Common Blood Monitoring Schedules

The information below only refers to blood monitoring requirements for monitoring potential toxicity/ side effects of common drugs; other tests may be required to monitor disease progression / response to treatment and subsequent dose adjustments, but these are not within the remit of this appendix.

This is not an exhaustive list and is for guidance only. **It should be read in conjunction with the BNF, the Summary of Product Characteristics (SPC) for individual drugs and Shared Care Protocols (SCP) /guidelines where available.** See also the references at the end of the document.

Individual patient factors that may alter monitoring frequency should also be considered; for example, drug interactions, multiple morbidities, previous abnormal results, changes in lifestyle (smoking cessation, weight changes, changes in alcohol intake).

5% to 8% of unplanned hospital admissions are due to preventable medication issues [57]. Five classes of medicines account for most of these admissions: NSAIDs, antiplatelets, anticoagulants, diuretics, antihypertensives. Some of these admissions may have been prevented if blood monitoring regimes were in place.

Practices are advised to set up processes to monitor patients in line with the recommendations below.

The drug column in the blood monitoring table is colour coded according to the Sheffield traffic light classification.

Updates process

This document will, as a live document, be updated by clinical leads when the need arises.

The clinical lead will invite peers from within their clinical groups/team, to give a sense check of the changes and the FSG link person will provide oversight, before a proposal for the change is submitted to FSG

Appendix 1 must be completed to log the date, detail, and author of the change when new or amended content has been added to the appropriate section of the table.

As the individual entries will be the responsibility of the relevant clinical lead the overarching review, not a clinical review, will remain at 5 yearly intervals.

	Sulfasalazine
	Tacrolimus (oral)

DRUG	MONITORING	FREQUENCY (once stable)	NOTES
CARDIOVASCULAR DRUGS			
ACE inhibitors and Angiotensin II Receptor Antagonists	U&Es [1, 2]	U&Es and renal function before treatment commences and then 1-2 weeks after each increase in dose. Once stabilised, ongoing routine monitoring should take into consideration the patient's current renal status and risk of deteriorating kidney function; it should be done at least annually in those without underlying chronic kidney disease or heart failure. Increased frequency of monitoring is needed in patients with heart failure with reduced ejection fraction (HFrEF) and those who are also on spironolactone or eplerenone. See local guidance on managing HFrEF[39].	Caution when prescribed with NSAIDs, spironolactone or eplerenone.[2] Potassium: Refer to hyperkalaemia pathway if $K^+ \geq 5.5$mmolL- see link. Sodium: Refer to hyponatraemia pathway if $Na^+ < 133$mmol/L – see link. Renal function: Increases in creatinine of >100% (or a level > 310micromol/L or an eGFR < 20ml/min/1.73m^2) should lead to stopping ACEI/A2RA and referral to a specialist[1]. The SPS drug monitoring document[1] gives further information regarding rises in creatinine >200micromol/L or eGFR<30ml/min/1.73m^2 and dose reduction/drug withdrawal. If on ACEI/A2RA and a mineralocorticoid receptor antagonist with serum creatinine>220micromol/L seek timely specialist cardiology advice and withdraw one of the two agents or reduce dose [39]. If eGFR is 45 ml/min/1.73 m^2 or below, consider lower possible doses of ACEI/A2RA [39].
Sacubitril valsartan	U&Es [39].	Once stable 6 monthly or 3 monthly in patients who are also taking spironolactone or eplerenone.	
Diuretics (Loops & thiazides)	U&Es [3, 34, 35]	1 week after treatment initiation or dose increase, within 4 to 6 weeks and then 12 monthly thereafter. In patients with heart failure who are taking a loop diuretic monitoring should be carried out every 6 months [35].	Potassium: If K+ decreases to less than 3mmol/L (or 4mmol/L in high-risk people), review diuretic treatment. Those considered high risk include the elderly, malnourished and/or polymedicated, cirrhotic patients with oedema and ascites, coronary artery disease and patients with cardiac failure. Sodium: Refer to hyponatraemia pathway if $Na^+ < 133$mmol/L – see link.

DRUG	MONITORING	FREQUENCY (once stable)	NOTES
Dalteparin	U&Es [26, 27]	Monitoring for hyperkalaemia at least every 4 weeks in patients at high risk[#]. – See notes section.	Monitor for hyperkalaemia in those patients at higher risk of raised plasma-potassium concentrations ([#]those with diabetes mellitus, chronic renal failure, acidosis, raised potassium concentrations, those taking potassium-sparing drugs / potassium supplements or patients on long-term treatment). Monitoring should be done regularly in these patients according to clinical judgement. May need dose adjustment with significant change in renal function (see shared care protocol – link below).
	Platelet counts- ONLY in high-risk surgical patients who have had exposure to heparin/ LMWH or cardiopulmonary bypass surgery within the previous 100 days.[26]	Secondary care will inform the GP of dates when platelet counts are required to be checked. Usually 24 hours after starting dalteparin then weekly for 2 weeks; some of which may have been completed during the inpatient admission.	If patient develops thrombocytopenia, skin reaction or new thrombosis within 14 days of starting therapy, HIT should be considered. If HIT is suspected, discuss as an emergency with a haematologist for assessment. See link - dalteparin SCP for more information.
Spironolactone	U&Es [4,35,36,37,39]	**For heart failure:** Initiation: at 1, 4, 8, 12 weeks and at each dose increment. Maintenance: once the target or maximum tolerated dose is reached, monitor the renal function monthly for three months and then every three months, or at any time the person becomes acutely unwell. **For other indications:** Fluid and electrolyte status should be regularly monitored particularly in the elderly, in those with significant renal and hepatic impairment. For further information see the summary of product characteristics [37].	Increased frequency of monitoring is needed in heart failure patients and those also on ACEIs or A2RAs. Potassium: There is a risk of hyperkalaemia when spironolactone is used in combination with ACEI, A2RAs or with sacubitril valsartan. If K+ ≥6.0 mmol/L stop and seek advice [36]. If K+ increases to 5.5-5.9 mmol/L reduce dose and monitor [36]. Renal function[39]: If patient has heart failure and is on ACEI/ A2RA and spironolactone with serum creatinine > 220micromol/L seek specialist cardiology advice and withdraw one of the agents or reduce dose. Note: Do not initiate in patients with heart failure on ACEI/A2RA who have serum creatinine >200micromol/L.
Eplerenone	U&Es[35,36, 38,39]	Initiation: at 1, 4, 8, 12 weeks and at each dose increment. Maintenance: once the target or maximum tolerated dose is reached, monitor the renal function monthly for three months and then every three months, or at any time the person becomes acutely unwell.	Increased frequency of monitoring is needed in heart failure patients and those also on ACEIs or A2RAs. Potassium: There is a risk of hyperkalaemia when eplerenone is used in combination with ACEI, A2RAs or with sacubitril valsartan. If K+ ≥6.0 mmol/L stop and seek advice [36]. If K+ increases to 5.5-5.9 mmol/L reduce dose and monitor [36]. Renal function[39]: If patient has heart failure and is on ACEI/ A2RA and eplerenone with serum creatinine > 220micromol/L seek specialist cardiology advice and withdraw one of the agents or reduce dose. Note: Do not initiate in patients with heart failure on ACEI/A2RA who have serum creatinine >200micromol/L.

DRUG	MONITORING	FREQUENCY (once stable)	NOTES
Digoxin	U&Es[1]	Appropriate electrolyte monitoring should be carried out in patients predisposed to electrolyte imbalances e.g. patients on loop diuretics, renal dysfunction and elderly patients.	NB. Digoxin level only required if overdose / non-compliance / toxicity is suspected or during dose adjustment. Hypokalaemia, hypomagnesaemia, and hypercalcaemia predispose the patient to digoxin related problems. Hypocalcaemia may indicate that magnesium levels are also low. If levels needed – take at least 6 hours post dose (NICE NG106 recommends 8-12 hours post dose).
Methyldopa	FBC and LFTs[2]	Before treatment and at intervals during the first 6 to 12 weeks or if unexplained fever occurs.	
Statins	U&Es, total cholesterol, HDL cholesterol and non-HDL cholesterol [5,40] Also, triglyceride and TSH at baseline [5, 40] LFTs[5, 40] CK[5,40]	Baseline, at 3 months and 12 months. Monitor at baseline, 3 months, 12 months then when clinically indicated. Only if muscle symptoms; check for these symptoms prior to starting treatment, and measure CK levels if symptomatic or if history.	Aim for a greater than 40% reduction in non-HDL cholesterol from baseline pre-statin levels. Consider compliance and adherence to diet and lifestyle advice. Stop if transaminases persistently 3 x upper limit of normal (ULN). Stop if CK >5 x ULN. Creatine kinase (CK) should not be measured following strenuous exercise or in the presence of any plausible alternative cause of CK increase as this makes value interpretation difficult.
Fenofibrate	U&Es [32] LFTs[32] CK[32,40]	Within 3 months of starting, then annually thereafter. Monitor every 3 months for the first 12 months then annually thereafter. Discontinue if ALT/AST > 3 x ULN. Only if muscle symptoms; check for these symptoms prior to starting treatment, and measure CK levels if symptomatic or if history	 Stop if transaminases persistently 3 x upper limit of normal (ULN). Stop if CK >5 x ULN.
Warfarin	INR[1,23]	1 to 12 weeks. For practices that initiate warfarin under the anticoagulant LCS see warfarin SOP for monitoring requirements on initiation.	Check BNF[2] for drug interactions. Risk of bleeding increases greatly once INR > 5[1]. See anticoagulant service standard operating procedure for further information [23].
Direct oral anticoagulants (DOACs): rivaroxaban, apixaban, edoxaban and dabigatran (traffic light status dependant on indication – see TLDL)	U&Es, FBC and LFTs[58] Clotting screen at baseline[58]	Monitor before treatment commences- and at least annually. More frequent U&Es /LFTs may be needed in patients with impaired renal function; or with intercurrent illness that may impact renal, and hepatic function) and those over 75 years on dabigatran.	See local SPAF guidance for further information. Note: weight and height needed to calculate creatinine clearance (CrCl) and adjust DOAC dose accordingly.
Amiodarone	TFTs, LFTs, U&Es[1,7,8] Digoxin levels (if on digoxin)	TFTs, LFTs, U&Es before treatment commences, during loading and then 6 monthly. Digoxin levels should be monitored at baseline and every 6 months if patient on digoxin.	See amiodarone SCG for further details[8].

DRUG	MONITORING	FREQUENCY (once stable)	NOTES
***Dronedarone**		**Ongoing monitoring should occur under specialist supervision** [2]	
	LFTs [1,29]	Before treatment, after 1 week, then after 1 month, then monthly for 6 months and at months 9 and 12, and six monthly thereafter.	If ALT is >3x ULN retest after 48-72 hours, if ALT remains >3x ULN stop treatment.
	U&Es (including creatinine) [1,28,29]	Before treatment and at 7 days then six monthly thereafter.	Correct any electrolyte balances prior to starting dronedarone and during treatment. Creatinine may increase on initiation; this usually plateaus after 7 days. If creatinine has stabilised this value is used as the new baseline. If serum creatinine continues to rise then consideration should be given to further investigation and discontinuing treatment [28].
Ticagrelor	U&Es[33]	Once at 1 month after initiation.	Patients on treatment beyond 12 months consider U&Es annually.
RESPIRATORY			
Theophylline	Theophylline level (10 – 20mg/L)[1]	Check 5 days after initiation and at least 3 days after each dose adjustment. Once stable, check 6 to 12 monthly.	Levels should usually be taken 4-6 hours after MR dose. State sample time to enable labs to interpret the result. Check more regularly in older people or those with heart failure or hepatic impairment. Need to check other factors: • Smoking status-if the person stops or starts smoking as tobacco can lower plasma levels of theophylline. • Alcohol consumption-high alcohol consumption can reduce plasma concentration of theophylline. • Pregnancy- check levels during pregnancy as a lower therapeutic range is probably appropriate. BTS/SIGN particularly recommends checking levels in pregnant women with acute severe asthma and in those that are critically dependent on therapeutic theophylline levels [17].
	U&Es	At baseline and then regularly if at risk of hypokalaemia (see notes)	Plasma potassium concentrations may be reduced by beta-2 agonists, corticosteroids, and diuretics. This effect may be potentiated by theophylline, and further exacerbated by hypoxia [1].
	LFTs	At baseline.	A lower dose may be required in those with hepatic impairment.

CENTRAL NERVOUS SYSTEM			
Carbamazepine	FBC, LFTs, U&Es [24,25] Baseline, FBC, LFTs.	**Bipolar disorder** – Periodically, or if clinically indicated **Epilepsy** - NICE suggest that in epilepsy FBC, U&Es, liver enzymes, Vitamin D levels, and other tests of bone metabolism every 2-5 years for adults taking enzyme-inducing drugs. Also refer to epilepsy SCPs [45, 46]	See Bipolar Prescribing Guideline Manufacturer recommends periodic blood counts and hepatic and renal function tests (but evidence of practical value uncertain). Patients or their carers should be told how to recognise signs of blood, liver, or skin disorders and be advised to seek medical attention if symptoms such as fever, rash, mouth ulcers, bruising or bleeding develop [24]. Note: patients on the SMI register should have an annual health check. Local guidance (see the adult and children's SCPs for epilepsy): Regular blood test monitoring in patients with epilepsy is not generally recommended as routine and should be done only if clinically indicated. If blood tests are undertaken, prescribers should be aware that certain antiepileptic drugs including carbamazepine, induce liver enzymes but that this process is harmless to the liver. However, the increased potential for drug interactions should be considered. The use of drug level monitoring is discouraged unless there is a question of compliance or intoxication. Note: elevated gamma GT anticipated because of enzyme induction. Warn patients to look out for symptoms of neutropenia.
Antipsychotics (traffic light status dependant on indication – see TLDL)	Fasting blood glucose, and lipids HbA1c [41,10] Prolactin [41] LFTs, U&Es, TFTs and FBC [1]	Prior to starting treatment, at 3 months after starting treatment and then annually. More frequently if evidence of elevated levels. For olanzapine repeat after first month of treatment, at month 3, then annually [42]. At baseline, then only if symptoms of raised prolactin. At baseline then annually.	Increased risk of diabetes with anti-psychotics. **Note: Patients on the SMI register should have an annual health check.**
***Clozapine**	As per antipsychotics above PLUS blood counts (white cell count with a differential count) [9]	**Ongoing monitoring should be undertaken by the specialist**. At least weekly for the first 18 weeks of treatment. At least at 2 week intervals between weeks 18 and 52. After 1 year of treatment with stable neutrophil counts, patients may be monitored at least at 4 week intervals. Monitoring must continue throughout treatment and for at least 4 weeks after discontinuation.	Prescribers should add clozapine to the patient's medicines list as a specialist issued drug (SID), this avoids inadvertent issuing of prescriptions but allows drug/disease interactions to be checked and side effects to be picked up (see Guidance for Recording SIDs). Monitoring blood clozapine levels for toxicity is now advised in certain clinical situations [56]. Refer patients on clozapine to specialist/clozapine monitoring service in the following circumstances: • patient stops smoking/switches to an e-cigarette • patient initiated or stopped an interacting medication • patient has pneumonia or other serious infection • if poor (reduced) clozapine metabolism is suspected • toxicity is suspected
Dantrolene	LFTs [61, 62]	Measure baseline LFTs and then again after 45 days (between 6- 8 weeks) of reaching the target dose. If target dose is above 200mg per day or given in combination with tizanidine repeat at 6 months Annual LFTs for all patients on dantrolene above 200mg per	In the event of any elevation of LFTs, the medication should be stopped immediately and LFTs rechecked within 2-4 weeks

		day or dantrolene with tizanidine. Repeat LFTs after 45 days (between 6 and 8 weeks) if dose is escalated	
Lithium (should only be prescribed by brand)	Lithium level[1, 25] U&Es including calcium, eGFR, thyroid function [1, 2, 10]	Weekly after initiation and after each dose change until lithium concentrations are stable (0.4 – 1 mmol/L). Then every 3 months for the first year. Every 6 months after the first year or every 3 months for people in the following groups: • Older people • Patients taking drugs that interact with lithium • Patients at risk of impaired renal or thyroid function, raised calcium levels or other complications • Patients who have poor symptom control, poor adherence, last plasma lithium level was 0.8mmol/L or higher. Every 6 months. More often if there is evidence of any of the following: • impaired renal or thyroid function. • raised calcium levels. • an increase in mood (symptoms that might be related to impaired thyroid function). • other risk factors such as starting ACE inhibitors, NSAIDS or diuretics.	Take blood levels 12 hours after last lithium dose. Monitor lithium concentration if patient becomes dehydrated or nausea and vomiting. See NPSA lithium alert (NPSA/2009/PSA005). See Bipolar Prescribing Guideline for more information Additional serum lithium monitoring is recommended if patient develops significant intercurrent disease or if there is change in the patient's sodium or fluid intake
***Apomorphine**	FBC, LFTs and U&Es[2]	Monitoring to be done by specialist: 6 monthly.	See Parkinson's disease SCP
***Ergot derivatives (e.g. bromocriptine, cabergoline and pergolide)**	FBC and biochemistry test[43]	Annually – Normally carried out by secondary care.	See Parkinson's disease SCP
Phenytoin		NICE CG137[44] suggests FBC, U&Es, liver enzymes, vitamin D levels, and other tests of bone metabolism are done every 2-5 years for adults taking enzyme-inducing drugs.	Regular blood test monitoring in patients with epilepsy is not recommended as routine and should be done only if clinically indicated. If blood tests are undertaken, prescribers should be aware that certain antiepileptic drugs including phenytoin, induce liver enzymes but that this process is harmless to the liver. However, the increased potential for drug interactions should be considered - induces p450 enzymes [45,46]. Patients or their carers should be told how to recognise signs of blood or skin disorders and advised to seek immediate medical attention if symptoms such as fever, rash, mouth ulcers, bruising, or bleeding develop. Leukopenia that is severe, progressive, or associated with clinical symptoms requires withdrawal[1].

Sodium Valproate (including semi-sodium valproate and valproic acid)	LFTs, FBC [1,25,10]	**Bipolar disorder** – prior to initiation then at 6 months, then repeat annually[25]. **Epilepsy** [45, 46] Regular blood test monitoring in patients with epilepsy is not recommended as routine and should be done only if clinically indicated. The use of drug level monitoring is discouraged unless there is a question of compliance or intoxication.	See Bipolar Prescribing Guideline See SCP for epilepsy in adult and SCP for epilepsy in children **If spontaneous bruising or bleeding withdraw drug pending investigations (FBC).**
Riluzole	LFTs[60]	Before and during therapy every month for the first 3 months then 3 monthly for a further 9 months then annually.	ALT levels should be measured more frequently in patients who develop elevated ALT levels. Discontinue if ALT levels increase to 5 x the upper limit of normal (ULN). Patients should be warned to report any febrile illness to their physicians. White blood cell counts should be checked and riluzole discontinued if: • WBC <3.5 x 10^9/L • Neutrophils <2 x 10^9/L
Tizanidine	LFTs[63]	Measure baseline LFTs and for the first 4 months, monthly monitoring in those with daily doses of 12 mg or higher and in those with symptoms suggestive of liver/hepatic dysfunction such as unexplained nausea, anorexia or fatigue. Annual LFTs for all patients on tizanidine with dantrolene.	Discontinue in patients with symptoms compatible with hepatitis or where jaundice occurs Discontinue if serum levels of SGPT (serum glutamic-pyruvic transaminase) and/or SGOT (serum glutamic-oxaloacetic transaminase) are persistently above 3 x the upper limit of normal (ULN).
INFECTIONS			
Minocycline	If treatment continued for longer than 6 months, monitor every 3 months thereafter for hepatotoxicity and for systemic lupus erythematosus[2]		Discontinue if any signs or symptoms of hepatotoxicity, systemic lupus erythematosus or pigmentation develop.
ENDOCRINE			
Corticosteroids (long term oral therapy)	Triglycerides and Potassium[1] HbA1c[1]	Prior to starting treatment, one month after initiation and then every 6 to 12 months thereafter. Prior to starting treatment, one month after initiation then 3 monthly thereafter.	
Metformin	U&Es[11] Vitamin B12	At baseline then 12 monthly in patients with a normal renal function. Two to four times a year in patients with creatinine clearance at the lower limit of normal and in elderly subjects. Annually for patients with risk factors for B12 deficiency	Avoid metformin in patients with renal failure i.e. if eGFR falls below 30ml/min/1.73m^2 (In line with NICE NG28 [53]). Risk factors for vitamin B12 deficiency include: • Conditions associated with reduced vitamin B12 absorption (including elderly people and those with gastrointestinal disorders such as total or partial gastrectomy, Crohn's disease, other inflammatory bowel disorders, or autoimmune conditions.) • Diets with reduced sources of B12, such as strict vegan and some vegetarian diets.

			• Concomitant medication known to impair B12 absorption e.g. proton pump inhibitors or colchicine. • Genetic predisposition to vitamin B12 deficiency such as intrinsic factor receptor deficiency (Imerslund-Gräsbeck syndrome) and transcobalamin II deficiency. See MHRA alert for more information (June 2022)
Pioglitazone	LFTs[1, 12]	At baseline then as clinically indicated (at least once a year).	Stop if ALT levels reach 3X upper limit of normal. Contraindicated in heart failure. Monitor weight & symptoms, on initiation, in patients with risk factors for heart failure.
Propylthiouracil (specialist initiation)	TFTs[59] FBC[59] LFTs[59]	TSH, FT4 and FT3 every 6 weeks until TSH is within the reference range, then TSH (see note) every 3 months until antithyroid drugs are stopped. For adults who have stopped antithyroid drugs, consider measuring TSH (see note) within 8 weeks of stopping the drug, then every 3 months for a year and then once a year. If clinical suspicion of agranulocytosis. If clinical suspicion of liver damage.	Note: FT4 & FT3 will be added in the lab if the TSH result or the clinical details selected on ICE indicate that they are required. For further information see 'Using ICE to request TFTs for adults in Sheffield'.
Levothyroxine	TFTs[1,59]	For adults measure TSH every 3 months until the level has stabilised (2 similar measurements within the reference range 3 months apart), and then annually.	Note: FT4 & FT3 will be added in the lab if the TSH result or the clinical details selected on ICE indicate that they are required. For further information see 'Using ICE to request TFTs for adults in Sheffield'.
Carbimazole (specialist initiation)	TFTs[2,13, 59] FBC[59] LFT[59] CK[1,13]	TSH, FT4 and FT3 every 6 weeks until TSH is within the reference range, then TSH (see note) every 3 months until antithyroid drugs are stopped. For adults who have stopped antithyroid drugs, consider measuring TSH (see note) within 8 weeks of stopping the drug, then every 3 months for a year and then once a year. If clinical suspicion of agranulocytosis. If clinical suspicion of liver dysfunction. Only in patients experiencing myalgia.	Note: FT4 & FT3 will be added in the lab if the TSH result or the clinical details selected on ICE indicate that they are required. For further information see 'Using ICE to request TFTs for adults in Sheffield'.
Testosterone	FBC, testosterone levels and PSA[2, 54] Lipids[2]	Prior to treatment then at 3 to 6 months then at 12 months then annually. Annually.	FBC to detect polycythaemia.

Denosumab	P1NP[49] Plasma calcium[48,49]	**Following 1st injection only (6 months):** Check P1NP is reduced by 10ng/mL from baseline and/or the post treatment level is <35ng/mL. Two weeks prior to each injection.	Consider rechecking if patient develops symptoms suggestive of hypocalcaemia post-treatment. If patient is identified by secondary care at baseline as being at risk of hypocalcaemia, calcium levels should be checked two weeks post-injection See Denosumab Prescribing Guideline
NUTRITION AND BLOOD			
Alfacalcidol, calcitriol	Plasma calcium[2]	All patients receiving pharmacological doses of vitamin D should have their plasma-calcium concentration checked at intervals (initially once or twice weekly) and whenever nausea or vomiting occur.	Monitoring requirements vary depending on indication, refer to individual SPCs.
Cinacalcet - for Primary Hyperparathyroidism in Adults	Adjusted calcium levels[64]	After maintenance dose has been established the patient's care will be handed over to GP who will then monitor adjusted calcium levels every 3 months for a year from commencing cinacalcet; if adjusted calcium levels are well controlled patient then to be monitored / checked every 6 months.	Cinacalcet Shared care protocol for primary hyperparathyroidism
Cinacalcet - for Secondary Hyperparathyroidism in Adults			Cinacalcet is a red traffic light drug and is NHS England commissioned for secondary hyperthyroidism in end stage renal disease. It should not be prescribed in primary care; for further information clarify with specialist and see SPC
High dose oral colecalciferol, parenteral vitamin D	Adults – bone profile, and 25(OH)D[50] Children - bone profile and 25(OH)D[51]	At baseline, 4 months and 12 months post starting treatment for deficiency. At baseline and 2-3 months from starting treatment for deficiency. NB. Levels not needed with standard prophylactic doses.	Refer to local vitamin D guidelines for full details on monitoring requirements for adult and children
***Hydroxycarbamide**	U&Es, FBC, LFTs, serum uric acid[1]	Ongoing monitoring should be undertaken by the specialist.	Frequency of monitoring is dependent on indication. See SPS drug monitoring document.
DISEASE MODIFYING AND ANTI-INFLAMMATORY			
NSAIDs including COX-2 inhibitors	U&Es if patients have diabetes mellitus, hypertension, renal, cardiac or hepatic impairment or if elderly, or if taking diuretics or ACEI/A2RA [1, 14, 15]	12 monthly.	Except low dose aspirin. Monitor U&Es 1–2 weeks after starting or increasing NSAID dose in patients with mild to moderate HF or renal impairment, particularly in people taking an ACE inhibitor, an angiotensin-II receptor antagonist or a diuretic.
Azathioprine (traffic light status dependant on indication – see TLDL)	FBC, extended LFTs, U&Es/creatinine. Also, in rheumatology patients prescribed azathioprine measure CRP every 3 months. [18]	3 monthly once shared care agreed.	If blood results outside normal range, refer to SCP for advice on whether to stop drug and contact helpline, or to repeat test. See Azathioprine & Mercaptopurine Shared Care Protocol for more information.
Mercaptopurine	FBC, extended LFTs, U&Es/creatinine. [18]	3 monthly once shared care agreed.	If blood results outside normal range, refer to SCP for advice on whether to stop drug and contact helpline, or to repeat test. See Azathioprine & Mercaptopurine Shared Care Protocol for more information.

***Ciclosporin**	FBC, extended LFTs, U&Es/creatinine, calculated GFR, blood glucose[16] Blood lipids[2] Monitor serum magnesium[2]	Every two weeks until on stable dose for six weeks then monthly for at least 12 months. Reduced frequency of monitoring may be considered at this point on individual patient basis. BNF advises measure before treatment and after 1st month of treatment. As per BNF.	
Mycophenolate (traffic light status dependant on indication – see TLDL)	FBC, extended LFTs, CRP, U&Es and eGFR [31]	3 monthly once shared care agreed.	If blood results outside normal range, refer to SCP for advice on whether to stop drug and contact helpline, or to repeat test. See mycophenolate SCP for more information.
***Tacrolimus (oral)**			Oral tacrolimus is a red traffic light drug. Monitoring is dependent on indication. Prescribers should ensure appropriate monitoring is being carried out prior to prescribing. For further information clarify with specialist and see SPC.
***Sirolimus**			Sirolimus is a red traffic light drug and is NHS England commissioned so should not be prescribed in primary care. For further information clarify with specialist and see SPC.
Febuxostat	LFTs[2]	Prior to treatment and periodically thereafter based on clinical judgement.	
Leflunomide	FBC, U&Es, creatinine, CRP, extended LFTs[20, 30]	3 monthly once shared care agreed.	If blood results outside normal range, refer to SCP for advice on whether to stop drug and contact helpline, or to repeat test. See leflunomide SCP for more information
Methotrexate	FBC, U&Es, CRP (for rheumatology patients only) full LFTs [21]	3 monthly once shared care agreed.	If blood results outside normal range, refer to SCP for advice on whether to stop drug and contact helpline, or to repeat test. See methotrexate SCP for more information.
***Penicillamine**	FBC & U&Es [1,2,52]	Monthly. Once patients have been stable for 12 months consider reduction to 3 monthly on a case by case basis. If patient develops flu-like symptoms check FBC.	The BNF and SPC state that longer intervals may be adequate when used in cystinuria and Wilson's disease. Consultant will advise on a case by case basis. Discontinue and discuss with specialist if: • Platelets < 120 x10^9/L (unless stable pre-existing thrombocytopenia of which the specialist is aware) • WCC < 2.5 x10^9/l (members of the Somali community tend to have lower WCC and neutrophil counts than Caucasians, and a lower WCC threshold should apply: the specialist will/should advise) • or if 3 successive falls of platelets or WCC within reference range Contraindicated in patients with moderate and severe renal impairment[52].
Sulfasalazine	FBC, extended LFTs, U&Es[22]	Once patient is stabilised and shared care agreed, monitor LFTs and FBC 3 monthly and U&Es when clinically indicated. Monitoring is not routinely required once a patient has had stable blood levels for a year. Selected patients who are deemed to be at higher risk may require longer periods of monitoring, but those patients will be clearly identified by the	If blood results outside normal range, refer to SCP for advice on whether to stop drug and contact helpline, or to repeat test. See sulfasalazine SCP for more information.

		responsible consultant.	
Mesalazine	U&Es[2]	At baseline, 3 months and then annually.	There is no national standard for long term monitoring. It is left to the discretion of the physician and should take into account the person's risk factors [1]. Additionally, LFTs and FBCs may sometimes be recommended [55]. Haematological investigations should be performed if the patient develops unexplained bleeding, bruising, purpura, anaemia, fever or sore throat. Treatment should be stopped if there is suspicion or evidence of blood dyscrasia [1].

*****Indicates monitoring usually carried out in secondary care.

Appendix 1

Date	Review/update description	Author
Dec 2021	Tizanidine added	S Kebell
Dec 2021	Dantrolene added	S Kebell
October 2022	Cinacalcet referencing Red and Amber TLDL	S Kebell
March 2023	Metformin monitoring updated	C Bullen

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1. London & South East Medicines Information Service, South West Medicine Information Service and Croydon Clinical Commissioning Group. Suggestions for Drug Monitoring in Adults in Primary Care. https://www.sps.nhs.uk/wp-content/uploads/2017/12/Drug-monitoring-Sept-2020.pdf **
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** Ref 1; this has been replaced by the SPS: Drug Monitoring Guidance tool..