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After studying this article, you should be able to:

- Use monitoring recommendations to provide safe psychotropic prescribing

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Psychotropic Medication Monitoring: A Review

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ABSTRACT

Objective: To address a gap in the literature for concise recommendations on psychotropic medication monitoring geared to prescribers in primary care psychiatry.

Data Sources: Large institutional guidelines from the United States, United Kingdom, Canada, and Australia/New Zealand combined with manual searches for psychiatric medication monitoring consensus and other recommendations up to January 31, 2018.

Study Selection: Any available guidelines and consensus statements making psychotropic medication monitoring recommendations for treatment of adults and published in English.

Data Extraction: Manual identification of all specific recommendations on psychotropic medication monitoring from the sources.

Results: Psychotropic medication monitoring recommendations vary by source, but there is considerable agreement among English-language sources, which can be readily summarized for teaching and everyday use.

Conclusions: For prescribers working in many disciplines, medication monitoring may be improved by having more ready access to recommendations.

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In addition to therapeutic benefits, psychotropic medications carry iatrogenic risks. Medication monitoring helps minimize this risk and is an essential part of safe prescribing reflected in professional guidelines and recommendations. These guidelines have never, to our knowledge, been summarized in one place for clinicians' easy access. We review a wide range of these sources and present monitoring recommendations along with a 1-page quick guide for reference.

As more practitioners prescribe psychotropic medications, it is important to ensure that providers are familiar with medication monitoring recommendations, especially since there is evidence that performance could be improved. For example, 1 study noted that "up to 70% of people taking antipsychotics remain unscreened and untreated"[1(p1083)] for cardiovascular health issues. In another study,[2] patients treated with second-generation antipsychotics in a commercially insured population were monitored at a rate of 38% for glucose and 23% for lipids. While monitoring rates differ across study populations, they are consistently lower than optimal based on recommendations.[3–5]

Clinical Points

- Better access to monitoring recommendations will improve safe psychotropic prescribing.
- A quick guide to psychotropic monitoring will facilitate teaching and make it easier for providers to remember.

The reasons for lower-than-ideal adherence to monitoring guidelines are not well studied.[6] A convenient source for this information could provide a useful tool for education about monitoring and serve as a reference for active prescribers in diverse clinical settings—from primary care to specialty mental health clinics—with the aim of improving prescribing performance and, ultimately, patient safety.[7]

METHODS

To identify medication monitoring recommendations, major professional organization websites were serached for English-language guidelines relating to major depressive disorder, bipolar disorder, and schizophrenia. Organizations included the American Psychiatric Association (APA), UK National Institute for Health and Care Excellence (NICE), US Veterans Affairs/Department of Defense (VA/DoD), and Canadian Network for Mood and Anxiety Treatments (CANMAT). When guidelines for other conditions contained medication monitoring recommendations, these were also included. To supplement this material, we conducted PubMed and internet searches for terms relating to specific psychiatric conditions paired with terms for guidelines and treatment recommendations. Searches were from inception up to January 31, 2018. Finally, we also incorporated recommendations from *Stahl's Essential Psychopharmacology Prescriber's Guide*,[8] acknowledging its widespread use among prescribers and trainees. Within each source, we searched specifically for monitoring recommendations and collected these together.

There is no large evidence base for the effectiveness of specific recommendations, and for this reason, it is not readily possible to apply PRISMA standards to review of this material. Thus, we took a practical, narrative approach of assembling a monitoring quick guide by reviewing the collected guidelines, extracting the recommendations from each guideline, and assessing which recommendations were most frequently made across guidelines. These recommendations appear in bold type in the quick guide. Less frequently made recommendations (eg, did not appear in multiple guidelines but we considered useful for prescribers to consider on the basis of clinical judgment) follow these bolded consensus recommendations in the quick guide and are not in bold type. We also added a few clinically relevant monitoring situations that are not addressed by the reviewed guidelines directly but can be found elsewhere in the clinical literature, for example, monitoring sodium when using some antidepressants. As more research becomes available, it may be possible to specifically determine which recommendations provide the strongest benefit to patients and to consider practical and economic aspects of testing. As this happens, or as guidelines change over time, it would be straightforward to update this quick guide.

Finally, there are some notable exceptions to what we have included. We do not systematically address use of drug levels for therapeutic, as opposed to medication safety, purposes. We did not include clozapine, which requires participation in a risk evaluation and mitigation strategy program due to its highly specific monitoring requirements. We do not address the merits of these recommendations or provide research material on their utility. Also, it is important to note that the guidelines we reviewed, with few if any exceptions, do not give recommendations on what actions to take with the results. These decisions are made according to the individual clinical judgment of the prescriber ordering the tests.

Definitions of Terms Used by Guidelines

Guidelines often use common shorthand terms for types of laboratory test by category, and this is reflected in the quick guide. Three in particular can be highlighted.

Liver/hepatic function. Guidelines often reference LFTs (liver function tests), which are seldom defined in detail (eg, see APA Work Group on Bipolar Disorder[9] and Ng et al[10]). Consolidating across guidelines, it seems reasonable to suggest that LFTs should at a minimum include aspartate aminotransferase/serum glutamic-oxaloacetic transaminase, alanine transaminase/serum glutamic-pyruvic transaminase, and total bilirubin. LFTs also might include liver synthetic function tests such as international normalized ratio (INR) or albumin, but this is not made clear across available recommendations.

Hematology. Similarly, when recommending a complete blood count, although not consistently explicitly mentioned, we would suggest always obtaining a differential as part of monitoring, in particular due to several medications that have the potential to cause neutropenia or thrombocytopenia.

Thyroid. Thyroid tests are frequently recommended but seldom precisely defined. Most commonly, thyroid-stimulating hormone is the specific test cited, and other tests to further refine assessment of thyroid function are not often discussed but might include free T_4 and free T_3, as suggested when using thyroid augmentation of antidepressants.[11] In general, we have used the most common terminology utilized across sources and leave the specific tests to the judgment of individual clinicians, which may be influenced, for example, by local customary procedures. For this reason, we use the most general terms when referring to these groups of tests.

RESULTS

The main guidelines reviewed are listed in Table 1. Overall, there is much agreement across a wide range of sources for the major classes of psychotropics, providing prescribers with a solid basis for medication monitoring recommendations. In Supplementary Table 1, the raw information from all

Table 1. Sources Reviewed for Medication Monitoring Recommendations

American Psychiatric Association
Practice Guideline for the Treatment of Patients With Bipolar Disorder, 2nd ed (2002)[9]
Practice Guideline for the Treatment of Patients With Major Depressive Disorder, 3rd ed (2010)[12]
Practice Guideline for the Treatment of Patients With Schizophrenia, 2nd ed (2004)[13]
Canadian Network for Mood and Anxiety Treatments
Guidelines for the Management of Patients With Bipolar Disorder (2005)[14]
Clinical Guidelines for the Management of Adults With Major Depressive Disorder (2016)[15]
UK National Institute for Health and Care Excellence
Attention-Deficit/Hyperactivity Disorder Guidelines, CG72 (2008)[16]
Depression in Adults Guidelines, CG90 (2009, update 2016)[17]
Bipolar Disorder Guidelines, CG185 (2014)[18]
Psychosis and Schizophrenia in Adults Guidelines, CG178 (2014)[19]
US Veterans Affairs/Department of Defense
Clinical Practice Guideline for Management of Bipolar Disorder in Adults (2010)[20]
Clinical Practice Guideline for the Management of Substance Use Disorders, version 3.0 (2015)[21]
Clinical Practice Guideline for the Management of Major Depressive Disorder, version 3.0 (2016)[22]
Clinical Practice Guideline for the Management of Posttraumatic Stress Disorder and Acute Stress Disorder, version 3.0 (2017)[23]
Other Sources of Recommendations
American Diabetes Association/American Psychiatric Association/American Association of Clinical Endocrinologists/North American Association for the Study of Obesity Consensus Development Conference on Antipsychotic Drugs and Obesity and Diabetes (2004)[24]
Mount Sinai Conference on the Pharmacotherapy of Schizophrenia (2002)[25]
American Society for Addiction Medicine (ASAM) National Practice Guideline for the Use of Medications in the Treatment of Addiction Involving Opioid Use (2015)[26]
Stahl's Essential Psychopharmacology Prescriber's Guide, 6th ed (2017)[8]
Expert Group. Schizophrenia and Diabetes Expert Consensus Meeting (2004)[27]
Consensus Working Group. Diabetes, Psychotic Disorders and Antipsychotic Therapy Consensus Statement (2005)[28]
International Society for Bipolar Disorders Consensus Guidelines for the Safety Monitoring of Bipolar Disorder Treatments (2009)[10]
US Food and Drug Administration Drug Safety Communication. Revised Recommendations for Celexa Related to a Potential Risk of Abnormal Heart Rhythms With High Doses (released March 28, 2012)[29]

sources reviewed is presented to facilitate comparison. In Table 2, we provide a quick guide based on recommendations that are most frequently found in the source material by medication category. Specific recommendations for individual agents are also shown. In some areas, there may be local prevailing clinical practices that may differ from these recommendations. Also, we review the basic findings for 3 major classes of psychotropics: antipsychotics, mood stabilizers/lithium, and antidepressants.

Antipsychotics

Medication monitoring recommendations for antipsychotics have been highly influenced by specific medication safety recommendations from the 2004 American Diabetes Association (ADA)/APA joint publication of recommended monitoring related to second-generation antipsychotics (SGAs),[24] of which clozapine, olanzapine, risperidone, ziprasidone, and aripiprazole were available for consideration at that time. A forerunner to these recommendations from the Mount Sinai Conference on the Pharmacotherapy of Schizophrenia in 2002 offered similar guidance.[25] These recommendations focus on the metabolic side effects of SGAs on blood sugar and lipids. Most guidelines recommend that fasting lipid profiles and fasting glucose level be measured at baseline, at 3 months after initiation, at 12 months, and annually thereafter. Because fasting blood glucose is a more direct indicator of glucose metabolism and is used in diabetes diagnosis, this is the recommended measure in most guidelines (including the ADA/APA consensus[24]).[30] In addition, the glucose level will be a more accurate reporter very early in the course of taking an SGA, since hemoglobin A_{1c} levels reflect glucose levels over a period of time.[31] NICE guidelines on schizophrenia (2014) recommend using the hemoglobin A_{1c} level to monitor metabolic effects.[19] In practice, many clinicians most likely use the hemoglobin A_{1c} level to monitor metabolic effects of atypical antipsychotics, and we include hemoglobin A_{1c} in the summary table to reflect this. However, clinicians should be aware of this discrepancy and try to ensure that fasting glucose and hemoglobin A_{1c} levels are obtained, especially early in the course of treatment. Tracking of weight and vital signs on the same schedule is also recommended. Less consistently, waist circumference is also recommended for monitoring in many guidelines. Of note, NICE guidelines on schizophrenia recommend similar monitoring when treating patients with typical (first-generation) antipsychotics.[19]

Another major monitoring consideration for antipsychotics is their effect on cardiac conduction, for which there are no well-established guidelines.[32] There are many resources for information on QT-prolonging medications (eg, CredibleMeds at www.crediblemeds.org). In practice, clinical concern is focused on medications

Table 2. Psychotropic Medication Monitoring Recommendation Quick Guide for Prescribers and Trainees[a]

Medication	Monitoring When Starting Medication	Monitoring During Maintenance Treatment
Lithium	**BMP (including electrolytes, BUN, and creatinine), calcium, TSH, CBC with differential**, Upreg, weight, ECG (if cardiac risk factors or patient is over age 40 years)	After starting and dose changes: **lithium level**; 6 months after starting: **BMP, calcium, TSH**, **lithium level**, weight; every 6 months after that: **BMP, lithium level**; every 12 months after that: **BMP, calcium, TSH, lithium level**, CBC, weight, ECG
Valproate	**CBC, LFT**, Upreg, BMP, fasting glucose, lipids, weight, vital signs	After starting and dose changes: **valproate level**; every 3 months for 1 year: **CBC, LFT**, INR, weight; every 12 months: **valproate level, CBC, LFT**, INR, weight
Carbamazepine	**CBC, LFT, BUN, creatinine**, Upreg, fasting glucose, lipids, weight, vital signs	After starting and dose changes: **carbamazepine level**; first 3 months: **CBC, LFT, BMP** monthly; every 12 months: **carbamazepine level, CBC, LFT, BMP**
Lamotrigine	CBC, BMP, LFT, fasting glucose, lipids, Upreg, weight, vital signs, baseline skin condition	Monitor for skin changes
Topiramate	Bicarbonate, renal function, Upreg	Bicarbonate, renal function
Atypical antipsychotics	**Lipids, fasting glucose**, hemoglobin A_{1c}, CBC, BMP, LFT, weight, vital signs, AIMS, ECG if there are cardiac risk factors or taking ziprasidone	Monthly for first 3 months: weight; 3 months after starting: **lipids, fasting glucose**, hemoglobin A_{1c}, vital signs; every 12 months: **lipids, fasting glucose**, hemoglobin A_{1c}, vital signs, weight, ECG, AIMS
Typical antipsychotics	**Lipids, fasting glucose**, hemoglobin A_{1c}, weight, vital signs, AIMS, ECG if risk factors or taking thioridazine	Lipids, fasting glucose, hemoglobin A_{1c}, weight, vital signs, ECG if indicated, AIMS
SSRIs	Any SSRI: **sodium** if aged >65 years or clinically indicated Citalopram: **magnesium, potassium**, ECG if dose >40 mg or if aged >59 years and dose >20 mg or using in combination with other QTc-prolonging agents	Any SSRI: **sodium** if indicated Citalopram: **magnesium, potassium, ECG** if change in cardiac risk
TCAs	Vital signs, ECG if cardiac risk factors or aged >40 years	Drug level monitoring if indicated for specific agent; ECG, if indicated
Bupropion	Vital signs	Vital signs if indicated
SNRI	Sodium if patient is over aged >65 years, vital signs	At 3 months: vital signs; every 12 months: vital signs
Nefazodone	LFT	LFT if indicated
Disulfiram	**LFT**, Upreg, ECG if risk factors	Monthly for 3–6 months: **LFT**, then LFT if indicated
Naltrexone	**LFT**, Upreg, CrCl (Vivitrol)	In first 6 months: **LFT**, then LFT if indicated
Stimulants	**UDAS, vital signs**, ECG, height and weight	**UDAS**, ECG if indicated, vital signs
Thyroid augmentation	**TSH, free T_3, free T_4**	3 months after starting: **TSH, free T_3, free T_4**; every 6–12 months: **TSH, free T_3, free T_4**

[a]Bold type recommendations have the strongest support in published guidelines; other recommendations are made less frequently but are considered useful for prescribers.

Abbreviations: AIMS = Abnormal Involuntary Movement Scale, BMP = basic metabolic panel, BUN = blood urea nitrogen, CBC = complete blood count, CrCl = estimated creatinine clearance, ECG = electrocardiogram, INR = international normalized ratio, LFT = liver function test, SNRI = serotonin-norepinephrine reuptake inhibitor, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant, TSH = thyroid-stimulating hormone, UDAS = urine drugs of abuse screen, Upreg = urine pregnancy test.

that are known to have relatively large QT-prolonging potential, particularly among antipsychotics, thioridazine, and ziprasidone; with these medications, more frequent electrocardiogram (ECG) monitoring is recommended.[25] More generally, clinical recommendations focus on taking into account patient-specific risk factors including cardiac history, as well as assessment of overall patient regimens for multiple medications with QT-prolonging potential (eg, nonpsychotropics including methadone, quinolones, and others). Similar to pregnancy testing, much is left to the judgment of the individual clinician with regard to which patients should obtain an ECG and when.

Finally, the potential for antipsychotics to cause involuntary movement disorders warrants tracking of patients with the Abnormal Involuntary Movement Scale[33]), although this is not directly addressed in most guidelines.

Mood Stabilizers and Lithium

Because levels of mood stabilizers and lithium are used to guide treatment (and due to the low therapeutic index of lithium), laboratory monitoring with these agents is well known to psychiatrically trained prescribers but may be less familiar to those who may come into contact with patients in other clinical areas such as primary care. Recommendations for monitoring during lithium use include baseline calcium level due to risk of hyperparathyroidism, creatinine for renal function, and thyroid profiles, with follow-up generally recommended every 6 months. However, there are some differences in approach across guidelines. APA guidelines specify that lithium levels should be monitored 5 to 7 days after dose changes, with no further recommendations on routine monitoring,[9] while the VA/DoD recommends that lithium levels be obtained every 6 months.[20] NICE advises to check levels every 6 months, increasing surveillance to every 3 months when patients are older or have medical complications raising their risk of adverse lithium effects, if there is poor clinical symptom control, or if previous lithium levels have been greater than 0.8 mEq/L.[18] Of note, the International Society for Bipolar Disorders (ISBD)[10] has issued detailed treatment guidelines independently. These

guidelines[10] recommend that lithium levels (along with electrolytes, urea/blood urea nitrogen, and creatinine) be obtained every 3 to 6 months and also provide a wealth of other information on lithium monitoring and use.

For divalproex, recommendations emphasize tracking hepatic adverse effects with liver function tests (although the precise tests are not specified in most guidelines) and hematologic toxicity with complete blood counts at initiation and then every 6 or 12 months. Guidelines do not suggest monitoring liver synthetic function (eg, using the INR), although some clinicians may do this. There are no clear consensus recommendations on metabolic monitoring for divalproex, and guidelines vary from scheduled measurement to only testing when clinically indicated (although this is not specifically defined). For example, CANMAT,[14] ISBD,[10] and NICE[18] recommend tracking weight (and BMI and waist circumference). In turn, clinicians may want to follow other metabolic parameters such as lipids depending on weight changes.

For carbamazepine, recommendations are similar to divalproex overall, as known toxicities for these 2 antiepileptic drugs overlap considerably. Pregnancy risk is discussed here in general terms but is a well-known concern with lithium, divalproex, and carbamazepine in particular among psychotropics.

Antidepressants

There are far fewer recommendations for monitoring with antidepressants; recently published consensus recommendations addressing this are useful.[30] The cardiac rhythm effects of antidepressants, in particular tricyclic antidepressants (TCAs) as a class, and citalopram warrant mention, although there is little specific guidance from published guidelines. In particular, there are no consensus guidelines for when to obtain ECGs to monitor these effects. For example, the APA recommends an ECG for patients "with significant cardiac risk factors and patients older than age 50 years" at baseline,[12(p40)] and more specific recommendations for monitoring after initiating tricyclics in the same guidelines suggest considering a follow-up ECG. Other guidelines do not offer explicit guidance on ECG monitoring with TCAs (outside of overdose settings). In this absence, independent clinical judgment can be used. It seems reasonable to suggest that when prescribing TCAs, ECGs are useful in patients over 50 years of age with known cardiac risk factors, including known cardiac disease or history of abnormal rhythm or with family history of arrhythmia or sudden death (presumed to be due to unspecified cardiac issues, especially congenital long QT syndrome).

In addition to TCAs for which cardiac rhythm effects, especially in overdose, are well known, QT prolongation with citalopram has been a focus of concern, and monitoring recommendations related to this have posed a more complex issue. In a Drug Safety Communication, the US Food and Drug Administration (FDA) in 2012[29] revised recommendations to suggest "more frequent" ECG monitoring in patients for whom citalopram is not recommended but is considered essential, as well as baseline serum potassium and magnesium measurement in "patients at risk for significant electrolyte disturbances." In addition, the FDA recommends that citalopram should be discontinued in patients with persistent QTc measurements greater than 500 msec. The FDA does not specify exactly when monitoring ECGs should be done, and this decision is left to clinical judgment.

Other considerations are hyponatremia and weight gain. Particularly with selective serotonin reuptake inhibitor and serotonin-norepinephrine reuptake inhibitor antidepressants, hyponatremia is a risk. Recently, a consensus paper on antidepressant use recommended checking sodium levels (along with electrolytes in general) prior to initiating antidepressants, with repeat testing 3–5 weeks into treatment.[30] The same source[30] points out that for weight gain, mirtazapine and TCAs pose the most concern and suggests that TCAs be avoided in patients with obesity due to baseline cardiovascular risk.

Medication monitoring for pregnancy. Pregnancy testing is important to single out as a consideration for monitoring. There are 2 distinct considerations: monitoring for pregnancy in patients who may become pregnant and monitoring of medications during pregnancy (once collaborative medication use decisions have been made). There are few consistent guidelines of when to test for pregnancy other than to consider testing (and to document this) in all women of childbearing potential. Some guidelines recommend urine pregnancy tests in some specific situations (eg, when starting lithium). There is no specific guidance on when a serum pregnancy test would be indicated instead due to its higher sensitivity. For monitoring medications in patients who are known to be pregnant, there is little direct guidance on how monitoring should change. However, considering physiologic changes in pregnancy, in general, clinicians should consider closer monitoring of medications with crucial blood levels, particularly lithium, which is very sensitive to volume status.

Other monitoring issues. To help focus the results and make them of the most general use, we have compiled recommendations for commonly used agents and classes of agents, but the absence of a medication does not imply that monitoring is not recommended or required. For example, nefazodone, which is now very infrequently prescribed, requires monitoring for liver inflammation. While no available guidelines address these issues in detail, this information is readily accessible in the literature for specific medications. In addition, in some countries, certain monitoring is required (eg, liver monitoring when using agomelatine), and we do not address this here due to variation across locations.[30] Finally, while guidelines make recommendations about monitoring, they do not often address follow-up actions for abnormal laboratory values. In this vein, NICE bipolar disorder guidelines[18] state that the ordering professional should ensure further investigations and treatment are offered to the patient but

do not offer more specific guidance. A future review on this subject might also be useful for prescribers.

DISCUSSION

By gathering recommendations from a wide variety of sources, we hope to increase their accessibility for both trainees and independent prescribers. While there are some differences among expert recommendations listed in Table 1, which can be reviewed in detail in Supplementary Table 1, there is substantial agreement across sources that we summarize in the quick guide (see Table 2). Monitoring has not typically been a focus for education, but teaching from these summarized recommendations could facilitate better practice of medication reconciliation and provider education to patients, both of which have been the focus in improving medication safety and reducing medication errors.[34] In turn, it may be possible to continue to improve performance with regard to safe and effective prescribing for providers across a wide range of fields.

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REFERENCES

1. Mangurian C, Newcomer JW, Modlin C, et al. Diabetes and cardiovascular care among people with severe mental illness: a literature review. *J Gen Intern Med*. 2016;31(9):1083–1091.
2. Morrato EH, Newcomer JW, Kamat S, et al. Metabolic screening after the American Diabetes Association's consensus statement on antipsychotic drugs and diabetes. *Diabetes Care*. 2009;32(6):1037–1042.
3. Moeller KE, Rigler SK, Mayorga A, et al. Quality of monitoring for metabolic effects associated with second generation antipsychotics in patients with schizophrenia on public insurance. *Schizophr Res*. 2011;126(1-3):117–123.
4. Barnett M, VonMuenster S, Wehring H, et al. Assessment of monitoring for glucose and lipid dysregulation in adult Medi-Cal patients newly started on antipsychotics. *Ann Clin Psychiatry*. 2010;22(1):9–18.
5. Keller WR, Fischer BA, McMahon R, et al. Community adherence to schizophrenia treatment and safety monitoring guidelines. *J Nerv Ment Dis*. 2014;202(1):6–12.
6. McLaren JL, Brunette MF, McHugo GJ, et al. Monitoring of patients on second-generation antipsychotics: a national survey of child psychiatrists. *Psychiatr Serv*. 2017;68(9):958–961.
7. Scheiber SC, Kramer TAM, Adamowski SE. *Core Competencies for Psychiatric Practice. A Report of the American Board of Psychiatry and Neurology, Inc*. Washington, DC: American Psychiatric Association; 2003.
8. Stahl SM. *Stahl's Essential Psychopharmacology Prescriber's Guide*. 6th ed. New York, NY: Cambridge University Pres; 2017.
9. American Psychiatric Association Work Group on Bipolar Disorder. Practice Guideline for the Treatment of Patients With Bipolar Disorder, second edition. 2002. http://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/bipolar.pdf.
10. Ng F, Mammen OK, Wilting I, et al; International Society for Bipolar Disorders. The International Society for Bipolar Disorders (ISBD) Consensus Guidelines for the Safety Monitoring of Bipolar Disorder Treatments. *Bipolar Disord*. 2009;11(6):559–595.
11. Rosenthal LJ, Goldner WS, O'Reardon JP. T3 augmentation in major depressive disorder: safety considerations. *Am J Psychiatry*. 2011;168(10):1035–1040.
12. American Psychiatric Association Work Group on Major Depressive Disorder. Practice Guideline for the Treatment of Patients With Major Depressive Disorder, third edition. http://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/mdd.pdf. 2010.
13. American Psychiatric Association. Practice Guideline for the Treatment of Patients with Schizophrenia, second edition. http://psychiatryonline.org/pb/assets/raw/sitewide/practice_guidelines/guidelines/schizophrenia.pdf. 2004.
14. Yatham LN, Kennedy SH, O'Donovan C, et al; Canadian Network for Mood and Anxiety Treatments. Canadian Network for Mood and Anxiety Treatments (CANMAT) Guidelines for the Management of Patients With Bipolar Disorder: consensus and controversies. *Bipolar Disord*. 2005;7(suppl 3):5–69.
15. Kennedy SH, Lam RW, McIntyre RS, et al; CANMAT Depression Work Group. Canadian Network for Mood and Anxiety Treatments (CANMAT) 2016 Clinical Guidelines for the Management of Adults With Major Depressive Disorder, section 3: pharmacological treatments. *Can J Psychiatry*. 2016;61(9):540–560.
16. United Kingdom National Institute for Health and Care Excellence. Attention Deficit Hyperactivity Disorder: Diagnosis and Management. 2008;CG72. https://www.nice.org.uk/guidance/cg72. Accessed October 29, 2017.
17. United Kingdom National Institute for Health and Care Excellence. Depression in Adults: Recognition and Management. 2009;CG90. https://www.nice.org.uk/guidance/cg90. Accessed October 29, 2017.
18. United Kingdom National Institute for Health and Care Excellence. Bipolar Disorder: Assessment and Management. 2014;CG185. https://www.nice.org.uk/guidance/cg185/resources/bipolar-disorder-assessment-and-management-pdf-35109814379461. Accessed October 29, 2017.
19. United Kingdom National Institute for Health and Care Excellence. Psychosis and Schizophrenia in Adults: Prevention and Management. 2014;CG178. https://www.nice.org.uk/guidance/cg178/resources/psychosis-and-schizophrenia-in-adults-prevention-and-management-pdf-35109758952133. Accessed October 29, 2017.
20. US Department of Veterans Affairs and Department of Defense. Clinical Practice Guideline for Management of Bipolar Disorder in Adults. https://www.healthquality.va.gov/bipolar/bd_306_sum.pdf. 2010.
21. US Department of Veterans Affairs and Department of Defense. VA/DoD Clinical Practice Guideline for the Management of Substance Use Disorders, version 3.0. https://www.healthquality.va.gov/guidelines/MH/sud/VADoDSUDCPGRevised22216.pdf. 2015.
22. US Department of Veterans Affairs and Department of Defense. VA/DoD Clinical Practice Guideline for the Management of Major Depressive Disorder, version 3.0. https://www.healthquality.va.gov/guidelines/MH/mdd/VADoDMDDCPGFINAL82916.pdf. 2016. Accessed October 29, 2017.
23. US Department of Defense. Clinical Practice Guideline for the Management of Posttraumatic Stress Disorder and Acute Stress Disorder, version 3.0. https://www.guidelinecentral.com/summaries/vadod-clinical-practice-guideline-for-the-management-of-posttraumatic-stress-disorder-and-acute-stress-disorder/#section-society. Accessed October 29, 2017..
24. American Diabetes Association; American Psychiatric Association; American Association of Clinical Endocrinologists; North American Association for the Study of Obesity. Consensus development conference on antipsychotic drugs and obesity and diabetes. *J Clin Psychiatry*. 2004;65(2):267–272.
25. Marder SR, Essock SM, Miller AL, et al. The Mount Sinai Conference on the Pharmacotherapy of Schizophrenia. *Schizophr Bull*. 2002;28(1):5–16.
26. American Society for Addiction Medicine. National Practice Guideline for the Use of Medications in the Treatment of Addiction Involving Opioid Use. 2015. https://www.asam.org/docs/default-source/practice-support/guidelines-and-consensus-docs/asam-national-practice-guideline-supplement.pdf?sfvrsn=96df6fc2_24. Accessed October 29, 2017.
27. Expert Group. 'Schizophrenia and Diabetes 2003' Expert Consensus Meeting, Dublin, 3–4 October 2003: consensus summary. *Br J Psychiatry suppl*. 2004;47:S112–S114.
28. Firestone A. Diabetes, psychotic disorders and antipsychotic therapy: a consensus statement. *Med J Aust*. 2005;182(6):310, author reply 310.
29. United States Food and Drug Administration. FDA Drug Safety Communication: Revised recommendations for Celexa (citalopram hydrobromide) related to a potential risk of abnormal heart rhythms with high doses. 2012. https://www.fda.gov/Drugs/DrugSafety/ucm297391.htm. Accessed October 29, 2017.
30. Dodd S, Mitchell PB, Bauer M, et al. Monitoring for antidepressant-associated adverse events in

the treatment of patients with major depressive disorder: an international consensus statement. *World J Biol Psychiatry*. 2018;19(5):330–348.
31. Cooper SJ, Reynolds GP, Barnes T, et al; With expert co-authors (in alphabetical order). BAP guidelines on the management of weight gain, metabolic disturbances and cardiovascular risk associated with psychosis and antipsychotic drug treatment. *J Psychopharmacol*. 2016;30(8):717–748.
32. Beach SR, Celano CM, Noseworthy PA, et al. QTc prolongation, torsades de pointes, and psychotropic medications. *Psychosomatics*. 2013;54(1):1–13.
33. Abnormal IMS. (117-AIMS). In: Guy W, ed. *ECDEU Assessment Manual for Psychopharmacology*. Rockville, MD: National Institute of Mental Health; 1976:534–537.
34. Institute of Medicine of the National Academies. Committee on Identifying and Preventing Medication Errors. In: Aspden P, Wolcott JA, Bootman JL, et al, eds. *Preventing Medication Errors*. Washington, DC: The National Academies Press; 2007.

Supplementary material follows this article.

POSTTEST

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1. **A 63-year-old man with a history of difficult-to-treat schizophrenia and opioid use disorder (OUD) returns to see you for follow-up. Keith's schizophrenia has finally stabilized with ziprasidone, and his OUD is managed with methadone (30 mg daily), which he receives at another clinic. With Keith's regimen and risk factors, guidelines would most consistently recommend which test?**
   a. Hemoglobin A_{1c}
   b. Urine drug screen
   c. Liver function testing
   d. Electrocardiogram

2. **You are seeing a patient new to you in the clinic with a diagnosis of bipolar disorder. Maria is 26 years old, has been treated with lithium for 3 years, and has no current complaints. She came in for a routine annual checkup. For patients like Maria, measurement of which electrolyte is most consistently recommended by guidelines?**
   a. Magnesium
   b. Calcium
   c. Potassium
   d. Sodium

3. **You prescribed citalopram about 3 weeks ago for a 67-year-old woman with major depressive disorder. Jenetta is otherwise healthy. Today she presents with malaise, nausea, and mild confusion, which is a definite departure from baseline. Which of the following tests or measurements are recommended in the clinical literature, taking into account Jenetta's age?**
   a. Creatinine
   b. White blood count
   c. Sodium
   d. Thyroid-stimulating hormone

THE PRIMARY CARE COMPANION
FOR CNS DISORDERS

Supplementary Material

Article Title: Psychotropic Medication Monitoring: A Review

Author(s): Matthew A. Schreiber, MD, PhD; Stephanie C. Armstrong, MD; and Jesse D. Markman, MD, MBA

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List of Supplementary Material for the article

1. Supplementary Table 1

Disclaimer

This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary Table 1. Raw Information From All Sources Reviewed

Class/Medication	At Initiation	Titration Period	Maintenance Period	Source	Notes
Mood Stabilizers					
Lithium	Serum Cr, estimated Cr clearance, electrolytes, thyroid profile, pregnancy test	Li level q4-14 days	Li level q6 mo. Annual sCr, eCrCl, TSH (x5 yrs), CBC w/diff	VA/DoD bipolar disorder CPG 2010 (p. 77, Table E-5)	If sCr elevated, but still <2, after repeat check, obtain 24 hr CrCl q3-9 mo. If sCr>2, obtain 24 hr CrCl, and notify PCP/nephrology. TSH yearly x5 yrs, if continues to be normal, then check only when clinically warranted
	medical hx, physical exam, BUN/Cr, pregnancy test, thyroid function evaluation, consider CBC, EKG (if over 40)	Li levels 5 days after dose increase and before next dose increase.	First six months, renal (BUC/Cr) and thyroid function (TSH) check once or twice. After 6 months, renal and thyroid fx every 6mo to 1 year or if clinically indicated.	APA bipolar disorder PG 2002 (p. 34)	
	wt or BMI, BUN, electrolytes including calcium, eGFR, thyroid function, CBC. EKG if risk factors.	Li level 1 week after start, and 1 week after every dose change, then weekly until levels stable.	First year: Li level q3 mo. After, q6mo, or q3 mo if older, there are medical interactions of concern, risk for renal/thyroid/ca complications, poor adherence, poor sx control, or level has been >0.8. Q6mo: wt or BMI, BUN, electrolytes including Ca, eGFR, TSH.	NICE bipolar disorder, CG185 2014. Summary version (p. 34)	
	Kidney function tests (Cr, urine sp grav), thyroid function tests, EKG (age>50), wt, consider fglu/FLP	Level every 1-2 weeks until desired serum concentration resached, then every 2-3 for first 6 months.	Kidney function tests 1-2x/yr. Monitor wt and BMI. Frequent test to monitor trough lithium levels, 12 hours after last dose; stable monitoring every 6-12 months and after dose changes or other medication changes or illness. Consider measuring diabetes status (fGlu) and dyslpidemia due to risk of weight gain.	Stahl's 6th ed. 2017.	
	waist circ and/or BMI, BP, CBC, electrolytes/BUN/Cr, LFTs including Tbili, fGlu, FLP, upreg. EKG >40 or if indicated. Prolactin. Utox. PT/PTT, TSH.	2 Li levels to establish therapeutic dose after dose increases	urea/cr q3-6 mo. Ca/TSH/wt q6 mo twice, then annually. Li level q3-6 mo.	ISBD consensus monitoring guidelines 2009 (p. 562, Fig. 1)	CANMAT references this in recent 2013 update
	waist circ and/or BMI, BP, CBC,electrolytes/urea/cr, LFTs including Tbili, fGlu, FLP, upreg. EKG >40 or if indicated. Prolactin. Utox. PT/PTT, TSH.	Li level 5 days after dose titration, get 2 consecutive within therapeutic range	Li levels q3-6 mo. CBC and LFT at 1 month, then q3-6 mo. TSH and Cr/Bun annually.	CANMAT bipolar d/o guidelines 2005 (p. 47-50).	CANMAT issued guidelines in 2005 with several updates since that time, with same baseline labs recommended for all patients with bipolar disorder, not specific to treatment choice. In the detailed CANMAT update in 2014, providers were also directed to ISBD guidelines (also noted in this table) for other specific monitoring recommendations. Also note, if h/o renal disease, CANMAT recommends obtaining 24 hr creatinine clearance at baseline specific to lithium.
Carbamazepine	CBC w/diff, LFTs	CBZ level q2 wks x3 mo, CBC w/diff, LFTs at 1 and 3 mo.	annual CBZ level, CBC w/diff, LFTs, electrolytes	VA/DoD bipolar disorder. 2010 (p. 77, Table E-5).	
	Medical hx and physical exam (focusing on blood and liver concerns). CBC with diff and platelets, LFT (to include LDH, SGOT, SGPT, bilirubin, alkaline phosphatase), BUN, Cr. Consider electrolytes especially in eldarly.	First 2 mo: CBC, platelet, LFTs q2 weeks.	If normal and no evidence of bone marrow suppression or hepatitis, then CBC and LFTs q3 mo.	APA Bipolar disorder. 2002 (p. 38)	CBZ levels only if toxicity or noncompliance suspected
	waist circ and/or BMI, BP, CBC, electrolytes/urea/Cr, LFTs including Tbili, fGlu, FLP, Upreg. EKG if >40 or if indicated. Prolactin. Utox. PT/PTT, TSH.	CBC and LFT at 1 mo.	q3-6mo: CBC, LFT	CANMAT bipolar d/o guidelines 2005 (p. 47-50).	See above note on CANMAT
				NICE bipolar disorder guidelines CG 185 2014 do not give monitoring information for CBZ	
	CBC; liver, kidney and thyroid function tests. If Asian, consider screening for HLA-B*1502 allele	First 2 mo: CBC every 2-4 weeks.	CBC q3-6mo,liver, kidney, thyroid function tests q6-12mo. Consider Na due to risk of hyponatremia.	Stahl's 6th ed. 2017.	
	waist circ and/or BMI, BP, CBC, electrolytes/urea/cr, LFTs, fGlu, FLP, upreg	2 levels to est therapeutic dose, 1 mo apart. CBC, LFT, electrolytes/urea/cr monthly x3 mo.	CBC, LFT,electro lytes/urea/cr annually. Bone densitometry if risk factors. Review contraceptive efficacy.	ISBD consensus monitoring guidelines 2009	
Lamotrigine	CBC, BUN, electrolytes, LFT			NICE bipolar disorder guiidelines CG185 2014	
	waist circ and/or BMI, BP, CBC, electrolytes/urea/Cr, LFTs, fGlu, FLP, Upreg			ISBD consensus monitoring guidelines 2009	
Oxcarbazepine			consider monitoring Na due to risk of hyponatremia, especially during first 3 months.	Stah'ls 6th ed. 2017.	
Topiramate	Bicarb		periodic bicarb	Stahl's 6th ed. 2017.	
	renal function, Upreg		periodic creatinine/CrCl	VA/DoD Bipolar disorder CPG 2010	
	assess renal function, Upreg		monitor Cr and creatinine clearance periodically, particularly in patients with renal insufficiency and the elderly	VA/DoD SUD CPG 2015	
VPA	CBC w/diff, LFTs	VPA level no sooner than 5-7 days after change in dose. CBC w/diff, LFTs at 1 and 3 mo.	Annual: VPA level, CBC w/diff, LFTs, electrolytes	VA/DoD Bipolar disorder CPG 2010 (Table E-5, p 77)	
	waist circ and/or BMI, BP, CBC,electrolytes/urea/cr, LFTs including Tbili, fGlu, FLP, upreg. EKG >40 or if indicated. Prolactin. Utox. PT/PTT, TSH.	VPA level to ensure therapeutic on 2 occasions. CBC and LFT at 1 mo.	q3-6mo: VPA level, CBC, LFT	CANMAT bipolar d/o guidelines 2005 (p. 47-50).	See CANMAT note above.
	medical hx (focus on liver/blood abnormalities). LFT, CBC	VPA level after dose initiation at 20-30mg/kg to guide dose adjustments	Debate: some only monitor clincally and provide education on liver and hematologic dysfunc. Most psychiatrists: CBC, LFTs q6 mo. Sooner if unreliable pt.	APA Bipolar disorder. 2002. (p. 36)	
	wt or BMI, CBC, LFT	at 6 mo: wt/BMI, LFT, CBC	Annually: wt/BMI, LFT, CBC	NICE bipolar disorder CG185 2014. Full version, p. 324.	levels only if question of noncompliance/toxicity
	CBC, coagulation tests, LFT	First few months: regular LFT, platelet	LFT, platelet ct 1-2x/yr. Monitor wt/BMI. Consider diabetes (glucose monitoring) and dyslipidemia assessment. Plasma drug levels, no specific intervals.	Stahl's 6th ed. 2017.	
	waist circ and/or BMI, BP, CBC, lytes/urea/cr, LFTs, fGlu, FLP, Upreg	2 levels to establish therapeutic dose.	wt, CBC, LFT, menstrual hx q 3mo in first year, then annually. BP/fGlu/FLP if risk factors, bone densitometry if risk factors.	ISBD consensus monitoring guidelines 2009. Baseline recommendations for all patients as in Figure 1, p. 563; specific to VPA in Table 5, p. 574.	

Antipsychotics	Fasting (or random) glucose, lipid profile (fasting if possible, random if not), BMI/weight, BP.		Hemoglobin A1c for long-term monitoring, fasting or random glucose, and lipid profile (fasting, or random if this cannot be done) at 12 weeks, 6 months, then annually. BMI/weight frequently early in treatment, e.g. weekly for first 4-6 weeks, at a minimum once every 4 weeks for 12 weeks,then at 6 months and after that annually unless clinically indicated to be more frequent. BP at 12 weeks, 6 months, then annually.	British Association for Psychopharmacology (2016).	
Atypical Antipsychotics	personal family history, weight and BMI, waist circ, BP, fasting glucose, FLP, upreg	weight and BMI: at 2, 8, 12 weeks. At 12 wks: BP, fGlu, FLP	First year Q3 months: weight and BMI. Q12 months: waist circ, BP, fGlu. Q5 yr: FLP if perviously normal and no weight gain.	VA/DoD Bipolar d/o CPG 2010 (p 102) based on ADA/APA recommendations	fGlu recommended rather than A1c.
	personal FH, weight and BMI, waist circ recommended, fGlu, FLP	weight/BMI: every visit x6 mo. fGlu: at 4 mo.	wt and BMI: quarterly if stable. Fglu: if no s/s diabetes and no sig wt gain, annually. If wt gaiin >=1 unit BMI increase, q4 mo. FLP: q2 yr ifi normal, q6 mo if LDL >130.	VA/DoD Bipolar d/o CPG 2010 (p 102) based on Mt Sinai Conf. recommendations	waist circ: intervention for women >=35", men >=40". Mt. Sinai conference paper: https://academic.oup.com/schizophreniabulletin/article/28/1/5/1907056
	BMI, waist circ, BP, fGlu, FLP	wt: 4, 8, and 12 wks initially. BP, FLP, and fGlu at 12 wks.	Wt quarterly. Annual: personal history, BP and fGlu. Q5 yr: FLP.	ADA/APA/AACE 2004	Consensus development conference on antipsychotic drugs and obesity and diabetes. Diabetes Care 2004; 27: 596-601
	wt (charted), HR, BP, fGlu, A1c, FLP. EKG if h/o CV risk (sudden death, arrhythmia), inpatient, or product literature specifies.	First 6 weeks: wt or BMI weekly.	Weight charted at 12 weeks, one year and annually. Annually waist circumference. At 12 weeks, FG, A1c, HR/BP, FLP.	NICE psychosis and schizophrenia in adults. CG178, p. 587. 2014.	
	wt, BMI, waist circ, BP, fGlu, FLP	BMI monthly x3. At 3mo: BP, fglu, ; consider getting monthly for several months if at high risk for metabolic complications.	BMI quarterly. Annually: BP, fGlu, FLP. More frequently if risk factors.	Stahl's 6th ed. 2017.	CBC(if having low WBC or history of drug-induced neutropenia or leukopenia); LFT (if having liver disease, measure a few times/year).
	weight, BP,FG, FLP.	wt monthly x3 mo. BP and fGlu q3 mo x1 year. FLP at 3 mo.	q3 mo: wt. annually: BP and fGlu, FLP. ECG and prolactin as indicated.	ISBD consensus monitoring guidelines 2009 (p. 579, Table 7).	
	fGlu, A1c		A1c and fGlu after 4 mo; if normal, annually	British expert group, BJP 2004	
	BMI, waist circ, BP, fGlu, FLP		Q3mo: weight, waist/hip ratio. Q6 mo: fGlu, BP, LP (for 1 year, then annually).	Australian consensus group (Lambert, et al.) 2005	A1c only if diabetes diagnosed based on fasting glucose results. Not specified if lipids are fasting. Based on ISBD recommendations and also combined with Belgian Consensus Group 2005. Lambert and Chapman. Diabetes, psychotic disorder and antipsychotic tx: a consensus statement. Med J Aust 2004; 181: 544-548.
Typical Antipsychotics	No specific monitoring discussed.			VA/DoD Bipolar disorder. 2010	
	No specific monitoring discussed.			APA schizophrenia. 2004	Detailed prescribing and safety information is presented, but without specific monitoring recommendations.
	(AP in general) wt, waist circ, HR, BP, fGlu, a1c, FLP, prolactin. EKG if RF	wt weekly x6 wks, then at 12 wks, then 1 year. HR, BP, fGlu, a1c, FLP at 12 weeks, then 1 year.	Annually: wt, waist circ, HR, BP, fGlu, a1c, FLP	NICE psychosis and schizophrenia in adults. CG178, p. 587. 2014.	Carduac risk factors to consider for EKG include HTN (any personal hx of CV disease)
	Weight/BMI. Consider checking diabetes status, lipids due to risk of weight gain. BP in elderly.	Consider monitoring fasting triglycerides monthly for several months in patients at risk for metabolic complications, as well as glucose status in those at risk. Follow BP in first few weeks in elderly.	Monitor weight/BMI.	Stahl's 6th ed. 2017.	Monitoring elevated prolactin levels of dubious clinical benefit. In patients with low WQBC or history of drug-induced neutropenia/leukopenia, mointor CBC frequently during first few months.
Antidepressants	consider pregnancy test; consider ECG if cardiovascular risk factors present, electrolytes in older patients, and bone desnity scan especially if risk factors for osteoporosis		hyponatremia risk should be monitored in at risk groups (e.g., older patients) especialy with SSRI/SNRI/mirtazapine	Dodd et al. 2017.	Expert consensus group published in World Journal of Biological Pyschiatry, 2017.
SSRI	No specific monitoring guidelines.			VA/DoD major depressive disorder. 2016	
	No specific monitoring guidelines.			APA major depression. 2010	
	No specific monitoring guidelines.			RANZCP 2015	
	No specific monitoring guidelines.			CANMAT Major depression 2016	
	No specific monitoring guidelines.			NICE Depression in adults. CG90. 2009, last updated 2016	
TCAs	No guidelines for initiation mnitoring.		monitor plasma drug concentrations for therapeutic dose and to limit tox risk: desipramine, imipramine, nortriptyline	VA/DoD Major depression CPG 2016. (p. 98, Table C-2)	therapeutic plasma drug concentrations: desipramine (125-300 ng/mL), imipramine (200-350 ng/mL), nortriptyline (50-175 ng/mL)
	EKG for patients "with significant cardiac risk factors and patients older than age 50 years."		consider f/u EKG. Consider plasma levels, especially nortriptyline, amitriptyline, desipramine, imipramine.	APA Major depression guideline 2010. (p. 41)	
Venlafaxine			BP at higher doses	NICE depression in adults, CG90 2016	
Stimulants	weight/height, EKG if indicated			NICE attention deficit disorder, CG 72. 2008.	with the National Collaborating Centre for Mental Health (NICE)
			HR and BP (when used as augmentation)	VA/DoD Depression CPG 2016	

Substance Use Disorders					
Disulfiram	Liver transaminases, EKG if h/o cardiac dz, upreg, verify abstinence with breathlyzer or blood alcohol level	LFTs within 1st month, then monthly for 3 months	LFTs periodically after 3 months as indicated	VA/DOD Substance use disorder. 2015.	VA/DoD CPG Management of SUD 2015
Naltrexone	Liver transaminases, total bilirubin, upreg for females. For long acting injectable (Vivitrol), specifically notes to assess for CrCl > 50, estimated or measured.	Liver transaminases at 6 months	Liver transaminases annually	VA/DOD Substance Use Disorder CPG 2015	
Acamprosate	CrCl, upreg for females		monitor creatinine/CrCl particularly in elderly and renal dz	VA/DOD Substance Use Disorder CPG 2015	
Opiate Substitution	No specific monitoring guidelines.			ASAM guidelines. 2015.	ASAM (American Society of Addiction Medicine). The National Practice Guideline for the Use of Medications in the Treatment of Addiction Involving Opioid Use. 2015
Methadone	consider baseline EKG for patients at risk of QT prolongation or arrhythmias			VA/DOD Substance Use Disorder CPG 2015	
Buprenorphine	Liver transaminases		Liver function tests prior to initiation and during therapy.	VA/DOD Substance Use Disorder CPG 2015	
SUD	No specific monitoring guidelines.			NICE alcohol use disorder. 2011.	National Collaborating Centre for Mental Health (NICE) 2011 Alcohol Use Disorders
Other					
T3 augmentation	TSH, free T3 and free T4 prior to initiation.		Repeat same thyroid panel at 3 months, then every 6 months or at a minimum, annually.	Source from published literature.	Rosenthal et al, (2011) AJP 168:1035. See page 1038. Goal TSH at lower limit of normal or below if there are no clinical hypothyroid symptoms. Measure bone dsenity every two years in post-menopausal women while treating with T3 augmentation.