Classification: Official

Publication approval reference: PAR960

Optimising blood testing in secondary care

16 September 2021

1. Introduction

1.1 This document signposts best practice guidance and practical advice for optimising use of blood testing while maintaining clinical standards – this represents best practice that should be followed in normal day-to-day practice.

1.2 This document does not supplant clinical judgement: it is intended to highlight best practice recommendations, including some that relate to very specific situations, that may inform and support practice.

1.3 Requesting blood tests is a clinical responsibility and sits with the assessing clinician. This can be anyone in the primary, community or acute trust clinical team including nurses, allied health professionals (AHPs) and doctors.

1.4 As with any guidance, this collation of best practice guidance should be considered and adapted as appropriate to the specific situation and the specific needs of the patient (taking into account any particular preferences, needs or characteristics they may have or any risks that may apply).

1.5 The GMC provides guidance for doctors on planning, using and managing resources. Similar considerations apply to all healthcare professionals working in the NHS:

- Whatever your role or level in your organisation, whether you are a junior, non-training grade or other doctor, you should be willing to demonstrate leadership in managing and using resources effectively. This means that you should be prepared to contribute to discussions and decisions about:
  - allocating resources and setting priorities in any organisation in which you work

  - commissioning services for the wider population of patients.
- To minimise waste, improve services and promote the effective use of resources, you should take financial responsibility for delivering your service at a level appropriate to your role. You should understand the roles and policies of local and, where relevant, regional and national agencies involved in healthcare if they affect your role as a doctor.

1.6 Requesting blood tests appropriately has benefits for patients, the health system and the environment:

- There is significant unwarranted variation in blood test requesting across secondary care. Rationalising blood taking improves patient experience (fewer venepuncture events, less time/travel for outpatient blood taking); reduces the risk of anaemia associated with repeated blood taking; and reduces the harms associated with investigation of incidental findings.
- Appropriate blood test planning and requesting reduces demands on phlebotomy and laboratory resources and reduces avoidable costs (for example, of unnecessary retesting or more invasive knock-on investigations) to the NHS.
- The carbon footprint of common blood tests is mostly attributable (>50% and, depending on the test, as much as 90%) to the sample collection process: blood tubes, blood collection system components, gloves, gowns, sample bags, etc are required. Therefore, rationalising the requesting of tests (and, where appropriate, combining multiple tests or adding on tests to a single sample) has environmental benefits. While the carbon footprint of each individual test is small, this adds up over the millions of tests requested each year.[1]

1.7 Given the current acute shortage of blood tubes, this document may also support local efforts to safely deliver the NHS England and NHS Improvement guidance on conserving blood tubes for as long as this shortage lasts.

1.8 In recovering from the acute shortage, the best practice guidance included here is intended to support return to best (rather than existing) practice. We therefore ask acute providers to consider implementing this advice for longer-term change.

1.9 This document is divided into several sections – and separates general best practice and advice specific to the acute shortage:

[1] McAlister S et al. The carbon footprint of pathology testing. Med J Aust 2020; 212(8): 377-82. doi: 10.5694/mja2.50583

- Sections 2 to 6 gives general best practice guidance (applicable in normal day-to-day practice) and are not specific to the period of acute shortage.
  - Section 2 gives general best practice for optimising blood test resource use
  - Sections 3 to 5 give best practice advice for optimising blood testing in pathways/protocolised testing (eg preop, postop, outpatient, certain emergency and surgical pathways), acute presentations and the inpatient setting
  - Section 6 gives best practice advice relating to specific tests and specialties.
- Section 7 gives advice specific to the period of acute shortage – this will be updated as appropriate in response to the evolving situation.
- The appendix summarises general best practice advice (applicable in normal day-to-day practice) on frequency of testing (minimum retesting intervals) and is not specific to the period of acute shortage.

2. Optimising blood testing resource use – best practice advice

2.1 Think twice, Check twice, Order once

Think twice

2.1.1 Before requesting blood tests, consider if the test is essential for management and adheres to clinical guidance:

- Consider the guidance below relating specifically to outpatient and pathway patients, acute presentations and inpatients.
- Always look up when the last blood test was done.
- Before repeating a test, refer to the national guidance on minimum retesting intervals, defined as the minimum time before a test should be repeated, based on the properties of the test and the clinical situation in which it is used. This document provides guidance on when to consider repeating common hospital biochemistry and haematology tests such as renal, bone and liver profiles, BNP, FBC and coagulation tests, depending on the specific clinical situation.
- Consider using point of care testing (POCT) for glucose, INR (or viscoelastic tests such as TEG and ROTEM) and haemoglobin where available and appropriately quality assured.

Check twice

2.1.2 Check if tests have been done recently (in primary or secondary care) and results are accessible – this may include serologies and renal/liver profiles, for example. **Do they really need to be repeated?**

- Some tests have relatively long turnaround times – when appropriate, check if a sample has been received in the lab but the result is still pending, before requesting again.
- To support this check, acute trusts and integrated care systems (ICSs)/CCGs are asked to work together to ensure that clinicians in both primary and secondary care have access to the results of tests conducted for their patients in all care settings.

Order once

2.1.3 Check with the lab if additional tests can be added on to existing samples (eg taken within the past days to a week) before requesting again – do not rebleed your patient without checking first.

2.1.4 Plan what is going to be requested in the coming hours/days and combine tests where possible – avoid use of multiple blood collections/venepuncture, multiple blood bottles, etc.

2.2 Sample collection, labelling and dispatch best practice

2.2.1 Correct identification of patient beforehand.

2.2.2 Ensure you use the correct tubes and the correct number of each (as advised by your requesting system or local protocols).

2.2.3 When taking specimens please only collect the number of tubes stated by order comms or on the request form (do not send an extra tube just in case).

2.2.4 Where samples can be combined, please only send a single tube:

- This may be the case, for example, for: HbA1c and FBC (a single purple top/EDTA tube), HbA1c and glucose (a single grey top tube), FBC and BNP (a single purple top/EDTA tube), biochemistry and immunology or virology samples (a single yellow top/SST tube).
- Local lab practices vary, however, so it is important to follow relevant local guidance.

2.2.5 Follow phlebotomy best practice – please follow local policies and guidance:

- Use experienced phlebotomists whenever practical.
- Order of draw.
- Avoidance of haemolysis and sample activation.
- Adequate filling of sample tubes (esp clotting).
- Label the sample at the patient's side to prevent patient and specimen mix ups.
- Verify the accuracy of specimen labelling before you or the patient leaves the treatment area.
- Ensure correct labelling and double check for any errors – this is particularly important for hand-labelled samples (including transfusion samples) – please refer to local laboratory requirements for transfusion sample labelling).
- Ensure prompt transfer of samples to the laboratory – unnecessary delays in transit and incorrect storage of samples should be avoided.

3. Pathways and protocolised blood testing – best practice advice

3.1 Review protocolised tests/testing panels

3.1.1 Examples include: referral pathways, outpatient clinic investigation protocols, ED protocols, preop pathways, postop pathways.

3.1.2 Where a panel of blood tests is required as a condition for referral (eg to memory clinic or where a clotting profile is required for referral to a 2WW pathway), review these requirements and consider whether they can be reduced to a minimum, made conditional on clinical factors (eg clotting only where known liver disease or suspected bleeding problem) or deferred and requested if indicated after secondary care review – work with ICS/CCGs to ensure that referrers are consulted and aware.

3.1.3 Review outpatient 'pathway' panels (eg hepatology new patient/follow-up patient panels) to see if these can be rationalised. Examples of good, and cost-effective, practice include the 'intelligent' liver function (iLFT) testing pathway from NHS Tayside:

- Work with ICS/CCGs and primary care providers to ensure that post-discharge follow-up blood testing (eg renal function after initiation or cessation of drugs, routine postop testing) is rationalised, including reference to national minimum retesting intervals where appropriate.

3.1.4 Consider reducing the standard testing panel to a minimum with addition of other tests by clinical indication and in discussion with a senior clinical decision-maker – especially where additional tests would necessitate additional tube use.

3.1.5 Where the requesting clinician is not a senior clinical decision-maker (eg not a medical or nurse consultant) consider instituting a review process, eg after each clinic and before requesting tests, to ensure that test requesting is tailored to specific patient needs rather than routine or standardised.

4. Acute presentations – best practice advice

4.1 Review any routine blood tests in:

- Minor injuries and minor illness (eg sore throat and UTI in physiologically well patients).
- Non-specific symptoms in the absence of further clinical concerns.

4.2 For acute presentations requiring admission:

4.2.1 Check if tests have been done recently (in primary or secondary care) and results are accessible – this may avoid the need for a repeat.

4.2.2 Use only one serum or lithium heparin plasma tube (do not take more than one).

4.2.3 Do not use serum glucose – POCT glucose (from a glucometer or blood gas machine are sufficient)

4.2.4 Consider if coagulation profile is really required – in many cases it is not. INR point of care may be used as an alternative for some coagulation tests such as INR.

4.2.5 D-dimer testing for venous thromboembolism (VTE) should be done in accordance with NICE guidance NG158, taking into account the clinical likelihood of VTE and the availability and timing of testing – please see the more detailed summary below.

4.2.6 Consider use of appropriately validated POCT testing only, eg venous gas for haemoglobin (example: a patient presenting with menorrhagia but physiologically well) or for sodium or potassium (example: a patient referred in for a blood test in the community showing an unexpectedly high sodium/potassium but who is otherwise well).

4.2.7 If a patient has been transferred from another trust for specialist services, do not routinely repeat bloods on arrival. Ensure that any results from the transferring hospital are appropriately stored and accessible to the receiving teams.

4.2.8 Ensure patients presenting with acute paracetamol poisoning have bloods done at the correct time post ingestion (4 hours) rather than immediately on arrival (if <4 hours); otherwise they will need to be repeated when the time interval has elapsed.

4.2.9 Emergency department coagulation screening should be limited to bleeding and trauma presentation, patients on anti-coagulation, liver disorders, suspected sepsis and over-dose patients. Consider using POCT tests such as viscoelastic tests (eg TEG or ROTEM) or POCT INR where clinically appropriate.

4.2.10 Do not repeat bloods within 48 hours unless the clinical situation has changed:

- National guidance is available on minimum retesting intervals, defined as the minimum time before a test should be repeated, based on the properties of the test and the clinical situation in which it is used. This provides guidance on when to consider repeating common hospital biochemistry and haematology tests such as renal, bone and liver profiles, BNP, FBC and coagulation tests, depending on the specific clinical situation.
- This is a comprehensive reference document. For easy reference, some key examples relevant to secondary care are included in the appendix.

5. Inpatients – best practice advice

5.1 All tests should be requested based on a clear clinical indication – avoid testing just as a routine, and clinically justify repeating blood tests.

5.2 Look at the patient trajectory/test result trends over a period and decide whether and when repeat is necessary:

- National guidance is available on minimum retesting intervals, defined as the minimum time before a test should be repeated, based on the properties of the test and the clinical situation in which it is used, is available. This provides guidance on when to consider repeating common hospital biochemistry and haematology tests such as renal, bone and liver profiles, BNP, FBC and coagulation tests, depending on the specific clinical situation.

- This is a comprehensive reference document. For easy reference, some key examples relevant to secondary care are included in the appendix.
- Note that in the context of an acute deterioration or critical illness, patients may require tests more urgently or frequently than set out in the minimum retesting interval recommendations. This is guidance only and decisions on the need for testing must always be based on clinical assessment.

5.3 **Discuss planned requests with a senior clinical decision-maker to decide what is/is not needed.**

5.4 Consider which specific tests are required – and document rationale for repeat of tests in the notes.

5.5 If someone is medically fit for discharge, they do not need routine bloods, unless these form part of the ongoing care plan.

6. Specific tests and services – best practice advice

6.1 Refer to the national minimum retesting intervals guidance:

6.1.1 National guidance is available on minimum retesting intervals, defined as the minimum time before a test should be repeated, based on the properties of the test and the clinical situation in which it is used. This provides guidance on when to consider repeating common hospital biochemistry and haematology tests such as renal, bone and liver profiles, BNP, FBC and coagulation tests depending on the specific clinical situation

6.1.2 The appendix highlights frequently performed tests/clinical situations from the national minimum retesting intervals guidance

6.2 FBC

6.2.1 For inpatients, if FBC is normal or near normal, there is no need to repeat this regularly.

6.2.2 Further guidance is included in the national minimum retesting intervals document.

6.3 D-dimer

6.3.1 D-dimer testing for venous thromboembolism (VTE) should be done in accordance with NICE guidance NG158, taking into account the clinical likelihood of VTE and the availability and timing of testing.

6.3.2 For people in whom DVT is likely (Wells score ≥2), D-dimer testing should be done if an initial ultrasound scan is negative or if an ultrasound scan cannot be obtained within 4 hours and further NICE guidance followed (NICE NG158 1.1.3–1.1.7).

6.3.3 For people in whom DVT is unlikely (Wells score ≤1), a D-dimer test should be done and further NICE guidance followed (NICE NG158 1.1.8–1.1.11).

6.3.4 For people in whom pulmonary embolism is unlikely (Wells score ≤4), a D-dimer test should be done and further NICE guidance followed (NICE NG158 1.1.21).

6.3.5 D-dimer testing should not be done in patients in whom pulmonary embolism is likely (Wells score >4).

6.3.6 D-dimer testing should only be done in patients in whom DVT is likely (Wells score ≥2) in accordance with the NICE guidance above.

6.3.7 D-Dimer POCT should not need to be confirmed by lab sample testing, and should be used first line where available.

6.4 Clotting – specific indications/tests, including pre-surgery and ED

6.4.1 Routine clotting screens pre-surgery should be avoided except where indicated by NICE guidance NG45, such as in ASA 3 or 4 patients with liver dysfunction having intermediate or major/complex surgery (see Section 7.9 on preoperative testing).

6.4.2 ED coagulation screening should be limited to bleeding and trauma presentations, patients on anti-coagulation, liver disorders, suspected sepsis and over-dose patients. Consider using POCT tests such as viscoelastic tests (eg TEG or ROTEM) or POCT INR where clinically appropriate.

6.4.3 Further guidance is included in the national minimum retesting intervals document.

6.5 Blood transfusion – group and screen (G&S)

6.5.1 Avoid routine G&S testing unless patient is likely to require transfusion, in line with the Choosing Wisely guidance, including in critical care patients.

6.5.2 Requests for G&S should follow British Society for Haematology guidelines and local policies, and should be limited to those cases where blood transfusion is an expected outcome, or where the need to know red cell antibody status is critical or the patient needs blood group confirmed on the 'minimum 2 sample requirement rule' to allow safe provision of blood.

6.5.3 Further guidance is included in the national minimum retesting intervals document.

6.6 Use of POCT, eg blood gases, INR, Hb

6.6.1 Clotting tests, such as for INR, can also be done by POCT, especially in the community or outpatient setting. Results should not normally need to be confirmed by a laboratory test unless they are out of analytical range of the POCT device or there is significant clinical concern. (POCT testing should be prioritised where it does not require a citrated blood tube.)

6.6.2 Glucose results from POCT should not routinely require a confirmatory lab blood glucose unless they are outside the analytical range of the device.

6.6.3 Where close monitoring of sodium or potassium is required, POCT with a blood gas machine should be the default. It does not require confirmation with laboratory testing unless there is a clinical indication or suspected machine malfunction.

6.7 Microbiology/virology serology

6.7.1 Screening for HIV, and hepatitis B and C in high-risk groups should be done in accordance with BHIVA and NICE guidance, respectively. These are treatable conditions and delayed diagnosis contributes to poor outcomes and health inequalities.

6.7.2 Care should be taken to minimise unnecessary repeat testing, especially if a previous positive result has been obtained (eg HIV or hepatitis).

6.7.3 National guidance exists on recommended frequency of testing for microbiology, virology and fungal tests.

6.7.4 Note that virology testing may need to be repeated to confirm the diagnosis (eg following a first positive test for HIV or viral hepatitis). This practice is to mitigate the risks associated with incorrect samples, mislabelling, sample contamination, etc and consequently giving the patient an incorrect diagnosis. Such repeat testing should be requested by a relevant senior clinical decision-maker (eg a virologist, microbiologist, infectious diseases clinician) in line with locally agreed protocols.

6.7.5 Antenatal serology testing should be done in accordance with the NHS infectious diseases in pregnancy screening programme guidance.

6.8 Vitamin D

6.8.1 Vitamin D testing is not indicated in asymptomatic people and is often requested unnecessarily. The NICE Clinical Knowledge Summary summarises situation in which vitamin D testing is indicated.

6.8.2 Further guidance is included in the national minimum retesting intervals document.

6.9 Critical care

6.9.1 It is common practice to use routine daily blood set orders. However, this can result in both the omission of specific indicated tests (leading to a separate blood sample collection for that test alone) and requesting or repeating of tests unnecessarily.[2] Additionally, routine blood testing in critical care patients is associated with anaemia (and risk of transfusion).

6.9.2 Evidence supports reviewing each patient on a daily/per shift basis (eg as part of the ward round) to determine what blood tests are necessary (and what frequency of/indications for repeat are appropriate), taking into account the current situation and clinical trajectory

6.9.3 Examples of opportunities to rationalise critical care blood testing include:

- Routine preop clotting is unlikely to be necessary where there are no clinical concerns (see NICE guidance NG455).
- Routine postoperative blood tests may not be indicated in all patients, and may in some cases be replaced by POCT such as Hb measurement using blood gas analysers – consider discussing this with the surgical team.
- Try to anticipate and combine (or add on) requests – especially where this will save blood tubes: for example, if there are time-dependent tests (such as aminoglycoside or other drug levels), consider combining these with the daily biochemistry panel in a single sample.
- Consider whether an immediate lab repeat FBC is necessary after red cell or platelet transfusion.

[2] Mikhaeil et al. Non-essential blood tests in the intensive care unit: a prospective observational study. *Can J Anesth/J Can Anesth* 2017; 64: 290–295. DOI 10.1007/s12630-016-0793-9

- Consider whether regular repeat G&S is necessary – the risk of the patient requiring urgent transfusion may be very low.
- Consider what is available via local POCT, eg Hb, INR, glucose, viscoelastic tests (eg TEG or ROTEM) – POCT test results may not require laboratory confirmation unless the result is outside the range of the device or malfunction is suspected.

6.10 Haematological oncology

6.10.1 Many patients in haematological oncology inpatient wards have blood tests done daily. Often, this is clinically appropriate as patients on myelosuppressive chemotherapy regimens are acutely unwell and may require blood components and replacement of electrolytes daily.

6.10.2 However, there are circumstances in which routine daily testing is not required: for example, patients being cared for with palliative intent or who are clinically stable during routine chemotherapy cycles but have yet to become cytopenic. Inpatients with stable renal function do not generally need daily biochemistry except when having nephrotoxic treatment. Repeat FBC is not necessary the on day of a planned transfusion.

6.10.3 It is important in this overall context to educate everyone in the system, including patients, as they may be expecting a daily blood result. Appropriate reduction in testing in the haematological oncology setting will require specific and co-ordinated action by clinical and nursing leads.

6.11 Nutritional trace elements

6.11.1 Check with the laboratory prior to taking these samples to ensure the correct tubes are used

6.12 Perioperative care

6.12.1 NICE has published guidance (NG54) on routine preoperative testing which should be followed by preoperative assessment services.

6.12.2 Preoperative HbA1c testing and identification of anaemia are of particular importance as they may change management.

6.12.3 Any deviation from these national guidelines (NICE NG54) should be discussed with and approved by a senior decision-maker.

6.12.4 Follow local protocols for postoperative care. We suggest that local departments establish their own protocols based on best practice,

6.12.4 NICE has also published guidance on perioperative care (NG180).

7. Advice specific to the acute shortage

7.1 Conserving blood sample tubes during the period of acute shortage

7.1.1 Requesting blood tests based on established clinical indications only is good practice at all times. During the acute shortage, making sure that testing capacity is preserved has additional important implications for the equitable provision of clinical care to all patients.

7.1.2 In particular, consider not just test requesting/laboratory resource, but specifically blood tube use.

7.1.3 Practical advice on conserving blood tubes:

- Local laboratories will advise on which samples can be taken in which tubes; any blood tube substitutions; which samples can be combined in one tube (and the volume of sample required).
- Please only take the tubes/samples specified – do not take extra tubes just in case.
- Please think ahead and try to combine tests that might be taken in the same type of tube on subsequent days into one sample.
- Each day think not only about the tests requested but the implications for blood tube usage and whether there might be a clinically appropriate way of rationalising this, including liaising with the lab to allow 'add on' tests rather than taking another sample.
- Optimise phlebotomy technique, labelling and sample dispatch to minimise wastage.

7.2 Blood transfusion (G&S)

7.2.1 The National Blood Transfusion Committee (NBTC) has produced guidance relevant to transfusion-related testing and laboratory practices during the period of acute shortage. Clinical and laboratory transfusion staff should follow local policies

and laboratories and haematology departments but are encouraged to review this guidance.

7.2.2 The provision of safe and timely blood components remains a priority and transfusion delays must be avoided.

7.3 Rheumatology – monitoring of DMARDs

7.3.1 The following provides a **suggested** approach to modifying DMARD monitoring protocols **in the context of the acute shortage of blood tubes/testing capacity.**

7.3.2 Patients who have been on treatment for <12 months and/or on their current dose for <6 weeks should continue to be monitored as per the standard shared care agreement schedule.

7.3.3 For patients under shared care who have been on treatment for >12 months **and** where their last **two** blood monitoring tests have been normal **and** current dose has been stable for **3 months**:

Medication	Current monitoring schedule	Suggested modified schedule during shortage
Methotrexate (MTX)	3 monthly	**6 monthly**
Azathioprine	3 monthly	**6 monthly**
Mercaptopurine	3 monthly	**6 monthly**
Penicillamine	3 monthly	**6 monthly**
Leflunamide	3 monthly	**6 monthly**
Hydroxychloroquine	Nil	Nil

7.3.4 No monitoring is required for patients on sulfasalazine after 1 year, based on current shared care schedule. For patients on treatment for <1 year, 3-monthly monitoring should continue.

7.4 Paediatrics

7.4.1 There is no current shortage of paediatric blood tubes and therefore laboratory testing in children should follow existing best practice protocols.

7.4.2 Paediatric teams should liaise with local labs to consider whether using paediatric blood tubes for older children would be appropriate.

7.4.3 Paediatric blood tubes should not be used for adult patients to avoid creating shortages in these tubes.

7.5 Genomics testing

7.5.1 Genomic testing remains a high priority, including for all referrals classified as urgent, genomic testing within the neonatal setting, prenatal screening and for cancer diagnosis. NHS England and NHS Improvement will issue this guidance to all genomics laboratory hubs.

7.6 Antenatal testing

7.6.1 Antenatal serology and fetal anomaly blood tests are time-sensitive and should not be delayed.

7.7 Blood tests as part of clinical research

7.7.1 Blood tests in the context of ongoing clinical research studies should not be disrupted where doing so would lead to deviation from the study protocol or risk invalidating the research. Where tests can safely be modified or omitted, this should be done in consultation with the appropriate research governance bodies.

7.7.2 Please continue to follow the study protocol (without modifications or deviations) except where changes have been agreed in advance with the chief investigator.

Appendix: Key secondary care minimum retesting intervals guidance

The table below summarises key guidance for acute care and is adapted from the comprehensive national guidance on National minimal retesting intervals in pathology guidance (March 2021). Please refer to the full document for further detail.

A separate summary table highlights guidance relevant to primary, community and outpatient care and may also be useful to support outpatient care.

These represents general best practice advice and are not specific to the exceptional period of acute supply shortage.

The guidance below does not supplant clinical judgement: it is intended to highlight best practice recommendations, including some that relate to very specific situations, that may inform and support practice. It must be adapted as appropriate to the specific situation and the specific needs of the patient (taking into account any particular preferences, needs or characteristics they may have or any risks that may apply).

In the context of an acute deterioration, patients may require tests more urgently or frequently than set out below.

Renal		
Inpatient monitoring of a stable patient not on IV fluids	An inpatient with an admission sodium within the reference range should not have a repeat sodium within the average length of stay of 4 days	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
Inpatient monitoring of a stable patient on IV fluids (adults as well as children)	Daily monitoring of U&E and glucose (which may be monitored using POCT)	GAIN, 2010 *[Level of evidence – D]*
In symptomatic patients or following administering of hypertonic saline	Monitoring should be more frequent, ie every 2–4 hours	GAIN, 2010 *[Level of evidence – D]*
Patient diagnosed with AKI	U&E checked on admission and within 24 hours	The Renal Association, 2011[3]

[3] The Renal Association. *Clinical Practice Guidelines. Acute Kidney Injury* (5th edition). Hampshire, UK: The Renal Association, 2011.

		[Level of evidence – A]
Monitoring of ACE inhibitors	Within 1 week of starting and 1 week after each dose titration, then annually (unless required more frequently because of impaired renal function)	NICE Clinical Knowledge Summary, 2019 *[Level of evidence – D]*
Diuretic therapy	Before the initiation of therapy and after 4 weeks, and then 6 monthly/yearly or more frequently in the elderly or in patients with renal disease, disorders affecting electrolyte status or patients taking other drugs (eg corticosteroids, digoxin)	NICE Clinical Knowledge Summary, 2019 *[Level of evidence – D]*
Bone		
Acute settings	Testing at 48-hour intervals	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
Acute hypo/hypercalcaemia, TPN and ITU patients	May require more frequent monitoring	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
ALP and total protein in acute setting	Testing at weekly intervals. ALP may need checking more often, but probably only in the context of acute cholestatic changes (see Liver section of the full document)	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
Vitamin D request: no clinical signs and symptoms	Do not retest (whatever the result as there may be no indication to test in the first place)	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
Liver		
Acute inpatient setting	Testing at 72-hour intervals in acute setting (apart from those in L4)	Consensus opinion of the relevant

		expert working group *[Level of evidence – GPP]*
GGT and conjugated bilirubin in acute setting	Testing at weekly intervals	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
Acute poisoning (eg paracetamol), TPN, liver unit, acute liver injury and ITU patients	May require more frequent monitoring	Consensus opinion of the relevant expert working group *[Level of evidence – GPP]*
Inflammatory markers		
CRP	May be most informative, in the acute setting, at an interval of 48–72 hours. This includes in critically ill patients. Discussion with local infectious disease/microbiology team is advised to agree appropriate frequencies of retesting CRP should not be retested within 24 hours (with the exception of paediatric requests) – this includes patients who have had a CRP tested on admission through the ED and are subsequently admitted to a ward	Hutton HD et al *Ann Clin Biochem* 2009; 46:155–8 *[Level of evidence – D]*
Procalcitonin	May be most informative, in the acute setting, at an interval of 48–72 hours. This includes in critically ill patients. Discussion with local infectious disease/microbiology team is advised to agree appropriate frequencies of retesting	Hochreiter M et al *Crit Care* 2009; 13: R83 Seguela PE et al *Cardiol Young* 2011; 21: 392–9[4] *[Level of evidence – D]*
Cardiac		
Using BNP (NT-ProBNP):	In people presenting with new suspected acute heart failure, use a single measurement of serum natriuretic peptides (BNP or NT-ProBNP)	NICE CG187, 2014 *[Level of evidence – A]*

[4] Seguela PE, Joram N, Romefort B, Manteau C, Orsonneau JL, Branger B et al. Procalcitonin as a marker of bacterial infection in children undergoing cardiac surgery with cardiopulmonary bypass. *Cardiol Young* 2011; 21: 392–9

Secondary care (acute failure) Therapeutic guidance in heart failure	Consider measuring NT-ProBNP as part of a treatment optimisation protocol only in a specialist care setting for people aged under 75 who have heart failure with reduced ejection fraction and an eGFR >60 mL/min/1.73 m^2	NICE. NG106, 2018 *[Level of evidence – A]*
Iron deficiency		
Iron deficiency diagnosis	Repeat measurements of iron status (whether with ferritin or with an extended panel of iron studies) are not required unless there is doubt regarding the diagnosis	Goddard AF et al *Gut* 2011; 60: 1309–16 *[Level of evidence – D]*
Iron deficiency treatment	Check FBC 2 weeks post-iron therapy Once Hb normalised check FBC after 2 months	GAIN, 2015 *[Level of evidence – D]*
General haematology (FBC)		
Inpatient monitoring of a stable patient	An inpatient with a normal admission FBC should not have a repeat within the average length of stay of 4 days	Consensus of the haematology working group *[Level of evidence – GPP]*
Inpatient monitoring of an unstable patient who is not actively bleeding or a patient receiving cytotoxic drugs	Not usually required more than once daily	Consensus of the haematology working group *[Level of evidence – GPP]*
Patients with major bleeding	Repeat interval should be determined by the clinical situation. Should be repeated at least every hour for massive haemorrhage	Thomas D et al *Anaesthesia* 2010; 65: 1153–61 *[Level of evidence – D]*
Stable patients following red cell transfusion	Follow the relevant NICE guidance (NG24), including restrictive transfusion thresholds and single-unit transfusions in appropriate patients When checking haemoglobin levels following transfusion, consider whether a POCT test or checking with the next set of scheduled bloods (rather than immediately following transfusion) is appropriate	
Coagulation and D-dimer		

Patients with major bleeding	Repeat interval should be determined by the clinical situation and the coagulation screen must include fibrinogen. Should be repeated at least every hour for massive haemorrhage	Thomas D et al *Anaesthesia* 2010; 65: 1153–61 *[Level of evidence – D]*
Patients with acute coagulopathy	Usually no more than once daily if not receiving coagulation factors and no active bleeding	Consensus of the haematology working group *[Level of evidence – GPP]*
Patients with chronic liver disease	PT/INR every 3 months if otherwise stable	Consensus of the haematology working group *[Level of evidence – GPP]*
Patient requiring urgent reversal of VKA (or to treat any acquired deficiency of vitamin K-dependent coagulation factors) with vitamin K	Repeat INR only after at least 6 hours following IV dose and the following day after an oral dose	Consensus of the haematology working group *[Level of evidence – GPP]*
Patient requiring urgent reversal of VKA with a four-factor PCC	Repeat INR within an hour of administration	Consensus of the haematology working group *[Level of evidence – GPP]*
Patient receiving intravenous infusion of unfractionated heparin	Repeat APTTr 6 hours after dose adjustment (2 hours if previous APTT ratio >5.0) and daily when APTT in the target range	Raschke RA et al *Ann Intern Med* 1993; 119: 874–81 *[Level of evidence – B/C]*
D-dimer	D-dimer testing for venous thromboembolism (VTE) should be done in accordance with NICE guidance NG158, taking into account the clinical likelihood of VTE and the availability and timing of testing For people in whom DVT is likely (Wells score ≥2), D-dimer testing should be done if an initial ultrasound scan is negative or cannot be obtained within 4 hours and further NICE guidance followed (NICE NG158 1.1.3–1.1.7) For people in whom DVT is unlikely (Wells score ≤1), a D-dimer test should be done and further NICE guidance followed (NICE NG158 1.1.8–1.1.11) For people in whom pulmonary embolism is unlikely (Wells score ≤4), a D-dimer test should be done and	

	further NICE guidance followed (NICE NG158 1.1.21) D-dimer testing should not be done in patients in whom pulmonary embolism is likely (Wells score >4) D-dimer testing should only be done in patients in whom DVT is likely (Wells score ≥2) in accordance with the NICE guidance above D-Dimer POCT should be considered where laboratory testing is not immediately available (eg in the primary care/community setting if not referring to same day emergency care or the ED) and do not need to be confirmed by lab sample testing, and should be used first line where available.	
Transfusion (G&S) The following is intended to cover some of the commonest indications and is not intended to be exhaustive. Please see additional guidance from the National Blood Transfusion Committee, other relevant national guidance and local policies.		
A patient before transfusion	A valid sample is required for transfusion – see below for typical durations of validity and check with lab if in doubt before sending another sample If the patient has no transfusion history, two samples taken in accordance with local policies will be required	Milkins C et al *Transfus Med* 2013; 23: 3–35 *[Level of evidence – D]*
A patient who has not had a transfusion or pregnancy within the previous 3 months	The original sample is likely to be valid for 7 days – check with lab before sending another sample	Milkins C et al *Transfus Med* 2013; 23: 3–35 *[Level of evidence – D]*
A patient who has had a transfusion or pregnancy within the previous 3 months	The original sample is valid for up to 3 days – check with lab before sending another sample	Milkins C et al *Transfus Med* 2013; 23: 3–35 *[Level of evidence – D]*
A pregnant women who requires blood on standby for obstetric emergencies (eg placenta praevia)	A sample may be considered valid for up to 7 days – check with lab before sending another sample	Milkins C et al *Transfus Med* 2013; 23: 3–35 *[Level of evidence – D]*
A chronically transfused patient with no red cell alloantibodies	A sample may be considered valid for up to 7 days after individual risk assessment – check with lab before sending another sample	Milkins C et al *Transfus Med* 2013; 23: 3–35 *[Level of evidence – D]*
Fungal screening		

Aspergillus GM (Bio-Rad Platelia *Aspergillus* ELISA)	Discussion with local infectious disease/microbiology team is advised to agree appropriate frequencies of retesting on a per patient basis In interpreting serial screening for blood GM in high-risk haematology patients*: • single negative sample can be used to exclude IA • two consecutive positive samples provide good positive predictive value • reduction of the GM index during the first 2 weeks of antifungal therapy is a reliable predictor of treatment response Diagnostic GM on BAL is the most sensitive test *Neutropenic patients and allogeneic stem cell transplantation recipients during the early engraftment phase, who are not on mould-active antifungal prophylaxis or treatment	Maertens J *et al. Blood* 2001; 97: 1604–10 Furfaro E et al *Transpl Infect Dis* 2012; 14 :E38–E39 Leeflang MM et al *Cochrane Database Syst Rev* 2008; 4: CD007394 Chai LY et al *J Clin Microbiol* 2012; 50: 2330–6 Nouer SA *et al. Clin Infect Dis* 2011; 53: 671–6 Bergeron A et al *J Clin Microbiol* 2012; 50: 823–30 Schelenz S et al *Lancet Infect Dis* 2015; 15: 461–74 Lass-Florl C *Med Mycol* 2019; 57: S155–S160
Beta-D-glucan (BDG)	Discussion with local infectious disease/microbiology team is advised to agree appropriate frequencies of retesting on a per patient basis. In interpreting BDG screening for severely ill ICU patients and patients with haematological malignancies and post-allogeneic hematopoietic stem cell transplants: • single negative sample can be used to exclude diagnosis of most invasive fungal infections (notable exceptions include mucoraceous mould infection, cryptococcosis, some dimorphic fungi and other rare fungi) • repeating positive BDG results is not clinically helpful as it may take several weeks to clear from system	Eggimann P et al *Crit Care* 2011; 15: 1017 Cuenca-Estrella M et al *Clin Microbiol Infect* 2012; 18: S9–S18 Hammarström H et al *Eur J Clin Microbiol Infect Dis* 2015; 34: 917–25 Schelenz S et al *Lancet Infect Dis* 2015; 15: 461–74 Rautemaa-Richardson R et al *J Antimicrob Chemother* 2018; 73: 3488–95
COVID-19 serology		
COVID-19 anti-Spike (anti-S) serology	Criteria for access to neutralising monoclonal antibody therapies for prophylaxis or treatment of	

	COVID-19 may include establishing COVID-19 seronegativity In this case, testing for anti-Spike (anti-S) IgM and IgG is indicated. If positive, this test should not be repeated except in exceptional circumstances	
COVID-19 anti-nucleocapsid (anti-N) serology	COVID-19 anti-nucleocapsid (anti-N) serology is a test specifically for immunity acquired from previous natural infection with COVID-19 (as opposed to immunity acquired by vaccination). This test is not indicated in the work-up for monoclonal antibody therapy	

See Appendix A of National minimal retesting intervals in pathology guidance for explanation of evidence levels.