BMJ Open

Current and future use of point-of-care tests in primary care: an international survey in Australia, Belgium, The Netherlands, the UK and the USA

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To cite: Howick J, Cals JWL, Jones C, *et al*. Current and future use of point-of-care tests in primary care: an international survey in Australia, Belgium, The Netherlands, the UK and the USA. *BMJ Open* 2014;**4**: e005611. doi:10.1136/bmjopen-2014-005611

► Prepublication history and additional material is available. To view please visit the journal (http://dx.doi.org/10.1136/bmjopen-2014-005611).

Received 2 May 2014
Revised 17 June 2014
Accepted 17 July 2014

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ABSTRACT

Objective: Despite the growing number of point-of-care (POC) tests available, little research has assessed primary care clinician need for such tests. We therefore aimed to determine which POC tests they actually use or would like to use (if not currently available in their practice).

Design: Cross-sectional survey.

Setting: Primary care in Australia, Belgium (Flanders region only), the Netherlands, the UK and the USA.

Participants: Primary care doctors (general practitioners, family physicians).

Main measures: We asked respondents to (1) identify conditions for which a POC test could help inform diagnosis, (2) from a list of tests provided: evaluate which POC tests they currently use (and how frequently) and (3) determine which tests (from that same list) they would like to use in the future (and how frequently).

Results: 2770 primary care clinicians across five countries responded. Respondents in all countries wanted POC tests to help them diagnose acute conditions (infections, acute cardiac disease, pulmonary embolism/deep vein thrombosis), and some chronic conditions (diabetes, anaemia). Based on the list of POC tests provided, the most common tests currently used were: urine pregnancy, urine leucocytes or nitrite and blood glucose. The most commonly reported tests respondents expressed a wish to use in the future were: D-dimer, troponin and chlamydia. The UK and the USA reported a higher actual and desired use for POC tests than Australia, Belgium and the Netherlands. Our limited data suggest (but do not confirm) representativeness.

Conclusions: Primary care clinicians in all five countries expressed a desire for POC tests to help them diagnose a range of acute and chronic conditions. Rates of current reported use and desired future use were generally high for a small selection of POC tests, but varied across countries. Future research is warranted to explore how specific POC tests might improve primary care.

Strengths and limitations of this study

- This is the first survey assessing primary care clinician (family doctor) use and desire for point-of-care tests.
- In total, 2770 respondents across five countries (Australia, Belgium, the Netherlands, the UK and the USA) responded to the survey.
- The study identified a clinical need for a variety of point-of-care tests that will inform policy decisions about which tests might be used in primary care, and industry strategy regarding which point-of-care tests require further development.
- Response rates varied across countries, and representativeness (although suggestive) could not be confirmed.

BACKGROUND

Diagnostic testing forms the backbone of a large proportion of primary healthcare, informing decisions about treatment, specialty referral and hospital admission. Over the past few decades, diagnostic technologies have become cheaper, smaller, and in some cases more accurate. A wide range and growing[1 2] number of point-of-care (POC, 'near patient') tests which provide rapid 'on site' results are now available. These may have potential to improve outcomes in primary care by optimising prescribing decisions, reducing referrals, improving efficiency of care and decreasing costs.[3 10]

While growing in number, POC tests have not generally been adopted in primary care in many high-income settings. A recent systematic review of primary care clinicians' attitudes towards blood POC tests highlighted a number of barriers, as well as potential

facilitators, to their wider adoption in primary care.[11] Barriers included concerns about accuracy, over-reliance on tests and limited usefulness. Facilitators included improved diagnostic certainty, targeting of treatment, communication and shared decisions. Concern about the evidence base for the effectiveness of POC tests was noted over 15 years ago[12] and remains a problem, with few high-quality studies focusing on patient outcomes (rather than test accuracy).[13]

Understanding which POC tests primary care clinicians (general practitioners, family physicians) consider priorities could bridge the gap between the number of tests available and the number actually used in primary care. Understanding clinician priorities has also been shown as a key step in the successful development (by industry) and implementation of new tests.[14] Yet an obstacle to assessing priorities is that clinicians may currently be unaware of some newly available technologies, and are unlikely to know what could feasibly be developed in the (near) future. Likewise, industry may not be familiar with the tests or research avenues that are likely to benefit general practice. In spite of the many benefits of understanding which POC tests clinicians find useful, there has been little effort to assess primary care clinician needs (or perceived needs) for POC tests.[5]

Our aim was therefore to conduct an international survey of primary care clinicians in five countries with well-developed yet different primary care health systems: Australia, Belgium, the Netherlands, the UK and the USA. Specifically, we aimed: (1) to identify the conditions for which general practitioners would find POC tests useful to help them make diagnostic decisions, (ii) evaluate which POC tests primary care clinicians use in their current practice and (iii) determine what POC tests they would like to use but are not currently available in their practices. An advantage of our approach was that the questions focused on the conditions for which the responder considered a POC test might be of value in decision-making.

METHODS

Study design

We conducted an international cross-sectional survey of primary care clinicians in Australia, Belgium (Flanders region only), the Netherlands, the UK and the USA.

The survey

We first asked primary care clinicians to identify up to five health conditions for which POC testing might help them to in making diagnostic decisions. We specified that they could list the condition whether or not a POC test currently exists (in the UK version of the survey we also asked similar questions about reducing referrals and monitoring acute conditions. Because these questions were not asked in other countries we do not report them in this international report. These data will be reported separately). Respondents also had the option to state: "I do not believe POC Tests would help me make a diagnosis." Next, we presented a list of 50 tests and asked respondents to identify which tests were available to them and they currently used as POC tests. All 50 tests were POC blood, urine or other specimen tests (as opposed to POC devices such as blood pressure monitors or electrocardiography). We did not require respondents to specify the condition for which they might use the test. Respondents were then presented with the same list (minus the tests they previously stated were already available to them) and asked them to indicate which they would wish to have available as a POC test in their practice. Hence, for each of the 50 tests primary care clinicians could indicate 1 of 4 options:

1. (Current use) This test is available as a POC test in my practice and I use it.
2. (Current use) This test is available as a POC test in my practice, but I do not use it.
3. (Desired use) This test is not available as a POC test in my practice, but I would use it if were available.
4. (Desired use) This test is not available as a POC test in my practice, and I would not use it if it were available.

For respondents who stated that they either currently used or desired to use a test, we followed up with a question about how frequently they used/desired to use the test (at least once daily, weekly, monthly, once per year or less).

Finally, respondents were asked to indicate the distance between their practice and the nearest emergency department, how long it took them (on average) to get results from a blood test, the type of location of their practice (urban, rural), the number of registered patients in their practice, how many hours per week they worked (on average), their year of qualification, age and sex. The complete version of the UK survey is in online supplementary appendix VI.

Survey development and implementation

After development by five authors (JH, CJ, MT, CH and JWLC) the survey was checked for relevance and omissions by authors in all countries, pilot tested by 30 primary care clinicians in the UK and adjusted accordingly. The list of 50 tests used in the survey was based on the most commonly ordered laboratory tests by primary care in Oxfordshire, UK, and was modified based on input from general practitioners in other countries. The survey underwent additional changes to make it relevant to each country. For example, the Australian version did not ask about use or desire for protein/creatinine ratio because protein/creatinine ratio is known in Australia as albumin:creatinine ratio (ACR) or urinary microalbumin; leucocytes/nitrites testing was excluded from the Australian survey due to survey length restrictions. Neither Belgium nor the Netherlands asked about use/desire for prothrombin time testing because of overlap (and therefore confusion) with international normalised ratio (INR). The survey was translated to Dutch for the

Netherlands and Belgium (translation led by JWLC) so respondents could complete the survey in their own language. In Belgium, the Netherlands, the UK and the USA, the surveys were conducted using online survey tools. In Australia the survey was conducted both online and via postal mailings (see table 1). Up to three reminders were sent in each country.

Our target sample size ranged between 357 (for Belgium with 5000 practising family care physicians) and 383 (for the USA with 208, 807 primary care physicians) based on 95%±5% CI and an estimated proportion of 50%.[15 16]

Statistical analyses

Data were entered and analysed using Excel. Respondent characteristics were compared with known characteristics of primary care clinicians in each country, based on publically available data on primary care clinician characteristics.

We categorised responses to the open-ended question (about conditions for which respondents would like POC tests to help them make diagnoses) using the International Classification of Primary Care (ICPC-2-R)[17] system (see online supplementary appendix VII). We then generated frequencies of responses using SPSS (V.21) or (in Australia) Stata (V.13). Some modification of the ICPC-2-R was required to account for the responses. For example, many respondents listed cancer as a condition for which they would like a POC test, yet cancer is not currently a condition in the ICPC handbook. We also combined some conditions. For example, many respondents listed pulmonary embolism (PE) and deep vein thrombosis (DVT) as a single condition, whereas others listed these separately, so we combined PE and DVT into a single category. Four authors (JH, MT, JWLC and AVdB) were responsible for modifying the coding frame. One person conducted the coding in each country, and ambiguities were resolved by discussion with additional authors. Descriptive statistics were used to display frequencies for each (adapted) ICPC-2-R condition, and a list was compiled of all tests that were actually used or desired by at least 25% of respondents in each individual country. The individual country data for tests that at least 25% of respondents either use or would use are reported in the web appendix, tables I-V. These tables also provide details about how frequently respondents used (or would use) the test.

RESULTS

Sample characteristics

A total of 2770 primary care clinicians responded to the survey (see table 1). Response rates varied from 10% (Australia) to 68% (UK). Between 29% (USA) and 43% (UK) of the respondents were women, and the average distance between the practice and the nearest hospital ranged from 7.1 (Belgium) to 11.2 km (UK). The proportion of rural/semirural respondents ranged from 25% (USA) to 55% (Belgium). The average year of qualification ranged from 1988 (Australia) to 1993 (UK).

Representativeness

Australian respondents reported working fewer hours per week than the national average (28 vs 33) and there was an over-representation of rural respondents (44% rural, whereas the national average is 30%).[18] In Belgium 40% of respondents were women and the average year of qualification was 1990, whereas on average 28% of primary care clinicians are women and the average year of qualification is 1987 in the region.[19] Respondents in the Netherlands were similar to national averages in terms of age (average age 48.9 years and national average 48.5 years), and average number of hours worked per week (44 for respondents and national average).[20] Respondents in the UK were representative of UK general practitioners in terms of percentage female (43% of respondents and 48% UK general practitioners) and median year of qualification: 1996 for respondents and 1997 for national average (national average data provided median but not mean, whereas table 1 reports mean in order to retain consistency with data reported in other countries).[21] In the USA the sample had fewer female respondents (29%) than the national average (39%) and the proportion of rural respondents was slightly higher among respondents (25%) than the national average (19%).[22] These results suggest that our samples were broadly representative, yet the lack of comparative national average data prevents us from drawing firm conclusions.

Conditions for which primary care clinicians would like to use a POC test to help make a diagnosis

Table 2 displays the top 10 conditions which primary care clinicians most commonly reported wanting POC tests to help them diagnose. The most commonly listed conditions by country were: urinary tract infection (Australia, the UK and the USA) and PE/DVT (Belgium and the Netherlands). Respondents in all five countries included urinary tract infections, diabetes, acute cardiac disease and anaemia among the top 10 conditions. Respondents in at least four countries included heart failure and PE/DVT among the top 10 conditions.

POC tests that primary care clinicians currently use

Table 3 shows current use of POC tests, ranked in descending order according to the total percentage of primary care clinicians who currently use each test. Blood glucose, urine pregnancy test and urine leucocytes or nitrite were the most frequently used POC tests in the five countries, all being used by more than 80% of respondents. Beyond the top three tests, frequency of current use differed across countries. Overall, more respondents in the UK and the USA reported using POC tests than respondents in the other countries. At least 10% of respondents reported using 47 of the tests in the USA and 46 of the tests in the UK. The number

Table 1 Characteristics of respondents in each country

Country	Australia	Belgium	The Netherlands	UK	USA
Total number of respondents	298	319	639	1109	405
Response rate	10%	NA	30%	68%	NA
Dates of data collection	Sent out May 2013, one reminder, closed in October 2013	Sent out February 2013, no reminder, closed March 2013	Sent out February 2013, one reminder, closed March 2013	Sent out September 2012, three reminders closed October 2012	December 2013 through February, 2014
Female (%)	NA	131 (40)	239 (37)	475 (43)	119 (29)
Kilometres to nearest hospital (average)	NA	7.1	8.6	11.2	7.9
Location of practice					
Rural or semirural	280 (44%)	176 (55%)	280 (44%)	377 (34%)	102 (25%)
Urban or suburban	359 (56%)	143 (45%)	359 (56%)	732 (66%)	303 (75%)
Number of patients registered at practice (average)	NA	2800	4110	8275	NA
Sampling method	2933 GPs Australian Medical Association membership list with addition of data from other sources (approximately 80% GPs covered)	Existing mailing list of GPs and GP groups in the region were contacted. The survey was only sent to GPs in Flanders (the Flemish speaking part of Belgium)	All GPs in three regionally distributed GP networks approached	Randomly sampled, stratified according to age, length of time in practice, specialty and location	AAFP National Research network and a randomly sampled group of practitioners, stratified according to age, length of time in practice, specialty and location
Source	Australasian Medical Publishing Company Data Direct	Academic networks and GP groups of the region collectively contacted	GPs in three regions of departments of general practice	Doctors.net	Practice Based Research Network and commercial polling agency
Type of survey	Electronic and paper	Electronic	Electronic	Electronic	Electronic
Year qualified as a doctor: average	1988	1990	1991	1993	1990

AAFP, American Academy of Family Practitioners; GP, general practitioner; NA, not available.

Table 2 Conditions for which respondents would like a point-of-care test to help them diagnose conditions: top 10 in each country

Australia (n=298)		Belgium (n=319)		The Netherlands (n=639)		UK (n=1109)		USA (n=405)	
Condition	Per cent (n)	Condition	Per cent (n)	Condition	Per cent (n)	Condition	Per cent (n)	Condition	Per cent (n)
Diabetes	57 (170)	PE/DVT	94 (300)	PE/DVT	106.5 (651)*	UTI	47 (521)	UTI	56 (225)
Acute cardiac disease	42 (126)	Acute cardiac disease	76 (241)	Acute cardiac disease	62.7 (383)	PE/DVT	43 (478)	Strep throat	54 (218)
UTI	32 (95)	Heart failure	24 (75)	Chest infection/ cough/LRTI	54.7 (334)	Diabetes	35 (385)	Diabetes	42 (169)
Pregnancy	26 (79)	Chest infection/ cough/LRTI	24 (75)	UTI	26.0 (159)	Acute cardiac disease	25 (282)	Influenza	40 (162)
Anaemia	18 (53)	Infections	23 (74)	Heart failure	22.9 (140)	INR/anticoagulation	18 (199)	Pregnancy	25 (103)
Chronic and acute renal conditions (excluding UTI)	15 (45)	UTI	19 (61)	Anaemia	20.0 (122)	Pregnancy	16 (178)	Infectious mono	14 (56)
INR/anticoagulation	17 (51)	Acute and chronic renal impairment	12 (39)	Diabetes	14.7 (90)	Anaemia	15 (162)	Anaemia	13 (52)
PE/DVT	13 (40)	Diabetes	12 (37)	Infections	13.1 (80)	Heart failure	11 (124)	STDs	7 (27)
Heart failure	12 (37)	Anaemia	8 (24)	Appendicitis	10.8 (66)	COPD/asthma	10 (116)	INR	7 (27)
COPD/asthma	12 (35)	STDs	7 (21)	STDs	9.0 (55)	Chest infection/ cough/LRTI	9 (102)	Acute cardiac disease	6 (23)

*>100% Since we combined PE and DVT. This is because some respondents in the Netherlands listed *both* PE and PE/DVT. In other countries we faced similar problems. Since it was impossible to split PE from DVT when respondents listed PE/DVT as a single condition, we lumped them together.
COPD, chronic obstructive pulmonary disease; DVT, deep vein thrombosis; INR, international normalised ratio; LRTI, lower respiratory tract infection; PE, pulmonary embolism; STD, sexually transmitted disease; UTI, urinary tract infection.

Table 3 Point-of-care tests that at least 25% of respondents in at least one country reported currently using, ranked in descending order according to total percentage of general practitioners that reported using the tests

	Australia (n=298)	Belgium (n=319)	The Netherlands (n=639)	UK (n=1109)	USA (n=405)	Total (n=2770)
Urine pregnancy test	68% (203)	61% (193)	94% (603)	80% (887)	86% (350)	81% (2236)
Urine leucocytes or nitrite	NA	87% (275)	96% (611)	90% (993)	88% (355)	81% (2234)
Blood glucose	74% (221)	87% (278)	96% (616)	69% (760)	82% (334)	80% (2209)
INR	48% (144)	12% (37)	1% (6)	43% (476)	47% (189)	31% (852)
Haemoglobin	10% (29)	3% (8)	58% (371)	16% (174)	50% (202)	28% (784)
Faecal occult blood	6% (19)	18% (56)	2% (14)	13% (143)	83% (335)	20% (567)
Throat swab for group A streptococci	6% (19)	4% (12)	1% (4)	15% (164)	86% (348)	20% (547)
C reactive protein	3% (8)	3% (10)	48% (305)	15% (163)	10% (42)	19% (528)
Quantitative β-human chorionic gonadotropin	6% (18)	19% (59)	22% (138)	17% (193)	28% (112)	19% (520)
HbA1c	6% (17)	2% (6)	6% (38)	17% (183)	40% (162)	15% (406)
Nose/throat swab for influenza	7% (20)	1% (3)	0% (2)	6% (61)	60% (242)	12% (328)
Platelet count	4% (11)	0% (1)	1% (3)	15% (163)	28% (112)	10% (290)

HbA1c; glycated haemoglobin; INR, international normalised ratio; NA, not applicable.

of tests reported as used by at least 10% of respondents in the other countries was lower: five in Australia, seven in Belgium and nine in the Netherlands. The number of tests used could be a function of practice size (which was much higher in the UK than other countries where it was reported, see table 1).

A POC test for INR was used by nearly half of the Australian, American and British primary care clinicians, compared with only 1% (6/639, 95% CI 0% to 2%) of the Dutch and 12% (37/319, 95% CI 9% to 16%) of Belgian (Flemish) primary care clinicians. Haemoglobin tests were used by more respondents in the Netherlands (58%, 371/639, 95% CI 54% to 62%) and the USA (50%, 202/405, 95% CI 45% to 55%) than in other countries. Haemoglobin use was 16% (174/1109, 95% CI 14% to 18%) in the UK, 3% (8/319, 95% CI 1% to 5%) in Belgium and 10% (29/298, 95% CI 7% to 12%) in Australia. POC tests were used by a higher proportion of respondents in the USA compared with other countries. For example, 60% used throat swabs for influenza and 86% tested for group A streptococci, while these tests were used by between 0% and 15% of primary care clinicians in the other countries. Similarly, 83% of US doctors used faecal occult blood tests, while only 2–18% of primary care clinicians in the other countries used this POC test. C reactive protein (CRP) was used by 48% (305/639, 95% CI 44% to 52%) of the Dutch primary care clinicians, in contrast with less than 15% in the other countries (see table 3 for details).

Desired POC tests (that primary care clinicians do not currently use but would use if available)

Desired use was higher than reported current use, suggesting a demand for POC tests (see table 4). Overall 19 tests were desired by at least 50% of respondents in at least one country, while only 8 tests were actually used by at least 50% of respondents in at least one country. POC tests for D-dimer, troponin, chlamydia, gonnorrhoea, B-type natriuretic peptide, CRP, glycated haemoglobin, white cell count and haemoglobin were desired by more than half of respondents across all countries.

Desire for POC tests was highest in the UK, where at least 50% of respondents expressed the desire to use 18 of the listed tests. The numbers of tests desired by at least 50% of respondents in other countries were: 12 (Belgium), 11 (US A), 6 (the Netherlands) and 1 (Australia). Reported current use seemed to be inversely correlated with higher desired use. For example, INR actual use in the Netherlands (1%, 6/639, 95% CI 0% to 2%) and Belgium (12%, 37/319, 95% CI 9% to 16%) was low, yet desire for INR was higher in Belgium (77%, 244/319, 95% CI 72% to 81%) and the Netherlands (54%, 347/639, 95% CI 50% to 58%) than in other countries.

DISCUSSION

This international survey of primary care clinicians indicates a desire for POC tests to help diagnose a range of acute (infections and acute cardiopulmonary) conditions and some chronic conditions (such as diabetes and anaemia). The most frequently used POC tests used currently (blood glucose, urine pregnancy and urine leucocytes/nitrites) only partially correspond with the conditions for which primary care clinicians would like POC tests to help them make diagnoses (urinary tract infection, PE/DVT and acute cardiac disease, diabetes and anaemia). This suggests an unmet clinical need for a more widely accessible range of POC tests to assist clinicians with immediate decisions (urgent referrals, or immediate treatment decisions such as the decision to treat with antibiotics).

Table 4 Point-of-care tests that at least 50% of respondents in at least one country would use, ranked in descending order according to total percentage of general practitioners that would use the tests

	Australia (n=298)	Belgium (n=319)	The Netherlands (n=639)	UK (n=1109)	USA (n=405)	Total (n=2770)
D-dimer	41% (121)	83% (265)	70% (448)	73% (811)	62% (251)	68% (1896)
Troponin	43% (129)	85% (271)	65% (418)	69% (765)	59% (238)	66% (1821)
Chlamydia	49% (145)	67% (212)	60% (382)	65% (721)	66% (267)	62% (1727)
B-type natriuretic peptide	28% (82)	51% (164)	62% (398)	66% (734)	60% (244)	59% (1622)
C reactive protein	38% (114)	75% (238)	47% (302)	61% (682)	45% (181)	55% (1517)
Gonorrhoea	34% (100)	56% (180)	51% (326)	58% (645)	65% (262)	55% (1513)
HbA1c	52% (156)	61% (195)	37% (239)	61% (679)	50% (202)	53% (1471)
White cell count	43% (127)	67% (212)	40% (256)	60% (661)	52% (212)	53% (1468)
Haemoglobin	47% (139)	47% (150)	26% (168)	72% (793)	39% (159)	51% (1409)
Potassium	33% (97)	47% (150)	33% (210)	61% (679)	57% (232)	49% (1368)
International normalised ratio	21% (63)	77% (244)	54% (347)	47% (517)	43% (176)	49% (1347)
Nose/throat swab for influenza	43% (128)	59% (187)	36% (231)	55% (609)	33% (134)	47% (1289)
Erythrocyte sedimentation rate	29% (86)	40% (128)	29% (183)	58% (645)	48% (194)	45% (1236)
Quantitative β-human chorionic gonadotropin	40% (120)	56% (177)	23% (149)	53% (586)	46% (187)	44% (1219)
Creatinine	34% (102)	41% (130)	28% (177)	53% (593)	53% (214)	44% (1216)
Thyroid stimulating hormone	32% (95)	33% (105)	27% (171)	53% (586)	62% (253)	44% (1210)
Throat swab for group A streptococci	35% (103)	60% (190)	33% (208)	53% (588)	11% (45)	41% (1134)
Uric acid	28% (82)	30% (94)	26% (167)	50% (549)	51% (205)	40% (1097)
Sodium	30% (88)	21% (66)	19% (122)	51% (571)	42% (172)	37% (1019)

HbA1c; glycated haemoglobin.

While there were similarities between countries in terms of the tests used and the conditions for which respondents expressed a desire for POC tests, there were also important differences. Both actual use and reported desired use was higher in the UK and the USA (see web appendices I–V). Different reimbursement methods across countries are likely to influence actual use, as well as attitudes towards future use. For instance, the low uptake of INR POC testing in Belgium could be due to the fact that INR POC tests are not reimbursed, whereas the regular laboratory INR test would be. The Netherlands also reported lower INR usage, which could be because there are separate thrombosis clinics monitoring anticoagulation therapy in the Netherlands. In Australia, although INR is not reimbursed (whereas a centralised laboratory test would be), primary care clinicians still use it because it improves patient flow and management. Another source of intercountry variability could be differences between practice set-ups. Rural primary care clinicians in Australia or the USA are often far more isolated than rural clinicians in Europe, and ruling out a serious condition that requires immediate transfer to the nearest hospital has important logistical consequences. The differences in reimbursement and care models across countries for POC tests need to be explored further to discover whether and how specific POC tests might improve patient outcomes in specified settings. Other factors that could affect intercountry variability include: type of reimbursement (fixed price vs test cost), space and the need to accommodate a range of technologies, staff time and the need to train staff on a range of technologies, the need to change clinic organisation expertise, expertise, regulatory requirements and uncertainty about test accuracy.

Strengths and limitations

This is the first international survey of primary care clinicians on this topic. Our responses were internally validated by asking about both desire for POC tests (from a specified list) as well as conditions for which respondents would like a POC test to help them make a diagnosis. The results of the survey suggest that there is good agreement between the conditions for which POC tests are considered useful, and POC tests primary care clinicians would like to use in the future.

Response numbers exceeded target numbers in three countries, and we were able to estimate representativeness by comparing characteristics of respondents with the characteristics of primary care clinicians in each country for many important variables. However, representativeness could not be confirmed with certainty due to limited data about national primary care clinician characteristics. Specifically, over-representation of primary care clinicians interested in POC testing could have occurred despite high response rates in some countries. We also cannot assume, based on this survey, that

the results can be generalised to other countries, especially low-income or middle-income countries.

It was somewhat surprising that some respondents reported a desire to use some tests that should (in principle) already be widely available. For example, potassium tests have been available in the USA for over two decades and take less than 3 min to conduct. Yet 57% (232/405, 95% CI 52% to 62%) of US respondents expressed a desire to use potassium POC tests in the future. This suggests the possibility that respondents misunderstood the question, provided invalid responses or that the test was not available in their practice. Some of the tests, for example, tests for acute cardiac disease, may not be suitable or relevant in all countries. However, this represents a mismatch between tests that may be available commercially, yet not available to a particular respondent in their particular clinic. Further research is warranted to investigate this issue.

Implications for clinicians, policymakers and industry

Conditions that primary care clinicians claim POC tests would help them diagnose, as well as POC tests that are widely desired, deserve further research and industry development to assess their roles within evidence-based diagnostic pathways. Studies of POC test clinical effectiveness will depend on adherence to quality control protocols, while cost-effectiveness studies will have to address known barriers to cost-effectiveness of diagnostic studies in general, and POC testing in particular,[23] as well as the barriers to implementation such as concerns about the over-reliance on tests. Existing data about cost-effectiveness of POC testing to date are mixed. The potential for POC tests to reduce costs, for example, by reducing the number of clinic visits[24] is not always borne out in practice.[25] Cost-effectiveness will also be test and setting specific: an Australian trial indicated that POC testing resulted in a reduction in costs for some tests (ACR) but greater for others (INR).[26] Future research is warranted to determine the clinical utility and cost-effectiveness of individual tests (or clusters of tests).[24] More research is also warranted to investigate the barriers to implementation, some of which we have studied previously.[11 27] Once this research is done, tests which are likely to improve patient care in a cost-effective way require targeting by industry for development and optimisation. Tests used in low-prevalence settings have particular problems that may require independent investigations.[28]

CONCLUSION

Primary care practitioners are eager to use a variety of POC tests. Some conditions for which POC tests are deemed most useful are similar across five countries despite important differences in healthcare organisation. Future research is now warranted to investigate how and whether these POC tests can improve patient outcomes in a cost-effective way.

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Acknowledgements Gus Sohn, Sandy Young and Fasika Alem assisted with the data analysis in the USA. Ruth Davis helped organise a meeting about the paper in December 2013.

Contributors JH drafted the first manuscript. JH, MT, CJ, CPP, CH and JWLC designed the initial (UK) version of the survey. JH did the UK data analysis; JWLC, FB, MYB, HCvW and AVdB adapted the survey for Belgium (Flanders) and the Netherlands. JWLC did the data analysis for the Dutch data and EvS did the data analysis for the Belgian data. CL and TB adapted the survey for Australia. CL and AP did the data analysis for the Australian data. JH and WP adapted the survey for the USA. JH did the data analysis for the USA. All authors contributed to the decisions about how to present the data, organise the final manuscript and edit the final manuscript.

Funding This project was partly supported by educational grants from the following companies: Alere, Atlas Genetics, BD (Becton, Dickinson and Company), Ortho Clinical Diagnostics, Philips Home Clinical Monitoring (the Netherlands), Siemens Healthcare Diagnostics, and Nova Biomedical.

Competing interests JH was funded by the National Institute for Health Research (NIHR) School for Primary Care Research (SPCR). JWLC is supported by a Veni-grant (91614078) of the Netherlands Organisation for Health Research and Development (ZonMw). MT, CH, CPP, AvdB, AP and CJ are supported by the NIHR Diagnostic Evidence Co-operative Oxford at Oxford Health NHS Foundation Trust.

Ethics approval Because it involved asking practising clinicians about their work, ethical approval was not required in the UK, the Netherlands, Belgium or Australia. In the USA the project was reviewed and exempted by the American Academy of Family Practitioners (AAFP) Institutional Review Board as exempt research.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement All data are included in the manuscript or online appendices. The translations of the survey into Dutch and Flemish are available on contacting JH.

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Web Appendix Table I. POC tests that are either used or desired by at least 25% of respondents in Australia

Test	Percentage of respondents who indicate they currently use the test (*n*=298)	Percentage of respondents who indicate they would use the test if it were made available in their practice (*n*=298)	Frequency of current or desired use (whichever was higher) = % (number of GPs who use it or would use at that frequency / number of GPs who do use + would use)
1. Blood glucose	74%	1%	Once daily or more: 59% (132/224)
2. Urine pregnancy test	68%	4%	Weekly: 32% (68/216)
3. INR (international normalised ratio)	48%	21%	Once daily or more: 63% (130/207)
4. Troponin	14%	43%	Weekly: 36% (61/172)
5. Haemoglobin	10%	47%	Weekly: 32% (54/168)
6. Potassium	9%	33%	Weekly: 35% (43/124)
7. Sodium	9%	30%	Once daily or more: 41% (47/115)
8. Creatinine	8%	34%	Weekly: 31% (39/127)
9. Nose/throat swab for influenza	7%	43%	Weekly: 32% (48/148)
10. HbA1c	6%	52%	Once daily or more: 56% (97/173)
11. Quantitative Beta HCG (Human	6%	40%	Weekly and Monthly: 28% (39/138)
12. Throat swab for Group A	6%	35%	Weekly: 27% (33/122)
13. Faecal occult blood	6%	29%	Weekly: 34% (36/106)
14. BNP (B-type natriuretic peptide)	5%	28%	Monthly: 43% (41/96)
15. D-dimer	4%	41%	Monthly: 39% (52/133)
16. White cell count	4%	43%	Weekly: 28% (39/139)
17. Platelet count	4%	21%	Once daily or more: 50% (37/73)
18. Urine albumin:creatinine ratio	4%	39%	Once daily or more: 32% (40/128)
19. Total cholesterol	3%	33%	Once daily or more: 59% (63/107)
20. HDL/LDL cholesterols	3%	40%	Once daily or more: 60% (77/129)
21. Triglycerides	3%	27%	Once daily or more: 53% (47/89)
22. Calcium	3%	14%	Weekly: 28% (15/53)
23. CRP (C-reactive protein)	3%	38%	Weekly: 38% (46/120)
24. ESR (Erythrocyte sedimentation	3%	29%	Weekly: 23% (22/94)
25. Gonorrhoea	3%	34%	Monthly: 32% (35/108)

26. Uric Acid	2%	28%	Weekly: 34% (30/89)
27. TSH (thyroid stimulating hormone)	2%	32%	Weekly: 32% (33/103)
28. PSA (Prostate Specific Antigen)	2%	26%	Once daily or more: 37% (30/82)

Web Appendix Table II. POC tests that are either used or desired by at least 25% of respondents in Belgium .

Test	Percentage of respondents who indicate they currently use the test (*n*=319)	Percentage of respondents who indicate they would use the test if it were made available in their practice (*n*=319)	Frequency of current or desired use (whichever was higher) = % (number of GPs who use it or would use at that frequency / number of GPs who do use + would use)
1. Blood Glucose	87%	6%	Once daily or more 49% (145/296)
2. Urine leukocytes or nitrite	86%	5%	Weekly 46% (134/292)
3. INR (international	12%	77%	Once daily or more 55% (154/281)
4.Troponin	1%	85%	Monthly 43% (117/275)
5. D-dimer	1%	83%	Monthly 48% (129/268)
6. CRP (C-reactive protein)	3%	75%	Once daily or more 42% (103/248)
7. Urine Pregnancy test	61%	16%	Monthly 40% (99/245)
8. Quantitative Beta HCG	19%	56%	Monthly 46% (108/236)
9. White cell count (WBC)	1%	67%	Once daily or more 40% (85/215)
10. Chlamydia	2%	67%	Monthly 44% (95/214)
11. Creatinine	0%	41%	Weekly 46% (60/131)
12. Potassium	1%	47%	Weekly 48% (73/152)
13. Uric Acid	0%	40%	Weekly 36% (34/95)
14. BNP (B-type natriuretic	0%	51%	Monthly 44% (73/165)
15. HbA1c	2%	61%	Weekly 47% (94/201)
16. TSH (thyroid stimulating	1%	33%	Weekly 40% (43/107)
17. Haemoglobin	3%	47%	Weekly 36% (57/158)
18. Throat swab for Group A	4%	60%	Weekly 42% (84/202)
19.Influenza	1%	59%	Weekly 32% (61/190)
20. MRSA (Methicillin-	2%	39%	Monthly 45% (58/130)
21. Leukocyte differentiation	0%	50%	Once daily or more 42% (67/161)
22. *Helicobacter pylori*	0%	28%	Monthly 43% (39/91)
23. *Helicobacter pylori*	0%	45%	Monthly 41% (59/145)
24. BSE (Bovine spongiform	1%	55%	Weekly 39% (51/132)

Web Appendix Table III. POC tests that are either used or desired by at least 25% of respondents in the Netherlands.

Test	Percentage of respondents who indicate they currently use the test (*n*=639)	Percentage of respondents who indicate they would use the test if it were made available in their practice (*n*=639)	Frequency of current or desired use (whichever was higher) = % (number of GPs who use it or would use at that frequency / number of GPs who do use + would use)
1. Blood Glucose	96%	2%	Once daily or more 9% (431/629)
2. Urine leukocytes or nitrite	96%	2%	Once daily or more 89% (555/621)
3. Urine pregnancy test	94%	2%	Weekly 42% (259/618)
4. Haemoglobin	58%	26%	Weekly 50% (268/539)
5. CRP (C-reactive protein)	48%	47%	Weekly 47% (282/607)
6. D-dimer	18%	70%	Monthly 54% (306/562)
7. Troponin	2%	65%	Monthly 44% (187/430)
8. BNP (B-type natriuretic peptide)	1%	62%	Monthly 47% (188/402)
9. Chlamydia	1%	60%	Weekly 47% (182/387)
10. INR (international normalised ratio)	1%	54%	Monthly 42% (147/353)
11. Gonorrhea	1%	51%	Weekly 42% (140/330)
12. ESR (erythrocyte sedimentation rate)	21%	29%	Weekly 49% (154/316)
13. Faecal occult blood	2%	44%	Monthly 45% (132/292)
14. Quantitative Beta HCG (Human	22%	23%	Monthly 39% (113/287)
15. HbA1c	6%	37%	Once daily or more 47% (129/277)
16. White cell count (WBC)	1%	40%	Weekly 55% (144/262)
17. Influenza	0%	36%	Weekly 34% (78/234)
18. Throat swab for Group A Streptococci	1%	33%	Once yearly or less 35% (75/212)
19. Potassium	0%	33%	Weekly 44% (93/210)
20. MRSA (Methicillin-resistant *Staphylococcus aureus*)	3%	29%	Once yearly or less 55% (115/209)
21. Leukocyte differentiation	1%	28%	Weekly 51% (94/185)
22. Creatinine	0%	28%	Weekly 42% (74/177)
23. TSH (thyroid stimulating hormone)	0%	27%	Weekly 46% (80/173)
24. Uric Acid	0%	26%	Monthly 55% (91/167)

Web Appendix Table IV. POC tests that are either used or desired by at least 25% of respondents in the United Kingdom.

Test	Percentage of respondents who indicate they currently use the test (*n*=1109)	Percentage of respondents who indicate they would use the test if it were made available in their practice (*n*=1109)	Frequency of current or desired use (whichever was higher) = % (number of GPs who use it or would use at that frequency / number of GPs who do use + would use)
Urine leukocytes or nitrite	90%	8%	Once daily or more 78% (843/1086)
Urine pregnancy test	80%	15%	Weekly 48% (500/1051)
Blood glucose	69%	28%	Once daily or more 48% (515/1066)
INR (international normalised ratio)	43%	47%	Once daily or more 47% (465/993)
Total cholesterol	18%	46%	Once daily or more 52% (368/710)
ESR (Erythrocyte sedimentation rate)	18%	58%	Weekly 38% (326/849)
HDL/LDL cholesterols	17%	43%	Once daily or more 53% (346/658)
HbA1c	17%	61%	Once daily or more 43% (374/862)
Quantitative Beta HCG (Human chorionic gonadotropin)	17%	53%	Monthly 42% (324/779)
Chlamydia	17%	65%	Weekly 53% (486/913)
Urine albumin:creatinine ratio	17%	49%	Weekly 47% (339/724)
Triglycerides	16%	35%	Once daily or more 53% (298/568)
Haemoglobin	16%	72%	Once daily or more 48% (460/967)
Sodium	15%	51%	Once daily or more 52% (378/732)
D-dimer	15%	73%	Monthly 55% (532/977)
TSH (thyroid stimulating hormone)	15%	53%	Weekly 41% (308/748)
White cell count	15%	60%	Once daily or more 52% (426/825)
Platelet count	15%	51%	Once daily or more 50% (365/725)
CRP (C-reactive protein)	15%	61%	Once daily or more 41% (346/845)
Throat swab for Group A Streptococci	15%	53%	Weekly 40% (301/752)
Urine total protein	15%	31%	Weekly 44% (225/510)
Creatinine	14%	53%	Once daily or more 52% (389/751)
Potassium	14%	61%	Once daily or more 47% (394/839)
Calcium	14%	40%	Once daily or more 37% (223/599)
Uric Acid	14%	50%	Monthly 44% (308/701)
Free T4 or T3 (thyroid hormone)	14%	45%	Weekly 38% (249/652)
AST/ALT (aspartate aminotransferase–alanine aminotransferase ratio)	14%	38%	Once daily or more 49% (287/593)

Alkaline phosphatase	14%	36%	Once daily or more 50% (281/558)
Bilirubin	14%	42%	Once daily or more 46% (284/621)
Gamma GT (ɣ-glutamyltransferase)	14%	37%	Once daily or more 41% (231/571)
Albumin	14%	30%	Once daily or more 53% (259/492)
PSA (Prostate Specific Antigen)	14%	42%	Weekly 40% (246/621)
Vitamin B12	14%	32%	Weekly 41% (207/504)
Folate	14%	31%	Weekly 41% (199/492)
Urine protein:creatinine ratio	14%	35%	Weekly 46% (248/544)
Prothrombin time	13%	33%	Once daily or more 29% (151/513)
Rheumatoid factor	13%	29%	Monthly 43% (202/466)
Nasal swab for MRSA (Methicillin-resistant *Staphylococcus aureus*)	13%	28%	Monthly 52% (238/460)
Faecal occult blood	13%	38%	Monthly 41% (232/567)
Hepatitis B	12%	27%	Monthly 49% (211/435)
CA125	12%	35%	Monthly 51% (267/525)
Vitamin D	12%	29%	Monthly 33% (148/455)
BNP (B-type natriuretic peptide)	11%	66%	Monthly 53% (450/852)
Gonorrhoea	11%	58%	Weekly 47% (360/768)
HIV blood test	10%	28%	Monthly 44% (184/422)
Troponin	7%	69%	Monthly 52% (433/841)
Nose/throat swab for influenza	6%	55%	Monthly 37% (248/670)

Web Appendix Table V. POC tests that are either used or desired by at least 25% of respondents in the United States.

Test	Percentage of respondents who indicate they currently use the test (*n*=405)	Percentage of respondents who indicate they would use the test if it were made available in their practice	Frequency of current or desired use (whichever was higher) = % (number of GPs who use it or would use at that frequency / number of GPs who do use + would use)
Urine leukocytes or nitrite	88%	7%	Once daily or more 75% (289/385)
Throat swab for Group A Streptococci	86%	11%	Once daily or more 64% (252/393)
Urine Pregnancy Test	86%	10%	Weekly 40% (156/392
Faecal occult blood	83%	10%	Once daily or more 50% (186/374)
Blood glucose	82%	13%	Once daily or more 81% (312/386)
Nose/throat swab for influenza	60%	33%	Once daily or more 56% (212/376)
Haemoglobin	50%	39%	Once daily or more 63% (227/361)
INR (international normalised ratio)	47%	43%	Once daily or more 62% (225/365)
Hb1AC	40%	50%	Once daily or more 79% (289/364)
Prothrombin time	29%	34%	Once daily or more 57% (147/258)
White cell count	28%	52%	Once daily or more 62% (204/327)
Platelet count	28%	40%	Once daily or more 63% (173/275)
Quantitative Beta HCG (Human chorionic	28%	46%	Weekly 41% (122/299)
Total cholesterol	22%	45%	Once daily or more 79% (217/273)
Urine total protein	22%	31%	Once daily or more 39% (83/213)
Creatinine	21%	53%	Once daily or more 63% (190/300)
Potassium	21%	57%	Once daily or more 61% (193/319)
Sodium	21%	42%	Once daily or more 63% (161/256)
Urine albumin:creatinine ratio	21%	38%	Once daily or more 45% (107/236)
HDL/LDL cholesterols	20%	50%	Once daily or more 79% (224/285)
Triglycerides	20%	47%	Once daily or more 77% (211/273)
ESR (erythrocyte sedimentation rate)	20%	48%	Weekly 48% (131/273)
Calcium	18%	34%	Once daily or more 58% (120/207)
AST/ALT (aspartate aminotransferase–	18%	49%	Once daily or more 61% (167/272)
Bilirubin	18%	40%	Once daily or more 55% (128/233)
Alkaline phosphatase	17%	33%	Once daily or more 64% (129/201)

Albumin	16%	30%	Once daily or more 61% (114/186)
Nasal swab for MRSA (Methicillin-	16%	49%	Weekly 38% (102/263)
Chlamydia	16%	66%	Weekly 41% (137/333)
Gonorrhea	16%	65%	Weekly 41% (134/325)
Uric acid	15%	51%	Weekly 39% (104/266)
TSH (thyroid stimulating hormone)	15%	62%	Once daily or more 60% (189/312)
Urine protein:creatinine ratio	15%	34%	Once daily or more 38% (76/198)
Gamma GT (Υ-	14%	34%	Once daily or more 51% (99/192)
HIV blood test	13%	44%	Weekly 37% (87/233)
BNP (B-type natriuretic peptide)	12%	60%	Weekly 47% (128/291)
Free T4 or T3 (thyroid hormone)	12%	40%	Once daily or more 51% (108/211)
PSA (Prostate Specific Antigen)	12%	37%	Once daily or more 49% (97/196)
Vitamin D	12%	49%	Once daily or more 49% (121/244)
Hepatitis B	11%	38%	Weekly 37% (74/200)
Vitamin B12	11%	44%	Once daily or more 37% (83/221)
D-dimer	10%	62%	Monthly 44% (130/290)
Troponin	10%	59%	Monthly 40% (113/279)
CRP (C-reactive protein)	10%	45%	Weekly 46% (103/223)
Folate	10%	36%	Weekly 36% (69/188)
Rheumatoid factor	10%	39%	Weekly 41% (82/199)
ANA (anti-nuclear antibodies)	10%	38%	Weekly 42% (83/195)

Web Appendix VI. Survey (UK version)

POCT (POINT OF CARE TESTS) STUDY

Doctors.net.uk invites you to participate in a survey commissioned by an academic institution concerning usage of Point of Care Tests. The survey will take around 5 minutes to complete. All eligible members completing the survey will receive 1,000 eSR points. Please read the following text, which explains the intent of this research.

Doctors.net.uk would like to reassure you that:

- Doctors.net.uk will comply with all UK laws protecting your personal data and the British Healthcare Business Intelligence Association and Market Research Society guidelines
- Your responses will be used by us and the sponsoring academic institution for market research only. All information included is for research only.
- Your responses will be collated with other respondents and presented to the sponsor in aggregated or anonymised form
- Your responses will be confidential and will not be used for any other purposes or disclosed to any third party without your approval.

Please confirm that you have read and understood this information

Yes

No *CLOSE*

We would like to know about your use of, and opinions about, tests that could be delivered quickly in your practice – namely **Point of Care Tests (POCTs), which are also known as 'near-patient tests'.**

By **Point of Care Tests (POCTs)** we mean tests that are done in a primary care setting with results becoming available during the clinic visit. We are asking you about POCTs on samples taken from the body, including blood, urine and other bodily fluids.

You will be familiar with some tests, and others will be unknown to you (and new POCTs are always being developed). We think it is important to find out which tests GPs use and would like to use.

You will be able to view this definition again later in the survey by mousing over "Point of Care Tests (POCTs)," in the text of questions that concern them.

If you would like any more information about this project then please contact Dr Jeremy Howick or Dr Caroline Jones at the Department of Primary Care Health Sciences, Oxford (Jeremy.howick@phc.ox.ac.uk; Caroline.jones@phc.ox.ac.uk).

Are you happy to proceed with the interview on this basis?

Yes

No *CLOSE*

Point of care tests are designed to give clinicians a rapid result to a test using blood, urine, respiratory samples or other body fluids. We would like you to tell us **in which CONDITIONS / ILLNESSES you feel that point of care tests (POCTs) would be most useful, in different situations** (diagnosis, monitoring, and reducing referrals).

Q1 Diagnosis

Please name up to 5 conditions for which a POCT could help you make a **DIAGNOSIS**. Please list the conditions irrespective of whether or not POCTS currently exist

a) _____ (please specify)
b) _____ (please specify)
c) _____ (please specify)
d) _____ (please specify)
e) _____ (please specify)

- I do not believe POCTS would help me make a diagnosis

Open end; Must select "Open End a" or "I do not believe…" ; Open ends b-e are non-mandatory

Q2 Monitoring

Please name up to 5 conditions that a POCT could help you **MONITOR** or manage. Please list the conditions irrespective of whether or not POCTS currently exist

a) _____ (please specify)
b) _____ (please specify)
c) _____ (please specify)
d) _____ (please specify)
e) _____ (please specify)

- I do not believe POCTS would help me monitor or manage conditions

Open end; Must select "Open End a" or "I do not believe…" ; Open ends b-e are non-mandatory

Q3 Reduction of referrals

Please name up to 5 conditions for which a POCT could help you **REDUCE REFERRALS for specialty care or hospital admission**. Please list the conditions irrespective of whether or not POCTS currently exist

a) _____ (please specify)
b) _____ (please specify)
c) _____ (please specify)
d) _____ (please specify)
e) _____ (please specify)

- I do not believe POCTS would help me reduce referrals

Open end; Must select "Open End a" or "I do not believe…" ; Open ends b-e are non-mandatory

Q4 POCTs used

Please select the answer that best matches your views about current or potential use of point of care tests (POCTs)

We are aware that this is a long list but this data is critical to the study and this is the longest question.

	This test **is** currently available as a point of care test (POCT) in my clinic		This test **is not** currently available as a point of care test (POCT) in my clinic	
	(1) I **do** use this test	*(2)* I **do not** use this test	*(3)* I **would** use this test	*(4)* I **would not** use this test
TESTS ON BLOOD				
Cardiovascular				
Creatinine				
Potassium				
Sodium				
Total cholesterol				
HDL/LDL				

cholesterols				
Triglycerides				
Calcium				
Uric Acid				
BNP (B-natriuretic peptide)				
D-dimer				
Troponin				
Endocrine				
Blood glucose				
HbA1c				
TSH (thyroid stimulating hormone)				
Free T4 or T3				
Haematology				
INR				
Haemoglobin				
White cell count				
Platelet count				
Prothrombin time				
Infection related				
CRP (C-reactive protein)				
Procalcitonin				
HIV blood test				
Hepatitis B				
Liver				
AST/ALT				
Alkaline phosphatase				
Bilirubin				
Gamma GT (ɣ-glutamyltransferase)				
Albumin				
Other (blood)				
ESR (*Erythrocyte sedimentation rate)*				
CA125				
PSA (Prostate Specific Antigen)				
Vitamin D				
Vitamin B12				
Folate				
Quantitative Beta HCG (Human chorionic gonadotropin)				

Rheumatoid factor				
ANA (anti-nuclear antibodies)				

	This test **is** currently available as a point of care test (POCT) in my clinic		This test **is not** currently available as a point of care test (POCT) in my clinic	
	(1) I **do** use this test	*(2)* I **do not** use this test	*(3)* I **would** use this test	*(4)* I **would not** use this test
RESPIRATORY SAMPLES				
Throat swab for Group A Streptococci				
Nasal swab for MRSA				
Nose/throat swab for influenza				
TESTS ON URINE OR GENITAL FLUIDS				
Urine pregnancy test				
Urine leukocytes or nitrite				
Chlamydia				
Gonorrhoea				
Urine albumin:creatinine ratio				
Urine total protein				
Urine protein:creatinine ratio				
TESTS ON FAECES				
Faecal occult blood				
Faecal calprotectin				
OTHER TESTS WE HAVE NOT LISTED HERE				

Select one answer each row

Q4a Frequency of POCT usage ***ASK IF CODE 1 OR 3 IS SELECTED AT ONE ROW AT Q4***

Below is a list of point of care tests (POCTS) you indicated that you would use or currently use in your practice. Please tell us how often you would use or do use these

Please select the answer that best matches your views

	More than once per day	Daily	Weekly	Monthly	Once per year or less
TESTS ON BLOOD					
Cardiovascular					
Creatinine					
Potassium					
Sodium					
Total cholesterol					
HDL/LDL cholesterols					
Triglycerides					
Calcium					
Uric Acid					
BNP (B-natriuretic peptide)					
D-dimer					
Troponin					
Endocrine					
Blood glucose					
HbA1c					
TSH (thyroid stimulating hormone)					
Free T4 or T3					
Haematology					
INR					
Haemoglobin					
White cell count					
Platelet count					

Prothrombin time					
Infection related					
CRP (C-reactive protein)					
Procalcitonin					
HIV blood test					
Hepatitis B					
Liver					
AST/ALT					
Alkaline phosphatase					
Bilirubin					
Gamma GT (ɣ-glutamyltransferase)					
Albumin					
Other (blood)					
ESR (*Erythrocyte sedimentation rate)*					
CA125					
PSA (Prostate Specific Antigen)					
Vitamin D					
Vitamin B12					
Folate					
Quantitative Beta HCG (Human chorionic gonadotropin)					
Rheumatoid factor					
ANA (anti-nuclear antibodies)					

	More than once per day	Daily	Weekly	Monthly	Once per year or less
RESPIRATORY					

SAMPLES					
Throat swab for Group A Streptococci					
Nasal swab for MRSA					
Nose/throat swab for influenza					
TESTS ON URINE OR GENITAL FLUIDS					
Urine pregnancy test					
Urine leukocytes or nitrite					
Chlamydia					
Gonorrhoea					
Urine albumin:creatinine ratio					
Urine total protein					
Urine protein:creatinine ratio					
TESTS ON FAECES					
Faecal occult blood					
Faecal calprotectin					
OTHER TESTS WE HAVE NOT LISTED HERE					

DISPLAY ANSWERS WHERE CODE 1 OR 3 WAS SELECTED AT Q4

Q5 Impact of Health Policy

Do you think current changes in health care or policy are likely to have any impact on the use of POCTs? If so, please explain.

Open end

Q6 Other comments

Please share any other comments, including benefits and concerns about POCTs.

Open end. Non-Mandatory

Finally we have a few questions about you

Q7 How many miles to your nearest emergency department that admits patients to hospital?

Numeric. Range =0-150

Q8 Gender

Please select your gender:

❍ Male
❍ Female

Q9 Length of time for blood test

How long does it typically take you to get results from a routine blood test, such as a full blood count?

❍ 1 day or more: ---------- days
❍ Less than 1 day: ---------- hours
❍ I already use a POCT for this test, so it is done immediately

Q10 Year of qualification

What year did you qualify as a doctor?

Drop down list. Range 1960-2011

Q11 Patients in practice

Approximately how many patients are registered in your practice?
Numeric box. Range 0-20000; 0dp

Q12GP role

Which of the following best describes your role in the practice?

❍ GP Partner/Principal
❍ Salaried GP
❍ Retainer GP
❍ Sessional GP
❍ GP Registrar/In training
❍ Locum GP
❍ Other (please specify) *Other specify*

Q13 Practice location

Is your practice based in a…

❍ Rural area
❍ Semi-rural area
❍ Urban area
❍ Suburban area

Q14Hours worked

How many hours per week do you work (on average)

Numeric box. Range 0-60; 0dp

Thank you very much for your help!

Web Appendix VII. Modified International Classification of Primary Care Codes

ICPC-2 Code	ICPC-2 Name
A01	Pain, general/multiple sites (including chronic general pain, multiple aches)
A03	Pyrexia of unknown origin (*NOT Glandular fever, which has it's own category)
A04	Weakness/tiredness, general (including chronic fatigue syndrome, exhaustion, fatigue, lassitude, lethargy, postviral fatigue)
A10	Bleeding/haemorrhage NOS
A70	Tuberculosis (including tuberculosis infection of any body site, late effect of tuberculosis)
A71	Measles (including complications of measles)
A72 / S70	Chickenpox (including complications of chickenpox) / Herpes zoster (including post-herpetic neuralgia, shingles, herpes zoster ophthalmicus)
A73	Malaria
A75/A77	Infectuous mononucleosis (including glandular fever, M.Pfeiffer); Viral disease, other/NOS (including adenovirus, Coxsackie disease, dengue fever, Ross River fever)
A78.1	Infectious disease, other/NOS (including brucellosis, infection unspecified site, Lyme disease, mycoplasma, Q feber, rickettsial disease, scarlet fever, sexually transmitted disease NOS, thrus NOS, toxoplasmosis); and gonorrhoea (male and female) and chlamydia (male and female) (X71/Y71)
A78.2	Infectious disease, other/NOS (including brucellosis, infection unspecified site, Lyme disease, mycoplasma, Q feber, rickettsial disease, scarlet fever, sexually transmitted disease NOS, thrus NOS, toxoplasmosis)
A78.3	Infectious disease, other/NOS (including brucellosis, infection unspecified site, Lyme disease, mycoplasma, Q feber, rickettsial disease, scarlet fever, sexually transmitted disease NOS, thrus NOS, toxoplasmosis)
A91/T87	Abnormal result investigation NOS (including abnormal unexplained pathology/imaging test, electrolyte disorder, hyperglycaemia)
A92	Allergy/allergic reaction NOS (including allergic oedema, anaphylactic shock, angioneurotic oedema, food allergy)
B75	Neoplasm blood, benign/unspecified (including benign neoplasm blood, neoplasm blood not specified as benign or malignant/ when test is not available, polycythaemia rubra vera)

B78/80/81/82	Hereditary haemolytic anaemia/Iron deficiency anaemia/Anaemia, vitamin B12-folate deficiency/Anaemia other,unspecified
B83	Purpura/coagulation defect (including abnormal platelets, haemophilia, thrombocytopenia)
B90	HIV infectio/AIDS
B99	Blood/lymph/spleen disease, other (including complement defect, hypersplenism, immunodeficiency disorder, other/unspecified haemotologicl abnormality, raise ESR, red cell abnormality, sarcoidosis, secondary polycythaemia)
D01/D02/D06	Abdominal pain/cramps, general (including abdominal colic, abdominal cramps/discomfort/pan NOS, infant colic); Abdominal pain, epigastric (including epigastric discomfort, fullness, stomach ache/pain); Abdominal pain, localised, other (including colonic pain)
D07	Dyspepsia/indigestion
D09/D10/D11	Nausea/Vomiting (including emesis/hyperemesis, retching)/Diarrhea(including frequent/loose bowel movements, watery stools)
D13	Jaundice
D16	Rectal bleeding
D70	Gastrointestinal infection (including gastrointestinal infection/dysentry with specified organisms including campylobacter, giardia, salmonella, shigella, typhoid, cholera)
D72	Viral hepatitis (including all hepatitis presumed viral, chronic active hepatitis)
D73	Gastroenteritis, presumed infection (including diarrhoea/vomiting presumed to be infective, dysentry NOS, food poisoning, gastric flu)
D86/D87	Peptic ulcer, other (including gastric/gastrojejunal /marginal ulcer, acute erosion, Zollinger-Ellison syndrome); Stomach function disorder (including acute dilation stomach, duodenitis, gastritis)
D88	Appendicitis (including appendix abscess/perforation)
D92	Diverticular disease (including diverticulitis/diverticulosis of intestine)
D93/D94.0	Irritable bowel syndrome (including mucous colitis, spastic colon), Chronic entiritis/ulcerative colitis (including Chrohn's disease, endoscopic/imaging/histologial findings)
D93/D94.1	Irritable bowel syndrome (including mucous colitis, spastic colon), Chronic entiritis/ulcerative colitis (including Chrohn's disease, endoscopic/imaging/histologial findings)

D97	Liver Disease NOS (including liver failure, alcohol hepatitis, cirrhosis, hepatitis NOS, portal hypertension)
D98	Cholecystitis/cholelithiasis (including biliary colic, cholangitis, gallstones)
D99.0	Disease digestive system, other (including abnormal adhesions, coeliac disease, dumping syndrome, food intolerance, allergic/toxic/dietetic gastroenteropathy, ileus, intestinal obstruction, intussusception, lactose intolerance, malabsorption syndrome, mesenteric vascular disease, pancreatic disease, peritonitis, secondary megacolon, sprue)
D99.1	Disease digestive system, other (including abnormal adhesions, coeliac disease, dumping syndrome, food intolerance, allergic/toxic/dietetic gastroenteropathy, ileus, intestinal obstruction, intussusception, lactose intolerance, malabsorption syndrome, mesenteric vascular disease, pancreatic disease, peritonitis, secondary megacolon, sprue)
F71/F79/F83/F93/F99	Conjunctivitis, allergic (including allergic conjunctivitis with/without rhinorrhea)
H70/H71/H72	Acute otitis media/myringitis (inclusing acute suppurative otitis media, otitis media NOS, acute mastoiditis, acute tympanitis); Serous otitis media (including glue ear, otitis media with effusion (OME)
H86	Deafness (including congenital deafness, deafness on ear, partial/complete deafness both ears) and ear problems NOS (H82)
K70	Infection of circulatory system (including acute/subacute endocarditis, bacterial endocarditis, myocarditis, pericarditis (other than rheumatic)
K74/K75/K76	Acute coronary syndrome / myocardial infarction /Ischaemic heart disease / angina / Cardiac disease, cardiac disease NOS
K77	Heart failure (including cardiac asthma, congestive heart failure, heart failure NOS, left ventricular failure, pulmonary oedema, right ventricular failure)
K80	Cardiac arrhythmia NOS (including atrial/junctional/ventricular premature beats, bradycardia, bigeminy, ectopic beats, extrasystoles, premature beats, sick sinus syndrome, ventricular fibrillation/flutter)
K86/K87/K88	Hypertension, uncomplicated (including essential hypertension, hypertension NOS, idiopathic hypertension); Hypertension, complicated (including malignant hypertension)
K90	Stroke (including apoplexy, cerebral embolism/infarction/thrombosis/occlusion/stenosis/haemorrhage, cerebrovascular accident (CVA), subarachnoid haemorrhage)

K93/K94	Pulmonary embolism (including pulmonary (artery/vein) infarction, thromboembolism, thrombosis); Phlebitis/thrombophlebitis (including superficial/deep vein thrombosis, phlebothrombosis, portal thrombosis)
K99	Cardiovascular disease, other (including aortic aneurism, arteriovenous fistula, arteritis, lymphoedema, oesopageal varices, other aneurysm, polyarteritis nodosa, vasculitis, varicose veins of sites othe than lower extremities)
L02	Back symptom/complaint (including backache NOS, thoracic back pain); Low back symptom/complaint (including lumbar/sacroiliac), coccydynia, lumbago, lumbalgia)
L18	Muscle pain (including fibromyalgia, fibositis, myalgia, panniculitis, rheumatism)
L70	Infection of musculoskeletal system (including infective tenosynovitis, osteomyelitis, pyogenic arthritis)
L88/L89/L90/L91.0	Rheumatoid arthritis /Osteoarthritis of hip / Osteoarthritis of knee / Osteoarthritis,other (including arthritis NOS)
L99.0	Polymyalgia Rheumatica
L99.1	Musculoskeletal disease, NOS (including arthrodesis, chronic internal derangement of knee, contractures, costochondritis, dermatomysositis, disorder of patella, mal-union/non-union of fracture, myositis, Paget's disease of bone, pathological fracture NOS, polymyalgia rheumatica, psoriatic arthritis (code also S91), Reiter's disease, scleroderma, Sjogren's syndrome, spontaneous rupture tendon, systemic lupos eythematosus)
L70/L88/L89/L90/L99.0	Musculosceletal inflammation and infection (including rheumatic disease)
L88/L89/L90/L99.1	Rheumatoid arthritis Drug Monitoring
N71	Meningitis/encephalitis
N89/N90/N95	Migraine (including vascular headache with/without aura); Cluster headache; Tension headache
N93	Carpal Tunnel Syndrome (including loss/impairment of superficial sensation affecting the thumb, index and middle finger, that may or may not split the ring finger. Dysaesthesia and pain worsen usually during the night, and may radiate to the forearm)
N99	Neurological disease, other (including cerebral palsy, dystonia, motor neuron disease, myasthenia gravis, neuralgia NOS) also including abnormal involuntary movements (N08), vertigo/dizziness (N17), head injury other (N80), multiple sclerosis (N86), epilepsy (N88)
P06	Sleep disturbance (including insomnia, nightmares,

	sleep apnoea, sleepwalking, somnolence), also including abnormal involuntary movements (N08), vertigo/dizziness (N17)
P15/P16	Chronic alcohol abuse (including alcohol brain syndrome, alcohol psychosis, alcoholism, delirium tremens); Acute alcohol abuse (including drunk)
P17	Tobacco abuse (including smoking problem)
P19	Drug abuse
P70	Dementia (including Alzheimer's disease, senile dementia)
P73	Affective psychosis (including bipolar disorder, hypomania, mania, manic depression)
P99	Psychological disorder, other (including autism, neurosis NOS), and also schizophrenia (P72), depression (P76) suicide/suicide attempt (P77), post-traumatic stress disorder (P82)
R02	Shortness of breath/dyspnoea (including orthopnoea)
R05/R78	Acute bronchitis/bronchiolitis (including chest infection, acute lower respiratory infection NOS, bronchitis NOS, chest infection NOS, laryngotracheobronchitis, tracheobronchitis); Cough; Pneumonia (R81), Pleurisy/pleural infusion (R82)
R71	Whooping cough (including parapertussis, pertussis)
R72	Strep throat (including proven streptococcal pharyngitis/tonsilitis); also including R76/R90
R74	Upper respiratory tract infection, acute (including acute rhinitis, coryza, head cold, nasophryngitis, pharyngitis, URTI/URI)
R75	Sinusitis acute/chronic (including sinusitis affecting any paranasal sinus)
R80	Influenza (including influenza-like illness, para-influenza)
R83	Respiratory infection, other (including chronic nasopharyngitis, chronic pharyngitis, chronic rhinitis NOS, diptheria, empyema, epiglottis, fungal respiratory infection, lung abcess, protozoael infection (without pneumonia)
R95/R96	Chronic Obstructive Pulmonary Disease (including chronic obstructive airways (COAD), lung (COLD), pulmonary (COPD disease, chronic airways limitation (CAL), emphysema; Asthma (including reactive airways disease, wheezy bronchitis)
R98	Hyperventilation syndrome (including symptoms related to hyperventilation and relieved by rebreathing expired air)
R99	Respiratory disease, other (including aspiration pneumonia, bronchiectasis, deviated nasal septum, lung

	coplication of other disease, mediastinal disease, nasal polyp, other disease of larynx; pneumoconiosis, pneumothorax, pneumonitis due to allergychemicals/dust,fumes/mould, pulmonary collapse, respiratory failure)
S11	Skin infection, post-traumatic (including infected post-traumatic wound/bite), including skin infection, other (S76) and impetigo (S84)
S20	Corn/callosity
S72	Scabies/other acariasis
S74	Dermatophytosis (including fungal skin infection, onychomycosis, pityriasis, versicolor, ringworm, tinea); also including infected finger/toe
S77	Malignant neoplasm of skin (including basal cell carcinoma, malignant carcinoma, rodent ulcer, squamous cell carcinoma of skin); also including moles (S82)
S99	Skin disease, other (including dermatitis artefacta, discoid lupus erythematosus, erythema multiforme, erythema nodosum, folliculitis, granuloma, granuloma, granuloma annulare, hyperkeratosis NOS, keloid, keratoacanthoma, lichen planus, neurodermatitis, onychogryphosis, rosacea, pigmentation, rhinophyma, scar, seborrhoeic or senile warts, striae atrophicae, vitiligo); also including rash (S06) and bruise (S16) and chronic skin ulcer (S97) and dermatitis (S87)
T11	Dehydration (including water depletion)
T81/T85/T86/T99	Goitre (including non-toxic goitre, thyroid nodule)/Hyperthyroidism/thyroidtoxicosis (including Grave's disease, toxic goitre)/Hypothyroidism/myxoedema
T89/T90.0	Diabetes insulin dependent/ Diabetes, non-insulin dependent (including Diabetes NOS)
T89/T90.1	Diabetes (glucose)
T89/T90.2	Diabetes (DKA)
T89/T90.3	Diabetes (urine)
T89/T90.4	Diabetes (ACR)
T89/T90.5	Diabetes NOS
T91	Vitamin/nutritional deficiency (including beri-beri, dietary mineral deficiency, iron deficiency without anaemia, malnutrition, marasmus, scurvy)
T92	Gout
T93	Lipid disorder (including abnormality of lipoprotein level, hyperlipidaemia, raised level of cholesterol/triglycerides, xanthoma)

T99	Endocrine/metabolic/nutritional disease, other (including acromegaly, adrenal/ovarian/pituitary/parathyroid/testicular/other endocrine dysfunction, amyloidosis, crystal arthropathy, Cushing's syndrome, cystic fibrosis, diabetes insipidus, Gilbert's syndrome, hyperaldosteronism, osteomalacia, porphyria, precocious/delayed puberty, pseudo-gout, renal glycosuria, thyroiditis)
U06	Haematuria (including blood in urine)
U14	Kidney symptom/complaint (including kidney pain, kidney trouble, renal colic); and Unirnary calculus (U95)
U28/U99	Urinary disease, other (including bladder diverticulum, hydronephrosis, hypertrophic kidney, obstruction bladder neck, renal failure, urethral caruncle, urethral stricture, ureteric reflux, uraenemia)
U70/U71	Pyelonephritis/pyelitis (including infection of kidney, renal/perinophric abcess) / Cystitis/urinary infection, other (including lower urinary tract infection, urinary tract infection NOS) and Dysuria
U88	Glomerulonephritis/nephrosis (including acute glumerulonephritis, analgesis nephropathy, chronic glomerulonephritis, nephritis, nephropathy, nephroscelerisos, nephrotic syndrome)
U98	Abnormal urine test NOS (including glycosuria, proteinuria, pus in urine, pyuria)
W05 (+D09/D10, D11)	Pregnancy vomiting/nausea (including hypermesis, morning sickness in confirmed pregnancy)
W15/Y10	Infertility/subfertility, female (including sterility, primary and secondary); Infertility, male (including failure of conception after 2 years of trying)
W80	Ectopic Pregnancy
W81	Toxaemia of pregnancy (including eclampsia, hypertension, oedema and proteinuria in pregnancy, pre-eclampsia)
W82	Abortion, spontaneous (including abortion threatened/complete/incomplete/missed/habitual, miscarriage) and disorder of pregnancy (W99)
X06/X08	Menstruation excessive (including menorrhagia, pubertal bleeding); Intermenstrual bleeding (including breakthrough bleeding, dysfunctional uterine bleeding, metorrhagia, ovulation bleeding, spotting)
X11	Menopausal symptom/complaint (including atrophic vaginitis, menopause syndrome, symptom/complaint related to menopause, senile vaginitis)
X14	Vaginal discharge (including fluor vaginalis, leukorrhoea), and genital candidasis (X72) and vaginosis (X84)

X21	Breast symptom/complaint female, other (including mastitis (non-lactating), mastopathy, galactorrhoea)
X71/Y71	Gonorrhoea female (including gonorrhoea any site); Gonorrhoea male (including gonorrhoea any site)
X74	Pelvic inflammatory disease (including endometritis, salpingitis)
X84	Vaginosis/vulvitis NOS (vaginosis, gardnerella)
X99/Y99	Genital disease, female, other (including Bertholin cyst/abcess, endometriosis, genital trat fistula female, pelvic congestion syndrome, physiological ovarian cyst) Genital disease, male, other (including other disease of male breast, epidymal cyst, spermatocele, torsion of the testis)
XX00 (not ICPC code)	INR / anticoagulation
XX01 (not ICPC code)	Rare endocrine disorders
XX02 (not ICPC code)	Urea and Electrolytes
XX03 (not ICPC code)	Dysphagia
XX04 (not ICPC code)	Neutropenia
XX05 (not ICPC code)	Hypoxia
XX06 (not ICPC code)	Arterial/Venous Ulcer
XX07 (not ICPC code)	Cancer (All)
XX08 (not ICPC code)	Pregnancy
XXX (not ICPC code)	Uncodable (because it is a test for several conditions, or is ambiguous)
XXX.0 (not ICPC code)	OTHER
Y05	Scrotum/testis symptom/complaint, other
Y06	Prostate symptom/complaint, other (including prostatism)
Y29	Genital symptom/complaint male, other