

Supplementary material

Table S1

Reference	Year	Location	Research objective
Afifa et al ¹	2016	Tunisia	To determine the prevalence of microalbuminuria and describe the Micral-test validity.
Aizpuru et al ²	2012	Spain	To describe the variability in the detection and surveillance of chronic conditions in primary care
Al-Foraih N et al ³	2017	Canada	To identify which laboratory tests were associated with lupus outcomes including flare, mortality and damage
Allen et al ⁴	2010	USA	To assess quality of care for Chronic Kidney Disease according to patient risk and identify correlates of improved care delivery
Al-Naher et al ⁵	2018	United Kingdom	To review the optimal frequency of monitoring renal function in heart failure patients
Arena et al ⁶	2014	Brazil	To analyse the requests and expenditures of unnecessary tests for hypertensive and diabetic patients
Aziz KM et al ⁷	2015	Saudi Arabia	To utilize spot urine protein among diabetic patients and to find its association with routine dipstick urine test for albumin, and microalbuminuria
Bajwa-Dulai et al ⁸	2013	Lebanon	To quantify the overall frequency of abnormal results and the proportion of patients with abnormal results in whom testing led to a meaningful change in care.
Bakarman et al ⁹	1997	Saudi Arabia	To investigate the utilisation of lab testing in primary health care centres in the Al-Khobar area.
Bell et al ¹⁰	2014	Australia	To describe how evidence from trials and cohort studies may be used to guide choice of test for monitoring patients with chronic disease.
Bialkowska-Warzecha J ¹¹	1998	Poland	Is 99mTc-Hepida plasma clearance test a useful investigation in assessing the course of cirrhosis of the liver?
Bozic-Mijovski M et al ¹²	2016	Slovenia	To assess a diluted thrombin (dTT) assay based on the same thrombin reagent already used for traditional thrombin time measurements, which reliably measures low to intermediate plasma dabigatran levels.
Bramlage P et al ¹³	2003	Germany	To show the prevalence of a single positive test result for microalbuminuria in hypertensive and diabetic patients that present in primary care and the association of a positive test with the prevalence of secondary diseases and the severity of symptoms. To investigate whether routine monitoring of microalbuminuria is established in primary care.
Bull et al ¹⁴	1986	United Kingdom	To evaluate the ability of a newly devised statistical method "consensus analysis" to identify the best test for monitoring disease activity in rheumatoid arthritis.
Cohen et al ¹⁵	2018	USA	To assess how often clinicians assess the effectiveness of statin treatment

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Coleman et al¹⁶	2010	United Kingdom	To examine the extent and effect of laboratory monitoring in a cohort of patients in UK general practice with newly diagnosed hypertension and newly treated with antihypertensive drugs.
Crippa et al¹⁷	2012	Italy	To investigate the association between uric acid and cardiovascular disease in hypertensive patients
Curtis et al¹⁸	2012	USA	To evaluate the proportion of RA patients receiving lipid testing and the frequency of testing compared to controls (patients with osteoarthritis [OA]).
Dauernheimer Machado J et al¹⁹	2015	Brazil	To evaluate the accuracy of creatinine and cystatin C equations, either alone or in combination, to estimate GFR in type 2 DM patients as compared to healthy adults.
DeLong et al²⁰	1985	USA	To use a partial likelihood solution to the discrete logistic model in order to obtain estimates of the diagnostic test indices and to provide a significance test when the diagnostic test is administered repeatedly to individuals
Doganer et al²¹	2014	USA	To assess the degree to which the frequency of lipid screening tests exceeds recommendations among family medicine patients who have cardiovascular risk factors, to test the association between testing frequency and achievement of lipid goals, and to identify predictors of more frequent testing.
Dolan et al²²	2008	United Kingdom	To investigate the relationship between time spent in the recommended target International Normalised Ratio (INR) range and the setting and intensity of anticoagulant monitoring, in both treatment-experienced and treatment-naïve atrial fibrillation (AF) patients receiving oral anticoagulation (OAC) therapy for the prevention of ischaemic stroke.
Doll et al²³	2011	United Kingdom	To (1) report the change in the number of cholesterol tests during the 20-year period by source (primary or secondary care) and patient demographics (age, sex); (2) calculate the number of tests by 3-year period and estimate the proportion of tests for monitoring rather than diagnosis, and the proportion that may be unnecessary; and (3) relate frequency of testing to estimated changes in mean cholesterol levels.
Duddy et al²⁴	2018	United Kingdom	To improve our understanding of how and why variation in laboratory test ordering comes about
Duff et al²⁵	2018	United Kingdom	To examine the effect of tests/year on achievement of commonly utilised HbA1c targets and on HbA1c changes over time.
Dufour et al²⁶	2000	USA	To review information of performance characteristics for tests that are commonly used to identify (and monitor?) acute and chronic hepatic injury, with the aim of developing new guidelines.
Elhayany A et al²⁷	2011	Israel	To evaluate the clinical impact of abnormal liver and muscle enzyme test results on patients in primary care practice who are on statin therapy.
Farmer et al²⁸	2014	NA	To estimate the clinical value and cost-effectiveness of different screening intervals to diagnose early diabetic kidney disease in type1 and 2 diabetics.

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Fazlalizadeh et al ²⁹	2014	United Kingdom	To assess whether plasma concentration of aminoterminal probrain natriuretic peptide (NTproBNP) could be a simple tool for screening for cardiovascular disease and cardiac dysfunction amongst older patients with Type 2 diabetes
Fazlalizadeh H et al ³⁰	2014	United Kingdom	To investigate whether natriuretic peptides or glycosolated haemoglobin can be used as markers of micro and macrovascular complications amongst older patients with type 2 diabetes mellitus.
Fischer SH et al ³¹	2014	US	To determine physician factors associated with ordering recommended laboratory monitoring tests for high-risk medications.
Flynn D et al ³²	2015	Ireland	To identify all patients in a GP practice prescribed NOACs and to measure the percentage that had annual renal function monitoring since commencing treatment. To check if a patient's dosing is correct as per their creatinine clearance (CrCl).
Garg D et al ³³	2018	Canada	To calculate the positive predictive value (PPV) of a single random abnormal urine ACR compared with repeat test results in patients with type 2 diabetes to diagnose CKD. We also explored the relationship between the first and second urine ACR values (between 2 and 20 mg/mmol) when performed within 120 days.
Garg et al ³⁴	2018	Canada	To determine if there is Canadian Diabetes Association (CDA) guideline compliant screening for chronic kidney disease in patients with diabetes. We explore relation to patient age, gender, hypertension and urban versus rural practice.
Glasziou PP et al ³⁵	2008	Australia and New Zealand	To estimate, in patients receiving cholesterol-lowering medication, the variation in initial response to treatment, the longterm drift from initial response, and the detectability of long-term changes in on-treatment cholesterol level ("signal") given shortterm, within-person variation ("noise").
Glasziou PP et al ³⁶	2013	Australia, New Zealand and Finland	To evaluate the optimal lipid to measure in monitoring patients, we assessed three factors that influence the choice of monitoring tests: (1) clinical validity; (2) responsiveness to therapy changes and (3) the size of the long-term 'signal-to-noise' ratio.
Griger DR et al ³⁷	1999	US	To investigate the utility of liver enzyme monitoring in RA patients undergoing treatment with azathioprine.
Gudmundsdottir BR et al ³⁸	2018	Iceland	To evaluate anticoagulation variability, testing and dose adjustment frequency during FIIIX-NR monitoring compared to prior warfarin management using standard INR in the same patients treated for one year before and after monitoring test replacement and in warfarin naive patients.
Hajati et al ³⁹	2018	Australia	To examine the extent to which the adult Australian population on lipid-lowering medications receives the level of high-density lipoprotein cholesterol (HDL-C) testing recommended by national guidelines.
Harano et al ⁴⁰	1984	Japan	To assess whether quantification of serum levels of ketone bodies is useful (a) to differentiate Type 1 from Type 2 diabetes, and (b) to monitor diabetic control
Harish S et al ⁴¹	2019	India	To evaluate the correlation between salivary and serum levels of glucose in non-diabetic and diabetic (controlled and uncontrolled) individuals.
Heyman et al ⁴²	2007	Sweden	To investigate the sufficiency of S-cholesterol analysis (TC) in monitoring all blood lipids

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Hinton et al ⁴³	2017	United Kingdom	To compare glycaemic control (HbA1c), renal function using estimated glomerular filtration rate (eGFR), and blood pressure (BP) across socio-economic status and ethnic groups, and identified any disparities contributing to these incongruent outcomes.
Hirst et al ⁴⁴	2015	United Kingdom	To report the utilisation of HbA1c tests and establish how HbA1c testing frequency impacts on glycaemic control
Holden WE et al ⁴⁵	1993	US	To test the utility of a novel collection system that allows measurement of theophylline in oral mucosal tracts to calculate serum theophylline concentrations.
Jacob et al ⁴⁶	2018	Germany	To analyze the frequency of blood pressure (BP) and estimated glomerular filtration rate (eGFR) monitoring in hypertension patients followed in primary care practices in Germany.
Kadiyala R et al ⁴⁷	2010	GB	To review the current literature on the association between thyroid dysfunction and diabetes mellitus, to highlight relevant clinical implications, and to examine present thyroid disease screening strategies in routine diabetes care.
Kent PD et al ⁴⁸	2004	US	To further define the risk factors for abnormal laboratory monitoring tests while receiving MTX and to determine whether these influence the need to maintain, decrease, or discontinue MTX.
Kessler et al ⁴⁹	2012	Switzerland	To evaluate the cost-effectiveness of microalbuminuria screening and subsequent treatment in different populations.
Khan FA et al ⁵⁰	2015	Saudi Arabia	To analyze and compare the Cu(II), Fe(III), Mg(II), and Zn(II) statuses in T2DM with proteinuria, without proteinuria, and only proteinuria patients.
Kneepkens EL ⁵¹	2017	Netherlands	To describe how dried blood spot/finger prick can be used in a controlled environment in patients with rheumatic inflammatory diseases treated with adalimumab to obtain reliable estimates of serum concentrations of adalimumab and antiadalimumab (ADA).
Knudsen et al ⁵²	2012	Denmark	To evaluate the frequency of screening for microalbuminuria, albuminuria and renal function in patients with type 2 diabetes followed in primary care settings in Denmark.
Kostev et al ⁵³	2012	Germany and UK	To measure the quality of diabetic care as indicated by HbA1c testing frequency and to compare the frequency of HbA1c testing in primary care diabetes patients in Germany (DE) and UK.
Kostev et al ⁵⁴	2018	Germany	To analyse the annual frequency of HbA1c testing, as well as the factors associated with higher or lower testing frequency, in people with Type 2 diabetes mellitus in general practices and specialist diabetes practices in Germany.
Kostev et al ⁵⁵	2019	Germany	To analyze the frequency of BP and eGFR testing in T2DM patients followed in German general and diabetological practices.
Lamb et al ⁵⁶	2014	United Kingdom	To reduce uncertainty regarding the optimal method to estimate glomerular filtration rate (GFR) for disease detection and monitoring.
Lau et al ⁵⁷	2017	US	To describe changes made to Methotrexate dosing in response to elevated aspartate aminotransferase (AST) levels and define any correlation between elevated AST to Methotrexate dose and duration of therapy.
Lenzi et al ⁵⁸	1987	Italy	To assess the clinical usefulness of glycated haemoglobin (HbA1) in monitoring diabetes

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Liang et al ⁵⁹	2015	United Kingdom	To (1) assess the frequency of proteinuria monitoring in patients with T2DM; (2) understand the association between proteinuria monitoring and renal disease risk factors in patients with T2DM, and whether the frequency of proteinuria testing varies by age, sex, smoking status, history of hypertension, renal complications, and antidiabetic drug therapy; and (3) evaluate the prevalence of proteinuria in patients with T2DM in the UK.
Lloyd LA et al ⁶⁰	2009	United Kingdom	To audit methotrexate monitoring in all 29 general practices (GPs) in a Local Health Board.
Luqmani R et al ⁶¹	1994	United Kingdom	To determine the value of serial measurements of circulating cytokines in patients with rheumatoid arthritis in response to the introduction of disease modifying anti-rheumatic drugs (DMARDs).
Manski-Nankervis et al ⁶²	2018	Australia	To explore: (1) the proportion of patients with T2D attending general practice who have had screening for, or ongoing monitoring of, CKD; (2) the proportion of patients without a documented diagnosis of CKD who have pathology consistent with CKD diagnosis; and (3) the patient factors associated with screening and the recording of a diagnosis of CKD.
McAlister et al ⁶³	2007	Canada	To examine the frequency of laboratory monitoring in patients newly started on antihypertensive therapy who did not have comorbidities or non-blood pressure lowering indications for these drugs; our primary interest was in determining whether the pattern of laboratory monitoring differed according to the drug class that was prescribed as initial monotherapy.
McCoy et al ⁶⁴	2015	USA	To assess the extent and effect of excessive testing for glycated hemoglobin (HbA1c) among adults with controlled type 2 diabetes
McGill et al ⁶⁵	2004	USA	To assess the ability of 1,5AG measurements to monitor glycemic control in a cohort of 77 patients with diabetes (22 with type 1 diabetes, 55 with type 2 diabetes) who presented with suboptimal glycemic control at baseline (defined as HbA1c >7%).
McGovern AP et al ⁶⁶	2013	United Kingdom	To investigate the association of adverse vascular and renal outcomes in people with diabetes, with or without hypertension, who did not have monitoring of their renal function.
Mohiuddin et al ⁶⁷	2016	United Kingdom	To assessed the cost-effectiveness of BNP-guided monitoring for heart failure in various patient subgroups
Moroni et al ⁶⁸	2008	Italy	To assess the possible role of C3, C4, anti-dsDNA and anti-C1q in differentiating patients with active and inactive lupus nephritis (LN).
Naing C et al ⁶⁹	2017	NA	To systematically review the evidence on the relationship between salivary glucose level and blood glucose level in monitoring glycaemia in patients with type 1 diabetes mellitus.
Nansseu JR et al ⁷⁰	2015	NA	To search for and summarise available evidence on the accuracy of fructosamine measurements to diagnose and monitor DM.
Nilsson E et al ⁷¹	2018	Sweden	To assess to what extent the clinical heart failure guidelines are being followed regarding monitoring of creatinine and potassium through the initial weeks of mineralocorticoid receptor antagonists.
Oke et al ⁷²	2012	United Kingdom	To estimate, in a representative group of well-controlled patients with Type 2 diabetes: (1) the extent to which HbA1c varies over time between and within patients; (2) the extent to which change, defined as attaining an HbA1c

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			level $\leq 7.5\%$ (58.5 mmol/mol), could be accurately detected taking into account short-term, within patient variability and the length of the interval between the initial test and the follow up test.
Ormseth et al ⁷³	2015	USA	To assess the utility of seven candidate plasma miRNAs, selected for biologic plausibility, for diagnosis of RA and use as markers of disease activity and cardiovascular risk in RA.
Onundarson PT et al ⁷⁴	2014	Iceland	To compare the use of two different warfarin monitoring tests (Fiix-prothrombin to prothrombin time) and their effect on fatal and non-fatal thromboembolism rate.
Oskarsdottir AR et al ⁷⁵	2018	Iceland	To compare anticoagulation outcome and dosing frequency during 12 months prior to switching from PT-INR based management (Pre-Fiix monitoring period) and during 12 months following switch to Fiix-NR monitoring (Fiix monitoring period).
O'Sullivan JW et al ⁷⁶	2018	United Kingdom	To identify overuse and underuse of diagnostic tests in primary care
Parcero et al ⁷⁷	2011	USA	To assess association between meeting a target A1C level of $<7\%$ and adherence to monitoring guidelines.
Pereira and Cachapuz ⁷⁸	2018	Portugal	To determine the prevalence of requesting outside guidance with HbA1c in patients with diabetes mellitus as a model, in order to identify the magnitude of inappropriate requesting
Perrotta PL et al ⁷⁹	2014	US	To measure how frequently diabetes mellitus patients are tested for hemoglobin A1c (HbA1c), low density lipoprotein, and urine protein and to determine whether the frequencies with which these analytes are tested are consistent with recognized guidelines.
Razi F et al ⁸⁰	2015	Iran	To assess the variability of the results obtained from different techniques in two groups of T2D patients: those with controlled blood glucose levels, and the patients with uncontrolled glucose concentrations.
Rickard JP et al ⁸¹	2018	US	To determine the rates at which monitoring of amiodarone or dofetilide was performed in accordance with package labels and published guidelines and to determine rates of severe adverse drug events
Satoh K et al ⁸²	2012	Japan	To establish an assay system for cilostazol monitoring, using AA-induced platelet aggregation in the presence of PGE1, since AA appears to be most sensitive to the inhibitory effect of cilostazol.
Sezgin G et al ⁸³	2018	Australia	To describe general practice activity and characteristics of pathology test ordering based on electronic health record data. Investigate compliance with evidence-based guidelines to determine the appropriateness and quality use of pathology in general practice.
Shah KB et al ⁸⁴	2008	Not specified	To study how well patients taking spironolactone are monitored for hyperkalemia
Shardlow A et al ⁸⁵	2017	United Kingdom	To assess the impact of use of cystatin-C-based and combined creatinine and cystatin C eGFR compared to standard creatinine-based estimates in a primary care population with baseline CKD stage 3, defined by 2 measures of GFR more than 90 days apart, and to evaluate the non-GFR determinants of cystatin-C-based eGFR. Additionally, we compared creatinine- and cystatin-C-based estimates of GFR over 5 years of follow-up and evaluated the prognostic accuracy of cystatin C in risk prediction. Finally, we evaluated the cost implications of implementing NICE guidance to confirm a diagnosis of CKD G3aA1 based on creatinine eGFR

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			(eGFRcreat) by checking cystatin C eGFR (eGFRcys) and also considered the use of creatinine and cystatin C eGFR (eGFRcreat-cys) as an alternative strategy.
Stevens RJ et al ⁸⁶	2010	United Kingdom	To develop a general framework for modelling the control phase of a monitoring programme, by reviewing the statistical models that have been used to study the transition between phases three and four in recent papers in diverse clinical fields.
Tanaka H et al ⁸⁷	2016	Japan	To assess the process quality of diabetes care in terms of persistent follow-up and routine examinations of glycemic control and other complications under favorable access to healthcare conditions using health insurance claims data.
Thorpe CT et al ⁸⁸	2012	US	To examine the extent to which receipt of annual HbA1c tests, LDL-C tests, and eye examinations differed for patients with and without comorbid dementia.
van Bruggen S et al ⁸⁹	2019	Netherlands	To investigate the association between full monitoring of biomedical and lifestyle-related diabetes target indicators and HbA1c level in patients with T2DM who receive a structured diabetes care protocol facilitated by a care group.
Van de Ree et al ⁹⁰	2001	Netherlands	To compare the Cockcroft formula with the endogenous creatinine clearance for estimation of the GFR to evaluate the influence of extreme obesity in T2DM n the formulas.
Wang B et al ⁹¹	2017	China	To compare the glucose concentrations in mixed saliva from all salivary glands (i.e., saliva secreted into the oral cavity), unstimulated parotid glands, and blood glucose in patients with type 2DM and subjects without diabetes.
Wermeling PR et al ⁹²	2014	Netherlands	To investigate whether 6-monthly monitoring of well-controlled type 2 diabetes patients results in equivalent cardiometabolic control at reduced costs compared to 3-monthly monitoring.
Yamanouchi T et al ⁹³	1996	Japan	To assess the utility of serum measurements of 1,5AG in assessing the control of plasma glucose in patients with non-insulin-dependent diabetes mellitus (NIDDM).
Yoo KH et al ⁹⁴	2017	Korea	To analyze compliance to the HbA1c testing guideline and explore individual and area level determinants associated with compliance, focusing on the regional differences

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