National minimum retesting intervals in pathology

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Produced by	Dr Tim Lang is the main project lead and author of the previous minimum retesting intervals for clinical biochemistry. Dr Bernie Croal is the demand optimisation lead and coordinator of this wider pathology version.
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Comments	This document will replace the 1st edition of *National minimum retesting intervals in pathology* published in December 2015. This version, incorporating other pathology disciplines, was coordinated by the Royal College of Pathologists (RCPath). While it is published in accordance with the RCPath's publication policy, it should be regarded as a joint document between the RCPath and Association for Clinical Biochemistry and Laboratory Medicine and therefore the intellectual property of both. Both organisations, along with the Institute of Biomedical Science, have formally endorsed its contents and hence their logos appear above. In accordance with the College's pre-publications policy, this document was on the Royal College of Pathologists' website for consultation from 15 December 2020 to 12 January 2021. Responses and authors' comments are available to view, following final publication of this document. **Dr Brian Rous** **Clinical Lead for Guideline Review**

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Foreword

The *National minimum retesting interval in pathology* guidelines published by the Royal College of Pathologists (RCPath) are guidelines which enable pathologists, clinical scientists and biomedical scientists to identify and deal with inappropriate requesting of samples performed in the management of patients in a consistent manner and to a high standard. Guidelines are systematically developed statements to assist the decisions of practitioners and patients about appropriate healthcare for specific clinical circumstances and are based on the best available evidence at the time the document was prepared. This guideline has been developed to cover most common circumstances. However, we recognise that guidelines cannot anticipate every pathological specimen type and clinical scenario. Occasional variation from the practice recommended in this guideline may therefore be required to report a result on a specimen in a way that maximises benefit to the patient.

The guidelines themselves constitute the tools for implementation and dissemination of good practice.

The following stakeholders were contacted to consult on this document:

- National Demand Optimisation Group Scotland
- GIRFT team for NHS England
- Association for Clinical Biochemistry and Laboratory Medicine
- Institute of Biomedical Scientists.

The information used to develop this guideline was collected from the current medical literature and a previous version of this guideline. Published evidence was evaluated using modified SIGN guidance (see Appendix A). Consensus of evidence in the guideline was achieved by expert review. Gaps in the evidence were identified by College Fellows via feedback received from consultation. The sections of this guideline that indicate compliance with each of the AGREE II standards are indicated in Appendix B.

No major organisational changes or cost implications have been identified that would hinder the implementation of the guideline. The remit of our guidelines (and the College) is to provide guidance on the quality of a diagnostic service and detailed consideration of costs is outside the College's remit.

A formal revision cycle for all guidelines takes place on a five-yearly basis. However, each year, the College will ask the author(s) of the guidelines, in conjunction with the relevant specialty advisers to the College, to consider whether or not the document needs to be updated or revised. A full consultation process will be undertaken if major revisions are required. If minor revisions are required, an abridged consultation process will be undertaken whereby a short note of the proposed changes will be placed on the College website for two weeks for members' attention. If members do not object to the changes, the changes will be incorporated into the guideline and the full revised version (incorporating the changes) will replace the existing version on the publications page of the College.

The pathway has been reviewed by the Clinical Effectiveness team, Lay Governance Group and the RCPath Specialty Advisory Committees and was placed on the College website for consultation with the membership from 15 December 2020 to 12 January 2021. All comments received from the membership were addressed by the authors to the satisfaction of the Clinical Lead for Guideline Review.

This guideline was developed without external funding to the writing group. The College requires the authors of guidelines to provide a list of potential conflicts of interest; these are monitored by the Clinical Effectiveness team and are available on request. The authors of this document have declared that there are no conflicts of interest.

Abbreviations and acronyms

ACS	Acute coronary syndrome
AFB	Acid-fast bacilli
AKI	Acute kidney injury
ALP	Alkaline phosphatase
AMPA	2-amino-3-(5-methyl-3-oxo-1,2-oxazol-4-yl) propanoic acid
ANCA	Anti-neutrophil cytoplasmic antibody
Anti-HBc	Hepatitis B total core antibody
Anti-HBs	Hepatitis B surface antibody
Anti-HCV	Hepatitis C antibody
APA	Anti-pneumococcal antibody
aPL	Antiphospholipid
APTT	Activated partial thromboplastin time
ASO	Antistreptolysin O
ATPOab	Anti-thyroid peroxidase antibodies
BBV	Blood-borne virus
BCSH	British Committee for Standards in Haematology
BDG	β-1-3-*D*-glucan
BMI	Body mass index
BNP	B-type natriuretic peptide
C3	Complement component C3
C4	Complement component C4
CA15.3	Carbohydrate antigen 15.3
CA19.9	Carbohydrate antigen 19.9
CCP	Cyclic citrullinated peptide antibody
CEA	Carcinoembryonic antigen
CFA	Coagulation factor assay
CFT	Complement fixation test
CG	Clinical Guideline
CKD	Chronic kidney disease
CRP	C-reactive protein
CS	Clotting screen
CSF	Cerebrospinal fluid
DIF	Direct immunofluorescence
EASL	European Association of the Study of the Liver
ED	Exposure day
eGFR	Estimated glomerular filtration rate
eGFR-EPI	eGFR according to CKD Epidemiology Collaboration equation
ENA	Extractable nuclear antigen
ESR	Erythrocyte sedimentation rate
FSH	Follicle stimulating hormone

FBC	Full blood count
FMH	Fetomaternal haemorrhage
fT3	Free triiodothyronine
fT4	Free thyroxine
GAD65	Glutamic acid decarboxylase antibody
GAIN	Guidelines and Audit Implementation Network
GC	*Neisseria gonorrhoeae*
GDH	Glutamate dehydrogenase
GGT	Gamma-glutamyltransferase
GM	Galactomannan
GPC	Gastric parietal cell antibody
Hb	Haemoglobin
HbA1c	Haemoglobin A1c
HBsAg	Hepatitis B surface antigen
HBV	Hepatitis B virus
HCC	Hepatocellular carcinoma
hCG	Human chorionic gonadotropin
HCV	Hepatitis C virus
HCV RNA PCR	Hepatitis C RNA PCR
HD	Haemodialysis
HDL	High-density lipoprotein
Hib	*Haemophilus influenza* type b
HIV	Human immunodeficiency virus
HIV Ag/Ab	Human immunodeficiency virus antigen/antibody
HRT	Hormone replacement therapy
IA	Invasive aspergillosis
Ig	Immunoglobulin
IGF-1	Insulin-like growth factor 1
IHD	Ischaemic heart disease
INR	International normalised ratio
ITT	Immune tolerance therapy
ITU	Intensive treatment unit
IUCD	Intrauterine contraceptive device
IV	Intravenous
IVF	In vitro fertilisation
LA	Lupus anticoagulant
LCMS	Liquid chromatography mass spectrometry
LFT	Liver function test
LMWH	Low-molecular-weight heparin
MAG	Myelin-associated glycoprotein
MBD	Mineral bone disease
MDRD	Modification of diet in renal disease

MGUS	Monoclonal gammopathy of undetermined significance
MOG	Myelin oligodendrocyte
MPO	Myeloperoxidase antibodies
MRI	Minimum retesting interval
MRSA	Methicillin-resistant *Staphylococcus aureus*
MTC	Medullary thyroid carcinoma
NAAT	Nucleic acid amplification test
NICE	National Institute for Health and Care Excellence
NMDA	N-methyl-D-aspartate
NMO	Neuromyelitis optica
NT-ProBNP	N-terminal pro-B-type natriuretic peptide
OGTT	Oral glucose tolerance test
OH	Occupational Health
PBLC	Peripheral blood lymphocyte cells
PCC	Prothrombin complex concentrate
PD	Peritoneal dialysis
Plt	Platelets
PEP	Post-exposure prophylaxis
PR3	Proteinase 3 antibodies
PSA	Prostate-specific antigen
PT	Prothrombin time
PTH	Parathyroid hormone
RCPath	The Royal College of Pathologists
RPR	Rapid plasma regain
SAC	Specialty Advisory Committee of the RCPath
SIGN	Scottish Intercollegiate Guidelines Network
TB IFN	Tuberculosis interferon
TFT	Thyroid function tests
Tg	Thyroglobulin
TgAb	Tg autoantibodies
tIgE	Total IgE
TPN	Total parenteral nutrition
TSH	Thyroid stimulating hormone
tTG	Tissue transglutaminase
U&E	Urea and electrolytes
VGCC	Voltage-gated calcium channel
VGKC	Voltage-gated potassium channel
VKA	Vitamin K antagonist
WCC	White cell count

1 Introduction

There is currently a drive in pathology to harmonise processes and remove unnecessary waste, thereby saving money. In addition, any intervention that acts to reduce waste and avoid unnecessary phlebotomy/booking appointments for the patient can only be seen as contributing to the optimisation of patient care. At a time when many laboratories and providers are implementing electronic requesting of laboratory tests, which allows the requestor and the laboratory to manage what is requested, there needs to be a solution to support this process based on the best available evidence. Similar initiatives have been reported including the work of the Pathology Harmony Group and the recent proposal to standardise test profiles.[1,2] The frequency with which a test should be repeated, if at all, should be based upon a number of criteria:

- the physiological properties
- biological half-life
- analytical aspects
- treatment and monitoring requirements
- established guidance.

This report proposes a set of consensus recommendations from the perspective of pathology and laboratory medicine.

1.1 What is a minimal retesting interval?

Minimal retesting intervals (MRI) are 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.

Each MRI is proposed for a specific clinical scenario and therefore the population to which the guideline refers to is specific to that population described. This may be all patients being investigated, those in the general practice population, those in hospital population or a combination. If not stated specifically in the guideline, then it applies to all patients being managed.

1.2 Establishing MRI

The original work on MRI was carried out with the support of the Association for Clinical Biochemistry and Laboratory Medicine (ACB) and was published in 2013.[3] It was prepared through the members of the Clinical Practice Section (CPS) of the ACB. This group represents the medically qualified practitioners in clinical biochemistry who are members of the ACB. The methodology is briefly described below.

A survey and a literature search were performed using a strategy previously used in this area.[4] However, little published evidence was identified on the use or production of MRI in clinical practice.

The next phase of the project was the convening of small groups, made up of invited members of the CPS of the ACB, to investigate the evidence and existing guidelines and prepare recommendations in a number of work streams. The method used was an approach based on that used by Glaser *et al* termed ‘the state of the art’.[5]

The evidence or source for these recommendations has been taken from a number of authorities such as the National Institute for Health and Care Excellence (NICE), NHS Clinical Knowledge Summaries (formerly PRODIGY) and the SIGN. The Clinical Knowledge Summaries are a reliable source of evidence-based information and practical know-how about

the common conditions managed in primary care that were identified following a literature search and expert opinion strategy.

When the draft recommendations were completed, they were sent to an independent reviewer for assessment and comment.

The final stage of this project was a review of the prepared recommendations by a panel made up of representatives of the authors from each major region of the UK and invited members from the ACB Executive. The recommendations were discussed and accepted by consensus. Where no evidence-based guidance existed, either in the literature or published guidance, recommendations were prepared based on the consensus opinion of the working group. The final document was then sent out for final consultation by the full membership of the CPS and the chairs of each ACB region, before submission to the ACB Executive.

A similar approach was used in the preparation of these pan-pathology recommendations.

It should be noted that only disciplines with anticipated MRI development are included in this draft.

1.3 Target users and health benefits of these guidelines

The primary users of these guidelines are trainee and consultant pathologists, biomedical and clinical scientists, and laboratory managers.

1.4 Using MRI in practice

Information regarding College guidelines is via bulk email and the President's e-newsletter. Published guidelines can be downloaded free of charge from the College website (https://www.rcpath.org/profession/guidelines/cancer-datasets-and-tissue-pathways.html).
The recommendations presented in this document provide assistance in appropriately managing test requesting at all levels of the request cycle. They can be used in a number of different scenarios, either delivered manually or via a laboratory/remote requesting computer system. The implementation of the guidelines may be supported by:

- education of requesters so that appropriate tests are requested at the right time and for the right patient using different sources of evidence such as case studies, published studies showing the clinical and financial benefits, benchmarking and clinical audit
- information on request cards or in pathology handbooks regarding when to repeat a test
- delivery of prompts to remind the requester at point of requesting via remote/ward requesting software that a request is either too soon or inappropriate, with the facility to review previous results or ask questions. There should also be an option to record the reason for overriding a MRI.
- implementation of logic rules in the laboratory to remove or restrict requests based on previous patient data.

Any MRI being used must reflect not only the assay being used, but also how it is being used – thus, the MRI must reflect the local protocol. It should also be implemented following full consultation with the users, ideally supported with an education package if required. It is important to understand the mechanism employed to restrict any test or its request so that it does not appear too restrictive. There must always be the option for the clinicians/requesters to override a rule if they feel that it is clinically appropriate to continue to request the test. The way in which this is managed will reflect the way a test is requested locally. Ideally, there must be an opportunity for requestors to record their reason to override a rule and conversely to inform the requestor, at the earliest opportunity, why it has been rejected. The availability of previously reported laboratory results at or before the time of requesting a new test would

greatly assist the requester in deciding whether a test was appropriate. To support this initiative, the availability of an up-to-date clinical history from the requester or the patient's electronic patient record is of paramount importance so that prepared logic rules or MRI can be correctly implemented. The implementation of electronic requesting of tests provides an opportunity to improve the quality of information received from the requester for the laboratory to use. When a profile is recommended, this refers to the standardised profile.[2] It may also be useful to allow the requester to request individual tests from a recognised profile so only the required and necessary tests are performed. Limiting a test's use may also be achieved by restricting the requesting of a repeat test to a particular grade or level of staff. Therefore, only those of an appropriate level may have access to a particular test.

If implementing the MRI into a laboratory information system or remote request system, the programmer must be aware of how the system counts time so that the correct unit is used.

Each recommendation specifies a time interval that may be used to audit the implementation and adherence to the recommendation in clinical practice by measuring the percentage of requests that reflect the specific MRI.

1.5 Terms and conditions of use

These recommendations represent best practice in the opinion of the authors and have been reviewed through a consensus approach. However, new evidence at any time can invalidate these recommendations. No liability whatsoever can be taken as a result of using this information.

These recommendations should not be used in paediatric/neonatal patients unless specifically stated.

2 Biochemistry recommendations

2.1 Renal (refers to the measurement of U&E, unless otherwise stated)

Ref	Clinical situation	Recommendation	Source
B-R1	Normal follow up	A repeat would be indicated on clinical grounds if there was a significant change in the patient's condition that indicated that an acute renal (or other electrolyte-related problem) was developing	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-R2	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 four days	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-R3	Inpatient monitoring of a stable patient on IV fluids (adults as well as children)	Daily monitoring of U&E and glucose	GAIN, 2010.[6] *[Level of evidence – D.]*
B-R4	In symptomatic patients or following administering of hypertonic saline	Monitoring should be more frequent, i.e. every two to four hours	GAIN, 2010.[6] *[Level of evidence – D.]*
B-R5	Patient diagnosed with AKI	U&E checked on admission and within 24 hours	The Renal Association, 2011.[7] *[Level of evidence – A.]*
B-R6	Monitoring of ACE inhibitors	Within one week of starting and one week after each dose titration, then annually (unless required more frequently because of impaired renal function) Drugs containing trimethoprim can also result in a marked increase in serum creatinine without directly affecting kidney function. The serum creatinine should be repeated to obtain a more accurate serum creatinine (and eGFR) 48 hours after trimethoprim containing medications are stopped	NICE Clinical Knowledge Summary, 2019.[8] GAIN, 2015.[9] *[Level of evidence – D.]*
B-R7	Diuretic therapy	Before the initiation of therapy and after four weeks, and then six monthly/yearly or more frequently in the elderly or in patients with renal disease, disorders affecting electrolyte status or patients taking other drugs (e.g. corticosteroids, digoxin)	NICE Clinical Knowledge Summary, 2019.[8] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-R8	Monitoring of potassium concentrations in patients receiving digoxin	Eight days after initiation or change in digoxin therapy and/or addition/subtraction of interacting drug, then annually if no change	NICE Clinical Knowledge Summary, 2019.[10] NICE Clinical Knowledge Summary, 2019.[11] *[Level of evidence – D.]*
B-R9	Monitoring of potassium concentrations in patients receiving digoxin and diuretics	Regular monitoring	National Public Health Service for Wales, 2008.[12] *[Level of evidence – D.]*
B-R10	Aminosalicylates	In the elderly, every three months in first year, then every six months for the next four years, then annually after that based on personal risk factors	NICE Clinical Knowledge Summary, 2019.[13] *[Level of evidence – D.]*
B-R11	Carbamazepine	Six months	NICE Clinical Knowledge Summary, 2019.[13] *[Level of evidence – D.]*
B-R12	Antipsychotics	12 months	NICE Clinical Knowledge Summary, 2019.[14] *[Level of evidence – D.]*
B-R13a	eGFR-EPI: CKD	Repeat in 14 days if new finding of reduced GFR and/or confirmation of eGFR <60 mL/min/1.73 m^2 *eGFR by MDRD not valid in AKI	NICE. CG182, 2014.[15] *[Level of evidence – D.]*
B-R13b	eGFR-EPI: Radiological procedures/contrast administration	eGFR or creatinine within previous seven days in patients with acute illness or renal disease eGFR for angiography: <60 mL/min/1.73 m^2 should trigger local guidelines for contrast dosage eGFR for gadolinium: <30 mL/min/1.73 m^2 high-risk agents contraindicated eGFR: 30–59 mL/min/1.73 m^2 lowest dose possible can be used and not repeated within seven days	Royal College of Radiologists, 2015.[16] *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
B-R13c	eGFR: Cockcroft-Gault	For estimating chemotherapy and drug dosages. Within 24 hours unless rapidly changing creatinine concentrations or fluid balance	None (inferred from British National Formulary) *[Level of evidence – GPP.]*
B-R13d	Iohexol GFR	72 hours to avoid contamination (based on half-life of iohexol of two hours)	Krutzén E *et al. J Lab Clin Med* 1984;104:955–961.[17] *[Level of evidence – GPP.]*

2.2 Bone (refers to the measurement of the bone profile, unless otherwise stated)

Ref	Clinical situation	Recommendation	Source
B-B1	Non-acute setting unless there are other clinical indications	Testing at three-monthly intervals	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-B2	Acute settings	Testing at 48-hour intervals	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-B3	Acute hypo/ hypercalcaemia, TPN and ITU patients	May require more frequent monitoring	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-B4	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 recommendations (section 2.3)	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-B5	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.]*
B-B6	Vitamin D request: cholecalciferol or ergocalciferol therapy for whatever clinical indication, where baseline vitamin D concentration was adequate	Do not retest, unless otherwise clinically indicated, e.g. sick coeliac or Crohn's patient	Sattar N *et al. Lancet* 2012;379:95–96.[18] Sattar N *et al. Lancet* 2012;379: 1700–1701.[19] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-B7	Vitamin D request: cholecalciferol or ergocalciferol therapy for whatever clinical indication, where baseline vitamin D concentration was low and where there is underlying disease that might impact negatively on absorption	Repeat after three to six months on recommended replacement dose	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-B8	Vitamin D request: calcitriol or alphacalcidol therapy	Do not measure vitamin D	Consensus opinion of the relevant expert working group (GPP) *[Level of evidence – GPP.]*
B-B9	Biochemical testing in CKD-MBD: CKD stages 3–5	For stage 3b progressive, test bone profile every six months, PTH at baseline and 25OHVitD at baseline For stage 4, test bone profile every three months, PTH every six months and 25OHVitD at baseline For stage 5, test bone profile every month, PTH every three months and 25OHVitD at baseline For stage 5D, test bone profile every month, PTH every three months and 25OHVitD at baseline	The Renal Association, 2015.[20] *[Level of evidence – GPP.]*

2.3 Liver (refers to the measurement of LFTs, unless otherwise stated)

Ref	Clinical situation	Recommendation	Source
B-L1	Non-acute setting	Testing at one- to three-month intervals	Smellie S *et al.* ACB Venture Publications, 2011.[21] *[Level of evidence – D.]*
B-L2	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.]*
B-L3	GGT and conjugated bilirubin in acute setting	Testing at weekly intervals	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-L4	Acute poisoning (e.g. 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.]*
B-L5	Neonatal jaundice	These recommendations must not be used in the management of neonatal jaundice	N/A
B-L6	Initiating or changing therapies for primary or secondary cardiovascular disease prevention (LFTs)	Three months	NICE Clinical Knowledge Summary, 2019.[22] *[Level of evidence – C.]*

2.4 Lipids (refers to the measurement of lipid profile [non-fasting], unless otherwise stated)

Ref	Clinical situation	Recommendation	Source
B-LP1	Low-risk cases for IHD assessment	Three years	Smellie WS *et al*. *J Clin Pathol* 2005;58:1016–1024.[23] *[Level of evidence – D.]*
B-LP2	Higher risk cases for IHD assessment and those on stable treatment	One year	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-LP3	Initiating or changing therapies for primary or secondary prevention (include non-HDL cholesterol)	Three months	NICE Clinical Knowledge Summary, 2019.[22] *[Level of evidence – B.]*
B-LP4	When assessing triglyceridaemia to see effects of changing diet and alcohol	One week	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-LP5	In patients on TPN or who have hypertriglyceridaemia-induced pancreatitis	One day	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*

2.5 Endocrine related (for pregnancy-related endocrinology, see 2.12)

Ref	Clinical situation	Recommendation	Source
B-E1	Thyroid function testing in a healthy person in the absence of any clinical symptoms	Three years	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-E2	Hyperthyroid: monitoring of treatment in Graves' disease	Follow up in first one to two months after radioactive iodine treatment for Graves'. Measure fT4 and total T3. If patient remains thyrotoxic, biochemical monitoring should continue at four- to six-week intervals Following thyroidectomy for Graves' disease (and commencement of levothyroxine), serum TSH should be measured six to eight weeks post-op	Bahn Chair RS *et al. Thyroid* 2011;21:593–646.[24] *[Level of evidence D – 1/+00 = strong recommendation but weak evidence.]*
B-E3	Hyperthyroid: monitoring of treatment in toxic multinodular goitre and toxic adenoma	Follow up in first one to two months after radioactive iodine treatment for toxic multinodular goitre and toxic adenoma. Measure fT4 and total T3 and TSH. Should be repeated at one- to two-month intervals until stable results, and then annually thereafter Following surgery for toxic multinodular goitre and start of thyroxine therapy, TSH should be measured one to two monthly until stable and annually thereafter Following surgery for toxic adenoma, TSH and fT4 concentrations should be measured four to six weeks post-op	Bahn Chair RS *et al. Thyroid* 2011;21:593–646.[24] *[Level of evidence D – 1/+00 = strong recommendation but weak evidence.]*

Ref	Clinical situation	Recommendation	Source
B-E4	UK Thyroid guidelines	TFTs should be performed every four to six weeks for at least six months following radioiodine treatment. Once fT4 remains in reference range then frequency of testing should be reduced to annually. Lifelong annual follow up is required Indefinite surveillance required following radioiodine or thyroidectomy for the development of hypothyroidism or recurrence of hyperthyroidism. TFTs should be assessed four to eight weeks post-treatment, then three monthly for up to one year, then annually thereafter. TFTs should be performed every four to six weeks after commencing thionamides. Testing at three-monthly intervals is recommended once maintenance dose achieved In patients treated with 'block and replace', assess TSH and T4 at four- to six-weekly intervals, then after a further three months once maintenance dose achieved, then six monthly thereafter	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – B.]*
B-E5	Hypothyroidism: monitoring treatment	The minimum period to achieve stable concentrations after a change of dose of thyroxine is two months and TFTs should not normally be assessed before this period has elapsed Patients stabilised on long-term thyroxine therapy should have serum TSH checked annually An annual fT4 should be performed in all patients with secondary hypothyroidism stabilised on thyroxine therapy	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – B.]*

Ref	Clinical situation	Recommendation	Source
B-E6	Monitoring adult subclinical hyperthyroidism	If a serum TSH below reference range but >0.1 mU/L is found, then the measurement should be repeated one to two months later along with T4 and T3 after excluding non-thyroidal illness and drug interferences. This is contradicted later in the guidelines when the authors state that a three- to six-month repeat interval is appropriate unless the patient is elderly or has underlying vascular disease If treatment is not undertaken, then serum TSH should be measured in the long term every six to 12 months, with follow up with fT4 and fT3 if serum TSH result is low	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – B.]*
B-E7	Monitoring adult subclinical hypothyroidism	Patients with subclinical hypothyroidism should have the pattern confirmed within three to six months to exclude transient causes of elevated TSH Subjects with subclinical hypothyroidism who are ATPOab positive should have TSH and fT4 checked annually Subjects with subclinical hypothyroidism who are ATPOab neg should have TSH and fT4 checked every three years	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – B.]*
B-E8	Follow up of patients who have had differentiated (papillary and follicular) thyroid carcinoma and a total thyroidectomy and 131I ablation	TSH and fT4 should be measured as dose of levothyroxine increases (every six weeks) until the serum TSH is <0.1 mIU/L. Thereafter, they should be measured annually unless clinically indicated/pregnant Samples for Tg should not be collected sooner than six weeks post-thyroidectomy or 131I ablation/therapy. TSH, fT4/fT3 (whichever is being supplemented) and TgAb should be requested when Tg is measured. If TgAb are detectable, measurement should be repeated every six months	British Thyroid Association, Royal College of Physicians, 2014.[26] *[Level of evidence – C.]*

Ref	Clinical situation	Recommendation	Source
B-E9	Follow up of patients who have had medullary thyroid cancer and surgical resection	A baseline CEA and fasting calcitonin should be taken prior to operation. Postoperative samples should be measured no earlier than 15 days after thyroidectomy and plasma calcitonin concentrations are most informative six months after surgery At least four measurements of calcitonin over a two- to three-year period can be taken to provide an accurate estimate of the calcitonin doubling time. CEA is elevated in approximately 30% of MTC patients and in those patients, CEA doubling time is comparably informative to calcitonin doubling time Calcitonin monitoring should continue lifelong TFTs should be measured as per guidance for hypothyroidism	British Thyroid Association, Royal College of Physicians, 2014.[26] Laure Giraudet A *et al*. *Eur J Endocrinol* 2008;158: 239–246.[27] *[Level of evidence – C.]*
B-E10	Anaplastic thyroid cancer	There is no need for any monitoring of thyroid function unless patient is on thyroid replacement, then as per hypothyroidism	British Thyroid Association, Royal College of Physicians, 2014.[26] *[Level of evidence – C.]*
B-E11	Patients on amiodarone	Should have thyroid function tested before commencing treatment and then should be routinely monitored every six months thereafter while on treatment and up to 12 months after cessation of therapy	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – B.]*
B-E12	Patients on lithium	Thyroid function tested before commencing treatment and then should be routinely monitored every six to 12 months while on treatment	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – B.]*
B-E13	Progesterone testing in women with prolonged irregular menstrual cycles	Testing weekly in patients with irregular cycle from day 21 until next menstrual period	NICE. CG156, 2013.[28] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-E14	Diagnosing premature ovarian insufficiency in women aged under 40 years with possible menopausal symptoms	Two tests four to six weeks apart in women with possible early or premature menopause	NICE NG23 2019.[29] *[Level of evidence – A.]*
B-E15	Patients with suspected drug-induced hyperprolactinaemia	Discontinue medication for three days and re-measure prolactin	Casanueva FF*et al*. *Clin Endocrinol (Oxf)* 2006;65:265–273.[30] Melmed S *et al. J Clin Endocrinol Metab* 2011;96:273–288.[31] *[Level of evidence – D.]*
B-E16	Patients with hyperprolactinaemia commencing dopamine agonist therapy	Repeat prolactin measurement after one month to guide therapy	Melmed S *et al. J Clin Endocrinol Metab* 2011;96:273–288.[31] *[Level of evidence – D.]*
B-E17	Screening for diabetes in asymptomatic patients	Adults <45 years old with normal weight and no risk factor: screening not recommended Adults >45 years old with normal weight (BMI <25 kg/m^2) and no risk factor*: three years Adults >18 years old with BMI ≥25 kg/m^2 and 1 risk factor*: three years, if result is normal *Risk(s) factors listed in Table 4 of *Diabetes Care* 2012;35(S1):S11–S63.[32]	*Diabetes Care* 2012;35(S1):S11–S63.[32] *[Level of evidence – B.]* *[Level of evidence – GPP.]* *[Level of evidence – B.]*
B-E18	Diagnosing diabetes using HbA1c in an asymptomatic patient (not to be used in children or young adults)	Diagnosis should not be made on the basis of a single abnormal plasma glucose or HbA1c value. At least one additional HbA1c or plasma glucose test result with a value in the diabetic range is required within two weeks of the initial measurement, either fasting, from a random (casual) sample, or from the OGTT	WHO, 2011.[33] *[Level of evidence – B.]*

Ref	Clinical situation	Recommendation	Source
B-E19	HbA1c monitoring of patients with type 2 diabetes	Two to six-monthly intervals (tailored to individual needs) until the blood glucose concentration is stable on unchanging therapy; use a measurement made at an interval of less than three months as an indicator of direction of change, rather than as a new steady state Six-monthly intervals once the blood glucose concentration and blood glucose lowering therapy are stable	NICE. NG28, 2015.[34] *[Level of evidence – B.]*
B-E20	Diagnosis of male androgen deficiency	Repeat testosterone measurement to confirm diagnosis recommended	Bhasin S *et al. J Clin Endocrinol Metab* 2010;95:2536–2559.[35] *[Level of evidence – D.]*
B-E21	Monitoring of male patient with androgen deficiency on replacement therapy	Measure testosterone value three to six months after initiation of testosterone therapy Measure testosterone every three to four months for first year Measurement of PSA. Please refer to B-TM7	Bhasin S *et al. J Clin Endocrinol Metab* 2010;95:2536–2559.[35] *[Level of evidence – D.]* Petak SM *et al. Endocr Pract 2002*;8:440–456.[36] *[Level of evidence – D.]*
B-E22	Female androgen excess	If testosterone measurement found to be raised by an immunoassay method, confirm measurement with a LCMS method Thereafter, measurement should be repeated yearly	Martin KA *et al. J Clin Endocrinol Metab* 2008;93:1105–1120.[37] Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
B-E23	Oestradiol	No evidence, guideline or consensus exists for repeat frequency For patients undergoing IVF samples may be taken daily For patients receiving implant treatment (HRT) a pre-implant value is checked to avoid tachyphylaxis. Frequency depends on frequency of implant For patients receiving implant treatment a pre-implant value is checked to avoid tachyphylaxis	*[Level of evidence – GPP.]*
B-E24	Growth hormone deficiency	IGF-1 is the most useful marker for monitoring and should be measured at least yearly. Assessment should be performed no earlier than six weeks following a dose change	Ho KK *et al. Eur J Endocrinol* 2007;157:695–700.[38] *[Level of evidence – D.]*
B-E25	Acromegaly: post-surgery Acromegaly: medical therapy Acromegaly: medical therapy using GH receptor antagonists Acromegaly: post-radiotherapy	Measure both GH and IGF-1 at three months. If normal, then at annual follow up Measure both GH and IGF-1 at three months. If normal, then at annual follow up Measure only IGF-1 at six-monthly intervals after dose titration. Monthly monitoring of LFTs for first six months Measurement of GH and IGF-1 annually	Growth Hormone Research Society, Pituitary Society. *J Clin Endocrinol Metab* 2004;89:3099–3102.[39] *[Level of evidence – D.]*

2.6 Cardiac

Ref	Clinical situation	Recommendation	Source
B-C1	Using troponin: general	MRI largely dependent on the manufacturers' assay being used and the clinical scenario. MRI should be implemented according to the local protocol used	Wu AHB *et al. Clin Chem* 2018;64:645–655.[40] *[Level of evidence – A.]*
	Using troponin: ACS	Algorithms that have been developed using high-sensitivity troponin assays will usually require several samples. A second sample is required one to two hours after presentation. The sensitivity for myocardial infarction is almost 100% For standard troponin assays: if the first blood sample for troponin is not elevated, a second sample should be obtained after six to nine hours. Sometimes a third sample after 12–24 hours is required	Boeddinghaus J *et al. Clin Chem* 2018;64:1347–1360.[41] *[Level of evidence – A.]* Hamm CW *et al*. *Eur Heart J* 2011;32:2999–3054.[42] *[Level of evidence – A.]* Thygesen K *et al*. *Eur Heart J* 2010;31:2197–2204.[43]
	Using troponin: cardiac surgery	Single measurement at 24 hours post-surgery gives best correlation with outcome. Serial samples justified if clinical condition worsens and/or new ECG changes to assess ACS	*[Level of evidence – A.]* Croal BL *et al*. *Circulation* 2006;114:1468–1475.[44]
	Using troponin: renal failure	Concentrations of troponin are usually increased in CKD patients (especially using high sensitivity assays). Serial samples will be required if suspected ACS as above	*[Level of evidence – C.]* Khan NA *et al. Circulation* 2005;112:3088–3096.[45] *[Level of evidence – C.]* Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
B-C2	Using BNP (NT-ProBNP):		
	Primary care (heart failure triage)	Should only be measured once unless there is a repeat episode of suspected heart failure with a change in clinical presentation and the diagnosis of heart failure has previously been excluded. Single time point use adequate for NICE guidance purposes	NICE. CG108, 2010.[46] *[Level of evidence – A.]*
	Secondary care (acute failure)	In people presenting with new suspected acute heart failure, use a single measurement of serum natriuretic peptides (BNP or NT-ProBNP)	NICE. CG187, 2014.[47] *[Level of evidence – A.]*
	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 above 60 ml/min/1.73 m^2	NICE. NG106, 2018.[48] *[Level of evidence – A.]*

2.7 Gastrointestinal

Ref	Clinical situation	Recommendation	Source
B-G1	Coeliac serology in known adult patients on follow up	IgA tTG can be used to monitor response to a gluten-free diet. Retesting at six to twelve months depending on pre-treatment value	Wolters Kluwer, 2019.[49] *[Level of evidence – D.]*
B-G2	Faecal elastase	MRI is six months	Molinari I *et al. Clin Biochem* 2004;37:758–763.[50] *[Level of evidence – D.]*
B-G3	Faecal calprotectin	MRI is six months	van Rheenen PF *et al. BMJ* 2010;341:c3369.[51] *[Level of evidence – A.]*
	Faecal calprotectin being used to discriminate irritable bowel syndrome from inflammatory bowel disease in primary care using the York Faecal Calprotectin Care Pathway	**Change due to York pathway** If initial sample is <100 mcg/g, then retesting not required If initial sample is >100 mcg/g, the MRI is two weeks. If repeat sample is >250 mcg/g, refer to gastroenterology urgently	Turvill J *et al. Frontline Gastroenterol* 2018;9:285–294.[52] *[Level of evidence – D.]*
B-G4	Trace elements (copper, zinc, selenium) in the monitoring of nutrition support	Baseline then every two to four weeks depending upon results	NICE.CG32, 2006.[53] *[Level of evidence – A.]*
B-G5	Ferritin monitoring for haemochromatosis	EASL recommends an initial retesting interval of three months, but this should be tested more frequently as ferritin approaches normal range BCSH 2000 recommends monthly ferritin during venesection	European Association for the Study of the Liver. *J Hepatol* 2010;53:3–22.[54] British Society for Haematology, 2018.[55] *[Level of evidence – B.]*
B-G6	Iron deficiency diagnosis	Repeat iron measurement not required unless doubt regarding diagnosis	Goddard AF *et al. Gut* 2011;60:1309–1316.[56] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-G7	Iron deficiency diagnosis	Check FBC two weeks post-iron therapy Once Hb normalised check FBC after two months	GAIN, 2015.[57] *[Level of evidence – D.]*
B-G8	Iron status in CKD	Monitor iron status no earlier than one week after receiving IV iron and at intervals of one to three months routinely	NICE. NG8, 2015.[58] *[Level of evidence – A.]*
B-G9	Iron profile/ferritin in a normal patient	One year	NICE. CG32, 2006.[53] *[Level of evidence – A.]* Smellie WS *et al*. *J Clin Pathol* 2006;59:781–789.[59] *[Level of evidence – D.]*
B-G10	Monitoring vitamin B12 and folate deficiency	Repeat measurement of vitamin B12 and folate is unnecessary in patients with vitamin B12 and folate deficiency However, vitamin B12 can be measured one to two months after starting treatment if there is no response Check FBC and reticulocyte count ten days post-treatment for response. Once Hb is normalised, the MRI is eight weeks	Clinical Knowledge Summary, 2019.[60] GAIN, 2015.[57] *[Level of evidence – D.]*

For more guidance on the laboratory monitoring of patients on nutritional support, particularly parenteral nutrition and those receiving enteral or oral feeds who are metabolically unstable or at risk of refeeding syndrome, please refer to the NICE Clinical Guideline CG32 *Nutrition support in adults*.[53]

2.8 Specific proteins

Ref	Clinical situation	Recommendation	Source
B-SP1	Paraproteins	Testing at three-month intervals initially	Smellie WS *et al*. *J Clin Pathol* 2005;58:1016–1024.[23] *[Level of evidence – D.]*
B-SP2	Patients with no features of plasma cell dyscrasia (e.g. anaemia, bone fracture or pain located in bone, suppression of other immunoglobulin classes, renal impairment) and a band of <15 g/L	Annual serum protein electrophoresis and quantitation by densitometry without need for further immunofixation is recommended	Smellie WS *et al*. *J Clin Pathol* 2005;58:1016–1024.[23] *[Level of evidence – D.]*
B-SP3	Monoclonal gammopathy of undetermined significance	Test at three- to four-monthly intervals within the first year of identification. Then six to 12 monthly as long as no symptoms of progression	Bird J *et al. Br J Haematol* 2009:147;22–42.[61] *[Level of evidence – D.]*
B-SP4	Immunoglobulins	Patients on immunoglobulin replacement therapy must have trough IgG concentrations and liver function tests performed at least quarterly	UK Primary Immunodeficiency Network, 2011.[62] *[Level of evidence – D.]*
B-SP5	Immunoglobulins	For other purposes, testing at a minimum interval of six months is recommended	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-SP6	Myeloma patients on active treatment	Local guidance and treatment regimens should be followed when requesting paraprotein concentrations for patients on active treatment	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-SP7	CRP	Should not be retested within a 24-hour period following an initial request with the exception of paediatric requests	Hutton HD *et al. Ann Clin Biochem* 2009;46:155–158.[63] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-SP8	Procalcitonin	24 hours	Hochreiter M *et al. Crit Care* 2009; 13:R83.[64] Seguela PE *et al*. *Cardiol Young* 2011;21:392–399.[65] *[Level of evidence – D.]*

2.9 Tumour markers

Ref	Clinical situation	Recommendation	Source
B-TM1	α-fetoprotein for HCC surveillance: screening patients at high HCC risk	Six months (UK)	Sturgeon CM *et al*. *Clin Chem* 2010:56;e1–48.[66] *[Level of evidence – A.]*
B-TM2	α-fetoprotein for monitoring disease recurrence in HCC	Three to six months	Sturgeon CM *et al*. *Clin Chem* 2010:56;e1–48.[66] *[Level of evidence – A.]*
B-TM3	Screening women with a family history of ovarian cancer with CA125	12 months	Sturgeon CM *et al*. *Clin Chem* 2008:54:e11–79.[66] *[Level of evidence – A.]*
B-TM4	Using CA125 in diagnostic strategies	Retesting CA125 when imaging is negative within one month	NICE. CG122, 2011.[67] *[Level of evidence – A.]*
B-TM5	Monitoring CA125 in disease recurrence	One month	Sturgeon CM *et al*. *Clin Chem* 2008:54:e11–79.[66] *[Level of evidence – A.]*
B-TM6	Monitoring disease recurrence with CA19.9	One month	No available evidence. All Wales Consensus Group *[Level of evidence – GPP.]*
B-TM7	PSA screening	When first result is raised, repeat once in the following 6 weeks to assess the trend	Public Health England, 2019.[68] *[Level of evidence – D.]*
B-TM8	Monitoring disease with PSA	Every three months for first one to two years Every six months for two years Annually thereafter	Smellie WS *et al. J Clin Pathol* 2006;59:1116.[69] *[Level of evidence – D.]*
B-TM9	Monitoring disease recurrence with CA15.3	Two months	Molina R *et al. Tumour Biol* 2005;26;281–293.[70] *[Level of evidence – B.]*

Ref	Clinical situation	Recommendation	Source
B- TM10	Serum β-hCG (tumour marker)	After evacuation of a molar pregnancy, hCG concentration should be monitored every week until normalisation then every month during the first year	Bidart JM *et al. Clin Chem* 1999;45:1695–1707.[71] *[Level of evidence – C.]*
B-TM11	Serum β-hCG (tumour marker)	After resection, prolonged marker half-life (>3 days for hCG) is a reliable indicator of residual tumour and a significant predictor of survival	Bidart JM *et al. Clin Chem* 1999;45:1695–1707.[71] *[Level of evidence – C.]*
B-TM12	Serum β-hCG (tumour marker)	If rate of change in tumour marker concentration changes velocity, an urgent repeat to confirm the result is reasonable	Sturgeon CM *et al*. *Clin Chem* 2008;54:1935–1939.[72] *[Level of evidence – A.]*

2.10 Therapeutic drug monitoring

As drugs are xenobiotics, the time for significant change is based on the kinetics of absorption and clearance. Steady state concentrations on new dose regimens are normally established after five plasma half-lives have elapsed.

For drugs where over 30% of clearance is renal, dosing and half-life are reflected by the creatinine clearance calculated using the Cockcroft & Gault formula (eGFR is less reliable though widely used). Tables of half-lives for most drugs are given and referenced in Brunton *et al*.[73]

Some drugs induce their own metabolism, e.g. carbamazepine, or can have hepatic clearance induced by another drug; specific details need to be checked with the literature; other xenobiotic interactions may significantly affect half-lives, e.g. smoking and clozapine.

Depending on the metabolic pathway, an individual's pharmacogenetic phenotype may result in more rapid or much slower metabolism than the general population. Therefore, the half-lives will be shorter or longer, respectively, and the five half-life rule applies, but using a half-life specific to the individual.

As there are so many different combinations of interaction, the advice given above is a general guide and the specific classes discussed below are for high-level guidance.

Ref	Clinical situation	Recommendation	Source
B-TD1	Anticonvulsant drugs (carbamazepine, phenytoin)	Five half-lives after dosage change (four to five days) during initial dose optimisation, unless toxicity is suspected. The kinetics of phenytoin are highly variable between individuals and when metabolism is saturated, a small dose change results in a disproportionate increase in plasma concentration. There is a significant risk of overdose and therefore when titrating dose changes check up to every 12 hours depending on clinical condition and therapy. This will be more frequent on IV therapy for status epilepticus. Note: carbamazepine induces its own metabolism and concentrations should be confirmed two to three months after commencing therapy	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
B-TD2	Digoxin	Five half-lives after dosage change (i.e. approx. seven days) during initial dose optimisation, unless toxicity is suspected. When renal function has changed significantly recognise the proportionate decrease in clearance. In overdose situations, up to every four hours depending on clinical condition and therapy	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-TD3	Aminoglycoside antibiotics (gentamicin, tobramycin)	Every 24 hours at start of therapy on high-dose parenteral regimens, less frequently when stable. Especially important in the elderly, patients with impaired renal function and those with cystic fibrosis. This only applies to once-daily dosing. If patient is on multiple doses per day, refer to local guidance	Consult local hospital guidelines *[Level of evidence – GPP.]*
B-TD4	Immunosuppressive drugs (ciclosporin, tacrolimus, sirolimus)	Initially three per week after transplantation, less frequently when stable. Concentrations should also be checked when any medication with possible interactions is prescribed, the dosage is changed, the formulation is changed or when there is unexplained graft dysfunction	Baker R *et al.* The Renal Association, 2011.[74] *[Level of evidence – C.]*
B-TD5	Theophylline	Five half-lives after dosage change (i.e. approx. two days) during initial dose optimisation on oral regimens. Note smoking significantly reduces the half-life. Daily on IV aminophylline. In overdose situations requiring haemodialysis, every four hours	Consensus opinion of the relevant expert working group. *[Level of evidence – GPP.]*
B-TD6	Methotrexate (high dose IV)	24 hours after completion of therapy then every 24 hours until plasma methotrexate is below cut-off concentration for toxicity (1 μmol/L at 48 hours or according to local protocol)	See product literature. Plard C *et al. Cancer Chemother Pharmacol* 2007;60: 609–620.[75] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-TD7	Lithium	Days four to seven of treatment then every week until dosage has remained constant for four weeks, then every three months on stabilised regimens. Check concentration when preparation changed, when fluid intake changes or when interacting drugs are added/withdrawn. 100% renal clearance, so is dependent on renal function. Up to every four hours in overdose situations requiring intensive therapy	Joint Formulary Committee. *British National Formulary (77th edition)*, 2019.[76] *[Level of evidence – GPP.]*
B-TD8	Clozapine	Induces its own metabolism and is induced further by smoking. Approximately four days to reach new steady-state after dose change or smoking cessation with potentially fatal consequences due to the rapid increase to toxic concentrations	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*

2.11 Occupational/toxicology

Ref	Clinical situation	Recommendation	Source
B-O1	Occupational lead exposure (chronic)	Initial blood lead concentration before commencing work or within 14 days of starting Blood lead concentration monitoring performed at least every 12 months unless significantly exposed to metallic lead and its compounds, in which case the blood lead should be measured every three months If the blood lead concentration is ≥30 µg/dL in adult males (≥20 µg/dL in women of childbearing age), monitor at least every six months If the blood lead concentration is ≥40 µg/dL in adult males (≥25 µg/dL in women of childbearing age), monitor at least every three months If the blood lead concentration is ≥60 µg/dL in adult males (≥30 µg/dL in women of childbearing age), repeat measurement of blood lead within two weeks	Health and Safety Executive Books, 2002.[77] *[Level of evidence – D.]*
B-O2	Acute lead poisoning in adults	If baseline blood lead concentration is <50 µg/dL and the patient is asymptomatic and not pregnant, repeat blood lead concentration after two weeks following removal from exposure If baseline blood lead concentration is ≥50 µg/dL, monitor blood lead concentrations daily during chelation therapy and measure 24-hour urine lead excretion to assist in deciding the duration of treatment. Repeat the blood lead measurement one week after the end of chelation treatment	TOXBASE.[78] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
B-O3	Acute lead poisoning in children	If baseline blood lead concentration is 10–50 µg/dL, repeat blood lead measurement in one month following removal from exposure If baseline blood lead concentration is >50 µg/dL, monitor blood lead daily during chelation therapy and measure 24-hour urine lead excretion to assist in deciding the duration of therapy. Repeat the blood lead measurement one week after the end of treatment	TOXBASE.[78] *[Level of evidence – D.]*
B-O4	Amphetamine toxicity	Retesting is not indicated in the same acute episode	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-O5	Benzodiazepine toxicity	Retesting is not indicated in the same acute episode	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-O6	Cocaine toxicity	Retesting is not indicated in the same acute episode	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-O7	Opiate toxicity including morphine, codeine and heroin	Retesting is not indicated in the same acute episode	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*
B-O8	Opioid toxicity including methadone	Retesting is not indicated in the same acute episode	Consensus opinion of the relevant expert working group *[Level of evidence – GPP.]*

2.12 Pregnancy related

Ref	Clinical situation	Recommendation	Source
B-P1	Urine β-hCG (pregnancy)	Urine pregnancy test can be repeated at three days after a negative result or approx. 28 days after period commences	Manufacturer's instructions *[Level of evidence – GPP.]*
B-P2	Serum β-hCG (pregnancy)	Serum β-hCG test: do not repeat if positive. Repeat after three days if negative and no menstrual period has occurred	Serum β-hCG doubling time = 1.5–2 days *[Level of evidence – GPP.]*
B-P3	Serum β-hCG (ectopic pregnancy)	48-hour repeat interval	NICE. NG126, 2019.[79] *[Level of evidence – C.]*
B-P4	Serum β-hCG (tumour marker)	After evacuation of a molar pregnancy, the β-hCG concentration should be monitored every week until normalisation and then every month during the first year	Bidart JM *et al. Clin Chem* 1999;45:1695–1707.[71] *[Level of evidence – C.]*
B-P5	LFTs in obstetric cholestasis	Once obstetric cholestasis is diagnosed, it is reasonable to measure LFTs weekly until delivery Postnatally, LFTs should be deferred for at least 10 days	RCOG. *Obstetric Cholestasis: Green-top Guideline No 43*, 2011.[80] *[Level of evidence – D.]*
B-P6	Bile acids in obstetric cholestasis	Weekly monitoring. Twice-weekly monitoring advised in later weeks if clinical state changing	No evidence available but reflects expert opinion and practice *[Level of evidence – GPP.]*
B-P7	Measurement of urate in pre-eclampsia	Awaiting expert advice whilst not admitted: twice-weekly urate	No evidence but reflects the practice of tertiary centre of excellent *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
B-P8	Urine protein in pre-eclampsia	At each antenatal visit to screen for pre-eclampsia Once diagnosed do not repeat quantification of proteinuria Only repeat if clinically indicated, for example, if new symptoms and signs develop or if there is uncertainty over diagnosis	NICE. CG62, 2008.[81] NICE. NG133, 2019.[82] *[Level of evidence – B.]*
B-P9	LFT/renal in pre-eclampsia	At least daily when the results are abnormal but more often if the clinical condition If mild hypertension*, perform tests twice weekly If moderate hypertension*, perform tests three times a week If severe hypertension*, perform tests three times a week *See source guidelines for definitions of hypertension	RCOG. Green-top Guideline No 10A, 2006.[83] NICE. NG133, 2019.[82] *[Level of evidence – B.]*
B-P10	Monitoring of thyrotoxicosis treatment in pregnant women (UK)	In women taking anti-thyroid drugs, TFTs should be performed prior to conception, at time of confirmation of pregnancy or at antenatal booking Newly diagnosed hyperthyroid patients require monthly testing during pregnancy until stabilised Pregnant women receiving anti-thyroid drugs should be tested frequently (perhaps monthly)	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – C.]*
B-P11	Monitoring of thyrotoxicosis treatment in pregnant women (USA)	fT4 and TSH should be monitored approximately every two to six weeks in women treated with anti-thyroid drugs in pregnancy	Stagnaro-Green A *et al. Thyroid* 2011;21:1081–1125.[84] *[Level of evidence – C.]*

Ref	Clinical situation	Recommendation	Source
B-P12	Pregnancy subclinical hypothyroidism	Women with subclinical hypothyroidism who are not initially treated should be monitored for progression to overt hypothyroidism. Serum fT4 and TSH should be measured every four weeks until 16–20 weeks gestation and at least once between 26–32 weeks (Euthyroid women [not receiving LT4] who are anti-thyroid antibody positive should be monitored during pregnancy. Serum fT4 and TSH should be measured every four weeks until 16–20 weeks gestation and at least once between 26 and 32 weeks)	Stagnaro-Green A *et al*. *Thyroid* 2011;21:1081–1125.[84] *[Level of evidence – C.]*
B-P13	Women with diabetes who are planning to become pregnant	Monthly measurement of HbA1C	NICE. NG3, 2015.[85] *[Level of evidence – A.]*
B-P14	Assessing glycaemic control using HbA1c in pregnancy	HbA1C should not be used routinely for assessing glycaemic control in the second and third trimesters of pregnancy however consider measuring HbA1C for women with pre-existing diabetes to assess risk to pregnancy	NICE. NG3, 2015.[85] *[Level of evidence – A.]*
B-P15	For management of hyponatraemia in labour and the immediate postpartum period, women require sodium monitoring if they are: • on an oxytocin infusion (includes induction and augmentation of labour, treatment of postpartum haemorrhage) • in labour and require IV insulin and dextrose • noted to have a blood sodium below 130 mmol/L for any reason • have a positive fluid balance of greater than 1,500 ml	Refers to measurement of sodium **Women on insulin infusions:** MRI is 4 hours **During labour:** Sodium >129 mmol/L MRI is 8 hours Sodium 129–125 mmol/L MRI is 4 hours Sodium <125 mmol/L MRI is 2 hours **Delivery or completion of oxytocin infusion:** Sodium >129 mmol/L Retesting not required Sodium 129–125 mmol/L AND asymptomatics MRI is 4 hours Sodium <125 mmol/L OR symptomatic <130 mmol/L MRI is 2 hours	GAIN, 2017.[86] *[Level of evidence – A.]*

Ref	Clinical situation	Recommendation	Source
B-P16	Women with type 1 diabetes are three-times more likely to develop post-partum thyroid dysfunction	Serum TSH, fT4 and thyroid peroxidase antibody status should be established preconception, at booking when pregnant and at three months post-partum	Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation, 2006.[25] *[Level of evidence – C.]*

2.13 Paediatric related

Ref	Clinical situation	Recommendation	Source
B-CH1	HbA1C monitoring in children and young people with type 1 diabetes	Two months	NICE. NG18, 2004.[87] *[Level of evidence – A.]*
B-CH2	Coeliac serology in known paediatric patients on follow up	Testing at six months in children	Murch S *et al*. *Arch Dis Child* 2013;98:806–811.[88] *[Level of evidence – D.]*

3 Haematology recommendations

3.1 Haematology general

Note: FBC refers to the measurement of Hb, WCC and Plt count unless otherwise stated.

Ref	Clinical situation	Recommendation	Source
FBC			
H-FBC1	Normal follow up	A repeat would be indicated on clinical grounds if there were a significant change in the patient's condition	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-FBC2	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 four days	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-FBC3	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.]*
H-FBC4	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;65:1153–1161.[89] *[Level of evidence – D.]*
H-FBC5	Pregnant on haematinic supplements (iron, folate, B12)	Repeat after at least 14 days	BCSH, 2011.[90] *[Level of evidence – B.]*
H-FBC6	Routine pregnancy monitoring	At booking, 28 weeks and postpartum	NICE. CG62, 2008.[81] *[Level of evidence – A.]* BCSH, 2011.[90] *[Level of evidence – B.]*

Ref	Clinical situation	Recommendation	Source
H-FBC7	Hypertensive disorders of pregnancy* *FBC in combination with renal and liver function	Once only if moderate antenatal gestational hypertension (<160/110) without proteinuria. Weekly if severe gestational hypertension. Twice weekly if mild antenatal hypertension with pre-eclampsia, three times weekly if moderate to severe. As clinically indicated in peripartum period (may require multiple repeats over 24 hours) and then repeat 48 hours after delivery/step down from critical care and stop monitoring if normal values	NICE. NG133, 2019.[82] *[Level of evidence – A.]*
H-FBC8	Inpatients with suspected platelet alloantibodies or receiving HLA matched platelets	Repeat one hour after completion of platelet transfusion	*[Level of evidence – GPP.]*
H-FBC9	Patients with anaemia of chronic kidney disease	Every two to four weeks in the induction phase of ESA therapy and every one to three months in the maintenance phase of ESA therapy	NICE. NG8, 2015.[58] *[Level of evidence – A.]*
ESR			
H-ESR1	Temporal arteritis/polymyalgia rheumatica	Every three months following first month of treatment	Dasgupta B *et al*. *Rheumatology* 2010;49:186–190.[91] *[Level of evidence – B.]*
H-ESR2	Rheumatoid arthritis	Every month until treatment has controlled the disease (NICE CG79 recommends use of CRP)	NICE. CG79, 2009.[92] *[Level of evidence – A.]*

3.2 Haematology coagulation

Notes: Basic CS refers to the combined measurement of PT and APTT unless otherwise stated. PT expressed as time in seconds. APTT expressed as time in seconds and/or as a ratio with normal. CFA refers to the measurement of antigen and/or activity of a coagulation factor (procoagulant or anticoagulant). Coagulation factor inhibitor testing including the use of a Bethesda assay or equivalent, other inhibitor screens, ELISA or trough factor measurement.

Ref	Clinical situation	Recommendation	Source
H-CS1	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;65:1153–1161.[89] *[Level of evidence – D.]*
H-CS2	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.]*
PT			
H-PT1	Patients with chronic liver disease	Every three months if otherwise stable	Consensus of the haematology working group *[Level of evidence – GPP.]*
INR			
H-INR1	Patients being initiated on VKA	No more than once daily	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-INR2	Unstable inpatient on VKA	No more than once daily	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-INR3	Stable outpatient on VKA	Usually no more than once weekly and up to 12 weeks when very stable	Consensus of the haematology working group *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
H-INR4	Patient requiring urgent reversal of VKA (or to treat any acquired deficiency of vitamin K dependent coagulation factors) with vitamin K	Repeat only after at least six hours following IV dose and the following day after an oral dose	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-INR5	Patient requiring urgent reversal of VKA with a four-factor PCC	Repeat within an hour of administration	Consensus of the haematology working group *[Level of evidence – GPP.]*
APTT			
H-APTT1	Patient receiving intravenous infusion of unfractionated heparin	Repeat 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;119:874–881.[93] *[Level of evidence – B/C.]*
H-APTT2	Patients receiving intravenous infusion of a parenteral direct thrombin inhibitor (bivalirudin, argatroban)	Repeat two hours after each dose adjustment then daily when in the target range	Summary of product characteristics *[Level of evidence – GPP.]*
Clauss fibrinogen assay			
H-F1	Patients with acute coagulopathy	Usually no more than daily if not receiving coagulation factors and no active bleeding	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-F2	Patients with major bleeding	Repeat interval should be determined by the clinical situation. Should be repeated at least every hour in massive haemorrhage	Thomas D *et al*. *Anaesthesia* 2010;65:1153–1161.[89] *[Level of evidence – D.]*
Anti-Xa assay			
H-Anti-Xa1	Patient on therapeutic dose of LMWH with significant renal impairment, extreme weight, pregnancy or other indication for measurement	At least three days after initiation or dose adjustment, then no more than once weekly if the dose is unchanged	Consensus of the haematology working group *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
LA screen			
H-LA1	Investigation of suspected antiphospholipid syndrome	Repeat after 12 weeks if abnormal	Keeling D *et al. Br J Haematol* 2012;157:47–58.[94] *[Level of evidence – D.]*
H-LA2	Investigation for antiphospholipid syndrome after completion of anticoagulation	At least seven days after stopping anticoagulation	Keeling D *et al. Br J Haematol* 2012;157:47–58.[94] *[Level of evidence – B.]*
CFA			
H-CF1	A patient under investigation for suspected coagulation factor deficiency	An abnormal result can be repeated for confirmation at a clinically appropriate interval	Consensus of the haematology working group *[Level of evidence – GPP.]*
H-CF2	A patient receiving coagulation factor replacement therapy	An assay immediately before and up to 60 minutes after administration and then as clinically indicated, usually no more than once daily (either trough, peak or both)	Consensus of the haematology working group *[Level of evidence – GPP.]*
Coagulation factor inhibitor testing			
H-CFI1	Surveillance in patients with severe haemophilia A or B	After every third factor ED or every three months (whichever is sooner) until 20 ED, then every three to six months until 150 ED (then one to two times per year in severe haemophilia A only)	Collins PW *et al*. *Br J Haematol* 2013;160:153–170.[95] *[Level of evidence – B/C.]*
H-CFI2	Surveillance after change of factor concentrate in severe haemophilia A	Before the change and then twice in the first six months after the change	Collins PW *et al*. *Br J Haematol* 2013;160:153–170.[95] *[Level of evidence – B/C.]*
H-CFI3	Surveillance in patients with moderate or mild haemophilia A	Annually if exposed to factor concentrate or after intensive exposure (>5 ED) or surgery	Collins PW *et al*. *Br J Haematol* 2013;160:153–170.[95] *[Level of evidence – C.]*
H-CFI4	Monitoring of ITT during treatment	Monthly	Collins PW *et al*. *Br J Haematol* 2013;160:153–170.[95] *[Level of evidence – C.]*

Ref	Clinical situation	Recommendation	Source
H-CFI5	After completion of successful ITT	Monthly for six months then every two months for up to a year	Collins PW *et al*. *Br J Haematol* 2013;160:153–170.[95] *[Level of evidence – C.]*
H-CFI6	Monitoring patients with newly diagnosed acquired coagulation factor inhibitor	Monthly until six months after remission	Consensus of haematology working group Collins PW *et al*. *Br J Haematol* 2013;162:758–773.[96] *[Level of evidence – D.]*

3.3 Haematology transfusion (general and screening group in PBLC)

Note: Estimation of FMH refers to the measurement of FMH by Kleihauer and/or flow cytometry

Ref	Clinical situation	Recommendation	Source
Blood group and antibody screen			
H-BGAS1	A first-time patient prior to transfusion	A second sample should be requested prior to transfusion	Milkins C *et al*. *Transfus Med* 2013;23:3–35.[97] *[Level of evidence – D.]*
H-BGAS2	A patient who has not had a transfusion or pregnancy within the previous three months	The original sample can be valid for up to three months	Milkins C *et al*. *Transfus Med* 2013;23:3–35.[97] *[Level of evidence – D.]*
H-BGAS3	A patient who has had a transfusion or pregnancy within the previous three months	The original sample is valid for up to three days	Milkins C *et al*. *Transfus Med* 2013;23:3–35.[97] *[Level of evidence – D.]*
H-BGAS4	A pregnant woman who requires blood on standby for obstetric emergencies (e.g. placenta praevia)	A sample may be considered valid for up to seven days	Milkins C *et al*. *Transfus Med* 2013;23:3–35.[97] *[Level of evidence – D.]*
H-BGAS5	A chronically transfused patient with no red cell alloantibodies	A sample may be considered valid for up to seven days after individual risk assessment	Milkins C *et al*. *Transfus Med* 2013;23:3–35.[97] *[Level of evidence – D.]*
H-BGAS6	A pregnant woman over 20 weeks gestation who has anti-D, -c or -K antibodies	Repeat with quantification of c and D antibodies, and anti-K by titration every four weeks until 28 weeks and then every two weeks until delivery	White J *et al.* *Transfus Med* 2016;26:246–263.[98] *[Level of evidence – C/D.]*
Estimation of FMH			
H-FMH1	An antenatal sensitising event in RhD-negative women after 20 weeks gestation who are at risk of developing RhD antibodies	Repeat for each new sensitising event unless there is an ongoing sensitising event (e.g. intermittent uterine bleeding) then repeat no more frequently than every two weeks	Qureshi H *et al.* *Transfus Med* 2014;24:8–20.[99] *[Level of evidence – C.]*

Ref	Clinical situation	Recommendation	Source
H-FMH2	FMH >4 ml in RhD-negative women after 20 weeks gestation who are at risk of developing RhD antibodies (RhD-positive baby or fetal RhD status unknown)	Repeat 48 hours after IV anti-D or 72 hours after IM anti-D and repeat process until no detectable fetal cells	Qureshi H *et al. Transfus Med* 2014;24:8–20.[99] *[Level of evidence – C.]*
H-FMH3	After cell salvage in RhD-negative women	Check 30–45 minutes after reinfusion of salvaged cells then as per FMH1	Qureshi H *et al. Transfus Med* 2014;24:8–20.[99] *[Level of evidence – C.]*

4 Immunology recommendations

If no source is quoted, then the recommendation is based on the response from the RCPath SAC for immunology.

Ref	Test	Recommendation	Source
I-1	A3 ganglionic receptor antibody	Repeat testing once diagnosis is confirmed is of limited value	*[Level of evidence – GPP.]*
I-2	Acetyl choline receptor antibody	Frequency determined by clinical context. Every six months while on treatment	*[Level of evidence – GPP.]*
I-3	Adrenal cortex antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-4	aPL antibody	Once diagnosis is confirmed using BCSH guidelines, repeat testing is of limited value	Keeling D *et al. Br J Haematol* 2012;157:47–58.[94] *[Level of evidence – D.]*
I-5	Alpha-1 antitrypsin genotype	Not routinely required	*[Level of evidence – GPP.]*
I-6	AMPA receptor antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-7	Anti-nuclear antibody (HEP2)	Once diagnosis is established, repeat testing is of limited value	*[Level of evidence – GPP.]*
I-8	Aquaporin 4 antibodies (NMO) CSF	Repeat testing guided by clinical context and discussion with specialist laboratory service providing assay	*[Level of evidence – GPP.]*
I-9	Aquaporin 4 antibodies (NMO) serum	Repeat testing guided by clinical context and discussion with specialist laboratory service providing assay	*[Level of evidence – GPP.]*
I-10	Basal ganglia antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-11	Beta-2 microglobulin	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*

Ref	Test	Recommendation	Source
I-12	Beta-2 glycoprotein I antibody	Once diagnosis is confirmed using BCSH guidelines, repeat testing is of limited value	Keeling D *et al. Br J Haematol* 2012;157:47–58.[94] *[Level of evidence – D.]*
I-13	C3/4	90 days (earlier frequency of testing maybe required in exceptional cases)	Consensus of surveyed labs *[Level of evidence – GPP.]*
I-14	C3 nephritic factor	Not routinely required if positive. Only allowed if C3 below reference range	*[Level of evidence – GPP.]*
I-15	Cardiac muscle antibody	Not routinely required	*[Level of evidence – GPP.]*
I-16	Cardiolipin antibody	Once diagnosis is confirmed using BCSH guidelines, repeat testing is of limited value	Keeling D *et al. Br J Haematol* 2012;157:47–58.[94] *[Level of evidence – D.]*
I-17	CCP	Repeat testing once diagnosis is confirmed is of limited value	Consensus of surveyed labs *[Level of evidence – GPP.]* NICE. NG100, 2018.[100] *[Level of evidence – D.]*
I-18	CD62 ligand shedding	Discuss with lab	*[Level of evidence – GPP.]*
I-19	Complement C1q	Repeat testing of limited value. Frequency to be determined by clinical context	Tarzi MD *et al. Clin Exp Immunol* 2007; 149:513–516.[101] *[Level of evidence – D.]*
I-20	Complement 1 inhibitor immunochemical	Only once to confirm; repeat testing limited to exceptional cases Generally, only performed if C4 is low or with compatible clinical information	*[Level of evidence – GPP.]*
I-21	Complement AP100	Only once to confirm Only allowed with compatible clinical information	*[Level of evidence – GPP.]*

Ref	Test	Recommendation	Source
I-22	Complement C2	Only once to confirm Only allowed with compatible clinical information	*[Level of evidence – GPP.]*
I-23	Complement CH100	Only once to confirm Only allowed with compatible clinical information	*[Level of evidence – GPP.]*
I-24	Complement factor B	Only once to confirm Only allowed with compatible clinical information	*[Level of evidence – GPP.]*
I-25	Complement factor H	Only allowed with compatible clinical information	*[Level of evidence – GPP.]*
I-26	CSF oligoclonal	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-27	Cryoglobulin screen	After initial confirmation of cryoglobulin, which may require testing more than once, repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-28	Cryoglobulin type	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-29	dsDNA Ab ELISA	Every three to six months while on treatment	*[Level of evidence – GPP.]*
I-30	Endomysial antibody (IgA)	Not routinely required Only for confirmation of tTg positives	*[Level of evidence – GPP.]*
I-31	Endomysial antibody (IgG)	Only for patients with complete IgA deficiency and confirmation of positive tTG IgG Indicate that this test should not be undertaken and refer to relevant NICE guidelines	*[Level of evidence – GPP.]*
I-32	ENA RNP, Sm, Ro, La, Scl, Jo1 and centromere	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-33	GABA receptor antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-34	GAD65 antibody	Not routinely required	*[Level of evidence – GPP.]*
I-35	Ganglioside GD1b antibody	Not routinely required	[*Level of evidence – GPP.*]

Ref	Test	Recommendation	Source
I-36	Ganglioside GM1 antibody	Not routinely required	*[Level of evidence – GPP.]*
I-37	Ganglioside GQ1b antibody	Not routinely required	*[Level of evidence – GPP.]*
I-38	GBM antibody	Every three to six months while on treatment or more frequent if receiving plasma exchange therapy	*[Level of evidence – GPP.]*
I-39	Glycine receptor antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-40	Hib antibody	Repeat testing to assess response to test immunisation. Serial monitoring of limited value	*[Level of evidence – GPP.]*
I-41	Histone antibody	Not routinely required	*[Level of evidence – GPP.]*
I-42	IA2 antibody	Not routinely required	*[Level of evidence – GPP.]*
I-43	IgA low level	Not routinely required	*[Level of evidence – GPP.]*
I-44	IgE	Not routinely required	*[Level of evidence – GPP.]*
I-45	IgG low level	Not routinely required	*[Level of evidence – GPP.]*
I-46	IgG subclasses (1, 2, 3, 4)	Not routinely required	*[Level of evidence – GPP.]*
I-47	IgG4	Repeat testing of limited value, although it may be useful for monitoring in certain patients	Abraham M *et al. Expert Rev Clin Immunol* 2017;13:867–875.[102] *[Level of evidence – D.]*
I-48	Insulin antibody	Not routinely required	*[Level of evidence – GPP.]*
I-49	Intrinsic factor antibody	Not routinely required	Khan S *et al. J Clin Path* 2009;62:439–441.[103] *[Level of evidence – D.]*
I-50	Islet cell antibody	Not routinely required	*[Level of evidence – GPP.]*
I-51	Liver antibody line blot, including M2-PDH	Not routinely required	*[Level of evidence – GPP.]*

Ref	Test	Recommendation	Source
I-52	Liver autoantibodies	Repeat testing of limited value. Frequency to be determined by clinical context	[*Level of evidence – GPP.]*
I-53	Lymphocyte phenotype CD3, 4, 8, 19, 56	Discuss with lab	[*Level of evidence – GPP.]*
I-54	Leucocyte adhesion molecules	Discuss with lab	[*Level of evidence – GPP.]*
I-55	Lymphocyte phenotyping extended panel	Discuss with lab	*[Level of evidence – GPP.]*
I-56	Mast cell tryptase	Three samples over a 24-hour period for assessment of anaphylaxis (Resuscitation Council UK guidelines advise that samples should be taken at as close to time 0 as possible, and 2 hours after onset with a baseline sample greater than 24 hours.) Repeat testing may be required in mastocytosis. Frequency to be determined by clinical context	NICE. CG134, 2011.[104] *[Level of evidence – D.]*
I-57	MPO ANCA	On treatment: six months or more frequent if receiving plasma exchange therapy Off treatment: annually	Ntatsaki E *et al. Rheumatology* 2014;53:2306–2309.[105] *[Level of evidence – D.]*
I-58	Muscle-specific kinase antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-59	MAG antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-60	MOG antibody	Not routinely required	*[Level of evidence – GPP.]*
I-61	Myositis antibody profile	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-62	Neutrophil cytoplasmic antibody	On treatment: six months or more frequent if receiving plasma exchange therapy Off treatment: annually	Ntatsaki E *et al. Rheumatology* 2014;53:2306–2309.[105] *[Level of evidence – D.]*

Ref	Test	Recommendation	Source
I-63	Neutrophil oxidative burst	Discuss with lab	*[Level of evidence – GPP.]*
I-64	NMDA receptor antibody CSF	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-65	NMDA receptor antibody serum	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-66	Ovarian antibody	Not routinely required	*[Level of evidence – GPP.]*
I-67	Paraneoplastic antibody profile	Not routinely required	*[Level of evidence – GPP.]*
I-68	Paraprotein (monolonal band) quantitation	Three months	[Level of evidence – GPP.]
I-69	Parathyroid antibody	Not routinely required	*[Level of evidence – GPP.]*
I-70	Parietal cell antibody	Not routinely required	*[Level of evidence – GPP.]*
I-71	Pemphigoid antibody	On treatment: six months Off treatment: annually	*[Level of evidence – GPP.]*
I-72	Pemphigus antibody	On treatment: six months Off treatment: annually	*[Level of evidence – GPP.]*
I-73	Phospholipase A2 receptor antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-74	Pituitary antibody	Not routinely required	*[Level of evidence – GPP.]*
I-75	PR3 ANCA	On treatment: six months or more frequent if receiving plasma exchange therapy Off treatment: annually	Ntatsaki E *et al. Rheumatology* 2014;53:2306–2309.[105] *[Level of evidence – D.]*
I-76	Protein (serum) electrophoresis	Three months	Smellie WS *et al. J Clin Pathol* 2005;58:1016–1024.[23] *[Level of evidence – D.]*

Ref	Test	Recommendation	Source
I-77	Protein (serum) electrophoresis	Annually for MGUS	Smellie WS *et al. J Clin Pathol* 2005;58:1016–1024.[23] *[Level of evidence – D.]*
I-78	Quantiferon TB IFN gamma	Discuss with lab	*[Level of evidence – GPP.]*
I-79	Rheumatoid factor	Not routinely required	*[Level of evidence – GPP.]*
I-80	Scleroderma antibody profile	Repeat testing of limited value. Frequency to be determined by clinical context	[Level of evidence – GPP.]
I-81	Serotype-specific anti-pneumococcal antibody (APA)	Repeat testing to assess response to test immunisation. Serial monitoring of limited value	*[Level of evidence – GPP.]*
I-82	Serum amyloid A	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-83	Serum free light chains	If available, local guidance and treatment regimens should be followed when requesting paraprotein concentrations for patients on active treatment If no local advice or treatment regimens are available, then the MRI is three months. This is only for diagnosis/monitoring of amyloidosis, non-secretory myeloma and light chain only myeloma	*[Level of evidence – GPP.]*
I-84	Serum immunofixation	Not routinely required unless there is a change in serum electrophoresis Not performed as follow up to electrophoresis unless for remission confirmation	*[Level of evidence – GPP.]*
I-85	Skeletal (striated) muscle antibody	Not routinely required Comment on ordering that imaging is superior for thymoma investigation	*[Level of evidence – GPP.]*
I-86	Specific IgE	Not routinely required	*[Level of evidence – GPP.]*
I-87	Submaxillary gland antibody	Never	*[Level of evidence – GPP.]*

Ref	Test	Recommendation	Source
I-88	Tetanus antibody	Repeat testing to assess response to test immunisation. Serial monitoring of limited value	Consensus of surveyed labs *[Level of evidence – GPP.]*
I-89	tIgE	Repeat testing of limited value. Frequency to be determined by clinical context	Consensus of surveyed labs *[Level of evidence – GPP.]*
I-90	Thyroid peroxidase antibody	Not routinely required	*[Level of evidence – GPP.]*
I-91	T-lymphocyte subset CD3, 4, 8	Discuss with lab	*[Level of evidence – GPP.]*
I-92	tTg IgA antibody	IgA tTG can be used to monitor response to a gluten-free diet Retesting at six to twelve months depending on pre-treatment value	Wolters Kluwer, 2019.[49] *[Level of evidence – GPP.]*
I-93	tTg IgG antibody	Retesting at six to twelve months Only in IgA-deficient patients	*[Level of evidence – GPP.]*
I-94	Urine electrophoresis	Not routinely required	*[Level of evidence – GPP.]*
I-95	Urine Free Light Chain Quant	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-96	VGCC antibody	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-97	VGKC antibody CSF	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*
I-98	VGKC antibody serum	Repeat testing of limited value. Frequency to be determined by clinical context	*[Level of evidence – GPP.]*

5 Microbiology recommendations

5.1 General microbiology

Ref	Clinical situation	Recommendation	Source
M-1	AFB microscopy and culture	N/A	N/A
M-2	Antrum washings	Seven days	*[Level of evidence – GPP.]*
M-3	ASO titre	14 days	*[Level of evidence – GPP.]*
M-4	Aspirates and fluids from sterile sites	N/A	N/A
M-5	Blood culture	N/A	N/A
M-6	*Borrelia burgdorferi* (Lyme)	14 days	*[Level of evidence – GPP.]*
M-7	CSF	N/A	N/A
M-8	Chlamydia NAAT	N/A	N/A
M-9	GC NAAT	14 days	*[Level of evidence – GPP.]*
M-10	CFT	14 days	*[Level of evidence – GPP.]*
M-11	Cough swab	Seven days	*[Level of evidence – GPP.]*
M-12	CSF for molecular investigation, e.g. *Meningococcus*	N/A	N/A
M-13	CSF microscopy and culture	N/A	N/A
M-14	Drug monitoring: glycopeptides (vancomycin, teicoplanin, etc.)	24 hours	*[Level of evidence – GPP.]*
M-15	Drug monitoring: aminoglycoside (gentamicin, amikacin, etc.) Note: this only applies to once-daily dosing. If patient is on multiple doses per day please refer to local guidance	24 hours	*[Level of evidence – GPP.]*
M-16	Ear swab	Seven days	*[Level of evidence – GPP.]*
M-17	Ear/nose and throat swab	Seven days	*[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
M-18	Endocervical swab	N/A	
M-19	Eye swab on same eye	Seven days	*[Level of evidence – GPP.]*
M-20	Faeces – *Clostridium difficile*	Repeated testing after a first positive sample during the same diarrhoeal episode is not recommended in an endemic situation Repeated testing after a first negative sample during the same diarrhoeal episode may be useful in selected cases with ongoing clinical suspicion during an epidemic situation or in cases with high clinical suspicion during endemic situations Dependent on result: Confirmed positive: 28 days Equivocal*: 24 hours Negative: 24 hours A test of cure is not recommended *GDH positive/toxin negative	Crobach MJT *et al. Clin Microbiol Infect* 2016;22:S63–S81.[106] *[Level of evidence – A/B.]*
M-21	Faeces – ova, cysts and parasites	24 hours	
M-22	Faeces – routine	Seven days	*[Level of evidence – GPP.]*
M-23	Genital swab (GC only)	14 days if symptoms remain after treatment (see also M-9)	*[Level of evidence – GPP.]*
M-24	Genital swab microscopy and culture	N/A	*N/A*
M-25	*Helicobacter pylori* – negative serology	28 days	*[Level of evidence – GPP.]*
M-26	*Helicobacter pylori* – positive serology	Never	*[Level of evidence – GPP.]*
M-27	High vaginal swab	N/A	*N/A*
M-28	IUCD	N/A	*N/A*
M-29	IUCD for *Actinomyces*	N/A	*N/A*
M-30	Joint fluids, microscopy and culture	N/A	*N/A*

Ref	Clinical situation	Recommendation	Source
M-31	Mouth swab	Seven days	*[Level of evidence – GPP.]*
M-32	MRSA screen	Seven days	*[Level of evidence – GPP.]*
M-33	MRSA post-eradication therapy	48 hours	*[Level of evidence – GPP.]*
M-34	*M. pneumoniae* only	14 days (if CFT antibody tested; if PCR used no repeat) When testing for *Mycoplasma* IgM, a second sample should be taken seven to ten days after a negative if the initial sample was taken early in the illness	*[Level of evidence – GPP.]*
M-35	Nasal swab	Seven days	*[Level of evidence – GPP.]*
M-36	Nasopharyngeal aspirate	Seven days	*[Level of evidence – GPP.]*
M-37	PD fluids, microscopy and culture	N/A	*N/A*
M-38	Peritoneal fluid	N/A	*N/A*
M-39	Pernasal swab (for pertussis)	N/A	*N/A*
M-40	Pernasal swabs	Seven days	
M-41	Pleural effusion/chest fluids	N/A	*N/A*
M-42	Pleural fluid	N/A	*N/A*
M-43	*Pneumocystis jirovecii* (DIF/PCR)	N/A	*N/A*
M-44	Pus swab	Three days or once per episode of drainage	*[Level of evidence – GPP.]*
M-45	Pus/exudate	N/A	*N/A*
M-46	Seminal fluid	28 days	*[Level of evidence – GPP.]*
M-47	Skin, nail and hair for mycology	Three months	*[Level of evidence – GPP.]*
M-48	Sputum (this excludes investigation of TB, see M-56)	Three days	*[Level of evidence – GPP.]*
M-49	Syphilis	14 days after a negative result in an at-risk individual For treatment response, test rapid plasma regain (RPR) three monthly	*[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
M-50	Throat swab	Dependent on result: Positive: seven days Negative: three days	*[Level of evidence – GPP.]*
M-51	Tissue/bone microscopy and culture	N/A	*N/A*
M-52	Tissues and biopsies	N/A	*N/A*
M-53	*Toxoplasma* IgG screen negative	Seven days	*[Level of evidence – GPP.]*
M-54	*Toxoplasma* IgG screen positive	Never	
M-55	Tuberculosis	N/A	*N/A*
M-56	Urethral swab	N/A	*N/A*
M-57	Urine for tuberculosis	N/A	*N/A*
M-58	Urine, microscopy and culture	Three days	*[Level of evidence – GPP.]*
M-59	Wound and ulcer swab	Seven days	*[Level of evidence – GPP.]*

5.2 Fungal recommendations

Recommendations are based on consensus expert peer opinion with supporting references *[Level of evidence – GPP.]*

Ref	Clinical situation	Recommendation	Source
M-60	*Aspergillus* GM (Bio-Rad Platelia *Aspergillus* ELISA)	Twice-weekly 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 two 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;97:1604–1610.[107] Furfaro E *et al. Transpl Infect Dis* 2012;14:E38–E39.[108] Leeflang MM *et al*. *Cochrane Database Syst Rev* 2008;4: CD007394.[109] Chai LY *et al*. *J Clin Microbiol* 2012;50:2330–2336.[110] Nouer SA *et al. Clin Infect Dis* 2011;53:671–676.[111] Bergeron A *et al*. *J Clin Microbiol* 2012;50:823–830.[112] Schelenz S *et al*. *Lancet Infect Dis* 2015;15:461–474.[113] Lass-Florl C. *Med Mycol* 2019;57:S155–S160.[114]

Ref	Clinical situation	Recommendation	Source
M-61	BDG	Twice-weekly screening for severely ill intensive care unit 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 infection (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.[115] Cuenca-Estrella M *et al*. *Clin Microbiol Infect* 2012;18:S9–S18.[116] Hammarström H *et al. Eur J Clin Microbiol Infect Dis* 2015;34:917–925.[117] Schelenz S *et al*. *Lancet Infect Dis* 2015;15:461–474.[113] Rautemaa-Richardson R *et al. J Antimicrob Chemother* 2018;73:3488–3495.[118]

6 Virology recommendations

If no source is quoted, then the recommendation is based on the response from the RCPath SAC for virology.

Any life-threatening serology result must lead to resampling if this is the first occasion, and the result confirmed for specificity.

6.1 Congenital/perinatal blood-borne viral infection – testing in asymptomatic infants

Ref	Clinical situation	Recommendation	Source
V-1	Maternal infection with HIV	**Non-breastfed infant** Test infant blood (EDTA) for HIV proviral DNA PCR: • during the first 48 hours • at two weeks (if high risk*) • at six weeks (or two weeks after cessation of prophylaxis) • at 12 weeks (or eight weeks after cessation of prophylaxis) On other occasions if additional risk: • test HIV Ag/Ab for seroreversion at 18–24 months **Breastfed infant** Test infant blood (EDTA) for HIV proviral DNA PCR: • during the first 48 hours • at two weeks • monthly for the duration of breastfeeding • at four and eight weeks after cessation of breastfeeding On other occasions if additional risk: • test HIV Ag/Ab for seroreversion at 18–24 months *High risk denotes a detectable maternal HIV RNA viraemia at 36 weeks and at birth)	British HIV Association, 2018.[119] *[Level of evidence – C/D.]*

Ref	Clinical situation	Recommendation	Source
V-2	Maternal infection with hepatitis B	Test infant blood (clotted or dried blood spot) for HBsAg at 12 months of age	Public Health England, 2021.[120] *[Level of evidence – D.]*
V-3	Confirmed viraemic HCV infection in pregnancy	Test infant blood (EDTA) for HCV RNA PCR at two to three months of age. If detected, repeat HCV RNA PCR at six months of age In addition, test infant blood (clotted or dried blood spot) for anti-HCV at 12–18 months There is no further follow up if anti-HCV negative and the HCV RNA PCR at two to three months was also negative If anti-HCV is positive, perform a further HCV RNA PCR and refer to the PHE algorithm	Public Health England, 2018.[121] *[Level of evidence – A.]*

6.2 Renal testing

Ref	Clinical situation	Recommendation	Source
V-4	Renal failure – BBV status of patients starting HD in the UK	Test HIV Ag/Ab, Anti-HCV and HBsAg pre-dialysis Include HCV RNA PCR if current risk factors for HCV acquisition Anti-HBV should be checked prior to immunisation, especially in patients with risk factors for previous HBV exposure	The Renal Association, 2019.[122] *[Level of evidence – A.]*
V-5	Ongoing surveillance for HIV in the prevalent HD population	Test HIV Ag/Ab three-monthly (if risk factors)	The Renal Association, 2019.[122] *[Level of evidence – C.]*
V-6	Ongoing surveillance for HCV in the prevalent HD population	Test anti-HCV three-monthly (include HCV RNA PCR if there are current risk factors for HCV acquisition)	The Renal Association, 2019.[122] *[Level of evidence – C.]*
V-7	Ongoing surveillance for HBV in the prevalent HD population	Test HBsAg three-monthly (if anti-HBs >100 IU/mL, then can consider testing six monthly)	The Renal Association, 2019.[122] *[Level of evidence – C.]*
V-8	Renal failure – enhanced surveillance for those at intermediate/high risk for new BBV following dialysis abroad (all BBV testing) or if a new BBV infection is identified in the HD unit (only for the specific BBV infection) For HCV	Test HCV RNA PCR or HCV antigen or HCV antigen/antibody every two weeks for three months	Department of Health, 2002.[123] The Renal Association, 2019.[122] *[Level of evidence – B.]*
V-9	Renal failure – enhanced surveillance for those at intermediate/high risk for new BBV following dialysis abroad (all BBV testing) or if a new BBV infection is identified in the HD unit (only for the specific BBV infection) For HBV	Test HBsAg or HBV PCR every two weeks for three months (independent of anti-HBs level)	The Renal Association, 2019.[122] *[Level of evidence – B.]*

Ref	Clinical situation	Recommendation	Source
V-10	Renal failure – enhanced surveillance for those at intermediate/high risk for new BBV following dialysis abroad (all BBV testing) or if a new BBV infection is identified in the HD unit (only for the specific BBV infection) For HIV	Test HIV Ag/Ab or HIV RNA PCR every two weeks for three months (only if risk following dialysis away from base)	The Renal Association, 2019.[122] *[Level of evidence – B.]*

6.3 Post-exposure to blood-borne viruses

Ref	Clinical situation	Recommendation	Source
V-11	Potential significant exposure to HBsAg positive material, hepatitis B susceptible	Assess risk and recipient HBV immunity Collect baseline blood for storage from recipient Intervene with HBV vaccine ± HBIG as appropriate to scenario Test HBsAg at three months Test HBsAg, anti-HBc at six months Test anti-HBs one to two months after vaccine course	*[Level of evidence – GPP.]*
V-12	Potential significant exposure to HIV positive material but no post-exposure prophylaxis given (Note: if the recipient is taking PREP then be aware that this can alter the HIV Ag/Ab responses and the case should be discussed with a consultant virologist)	Collect baseline blood for storage If exposed to Occupational Health (OH), the guidance states that minimum testing should be an HIV Ag/Ab test 12 weeks after exposure. However, earlier testing can also occur in addition to this if required (at four weeks post-exposure) In a non-occupational health setting, the BASHH guidance should be followed stating that a negative HIV Ag/Ab test on a fourth-generation assay performed at 4 weeks post-exposure is likely to exclude HIV infection. A further test at eight weeks post-exposure need only be considered following an event assessed as carrying a high risk of infection	Department of Health and Social Care, 2008.[124] *[Level of evidence – D.]* BASHH guidelines, 2019.[125] *[Level of evidence – D.]*

Ref	Clinical situation	Recommendation	Source
V-13	Potential significant exposure to HIV positive material and post-exposure prophylaxis given	Collect baseline blood for storage The DOH OH guidance states that minimum testing should be an HIV Ag/Ab test 12 weeks after cessation of PEP In addition, an earlier test can be performed as well (at four to six weeks post-cessation PEP)	Department of Health and Social Care, 2008.[124] *[Level of evidence – D.]* BASHH guidelines, 2019.[125] *[Level of evidence – D.]*
V-14	Potential significant exposure to HCV-positive material	Test at six weeks by HCV RNA PCR and by both HCV RNA PCR and anti-HCV at 12 weeks If negative, test at 24 weeks with anti-HCV alone	Ramsay ME. *Commun Dis Public Health* 1999;2:258–262.[126] *[Level of evidence – D.]*

7 Cellular pathology recommendations

All recommendations in this area of pathology were based on consensus expert peer opinion.

[Level of evidence – GPP.]

Please note that the letters in parenthesis in the sections below refer to the recommendation number.

7.1 General aspects of laboratory practice

a) It is not helpful to specify MRI for the majority of cellular pathology specimens, which tend to be unique to a particular clinical episode. The areas where repeat sampling/re-biopsy or laboratory testing may be considered are detailed in sections 2 and 3 (CP-1).

b) When a diagnosis has been confidently established on preoperative biopsies, it is usually not necessary to confirm the immunohistochemical phenotype or molecular genetic changes on resection specimens. More specific guidance on retesting may be found in the RCPath's datasets for cancer histopathology reports and tissue pathways (www.rcpath.org/profession/guidelines/cancer-datasets-and-tissue-pathways.html) (CP-2).

c) No specific implications or roles have been identified for MRI in neuropathology or non-forensic autopsy (CP-3).

7.2 Exfoliative and fine needle aspiration cytology

a) For patients whose tissues are sampled as part of national screening programmes, the sampling interval for asymptomatic patients will be determined by the programme. The investigation of symptoms or clinical abnormalities should be investigated as appropriate and is out with the screening service (CP-4).

b) When considering the appropriate tests to request, the negative predictive value should be considered. Some tests, such as urine or nipple discharge cytology, are recognised as having a low negative predictive value and thus cannot be used to exclude significant disease. Repeating such tests does not provide further reassurance or negate previous equivocal results (CP-5).

c) Repeatedly sending samples when a definitive diagnosis (e.g. positive for specific tumour type) has been established is a waste of resources. A repeat sample may be necessary if an initial specimen does not provide sufficient information for clinical management (CP-6).

d) Cytological surveillance of asymptomatic patients following malignant disease (e.g. urine specimens as follow up for urothelial carcinoma) should not be performed more frequently than annually. The development of symptoms should be investigated as appropriate (CP-7).

7.3 Histopathology

a) In general, biopsies are taken for specific clinical indications. A repeat biopsy may be necessary if an initial biopsy does not provide sufficient information for clinical management (CP-8).

b) When clinical features or disease progression do not fit with a previously established diagnosis then a review of previous biopsy material should be undertaken before considering a repeat biopsy (CP-9).

c) Where patients are undergoing regular clinical review (e.g. endoscopies for Barrett's or inflammatory bowel disease), repeated biopsies may be required to monitor response to treatment or to detect progressive disease at an early stage (CP-10).

d) Re-biopsy in chronic renal disease – an annual (for example) biopsy is recommended for monitoring and should not be repeated more frequently unless clinically indicated (CP-11).

e) Repeat liver biopsies are only done by protocol for disease progression monitoring (e.g. post-transplant hepatitis C) or if the initial sample is insufficient for diagnosis (CP-12).

8 Criteria for audit

- There should be a full consultation with all users prior to any implementation of a MRI
  - standard: 100%.
- There should be an education package supporting the introduction of a MRI
  - standard: 100%.
- The number of requests ordered earlier than the defined MRI out the total workload of that test
  - standard: no more than 5%.
- The number of requests ordered earlier than the defined MRI in which the MRI is over-ruled and a reason is recorded by the requestor
  - standard: 100%.

9 Contributors

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10 References

1. Berg J, Lane V. Pathology Harmony; a pragmatic and scientific approach to unfounded variation in the clinical laboratory. *Ann Clin Biochem* 2011;48:195–197.
2. Smellie WS, Association for Clinical Biochemistry's Clinical Practice Section. Time to harmonise common laboratory test profiles. *BMJ* 2012;344:e11693.
3. Lang T. *National Minimum Re-testing Interval Project: A final report detailing consensus recommendations for minimum retesting intervals for use in Clinical Biochemistry*. London, UK: Association of Clinical Biochemistry and Laboratory Medicine, 2013.
4. Smellie WS, Finnigan DI, Wilson D, Freedman D, McNulty CA, Clark GJ. Methodology for constructing guidance. *J Clin Pathol* 2005;58:249–253.
5. Glaser EM. Using behavioral science strategies for defining the state-of-the-art. *J App Behavioral Sci* 1980;16:79–92.
6. Guidelines and Audit Implementation Network (GAIN). *Hyponatraemia in Adults (On or After 16th Birthday).* Belfast, UK: GAIN, 2010.
7. The Renal Association. *Clinical Practice Guidelines. Acute Kidney Injury (5th edition).* Hampshire, UK: The Renal Association, 2011.
8. NICE Clinical Knowledge Summary. *Hypertension – Not Diabetic*. Accessed July 2019. Available at: https://cks.nice.org.uk/hypertension-not-diabetic
9. GAIN and the Northern Ireland Nephrology Forum. *Northern Ireland Guidelines for the Management of Chronic Kidney Disease (CKD) Practical Points for Use of Estimated GFR and Albuminuria (ACR) in Assessing CKD.* Belfast, UK: GAIN, 2015.
10. NICE Clinical Knowledge Summary. *Atrial Fibrillation*. Accessed July 2019. Available at: http://cks.nice.org.uk/atrial-fibrillation
11. NICE Clinical Knowledge Summary. *Heart Failure – Chronic.* Accessed July 2019. Available at: http://cks.nice.org.uk/heart-failure-chronic
12. National Public Health Service for Wales. *Drug Monitoring: A Risk Management System (1st revision).* NPHS: Wales, 2008.
13. NICE Clinical Knowledge Summary. *Crohn's Disease.* Accessed July 2019. Available at: http://cks.nice.org.uk/crohns-disease#!prescribinginfo
14. Clinical Knowledge Summary. *Bipolar Disease*. Accessed July 2019. Available at: http://cks.nice.org.uk/bipolar-disorder#!prescribinginfosub:1
15. NICE. *Chronic Kidney Disease in Adults: Assessment and Management.* London, UK: NICE, 2014. Available at: www.nice.org.uk/guidance/cg182
16. The Royal College of Radiologists. *Standards for Intravascular Contrast Agent Administration to Adult Patients (3rd edition).* London, UK: Royal College of Radiologists, 2015.
17. Krutzén E, Bäck SE, Nilsson-Ehle I, Nilsson-Ehle P. Plasma clearance of a new contrast agent, iohexol: a method for the assessment of glomerular filtration rate. *J Lab Clin Med* 1984;104:955–961.
18. Sattar N, Welsh P, Panarelli M, Forouhi NG.Increasing requests for vitamin D measurement: costly, confusing, and without credibility. *Lancet* 2012;379:95–96.
19. Sattar N, Welsh P, Panarelli M, Forouhi NG. Vitamin D testing — Authors' reply. *Lancet* 2012;379:1700–1701.
20. The Renal Association. *CKD-Mineral and Bone Disorders (CKD-MBD).* Bristol, UK: The Renal Association, 2015.
21. Smellie S, Galloway M, McNulty S. *Primary Care and Laboratory Medicine, Frequently Asked Questions.* London, UK: ACB Venture Publications, 2011.

22. NICE Clinical Knowledge Summaries. *Lipid Therapy − Primary Prevention of CVD.* Accessed July 2019. Available at: https://cks.nice.org.uk/lipid-modification-cvd-prevention#!scenario

23. Smellie WSA, Wilson D, McNulty CAM, Galloway MJ, Spickett GA, Finnigan DI *et al*. Best practice in primary care pathology: review 1. *J Clin Pathol* 2005;58:1016–1024.

24. Bahn Chair RS, Burch HB, Cooper DS, Garber JR, Greenlee MC, Klein I *et al.* Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. *Thyroid* 2011;21:593–646.

25. Association for Clinical Biochemistry, British Thyroid Association and British Thyroid Foundation. *UK Guidelines for the Use of Thyroid Function Tests*. London, UK: Association for Clinical Biochemistry, British Thyroid Association, 2006.

26. British Thyroid Association, Royal College of Physicians. *Guidelines for the Management of Thyroid Cancer (3rd edition)*. London: Royal College of Physicians, 2014.

27. Laure Giraudet A, Al Ghulzan A, Aupérin A, Leboulleux S, Chehboun A, Troalen F *et al*. Progression of medullary thyroid carcinoma: assessment with calcitonin and carcinoembryonic antigen doubling times. *Eur J Endocrinol* 2008;158: 239–246.

28. NICE. *Fertility Problems: Assessment and Treatment*. London, UK: NICE, 2013. www.nice.org.uk/guidance/cg156

29. NICE. *Guideline NG23 Menopause: Diagnosis and Management*. Available at: www.nice.org.uk/guidance/ng23

30. Casanueva FF, Molitch ME, Schlechte JA, Abs R, Bonert V, Bronstein MD *et al*. Guidelines of the Pituitary Society for the diagnosis and management of prolactinomas. *Clin Endocrinol (Oxf)* 2006;65:265–273.

31. Melmed S, Casanueva FF, Hoffman AR, Kleinberg DL, Montori VM, Schlechte JA *et al.* Diagnosis and treatment of hyperprolactinemia: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab* 2011;96:273–288.

32. American Diabetes Association. Clinical practice recommendations. *Diabetes Care* 2012;35 (Supplement 1):S11–S63.

33. World Health Organisation. *Use of Glycated Haemoglobin (HbA1C) in the Diagnosis of Diabetes Mellitus*. Geneva, Switzerland: WHO, 2011.

34. NICE. *Type 2 Diabetes*. London: NICE, 2015. Available at: www.nice.org.uk/guidance/ng28

35. Bhasin S, Cunningham GR, Hayes FJ, Matsumoto AM, Snyder PJ, Swerdloff RS *et al.* Testosterone therapy in adult men with androgen deficiency syndromes Endocrine Society CG. *J Clin Endocrinol Metab* 2010;95:2536–2559.

36. Petak SM, Nankin HR, Spark RF, Swerdloff RS, Rodriguez-Rigau LJ. American Association of Clinical Endocrinologists Medical Guidelines for clinical practice for the evaluation and treatment of hypogonadism in adult male patients—2002 update. *Endocr Pract 2002*;8:440–456.

37. Martin KA, Chang RJ, Ehrmann DA, Ibanez L, Lobo RA, Rosenfield RL *et al.* Evaluation and treatment of hirsutism in premenopausal women: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab* 2008;93:1105–1120.

38. Ho KK, GH Deficiency Consensus Workshop Participants. Consensus guidelines for the diagnosis and treatment of adults with GH deficiency II: a statement of the GH Research Society in association with the European Society for Pediatric Endocrinology, Lawson Wilkins Society, European Society of Endocrinology, Japan Endocrine Society and Endocrine Society of Australia. *Europ J Endocrinol* 2007;157:695–700.

39. Growth Hormone Research Society, Pituitary Society. Biochemical assessment and long-term monitoring in patients with acromegaly: statement from a joint consensus conference of

Growth Hormone Research Society and Pituitary Society. *J Clin Endocrinol Metab* 2004;89:3099–3102.

40. Wu AHB, Christenson RH, Greene DN, Jaffe AS, Kavsak PA, Ordonez-Llanos J *et al.* Clinical laboratory practice recommendations for the use of cardiac troponin in acute coronary syndrome: expert opinion from the Academy of the American Association for Clinical Chemistry and the Task Force on Clinical Applications of Cardiac Bio-Markers of the International Federation of Clinical Chemistry and Laboratory Medicine. *Clin Chem* 2018;64:645–655.
41. Boeddinghaus J, Twerenbold R, Nestelberger T, Badertscher P, Wildi K, Puelacher C *et al.* Clinical validation of a novel high-sensitivity cardiac troponin I assay for early diagnosis of acute myocardial infarction. *Clin Chem* 2018;64:1347–1360.
42. Hamm CW, Bassand JP, Agewall S, Bax J, Boersma E, Bueno H *et al*. ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Eur Heart J* 2011;32:2999–3054.
43. Thygesen K, Mair J, Katus H, Plebani M, Venge P, Collinson P *et al*. Recommendations for the use of cardiac troponin measurement in acute cardiac care. *Eur Heart J* 2010;31:2197–2204.
44. Croal BL, Hillis GS, Gibson PH, Fazal MT, El-Shafei H, Gibson G *et al*. The relationship between post-operative cardiac troponin I levels and outcome from cardiac surgery. *Circulation* 2006;114:1468–1475.
45. Khan NA, Hemmelgarn BR, Tonelli M, Thompson CR, Levin A. Prognostic value of troponin T and I among asymptomatic patients with end-stage renal disease: a meta-analysis. *Circulation* 2005;112:3088–3096.
46. NICE. *Chronic Heart Failure: Management*. London, UK: NICE, 2010. Available at: www.nice.org.uk/guidance/CG108
47. NICE. *Acute Heart Failure*: *Management*. London, UK: NICE 2014. Available at: www.nice.org.uk/guidance/CG187
48. NICE. *Chronic Heart Failure in Adults: Diagnosis and Management*. London, UK: NICE, 2018. Available at: www.nice.org.uk/guidance/ng106
49. Wolters Kluwer. *UpToDate.* Accessed July 2019. Available at: www.uptodate.com
50. Molinari I, Souare K, Lamireau T, Fayon M, Lemieux C, Cassaigne A *et al.* Fecal chymotrypsin and elastase-1 determination on one single stool collected at random: diagnostic value for exocrine pancreatic status. *Clin Biochem* 2004;37:758–763.
51. van Rheenen PF, Van de Vijver E, Fidler V. Faecal calprotectin for screening of patients with suspected inflammatory bowel disease: diagnostic meta-analysis. *BMJ* 2010;341:c3369.
52. Turvill J, Turnock D, Holmes H, Jones A, Mclaughlan E, Hilton V *et al.* Evaluation of the clinical and cost-effectiveness of the York Faecal Calprotectin Care Pathway. *Frontline Gastroenterol* 2018;9:285–294.
53. NICE. *Nutrition Support in Adults: Oral Nutrition Support, Enteral Tube Feeding and Parenteral Nutrition.* London, UK: NICE, 2006. Available at: www.nice.org.uk/guidance/CG32
54. European Association for the Study of the Liver. EASL clinical practice guidelines for HFE hemochromatosis. *J Hepatol* 2010;53:3–22.
55. British Society for Haematology. *Diagnosis and Therapy of Genetic Haemochromatosis (Review and 2017 Update).* London, UK: British Society for Haematology, 2018
56. Goddard AF, James MW, McIntyre AS, Scott BB, British Society of Gastroenterology. Guidelines for the management of iron deficiency anaemia. *Gut* 2011;60:1309–1316.
57. GAIN. *Investigation and Management of the Adult Patient with Anaemia Microcytic Anaemia.* Available at: www.rqia.org.uk/RQIA/files/1e/1e2a9adc-7517-4a47-858a-5192b0746456.pdf

58. NICE guideline. *Chronic Kidney Disease: Managing Anaemia.* London, UK: NICE, 2015. Available at: www.nice.org.uk/guidance/ng8

59. Smellie WS, Forth J, Bareford D, Twomey P, Galloway MJ, Logan EC *et al*. Best practice in primary care pathology: review 3. *J Clin Pathol* 2006;59:781–789.

60. Clinical Knowledge Summary. *Anaemia – B12 and Folate Deficiency.* Accessed July 2019. Available at: http://cks.nice.org.uk/anaemia-b12-and-folate-deficiency

61. Bird J, Behrens J, Westin J, Turesson I, Drayson M, Beetham R *et al.* UK Myeloma Forum (UKMF) and Nordic Myeloma Study Group (NMSG): guidelines for the investigation of newly detected M-proteins and the management of monoclonal gammopathy of undetermined significance (MGUS). *Brit J Haemat* 2009:147;22–42.

62. UK Primary Immunodeficiency Network. *Standards of Care: CVID Diagnosis and Management (Version 2).* Newcastle, UK: UK Primary Immunodeficiency Network, 2011.

63. Hutton HD, Drummond HS, Fryer AA. The rise and fall of C-reactive protein: managing demand within clinical biochemistry. *Ann Clin Biochem* 2009;46:155–158.

64. Hochreiter M, Köhler T, Schweiger AM, Keck FS, Bein B, von Spiegel T *et al.* Procalcitonin to guide duration of antibiotic therapy in intensive care patients: a randomized prospective controlled trial. *Crit Care* 2009;13:R83.

65. 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;21:392–399.

66. Sturgeon CM, Duffy MJ, Hofmann BR, Lamerz R, Fritsche HA, Gaarenstroom K *et al*. National Academy of Clinical Biochemistry Laboratory Medicine Practice Guidelines for use of tumor markers in liver, bladder, cervical, and gastric cancers. *Clin Chem* 2010:56;e1–48.

67. NICE. *Ovarian Cancer: The Recognition and Initial Management*. London, UK: NICE, 2011. Available at: www.nice.org.uk/guidance/CG122

68. Public Health England. *Prostate Cancer Risk Management Programme: Overview*. Accessed July 2019. Available at: www.cancerscreening.nhs.uk/prostate/index.html

69. Smellie WS, Forth J, Sundar S, Kalu E, McNulty CA, Sherriff E *et al.* Best practice in primary care pathology: review 4. *J Clin Pathol* 2006;59:1116.

70. Molina R, Barak V, van Dalen A, Duffy MJ, Einarsson R, Gion M *et al.* Tumor markers in breast cancer – European Group on Tumor Markers recommendations. *Tumour Biol* 2005;26:281–293.

71. Bidart JM, Thuillier F, Augereau C, Chalas J, Daver A, Jacob N *et al.* Kinetics of serum tumour marker concentrations and usefulness in clinical monitoring. *Clin Chem* 1999;45:1695–1707.

72. Sturgeon CM, Hoffman BR, Chan DW, Ch'ng SL, Hammond E, Hayes DF *et al*. National Academy of Clinical Biochemistry Laboratory Medicine Practice Guidelines use of tumour markers in clinical practice: quality requirements. *Clin Chem* 2008;54:1935–1939.

73. Brunton LL, Chabner BA, Knollman BC (eds). *Goodman and Gilman's The Pharmacological Basis of Therapeutics (12th edition)*. New York, USA: McGraw-Hill, 2011.

74. Baker R, Jardine A, Andrews P. *Post-operative Care of the Kidney Transplant Recipient*. Hampshire, UK: The Renal Association, 2011.

75. Piard C, Bressolle F, Fakhoury M, Zhang D, Yacouben K, Rieutord A *et al.* A limited sampling strategy to estimate individual pharmacokinetic parameters of methotrexate in children with acute lymphoblastic leukemia. *Cancer Chemother Pharmacol* 2007;60:609–620.

76. Joint Formulary Committee. *British National Formulary (77th edition).* London, UK: BMJ Group and Pharmaceutical Press, 2019.

77. Health and Safety Executive. *Control of Lead at Work (3rd edition).* Surrey, UK: HSE Books, 2002.

78. TOXBASE. *TOXBASE.* Accessed July 2019. Available at: www.toxbase.org

79. NICE. *Ectopic Pregnancy and Miscarriage: Diagnosis and Initial Management*. London, UK: NICE, 2019. Available at: www.nice.org.uk/guidance/ng126

80. Royal College of Obstetricians and Gynaecologists. *Obstetric Cholestasis: Green-top Guideline No 43.* London, UK: Royal College of Obstetricians and Gynaecologists, 2011.

81. NICE. *Antenatal Care for Uncomplicated Pregnancies.* London, UK: NICE, 2008. Available at: www.nice.org.uk/guidance/cg62

82. NICE. *Hypertension in Pregnancy: Diagnosis and Management.* London, UK: NICE, 2019. Available at: www.nice.org.uk/guidance/ng133

83. Royal College of Obstetricians and Gynaecologists. *Severe Pre-eclampsia/Eclampsia, Management: Green-top Guideline No 10A*. London, UK: Royal College of Obstetricians and Gynaecologists, 2006.

84. Stagnaro-Green A, Abalovich M, Alexander E, Azizi F, Mestman J, Negro R *et al.* Guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and postpartum. *Thyroid* 2011;21:1081–1125.

85. NICE. *Diabetes in Pregnancy: Management from Preconception to the Postnatal Period.* London, UK: NICE: 2015. Available at: https://www.nice.org.uk/guidance/ng3

86. GAIN. *Management of Hyponatraemia in Labour and the Immediate Postpartum Period.* Belfast, UK: GAIN, 2017.

87. NICE. *Type 1 Diabetes: Diagnosis and Management of Type 1 Diabetes in Children and Young People*. London, UK: NICE, 2004.

88. Murch S, Jenkins H, Auth M, Bremner R, Butt A, France S *et al*. Joint BSPGHAN and Coeliac UK guidelines for the diagnosis and management of coeliac disease in children. *Arch Dis Child* 2013;98:806–811.

89. Thomas D, Wee M, Clyburn P, Walker I, Brohi K, Collins P *et al*. Blood transfusion and the anaesthetist: management of massive haemorrhage. *Anaesthesia* 2010;65:1153–1161.

90. British Committee for Standards in Haematology. *UK Guidelines on the Management of Iron Deficiency in Pregnancy*. London, UK: BCSH, 2011.

91. Dasgupta B, Borg FA, Hassan N, Barraclough K, Bourke B, Fulcher J *et al*. BSR and BHPR guidelines for the management of polymyalgia rheumatica. *Rheumatology* 2010;49:186–190.

92. NICE. *Rheumatoid Arthritis: The Management of Rheumatoid Arthritis in Adults*. London, UK: NICE, 2009. Available at: www.nice.org.uk/guidance/CG79

93. Raschke RA, Reilly BM, Guidry JR, Fontana JR, Srinivas S. The weight-based heparin dosing nomogram compared with a "standard care" nomogram. A randomized controlled trial. *Ann Intern Med* 1993;119:874–881.

94. Keeling D, Mackie I, Moore GW, Greer IA, Greaves M, British Committee for Standards in Haematology. Guidelines on the investigation and management of antiphospholipid syndrome. *Br J Haematol* 2012;157:47–58.

95. Collins PW, Chalmers E, Hart DP, Liesner R, Rangarajan S, Talks K *et al*. Diagnosis and treatment of factor VIII and IX inhibitors in congenital haemophilia: (4th edition). UK Haemophilia Centre Doctors Organization. *Br J Haematol* 2013;160:153–170.

96. Collins PW, Chalmers E, Hart D, Jennings I, Liesner R, Rangarajan S *et al*. Diagnosis and management of acquired coagulation inhibitors: a guideline from UKHCDO. *Br J Haematol* 2013;162:758–773.

97. Milkins C, Berryman J, Cantwell C, Elliott C, Haggas R *et al*. British Committee for Standards in Haematology, Guidelines for pre-transfusion compatibility procedures in blood transfusion laboratories. British Committee for Standards in Haematology. *Transfus Med* 2013;23:3–35.

98. White J, Qureshi H, Massey E, Needs M, Byrne G, Daniels G *et al.* Guideline for blood grouping and red cell antibody testing in pregnancy British Committee for Standards in Haematology. *Transfus Med* 2016;26:246–263.

99. Qureshi H, Massey E, Kirwan D, Davies T, Robson S, White J *et al.* BCSH guideline for the use of anti-D immunoglobulin for the prevention of haemolytic disease of the fetus and newborn. *Transfus Med* 2014;24:8–20.

100. NICE. *Rheumatoid arthritis in adults: management.* London, UK: NICE, 2018. Available at: www.nice.org.uk/guidance/ng100

101. Tarzi MD, Hickey A, Förster T, Mohammadi M, Longhurst HJ. An evaluation of tests used for the diagnosis and monitoring of C1 inhibitor deficiency: normal serum C4 does not exclude hereditary angioedema. *Clin Exp Immunol* 2007;149:513–516.

102. Abraham M, Khosroshahi, A. Diagnostic and treatment workup for IgG4-related disease. *Expert Rev Clin Immunol* 2017;13:867–875.

103. Khan S, Del-Duca C, Fenton E, Holding S, Hirst J, Doré PC *et al*. Limited value of testing for intrinsic factor antibodies with negative gastric parietal cell antibodies in pernicious anaemia. *J Clin Path* 2009;62:439–441.

104. NICE. *Anaphylaxis: Assessment and Referral After Emergency Treatment.* London, UK: NICE, 2011. Available at: www.nice.org.uk/guidance/cg134

105. Ntatsaki E, Carruthers D, Chakravarty K, D'Cruz D, Harper L, Jayne D *et al.* BSR and BHPR guideline for the management of adults with ANCA-associated vasculitis. *Rheumatology* 2014;53:2306–2309.

106. Crobach MJT, Planche T, Eckert C, Barbut F, Terveer EM, Dekkers OM *et al.* European Society of Clinical Microbiology and Infectious Diseases: update of the diagnostic guidance document for *Clostridium difficile* infection. *Clin Microbiol Infect* 2016;22:S63– S81.

107. Maertens J, Verhaegen J, Lagrou K, Van Eldere J, Boogaerts M. Screening for circulating galactomannan as a noninvasive diagnostic tool for invasive aspergillosis in prolonged neutropenic patients and stem cell transplantation recipients: a prospective validation. *Blood* 2001;97:1604–1610.

108. Furfaro E, Mikulska M, Miletich F, Viscoli C. Galactomannan: testing the same sample twice? *Transpl Infect Dis* 2012;14:E38–E39.

109. Leeflang MM, Debets-Ossenkopp YJ, Vissers CE, Scholten RJ, Hooft L, Bijlmer HA *et al*. Galactomannan detection for invasive aspergillosis in immunocompromized patients (Review). *Cochrane Database Syst Rev* 2008;4:CD007394.

110. Chai LY, Kullberg BJ, Johnson EM, Teerenstra S, Khin LW, Vonk AG *et al*. Early serum galactomannan trend as a predictor of outcome of invasive aspergillosis. *J Clin Microbiol* 2012;50:2330–2336.

111. Nouer SA, Nucci M, Kumar NS, Grazziutti M, Barlogie B, Anaissie E. Earlier response assessment in invasive aspergillosis based on the kinetics of serum aspergillus galactomannan: proposal for a new definition. *Clin Infect Dis* 2011;53:671–676.

112. Bergeron A, Porcher R, Menotti J, Poirot JL, Chagnon K, Vekhoff A *et al*. Prospective evaluation of clinical and biological markers to predict the outcome of invasive pulmonary aspergillosis in hematological patients. *J Clin Microbiol* 2012;50:823–830.

113. Schelenz S, Barnes RA, Barton RC, Cleverley JR, Lucas SB, Kibbler CC *et al*. British Society for Medical Mycology best practice recommendations for the diagnosis of serious fungal diseases. *Lancet Infect Dis* 2015;15:461–474.

114. Lass-Florl C. How to make a fast diagnosis in invasive aspergillosis. *Med Mycol* 2019;57:S155–S160.

115. Eggimann P, Marchetti O. Is (1→3)-β-D-glucan the missing link from bedside assessment to pre-emptive therapy of invasive candidiasis? *Crit Care* 2011;15:1017.

116. Cuenca-Estrella M, Verweij PE, Arendrup MC, Arikan-Akdagli S, Bille J, Donnelly JP *et al*. ESCMID* guideline for the diagnosis and management of Candida diseases 2012: diagnostic procedures. *Clin Microbiol Infect* 2012;18:S9–S18.

117. Hammarström H, Kondori N, Friman V, Wennerås C. How to interpret serum levels of beta-glucan for the diagnosis of invasive fungal infections in adult high-risk hematology patients: optimal cut-off levels and confounding factors. *Eur J Clin Microbiol Infect Dis* 2015;34:917–925.

118. Rautemaa-Richardson R, Rautemaa V, Al-Wathiqi F, Moore CB, Craig L, Felton TW *et al.* Impact of a diagnostics-driven antifungal stewardship programme in a UK tertiary referral teaching hospital. *J Antimicrob Chemother* 2018;73:3488–3495.

119. British HIV Association. *British HIV Association Guidelines for the Management of HIV in pregnancy and postpartum*. London, UK: British HIV Association, 2018.

120. Public Health England. Hepatitis B Guidance on the antenatal screening and selective neonatal immunisation programme.2021.. Available at https://www.gov.uk/government/publications/hepatitis-b-antenatal-screening-and-selective-neonatal-immunisation-pathway

121. Public Health England. *UK Standards for Microbiological Investigations V8: Vertical and Perinatal Transmission of Hepatitis C*. London, UK: Public Health England, 2018.

122. The Renal Association. *Clinical Practice Guideline Management of Blood Borne Viruses within the Haemodialysis Unit.* Bristol, UK: The Renal Association, 2019.

123. Department of Health. *Good Practice Guidelines for Renal Dialysis/Transplantation Units: Prevention and Control of Blood-borne Virus Infection.* London, UK: Department of Health, 2002.

124. Department of Health. HIV Post-Exposure Prophylaxis. *In: Guidance from the UK Chief Medical Officers' Expert Advisory Group on AIDS*. London, UK: Department of Health, 2008.

125. BASHH Guidelines. *BASHH/EAGA Statement on HIV Window Period.* Accessed July 2019. Available at: www.bashhguidelines.org/media/1069/bashh-eaga-statement-on-hiv-wp-nov-14.pdf

126. Ramsay ME. Guidance on the investigation and management of occupational exposure to hepatitis C. *Commun Dis Public Health* 1999;2:258–262.

Appendix A Summary table – explanation of grades of evidence

(modified from Palmer K *et al. BMJ* 2008;337:1832)

Grade (level) of evidence	Nature of evidence
Grade A	At least one high-quality meta-analysis, systematic review of randomised controlled trials or a randomised controlled trial with a very low risk of bias and directly attributable to the target population or A body of evidence demonstrating consistency of results and comprising mainly well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias, directly applicable to the target population.
Grade B	A body of evidence demonstrating consistency of results and comprising mainly high-quality systematic reviews of case-control or cohort studies and high-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relation is causal and which are directly applicable to the target population or Extrapolation evidence from studies described in A.
Grade C	A body of evidence demonstrating consistency of results and including well-conducted case-control or cohort studies and high-quality case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relation is causal and which are directly applicable to the target population or Extrapolation evidence from studies described in B.
Grade D	Non-analytic studies such as case reports, case series or expert opinion or Extrapolation evidence from studies described in C.
Good practice point (GPP)	Recommended best practice based on the clinical experience of the authors of the writing group.

Appendix B AGREE II guideline monitoring sheet

The guidelines of the Royal College of Pathologists comply with the AGREE II standards for good quality clinical guidelines. The sections of this guideline that indicate compliance with each of the AGREE II standards are indicated in the table.

AGREE standard	Section of guideline
Scope and purpose	
1 The overall objective(s) of the guideline is (are) specifically described	Introduction
2 The health question(s) covered by the guideline is (are) specifically described	Introduction
3 The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described	Foreword
Stakeholder involvement	
4 The guideline development group includes individuals from all the relevant professional groups	Foreword
5 The views and preferences of the target population (patients, public, etc.) have been sought	Foreword
6 The target users of the guideline are clearly defined	Introduction
Rigour of development	
7 Systematic methods were used to search for evidence	Foreword
8 The criteria for selecting the evidence are clearly described	Foreword
9 The strengths and limitations of the body of evidence are clearly described	Foreword
10 The methods for formulating the recommendations are clearly described	Foreword
11 The health benefits, side effects and risks have been considered in formulating the recommendations	Foreword and Introduction
12 There is an explicit link between the recommendations and the supporting evidence	2–7
13 The guideline has been externally reviewed by experts prior to its publication	Foreword
14 A procedure for updating the guideline is provided	Foreword
Clarity of presentation	
15 The recommendations are specific and unambiguous	2–7
16 The different options for management of the condition or health issue are clearly presented	2–7
17 Key recommendations are easily identifiable	2–7
Applicability	
18 The guideline describes facilitators and barriers to its application	Foreword
19 The guideline provides advice and/or tools on how the recommendations can be put into practice	1–7
20 The potential resource implications of applying the recommendations have been considered	Foreword
21 The guideline presents monitoring and/or auditing criteria	8
Editorial independence	
22 The views of the funding body have not influenced the content of the guideline	Foreword
23 Competing interest of guideline development group members have been recorded and addressed	Foreword