The effects of online patient access to laboratory results in British Columbia: A patient survey regarding comprehension and anxiety

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Abstract

Background: Online patient access to personal health information is limited but increasing in Canada and internationally.

Objective: This exploratory study aimed to increase understanding of how online access to laboratory test results in British Columbia (Canada) - which has been broadly available since 2010 - affects patients' experiences.

Methods: In November 2013, we surveyed adults in B.C. who had had a laboratory test in the previous 12 months. Using a retrospective cohort design, we compared reported wait-time for results, test result comprehension, and anxiety levels of "service users" who had online access to their test results (n=2047) with those of a general population panel that did not have online access (n=1245).

Results: The vast majority of service users (84.0%, 95% CI 82.3% – 85.7%) said they received their results within "a few days", compared to just over a third of the comparison group (37.8% 95% CI 35.0% – 40.7%). Most in both groups said they understood their test results, but the rate was lower for service users than the comparison group (75.5%, 95% confidence interval [CI] 73.6% - 77.5% vs. 84.7%, 95% CI% 82.6% - 86.8%). There was no significant difference between groups in levels of reported anxiety after receiving test results.

Conclusions: While most of those who received their laboratory test results online reported little anxiety after receiving their results and were satisfied with the service, there may be opportunities to improve comprehension of results.

Introduction

The use of consumer health solutions, including online patient access to laboratory test results, is limited but expanding internationally [1]. In Canada, more than 8 in 10 adults express interest in use of such services, but only about 6% said that they had online access to their laboratory test results in 2014. Availability was much higher than the national average in British Columbia (27% of those surveyed), where online access to laboratory test results has been available in most regions since 2010 [2]. In B.C., subscribers to the direct lab access service create an account and register with secure passwords; access to the service is free. Patients often learn about the service and are provided secure access through the lab testing facility. After a lab test has been conducted, service users can obtain their test results online. The lab report is presented verbatim, as the ordering clinician would receive it, without additional information. Ordering clinicians may contact their patients about the results or not based on their clinical practice and do not have to subscribe to the service in order for the patient to have access to lab test results. Appendix A presents a screenshot of a typical lab report, as would be available to patients.

As a relatively new technology, there is sparse literature about the benefits and risks of direct patient access to lab test results online, especially results that are abnormal or require follow-up with a healthcare provider [3]. For example, there is a lack of consensus on i) best practices in direct patient notification of abnormal results; ii) whether patients will know what to do with the results; and iii) how they will react if they receive abnormal results online. Concerns about potential risks, such as patient anxiety or confusion, have been documented in the literature [4]; however, this association has not been found in the small body of research to date in this area. On the other hand, previous studies have identified advantages for patients who accessed their personal health records (PHRs), such as improved quality of interactions with physicians, motivation to be better informed about and manage their own health [5,6,7], as well as a reduction in outpatient visits [8,9]. To our knowledge, this quasi-experimental study is the first to assess the effects of direct patient access to medical laboratory tests in Canada. Results presented here pertain to B.C. patients' experiences after seeing their lab test results online, focusing specifically on comprehension of test results and reported anxiety.

Methods

Data sources

The service user and comparison cohorts were recruited separately. Service users were recruited from the subscriber database of the B.C. service provider; specifically, from the approximately 15,000 subscribers who had given prior consent to be contacted for research purposes. Invitation emails were sent directly by the service provider in November 2013 to randomly selected subscribers (n=11,300) who were 18 years of age or older and had had a medical lab test conducted in the previous 12 months, the results of which they had accessed online. A pre-test of the survey was conducted among a small sample of participants in the online service users cohort (n=24). A total of 2,047 service users fully completed the survey, for a response rate of 18%. While the bulk of the service users group was comprised of participants who had first received their most recent test results online, some subscribers had first learned their most recent result in-person from their health care professional. The latter were omitted from analysis to isolate the impact of receiving results online.

The comparison cohort was recruited in December 2013 from members of a general population panel maintained by Vision Critical, the composition of which is benchmarked against known census sub-groups by age, gender, region, education, and income. The Vision Critical panel consists of approximately 130,000 panelists, of whom 15,000 reside in British Columbia. Each month, the panel fields a monthly survey to keep information about panelists current, to pre-screen panelists for specific study objectives, and to keep them actively engaged in the panel. In this case, the monthly screening tool served both to identify a potential comparison group and to target recruitment to match the online service users group as closely as possible on characteristics of age and gender. Two questions were used to pre-screen participants for our study: (1) Have you had any medical laboratory tests conducted in the past 12 months? (2) If yes, how did you receive the results for your medical laboratory test(s) – in-person, online, via mail, email, or over the phone? The 21% of those screened who reported having received results online in the past 12 months were disqualified. For the comparison group, a total of 2,762 panelists were recruited; these were randomly selected from demographic sub-groups to balance the study cohorts. Of these, 1,245 people fully completed the survey, resulting in a response rate of 45%.

Because of the relatively low response rate of service users, the results obtained are not considered representative of the broader population of online service users. The difference in response rates between the service users group and the comparison group may also have resulted in response bias (i.e., nonresponse and voluntary response biases). Although statistical methods such as analytical weighting were used to balance observable characteristics of the two samples, differences in measured outcome indicators can be confounded with unobservable factors, such as familiarity with lab results or anxiety associated with inexperience. The results of this study should be therefore be interpreted with some caution. This study received ethics approval.

Measures

Our survey included four sections: (i) self-reported health status and laboratory testing needs; (ii) experience receiving the most recent lab test result; (iii) perception of online access to laboratory results (service users group only); and (iv) socio-demographic characteristics and access to online consumer health solutions. Two questions were asked regarding respondents' comprehension of lab test results: (1) "Was it clear if you needed to follow-up with your doctor? (Yes/No)"; and (2) "How confident are you that you fully understood your lab results?" on a scale of 1 to 10 (where 1=Not at all confident and 10=Extremely confident).

The Global Anxiety-Visual Analog Scale (GA-VAS; where "0" means "not at all anxious" and "100" means "extremely anxious") was used because it has been reported to be useful and valid in assessing anxiety as a single construct (with many perceptible gradations) and as a measure of anxiety at a specific point in time, such as pre-operative anxiety [10].

Analysis

Analyses were conducted using version 18.0 of Statistical Package for the Social Sciences (SPSS). Preliminary analysis of our sample showed that the service users group had significantly more abnormal test results than the comparison group (35% vs. 16%). Since this variable was seen as key to patients' overall experience, we weighted the sample on this variable in order to adjust for its effect (see Appendix B). Independent Student`s t-tests for means or proportions of responses were used to assess differences between the two cohorts on socio-demographics, comprehension and anxiety. For categorical responses, Independent Student`s t-tests were used for inference instead of distributional tests such as Chi-square tests in order to be able to detect any substantial differences across the specific response items. In addition, logistic regression techniques were used to examine the association between socio-demographic variables and comprehension.

It should be noted that missing responses were excluded from analyses. Also, in each table, *n* is calculated based on the actual number of respondents in the sample, while proportions are estimated with analytical weight. Statistical significance levels are indicated as * $p < 0.1$, ** $p < 0.05$, *** $p < 0.001$.

Results

Sample Profile

Although the two cohorts were balanced in terms of age and gender, there were some statistically significant differences in other socio-demographic characteristics and health status (see Table 1). For example, the service users group included fewer participants who were born in Canada and who spoke English at home, more participants with university education, more urban participants, and more who made over $100,000 in annual income. In terms of health status, participants from the service users group reported being in slightly poorer health than the comparison group and having undergone more medical lab tests (3 or more times) in the last 12 months.

Our overall sample included a high proportion of participants over the age of 55 who had a chronic illness and who were therefore more likely to require health care services. Women also outnumbered men, consistent with existing literature which has found that more women subscribe to health portals than men [11,12].

Outcome analyses were conducted on sub-samples of the service users and comparison groups who knew the results of their most recent lab test at the time of the survey (91.0% and 73.5% respectively) and using the weighting procedures describe in Appendix B.

Table 1 Characteristics of survey participants

	Service Users Group		**Comparison Group**		***P***
	n=2047	%	n=1245	%	
Gender					
Male	770	38%	474	38%	
Female	1252	62%	767	62%	
Age group					
18-34 yrs old	193	10%	115	9%	
35-54	566	29%	347	28%	
55+	1220	61%	765	62%	
Immigration status and language spoken at home					
Born in Canada: yes	1429	70%	1043	84%	***
Language speak at home: English	1938	95%	1231	99%	***
Income					
<$50K	545	34%	429	43%	***
$50K-<$100k	626	39%	369	37%	
$100K plus	449	27%	207	20%	***
Education					
High school or under	164	8%	155	13%	***
Some/Completed college	708	35%	515	42%	***
Some University +	1134	57%	547	45%	***
Region					
Greater Vancouver	1107	55%	355	29%	***
Vancouver Island	442	22%	287	23%	
BC Southern Interior	340	17%	446	36%	***

	Service Users Group		Comparison Group		*P*
	n=2047	%	n=1245	%	
BC Northern Interior	23	1%	66	5%	***
Overall health (last 12 months)					
Excellent/Very Good	868	43%	552	44%	
Good	710	35%	445	36%	
Fair/Poor	465	23%	246	20%	**
Has a chronic health condition					
Yes	1213	60%	727	59%	
Number of medical lab tests conducted (past 12 months)					
Six or more times	450	22%	148	12%	***
Three to five times	834	41%	412	33%	***
Two times	440	21%	363	29%	***
Once	323	16%	322	26%	***

Wait time to receive results

As expected, the wait time to receive lab test results was considerably shorter for the service users group, 88% of whom first learned the result of their most recent lab test online. The majority of service users (84.0%, 95% CI 82.3% – 85.7%) said they waited only “a few days” following their lab test before receiving their results, compared to just over a third of the comparison group (37.8% 95% CI 35.0% – 40.7%). Table 2 presents more information about the wait time to receive lab test results.

Table 2 Wait time to receive lab results

		Service Users Group (n=1818)	Comparison Group (n=1087)
Received the results within a few days	n	1527	411
	%	84.0 ***	37.8
	95 % C.I.	(82.3 – 85.7)	(35.0 – 40.7)
Received the results in about a week	n	209	335
	%	11.5	30.9***
	95 % C.I.	(10.0 – 13.0)	(28.1 – 33.6)
Received the results in 1 to 2 weeks	n	56	221
	%	3.1	20.3***
	95 % C.I.	(2.3 – 3.9)	(17.9 – 22.7)
Received the results between 2 and 4 weeks	n	16	85
	%	0.8	7.8***
	95 % C.I.	(0.5 – 1.3)	(6.2 – 9.4)

More than 4 weeks	n % 95 % C.I.	10 0.6 0.2 – 0.9	35 3.2*** (2.1 – 4.2)

Comprehension of lab test results

. All those who knew their most recent test results (n=2990) were asked about their confidence in fully understanding the results, as measured by a score of 7 or higher on a scale of 1 to 10. The majority of both service users and the comparison group were clear they understood if follow-up was needed and confident they understood the test results themselves, but the percentage was lower for service users (see Table 3).

Table 3 Comprehension of lab results

All who received results		Service Users Group (n=1,852)	Comparison Group (n=1,119)
How confident are you that you fully understood your lab results (score = 7-10)?	n	1,399	948
	%	75.5	84.7***
	95% C.I.	(73.6 – 77.5)	(82.6 – 86.8)

To further explore what might influence patients' comprehension of their lab results, we conducted a logistic regression using socio-demographic and health service-related variables and adjusted the results for receipt of abnormal lab test results. The variable "first learned the result online" was used this time to assess how comprehension was influenced by the service itself and not simply by being a subscriber to the service. As expected, first learning test results online was a significant *negative* predictor of comprehension, as were younger ages and lower levels of education (see Table 4).

Table 4 Very confident in fully understanding lab results (logistic regression) (n=2796)

		95% CI for exp *b*		
	B (SE)	Lower	exp *b*	Upper
Gender				
Female	- 0.16 (0.10)	0.70	0.85	1.04
Male (ref)	-	-	-	-
Education				
High school or under	- 0.72 (0.15)***	0.36	0.49	0.66
Some/Completed college	0.24 (0.10)**	0.65	0.79	0.97
Some University and + (ref)	-	-	-	-
Age				
18-34	-0.48 (0.16)***	0.45	0.49	0.85
35-54	-0.27 (0.11)***	0.62	0.77	0.95
55 and + (ref)	-			
First learned the result online				
Yes	-0.57 (0.10)***	0.47	0.57	0.69
No (ref)	-	-	-	-
Having a chronic condition				
Yes	-0.20 (0.10)*	0.68	0.82	1.00
No (ref)	-	-	-	-
Number of lab tests conducted (past 12 months)				
Six or more times	0.20 (0.13)	0.95	1.22	1.57
Five or less (ref)	-	-	-	-
Constant	2.15 (0.13)***		8.58	

n=194 excluded cases from analysis

% correct predicted values: 79.2%.

Anxiety

We also conducted between-group analyses on respondents' reported level of anxiety *after* receiving their lab test results. Since the distribution of GA-VAS scores was positively skewed, we divided these into three categories: no reported anxiety (0), "low" anxiety (1-49) and "some" anxiety (50-100). To isolate the influence of online access, we omitted from the analysis service users who had received the results of their most recent test in-person from their doctor or usual place of care.

We found no significant differences between service users and the comparison group in their level of anxiety following receipt of test results; as always, we adjusted for the effect of having a test result out of the normal range. As seen in Table 5, the majority of patients in both cohorts reported low or no anxiety after receiving test results. Table 5 also shows the results of analysis with a sub-group of participants in both cohorts that had a chronic health condition. Here, differences between the two cohorts emerged, such that service users reported being significantly less likely to be anxious at both ends of the scale (none and some).

Table 5 Anxiety after receiving lab test results

		All		Sub-group with chronic condition	
		Sub sample of service users who first learned results online (n=1,478)	Sub sample comparison group who learned otherwise (n=1,312)	Sub sample of service users who first learned results online (n=881)	Sub sample comparison group who learned otherwise (n=779)
No anxiety (0)	n	540	447	310	239
	%	36.5	34.1	35.2**	30.6
	95% C.I.	(34.1 – 39.0)	(31.5 – 36.6)	(32.0 – 38.3)	(27.4 – 33.9)
Low anxiety (1-49)	n	734	670	453	401
	%	49.7	51.1	51.4	51.5
	95% C.I.	(47.1 – 52.2)	(48.4 – 53.8)	(48.1 – 54.7)	(48.0 – 55.0)
Some anxiety (50-100)	n	204	195	118	139
	%	13.8	14.9	13.4	17.9**
	95% C.I.	(12.0 – 15.6)	(12.9 – 16.8)	(11.1 – 15.6)	(15.2 – 20.6)

We also explored the link between anxiety and comprehension among service users specifically, to determine if individuals who first learned their results online AND who reported lower levels of comprehension also reported more anxiety. To measure comprehension in relation to anxiety, respondents were asked how clear it was if they needed to follow-up with their healthcare provider. As expected, service users who first learned the results of their most recent lab test online and who indicated they felt confident they understood their results were almost three times as likely to report no anxiety (43.5%, 95% CI 40.5-46.4) as those who reported less confidence in their comprehension (15.2%, 95% CI 11.5-18.1). The same pattern held at the other end of the anxiety spectrum. Similarly, Table 6 shows that participants who were not clear on the need for follow-up were more likely to report being anxious.

Table 6 Anxiety-level after receiving lab test results according to comprehension

		Service users who first learned results online (n=1,412)	
		Clear if you need to follow-up? Yes (n=1107)	Clear if you need to follow-up? No (n=305)
No anxiety (0)	n	424	91
	%	38.3***	29.8
	95% C.I.	(35.4 – 41.2)	(24.7 – 34.9)
Low (1-49)	n	551	153
	%	49.8	50.2
	95% C.I.	(46.9 – 52.8)	(44.6 – 55.8)
Some (50-100)	n	132	61
	%	11.9	20.0***
	95% C.I.	(10.0 – 13.8)	(15.5– 24.5)

Interpretation

Our findings suggest that patient experience overall can be improved by the availability of online lab results, but with important caveats. Service users were more likely to report a shorter wait for test results, and also reported high levels of satisfaction with the online service. There was no overall difference in post-result anxiety levels between those who saw results online and those who received results in other ways (e.g., by mail or telephone), although among the subset of patients with chronic conditions, service users were less likely to report anxiety. However, service users were *more* likely to report lower comprehension of lab test results than the comparison group, and there was a significant correlation between anxiety and lower comprehension. This is not surprising, given that the format of lab results provided by the online platform is the same as that provided to ordering clinicians, with no additional contextual or explanatory information for patients.

Our study results support Pyper et al.'s (2004) call for more information and tools to help patients understand and interpret their health information [5]. A range of tools has been suggested in the literature, including a glossary, integration with other health records, and patient education/information support.

Limitations

Although our comparison sample was recruited from a general population panel, differences between the service users group and the comparison group - including the rate of abnormal test results - somewhat limits the study's external validity. The service user group also had a lower response rate at 18%, which may indicate possible response bias. Both cohorts were recruited online, so our findings may not apply to the rapidly diminishing proportion of the population that does not have Internet access and a degree of digital literacy.

We also do not know much about the sequence and timing involved in obtaining test results by different means, and follow-up information and support. For example, we could not differentiate between tests conducted for diagnostic purposes versus monitoring a previously-known health condition. Additional clinical information would have provided a more focused interpretation of results about the patient experience. While we deliberately focused many of our survey questions on the most recent test to enhance precision of responses (i.e., content validity) and their reliability, patients' most recent test may not reflect their typical experience with lab tests or with direct lab access in general. Moreover, we did not focus our study on the experiences of patients with abnormal test results, possibly diluting any negative effects of online access on anxiety and comprehension, if they exist.

Finally, while we balanced our two cohorts as closely as possible and weighted the comparison cohort to take into account the type of test result received (i.e., in the normal range or not), the quasi-experimental design of our study limits our ability to attribute observed differences to the intervention with the same degree of confidence as with random assignment to treatment, had that been possible.

Conclusions

Laboratory tests are among the most common interventions in modern health systems, and effective communication of test results and required follow-up is a priority for research. As jurisdictions around the world move toward widespread adoption of digital health technologies for patients, better understanding is needed of the effects of such services on both patients and health care practice. This study explored these issues in relation to one such technology – direct patient access to online lab test results – currently in use in British Columbia, Canada. While exploratory, our study supports the emerging literature suggesting that personal health records are positively received by patients [13,14]. It also supports a recent systematic review which found that access to health records reduced or had no effect on anxiety [15]; in our case, we found no differences between service users and a comparison group in reported anxiety after receiving test results, although we did find that this differed by level of comprehension. While this study contributes to understanding the extent and nature of benefits and risks associated with direct lab access, important questions remain for future research about the mechanisms by which these benefits are achieved; how such benefits can be optimized in different healthcare contexts and for different groups of the population; and the specific experiences of patients who receive abnormal test results.

Conflicts of Interest

None declared.

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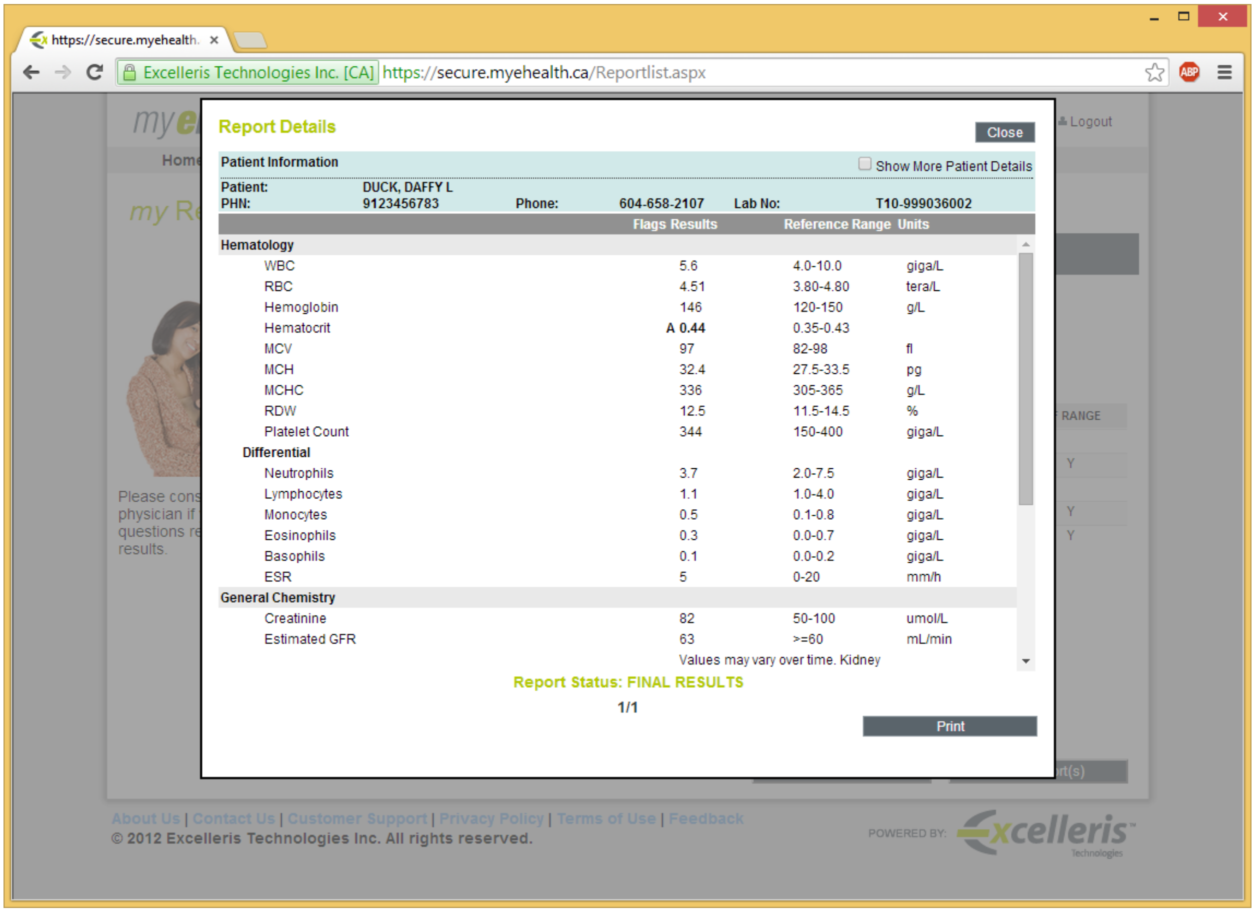
Appendix A – Screen Capture of a Sample Lab Report



Report Details

Patient Information ☐ Show More Patient Details

Patient: DUCK, DAFFY L
PHN: 9123456783 **Phone:** 604-658-2107 **Lab No:** T10-999036002

	Flags	Results	Reference Range	Units
Hematology				
WBC		5.6	4.0-10.0	giga/L
RBC		4.51	3.80-4.80	tera/L
Hemoglobin		146	120-150	g/L
Hematocrit	**A**	**0.44**	0.35-0.43	
MCV		97	82-98	fl
MCH		32.4	27.5-33.5	pg
MCHC		336	305-365	g/L
RDW		12.5	11.5-14.5	%
Platelet Count		344	150-400	giga/L
Differential				
Neutrophils		3.7	2.0-7.5	giga/L
Lymphocytes		1.1	1.0-4.0	giga/L
Monocytes		0.5	0.1-0.8	giga/L
Eosinophils		0.3	0.0-0.7	giga/L
Basophils		0.1	0.0-0.2	giga/L
ESR		5	0-20	mm/h
General Chemistry				
Creatinine		82	50-100	umol/L
Estimated GFR		63	>=60	mL/min
		Values may vary over time. Kidney		

Report Status: FINAL RESULTS

1/1

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Appendix B – Note on the weight construction

Question 9 asked whether the respondent knew their most recent lab test, and if the response was "yes", the respondent would be followed up with Question 17 asking whether the recent test result was considered within the normal range.

The distribution of answers are presented in Table B1. Without any adjustment or analytical weight, 57.3% and 30.9% of the service users group sample reported that their recent lab test result was within and out of the normal range, respectively. Among the comparison group sample, 60.5% and 11.6% of respondent reported that their recent lab test result was within and out of the normal range, respectively (Table B2).

In order to balance these differences in the responses to Questions 9 and 17, analytical weighting was created (Table B3) and applied to the outcome analysis. The weighted distribution of responses to Questions 9 and 17 among the comparison group match exactly that of the service users group. In other words, after applying the analytical weight, the two samples were completely balanced regarding the composition of receiving lab test within and out of the normal range.

Table B1 Frequencies of individuals (per cohort) who know the results of their most recent test and had an abnormal result

	Service Users Group	Comparison Group
Q9: Do you know the result of your most recent lab test?		
Missing	3	4
No	182	326
Yes	1862	915
Q17: Was your most recent test considered within the normal range?		
Missing	56	18
Yes	1173	753
No	633	144

Table B2 Proportion in each group in each cohort who received an abnormal result

	Service Users Group	Comparison Group
Q9 = missing or Q17 missing	t1 = 3+56/2047 = 0.0288	a1 = 4+18/1245 = 0.0177
Q9 = No	t2 = 182/2047 = 0.0889	a2 = 326/1245 = 0.2618
Q9 = Yes & Q17 = Yes	t3 = 1173/2047 = 0.573	a3 = 753/1245 = 0.6048
Q9 = Yes & Q17 = No	t4 = 633/2047 = 0.3092	a4 = 144/1245 = 0.1157

Table B3 Weight calculation in each cohort

	Service Users	Comparison
Q9 = missing or Q17 missing	w = 1	w = 0.0288/0.0177 = 1.631
Q9 = No	w = 1	w = 0.0889/0.2618 = 0.3396

Q9 = Yes & Q17 = Yes	w = 1	w = 0.573/0.6048 = 0.9475
Q9 = Yes & Q17 = No	w = 1	w = 0.3092/0.1157 = 2.6736