LONG PAPER

The value of a Patient Access Portal in primary care: a cross-sectional survey of 62,486 registered users in the UK

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Abstract

In England, primary care patients have access to Patient Access Portals (PAPs), enabling them to book appointments, request repeat medication prescriptions, send/receive messages and review their medical records. Few studies have elicited user views and value of PAPs, especially in a publicly funded primary care setting. This study aimed to elicit the value users of PAPs place on online access to medical records and linked services. Secondary data analysis of the completed electronic survey (available 2 May 2015–27 June 2015) distributed via the EMIS PAP to all its registered users. EMIS designed the survey; responses were voluntary. There were 62,486 responders (95.7% self-completed). The PAP was mainly used for medication requests (86.3%) and online appointment bookings (78.4%), and, to a lesser extent, medical record viewing (18.3%) and messaging (9.5%). The majority (70%) reported a positive impact from using it. One in five rated it as their favourite online service second only to online banking. Almost three out of four responders stated that availability of online access would influence their move to another practice. Nonetheless, responders were reluctant to award a high monetary value to it. These findings correlated with the number of long-term conditions. The majority of users place a relatively high value, but not monetary value, on the PAP and report a positive impact from using it. The potential for PAPs to enhance patient experience, especially for those with long-term conditions, appears to be largely untapped. Research exploring the reasons for non-use is also required.

1 Background

People across the globe use technology to conduct many essential and daily functions such as banking, shopping, social networking and information gathering. Increasingly, policy directives and technological innovation are also facilitating online engagement between patients and healthcare providers [1]. Patients are also demanding greater access to their own healthcare data [2]. Typically, this involves using a Patient Access Portal (PAP) that enables patients and/or carers to book appointments, make medication requests, view their medical records and send messages [3].

In the USA, two-thirds of Kaiser Permanente's 3.4 million members have signed up for online appointment booking, email communication and test results retrieval [4, 5]. Similarly, 600,000 members of the USA's Veterans Health Administration have registered for online services with over 20 million online visits [4]. In Sweden, recent figures indicate that national e-health services accounts have been set up by a third of the population [6, 7]. There has also been widespread uptake in Estonia and Denmark [8]. In the UK, progress in the National Health Service (NHS) has been somewhat slower, although in April 2015, the Department of Health mandated that all general practitioners (GPs) should give patients free online access to their medical records [9, 10].

A systematic review of online services in primary care [4] found that patients using PAPs reported increased convenience and satisfaction. Positive impacts on patient safety were

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noted. Professional concerns about privacy were unrealised, and those about workload were inconclusive. The review highlighted the paucity of studies in the British National Health System (NHS) and questioned the relevance of US-based research to the NHS while calling for further research on assessing the values patients place on online services [5]. The current study attempts to address that gap.

Egton Medical Information Systems (EMIS) is a leading primary care computer system which is used in over half (56%) of the general practices in the UK [11]. EMIS has a web-based PAP which went live in 2005 [12]. Subject to availability and approvals from their own practice, patients (or their carers) can register with EMIS to access the PAP to (a) book appointments, (b) submit requests of repeat medication prescriptions, (c) send/receive messages via the portal to clinical and administrative staff and (d) review their own medical record. As part of their ongoing evaluation of the PAP, EMIS designed and administered a survey to registered users, to elicit their perceived value of the PAP. EMIS conducted the initial analysis internally based on their own areas of interest. The portal is not available as a mobile application at present, and so no observations or conclusions can be made about the impact this might have on take-up and usage.

In this study, we undertook secondary analysis of the completed survey data to determine how people used the PAP and their views on its value compared to other online services such as banking and shopping. Perceived monetary value of the PAP was also assessed.

2 Methods

2.1 Design

A service user evaluation of the EMIS PAP was conducted. A cross-sectional survey was designed and administered by EMIS. Surveys were administered between 12 May 2015 and 27 June 2015 via the online Patient Portal feature in EMIS. Registered PAP users from the age of 16 upwards were invited to complete the voluntary (with no incentives) online survey. The survey could be completed by the users who were either the named patient or their carer.

The survey consisted of 17 multiple choice and two free text items (see "Appendix 1"). It captured demographic details including country of respondent, age range (see "Appendix 1", Part 1, Questions 2 and 3 for ranges) and health conditions (informed by long-term conditions (LTC) listed in the NHS Outcomes Framework [13], see "Appendix 1" Part 1, Question 4). A survey responder was deemed to have an LTC—subsequently summed into four levels (nil, one, two, three+)—if they selected any of the conditions from the survey: being involved in a preventative programme of treatment (associated with any of the following—congestive heart failure, diabetes,

asthma, angina, epilepsy, hypertension, influenza, pneumonia, chronic obstructive pulmonary disease (COPD), dehydration or gastroenteritis—all counting as one only), diabetes, epilepsy, breast cancer, lung cancer, colorectal cancer, any other cancer, cardiovascular disease, dementia, liver disease, other long-term conditions, serious mental illness, MRSA or asthma (see "Appendix 2"). Gender, in-country location and ability to make use of individual PAP features were not captured. For example, it was not clear whether individual respondents GP practices had "switched on" all four PAP features (online appointment booking, medication requests, patient messaging, and medical record viewer).

Responders were asked to report if, how and their frequency of PAP use (four possible uses included: appointment booking, medication request, patient messaging, medical record review), perceived value of the PAP versus other online services (banking, grocery shopping, shopping, social networks, search engines), and to assign a monetary value (on an ordinal scale ranging from £0 to £10,000) to the worth of the PAP per annum, and in general, via free text. Responders could also add additional comments in free text. (Free text responses are not reported in this paper.)

2.2 Statistical analysis

Based on findings and/or insights from previous studies [1, 14–17], we posited that survey responses were likely to be influenced by the reported age group (< 21 years, 21 to < 65 years, 65 to < 75 years, 75+ years), number of LTCs (nil, one, two, three+) and services used in the PAP (online appointment booking, medication request, patient messaging and medical record viewing). We tabulated all the results by the number of LTCs.

To examine the relationship between binary response variables and predictors (age group, number of LTCs and PAP functions used), we used trees which are a class of data mining tools, especially suited to identifying homogenous subgroups based on searching for nonlinear interactions [18]. In particular, we used conditional tree models using the *party* package [19] in *R* [20] by specifying $p < 0.001$ for statistical significance, along with a Bonferroni correction for multiple testing. Tree models are shown in "Appendix 3". Due to limitations within the survey, we were unable to report the results by gender, UK location or the number of PAP functions available in each practice and patient uptake.

3 Results

3.1 Characteristics of responders

There were 73,044 responses. Responders were excluded from analysis if they lived outside of the UK (3%, UK

citizens who maintain registration with a UK GP practice, and PAP, despite country of residence) or had not completed the survey fully (12%, defined as pressing the "Finish" button to submit their answers), resulting in a total number of 62,486 included respondents. Table 1 describes the characteristics of included responders. Included responders were aged 21 to < 65 years of age (66.4% 41,393/62,486), had one LTC (46% 28,718/62,486) and completed the survey themselves (95.6% 59,798/62,486) (see Table 2 for aggregate overview and "Appendix 3" for details stratified by number of LTCs and conditions). Remaining participants with missing data for other survey questions were retained for subsequent analysis.

3.2 Descriptive analysis

Most responders used the PAP monthly (66.3%) and had been using it for one to two years (39%). Medication requests were the most frequently cited function used by responders (86.3%); appointment booking was the second (78.4%). Most responders reported their favourite online service was banking (29.2%), PAP was the third (20%), behind search engines (22.8%). Most responders found PAP to be worth about the same to them as online banking (43.3%) and search engines (30.8%), and worth more than online grocery shopping (56%), online shopping (52.7%) and social media (57.1%). Most responders considered the PAP to have had a positive impact on their life (87%), and most considered it to have monetary value from at least £10 up to £10,000 (69.5%).

Table 1 Characteristics of responders

Characteristics	All (%)
Number of responders	62,486
Survey completed by	
Self	59,798 (95.7)
Someone else	2307 (3.7)
Missing	381 (0.6)
Age category (years)	
< 16	611 (1)
16 to < 21	832 (1.3)
21 to < 65	41,393 (66.2)
65 to < 75	14,043 (22.5)
75+	5473 (8.8)
Missing	134 (0.2)
Number of LTCs	
Nil	18,513 (29.6)
One	28,718 (46.0)
Two	10,922 (17.5)
Three+	4333 (6.9)

Table 2 Overview of uses and frequency of use

Uses and frequency of use of PAP	All (%)
How often was PAP used	
More than once a week	1323 (2.1)
Weekly	3914 (6.3)
Fortnightly	7564 (12.1)
Monthly	41,408 (66.3)
Every 6 months	5995 (9.6)
Yearly	1070 (1.7)
Missing	1212 (1.9)
How long have they used PAP	
Less than a year	20,608 (33)
1–2 years	24,368 (39)
3+ years	17,162 (27.5)
Missing	348 (0.6)
*What do they use PAP for**	
Online appointment booking	48,990 (78.4)
Medication requests	53,908 (86.3)
Patient messaging	5918 (9.5)
Medical record viewer	11,418 (18.3)
Favourite online service	
Banking	18,276 (29.2)
Grocery shopping	2428 (3.9)
Other online shopping	5905 (9.5)
PAP	12,480 (20)
Search engines	14,248 (22.8)
Social networking	7832 (12.5)
Missing	1212 (1.9)

Online appointment booking = selecting available dates for medical appointments at GP practice, medication requests = submitting electronic requests for repeat prescriptions of current medication, patient messaging = TBC, medical record viewer = ability to view personal record of current medication, doctor and nurse notes from appointments and any other information held, e.g. vaccination records, test results

Tables 2 and 3 present an aggregate overview, and "Appendix 3" provides details stratified by a number of LTCs.

3.3 Tree models

The trees, all with the same covariates (age group, number of LTCs and PAP service used), are shown in "Appendix 3".

We analysed the UK-based responders who had completed the survey (86% = 62,486/73,044, Table 1) stratified by the number of LTCs.

3.3.1 Self-completion of the survey

Age and the number of LTCs were significant predictors of self-completion; however, PAP service used was not

Table 3 Worth of PAP compared to other online services

Worth of PAP compared to other services	All (%)
Online banking	
Not applicable	4864 (7.8)
Less	9843 (15.8)
Same	27,074 (43.3)
More	20,705 (33.1)
Online grocery shopping	
Not applicable	12,301 (19.7)
Less	4522 (7.2)
Same	10,684 (17.1)
More	34,979 (56)
Online shopping	
Not applicable	6372 (10.2)
Less	6335 (10.1)
Same	16,821 (26.9)
More	32,958 (52.7)
Online social media	
Not applicable	12,416 (19.9)
Less	5347 (8.6)
Same	9050 (14.5)
More	35,673 (57.1)
Online search engines	
Not applicable	6019 (9.6)
Less	12,518 (20)
Same	19,250 (30.8)
More	24,699 (39.5)
Positive impact	
Yes (includes probably yes)	54,387 (87)
No (includes probably not)	4475 (7.2)
Missing/cannot say	3624 (5.8)

Table 4 Monetary value (£) of the PAP per year

Monetary value £ sterling per year	N (%)
£0	14,041 (22.5)
£10	9869 (15.8)
£25	9284 (14.9)
£50	8384 (13.4)
£100	7745 (12.4)
£250	2889 (4.6)
£500	2113 (3.4)
£1000	1589 (2.5)
£2500	395 (0.6)
£5000	371 (0.6)
£10,000	819 (1.3)
Missing	4897 (8.0%)

as their favourite online service, whereas users with nil or one LTC not using the messaging service were least likely (17.9%) to report the PAP as their favourite (see tree model 7).

Perceived positive impact of the PAP was modified by which service was used and the number of LTCs (see tree model 8). The positive impact was reported at its highest for those using the PAP for medication requests and online appointment booking (range 71.7–77.6%) though this was dependent on the number of LTCs, with responders with more than one LTC being more likely to report a positive impact. Those least likely to report a positive impact were not using medication requests (51.6%).

3.3.4 Comparability with other online services

The percentage of responders who found the PAP more valuable than other online services increased with the number of long-term conditions (see Table 4). Patient age, number of LTCs and purpose of usage predicted value ratings (see tree models 9–13 in "Appendix 3").

3.3.5 Monetary value

A monetary value of more than £0 per annum was higher for those with medication requests and more than three LTCs (see tree model 14). This was with or without online booking (yes 82.1% n = 30,748; no 75.1% n = 9885). Also awarding it high value were those with no LTCs but using medication requests and online booking (76.7%, n = 10,424). Those least likely to value the PAP at more than £0 per annum had no LTCs, were not using online booking but still having online medication requests (67.1% n = 2851), and those not having online medication requests aged 21 to < 65 years (67.1%, n = 6466).

(see tree model one). The lowest self-completion rate was amongst those under 21 (58.8% n = 1440), and the highest was of those aged 21 to < 65 years (98.8% n = 41,328) and 65 to < 75 years (96.9% n = 13,920.

3.3.2 Usage of the PAP: frequency and purpose

The reported usage included booking appointments online, medication requests, messaging and medical record viewing. Patient age, the number of LTCs and purpose of usage were significant predictors of usage patterns and age and the number of LTCs affected types of usage (see tree models two to six in "Appendix 3").

3.3.3 Favourability and positive impact

Favourite online service was modified by PAP service used and age group. Users with two or more LTCs and using the messaging service were most likely (30.4%) to rate the PAP

3.3.6 Changing doctors and the PAP

The likelihood of the availability of a PAP influencing the decision to change GP practice is shown in tree model 15. This comprised 72.3% (45,176/62,486) of respondents. This increased with the number of LTCs (range 68.7% nil LTCs to 77.4% three+ LTCs). Those most likely (82.6%, $n = 8984$) to respond that they would be influenced by PAP availability were those who used online booking, medication requests and medical record viewing. Those who were least likely (59.5%, $n = 3268$) to be influenced did not use online booking and had no LTCs.

3.3.7 Overview of significant/non-significant factors for binary response variables

Table 5 shows which factors are significant and non-significant predictors of the range of binary response variables considered in the fourteen tree models. The number of LTCs was a significant predictor in all bar one tree models (use of PAP for online messaging) as was the use of PAP for online booking in all bar two (self-completion and frequent use). The use of the PAP for medication requests was a significant predictor in all bar four tree models and patient age group in all bar five. The use of patient messaging was a significant predictor in four tree models and the use of the PAP for medical record viewing in three tree models.

4 Discussion

In a relatively large cross-sectional survey of NHS users of an online PAP in the UK, we found that they use it mainly for medication requests and online appointment bookings, and, to a lesser extent, medical record viewing and messaging. The vast majority of responders reported a positive impact from using the PAP. One in five rated the PAP as their favourite online service second only to online banking. Almost three out of four responders stated that availability of online access would influence their move to another general practice. Nonetheless, responders were reluctant to award a high monetary value to the PAP although this varied according to the number of LTCs: those users with a higher number being more willing to award value.

While the survey does not ask respondents to detail or elaborate on what they count as positive impact, we would suggest that such an articulation may be consistent with previous studies which report that users view online access to medical records as a positive development [4, 5, 21–26]. Overall, users see online access as "convenient, useful, usable and flexible" [23]. A 2014 audit of two UK primary care practices [23] who provided online access to a PAP found that users ($n = 226$) reported savings in time and money (from reduced travel and telephone calls) and being more active in the management of their health. This related to reviewing records online and recalling past consultations, often resulting in identifying omissions and discrepancies of information or outcomes of a consultation, and feeling more prepared for future consultations. Kruse et al. [27] in their systematic review of the effect

Table 5 Binary response variables

Tree no.	Binary response variable	Covariates					
		Age group	LTC	Online booking	Medication requests	Patient messaging	Medical record viewing
1	Self-completed?	✓	✓	✗	✗	✗	✗
2	Frequent user?	✓	✓	✗	✗	✓	✓
3	Using PAP for online booking?	✓	✓				
4	Using PAP for online medication requests?	✓	✓				
5	Using PAP for online patient messaging?	✗	✓				
6	Using PAP for online medical record viewing?	✓	✗				
7	Is PAP favourite online service?	✓	✓	✓	✗	✓	✗
8	Has PAP had a positive impact?	✗	✓	✓	✓	✗	✗
9	More valuable than online banking?	✗	✓	✓	✗	✓	✗
10	More valuable than online grocery shopping?	✓	✓	✓	✓	✗	✗
11	More valuable than online shopping?	✗	✓	✓	✓	✗	✓
12	More valuable than online social networks?	✓	✓	✓	✓	✗	✓
13	More valuable than online search engines?	✗	✓	✓	✓	✓	✗
14	PAP is worth more than £0 per annum?	✓	✓	✓	✓	✗	✗

Summary of which covariates are statistically significant (tick), statistically non-significant (cross). Blank is not applicable

of PAPs on quality outcomes found that patient satisfaction and patient retention were increased while Sorondo et al. [28] found improvements in mental wellbeing and lesser healthcare utilisation for patients with chronic conditions. Otte-Trojel et al. [29] suggested that PAPs—as a supplement to existing services—can result in improvements in patient behaviour and experiences, as well as clinical outcomes.

We found that responders did not place a high monetary value on the PAP. This finding aligns with studies from the US which also found that users were unwilling to pay for online services or were unwilling to pay more than a small sum [4, 5, 30]. This is despite a fundamental difference in the way in which healthcare services are paid for (cost to the patient (USA); free at the point of need (UK)). So, while users report increased satisfaction as a result of access to online services, this does not translate into a willingness to pay. We see this purely as a symbolic expression regarding value rather than one based on real monetary exchange.

We found higher usage of the PAP for medication requests and online booking of appointments compared with messaging and medical record viewing (although again it must be noted that we did not have access to data that identified enabled functions in each practice or of patient uptake). This ranking was also seen in a recent national UK GP Patient Survey (July 2017) which found that 11.8% of patients used a portal for medication requests, 8.9% for online appointment booking and 1.6% for viewing medical records (electronic messaging was not included in that survey) [31]. The same survey reports that 46.3% of patients are unsure of what online services their practices offer. The uptake of online services and the differential uptake of specific services raise important questions about access to such services. The general notion that users are not motivated or are incapable of using such services is not credible [24], suggesting, therefore, that other factors are constraining access to online services which need to be addressed. If a key constraining factor is usability from the users' perspective, then a way forward could be to involve them in the future design of online access systems [22, 24, 32]. If, however, the constraint emanates from the healthcare provider, perhaps as a consequence of concerns about increased workloads, then this may be misplaced as the evidence is both scarce and contradictory [7, 33–35].

4.1 Strengths and limitations

Although this was a large study and one of the few that has taken place in the UK, the findings are based on the experience of those people using the PAP offered by one, albeit leading supplier of primary care computer systems, who also designed and administered the survey. In addition, although we did not have the total number of registered users or the number of GP practices that used this supplier during the time period surveyed, we used data reported by Kontopantelis et al. [11] to note

that EMIS has a 56% market share and that this has remained the same since 2011. This is equivalent to 4199 practices and 32.2 million users (although obviously not all users are signed up to use the portal [36]). It must be noted, however, that this is clearly only a small proportion of the potential patient population: approximately 46 million [37]. We did not have access to data about the extent of PAP functions available, ease of use and patient uptake. This means that we do not know what services are enabled in each GP practice or of the influences which may have affected patient decisions about just what aspects of the PAP they chose to use or not use. Gender and other social characteristics were not available to us, yet evidence from other studies [4, 21, 24, 25, 38] suggests that these are important and that such factors—socioeconomic status, gender, race, social vulnerability—may affect access and usage. There is evidence to suggest that IT usage and acceptability may vary between participants within this category [33–35] most specifically in those aged 45–65 years [39]. However, trends may be changing with the proliferation of technology; for example, the latest Oxford Internet Institute study on internet usage indicates that gender is no longer a significant determinant [39].

We were, however, able to consider responses in terms of LTCs as well as the services used in the PAP. This is important as evidence from Newhouse et al. [34] suggests that as health conditions worsen the use of email by patients—where available—for healthcare communication increases. They found that email use, poor health, multimorbidity and number of physician visits are positively correlated. In addition, Palen et al. [33] found that where access to clinicians and to medical records was available, this resulted in an increase in usage of clinical services generally. This was consistent across age and chronic conditions.

Our findings will be of interest to a wide range of people—users, policy makers and healthcare professionals—and offer a timely patient-based perspective to inform ongoing attempts to enhance online services in the NHS [3]. The extent to which increased online access could mitigate the downward trend in patient satisfaction with access to GPs [31] also merits consideration, especially as 80% of general practices in England had the capability of giving the general population access to their medical records in 2014, but by 2017 only 8.9% were aware they could access their records and only 1.6% reported doing so [31]. By contrast, internet banking usage has increased from 30% (2007) to 60% (2016) [40]. Without trivialising the differences between banking and healthcare (for example the extensive advertising of online services in the banking sector), or overlooking negative consequences of online access, this striking difference in uptake of online services highlights how the former has embraced online services while the latter has lagged behind. The range of factors which influence adoption of online services is broad and includes: (1) concerns about privacy and security of data (although this does not seem to a barrier in the general practice context [4,

22]); (2) the notion that online access may increase health inequalities through uneven digital access and literacy especially amongst the elderly [3]; (3) the extent to which online access can support self-care and integration with other health and care data; (4) the extent to which online access is easy to obtain and use; (5) the extent to which online access is integrated into care processes and mitigate possible negative consequences for some patients [3, 4].

5 Conclusions

Most users place a relatively high value, though not monetary value, on the PAP and report a positive impact from using it. The potential for PAPs to enhance patient experience, especially for those with long-term conditions, appears to be largely untapped. Research and development addressing the reasons for non-use are also required.

Compliance with ethical standards

Ethical statement This type of study does not require ethical approval (University of Bradford Ethics Checklist: EC24675) because it meets the exemption criteria "Research limited to secondary use of information previously collected in the course of normal care (without an intention to use it for research at the time of collection), provided that the users or service users are not identifiable to the research team in carrying out the research" [41].

Appendix 1: Survey questionnaire

Part 1

1 Are you responding to this questionnaire as someone who primarily is using Patient Access for your own use or as a carer for someone else?

a. Self
b. Someone else

2 If you are responding as someone who is using Patient Access primarily for yourself what age bracket do you fall into?

a. 16–18
b. 19
c. 20
d. 21–64
e. 65–74
f. 75 and above

3 If you are responding as someone who is using Patient Access primarily as a carer for someone else what age bracket do they fall into?

a. Under 2 years
b. 2–7
c. 8–15
d. 16–18
e. 19
f. 20
g. 21–64
h. 65–74
i. 75 and above

4 Which of the following conditions or treatments do your answers relate to?

a. An acute condition
b. A preventative programme associated with at least one of the following: congestive heart failure, diabetes, asthma, angina, epilepsy, hypertension, influenza, pneumonia, chronic obstructive pulmonary disease (COPD), dehydration or gastroenteritis
c. Diabetes
d. Epilepsy
e. Breast cancer
f. Lung cancer
g. Colorectal cancer
h. Any other cancer
i. Cardiovascular disease
j. Dementia
k. Fragility fractures
l. Groin hernia
m. Hip replacement
n. Knee replacement
o. Liver disease
p. Lower respiratory tract infection
q. Maternity
r. Mental illness

s. Other long-term condition
t. Pressure ulcers
u. Respiratory disease
v. Serious mental illness
w. Stroke
x. Varicose veins
y. VTE (venous thromboembolism)
z. Clostridium difficile
aa. MRSA
bb. Asthma

10 Which of the following services do you use?

a. Online appointment booking
b. Medication requests
c. Patient messaging
d. Medical record viewer

Part 2

To help arrive at a view of the worth of Patient Access please answer the following questions. For question 8 please just answer with an amount in money terms.

1 Has Patient Access had a positive impact on your life?

a. Yes
b. Probably
c. Cannot say
d. Probably not
e. No

If no, please say why (free text)
2 How long have you been using Patient Access

1. Less than a year
2. 1–2 years
3. 3+ years

3 How often do you use Patient Access

1. More than once a week
2. Weekly
3. Fortnightly
4. Monthly
5. Every 6 months
6. Yearly

4 Have you ever used Patient Access between these times?

1. 6 am–2 pm
2. 2–10 pm
3. 10 pm–6 am

5 How do you compare it to other online services you use?

a. Banking—Patient Access is:

1. Worth a lot more
2. Worth a bit more
3. Worth about the same
4. Worth a bit less
5. Worth a lot less

b. Grocery shopping—Patient Access is:

a. Worth a lot more
b. Worth a bit more
c. Worth about the same
d. Worth a bit less
e. Worth a lot less

c. Other online shopping—Patient Access is:

a. Worth a lot more
b. Worth a bit more
c. Worth about the same
d. Worth a bit less
e. Worth a lot less

d. Social networks—Patient Access is:

a. Worth a lot more
b. Worth a bit more
c. Worth about the same
d. Worth a bit less
e. Worth a lot less

e. Search—Patient Access is:

a. Worth a lot more
b. Worth a bit more
c. Worth about the same
d. Worth a bit less
e. Worth a lot less

6 If you had to choose, which is your favourite online service?

a. Patient Access
b. Banking
c. Grocery shopping
d. Other online shopping
e. Social networks
f. Search

7 If you changed doctors, would the availability of Patient Access at that practice influence your decision?

a. Yes
b. No

8 How much do you think Patient Access is worth to you each year?

a. £10
b. £25
c. £50
d. £100
e. £250
f. £500
g. £1000
h. £2500
i. £5000
j. £10,000
k. £0

9 Considering all of these things, what worth in money terms do you feel Patient Access has to you?

10 Any other comments? [freetext]

Appendix 2: Profile of long term conditions

Characteristics	Number of long-term conditions				All
	Nil	One	Two	Three+	
Number of responders included	18,513 (29.6)	28,718 (46.0)	10,922 (17.5)	4333 (6.9)	62,486 (100)
Condition or treatment area					
Acute condition	2131 (11.5)	1726 (6)	1106 (10.1)	873 (20.1)	5836 (9.3)
Preventative treatment programme (LTC)	0 (0)	7447 (25.9)	5884 (53.9)	3502 (80.8)	16,833 (26.9)
Diabetes (LTC)	0 (0)	4163 (14.5)	3670 (33.6)	2295 (53)	10,128 (16.2)
Epilepsy (LTC)	0 (0)	354 (1.2)	384 (3.5)	279 (6.4)	1017 (1.6)
Breast cancer (LTC)	0 (0)	262 (0.9)	224 (2.1)	136 (3.1)	622 (1)

Characteristics	Number of long-term conditions				All
	Nil	One	Two	Three+	
Lung cancer (LTC)	0 (0)	24 (0.1)	50 (0.5)	45 (1)	119 (0.2)
Colorectal cancer (LTC)	0 (0)	71 (0.2)	83 (0.8)	96 (2.2)	250 (0.4)
Other cancer (LTC)	0 (0)	545 (1.9)	638 (5.8)	445 (10.3)	1628 (2.6)
Cardiac disease (LTC)	0 (0)	1176 (4.1)	1305 (11.9)	1153 (26.6)	3634 (5.8)
Dementia (LTC)	0 (0)	83 (0.3)	105 (1)	134 (3.1)	322 (0.5)
Fragility fractures	80 (0.4)	130 (0.5)	92 (0.8)	69 (1.6)	371 (0.6)
Hernia	56 (0.3)	118 (0.4)	75 (0.7)	49 (1.1)	298 (0.5)
hip replacement	354 (1.9)	565 (2)	346 (3.2)	175 (4)	1440 (2.3)
Knee replacement	329 (1.8)	741 (2.6)	444 (4.1)	214 (4.9)	1728 (2.8)
Liver disease (LTC)	0 (0)	89 (0.3)	167 (1.5)	202 (4.7)	458 (0.7)
Lower respiratory tract infection	25 (0.1)	56 (0.2)	68 (0.6)	108 (2.5)	257 (0.4)
Maternity care	267 (1.4)	132 (0.5)	36 (0.3)	7 (0.2)	442 (0.7)
Mental illness	2463 (13.3)	2352 (8.2)	1214 (11.1)	710 (16.4)	6739 (10.8)
Other long-term condition (LTC)	0 (0)	11,902 (41.4)	5176 (47.4)	3111 (71.8)	20,189 (32.3)
Pressure ulcer	29 (0.2)	55 (0.2)	43 (0.4)	50 (1.2)	177 (0.3)
Respiratory disease	280 (1.5)	492 (1.7)	586 (5.4)	534 (12.3)	1892 (3)
Serious mental illness (LTC)	0 (0)	187 (0.7)	202 (1.8)	217 (5)	606 (1)
Stroke	281 (1.5)	378 (1.3)	272 (2.5)	213 (4.9)	1144 (1.8)

Appendix 3

Tree Model 1 for self-completion of the online survey

Tree1

```
                                          [1]
                                       AgeGroup
                                       p < 0.001
                      {21<65, 65<75, 75+}            <21
                 [2]
              AgeGroup
              p < 0.001
        {21<65, 65<75}        75+
     [3]                            [6]
  AgeGroup                          LTC
  p < 0.001                        p < 0.001
  21<65    65<75            {0, 1}      {2, 3+}
  [4]        [5]            [7]          [8]              [9]
n = 41328  n = 13920     n = 3615     n = 1802        n = 1440
y = 0.988  y = 0.969     y = 0.883    y = 0.81        y = 0.588
```
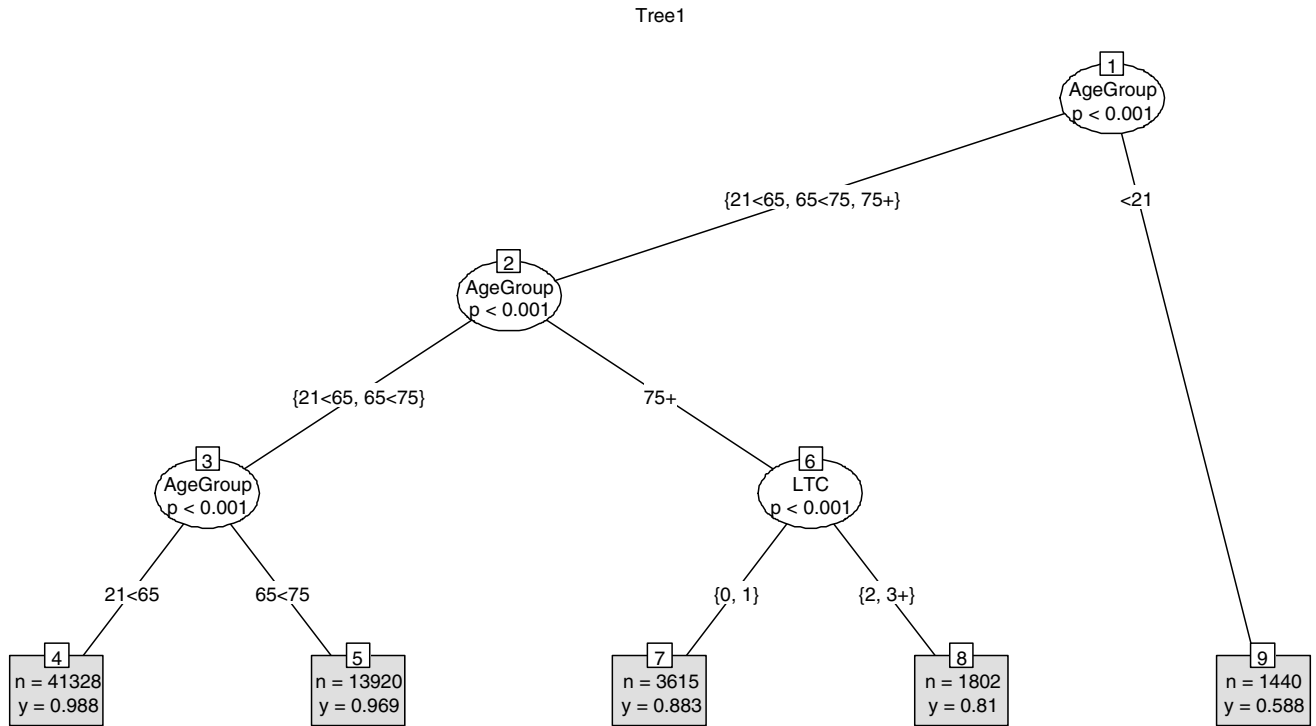
Tree Model 2 for frequent (< monthly) usage of the patient access portal

Tree2

```
                                    [1]
                                    LTC
                                  p < 0.001
                   {2, 3+}                          {0, 1}
             [2]                                            [9]
           med_rec                                        med_rec
           p < 0.001                                      p < 0.001
       Yes         No                                 Yes          No
    [3]              [6]                           [10]              [13]
    LTC              LTC                          pat_mes          AgeGroup
  p < 0.001        p < 0.001                      p < 0.001        p < 0.001
  3+    2          3+     2                      Yes       No    {<21, 75{21<65, 65<75}
  [4]    [5]      [7]      [8]                   [11]      [12]    [14]         [15]
n = 1073 n = 2262 n = 3202 n = 8526          n = 1899  n = 6022  n = 4118    n = 34172
y = 0.459 y = 0.363 y = 0.338 y = 0.248      y = 0.336 y = 0.256 y = 0.221   y = 0.152
```
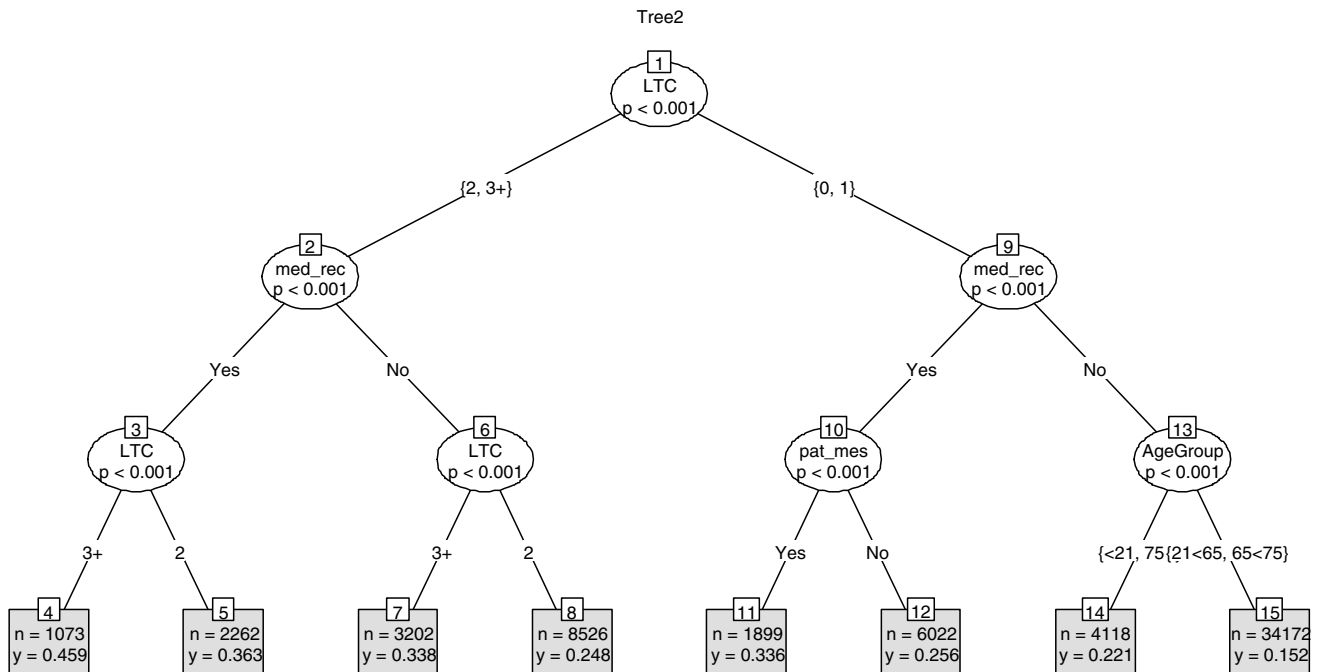
Tree Model 3 for using the Patient Access Portal for booking appointments online

Tree3
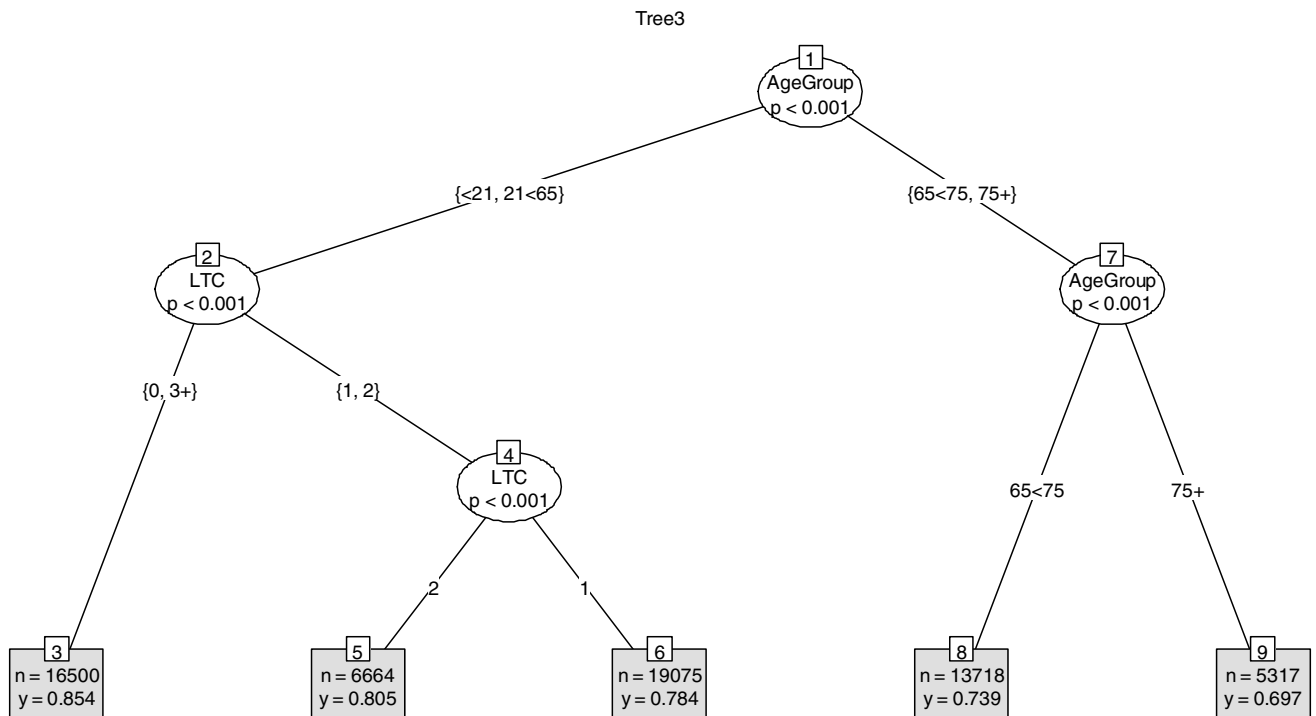
Tree Model 4 for using the Patient Access Portal for online medication requests

Tree4
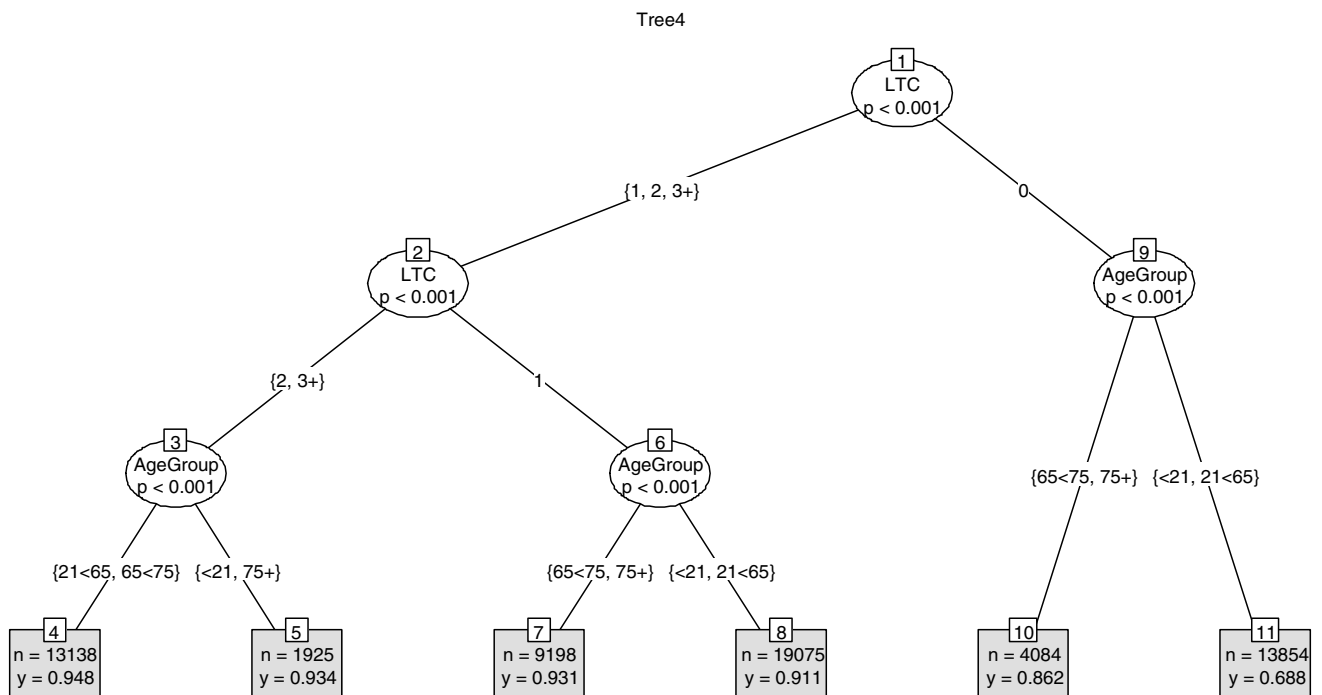
Tree Model 5 for using the Patient Access Portal for patient messaging

Tree5

```
                              ┌─┐
                              │1│
                              LTC
                            p < 0.001
                    {2, 3+}              {0, 1}
                 ┌─┐                              ┌─┐
                 │2│                              │5│
                 LTC                              LTC
               p < 0.001                        p < 0.001
          3+            2                    1              0
      ┌─┐            ┌─┐                 ┌─┐            ┌─┐
      │3│            │4│                 │6│            │7│
   n = 4275      n = 10788           n = 28273      n = 17938
   y = 0.158      y = 0.12            y = 0.091      y = 0.073
```
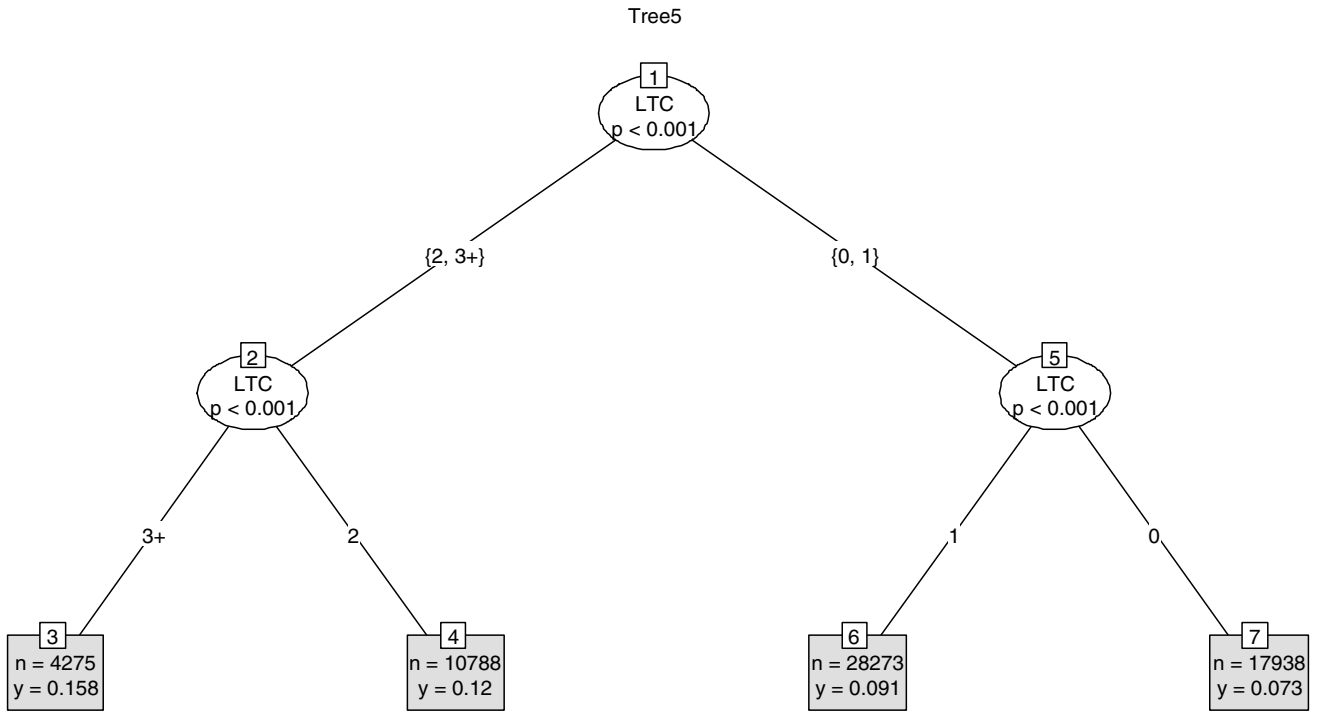
Tree Model 6 for using the Patient Access Portal for medical record viewing

Tree6

```
                                    ┌─┐
                                    │1│
                                    LTC
                                  p < 0.001
                      {2, 3+}                      {0, 1}
              ┌─┐                                        ┌─┐
              │2│                                        │9│
              LTC                                      AgeGroup
            p < 0.001                                  p < 0.001
        3+              2                    {21<65, 65<75}   {<21, 75+}
     ┌─┐            ┌─┐                        ┌──┐
     │3│            │6│                        │10│
   AgeGroup      AgeGroup                       LTC
   p < 0.001     p < 0.001                    p < 0.001
 65<75 {<21,21<65,75+}  21<65 {<21,65<75,75+}    1        0
  ┌─┐      ┌─┐       ┌─┐       ┌─┐          ┌──┐     ┌──┐        ┌──┐
  │4│      │5│       │7│       │8│          │11│     │12│        │13│
n = 1121 n = 3154  n = 6542  n = 4246    n = 25371 n = 16033  n = 4807
y = 0.277 y = 0.242 y = 0.224 y = 0.188   y = 0.182 y = 0.164  y = 0.143
```
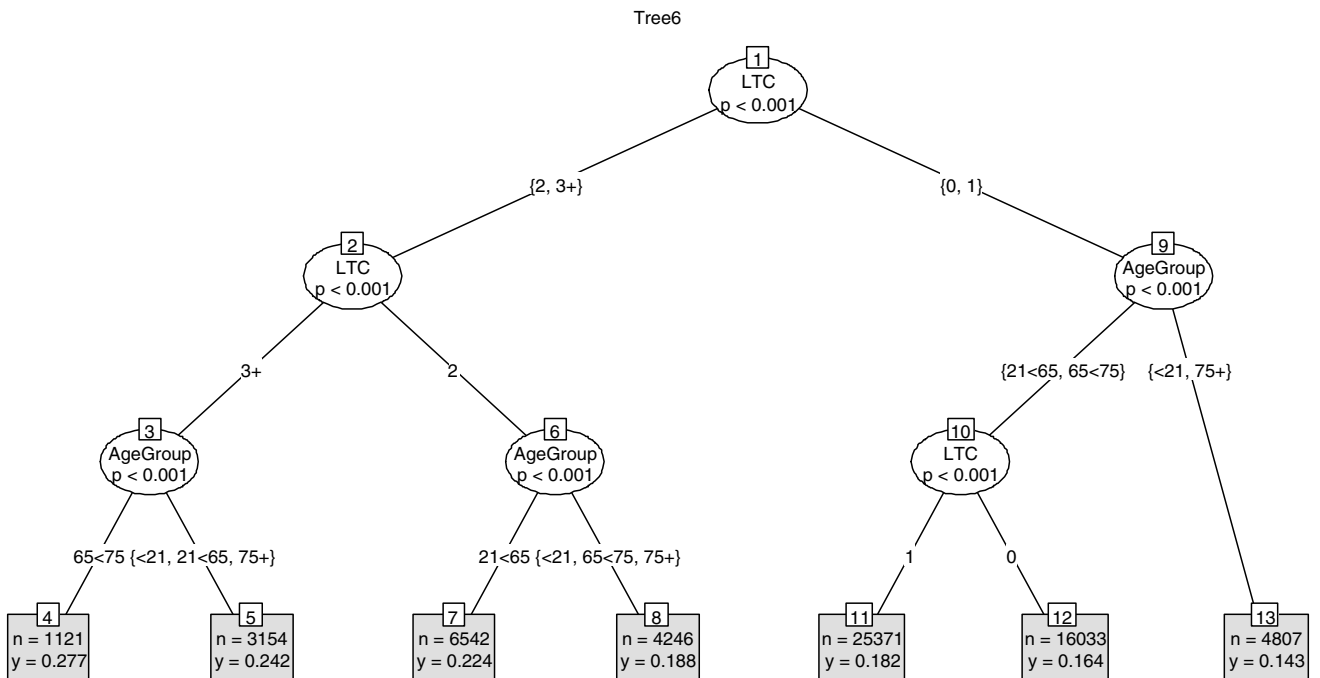
Tree Model 7 for rating the Patient Access Portal as their favourite online service

Tree7

```
                              ┌─┐
                              │1│
                             LTC
                           p < 0.001
                 {0, 1}                    {2, 3+}
            ┌─┐                                    ┌─┐
            │2│                                    │7│
         AgeGroup                              pat_mes
        p < 0.001                             p < 0.001
  {<21, 21<65, 65<75}      75+            Yes              No
       ┌─┐                                               ┌─┐
       │3│                                               │9│
     pat_mes                                       online_booking
    p < 0.001                                        p < 0.001
  Yes        No                                   Yes          No
```

┌─┐	┌─┐	┌─┐	┌─┐	┌──┐	┌──┐
│4│	│5│	│6│	│8│	│10│	│11│
n = 3577	n = 39065	n = 3517	n = 1941	n = 10039	n = 3030
y = 0.246	y = 0.179	y = 0.249	y = 0.304	y = 0.25	y = 0.207
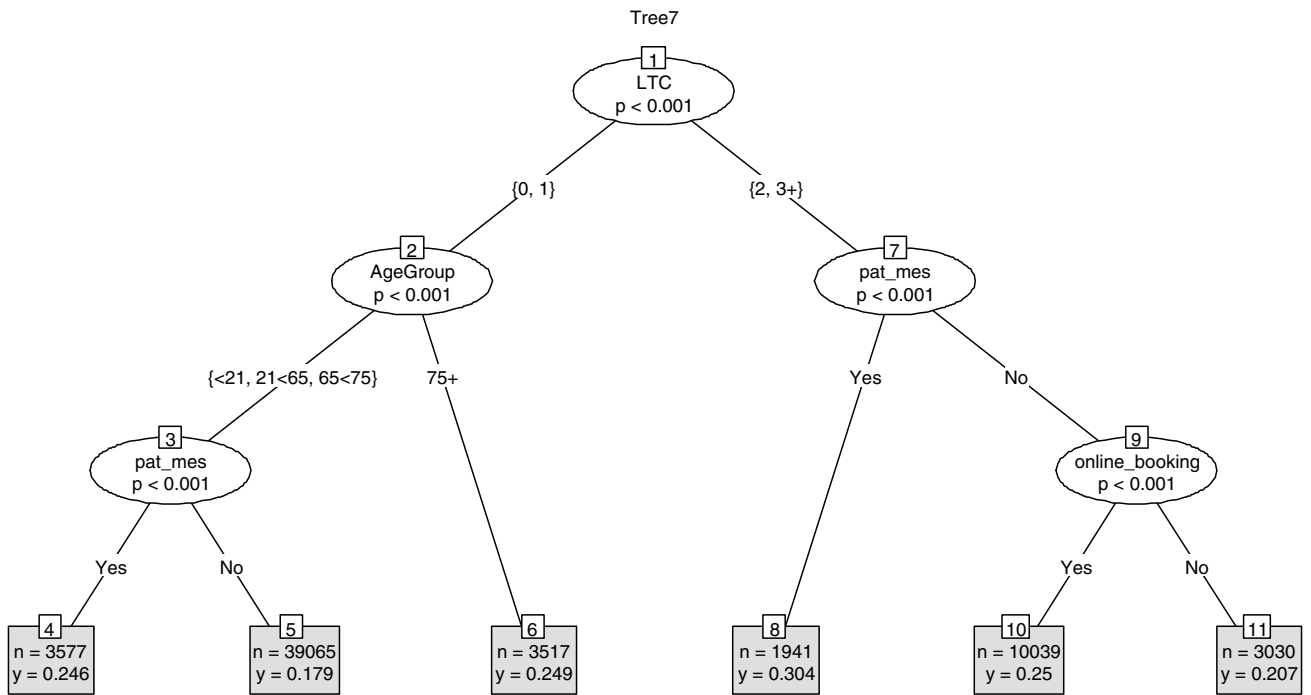
Tree Model 8 for patients reporting a positive impact from using patient access

Tree8

```
                                        ┌─┐
                                        │1│
                                     med_req
                                    p < 0.001
                           Yes                    No
                    ┌─┐
                    │2│
               online_booking
                 p < 0.001
            Yes              No
       ┌─┐
       │3│
      LTC
    p < 0.001
  {1, 2, 3+}        0
```

┌─┐	┌─┐	┌─┐	┌─┐
│4│	│5│	│6│	│7│
n = 30748	n = 10424	n = 12736	n = 8578
y = 0.776	y = 0.717	y = 0.633	y = 0.516
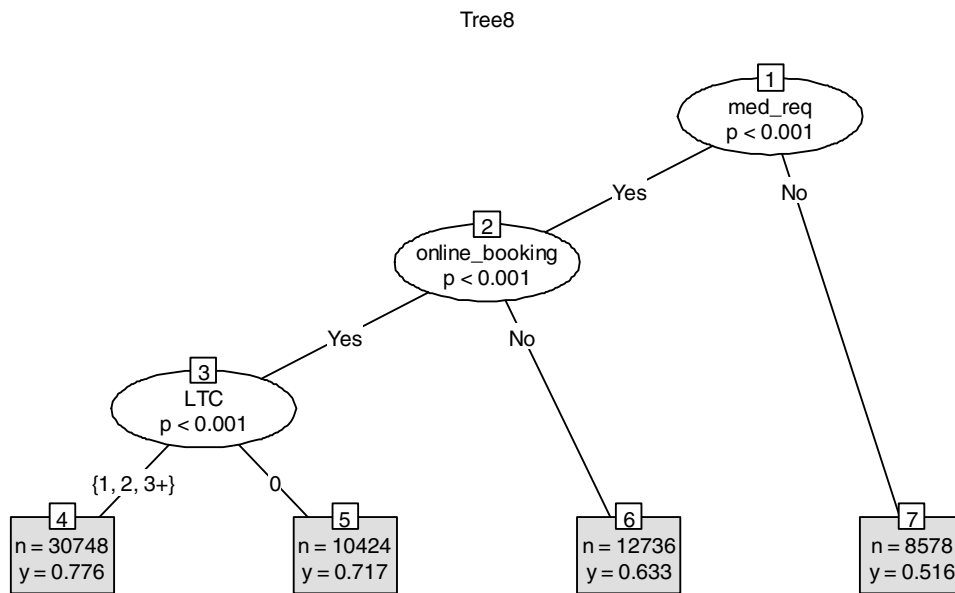
Tree Model 9 for rating the Patient Access Portal more than online banking

Tree9

```
                                    ┌─┐
                                    │1│
                                   LTC
                                  p < 0.001
                    {2, 3+}                      {0, 1}

              ┌─┐                                      ┌─┐
              │2│                                      │7│
         online_booking                          online_booking
           p < 0.001                                p < 0.001
       No            Yes                        No            Yes

    ┌─┐              ┌─┐                      ┌─┐              ┌─┐
    │3│              │4│                      │8│              │9│
  n = 3319        pat_mes                  n = 10006       pat_mes
  y = 0.335       p < 0.001                y = 0.253       p < 0.001
                No        Yes                            No        Yes

           ┌─┐        ┌─┐                          ┌──┐        ┌──┐
           │5│        │6│                          │10│        │11│
        n = 10156  n = 1722                      n = 33402  n = 3460
         y = 0.4    y = 0.46                      y = 0.323  y = 0.406
```
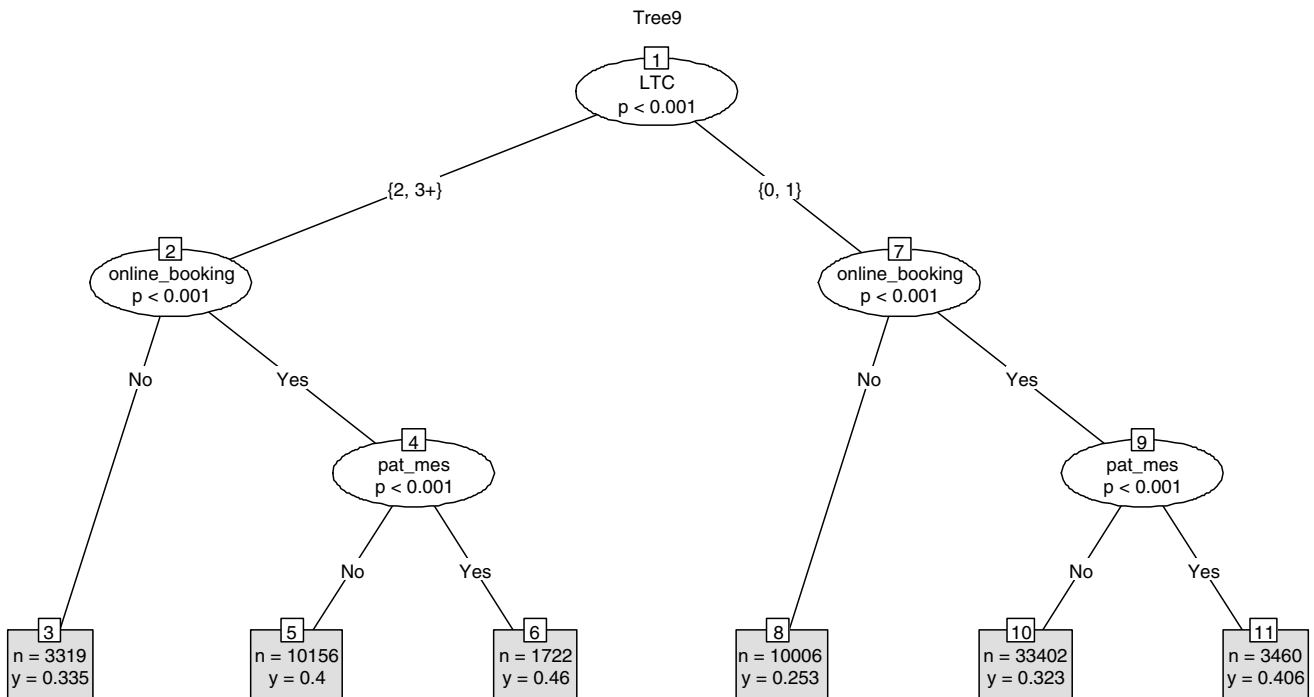
Tree Model 10 for rating the Patient Access Portal more than online grocery shopping

Tree10

```
                                    ┌─┐
                                    │1│
                               online_booking
                                 p < 0.001
                   Yes                          No

              ┌─┐                                      ┌─┐
              │2│                                      │7│
           med_req                                   LTC
          p < 0.001                                p < 0.001
       Yes           No                         0            {1, 2, 3+}

    ┌─┐              ┌─┐                      ┌─┐              ┌─┐
    │3│              │6│                      │8│              │9│
  AgeGroup       n = 7694                  n = 3141        AgeGroup
  p < 0.001      y = 0.509                 y = 0.415       p < 0.001

 {<21, 65<75, 75+}  21<65                            {65<75, 75+}  {<21, 21<65}

    ┌─┐              ┌─┐                          ┌──┐          ┌──┐
    │4│              │5│                          │10│          │11│
 n = 13179      n = 27588                      n = 4171     n = 5901
 y = 0.571      y = 0.627                      y = 0.452    y = 0.517
```
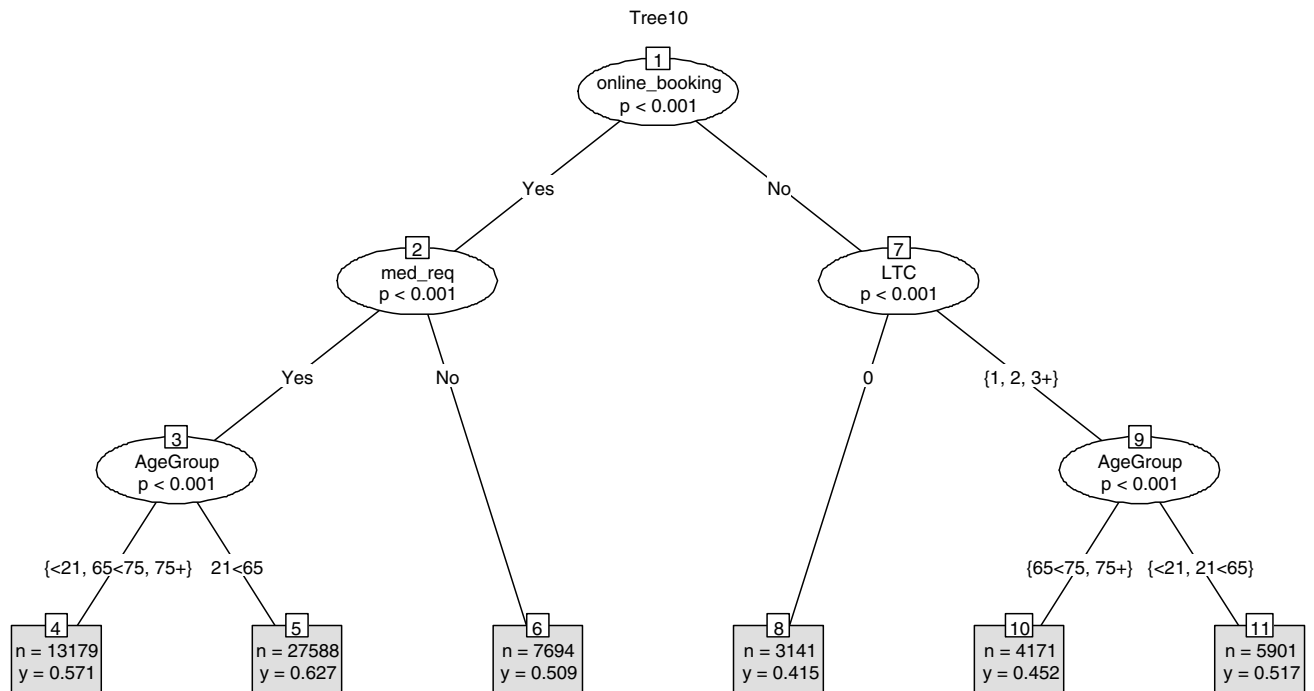
Tree Model 11 for rating the Patient Access Portal more than online shopping

Tree11

```
                              ┌─1─┐
                            online_booking
                              p < 0.001
                    No ───────┘      └─────── Yes
                   ┌─2─┐                        ┌─7─┐
                   LTC                          LTC
                  p < 0.001                   p < 0.001
          {0, 1} ─┘    └─ {2, 3+}    {2, 3+} ─┘    └─ {0, 1}
          ┌─3─┐                      ┌─8─┐            ┌─11─┐
          LTC                      med_rec          med_req
        p < 0.001                 p < 0.001        p < 0.001
       0 ─┘  └─ 1                Yes ─┘ └─ No      No ─┘ └─ Yes
```

4	5	6	9	10	12	13
n = 3143	n = 6769	n = 3291	n = 2891	n = 8906	n = 6934	n = 29682
y = 0.382	y = 0.44	y = 0.506	y = 0.672	y = 0.604	y = 0.463	y = 0.559
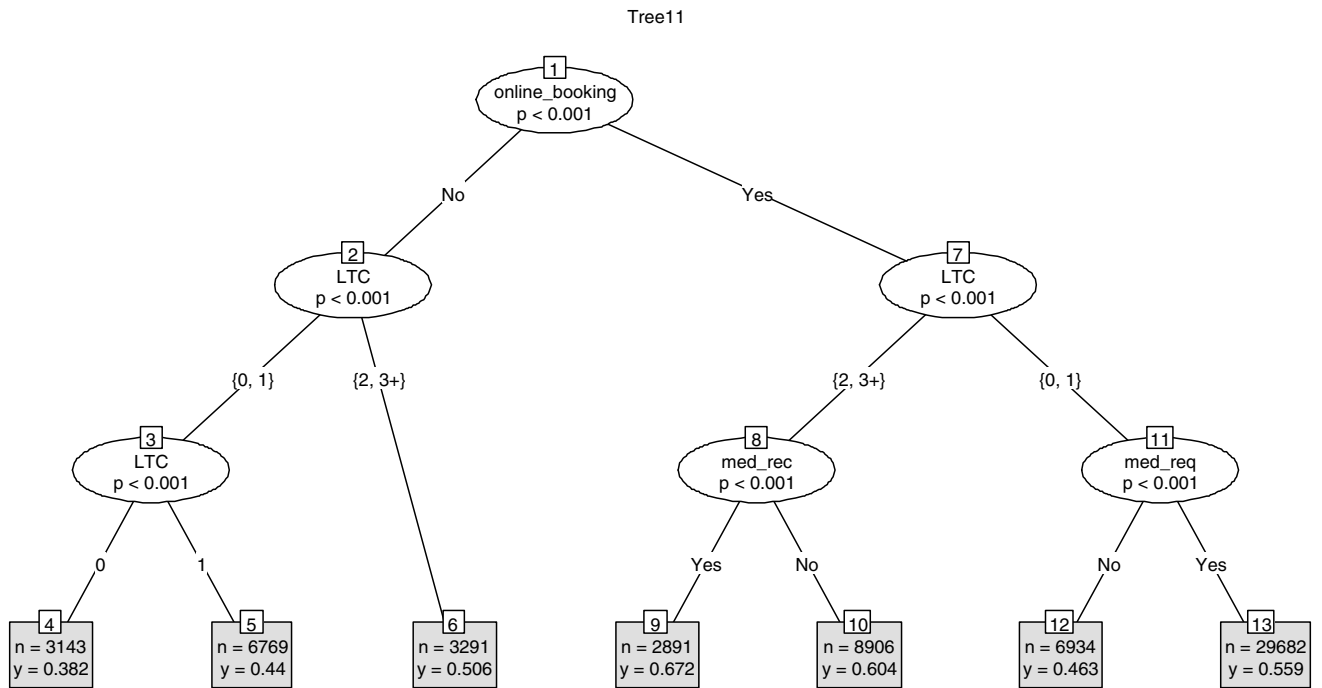
Tree Model 12 for rating the Patient Access Portal more than online social networks

Tree12

```
                              ┌─1─┐
                            online_booking
                              p < 0.001
                   Yes ───────┘      └─────── No
                   ┌─2─┐                        ┌─9─┐
                 med_req                        LTC
                p < 0.001                     p < 0.001
        Yes ─┘      └─ No         {2, 3+} ─┘      └─ {0, 1}
       ┌─3─┐         ┌─6─┐          ┌─10─┐          ┌─13─┐
     med_rec         LTC          AgeGroup        AgeGroup
    p < 0.001      p < 0.001      p < 0.001       p < 0.001
   No ─┘ └─ Yes   0 ─┘ └─ {1, 2, 3+}
```

{<21, 65<75, 75+21<65   75{<21, 21<65, 65<75}

| 4	5	7	8	11	12	14	15
n = 31857	n = 8886	n = 4718	n = 2956	n = 1591	n = 1712	n = 1058	n = 8839
y = 0.605	y = 0.674	y = 0.488	y = 0.55	y = 0.521	y = 0.581	y = 0.396	y = 0.48
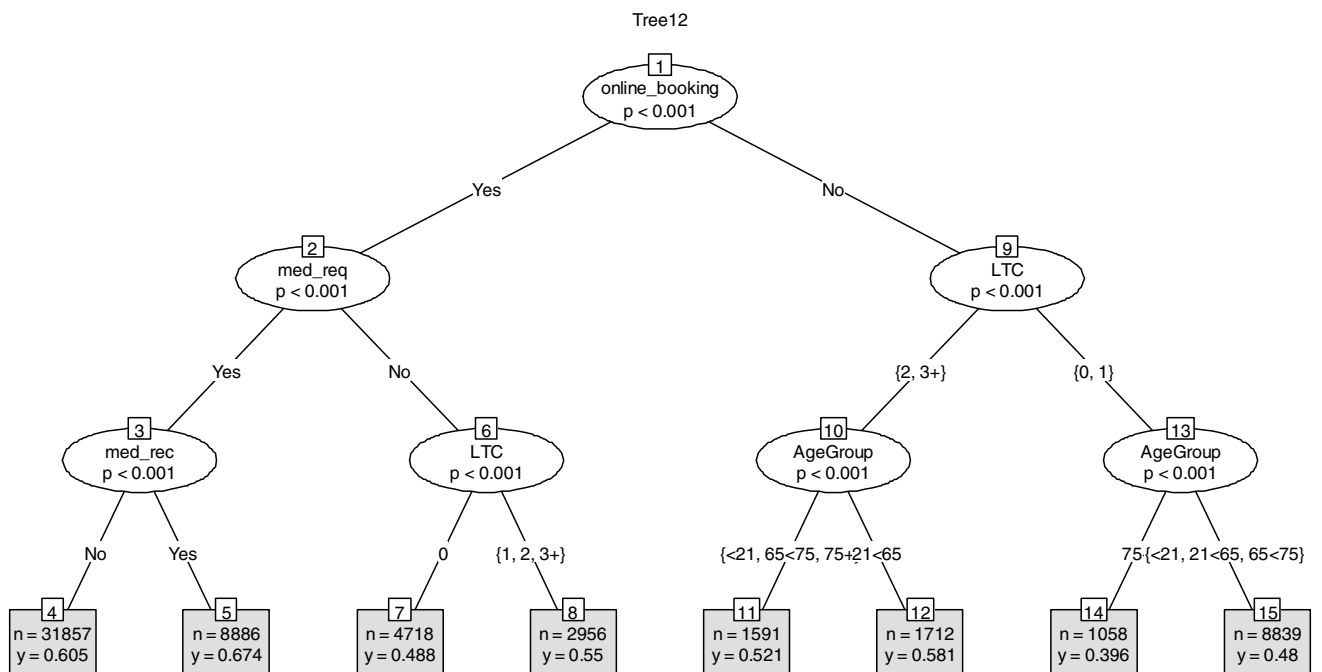
Tree Model 13 for rating the Patient Access Portal more than online search engines

Tree13

```
                                    ┌─┐
                                    │1│
                                    LTC
                                  p < 0.001
                         {2, 3+}              {0, 1}
                    ┌─┐                              ┌─┐
                    │2│                              │7│
              online_booking                    online_booking
                p < 0.001                         p < 0.001
            Yes          No                    Yes          No
        ┌─┐                                ┌─┐
        │3│                                │8│
      pat_mes                            med_req
     p < 0.001                          p < 0.001
    Yes      No                        Yes      No
```

┌─┐	┌─┐	┌─┐	┌─┐	┌──┐	┌──┐
│4│	│5│	│6│	│9│	│10│	│11│
n = 1722	n = 10140	n = 3312	n = 29805	n = 6979	n = 9976
y = 0.533	y = 0.46	y = 0.395	y = 0.41	y = 0.343	y = 0.319
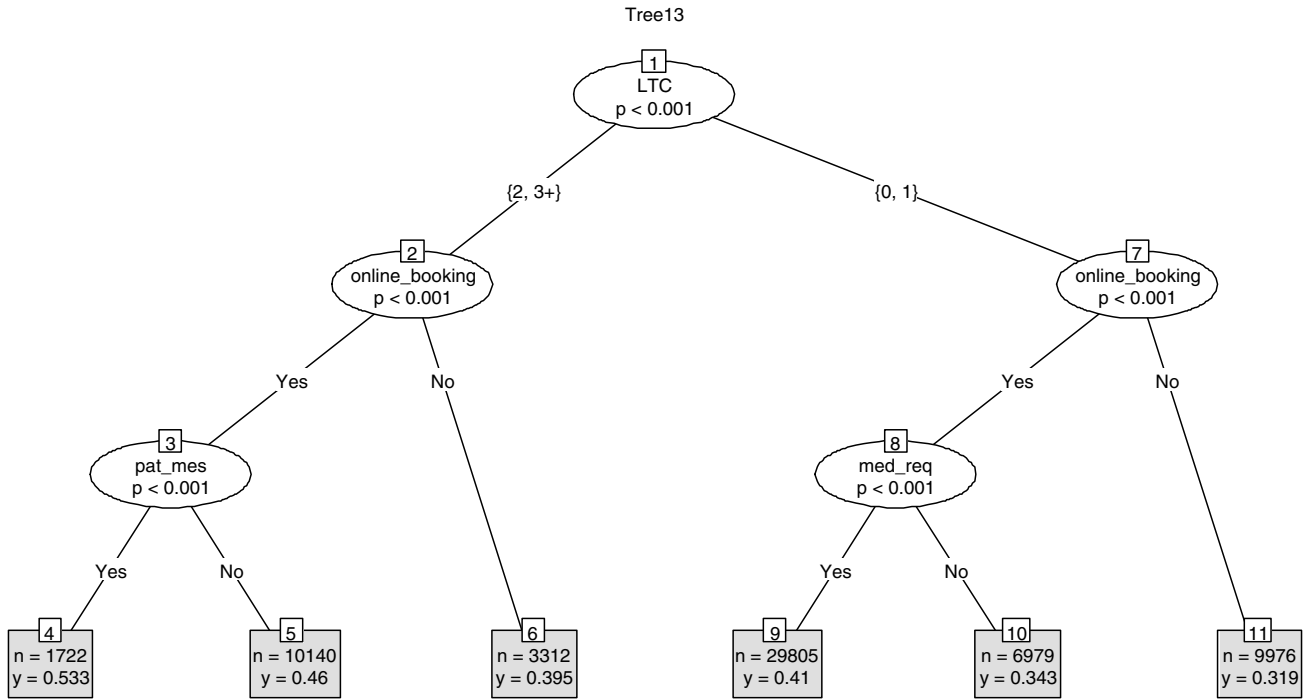
Tree Model 14 for those valuing patient access at more than £0 per annum

Tree14

```
                              ┌─┐
                              │1│
                            med_req
                           p < 0.001
                    No                   Yes
              ┌─┐                              ┌─┐
              │2│                              │5│
            AgeGroup                      online_booking
            p < 0.001                       p < 0.001
      21<65    {<21, 65<75, 75+}        No              Yes
                                    ┌─┐                      ┌─┐
                                    │6│                      │9│
                                    LTC                      LTC
                                 p < 0.001                 p < 0.001
                             {1, 2, 3+}     0            0      {1, 2, 3+}
```

┌─┐	┌─┐	┌─┐	┌─┐	┌──┐	┌──┐
│3│	│4│	│7│	│8│	│10│	│11│
n = 6466	n = 2112	n = 9885	n = 2851	n = 10424	n = 30748
y = 0.671	y = 0.73	y = 0.751	y = 0.671	y = 0.767	y = 0.821
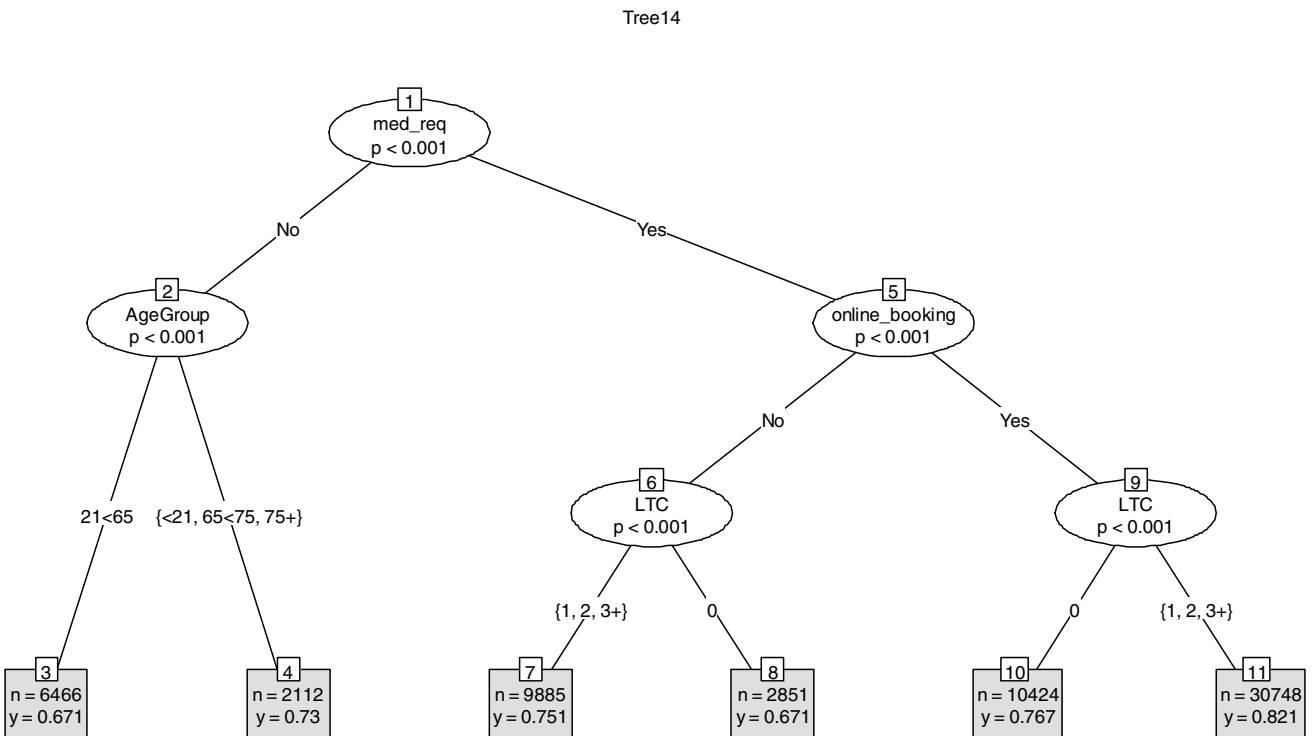
Tree Model 15 examining which factors are associated with responses to the question "If you changed doctors, would the availability of Patient Access Portal at that practice influence your decision?"

Tree15
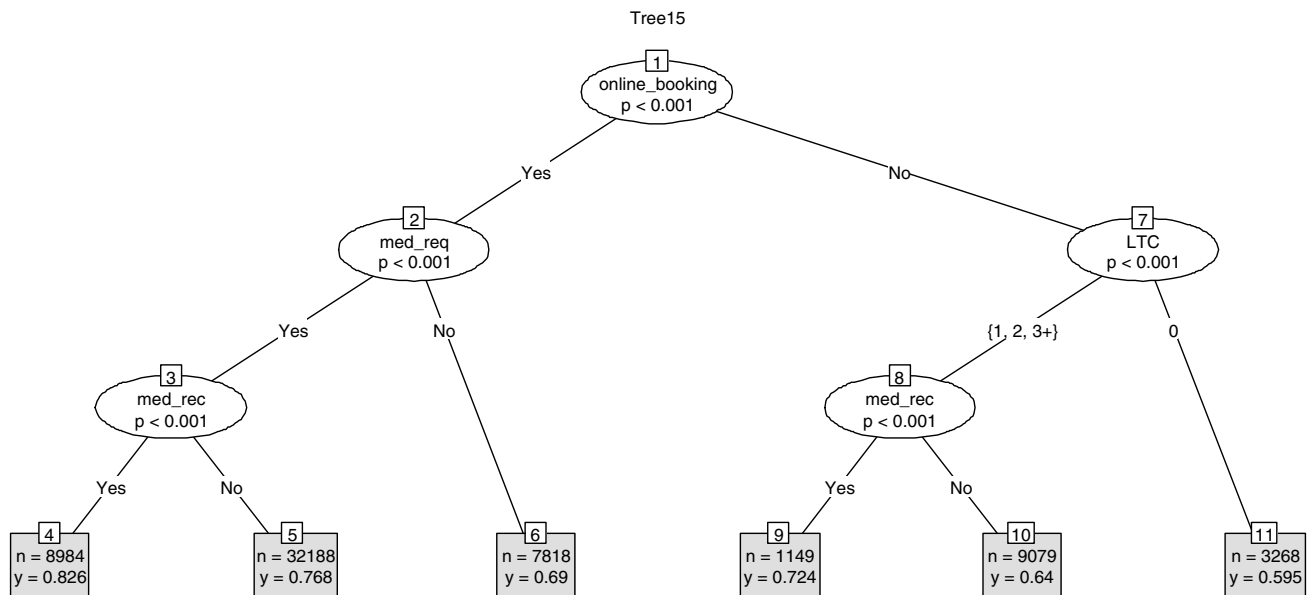
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