cancer Center or Children's Hospital (11.2%), Type of Health Care Institution not Defined Elsewhere (6.3%), Against Medical Advice (4.2%), and Inpatient Rehabilitation Facility (1.8%).

medications, imaging, laboratory, and other clinical resources (all  $p < .01$ , Figure 1). The most notable variation was in the utilization of CSF studies (median: 38.8 [interquartile range (IQR): 21.8, 55.8]), brain MRI (median: 30.9, [IQR: 19.3, 42.9]), anesthetic use (median: 15, [IQR: 7.6–33.3]), and use of therapy services (median: 64.3, [IQR: 43.8, 75.4]).

### Trends in resource utilization

Although the number of children hospitalized with new-onset psychosis did not increase notably over the study period ( $p = .059$ ; Table 1), resource utilization has significantly increased in all categories including medications, imaging, laboratory, and other clinical resources (all  $p < .001$ , Figure 2).

(a) *Medication utilization*: Trends suggest a significant increase in the use of anesthetic medication (adjusted odds ratio [aOR]: 3.4, 95% confidence interval [CI]: 2.0–5.8) and IVIG (aOR: 1.7, 95% CI: 1.3–2.2) (Figure 2).

(b) *Imaging utilization*: Brain MRI use (aOR: 1.9, 95% CI: 1.4–2.5) has significantly increased over time. Head CT was commonly performed, and frequency was stable over the course of the study.

(c) *Laboratory utilization*: Trends in laboratory utilization suggest a significant increase in the use of autoimmune labs (aOR: 4.1, 95% CI: 2.5–6.7) and infectious disease labs (aOR: 6.2, 95% CI: 3.7–10.4).

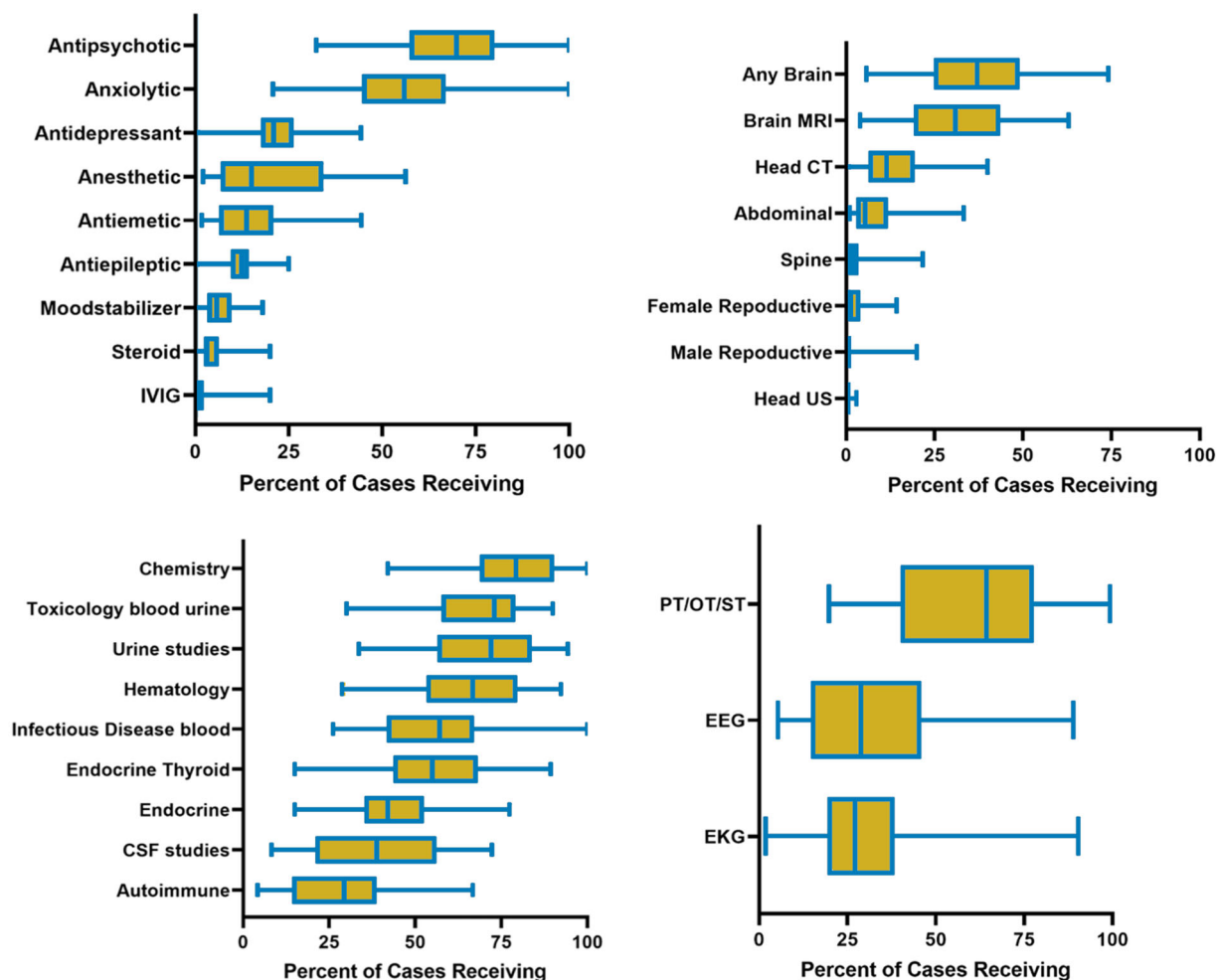
(d) *Other clinical resources*: Performance of both EEG (aOR: 2.1, 95% CI: 1.4–3.1) and EKGs (aOR: 1.0, 95% CI: 0.6–1.6) have increased over time ( $p = .012$  and  $p = .72$ , respectively).

### DISCUSSION

Our multicenter, retrospective study results show that there is a significant variation across children's hospitals in the management of children with new-onset psychosis. Findings also suggest an increase in resource utilization over the study period.

There is significant interhospital variability in the management of patients with new-onset psychosis across all four resource categories, most notable in CSF studies, brain MRI, anesthetic use, and use of therapy services. This variation in the management may be due to a number of reasons. Many medical conditions such as infectious disease, endocrinopathies, drug and toxin ingestions, and neurological conditions can present with symptoms of new-onset psychosis.<sup>10,13</sup> Because psychosis is often the only presenting symptom, the broad differential can make it challenging to limit the labs and imaging studies that are ordered for an otherwise undifferentiated patient, even after a thorough history and physical exam.<sup>9,14</sup> Variability may also exist because of a lack of national, standardized guidelines for diagnostic approaches to this patient population.<sup>15</sup> National guidelines can facilitate a stepwise approach to the identification and management of common and uncommon diagnoses.<sup>16</sup> Balancing early, accurate diagnosis with judicious use of healthcare resources for these patients is important. Nondiagnostic or low-yield testing may delay diagnosis and treatment of psychosis,<sup>17–20</sup> and misdiagnosis or unnecessary treatment can be equally harmful.<sup>4</sup> Our findings add to existing literature that highlights the need for future multidisciplinary investigation to help optimize the care of this complex patient population.

There are several implications when attempting to understand the increase in utilization of resources from 2011 to 2022, despite a stable rate of hospitalization for new-onset psychosis. The increase in diagnostic testing for new-onset psychosis may be part of a global trend of increasing unnecessary testing across the entire healthcare spectrum.<sup>21</sup> As previously mentioned, the lack of consensus guidelines can place physicians caring for children with new-onset acute psychosis in a difficult situation when deciding the extent of medical workup to pursue. Part of the reason for increased resource utilization could be related to increased awareness of and/or prevalence of pediatric mental health disorders in the last decade.<sup>22,23</sup> The increase in utilization of anesthetic medication, brain MRI, and CSF studies is of particular clinical interest. A potential explanation may be due to an

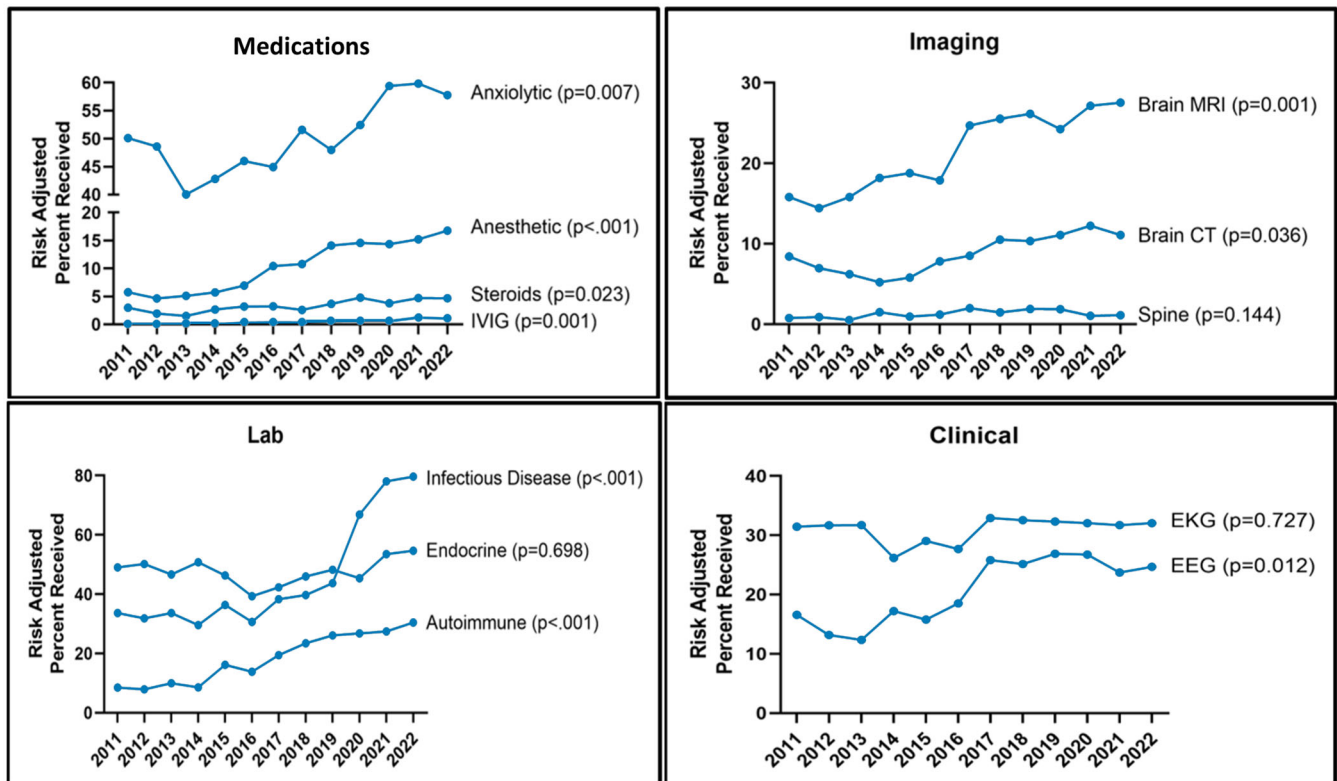


**FIGURE 1** Variability across hospitals in resource utilization.

increased concern for neurologic causes of new-onset psychosis such as autoimmune encephalitis (AIE).<sup>24,25</sup> In 2014, psychosis was found to be the 3rd most resource-demanding pediatric inpatient mental health diagnosis.<sup>2</sup> While our study did not specifically analyze costs related to resource utilization for children with new-onset psychosis, it does shed light on the potential impact of increasing imaging, labs, and other testing over time. Increased utilization of laboratory tests such as infectious disease labs, hematology labs, and autoimmune labs may be of little consequence as the benefits of lab work far outweigh the risks. However, increased utilization of invasive procedures such as brain MRI and lumbar puncture to obtain CSF studies, which often require sedation in the pediatric population, must be approached in a thoughtful and considerate manner. This study did not allow an analysis of any results or outcomes of medical testing and evaluation that was conducted. However, Muhrer et al. suggested that extensive medical workup for new-onset psychosis is typically unrevealing.<sup>26</sup> This is similar to prior studies done in the adult patient population.<sup>27</sup> For example, structural brain imaging in children with new-onset psychosis is often unrevealing and does not affect the management of patients undergoing medical evaluation.<sup>28-30</sup> Since caring for children often involves multiple disciplines, perhaps a strategy to manage

resources and mitigate risks could be to approach care in a multi-disciplinary fashion with hospitalists, neurologists, and psychiatrists sharing clinical perspectives regarding the extent of medical testing that should be done in each case.<sup>15</sup>

There are several limitations to this study. First, the study population was identified using primary discharge diagnosis codes, which are subject to coding errors. A lack of an established definition for “new-onset psychosis” and the heterogeneity of the population make it possible that the 10th revision of the International Classification of Diseases (ICD-10) codes selected in this study may not be fully representative of the population. This introduces the opportunity for misclassification bias in our analysis. Also, the details of the initial presentation could not be captured. An understanding of the patient’s initial presentation including the presence or absence of focal neurologic findings on exam or any “red flag” features on history would provide more insight into the trends in resource utilization. The inability to capture the full clinical picture could lead to interpretation bias. Additionally, the PHIS database uses billing data to identify resource utilization, but it cannot capture the indication for an intervention or the results of any test. Patients receiving intense psychotic therapies may need tests and treatments for monitoring



**FIGURE 2** Risk adjusted\* trends in select resources across years. \*Risk adjusted for age, sex, payor, severity, and accounting for hospital clustering. CT, computed tomography; IVIG, immunoglobulin; MRI, magnetic resonance imaging.

and titration of medicines including sedation during testing. Thus, it is possible that the study findings, specifically regarding resource utilization over time, are overstated or lack important clinical context. Lastly, this study is limited to practices at tertiary care children's hospitals and cannot be generalized to all settings that may care for children with new-onset psychosis.

## CONCLUSIONS

In conclusion, our study suggests that there is a significant variation across children's hospitals in the evaluation and management of children hospitalized with new-onset psychosis. Resource utilization for the initial workup for this patient population increased significantly in all examined categories. The next steps would involve additional subgroup analyses within conditions presenting as acute psychosis. This could then help develop an evidence-based practice guideline to guide clinicians in managing hospitalized children with new-onset psychosis.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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## APPENDIX A

Mental health disorder group	International classification of diseases code	Version	Description
Bipolar and related disorders	2967	9	Bipolar I disorder, most recent episode (or current) unspecified
Bipolar and related disorders	29600	9	Bipolar I disorder, single manic episode, unspecified
Bipolar and related disorder	29601	9	Bipolar I disorder, single manic episode, mild
Bipolar and related disorders	29602	9	Bipolar I disorder, single manic episode, moderate
Bipolar and related disorders	29604	9	Bipolar I disorder, single manic episode, severe, specified as with psychotic behavior
Bipolar and related disorders	29644	9	Bipolar I disorder, most recent episode (or current) manic, severe, specified as with psychotic behavior
Bipolar and related disorders	29654	9	Bipolar I disorder, most recent episode (or current) depressed, severe, specified as with psychotic behavior
Bipolar and related disorders	F302	10	Manic episode, severe with psychotic symptoms
Mental health symptom	7801	9	Hallucinations
Mental health symptom	R440	10	Auditory hallucinations
Mental health symptom	R441	10	Visual hallucinations
Mental health symptom	R442	10	Other hallucinations
Mental health symptom	R443	10	Hallucinations, unspecified
Mental health symptom	R462	10	Strange and inexplicable behavior
Miscellaneous	F28	10	Other psychotic disorders not due to a substance or known physiological condition
Neurocognitive disorders	29381	9	Psychotic disorder with delusions in conditions classified elsewhere
Neurocognitive disorders	29382	9	Psychotic disorder with hallucinations in conditions classified elsewhere
Schizophrenia spectrum and other psychotic disorders	2970	9	Paranoid state, simple
Schizophrenia spectrum and other psychotic disorders	2971	9	Delusional disorder
Schizophrenia spectrum and other psychotic disorders	2972	9	Paraphrenia
Schizophrenia spectrum and other psychotic disorders	2973	9	Shared psychotic disorder
Schizophrenia spectrum and other psychotic disorders	2978	9	Other specified paranoid states
Schizophrenia spectrum and other psychotic disorders	2979	9	Unspecified paranoid state
Schizophrenia spectrum and other psychotic disorders	2980	9	Depressive type psychosis
Schizophrenia spectrum and other psychotic disorders	2981	9	Excitative type psychosis
Schizophrenia spectrum and other psychotic disorders	2983	9	Acute paranoid reaction
Schizophrenia spectrum and other psychotic disorders	2984	9	Psychogenic paranoid psychosis
Schizophrenia spectrum and other psychotic disorders	2988	9	Other and unspecified reactive psychosis

(Continued)

Mental health disorder group	International classification of diseases code	Version	Description
Schizophrenia spectrum and other psychotic disorders	2989	9	Unspecified psychosis
Schizophrenia spectrum and other psychotic disorders	29500	9	Simple type schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29501	9	Simple type schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29502	9	Simple type schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29503	9	Simple type schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29504	9	Simple type schizophrenia, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29505	9	Simple type schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	29510	9	Disorganized type schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29511	9	Disorganized type schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29512	9	Disorganized type schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29513	9	Disorganized type schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29514	9	Disorganized type schizophrenia, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29515	9	Disorganized type schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	29520	9	Catatonic type schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29521	9	Catatonic type schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29522	9	Catatonic type schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29523	9	Catatonic type schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29524	9	Catatonic type schizophrenia, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29525	9	Catatonic type schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	29530	9	Paranoid type schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29531	9	Paranoid type schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29532	9	Paranoid type schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29533	9	Paranoid type schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29534	9	Paranoid type schizophrenia, chronic with acute exacerbation

(Continued)

Mental health disorder group	International classification of diseases code	Version	Description
Schizophrenia spectrum and other psychotic disorders	29535	9	Paranoid type schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	29540	9	Schizophreniform disorder, unspecified
Schizophrenia spectrum and other psychotic disorders	29541	9	Schizophreniform disorder, subchronic
Schizophrenia spectrum and other psychotic disorders	29542	9	Schizophreniform disorder, chronic
Schizophrenia spectrum and other psychotic disorders	29543	9	Schizophreniform disorder, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29544	9	Schizophreniform disorder, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29545	9	Schizophreniform disorder, in remission
Schizophrenia spectrum and other psychotic disorders	29550	9	Latent schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29551	9	Latent schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29552	9	Latent schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29553	9	Latent schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29554	9	Latent schizophrenia, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29555	9	Latent schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	29560	9	Schizophrenic disorders, residual type, unspecified
Schizophrenia spectrum and other psychotic disorders	29561	9	Schizophrenic disorders, residual type, subchronic
Schizophrenia spectrum and other psychotic disorders	29562	9	Schizophrenic disorders, residual type, chronic
Schizophrenia spectrum and other psychotic disorders	29563	9	Schizophrenic disorders, residual type, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29564	9	Schizophrenic disorders, residual type, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29565	9	Schizophrenic disorders, residual type, in remission
Schizophrenia spectrum and other psychotic disorders	29570	9	Schizoaffective disorder, unspecified
Schizophrenia spectrum and other psychotic disorders	29571	9	Schizoaffective disorder, subchronic
Schizophrenia spectrum and other psychotic disorders	29572	9	Schizoaffective disorder, chronic
Schizophrenia spectrum and other psychotic disorders	29573	9	Schizoaffective disorder, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29574	9	Schizoaffective disorder, chronic with acute exacerbation

(Continued)

Mental health disorder group	International classification of diseases code	Version	Description
Schizophrenia spectrum and other psychotic disorders	29575	9	Schizoaffective disorder, in remission
Schizophrenia spectrum and other psychotic disorders	29580	9	Other specified types of schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29581	9	Other specified types of schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29582	9	Other specified types of schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29583	9	Other specified types of schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29584	9	Other specified types of schizophrenia, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29585	9	Other specified types of schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	29590	9	Unspecified schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	29591	9	Unspecified schizophrenia, subchronic
Schizophrenia spectrum and other psychotic disorders	29592	9	Unspecified schizophrenia, chronic
Schizophrenia spectrum and other psychotic disorders	29593	9	Unspecified schizophrenia, subchronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29594	9	Unspecified schizophrenia, chronic with acute exacerbation
Schizophrenia spectrum and other psychotic disorders	29595	9	Unspecified schizophrenia, in remission
Schizophrenia spectrum and other psychotic disorders	F060	10	Psychotic disorder with hallucinations due to known physiological condition
Schizophrenia spectrum and other psychotic disorders	F061	10	Catatonic disorder due to known physiological condition
Schizophrenia spectrum and other psychotic disorders	F200	10	Paranoid schizophrenia
Schizophrenia spectrum and other psychotic disorders	F201	10	Disorganized schizophrenia
Schizophrenia spectrum and other psychotic disorders	F202	10	Catatonic schizophrenia
Schizophrenia spectrum and other psychotic disorders	F203	10	Undifferentiated schizophrenia
Schizophrenia spectrum and other psychotic disorders	F205	10	Residual schizophrenia
Schizophrenia spectrum and other psychotic disorders	F2081	10	Schizophreniform disorder
Schizophrenia spectrum and other psychotic disorders	F2089	10	Other schizophrenia
Schizophrenia spectrum and other psychotic disorders	F209	10	Schizophrenia, unspecified
Schizophrenia spectrum and other psychotic disorders	F22	10	Delusional disorders

(Continued)

Mental health disorder group	International classification of diseases code	Version	Description
Schizophrenia spectrum and other psychotic disorders	F23	10	Brief psychotic disorder
Schizophrenia spectrum and other psychotic disorders	F24	10	Shared psychotic disorder
Schizophrenia spectrum and other psychotic disorders	F250	10	Schizoaffective disorder, bipolar type
Schizophrenia spectrum and other psychotic disorders	F251	10	Schizoaffective disorder, depressive type
Schizophrenia spectrum and other psychotic disorders	F258	10	Other schizoaffective disorders
Schizophrenia spectrum and other psychotic disorders	F259	10	Schizoaffective disorder, unspecified
Schizophrenia spectrum and other psychotic disorders	F29	10	Unspecified psychosis not due to a substance or known physiological condition

## APPENDIX B

## Medications

## Anesthetics

Propofol  
Fentanyl (base) (citrate)  
Dexmedetomidine HCl  
Rocuronium bromide  
Ketamine HCl  
Morphine sulfate  
Pentobarbital sodium  
Etomidate  
Vecuronium bromide

## Antibiotics

Cephalexin (HCl) (monohydrate)  
Antibiotic combinations  
Azithromycin (dihydrate)  
Ceftriaxone sodium  
Sulfamethoxazole and trimethoprim (co-trimoxazole)  
Clindamycin (HCl) (palmitate) (phosphate)  
Amoxicillin trihydrate and potassium clavulanate  
Doxycycline (calcium) (hydrate) (monohydrate)  
Metronidazole (HCl)  
Vancomycin (HCl)  
Cefazolin sodium  
Nitrofurantoin  
Ciprofloxacin (HCl)  
Penicillin V potassium  
Penicillin G benzathine  
Antibiotic and steroid combinations  
Cefdinir  
Ampicillin sodium and sulbactam sodium  
Cefotaxime sodium  
Penicillin G benzathine and procaine

## Medications

Ampicillin (anhydrous) (sodium) (trihydrate)  
Nafcillin sodium  
Cefadroxil (monohydrate)  
Cefoxitin sodium  
Cefprozil (anhydrous)  
Cefixime  
Clarithromycin  
Tetracycline HCl  
Linezolid  
Rifaximin  
Neomycin sulfate and polymyxin B sulfate  
Rifampin  
Amoxicillin trihydrate  
Minocycline (HCl)

## Antidepressants

Sertraline HCl  
Fluoxetine HCl  
Trazodone HCl  
Escitalopram oxalate  
Bupropion (HBr) (HCl)  
Citalopram HBr  
Duloxetine HCl  
Venlafaxine  
Amitriptyline HCl  
Paroxetine (HCl) (mesylate)  
Desvenlafaxine  
Mirtazapine

## Anti-emetics

Promethazine HCl  
Ondansetron HCl

## Anti-epileptics

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**Medications**

Valproic acid and derivatives  
Clonazepam  
Oxcarbazepine  
Topiramate  
Levetiracetam  
Zonisamide  
Carbamazepine  
Clobazam  
Ethosuximide  
Lacosamide  
Antipsychotics  
Risperidone  
Olanzapine  
Aripiprazole  
Haloperidol (decanoate) (lactate)  
Quetiapine fumarate  
Ziprasidone (HCl) (mesylate)  
Chlorpromazine HCl  
Clozapine  
Asenapine  
Paliperidone  
Lurasidone HCl  
Perphenazine

**Anxiolytics**

Lorazepam  
Diphenhydramine (citrate) (HCl)  
Hydroxyzine (HCl) (pamoate)  
Midazolam HCl  
Alprazolam  
Diazepam  
Buspirone HCl

**Immune globulin (IVIG)****Mood stabilizers**

Lithium (carbonate) (citrate)  
Lamotrigine

**Steroids**

Dexamethasone  
Methylprednisolone  
Prednisone  
Prednisolone  
Hydrocortisone  
Beclomethasone dipropionate

**Imaging Brain MRI****Head CT****Head ultrasound****Abdominal imaging**

Abdomen supine X-ray  
Upper abdomen ultrasound real-time  
Noninvasive vascular ultrasound of the abdomen  
Retroperitoneum ultrasound real-time  
Abdomen supine upright decubitus and cross-table X-ray

**Medications**

Abdomen and pelvis CT scan  
Noninvasive vascular Doppler of the abdomen  
Lower abdomen MRI  
Upper abdomen MRI  
Upper abdomen ultrasound B-mode  
Lower abdomen CT scan  
Noninvasive vascular ultrasound of thoracic and abdominal aorta  
Noninvasive vascular Doppler of thoracic and abdominal aorta  
Abdomen arteriography CT scan

**Laboratory studies****Autoimmune labs**

Antinuclear antibody (ANA)  
Other specified immunology antibody  
Antimicrobial antibody  
Antithyroglobulin antibody  
Anti-DNA antibody  
SSA autoantibody  
Neuronal antibody  
IgG  
Anti-Sm (Smith) antibody  
C3  
Acetylcholine receptor antibody  
SSB autoantibody  
Anti GAD 65  
C4  
Antiribonucleoprotein antibody (RNP antibody)  
Anticardiolipin antibody  
IgA  
Anti-DNase B antibody  
Immunology antibody unspecified  
IgG  
Rheumatoid factor (RF)  
Antineutrophilic cytoplasmic antibody (ANCA) (ACPA)  
IgM  
Immunoglobulins  
Anti-Scl 70 antibody  
Ribosomal P antibody  
Total complement activity  
Antibody screen  
IgG  
Other specified immunology test  
Immunology test unspecified  
Endomysial antibody  
Anticentromere antibody  
IgE  
Neuromyelitis optica  
Anti-smooth muscle antibody  
Myelin  
Thyroxine binding globulin (TBG)  
Insulin antibody  
IgD  
Immunology profile  
Immunology antibody unspecified

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## Laboratory studies

Antiadrenal antibody  
 Anti-hu TransG  
 Parietal cell antibody  
 Reticulin antibody  
 Intrinsic factor antibody

## Chemistry

14-test chemistry profile  
 Lipid unspecified  
 8-test chemistry profile  
 Liver profile  
 Gamma-glutamyl transpeptidase (GGT)  
 Alanine aminotransferase (ALT)  
 Creatinine  
 Ceruloplasmin  
 Vitamin B12  
 Aspartate aminotransferase (AST)  
 Urea nitrogen  
 Phosphorus  
 Magnesium  
 Alkaline phosphatase  
 Albumin  
 Folate  
 Potassium  
 Ammonia  
 Sodium  
 Total bilirubin  
 Calcium  
 Creatine kinase (CK)  
 Chloride  
 Carbon dioxide (CO<sub>2</sub>)  
 Direct bilirubin  
 Total protein  
 Total cholesterol  
 Copper  
 Electrolyte profile  
 Vitamin D  
 Triglycerides  
 High-density lipoprotein (HDL)  
 Fasting blood glucose  
 Low-density lipoprotein (LDL)  
 Random glucose  
 Glucose unspecified  
 Ionized calcium  
 Kidney profile  
 Lipase  
 Lactate dehydrogenase (LD) (LDH)  
 Chemistry test unspecified  
 Vitamin B1  
 Indirect bilirubin  
 Total protein  
 Creatinine  
 Magnesium  
 Amylase  
 Prealbumin

## Laboratory studies

Albumin  
 Homocysteine  
 Other multitest chemistry profile  
 Troponin  
 Calcitriol  
 Magnesium  
 Vitamin B6  
 Tissue transglutaminase (TTG)  
 Albumin  
 Alkaline phosphatase  
 Other specified lipid  
 Hemoglobin  
 Bilirubin  
 Creatinine  
 Aldosterone  
 Renin  
 B-type natriuretic peptide (BNP)  
 Cystatin C  
 Other specified chemistry test  
 Chemistry test unspecified  
 Creatine  
 Creatinine  
 Phosphorus  
 Vitamin E  
 Albumin  
 8-test chemistry profile—ionized calcium  
 Vitamin B3  
 Liver kidney microsomal antibody  
 Vitamin A  
 Ionized calcium  
 Lipase

## CSF studies

Total protein  
 Glucose unspecified  
 Aerobic cultures  
 Specimen preparation  
 Hematology exam of other body fluid  
 Other specified immunology antibody  
 Neuronal antibody  
 Anti GAD 65  
 Meningitis/Encephalitis pathogen panel, molecular pathology testing, any method  
 Other specified amino acids and peptides  
 Other specified viral antibody  
 Neopterin  
 Protein electrophoresis  
 Herpes virus PCR  
 Myelin  
 Other specified catecholamines  
 Amino acids and peptides unspecified  
 Polymerase chain reaction (PCR)  
 Lactic acid  
 Other specified laboratory test  
 Vitamin B6

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**Laboratory studies**

Western equine encephalitis antibody  
 St Louis equine encephalitis antibody  
 Enterovirus RNA  
 Angiotensin-converting enzyme  
 Other specified meningitis bacteria  
 Islet cell antibody (ICA)  
 Immunoelectrophoresis (IEP)  
 Enterovirus PCR  
 Immunology antibody unspecified  
 Mycoplasma serology  
 Cryptococcus antigen  
 Microbial identification nucleic acid probe  
 West Nile virus PCR  
 Tetrahydrobiopterin (BH4)  
 Pyruvic acid  
 Other specified nonprotein nitrogenous compounds  
 IgM  
 Immunoglobulins  
 Other specified bacteria antibody  
 Cryptococcus antibody  
 India ink preparation  
 Epstein-Barr virus  
 Herpes culture  
 Rubeola antibody  
 Cytopathology slide reading/interpretation  
 Cytomegalovirus RT-PCR  
 Epstein-Barr virus PCR  
 Adenovirus PCR  
 Varicella PCR  
 Neuromyelitis optica

**Endocrine**

Chorionic gonadotropin (HCG)  
 Random glucose  
 Insulin  
 Hemoglobin A1C (HgbA1C)  
 Chorionic gonadotropin (HCG)  
 Prolactin  
 Cortisol  
 Follicle-stimulating hormone (FSH)  
 Luteinizing hormone (LH)  
 Parathyroid hormone (PTH)  
 Very long chain fatty acid  
 Insulin-like growth factor I (IGF-I)  
 Estradiol  
 Dehydroepiandrosterone (DHEA)  
 Estrogen  
 Androsterone

**Endocrine – thyroid**

Thyroxine (T4)  
 Free triiodothyronine (free T3)  
 Triiodothyronine (T3)  
 Thyroid-stimulating hormone (TSH)  
 T3 uptake

**Laboratory studies**

TSH receptor antibody  
 Thyroglobulin  
 Thyroid profile  
 Thyroid-stimulating hormone (TSH)  
 Free thyroxine

**Hematology**

Reticulocyte count  
 Transferrin  
 Fibrinogen level  
 Factor VIII-related antigen  
 D-dimer  
 ABO type antigen  
 Rh phenotype antigen  
 Occult blood  
 Direct antiglobulin test  
 B cells  
 Hemoglobin electrophoresis  
 T cells  
 Thrombin clotting time (TCT)  
 Protoporphyrin  
 Glucose-6-phosphate dehydrogenase (G-6-PD)  
 Haptoglobin  
 Myoglobin  
 Alpha-1 antitrypsin  
 Factor VIII assay  
 Porphyrin unspecified  
 White blood cell count with differential  
 Complete blood count unspecified (CBC)  
 Hemoglobin  
 Platelet count  
 Hematocrit  
 White blood cell count without differential  
 Hemoglobin electrophoresis  
 Factor VII assay  
 Factor IX assay  
 Factor VIII-related antigen  
 PT and PTT  
 Protein C  
 Protein S  
 Antithrombin III  
 CBC with differential  
 CBC without differential  
 Leukocyte differential count  
 Lactic acid  
 Prothrombin time (PT)  
 Iron  
 Partial thromboplastin time (PTT)  
 Ferritin  
 Uric acid  
 Peripheral blood smear evaluation  
 Iron binding capacity (TIBC)  
 Hematocrit  
 Hemoglobin S

**Infectious disease**

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## Laboratory studies

Erythrocyte sedimentation rate (ESR)  
 C-reactive protein (CRP)  
 SARS-CoV-2 (COVID-19) molecular pathology testing, any method (DNA probe, PCR, RNA, RT-PCR)  
 Gram stain  
 VDRL  
 HIV-1 antibody  
 Rapid plasma reagin (RPR)  
 Aerobic cultures  
 Chlamydia trachomatis, molecular pathology testing, any method  
 Neisseria gonorrhoeae, molecular pathology testing, any method  
 Beta hemolytic streptococcus antigen detection  
 HIV antigen  
 SARS-CoV-2 (COVID-19) test, unspecified  
 Group A Streptococcus, molecular pathology testing, any method  
 Anti-streptolysin O titer  
 Herpes virus PCR  
 Fluorescent treponemal antibody-absorption (FTA-ABS) (FTA)  
 Lyme disease  
 Hepatitis C antibody (HCV)  
 Hepatitis B surface antigen (HBsAg)  
 Aerobic cultures  
 Other specified viral antibody  
 Trichomonas, molecular pathology testing, any method  
 Aerobic and anaerobic cultures  
 Strep screen culture  
 Epstein-Barr virus  
 Combo SARS-CoV-2 and Multiple Respiratory Viral Organism molecular pathology testing, any method (DNA probe, PCR, RNA, RT-PCR)  
 Bacterial test unspecified  
 Neisseria gonorrhoeae, molecular pathology testing, any method  
 Enterovirus PCR  
 Chlamydia trachomatis, molecular pathology testing, any method  
 hs-CRP  
 Hepatitis test unspecified  
 Hepatitis B core antibody (HBcAb)  
 Staphylococcus  
 Hepatitis B surface antibody (HBsAb)  
 Respiratory pathogen panel, 12-25 targets, molecular pathology testing, any method  
 Mycoplasma serology  
 HIV-2 antibody  
 Hepatitis A viral antibody IgM (HAV-Ab IgM)  
 Aerobic cultures  
 Chlamydia PCR  
 Varicella PCR  
 Cytomegalovirus PCR  
 Other specified meningitis bacteria  
 West Nile virus antibody  
 Other specified bacteria antibody  
 Other specified microbiology test  
 HIV DNA polymerase chain reaction (PCR)  
 Epstein-Barr virus PCR

(Continued)

## Laboratory studies

QuantiFERON TB Gold  
 Aerobic cultures  
 Cytomegalovirus antibody  
 Microbiology test unspecified  
 Aerobic cultures  
 Infectious mononucleosis screen  
 Western equine encephalitis antibody  
 St Louis equine encephalitis antibody  
 Mycoplasma pneumoniae, molecular pathology testing, any method  
 Mycobacteria culture  
 Hepatitis A viral antibody (HAV) total  
 Chlamydia pneumoniae, molecular pathology testing, any method  
 Chlamydia trachomatis/Neisseria gonorrhoeae combination, molecular pathology testing, any method  
 Other specified SARS-CoV-2 (COVID-19) test  
 Molecular pathology unspecified  
 Neisseria PCR  
 SARS-CoV-2 (COVID-19) antibody  
 Other specified viruses  
 Procalcitonin  
 Mycoplasma other/unspecified, molecular pathology testing, any method  
 Group B Streptococcus, molecular pathology testing, any method  
 Wet prep for parasites  
 Herpes unspecified  
 Meningitis viruses  
 Varicella zoster  
 Hepatitis B core antibody IgM (HBcAb IgM)  
 Respiratory pathogen panel, 3-5 targets, molecular pathology testing, any method  
 Treponema pallidum unspecified  
 Influenza A and B antigen  
 Other specified viral culture  
 Aerobic cultures  
 Other specified bacteriology  
 Hepatitis C RNA (HCV RNA)  
 Chlamydia DNA probe  
 Lyme PCR  
 Streptococcus pneumoniae, molecular pathology testing, any method  
 Treponema pallidum unspecified  
 VDRL  
 Meningitis viruses  
 Microbial identification nucleic acid probe with amplification  
 Adenovirus PCR  
 Parechovirus, molecular pathology testing, any method  
 Enterovirus RT-PCR  
 Bordetella pertussis PCR  
 Neisseria gonorrhoeae  
 Herpes simplex antibody  
 West Nile virus antibody  
 Influenza virus PCR  
 Escherichia coli PCR  
 Cryptococcus, molecular pathology testing, any method  
 Neisseria meningitidis, molecular pathology testing, any method

(Continued)

## Laboratory studies

Listeria, molecular pathology testing, any method  
 Haemophilus influenzae, molecular pathology testing, any method  
 Mycoplasma pneumoniae, molecular pathology testing, any method  
 Methicillin-resistant staphylococcus (MRSA) PCR  
 Aerobic cultures  
 Aerobic cultures  
 Brucella species  
 Rickettsial antibody  
 H influenza  
 Cryptosporidium  
 Respiratory pathogen panel, unspecified # targets, molecular pathology testing, any method  
 Toxoplasma serology  
 Cytomegalovirus DNA probe  
 Epstein-Barr virus RT-PCR  
 Herpes virus DNA probe  
 Chlamydia PCR  
 Chlamydia trachomatis/Neisseria gonorrhoea combination, molecular pathology testing, any method  
 Anaerobic cultures  
 Bacteria antibody unspecified  
 Corynebacterium diphtheriae  
 Streptococcus unspecified  
 Streptococcus pneumoniae  
 Other specified parasitic antibody  
 Malarial smear  
 Adenovirus  
 Respiratory syncytial virus antigen  
 HIV-1 RNA  
 Hepatitis B core antibody (HBcAb)  
 Hepatitis Be antibody (HBeAb)  
 Hepatitis Be antigen (HBeAg)  
 Hepatitis B surface antigen (HBsAg)  
 Clostridium difficile PCR  
 Chlamydia antibody  
 Cryptococcus antigen  
 Fungal culture  
 Viral antibody unspecified  
 Meningitis viruses  
 Rubella antibody  
 Influenza A and B antibody  
 Coxsackievirus group A antibody  
 Coxsackievirus group B antibody  
 Echovirus test  
 Parvovirus test  
 HIV western blot  
 Other specified hepatitis test  
 SARS-CoV-2 (COVID-19) antigen  
 Other specified viral culture  
 Epstein-Barr virus PCR  
 Herpes virus PCR  
 Varicella PCR  
 Legionella pneumophila antigen  
 Staphylococcus

(Continued)

## Laboratory studies

H influenza  
 Leptospira antibody  
 Yersinia culture  
 Epstein-Barr virus  
 Herpes unspecified  
 Herpes simplex virus antigen  
 Parainfluenza antigen  
 Metapneumovirus (hMPV)  
 Poliovirus test  
 Respiratory syncytial virus antigen  
 Respiratory syncytial virus culture  
 HIV antigen neutralization  
 Hepatitis B viral DNA  
 Other specified viral culture  
 Other specified viruses  
 Common human coronavirus (229E, NL63, OC43, HKU1, etc.), molecular pathology testing  
 Cytomegalovirus PCR  
 Cytomegalovirus DNA probe  
 Epstein-Barr virus DNA probe  
 Herpes simplex/varicella zoster virus combination, molecular pathology testing  
 West Nile virus RT-PCR  
 Parainfluenza virus PCR  
 Parvovirus PCR  
 Parvovirus PCR  
 Respiratory syncytial virus RT-PCR  
 Other specified viral molecular pathology  
 Shiga/Shiga-like toxin, molecular pathology testing  
 Chlamydia RNA  
 Neisseria DNA probe  
 Varicella PCR  
 BK virus PCR  
 Chlamydia pneumoniae, molecular pathology testing

## Toxicology

Therapeutic drug monitoring (TDM) unspecified  
 Therapeutic drug monitoring (TDM) unspecified  
 Lidocaine therapeutic drug monitoring  
 Amitriptyline therapeutic drug monitoring  
 Alcohol toxicology unspecified  
 Toxicology unspecified  
 Toxicology unspecified  
 Benzodiazepine toxicology  
 Cannabinoid toxicology  
 Amphetamine toxicology  
 Acetaminophen toxicology  
 Barbiturate toxicology unspecified  
 Morphine and derivatives toxicology  
 Cocaine toxicology  
 Ethanol toxicology  
 Drug monitoring other therapeutic category  
 Phencyclidine toxicology  
 Other specified toxicology  
 Salicylate toxicology

(Continued)

**Laboratory studies**

Meprobamate therapeutic drug monitoring  
 Cannabinoid toxicology  
 Valproic acid therapeutic drug monitoring  
 Lead toxicology  
 Lithium therapeutic drug monitoring  
 Morphine and derivatives toxicology  
 Cocaine toxicology  
 Amphetamine toxicology  
 Barbiturate toxicology unspecified  
 Lead toxicology  
 Toxicology unspecified  
 Phencyclidine toxicology  
 Ethanol toxicology  
 Benzodiazepine toxicology  
 Mercury toxicology  
 Salicylate toxicology  
 Arsenic toxicology  
 Other antidepressant/antipsychotic/antianxiety therapeutic drug monitoring  
 Arsenic toxicology  
 Arsenic toxicology  
 Mercury toxicology  
 Lead toxicology  
 Mercury toxicology  
 Ethanol toxicology  
 Drug monitoring other therapeutic category  
 Heavy metal toxicology unspecified  
 Porphyrin unspecified  
 Dilute Russell's viper venom time (DRVVT)  
 Acetaminophen toxicology  
 Other antidepressant/antipsychotic/antianxiety therapeutic drug monitoring  
 Theophylline therapeutic drug monitoring  
 Zinc toxicology  
 Phenobarbital therapeutic drug monitoring  
 Cadmium toxicology  
 Other specified therapeutic drug monitoring  
 Sedatives and hypnotics therapeutic drug monitoring  
 Cadmium toxicology  
 Keppra therapeutic drug monitoring  
 Narcotic other than morphine toxicology  
 Trileptal therapeutic drug monitoring  
 Zinc toxicology  
 Carbamazepine therapeutic drug monitoring  
 Antidepressant/antipsychotic/antianxiety therapeutic drug monitoring unsp  
 Cadmium toxicology  
 Carbon monoxide  
 Anticonvulsant therapeutic drug monitoring unspecified  
 Other specified toxicology  
 Heavy metal toxicology unspecified

**Laboratory studies**

Arsenic toxicology  
 Lead toxicology  
 Mercury toxicology  
 Other specified toxicology  
 Anticonvulsant therapeutic drug monitoring unspecified  
 Phenytoin therapeutic drug monitoring  
 Other specified anticonvulsant therapeutic drug monitoring  
 Methotrexate therapeutic drug monitoring  
 Toxicology unspecified  
 Heavy metal toxicology unspecified  
 Manganese toxicology  
 Other specified alcohol toxicology  
 Phencyclidine toxicology  
 Cannabinoid toxicology  
 Acetaminophen toxicology

**Urine studies**

Chemical examination of urine  
 Copper  
 Porphobilinogen  
 Amino acids and peptides unspecified  
 Total protein  
 Porphyrin unspecified  
 Methylmalonic acid  
 Albumin  
 Cadmium toxicology  
 Microscopic examination of urine  
 Sodium  
 Osmolality  
 Metanephrines  
 Creatinine  
 Porphobilinogen  
 Potassium  
 Total protein  
 Urinalysis unspecified  
 Chloride  
 Creatine  
 Specimen collection  
 Metabolic screen  
 Carnitine  
 Glucose unspecified  
 Urea nitrogen  
 Uric acid  
 Microalbumin  
 Complete urinalysis  
 Macroscopic urinalysis  
 Copper

**Other clinical resources**

Electroencephalogram  
 Electrocardiogram  
 Therapies (PT/OT/ST)

(Continued)