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Use of a primary care online consultation system: evaluation of a pilot

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-016901
Article Type:	Research
Date Submitted by the Author:	17-Mar-2017
Complete List of Authors:	Edwards, Hannah; University of Bristol, School of Social and Community Medicine; NIHR CLAHRC West, Marques, Elsa; University of Bristol, School of Clinical Sciences Hollingworth, William; University of Bristol, Social and Community Medicine Horwood, Jeremy; University of Bristol, Centre for Academic Primary Care, School of Social & Community Medicine; NIHR CLAHRC West Bernard, Elly; One Care Consortium Salisbury, Chris; University of Bristol, Centre for Academic Primary Care, School of Social and Community Medicine Northstone, Kate; University of Bristol, School of Social and Community Medicine; NIHR CLAHRC West,
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Communication, Evidence based practice
Keywords:	PRIMARY CARE, general practice, online consultations, evaluation

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Use of a primary care online consultation system: evaluation of a pilot

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Word count: 3,997

Number of tables: 4

Number of figures: 2

Number of supplementary files: 1

Keywords: general practice, primary care, online consultations, e-consultations, evaluation

Abstract

Objectives: Evaluation of a pilot study of an online consultation system in primary care. We describe who used the system, when, why, and the NHS costs associated with its use.

Design: 14-month observational study.

Setting: Primary Care practices in South West England.

Results: 36 General Practices covering 396,828 patients took part in the pilot. The online consultation website was viewed 35,981 times over the pilot period (mean 9.11 visits per 1000 patients per month). 7,472 went on to complete an 'e-consultation' (mean 2.00 online consultations per 1000 patients per month). E-consultations were mainly performed on weekdays (Monday to Wednesday most popular) and during normal working hours. Women were more likely to use e-consultations than men (64.7% versus 35.3%) with a median age of 39 years (IQR 30-50). The most common reason for an e-consultation was an administrative request (e.g. test results, letters, fit notes, repeat prescriptions (22.5%)), followed by infections/immunological (14.4%) and musculoskeletal issues (12.4%). The majority of patients (65.2%) received a response within two days. The most common outcome was a face-to-face (38%) or telephone consultation (32%). Face-to-face consultations were more often needed for patients consulting about new conditions (OR 1.56, 95%CI 1.05, 2.27, $p=0.049$). The average cost of a practice's response to an e-consultation was £36.28, primarily in triage time, and the resulting face-to-face/telephone consultations needed.

Conclusions: Use of e-consultations is very low, particularly at weekends. Unless this can be improved, any impact on staff workload and patient waiting times is likely to be negligible. It is possible that use of e-consultations actually increases primary care workload and costs. Online consultation systems could be developed to improve efficiency both for staff and patients. These findings have implications for software developers as well as primary care services and policymakers who are considering investing in online consultation systems.

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Article summary:

Strengths and Limitations of this Study

- Largest UK study to date examining use of a primary care online consultation system.
- Benefits from a number of quantitative data sources (website usage statistics, subset of electronic patient records, public data on General Practices).
- We were unable to collect data on a control group and were therefore limited to a descriptive evaluation.

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BACKGROUND

There is an increasing demand for UK primary care services, with workload increasing by 16% between 2007 and 2014 (1). General practices have struggled to meet this challenge, particularly in the context of a declining workforce (2, 3) and difficulties accessing services have become a key source of patient dissatisfaction (4) and practitioner stress (5).

In response to this, the NHS England report 'General Practice Forward View' promotes greater use of technology by General Practices, for example via online consultation systems, as a potential way to meet demand (6). The Department of Health have said that by 2020 they will establish seven-day access to primary care, with the view that broadening access options may help meet demand (7). The Prime Minister's Challenge Fund (now called the GP Access Fund) was set up in 2013 to "improve access to general practice and stimulate innovative ways of providing primary care services" (8). In 2017 NHS England is increasing Clinical Commissioning Groups (CCGs) budgets, specifically for the provision of general practice IT/technology services, and making available an additional £45 million over three years to support the uptake of online consultations (9).

Communications and online technology (such as email, video, and online consultations) are currently being investigated as a way to improve patient access and make more efficient use of practitioners' time. So far the evidence about use and effectiveness is limited (10-19). Evaluation of online consultation systems is crucial before nationwide encouragement or roll-out of such systems. Practices will incur costs when introducing new systems (software fees, licences, staff time to learn and integrate the new system into their practice) so need information on acceptability, effectiveness and cost-effectiveness in order to make informed decisions about whether to invest in them. In the UK at least, the current policy could also have implications for the taxpayer, and in the context of other expensive, failed IT programmes in UK healthcare such as the partially developed and abandoned system of national electronic medical records (20, 21), early evaluation of other technological systems is important before they are implemented on a broad scale.

We performed a mixed-methods observational evaluation of a trial of an online consultation system, including quantitative, qualitative, and health economic analyses. Here we report on the quantitative and health economic findings. Qualitative findings will be reported separately.

METHODS

The pilot

In 2014 the GP Access Fund supported a consortium of general practices in South West England (22) to pilot an online consultation system called 'eConsult' (previously called WebGP) (23). eConsult (hereafter referred to as 'the system') is an online platform that allows adult patients to contact their GP, access self-help information, or learn more about NHS 111 and local pharmacy services via their general practices' website (24). To contact their GP a patient completes an online form describing the

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3 nature of their problem (hereafter referred to as an 'e-consultation'). This is submitted to their practice,
4 who commit to responding by the end of the next working day.
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7 **Data and data sources**

8 Three data sources were used in this evaluation:
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- 10 1. Routinely available data from Public Health England about general practices across England (25).
11 The National General Practice Profiles provide data on each general practice with a patient list size of
12 at least 900 included in the 2014/15 Quality and Outcomes Framework (QOF). Available data
13 includes local demography, QOF scores and GP patient satisfaction survey results.
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- 15 2. Website analytics data provided by the software developers. This was summary data on use of the
16 website by each participating practice from April 2015 until June 2016. This included data on number
17 of page landings, number of unique users, number of e-consultations, the days and times e-
18 consultations were performed, and the number of uses of the additional services (self-help, pharmacy
19 locator, NHS 111 signposting).
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- 21 3. A random sample of patients who used an e-consultation were identified in eight of the participating
22 practices and data were abstracted from their electronic patient records (485 e-consultations). Data
23 were collected on patient demographics; reason for contact; nurse and doctor's time and actions
24 taken in response to the e-consultation (e.g. telephone call, face-to-face appointment, request for
25 tests, email advice); any further care provided by the practice in the 30 days following the e-
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31 **Data analysis**

32 To examine the generalisability and potential selection bias in our results, we compared practices
33 participating in the pilot to those in the rest of England. Descriptive statistics (means and standard
34 deviations or absolute numbers and percentages) were used to show the number of patients using
35 the system over time, the most popular days of the week and times of day (from both the website
36 statistics and patient-level data), demographic characteristics of users, reasons for consulting, actions
37 taken in response to e-consultations, response times, and durations of subsequent consultations
38 (from patient-level data). Reasons for consulting were categorised from a free-text field in the e-
39 consultation into 11 broad categories: musculoskeletal, infection/immunological, neurological,
40 sexual/reproductive health, dermatological, respiratory, mental health, digestive, medication queries
41 or advice, administrative (requests for fit notes, repeat prescriptions, test results, referrals, and
42 requests to book appointments), and unclear/not stated. The reason for an e-consultation was also
43 cross-tabulated with the primary action taken to identify any patterns in types of response required.
44 Where appropriate, statistical differences were assessed using chi-squared tests. In addition, odds
45 ratios (ORs) with 95% confidence intervals (CIs) and p-values were calculated.
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53 Doctor and nurse time required to take the actions in response to an e-consultation, and any
54 subsequent contacts within 30 days, were collected from the individual patient data in the eight
55 participating practices described in data source 3 above. Triage time of five minutes per e-
56 consultation was assumed based on responses in our companion qualitative study. Staff time was
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3 valued using 2015 unit costs for health and social care (26) to derive the cost of e-consultations. This
4 micro-costed estimate was compared with national published average costs for GP and nurse contact
5 durations (26) (Supplementary Table 1)
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10 **RESULTS**

11 **Study sample**

12 36/102 (35%) self-selected general practices within the study area took part in the pilot, covering a
13 total patient population of 396,828. These 36 practices were broadly comparable to practices in the
14 rest of England (Table 1). The following differences were evident: participating practices tended to
15 have larger average patient list sizes (11,023 vs 7,321) and there were several markers of higher
16 socio-economic ratings in patients in participating practices compared to patients in the rest of
17 England (more in full time work/education (66.5% vs 60.8%), fewer with long-standing health
18 conditions or caring responsibilities (50.6% vs 54.0% and 15.7% vs 18.1% respectively), and
19 fractionally higher life expectancy (84.0 vs 82.9 years)). Study practices also tended to have slightly
20 higher nurse and administrative staff support compared to the average practice in England.
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26 **Extent of interest in the system**

27 There was a small amount of patient curiosity about the system, with a mean of 9.11 unique visits to
28 the system website per 1000 patients per month (average minimum across practices: 1.41, average
29 maximum across practices: 29.12 per 1000 patients per month). This included any time that someone
30 looked at the website ('page landings'), whether or not they went on to do an e-consultation or use the
31 other services. The majority (71.1%) made no return visit to the website. Patients rarely clicked
32 through to other information pages (the self-help link was viewed 3,348 times, the pharmacy link
33 1,744 times, and the NHS 111 link 1,527 times throughout the entire pilot, compared to 35,981 visits
34 overall).
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40 **Extent of use of e-consultations**

41 Website analytics data showed that the use of actual e-consultations was very low. Over the 36
42 participating practices, there was a mean of 2.00 e-consultations per 1000 patients per month
43 (minimum 0.33, maximum 5.70 per 1000 patients per month). As the mean number of patients per
44 practice was 11,023, this means that on average a practice might receive 18 e-consultations per
45 month. To put these figures into context, the most recent data on consultation rates in UK General
46 Practice indicates that on average there were 5.16 standard consultations per patient per annum (1),
47 equating to 4,740 consultations per month in a practice with 11,023 patients. This means that e-
48 consultations represent on average 0.002% of all consultations. There was a trend towards a gradual
49 increase in use over the pilot period, although the last three months of the pilot saw a slight decrease
50 in use. (Figures 1a and 1b)
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56 **Times of use**

Both website analytics and patient-level data showed that patients were much more likely to use the system at the start of the week and during typical (UK) surgery opening hours. 58.8% of all e-consultations took place Monday to Wednesday, with use declining towards the end of the week: only 12.4% were completed at the weekend. 69.9% occurred between 7am and 5pm, with peaks seen around 10am and 2pm. There was some interest in evening use, although this was much lower than daytime use (19.4% between 7pm and midnight, with a peak around 8pm). (Figures 1a and 1b, Table 2) There were no differences in characteristics of daytime compared to evening users ($p=0.715$ for age, $p=0.140$ for gender, $p=0.548$ for pre-existing health conditions, $p>0.08$ for all categories of reason for e-consultation).

User characteristics

Women were almost twice as likely to perform an e-consultation as men (64.7% versus 35.3%) and over half of all users were age 25-44 years (median age 39, IQR 30-50). After the age of 45, use declined with age, although young adults (age 18-24) also accounted for only a small proportion of total usage (8.7%). The oldest patient using the system was 90. (Table 2) There was no evidence that patient socioeconomic factors affected rates of use ($p=0.755$ for rates of use by IMD quartile, $p=0.276$ for employment status and $p=0.696$ for chronic health condition status).

Reasons for use

Over a fifth of all e-consultations were for administrative reasons. The next most common reasons for an e-consultation were related to infections/immunological issues (14.4%) and musculoskeletal issues, such as back or knee pain (12.4%). In almost a third of cases patients had consulted about the same issue within the previous six months, suggesting it was an ongoing health problem. (Table 3)

Practice response to e-consultations

Practices had committed to responding by the end of the next working day after submission of an e-consultation. The median time to response was 1 day (IQR 1-3 days) and the maximum was 20 days, although response time of over a week was uncommon. (Table 3) E-consultations submitted on a Friday or Saturday predictably had a longer median time to response (3 days) compared to other days as currently in the UK, GPs do not typically work on Saturdays or Sundays.

The most common *primary* response (defined as the most resource-intensive action) to an e-consultation was to arrange a face-to-face (38.1%) or telephone consultation (32.2%) with the patient. Other actions taken by the practice included issuing a prescription or fit note, requesting tests, and giving advice. In about two-thirds of cases a *secondary* (less resource-intensive) action was also taken, most commonly issuing a prescription or providing advice. (Table 3)

'Administrative' e-consultations were mainly dealt with via a telephone consultation (73.7%). About half of all clinical (not administrative) e-consultations resulted in a face-to-face consultation (range:

39% for sexual health, to 54% for neurological issues) and approximately a further third resulted in a telephone consultation (range: 21% for dermatological, to 42% for infection/immunological issues).

After the initial response, about a quarter of patients (25.8%) had a *further* consultation in the 30 days following their e-consultation. 19.5% of these were face-to-face, and 5.6% by telephone. (Table 3) Over half of the face-to-face consultations (57.5%) were with a GP, 17.0% with a practice nurse, and 25.5% with another health professional (e.g. health care assistant, practice pharmacist, phlebotomist). Almost all further telephone consultations (92.6%) were with a GP. Data on which health professionals had contact with the patients was only collected for follow-up actions, and not for the primary response (described in the preceding paragraph), but we could speculate that the distribution of staff resources there would be similar.

A face-to-face consultation was more likely to be needed for patients with a new, compared to a pre-existing condition (OR 1.56, 95% CI 1.05, 2.27, $p=0.049$, adjusted for age and gender). They were even more likely to be needed for patients who had not seen their GP about the problem in the preceding 30 days (OR 1.89, 95% CI 1.23, 2.86, $p=0.005$).

Cost of e-consultations

The average duration of a face-to-face appointment in response to an e-consultation was 14.5 minutes, and 7.6 minutes for a telephone consultation. In context, the most recently estimated national averages in 2013-14 are 9.2 minutes (95% CI 9.22–9.23) for face-to-face appointments and 5.4 minutes (95% CI 5.3–5.4) for telephone consultations (1). The average cost for the initial practice response to an e-consultation was £36.28. In context, the national estimates of cost for a standard GP face-to-face consultation is £33.00 (see supplementary table 1). The cost was driven mainly by the time needed for a GP to triage the e-consultations, and the relatively high proportion of e-consultations that resulted in a face-to-face or telephone consultation with a GP. (Table 4) When considering further follow-up actions taken in the subsequent 30 days, the average cost associated with an e-consultation increased to £45.39.

DISCUSSION

Principal findings

We report on a 14-month pilot trial of an online consultation system in primary care. Principal findings were that use of the system was very low, it was used more commonly by women than men, and used most often by working-age adults on weekdays, during typical UK surgery hours. The most common reason for an e-consultation was for an administrative request, e.g. fit notes, repeat prescriptions, and test results. The average time taken for a practice to respond to an e-consultation was one day, and about three-quarters of all e-consultations resulted in the patient being asked to arrange a face-to-face or telephone consultation. Patients reporting new conditions were more likely

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3 to require a face-to-face consultation than patients reporting on a pre-existing condition. The average
4 cost to a General Practice to respond to an e-consultation was £36.28.
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7 **Comparison with other studies**

8 Our findings on the types of patients using the system, and the most popular days and times of use
9 are consistent with findings from an earlier, smaller pilot study carried out by the software developers
10 (27) and from a second small study from the USA (28). A survey across 14 European countries found
11 that men were the highest users of email to communicate with their healthcare providers (15) where
12 we found women used online consultations more. This discrepancy could be due to the difference in
13 formats of email versus a structured online form. In regards to reasons for consulting, the earlier pilot
14 by the software developers (27) found that mental and sexual health were two of the most common
15 reasons for an e-consultation, whereas these were much less commonly cited in our study (5.9% and
16 8.5% respectively). More in line with our findings were the results of two randomised controlled trials
17 of email systems / web-based online communication systems in primary care, where patients and
18 clinicians felt that for mental and sexual health issues, online/email communication would not be their
19 preference or was less appropriate (29, 30). Research in North America has found that both patients
20 (10) and clinicians (31) feel email communication is particularly appropriate for administrative
21 requests, which fits with our observation that administrative requests were the most common reason
22 to use an e-consultation.
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30 **Possible explanations and implications**

31 The very low use of e-consultations has several possible explanations. One is that few patients knew
32 about the system, although all practices stated they were advertising the system in various ways
33 (banners in the practice, on their websites and answerphones, via texts to patients). Another
34 explanation is that there is currently low demand for online consultations, or at least in the format of
35 the system trialled here. Two key implications of this low usage: 1. Impact: part of the rationale for
36 online consultations is that they may reduce staff workload and speed up patient access. However if,
37 as estimated here, e-consultations make up on average only a tiny proportion of all consultations
38 (0.002%), the impact of introducing the system (without significantly increasing use) would be
39 negligible. It is also not clear that use of the system would reduce, rather than increase staff workload
40 (additional triage time, and potentially longer resulting consultations). 2. Cost: for commercial online
41 consultation systems operating on a per-patient cost model, much higher rates of use are likely to be
42 necessary to make such systems cost-effective for practices. The systems are also expensive in
43 terms of the work involved in using them, and potential duplication of effort where they lead to a
44 standard consultation anyway. Further research is needed to improve understanding of why use of e-
45 consultations is so low, and what could be done to increase usage. Another issue for future research
46 is that very low usage suggests that those who do use it may be atypical of primary care users. This
47 possibility is supported by the observation that patterns in the age and gender profile of UK general
48 practice users as reported in Hobbs et al. (1) differs from the age and gender profile of e-consultation
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3 users as found here. It would be useful to elucidate more about the characteristics of those who
4 choose to use e-consultations.
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7 The low use of the system at weekends could simply reflect the fact that habits take time to change,
8 and we are not yet used to the concept of being able to contact GPs at weekends. However it might
9 also indicate low demand for seven-day access to primary care services. The General Practice
10 Patient Survey (covering >880,000 patients in England) found that over 80% did not think they
11 needed weekend (particularly Sunday) opening hours (32). Consistently with this, an evaluation of
12 seven-day access pilots found very low demand for weekend appointments (only 12% of all Sunday
13 appointments filled) (33), and some pilots have been discontinued due to lack of demand (34). Further
14 follow-up, and interviews with patients about their appetite for seven-day access is important to help
15 understand this finding, particularly where policymakers are committing to rolling-out seven-day
16 access to primary care services (35).
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22 It might be anticipated that having submitted a prior e-consultation, a follow-up face-to-face
23 appointment about that issue would be shorter than at a standard consultation where the GP has no
24 prior information about the issue. However, follow-up face-to-face appointments resulting from an e-
25 consultation tended to be longer than the national averages (14.5 minutes compared to 9.2 minutes
26 for face-to-face appointments, and 7.6 minutes compared to 5.4 minutes for telephone consultations)
27 (1). As this was not a controlled study we were unable to directly compare consulting times with and
28 without e-consultations, so this observation should be interpreted as suggestive only. The observation
29 does however fit with the findings of a trial of pre-consultation telephone triage in UK General
30 Practices, where the prior telephone information from the patient made no difference to the duration of
31 resulting face-to-face consultations (36). The implication is that collecting information in an e-
32 consultation may not make subsequent consultations shorter, and it is possible that it increases,
33 rather than reduces, clinical workload. This is particularly important if part of the rationale for such
34 systems is to reduce pressure on primary care staff. (We note that the software developers' own
35 earlier, smaller pilot study reported 10 minutes for follow-up face-to-face appointments, and 5 minutes
36 for follow-up telephone calls (27), which are closer to the national average. However it is not clear
37 how these estimates were arrived at.)
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46 Online consultation systems could be amended to improve efficiency. For example, as booking a
47 telephone consultation was the response to three-quarters of all queries regarding medications, it may
48 be more efficient if the online system initially asked if patients had a medication query, and
49 automatically directed them to book a telephone consultation if so. This would save time for clinicians
50 processing an unnecessary form, and would speed up access for patients who otherwise spend time
51 completing the full e-consultation, waiting for a response, and then needing wait for a telephone
52 consultation anyway. (We note that an "admin button" has now been added to the system to deal with
53 fit notes, test results, and repeat prescriptions.) A second example is that patients consulting about a
54 pre-existing condition were far less likely to need a face-to-face consultation than patients consulting
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3 about a new condition. This could be because when a GP is already familiar with the patient and their
4 condition, they may feel more confident proceeding without seeing the patient in person. This
5 suggests that online consultation systems could potentially be more useful for patients consulting
6 about a pre-existing condition. For new conditions that are likely to require a face-to-face appointment
7 anyway, using the online system may unnecessarily add to delays and clinical workload by
8 introducing another step in the process of getting an appointment.
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11 12 13 **Strengths and weaknesses**

14 The key strength of this study is that it is, to our knowledge, the largest evaluation to date of a primary
15 care online consultation system. A weakness is the observational nature of the study design that limits
16 us to a descriptive evaluation. For the economic analyses we did not have data on which member of
17 staff performed the triaging, as different practices processed their e-consultations in different ways. It
18 was also not possible to know how much staff processing time was needed, we therefore had to
19 assume triage times based on our qualitative findings (reported separately). It is therefore possible
20 that the e-consultation cost is lower or higher than the £36 we have calculated, if triage is performed
21 by lower-grade staff or if processing time was greater than average. Future studies would benefit from
22 quantifying this.
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29 **CONCLUSIONS**

30 Use of e-consultations was very low, particularly at weekends. Unless this can be improved, the
31 impact of e-consultation systems on reducing staff workload and improving waiting times is likely to be
32 negligible. It is also possible that use of e-consultations may be associated with increased costs and
33 workload in primary care. Patterns in use suggest ways that online consultation systems could be
34 developed to improve efficiency, such as channelling administrative requests separately, and
35 targeting the system specifically for patients who regularly see their GP for an ongoing condition.
36 Future research should look at reasons for low uptake of e-consultations, and to trial different
37 approaches to improving uptake. If future research demonstrated significantly higher usage, this
38 would pave the way for a feasibility study to more formally evaluate the effectiveness and cost-
39 effectiveness of e-consultations.
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TABLES

Table 1: Comparison of study practices with practices in the rest of England

Characteristics	Pilot Practices n=36	Rest of England n=7705	p-value*
Mean (sd) number of patients	11,023 (3522)	7,321 (4418)	<0.001
Mean (sd) % of patients aged:			
0-4	6.2 (2.0)	6.0 (1.7)	0.430
5-14	10.6 (3.1)	11.5 (2.6)	0.029
<18	20.3 (4.1)	20.9 (4.2)	0.385
65+	14.7 (6.2)	16.9 (6.7)	0.051
85+	2.1 (1.1)	2.2 (1.2)	0.597
% patients male	49.9 (1.8)	50.1 (2.4)	0.604
Mean (sd) IMD score (2015) ^a	22.1 (13.4)	23.7 (11.8)	0.422
Mean (sd) IDACI ^b	20.1 (9.6)	18.8 (11.2)	0.446
Mean (sd) IDAOP ^c	18.4 (9.1)	20.5 (10.3)	0.200
% Patients in paid work/Full time education	66.5 (10.4)	60.8 (8.7)	<0.001
% Patients unemployed	4.8 (4.0)	6.2 (5.1)	0.134
% Patients who would recommend practice (definitely/probably)	79.9 (8.1)	77.1 (12.7)	0.188
% Patients satisfied with phone access (very/fairly)	72.0 (15.6)	76.6 (17.4)	0.109
% Patients satisfied with opening hours (very/fairly)	77.0 (5.9)	75.7 (9.3)	0.385
% Patients saw/spoke to nurse/GP same/next day	43.4 (10.1)	48.8 (14.9)	0.031
% Patients reporting good overall experience of making an appointment (very/fairly)	71.9 (9.5)	75.1 (13.5)	0.152
% Patients who know how to make out of hours GP appointment	55.8 (9.7)	56.3 (10.9)	0.753
% Patients with long standing health condition	50.6 (8.2)	54.0 (8.0)	0.011
% Patients with caring responsibilities	15.7 (4.7)	18.1 (5.1)	0.006
Mean (sd) QoF points	96.9 (6.9)	94.8 (6.9)	0.074
Mean (sd) Life expectancy (years)	84.0 (1.5)	82.9 (1.9)	0.002
Mean (sd) GP FTE	5.7 (1.8)	4.6 (3.2)	0.026
Mean (sd) Nurse FTE	3.4 (1.5)	1.9 (1.6)	<0.001
Mean (sd) Admin FTE	11.2 (3.6)	8.1 (5.0)	<0.001

* X2 for categorical variables; t-test for continuous variables

a Index of Multiple Deprivation: The higher the score, the higher the level of deprivation

b Income deprivation affecting children index: The higher the score, the higher the level of deprivation

c Income deprivation affecting older people index: The higher the score, the higher the level of deprivation

Table 2: Use of e-consultations (from patient electronic medical records and e-consultation data)

User characteristics	% of individual e-consultations (n=485)
Users	
Unique users	71.1% (345)
Repeat users	28.8% (140)
Gender	
Male	35.3% (171)
Female	64.7% (315)
Age group	
18-24	8.7% (42)
25-44	53.4% (259)
45-64	29.1% (141)
65-74	6.2% (30)
75-84	2.1% (10)
85+	0.2% (1)
Day of week	
Monday	19.8% (96)
Tuesday	18.6% (90)
Wednesday	20.4% (99)
Thursday	17.3% (84)
Friday	11.6% (56)
Saturday	5.4% (26)
Sunday	7.0% (34)
Time of day	
00:00 – 06:59	4.1% (20)
07:00 – 09:59	16.9% (82)
10:00 – 12:59	25.8% (125)
13:00 – 16:59	27.2% (132)
17:00 – 18:59	6.6% (32)
19:00 – 23:59	19.4% (94)

Table 3. Reasons for e-consultations and practice responses

	% of e-consultations from total of n=485 (n)
Reason for consulting	
Musculoskeletal / limb pain	12.4% (60)
Infection/Immunological	14.4% (70)
Neurological	5.4% (26)
Sexual/Reproductive health	8.5% (41)
Dermatological	6.8% (33)
Respiratory	5.1% (25)
Mental health	5.9% (29)
Digestive	3.9% (19)
Medication query/advice	3.9% (19)
Administrative ^a	22.5% (109)
Other / Unclear	11.1% (54)
Did patient consult about the same issue in the last 6 months	
Yes	30.1% (146)
No	68.5% (332)
Response time	
Same day	20.21% (98)
1-2 days	44.95% (218)
3-6 days	19.18% (93)
7-13 days	7.6% (37)
>14 days (max 20 days)	4.7% (23)
Primary response action	
Admit to hospital	0
F2F consultation	38.1% (185)
Telephone consultation	32.1% (156)
Prescription	7.2% (35)
Fit note	3.1% (15)
Test/treatment	1.6% (8)
Refer routine	1.6% (8)
Refer urgent /2week wait	0
Advice	9.1% (44)
Other	3.3% (16)
Unknown	3.1% (15)
Secondary response action	
Admit to hospital	0
F2F consultation	0.2% (1)
Telephone consultation	2.5% (12)
Prescription	22.5% (109)
Fit note	2.7% (13)
Test/treatment	8.6% (42)
Refer routine	7.2% (35)
Refer urgent /2week wait	1.6% (8)
Advice	12.8% (62)
Other	10.7% (52)
Unknown	0.2% (1)
Follow-up consultations in the 30 day period after the initial action	
F2F	19.5% (94)
Telephone	5.6% (27)
Other	0.6% (3)
Unknown	0.2% (1)
Not applicable (i.e. no follow-up consultation)	74.2% (360)

Table 4. Average cost of all initial primary care actions in response to an e-consultation¹

All initial response actions	n	% all e-consultations (n=482)	Average cost per e-consultation
GP face to face appointments	186	39%	£12.73
GP telephone calls	187	39%	£7.76
Nurse face to face contacts ²	70	15%	£1.76
Nurse telephone appointments	0	0%	£0.00
Prescriptions	151	31%	£1.25
Fit notes	31	6%	£0.37
Routine referral letters	56	12%	£0.67
2 week wait referral letters	10	2%	£0.12
GP given advice by email	125	26%	£0.00
Other GP actions	108	22%	£0.00
Unknown GP actions	15	3%	£0.00
GP-led triage cost			£11.60
Average cost of e-consultation			£36.28

1. Staff time collected from individual patient data from eight practices participating in the audit. Triage time of five minutes per e-consultation was assumed based on responses in our companion qualitative study. Staff time valued using 2015 unit costs for health and social care (Curtis and Burns, PSSRU).

2. Includes treatment room and tests

ETHICAL APPROVAL

was obtained from the Health Research Authority [HRA] (IRAS project ID: 204925; Protocol number: 2604; Sponsor: University of Bristol).

FUNDING STATEMENTS AND ACKNOWLEDGEMENTS

This research is part-funded by the One Care Consortium and supported by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care West at University Hospitals Bristol NHS Foundation Trust. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. Authors thank staff from participating practices for assisting with the collection of individual-level data, and the software developers for providing web usage statistics.

COMPETING INTERESTS

EB is employed by One Care who part-funded the research. HE, MF, EM, KN and JH are employed by CLAHRC West who received part-funding from One Care.

DATA SHARING:

No further data is available.

AUTHORS' CONTRIBUTIONS

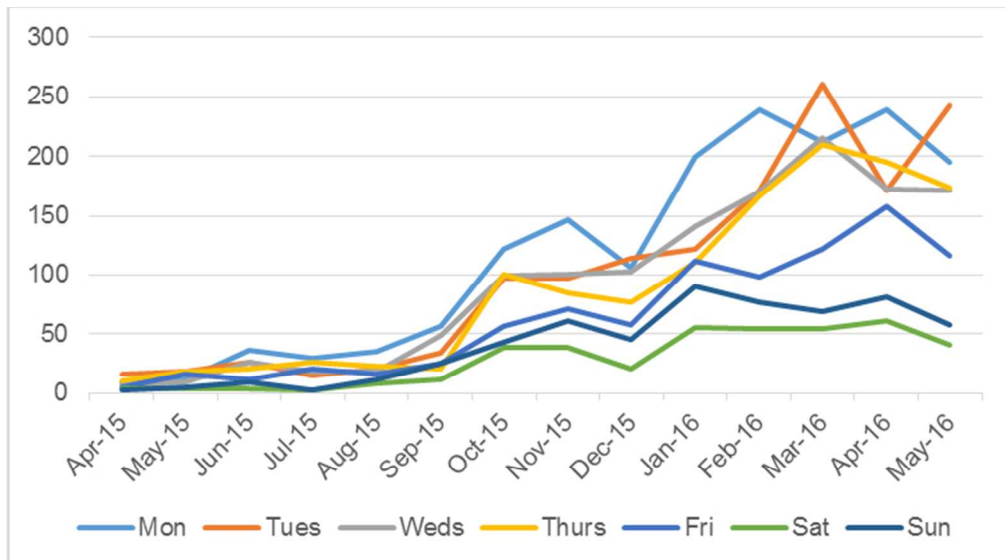
KN, JH, HE, MF, JB, EM, WH and EB were responsible for the study design and collection of data. KN, JH and EB were responsible for study management and co-ordination. CS was a project advisor throughout. HE, KN, EM and WH analysed the data. HE and KN drafted the paper. All authors read, commented on and approved the final manuscript.

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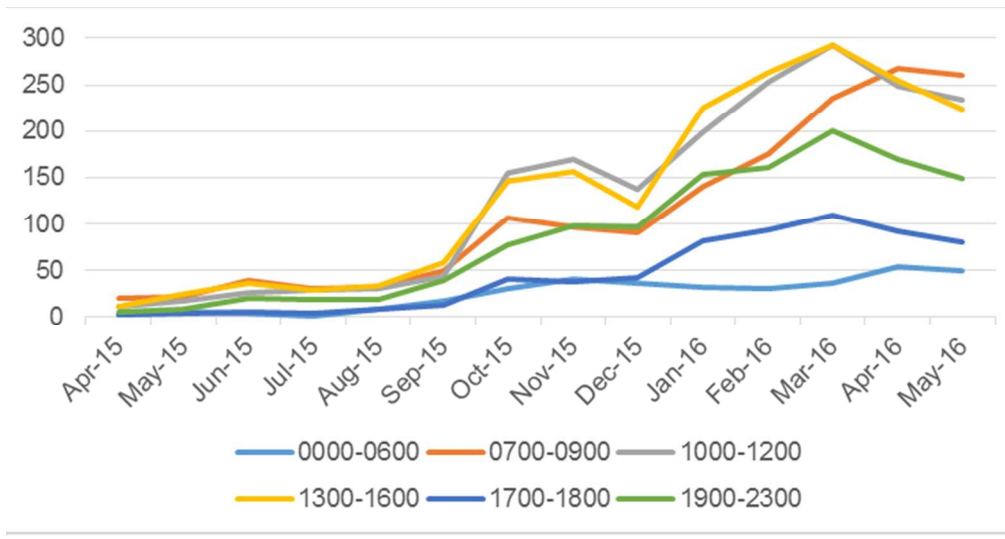
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Supplementary Table 1. Unit cost sources of health and social care

Resource	Assumptions for costing units of resource ¹
GP face to face appointments	Based on £33 per 11.7 minute GP consultation, excluding direct care staff costs and without qualification costs
GP telephone calls	Based on £20 per 7.1 minute GP consultation, , excluding direct care staff costs and without qualification costs
GP complete phone calls (sensitivity analysis)	Based on £2.9 per GP minute and observed 7.6 minutes of duration of audit GP telephone calls, excluding direct care staff costs and without qualification costs
GP failed telephone calls (sensitivity analysis)	Based on £2.9 per GP minute and assumed 1 minute per failed GP contact, excluding direct care staff costs and without qualification costs
Nurse face to face contacts ²	Based of £47 per hour and 15.5 average Nurse contact time, excluding qualification costs
Nurse telephone appointments	Based of £47 per hour and 15.5 average Nurse contact time, excluding qualification costs
Nurse face to face contacts (sensitivity analysis)	Based of £47 per hour, excluding qualification costs, and observed duration of nurse contact time. Given that data was unavailable for the initial e-consult response, we used nurse contact durations in the following 30 days.
Prescriptions	Based on 2 minutes of GP time at £2.9 per minute
Fit notes	Based on 2 minutes of GP time at £2.9 per minute
Routine referral letters	Based on 2 minutes of GP time at £2.9 per minute
2 week wait referral letters	Based on 2 minutes of GP time at £2.9 per minute
GP given advice by email	Cost included in the GP-led triage cost (not costed)
Other GP actions	Cost included in the GP-led triage cost (not costed)
Unknown GP actions	Cost included in the GP-led triage cost (not costed)
GP-led triage cost	Based on £2.9 per GP minute and 4 minutes of PSSRU published average GP-led triage time of a teleconsultation. In sensitivity analyses we used our qualitative findings where GPs reported requiring 5 minutes to triage e-consultations in our study.

1. All unit cost tariffs are published in the 2015 Curtis and Burns unit costs for health and social care, PSSRU

2. Includes treatment room and tests

BMJ Open

Use of a primary care online consultation system, by whom, when and why: evaluation of a pilot observational study in 36 general practices in South West England

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-016901.R1
Article Type:	Research
Date Submitted by the Author:	07-Jul-2017
Complete List of Authors:	Edwards, Hannah; University of Bristol, School of Social and Community Medicine; NIHR CLAHRC West, Marques, Elsa; University of Bristol, School of Clinical Sciences Hollingworth, William; University of Bristol, Social and Community Medicine Horwood, Jeremy; University of Bristol, Centre for Academic Primary Care, School of Social & Community Medicine; NIHR CLAHRC West Farr, Michelle; NIHR CLAHRC West Bernard, Elly; One Care Consortium Salisbury, Chris; University of Bristol, Centre for Academic Primary Care, School of Social and Community Medicine Northstone, Kate; University of Bristol, School of Social and Community Medicine; NIHR CLAHRC West,
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Communication, Evidence based practice
Keywords:	PRIMARY CARE, general practice, online consultations, evaluation

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3 **Use of a primary care online consultation system, by whom, when and why: evaluation of a**
4 **pilot observational study in 36 general practices in South West England**
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35 Word count: 4,288

36 Number of tables: 4

37 Number of figures: 2

38 Number of supplementary files: 1
39
40
41

42 Keywords: general practice, primary care, online consultations, e-consultations, evaluation
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Abstract

Objectives: Evaluation of a pilot study of an online consultation system in primary care. We describe who used the system, when and why, and the NHS costs associated with its use.

Design: 15-month observational study.

Setting: Primary Care practices in South West England.

Results: 36 General Practices covering 396,828 patients took part in the pilot. The online consultation website was viewed 35,981 times over the pilot period (mean 9.11 visits per 1000 patients per month). 7,472 patients went on to complete an 'e-consultation' (mean 2.00 online consultations per 1000 patients per month). E-consultations were mainly performed on weekdays and during normal working hours. Patient records (n=485) were abstracted for eight practices and showed that women were more likely to use e-consultations than men (64.7% versus 35.3%) and users had a median age of 39 years (IQR 30-50). The most common reason for an e-consultation was an administrative request (e.g. test results, letters, repeat prescriptions (22.5%)) followed by infections/immunological issues (14.4%). The majority of patients (65.2%) received a response within two days. The most common outcome was a face-to-face (38%) or telephone consultation (32%). The former were more often needed for patients consulting about new conditions (OR 1.56, 95%CI 1.05, 2.27, p=0.049). The average cost of a practice's response to an e-consultation was £36.28, primarily triage time, and resulting face-to-face/telephone consultations needed.

Conclusions: Use of e-consultations is very low, particularly at weekends. Unless this can be improved, any impact on staff workload and patient waiting times is likely to be negligible. It is possible that use of e-consultations increases primary care workload and costs. Online consultation systems could be developed to improve efficiency both for staff and patients. These findings have implications for software developers as well as primary care services and policymakers who are considering investing in online consultation systems.

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3 **Article summary:**
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6 **Strengths and Limitations of this Study**

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- 8 • Largest UK study to date examining use of a primary care online consultation system.
 - 9 • Benefits from a number of quantitative data sources (website usage statistics, subset of electronic
10 patient records, public data on General Practices).
 - 11 • We were unable to collect data on a control group and were therefore limited to a descriptive
12 evaluation.
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BACKGROUND

There is an increasing demand for UK primary care services, with workload increasing by 16% between 2007 and 2014 (1). General practices have struggled to meet this challenge, particularly in the context of a declining workforce, (2, 3) and difficulties accessing services have become a key source of patient dissatisfaction (4) and practitioner stress (5).

In response to this, the NHS England report 'General Practice Forward View' promotes a greater use of technology by General Practices, for example via online consultation systems, as a potential way to meet demand (6). The Department of Health have said that by 2020 they will establish seven-day access to primary care, with the view that broadening access options may help meet demand (7). The Prime Minister's Challenge Fund (now called the GP Access Fund) was set up in 2013 to "improve access to general practice and stimulate innovative ways of providing primary care services" (8). In 2017 NHS England is increasing Clinical Commissioning Groups (CCGs) budgets, specifically for the provision of general practice IT/technology services, and making available an additional £45 million over three years to support the uptake of online consultations (9).

Communications and online technology (such as email, video, and online consultations) are currently being investigated to improve patient access and make more efficient use of practitioners' time. So far, the evidence about use and effectiveness of such technology is conflicting (10-19) and few studies have been performed in the UK. Rigorous evaluation of online consultation systems is crucial before nationwide encouragement or roll-out of such systems. Practices will incur costs when introducing new systems (software fees, licences, staff time to learn and integrate the new system into their practice) and they need as much information as possible on acceptability, effectiveness and cost-effectiveness to make informed decisions about whether to invest in them. In the UK at least, the current policy could also have implications for the taxpayer. Also in the context of other expensive, failed IT programmes in UK healthcare such as the partially developed and abandoned system of national electronic medical records (20, 21), it is vital that other technological systems are evaluated as early as possible before they are implemented on a broad scale.

An online consultation system was piloted by 36 practices and a number of patient records were abstracted from eight of these practices. We performed a mixed-methods observational evaluation, including quantitative, qualitative, and health economic analyses. The objectives of this paper are to: 1) report on how often and when the online system was used (with e-consultations with a general practitioner being an option within that system), 2) to summarise the types of users, the reasons for e-consultation and what happened as a result and 3) estimate the cost associated with e-consultations. It should be noted that here we report on the quantitative and health economic findings. Qualitative findings will be reported separately.

METHODS

The pilot

In 2014 the GP Access Fund supported a consortium of general practices in South West England (22) to pilot an online consultation system called 'eConsult' (previously called WebGP) (23). eConsult (hereafter referred to as 'the system') is an online platform that allows adult patients to contact their GP, access self-help information, or learn more about NHS 111 (the UK NHS non-emergency number used to obtain advice for urgent healthcare needs) and local pharmacy services via their general practices' website (24). To contact their GP a patient completes an online form describing the nature of their problem (hereafter referred to as an 'e-consultation'). This is submitted to their practice, which commits to responding by the end of the next working day. 36 practices took part in the pilot and we use data from these to investigate when and how often the system was used. Patient level data was obtained from eight practices to examine the types of users, the reasons for and the outcomes of e-consultations.

Data and data sources

Three data sources were used in this evaluation:

1. Routinely available data from Public Health England about general practices across England (25). The National General Practice Profiles provide data on each general practice that has a patient list size of at least 900 and was included in the 2014/15 Quality and Outcomes Framework (QOF). Available data includes local demography, QOF scores and GP patient satisfaction survey results.
2. Website analytics data provided by the software developers. This was summary data on the use of the website by each participating practice from April 2015 until June 2016. This included data on the number of page landings, number of unique users, number of e-consultations, the days and times e-consultations were performed, and the number of uses of the additional services (self-help, pharmacy locator, NHS 111 signposting).
3. Eight participating general practices were purposively sampled to ensure a range of locations (rural/suburban/urban), area deprivation using the English Index of Multiple Deprivation (IMD) (26) and level of e-consultation use (high, medium and low, calculated by dividing the number of e-consultations by number of days the system was live). A random sample of patients who used an e-consultation were identified in each practice and anonymised data were abstracted from their electronic patient records (485 e-consultations equally distributed across the eight practices). Data were collected on patient demographics; reason for contact; nurse and doctor's time and actions taken in response to the e-consultation (e.g. telephone call, face-to-face appointment, request for tests, email advice); any further care provided by the practice in the 30 days following the e-consultation. A member of staff from one of the participating practices abstracted this data for all practices. An Excel spreadsheet was designed by the abstractor in conjunction with members of the research team (EM, WH, KN).

Data analysis

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3 To examine the generalisability and potential selection bias in our results, we compared the 36
4 practices participating in the pilot to those in the rest of England. Any differences were assessed
5 using chi-squared tests.
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7 To determine how often and when the system was used we present descriptive statistics (means and
8 standard deviations or absolute numbers and percentages) to show the number of patients using the
9 system over time, the most popular days of the week and times of day (from both the website
10 statistics and patient-level data).
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14 For the eight practices providing patient level data, demographic characteristics of users, reasons for
15 consulting, actions taken in response to e-consultations, response times, and durations of subsequent
16 consultations were summarised using means and standard deviations or absolute numbers and
17 percentages. In addition, odds ratios (ORs) with 95% confidence intervals (CIs) and p-values were
18 calculated. Reasons for consulting were categorised from a free-text field in the e-consultation into 11
19 broad categories (by HE at the time of analysis): musculoskeletal, infection/immunological,
20 neurological, sexual/reproductive health, dermatological, respiratory, mental health, digestive,
21 medication queries or advice, administrative (requests for fit notes (an official document regarding
22 fitness to work), repeat prescriptions, test results, referrals, and requests to book appointments), and
23 unclear/not stated. The reason for an e-consultation was also cross-tabulated with the primary action
24 taken to identify any patterns in types of response required. What happened as a result of the e-
25 consultation in the subsequent 30 days is summarised as primary and secondary GP actions. The
26 *primary action* is the most resource intensive action taken by the GP and the secondary action is the
27 next most resource intensive (the hierarchy was considered as the order of actions shown in Table 4).
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35 The time required to take the actions in response to an e-consultation by doctors and nurses, and any
36 subsequent contacts within 30 days were abstracted from the individual patient records in the eight
37 sampled practices described in data source 3 above. A triage time of five minutes per e-consultation
38 was assumed based on responses obtained from interviews in the companion qualitative study where
39 practice staff were asked to explain in detail how their practice dealt with e-consultations. Staff time
40 was valued using 2015 unit costs for health and social care (26) to derive the cost of e-consultations.
41 This micro-costed estimate was compared with national published average costs for GP and nurse
42 contact durations (26). (Supplementary Table 1)
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48 RESULTS

49 Study sample

50 36/102 (35%) self-selected general practices within the study area took part in the pilot, covering a
51 total patient population of 396,828. These 36 practices were broadly comparable to practices in the
52 rest of England (Table 1). The following differences were evident: participating practices tended to
53 have larger average patient list sizes (11,023 vs 7,321) and there were several markers of higher
54 socio-economic ratings in patients in participating practices compared to patients in the rest of
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3 England (more in full time work/education (66.5% vs 60.8%), fewer with long-standing health
4 conditions or caring responsibilities (50.6% vs 54.0% and 15.7% vs 18.1% respectively), and
5 fractionally higher life expectancy (84.0 vs 82.9 years). Study practices also tended to have slightly
6 higher nurse and administrative staff support compared to the average practice in England.
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9 10 **Extent of interest in the system (web analytics)**

11 There was a small amount of patient curiosity about the system, with a mean of 9.11 unique visits to
12 the system website per 1000 patients per month (average minimum across practices: 1.41, average
13 maximum across practices: 29.12 per 1000 patients per month). This included any time that someone
14 looked at the website ('page landings'), whether or not they went on to do an e-consultation or use the
15 other services. The majority (71.1%) did not return to the website. Patients rarely clicked through to
16 other information pages (the self-help link was viewed 3,348 times, the pharmacy link 1,744 times,
17 and the NHS 111 link 1,527 times throughout the entire pilot, compared to 35,981 visits overall).
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22 **Extent of use of e-consultations (web analytics)**

23 Website analytics data showed that the use of actual e-consultations was very low. Over the 36
24 participating practices, there was a mean of 2.00 e-consultations per 1000 patients per month
25 (minimum 0.33, maximum 5.70 per 1000 patients per month). As the mean number of patients per
26 practice was 11,023, this means that on average a practice might receive 18 e-consultations per
27 month based on these figures. To put this into context, the most recent data on consultation rates in
28 UK General Practice indicates that on average there were 5.16 standard consultations (GP or nurse
29 led) per patient per annum (1), equating to 4,740 consultations per month in a practice with 11,023
30 patients. This means that e-consultations represent 0.002% of all consultations on average. There
31 was a trend towards a gradual increase in use over the pilot period, although the last three months of
32 the pilot saw a slight decrease in use. (Figures 1 and 2)
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39 **Times of use (web analytics and patient level data)**

40 Patients were much more likely to use the system at the start of the week and during typical (UK)
41 surgery opening hours. 58.8% of all e-consultations took place Monday to Wednesday, with use
42 declining towards the end of the week: only 12.4% of e-consultations were completed at the weekend.
43 69.9% occurred between 7am and 5pm, with peaks seen around 10am and 2pm. There was some
44 interest in evening use, although this was much lower than daytime use (19.4% between 7pm and
45 midnight, with a peak around 8pm) (Figures 1 and 2, Table 2). When we looked just at the patient
46 level data (n=485 e-consultations) we showed that there were no differences in characteristics of
47 daytime compared to evening users (p=0.715 for age, p=0.140 for gender, p=0.548 for pre-existing
48 health conditions, p>0.08 for all categories of reason for e-consultation).
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54 **User characteristics (patient level data)**

55 From the data abstracted from a random sample of e-consultations from eight practices it can be seen
56 that women were almost twice as likely to perform an e-consultation as men (64.7% versus 35.3%)
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3 and over half of all users were age 25-44 years (median age 39, IQR 30-50). After the age of 45, use
4 declined with age, although young adults (age 18-24) also accounted for only a small proportion of
5 total usage (8.7%). The oldest patient using the system was 90 years old (Table 2). There was no
6 evidence to suggest that patient socioeconomic factors affected rates of use ($p=0.755$ for rates of use
7 by IMD quartile, $p=0.276$ for employment status and $p=0.696$ for chronic health condition status).
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10 11 **Reasons for use (patient level data)**

12 Over a fifth of all e-consultations were for administrative reasons. The next most common reasons for
13 an e-consultation were related to infections/immunological issues (14.4%) and musculoskeletal
14 issues, such as back or knee pain (12.4%). In almost a third of cases, patients had consulted about
15 the same issue within the previous six months, suggesting it was an ongoing health problem. (Table
16 3)
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20 21 **Practice response to e-consultations (patient level data)**

22 Practices had committed to responding by the end of the next working day after submission of an e-
23 consultation. The median time to response was 1 day (IQR 1-3 days) and the maximum was 20 days,
24 although response time of over a week was uncommon (Table 3). E-consultations submitted on a
25 Friday or Saturday predictably had a longer median time to response (3 days) compared to other
26 days, as currently in the UK, GPs do not typically work on Saturdays or Sundays.
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30 The most common *primary* response (defined as the most resource-intensive action) to an e-
31 consultation was to arrange a face-to-face (38.1%) or telephone consultation (32.2%) with the patient.
32 Other actions taken by the practice included issuing a prescription or fit note, requesting tests, and
33 giving advice. In about two-thirds of cases a *secondary* (less resource-intensive) action was also
34 taken, most commonly issuing a prescription or providing advice. (Table 3)
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39 'Administrative' e-consultations were mainly dealt with via a telephone consultation (73.7%). About a
40 half of all clinical (not administrative) e-consultations resulted in a face-to-face consultation (range:
41 39% for sexual health, to 54% for neurological issues) and approximately a further third resulted in a
42 telephone consultation (range: 21% for dermatological, to 42% for infection/immunological issues).
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46 After the initial response, a quarter of patients (25.8%) had a *further* consultation in the 30 days
47 following their e-consultation. 19.5% of these were face-to-face, and 5.6% by telephone. (Table 3)
48 Over half of the face-to-face consultations (57.5%) were with a GP, 17.0% with a practice nurse, and
49 25.5% with another health professional (e.g. health care assistant, practice pharmacist, phlebotomist).
50 Almost all further telephone consultations (92.6%) were with a GP. Data on which health
51 professionals had contact with the patients was only collected for follow-up actions, and not for the
52 primary response (described in the preceding paragraph), but we could speculate that the distribution
53 of staff resources there would be similar.
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3 A face-to-face consultation was more likely to be needed for patients with a new, compared to a pre-
4 existing condition (OR 1.56, 95% CI 1.05, 2.27, p=0.049, adjusted for age and gender). They were
5 even more likely to be needed for patients who had not seen their GP about the problem in the
6 preceding 30 days (OR 1.89, 95% CI 1.23, 2.86, p=0.005).
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9 10 **Cost of e-consultations**

11 The average duration of a face-to-face appointment in response to an e-consultation was 14.5
12 minutes, and 7.6 minutes for a telephone consultation. To put this into context, the most recently
13 estimated national averages (2013-14) are 9.2 minutes (95% CI 9.22–9.23) for face-to-face
14 appointments and 5.4 minutes (95% CI 5.3–5.4) for telephone consultations (1). The average cost for
15 the initial practice response to an e-consultation was £36.28. In context, the national estimates of cost
16 for a standard GP face-to-face consultation is £33.00 (see supplementary table 1). The cost was
17 driven mainly by the time needed for a GP to triage the e-consultations, and the relatively high
18 proportion of e-consultations that resulted in a face-to-face or telephone consultation with a GP.
19 (Table 4) When considering further follow-up actions taken in the subsequent 30 days, the average
20 cost associated with an e-consultation increased to £45.39.
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28 **DISCUSSION**

29 **Principal findings**

30 We report on a 15-month pilot trial of an online consultation system in primary care. Principal findings
31 from the website analytics data (36 practices) were that use of the system was very low, it was most
32 likely to be used on weekdays, during typical UK surgery hours. From the patient level data obtained
33 from eight practices we have shown that the system was used more commonly by women than men,
34 and most often by working-age adults. The most common reason for an e-consultation was for an
35 administrative request, e.g. fit notes, repeat prescriptions, and test results. The average time taken for
36 a practice to respond to an e-consultation was one day, and about three-quarters of all e-
37 consultations resulted in the patient being asked to arrange a face-to-face or telephone consultation.
38 Patients reporting new conditions were more likely to require a face-to-face consultation than patients
39 reporting on a pre-existing condition. The average cost to a General Practice to respond to an e-
40 consultation was £36.28.
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48 **Comparison with other studies**

49 Our findings on the types of patients using the system, and the most popular days and times of use
50 are consistent with findings from an earlier, smaller pilot study carried out by the software developers
51 (27) and from a second small study from the USA (28). However, when considering other types of
52 technology, a survey across 14 European countries found that men were more likely to use email to
53 communicate with their healthcare providers (15), whilst we found women were more likely to use
54 online consultations. This discrepancy could be due to the difference in formats of email versus a
55 structured online form but warrants further investigation in other populations. In regards to the
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3 reasons for consulting, the earlier pilot by the software developers (27) found that mental and sexual
4 health were two of the most common reasons for an e-consultation, whereas these were much less
5 commonly cited in our study (5.9% and 8.5% respectively). However, two randomised controlled trials
6 of email systems / web-based online communication systems in primary care showed that both
7 patients and clinicians felt that online/email communication would not be their preference or was less
8 appropriate for mental and sexual health issues (29, 30). Whilst these RCT results cannot be directly
9 compared with the earlier pilot study, there is a suggestion that these results are more in line with our
10 own findings. Research in North America has reported that both patients (10) and clinicians (31) felt
11 that email communication is particularly appropriate for administrative requests, which may help
12 explain our observation that administrative requests were the most common reason for completing an
13 e-consultation.
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19 **Possible explanations and implications**

20 The very low use of e-consultations has several possible explanations. One is that few patients knew
21 about the system, although all practices stated they were advertising the system in various ways,
22 though some were more active than others (banners in the practice, on their websites and
23 answerphones, via texts to patients). Another explanation is that there is currently low demand for
24 online consultations, or at least in the format that they exist in the system trialled here. There are two
25 key implications of this low usage. Firstly, *impact*: part of the rationale for online consultations is that
26 they may reduce staff workload and speed up patient access. However, if, as estimated here, e-
27 consultations make up on average only a tiny proportion of all consultations (0.002%), the impact of
28 introducing the system (without significantly increasing use) would be negligible. It is also not clear
29 that use of the system would reduce, rather than increase staff workload (additional triage time, and
30 potentially longer resulting consultations). Secondly, *cost*: for commercial online consultation systems
31 operating on a per-patient cost model, much higher rates of use are likely to be necessary in order to
32 make such systems cost-effective for practices. The systems are also expensive in terms of the work
33 involved in using them, and the potential duplication of effort in the cases where they lead to a
34 standard consultation anyway. Further research is needed to improve our understanding of why e-
35 consultation use is so low, and what could be done to increase it. Another issue for future research is
36 that very low usage suggests that those who do use it may be atypical of primary care users. This
37 possibility is supported by the observation that patterns in the age and gender profile of UK general
38 practice users as reported in Hobbs et al. (1) differs from the age and gender profile of e-consultation
39 users as found here. It would be useful to elucidate more about the characteristics of those who
40 choose to use e-consultations.
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51 The low use of the system at weekends could simply reflect the fact that habits take time to change,
52 and we are not yet used to the concept of being able to contact GPs at weekends. However, it might
53 also indicate low demand for seven-day access to primary care services. The General Practice
54 Patient Survey (covering >880,000 patients in England) found that over 80% did not think they
55 needed weekend (particularly Sunday) opening hours (32). Consistently with this, an evaluation of
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3 seven-day access pilots reported very low demand for weekend appointments (only 12% of all
4 Sunday appointments filled) (33), and some pilots have been discontinued due to lack of demand
5 (34). Further follow-up, and interviews with patients about their appetite for seven-day access is
6 important to help understand this finding, particularly where policymakers are committing to rolling-out
7 seven-day access to primary care services (35).
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11 It might be anticipated that having already submitted a prior e-consultation, a follow-up face-to-face
12 appointment about that issue would be shorter than at a standard consultation where the GP has no
13 prior information about the issue. However, follow-up face-to-face appointments resulting from an e-
14 consultation tended to be longer than the national averages (14.5 minutes compared to 9.2 minutes
15 for face-to-face appointments, and 7.6 minutes compared to 5.4 minutes for telephone consultations)
16 (1). As this was not a controlled study we were unable to directly compare consulting times with and
17 without e-consultations, so this observation should be interpreted as suggestive only. The observation
18 does however fit with the findings of a trial of pre-consultation telephone triage in UK General
19 Practices, where the prior telephone information from the patient made no difference to the duration of
20 resulting face-to-face consultations (36). The implication is that collecting information in an e-
21 consultation may not make subsequent consultations shorter, and it is possible that it increases,
22 rather than reduces, clinical workload. This is particularly important if part of the rationale for such
23 systems is to reduce the pressure on primary care staff. (We note that the software developers' own
24 earlier, smaller pilot study reported 10 minutes for follow-up face-to-face appointments, and 5 minutes
25 for follow-up telephone calls (27), which are closer to the national average. However, it is not clear
26 how these estimates were arrived at).
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35 Online consultation systems could be amended to improve efficiency. For example, as booking a
36 telephone consultation was the response to three-quarters of all queries regarding medications, it may
37 be more efficient if the online system initially asked if patients had a medication query, and
38 automatically directed them to book a telephone consultation if so. This would save time for clinicians
39 processing an unnecessary form, and would speed up access for patients who otherwise spend time
40 completing the full e-consultation, waiting for a response, and then needing to wait for a telephone
41 consultation anyway. (We note that an "admin button" has now been added to the system to deal with
42 fit notes, test results, and repeat prescriptions.) A second example is that of those who submitted an
43 e-consultation, patients consulting about a pre-existing condition were far less likely to need a face-to-
44 face consultation than patients consulting about a new condition. This could be because when a GP is
45 already familiar with the patient and their condition, they may feel more confident proceeding without
46 seeing the patient in person. This suggests that online consultation systems could potentially be more
47 useful for patients consulting about a pre-existing condition. For new conditions that are likely to
48 require a face-to-face appointment anyway, using the online system may unnecessarily add to delays
49 and clinical workload by introducing another step in the process of getting an appointment.
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56 57 **Strengths and weaknesses** 58 59 60

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3 The key strength of this study is that it is, to our knowledge, the largest independent evaluation to
4 date of a primary care online consultation system. A weakness is the observational nature of the
5 study design that limits us to a descriptive evaluation. For the economic analyses we did not have
6 data on which member of staff performed the triaging, as different practices processed their e-
7 consultations in different ways. It was also not possible to know how much staff processing time was
8 needed, we therefore had to assume triage times based on our qualitative findings (reported
9 separately). It is therefore possible that the e-consultation cost is lower or higher than the £36 we
10 have calculated, if triage is performed by lower-grade staff or if processing time was greater than
11 average. Future studies would benefit from quantifying this. It should also be noted that the figure of
12 5.16 consultations per patient per annum (1), does not differentiate between consultations performed
13 by GPs and those performed by nurses. This may impact our estimations.
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21 **CONCLUSIONS**

22 Use of e-consultations was very low, particularly at weekends. Unless this can be improved, the
23 impact of e-consultation systems on reducing staff workload and improving waiting times is likely to be
24 negligible. It is also possible that use of e-consultations may be associated with increased costs and
25 workload in primary care. Patterns in use suggest ways that online consultation systems could be
26 developed to improve efficiency, such as channelling administrative requests separately, and
27 targeting the system specifically for patients who regularly see their GP for an ongoing condition.
28 Future research should look at reasons for low uptake of e-consultations, and to trial different
29 approaches to improving uptake. If future research demonstrated significantly higher usage, this
30 would pave the way for a feasibility study to more formally evaluate the effectiveness and cost-
31 effectiveness of e-consultations.
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TABLES

Table 1: Comparison of study practices with practices in the rest of England

Characteristics	Pilot Practices n=36	Rest of England n=7705	p-value*
Mean (sd) number of patients	11,023 (3522)	7,321 (4418)	<0.001
Mean (sd) % of patients aged:			
0-4	6.2 (2.0)	6.0 (1.7)	0.430
5-14	10.6 (3.1)	11.5 (2.6)	0.029
<18	20.3 (4.1)	20.9 (4.2)	0.385
65+	14.7 (6.2)	16.9 (6.7)	0.051
85+	2.1 (1.1)	2.2 (1.2)	0.597
% patients male	49.9 (1.8)	50.1 (2.4)	0.604
Mean (sd) IMD score (2015) ^a	22.1 (13.4)	23.7 (11.8)	0.422
Mean (sd) IDACI ^b	20.1 (9.6)	18.8 (11.2)	0.446
Mean (sd) IDAOPI ^c	18.4 (9.1)	20.5 (10.3)	0.200
% Patients in paid work/Full time education	66.5 (10.4)	60.8 (8.7)	<0.001
% Patients unemployed	4.8 (4.0)	6.2 (5.1)	0.134
% Patients who would recommend practice (definitely/probably)	79.9 (8.1)	77.1 (12.7)	0.188
% Patients satisfied with phone access (very/fairly)	72.0 (15.6)	76.6 (17.4)	0.109
% Patients satisfied with opening hours (very/fairly)	77.0 (5.9)	75.7 (9.3)	0.385
% Patients saw/spoke to nurse/GP same/next day	43.4 (10.1)	48.8 (14.9)	0.031
% Patients reporting good overall experience of making an appointment (very/fairly)	71.9 (9.5)	75.1 (13.5)	0.152
% Patients who know how to make out of hours GP appointment	55.8 (9.7)	56.3 (10.9)	0.753
% Patients with long standing health condition	50.6 (8.2)	54.0 (8.0)	0.011
% Patients with caring responsibilities	15.7 (4.7)	18.1 (5.1)	0.006
Mean (sd) QoF points	96.9 (6.9)	94.8 (6.9)	0.074
Mean (sd) Life expectancy (years)	84.0 (1.5)	82.9 (1.9)	0.002
Mean (sd) GP FTE	5.7 (1.8)	4.6 (3.2)	0.026
Mean (sd) Nurse FTE	3.4 (1.5)	1.9 (1.6)	<0.001
Mean (sd) Admin FTE	11.2 (3.6)	8.1 (5.0)	<0.001

* X2 for categorical variables; t-test for continuous variables

a Index of Multiple Deprivation: The higher the score, the higher the level of deprivation

b Income deprivation affecting children index: The higher the score, the higher the level of deprivation

c Income deprivation affecting older people index: The higher the score, the higher the level of deprivation

Table 2: Use of e-consultations (from patient electronic medical records and e-consultation data)

User characteristics	% of individual e-consultations (n=485)
Users*	
Unique users	71.1% (345)
Repeat users	28.8% (140)
Gender *	
Male	35.3% (171)
Female	64.7% (315)
Age group*	
18-24	8.7% (42)
25-44	53.4% (259)
45-64	29.1% (141)
65-74	6.2% (30)
75-84	2.1% (10)
85+	0.2% (1)
Day of week **	
Monday	19.8% (96)
Tuesday	18.6% (90)
Wednesday	20.4% (99)
Thursday	17.3% (84)
Friday	11.6% (56)
Saturday	5.4% (26)
Sunday	7.0% (34)
Time of day**	
00:00 – 06:59	4.1% (20)
07:00 – 09:59	16.9% (82)
10:00 – 12:59	25.8% (125)
13:00 – 16:59	27.2% (132)
17:00 – 18:59	6.6% (32)
19:00 – 23:59	19.4% (94)

*abstracted from patient-level data

** from website analytics

Table 3. Reasons for e-consultations and practice responses (from patient-level data)

	% of e-consultations from total of n=485 (n)
Reason for consulting	
Musculoskeletal / limb pain	12.4% (60)
Infection/Immunological	14.4% (70)
Neurological	5.4% (26)
Sexual/Reproductive health	8.5% (41)
Dermatological	6.8% (33)
Respiratory	5.1% (25)
Mental health	5.9% (29)
Digestive	3.9% (19)
Medication query/advice	3.9% (19)
Administrative ^a	22.5% (109)
Other / Unclear	11.1% (54)
Did patient consult about the same issue in the last 6 months	
Yes	30.1% (146)
No	68.5% (332)
Response time	
Same day	20.21% (98)
1-2 days	44.95% (218)
3-6 days	19.18% (93)
7-13 days	7.6% (37)
>14 days (max 20 days)	4.7% (23)
Primary response action	
Admit to hospital	0
F2F consultation	38.1% (185)
Telephone consultation	32.1% (156)
Prescription	7.2% (35)
Fit note	3.1% (15)
Test/treatment	1.6% (8)
Refer routine	1.6% (8)
Refer urgent /2week wait	0
Advice	9.1% (44)
Other	3.3% (16)
Unknown	3.1% (15)
Secondary response action	
Admit to hospital	0
F2F consultation	0.2% (1)
Telephone consultation	2.5% (12)
Prescription	22.5% (109)
Fit note	2.7% (13)
Test/treatment	8.6% (42)
Refer routine	7.2% (35)
Refer urgent /2week wait	1.6% (8)
Advice	12.8% (62)
Other	10.7% (52)
Unknown	0.2% (1)
Follow-up consultations in the 30 day period after the initial action	
F2F	19.5% (94)
Telephone	5.6% (27)
Other	0.6% (3)
Unknown	0.2% (1)
Not applicable (i.e. no follow-up consultation)	74.2% (360)

Table 4. Average cost of all initial primary care actions in response to an e-consultation¹

All initial response actions	n	% all e-consultations (n=482)	Average cost per e-consultation
GP face to face appointments	186	39%	£12.73
GP telephone calls	187	39%	£7.76
Nurse face to face contacts ²	70	15%	£1.76
Nurse telephone appointments	0	0%	£0.00
Prescriptions	151	31%	£1.25
Fit notes	31	6%	£0.37
Routine referral letters	56	12%	£0.67
2 week wait referral letters	10	2%	£0.12
GP given advice by email	125	26%	£0.00
Other GP actions	108	22%	£0.00
Unknown GP actions	15	3%	£0.00
GP-led triage cost			£11.60
Average cost of e-consultation			£36.28

1. Staff time collected from individual patient data from eight practices participating in the audit. Triage time of five minutes per e-consultation was assumed based on responses in our companion qualitative study. Staff time valued using 2015 unit costs for health and social care (Curtis and Burns, PSSRU).

2. Includes treatment room and tests

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Figure Legends

Figure 1: Total e-consultations over time, by day of the week (from website analytics data)

Figure 2: Total e-consultations over time, by time of day (from website analytics data)

For peer review only

ETHICAL APPROVAL

was obtained from the Health Research Authority [HRA] (IRAS project ID: 204925; Protocol number: 2604; Sponsor: University of Bristol).

FUNDING STATEMENTS AND ACKNOWLEDGEMENTS

This research is part-funded by the One Care Consortium and supported by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care West at University Hospitals Bristol NHS Foundation Trust. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. Authors thank staff from participating practices for assisting with the collection of individual-level data, and the software developers for providing web usage statistics.

COMPETING INTERESTS

EB is employed by One Care who part-funded the research. HE, MF, EM, KN and JH are employed by CLAHRC West who received part-funding from One Care.

DATA SHARING:

No further data is available.

AUTHORS' CONTRIBUTIONS

KN, JH, HE, MF, JB, EM, WH and EB were responsible for the study design and collection of data. KN, JH and EB were responsible for study management and co-ordination. CS was a project advisor throughout. HE, KN, EM and WH analysed the data. HE and KN drafted the paper. All authors read, commented on and approved the final manuscript.

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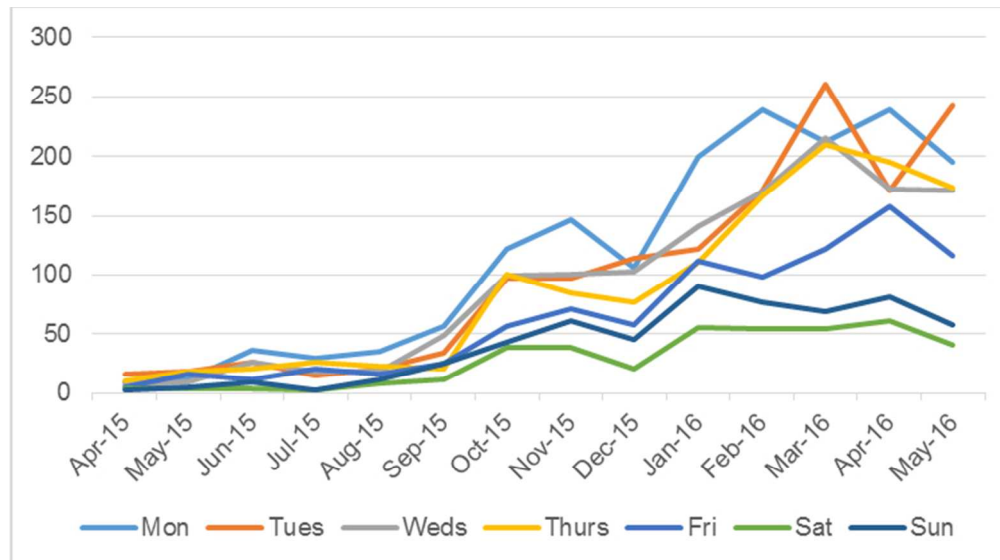


Figure 1: Total e-consultations over time, by day of the week (from website analytics data)

63x35mm (300 x 300 DPI)

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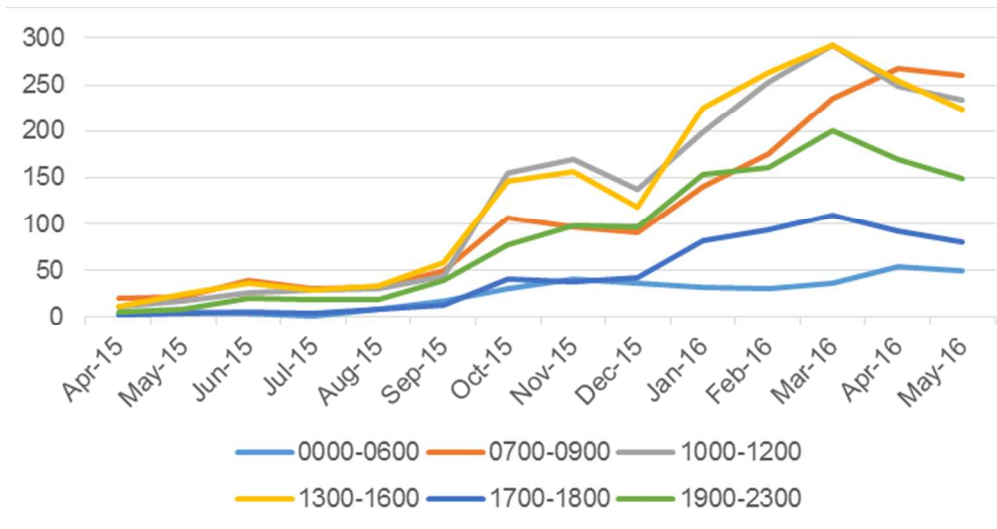


Figure 2: Total e-consultations over time, by time of day (from website analytics data)

62x32mm (300 x 300 DPI)

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Supplementary Table 1. Unit cost sources of health and social care

Resource	Assumptions for costing units of resource ¹
GP face to face appointments	Based on £33 per 11.7 minute GP consultation, excluding direct care staff costs and without qualification costs
GP telephone calls	Based on £20 per 7.1 minute GP consultation, , excluding direct care staff costs and without qualification costs
GP complete phone calls (sensitivity analysis)	Based on £2.9 per GP minute and observed 7.6 minutes of duration of audit GP telephone calls, excluding direct care staff costs and without qualification costs
GP failed telephone calls (sensitivity analysis)	Based on £2.9 per GP minute and assumed 1 minute per failed GP contact, excluding direct care staff costs and without qualification costs
Nurse face to face contacts ²	Based of £47 per hour and 15.5 average Nurse contact time, excluding qualification costs
Nurse telephone appointments	Based of £47 per hour and 15.5 average Nurse contact time, excluding qualification costs
Nurse face to face contacts (sensitivity analysis)	Based of £47 per hour, excluding qualification costs, and observed duration of nurse contact time. Given that data was unavailable for the initial e-consult response, we used nurse contact durations in the following 30 days.
Prescriptions	Based on 2 minutes of GP time at £2.9 per minute
Fit notes	Based on 2 minutes of GP time at £2.9 per minute
Routine referral letters	Based on 2 minutes of GP time at £2.9 per minute
2 week wait referral letters	Based on 2 minutes of GP time at £2.9 per minute
GP given advice by email	Cost included in the GP-led triage cost (not costed)
Other GP actions	Cost included in the GP-led triage cost (not costed)
Unknown GP actions	Cost included in the GP-led triage cost (not costed)
GP-led triage cost	Based on £2.9 per GP minute and 4 minutes of PSSRU published average GP-led triage time of a teleconsultation. In sensitivity analyses we used our qualitative findings where GPs reported requiring 5 minutes to triage e-consultations in our study.

1. All unit cost tariffs are published in the 2015 Curtis and Burns unit costs for health and social care, PSSRU

2. Includes treatment room and tests