National Health IT Board

Resource impacts of ePortals for general practice

Tom Love, Rohan Boyle

15 May 2015

sapere research group

About Sapere Research Group Limited

Sapere Research Group is one of the largest expert consulting firms in Australasia and a leader in provision of independent economic, forensic accounting and public policy services. Sapere provides independent expert testimony, strategic advisory services, data analytics and other advice to Australasia's private sector corporate clients, major law firms, government agencies, and regulatory bodies.

Wellington Level 9, 1 Willeston St PO Box 587 Wellington 6140 Ph: +64 4 915 7590 Fax: +64 4 915 7596	**Auckland 1** Level 17, 3-5 Albert St PO Box 2475 Auckland 1140 Ph: +64 9 913 6240 Fax: +64 9 913 6241	**Auckland 2** Level 1, 441 Queen St PO Box 2475 Auckland 1140 Ph: +64 9 354 4388
Sydney Level 14, 68 Pitt St GPO Box 220 NSW 2001 Ph: +61 2 9234 0200 Fax: +61 2 9234 0201	**Canberra** Unit 3, 97 Northbourne Ave Turner ACT 2612 GPO Box 252 Canberra City, ACT 2601 Ph: +61 2 6267 2700 Fax: +61 2 6267 2710	**Melbourne** Level 2, 65 Southbank Boulevard GPO Box 3179 Melbourne, VIC 3001 Ph: +61 3 9626 4333 Fax: +61 3 9626 4231

For information on this report please contact:

Name:	Tom Love
Telephone:	+64 4 915 7590
Mobile:	+64 21 440 334
Email:	tlove@srgexpert.com

Contents

Tables

Figures

Executive summary

Patients First is working with the National Health IT board to develop support for practices to make effective use of patient portals. As one component of this work, Sapere Research Group was commissioned by Patients First on behalf of the National Health IT Board to model the impact of patient portal implementation on general practice costs and revenues to help practices better understand the financial and workload impacts of implementing portals.

Our analysis of portal implementation involved three steps:

- step one: background research
- step two: design and assumptions
- step three: resource modelling

We interviewed key stakeholders to identify enablers and barriers to portal implementation and understand how implementation played out in practice. From the interviews several key themes emerged which helped guide the assumptions in the design stage of the model.

The design parameters for the modelling were established based on the information gathered in the background research and supplemented by data drawn from previous Sapere Research Group work analysing nursing and medical workload and revenue patterns. The established parameters were transposed into a general practice financial model developed by Sapere which has been applied extensively across Integrated Family Health Centre projects and formed the core of the resource modelling.

The resource modelling examined 'what if' scenarios of the financial consequences for practices based on the design parameters which emerged from step one and step two. This involved exploring the effect of various parameters such as patient uptake, practice size, number of "clinical queries" per patient and substitution of GP workload on the release of resources following portal implementation. Multiple parameters were then manipulated at once to observe more dynamic scenarios. This included modelling the responsiveness of patient demand to imposed financial costs.

Several key results were identified which will support practice to implement ePortals and achieve a positive financial result. These include:

- Scale of ePortal enrolment is essential to successful outcomes for practices
- Considerable resource release can be realised through low-level tasks
- Substitution between online clinical queries and in-person consults has a decreasing effect of GP workload and a small but positive effect on net monetary gains
- A high volume of online clinical queries can dampen a practices finances and increase GP workload. However the rate of substitution mitigates this effect to a large extent
- Cost-recovery models will affect practices on a case-by-case basis, but there are several broad options for practices to consider.

1. Background

Patients First is working with the National Health IT board to develop support for practices to make effective use of patient portals. As one component of this work, Sapere Research Group was commissioned by Patients First on behalf of the National Health IT Board to model the impact of patient portal implementation on general practices costs and revenues.

A patient portal is a secure online tool for patients to access their health information and interact with their general practice. Patient portals have the potential to streamline a number of clinical processes and improve practice communication with stakeholders. The anticipated benefits include:[1]

- saved time for practice staff
- improved workflow management
- reduced phone tag
- reduced paper work
- automated patient recalls and appointment reminders
- improved safety by giving patients a written record of clinical instructions
- 24/7 convenience for patients without extending practice hours
- Increased patient's awareness and ability to manage their own health

However, some stakeholders in the primary care sector are unclear about the financial and workload impacts of implementing portals.

The purpose of the modelling is to better understand how patient portals affect general practices by identifying where benefits can be realised and quantifying the amount. The results from the modelling are intended to support a more informed discussion and give general practices guidance about effective options for implementation.

[1] http://healthitboard.health.govt.nz/system/files/documents/pages/patient-portal-brochure_1.pdf

2. Approach

2.1 Methods

Our analysis of portal implementation involved three steps:

- step one: background research
- step two: design and assumptions
- step three: resource modelling

Our approach draws on a strong foundation of knowledge from the sector about existing examples of portal use and the barriers to uptake. This formed the basis to designing useful analysis which would be meaningful to a wide audience.

Each step is discussed in detail below.

2.1.1 Background research

We interviewed key stakeholders to identify enablers and barriers to portal implementation and to understand how implementation played out in practice.

Semi-structured phone interviews were conducted with both GPs and practice managers across the country from a range of general practice sizes. The interviews focussed on:

- practices experience setting up the patient portal
- how practices use the portal
- the impact on practice workload
- whether practices charge for the service

Interviewees were particularly responsive to the last three issues – consequently discussion around which typically dominated the interviews. This allowed us to explore in detail the types of tasks which patient portals compliment, time required to complete activities using the portal and the price-sensitivity of patients to charges for the service.

We wrote up each interview and compared the responses as they occurred. Several "key" themes quickly emerged from the interviews and are discussed later in the report.

The information from the interviews were then used to derive the key assumptions in the design phase.

2.1.2 Design and assumptions

Design parameters for the resource modelling were established based on the information gathered in the background research stage. This was supplemented by data drawn from previous Sapere Research Group work analysing nursing and medical workload and revenue patterns. The established parameters are outlined further in this report.

We consulted with key experts to validate the design parameters and assumptions. The resulting output included:

- design parameters about which there was relatively little uncertainty and formed the core of the model
- design parameters which there was uncertainty and were subject to more detailed exploration with different scenarios during the modelling phase

In general, the design parameters with relatively little uncertainty were constructed based on previous financial modelling and nurse diary information; whereas the design parameters with relative uncertainty were derived primarily from the information we retrieved in the interviews. The details of these data sources are discussed in the proceeding section

At the end of this stage we generated a short interim report for Patients First documenting the barriers and enablers which had been identified and set out the confirmed design parameters for the modelling for feedback. Face-to-face discussion with Patients First was also included in the steering process.

2.1.3 Resource modelling

Estimating profits and losses

Our approach to the modelling assumed that for a given practice there are a fixed number of activities; where the frequency of the activity and time required for each activity varied. The percentage of GP, nurse and admin staff time required to complete each activity also varied. [2]

A consultation fee was charged per activity which the practice captured as activity revenue. Practices also received capitation revenue.[3] The sum of the calculated revenue stream, plus a fixed "other revenue stream", equals the practices total revenue.

Calculating the activity revenue involved two sub calculations: a) the total number of consultations; and b) the average fee for each activity.

The total number of consultations was calculated by first dividing the total practice population into sub age-groups. Table 1 outlines the proportion of each sub group in relation to the total enrolled population.

[2] A complete list of the activities included in our modelling along with the time required and the proportion of GP, nurse and admin staff involvement is presented in the results section of this report

[3] Capitation rates were valid at 30 June 2014

Table 1 Enrolled population

Age-group	Gender	Percentage of practice population
< 6 years old	F	5%
	M	5%
6-44 years old	F	27%
	M	24%
45-64 years old	F	13%
	M	12%
65+ years old	F	7%
	M	6%

A multiplying factor was assigned to each age group representing the average number of consultations per year for a patient in their respective age group. These factors followed a U-shape pattern; that is the number of consultations per patient was assumed to be relatively high for the youngest demographics, fall as age increased and then rises again for the older demographics.

In addition we estimated a further number of consultations for activities such as causal patients, ACC, immunisations and scripts based on the percentage of enrolled population. The sum of all age group consultations, plus all additional consults, equals the total annual number of consultations for a practice.

Table 2 outlines the required calculation for the number of annual consultations and the associated fee.

The activities below were further broken-down to reflect the medical specific consultations within a practice. A percentage of the total number of annual consultations was allocated to each specific consultation and was charged a weighted average fee. Table 3 summaries the consultation break down and the associated average fee.[4]

[4] Fees are for GP consultations. For nurse only consultations we divided the consultation fee by 1.5.

Table 2 Multiplying factors for calculations and fees

Activity	Multiplying Factor	Calculation Type	Fee
Consults < 6 years old	4.4	Per population category	$0.00
Consults 6-44 years old	2.5	Per population category	$26.09
Consults 45-64 years old	4	Per population category	$34.78
Consults 65+	6	Per population category	$34.78
Casual	0.3	Per enrolled population	$60.87
ACC	0.3	Per enrolled population	$60.87
Immunisations	0.4	Per enrolled population	$17.39
CCM	0.15	Per enrolled population	$61.02
Scripts	0.5	Per enrolled population	$17.39

Table 3 Consultation breakdown and fees

Type of Consultation	Percentage of Total Annual Consultations[5]	Average fee
Stable Chronic	20%	$30.12
Acute	20%	$39.13
Unstable Chronic	15%	$30.12
Preventative Screening	11%	$30.12
Trauma	9%	$30.12
ELL/Community	4%	$30.12
Procedure Surgery	2%	$30.12
Scripts	10%	$17.39
Immunisation	8%	$17.39
Misc	3%	$30.12

[5]Note the sum of the percentage of total annual consultations is 102 percent. This is a result of rounding the percentages to the nearest whole number. The percentages correctly sum to 100 percent in the model.

The average acute consultation fee was greater than the weighted average fee because it included both the weighted average fee and the ACC fee.

Practice activity revenue was then equal to the product of multiplying the total number of annual consultations for each activity by the associated average fee.

We also calculated the number of FTE required completing all the activities within a practice based on the number of annual consultations. The FTE requirement (in terms of hours per year) for GPs, nurses and admin staff was multiplied by their respective hourly rate to generate the practices total wage costs.[6] For simplicity we assumed the following hourly rates:

- GP – $100
- Nurse – $30
- Admin staff – $20

Portal implementation introduced additional activities for the practice and changed the time required for some activities as well as the percentage of GP, nurse and admin time required completing these tasks. Consequently, the model calculated different total wage costs and total practice revenue. By comparing the net difference in total practice costs and total revenue before portals (referred to as status quo for the remainder of the report) against the net difference after portals were introduced (referred to as ePortal for the remainder of the report) we are able to assess the financial impact of implementing patient portals on general practices.

Scenario analysis

The modelling examined 'what if' scenarios of the financial consequences for practices based on the agreed design parameters. Several scenarios were modelled to identify the parameters which support positive financial outcomes for general practices.

For example, first we considered the effect of each design parameter individually while keeping the remaining parameters constant at a baseline level (derived from step one and two and outlined later in the report). This involved exploring the effect of various design parameters such as patient uptake, practice size, number of online clinical queries per patient, substitution of GP workload between in-person consultations and online queries. We then further manipulated multiple parameters at once to observe outcomes in more dynamic scenarios. This included modelling the responsiveness of patient demand to financial costs.

In this way we were able to hone in on the relevant parameters for successful patient portal implementation and understand how their relationships influenced general practices financial outcomes.

While the aim of the resource modelling was to understand the impacts of the design parameters upon the financial performance of patient portals in general practice, our analysis tended to focus on the release of resources following ePortal implementation rather than the net difference in practices' financials. Both results are reported but calculating the net

[6] Total practice costs also include annual lease cost and other and other fixed costs, and variable costs.

difference in practices' financials requires additional assumptions regarding how the value of the released resources are realised; we considered the results should be interpreted with specific focus on the design parameter relationships and trends rather than the specific monetary value calculated.

In addition, general practices are likely to vary in how they wish to realise the released resources – for example two reasonable responses to released resources may be expand practice size and while retaining current staff numbers or alternatively keep the same practice size and realise resources through reorganising the practice's staff structure. For the purpose of this analysis we monetised the value of the released resource as the sum of the change in FTE (in terms of hours per year) for GPs, nurses and admin staff multiplied by their respective cost per hour.

2.2 Sources of information

Three sources of information were utilised for the analysis including:

- Interviews with key stakeholders
- Previous financial modelling
- GP and nurse diary information

Several assumptions in the modelling were determined following the interviews with stakeholders. The number of interviews was not extensive but included a broad range of practices varying in the level patient portals were integrated into their practice. Moreover the responses from interviewees were noticeably consistent despite a less than desirable sample size.

The basis for resource modelling was derived from the practice financial model Sapere developed and has been applied extensively across Integrated Family Health centre projects. This model has achieved acceptance from practice owners and managers across a range of general practices in different circumstances.

The parameters in the practice financial model were established following previous analysis by Sapere of nursing and medical workload and revenue patterns from GP and nurse diaries. The diary data was aggregated to provide benchmarks for GP and nurse activity within a practice. We transposed these parameters to form the core of the resource modelling.

3. Results

3.1 Themes from interviews

The following key themes emerged for the interviews:

Pre-installation concerns generally weren't realised

Four main concerns were consistently raised in regards to patient portal implementation:

- Increased workload
- Legal liability
- Privacy risks
- Persistent emailers

GPs were particularly concerned that their workload would increase due to a high volume of emails. There were also fears that the inability to examine in person would lead to a misdiagnosis and expose doctors to legal liability. The security of uploaded content was also often questioned

However in practice these concerns generally weren't realised. There had been no significant change in GP workload; as several interviewees explained patients weren't asking for anything that they weren't already asking for. Practices could also control the speed of patient uptake to smooth any workload changes.

Interviewees stressed that doctors need to remember that they're in control – as soon as they don't feel comfortable answering a patient's questions they can simply tell the patient to make an appointment. There were also no serious reports of persistent emailers (and any serial offenders tended to be already known by the practice).

Scale of uptake important for benefits to be realised

Uptake varied considerably among the practices interviewed. This variation appeared to depend on the size of practice, the phase in which the portal had been implemented and whether everyone in the practice committed to promote the portal – among other factors. Once uptake reached a certain threshold the process became self-generating by word of mouth; however prior to this considerable effort was required to increase uptake.

Interviewees agreed the portal could deliver efficiency benefits from streamlining a number of processes however few had yet to reach a large enough uptake for these to be realised in a meaningful way.

Benefits primarily realised through improving the efficiency of low-level tasks

Benefits from the patient portal primarily occurred through reducing the distance between the patient and the doctor or nurse. Clinical processes such as repeat scripts, lab results and follow-up questions often involved double handling information

For example if a patient called the practice enquiring about a repeat script, admin staff typically used a nurse to pass the patients query on to the GP. The GP then signed it off and

gave the prescription and/or advice to the nurse who then relayed this information to the admin staff – and then finally the patient got an answer. Patients can take their enquiry directly to the doctor with patients portals, saving GP, nurse and particularly admin time.

Reducing the distance between the patient and the doctor or nurse also increased the accuracy and speed of communication, saving time across the practice and reduced errors.

Further benefits included improvements in patient health literacy from more readily available information regarding their consultations and reduced time taken for patients to get through the practice because they contacted the doctor directly with their concern prior to their consultation

Imposing a financial cost to patients was a significant barrier to uptake

Practices were inconsistent with their methods of charging for portal access. Some adopted a subscription model where patients paid a yearly retainer – anywhere up to $30 was considered reasonable. Alternatively, one practice charged for online consultation – a $5 fee. Further still, some practices did not charge a fee at all and considered the portal as "added-value".

Several practices interviewed had tried a subscription fee and found uptake was very slow. Once they changed to a pay-as-you go scheme the speed of uptake increased noticeably. However we were informed that a subscription model had been successfully implemented in a number of general practices in the Midland region.

Patients may be reluctant to pay an upfront cost for a new technology if they are unsure how the portal adds value to them. Once the portal is established and benefits are well understood, patients could be more willing to pay a subscription fee.

Potential for substitution of doctor workload

Patient portals appeared to reallocate GPs workload rather than reduce it. That is, GPs were in contact with more patients during the day but the contact was less intensive. GPs also had more flexibility around contacting their patients (i.e. GP can email a patient when they have a spare minute rather than having to work around the patients schedule to contact them).

Some practices were particularly keen to see a substitution between in-person consultations and online clinical queries – this tended to be practices with a younger cohort of patients.

3.2 Parameters and assumptions

The information from the interviews was used to derive many key assumptions in the design phase. We supplemented the information from the interviews with previous financial modelling and the diary information to make a series of further assumptions.

3.2.1 Design parameters with relative certainty

The core of the modelling was formed around a number of parameters whose values were relatively certain including:

- the number of activities a practice performs

- the time required for each activity and the proportion of time allocated between GPs, nurses (or both) and admin staff for each activity
- GP, nurse and admin compensation
- the fee charged for each activity
- capitation rates

From the interviews we made further assumptions regarding the additional activities associated with the patient portal and the reallocation of time required for each activity in the ePortal model.

Table 4 outlines the activities performed by a practice in our status quo model and the time required to perform the activity. Table 5 outlines the time required to perform each activity in our ePortal model.

Table 4 Status quo - time per episode

Minutes per episode			
	GP	Nurse	Admin
Stable Chronic	15	15	5
Acute	15	15	5
Unstable Chronic	15	15	5
Trauma	15	15	5
ELL/Community	15	15	5
Procedure Surgery	15	15	5
Immunisation	10	10	5
Misc	15	15	5
Subscription and support	0	0	0
Scripts administration	2	5	9
Lab results	5	12	3
Unavoidable consults	12	12	5
Booking appointments	0	0	5

Table 5 ePortal - time per episode

Minutes per episode			
	GP	Nurse	Admin
Subscription and support	2	0	5
Scripts administration	2	0	2
Lab results	2	5	2
Email-level consults/check-ins	5	0	0
Booking appointments	0	0	2

The time per episode for stable chronic, acute, unstable chronic, trauma, ELL/community, procedure surgery, immunisation and misc were omitted from Table 4 because they were unchanged from the status quo model.

Benefits identified in the interviews from portal implementation were realised by reducing double handling of information and activities. Since patients can contact GP directly, we assumed time savings would predominately be realised through activities completed by nurses and admin staff.

The largest potential time savings were through stream lining the processes for repeat scripts and lab results; we estimated nurses' time per episode decreased from five minutes to zero and 12 minutes to five minutes respectively. For admin staff time per episode reduced from nine minutes to two and three minutes to two minutes respectively. We also estimated admin staff time per episode for booking appointments decreased from five minutes to two minutes.

We assumed admin staff would take the lead in portal subscription and support and estimated this would require five minutes per episode. However, it's likely GP time would also be required to provide patients with information regarding the portal and assist with patient subscription; we estimated this to be two minutes per episode.[7]

The main potential time saving for GPs is through email-level clinical queries. The interviews indicated that a clinical query required 5 minutes of GP time on average. Given the nature of these consultations, we assumed the counterfactual would typically be shorter than a normal consult and therefore only require 12 minutes per episode (instead of 15).

For the time saving to be realised, a clinical query must cause an in-person consultation to be avoided. This introduces two interesting relationships between the design parameters. First, the realised time saving for GPs depends crucially on the rate of substitution between in-person consults and clinical queries. If an in-person consult can't be avoided because of the online query, the time per episode will increase to 17 minutes, creating more work for a GP. Second, the realised time saving further depends on the assumption of time per episode for avoided consults. Because the avoided consults are likely to be shorter than a full consultation, 12 minutes of GP time may be an over-estimate and the true time required is less. The closer the true time to the time required for online clinical queries the smaller the potential time saving will be.[8]

[7] The time required by GPs for subscription and support was omitted from the reported "steady-state" results. The model assumes the parameters are continuous and calculates yearly estimates; however GP time for subscription and support is likely to be a static (i.e. one-off) activity – that is they will only need to discuss with the patient about the portal once. Admin staff time required for subscription and support was treated as continuous as they are likely to be the patients' point of call if they have any issues using the portal. Therefore, the principal results reported are for the steady-state of portal implementation; we report summary results for the "investment-state" separately where GP time required for portal subscription and support was included in the calculations.

[8] Our analyses focused on the first relationship, given interviewees were particularly interested in the outcomes of this effect. However we recommend practices still give some thought to the second relationship when considering the impact implementing portals may have on their practices outcomes.

Further to the changes in time per episode, introducing the patient portal should reallocate the frequency GPs, nurses or both participate in each activity. Table 6 describes the percentage of time GPs, nurses or both allocated to each activity in the status quo model. Table 7 describes the percentage of time GPs, nurses or both allocated to each activity in the ePortal model.

We assumed admin staff workload was independent of GPs and nurses and therefore only the time required to complete the activity varied in the modelling.

Table 6 Status quo – activity allocation

Activity Allocation - % of time			
	GP only	Nurse only	Both
Stable chronic	0.50	0.05	0.45
Acute	0.50	0.05	0.45
Unstable chronic	0.50	0.05	0.45
Preventive screening	0.50	0.05	0.45
Trauma	0.50	0.05	0.45
ELL/Community	0.50	0.05	0.45
Procedure surgery	0.50	0.05	0.45
Scripts administration	0.00	0.00	1.00
Immunisation	0.50	0.05	0.45
Misc	0.50	0.05	0.45
Lab results	0.00	0.00	1.00

Table 7 ePortal - activity allocation

Activity Allocation - % of time			
	GP only	Nurse only	Both
Scripts administration	1.00	0.00	0.00
Lab results	0.00	0.20	0.80
Email Consults	1.00	0.00	0.00
Unavoidable consults	0.50	0.05	0.45
Subscriptions and support	1.00	0.00	0.00

The percentage of time allocated to stable chronic, acute, unstable chronic, preventable screening, trauma, ELL/community, procedure surgery, immunisation and misc were omitted from Table 4 because they were unchanged from the status quo model.

We assumed GPs completed 100 percent of script administration following portal implementation due to patients contacting them directly. Similarly, GPs were assumed responsible for all online clinical queries and subscriptions and support. We further assumed the portal improved the efficiency in which patients could access their lab results and gave nurses more independence reporting these to patients.

Unavoidable consults represent the consults that occur (i.e. could not be avoided) following an email consults. We assumed the activity allocation for these unavoidable consults would

not be dissimilar to other clinical activities within a practice and therefore allocated the proportion of GP and nurse time accordingly.

3.2.2 Design parameters with relative uncertainty

A number of design parameters with relative little certainty were also highlighted from the interviews. These parameters were subject to much scrutiny in the ePortal model and provided valuable insights for successful portal implementation.

Table 8 outlines these parameters, the value range of the parameters explored and the rationale for including these design parameters in the model.

Table 8 Design parameters with relative uncertainty

Parameter	Value	Rationale
Percentage of patient uptake	0-80%	Percentage of patient uptake captures how the outcome parameters evolve as the relative number of patients subscribe to the portal
Size of the practice	2500-10000	Practice size measures the absolute scale effect of patients subscribed to the portal
Email consults per patient	1-2	Interviews suggested on average patients made 1-2 emails per year
Rate of substitution (i.e. percentage of avoided consults	0-30%	Patient portal allows GPs to substitute between in-person and email consults. This could affect GP workload and financial outcomes through loss in fee revenue
Responsiveness of demand to financial costs incurred by patients	0.5-0.8 (elasticity)	Interviews highlighted a reluctance from patients to subscribe when there was a fee attached to the portal, ultimately slowing uptake

We measured the effect of percentage uptake by comparing the calculated GP, nurse and admin staff FTE in the ePortal model against the status quo when the number of patients subscribed to the portal increased linearly. The effect of percentage uptake on the net financial gains for a practice was calculated in the same way.

Three practice sizes were considered; 2500 patients (small), 5000 patients (medium), 10000 patients (large). The effect of increasing practice size was measured holding all other parameters constant and observing the change in FTE required and net financial gain in the ePortal model. In this way we could tease out the scale effect between percentage uptake (a relative measure) and the size of the practice (an absolute measure).

Several interviews indicated that GPs received 1-2 emails per patient per year on average. In addition we were provided with one practices monthly usage by staff; this consisted of 125 emails sent and 209 received from 1600 activated patients. Extrapolating this information over a year, GPs sent approximately 0.94 emails and received 1.57 emails. These results, albeit based on a sample of one, reasonably reflected the range suggested in other interviews.

The rate of substitution measured the percentage of in-persons consults avoided because of online clinical queries. We allowed this to vary between zero to 30 percent on the basis that practices are; a) likely to differ in their willingness to encourage patients to substitute between in-person consults to e-consults and b) it isn't clear how willing patients will be to substitute between in-person consults to online clinical queries.

Currently most practices receive a subsidy for using the patient portal. However at some stage practices will be required to bear the cost and therefore will look at recovering this from the subscribed patients. Two common approaches identified in the interviews were either a subscription model where patients paid a yearly retainer or a pay-as-you-go model which patients paid a fee for each email consult.

Any fee model is likely to reduce the attractiveness of the portal to patients and create different incentives for usage. A subscription type scheme imposes a cost to the patient regardless if they use the portal or not. Intuitively – and reinforced by interviewee responses – this type of model is likely to directly influence patients' willingness to subscribe to the portal. Consequently, we assumed patient uptake would be half of what the uptake would have been in the absence of any fee.[9]

Alternatively, a pay-as-you go scheme offers patients free uptake and then charges a fee for the activities completed using the portal. This creates a different set of incentives which shouldn't effect patients' decision to subscribe to the portal but may discourage active use of the portal. Without a reasonable counterfactual we assumed a pay-as-you go scheme reduced the number of email consults per patient by 20 percent.[10]

3.2.3 Baseline design parameters

We determined a baseline level for the above design parameters with relative uncertainty following the interviews. The baseline modelling provided a starting point for more detailed analysis of the outcomes for general practices from portal implementation.

Table 9 reports the baseline design parameters and their value.

[9] This value was arbitrarily chosen and intended to show what a reduction in uptake might do to the overall picture. In reality this reduction could be larger or smaller and is likely to vary from practice to practice

[10] Again, value was arbitrarily chosen following the same rationale as above

Table 9 Baseline design parameter values

Parameter	Value	Rationale
Patient uptake	40%	Mid-point of the range explored in the modelling
Practice Size	5000	Considered to be a "medium-sized" general practice
Substitution effect	0%	Assumed zero to demonstrate the "worst-case" scenario for increased GP workload
Email consults per patient	1.5	Mid-point of suggested range
Time of avoided consults	12 minutes	"Clinical query" would likely take less time than a typical consult
Subscription fee	$0	Assumed zero for simplicity
E-consult fee	$0	Assumed zero for simplicity
Scale of uptake required to realise released resources	0%	Assumed zero for simplicity
Fixed costs for patient portal (incurred by general practice)	$0	Assumed zero for simplicity

3.3 Resource modelling

Our analysis first looks at the impact of patient portals in a steady-state.[11] We then compared these results to the outcomes observed for practices in an investment-state.[12] Finally we document the patterns which emerge through imposing cost-recovery schemes on the model.

While the analysis of the modelling can be some-what technical we attempted to report the results in a way that was meaningful for a wide audience.

With this in mind we initially modelled the individual effect of each design parameter on the outcome variables (e.g. GP FTE, nurse FTE, Admin FTE and net gains) while holding the rest constant at baseline values. More complex interrelationships were then analysed separately.

3.3.1 Steady-state

The baseline modelling focused on how the outcome variables responded to:

- patient uptake
- rate of substitution
- number of email consults per patient.

[11] In the steady-state, GP time spent on portal subscription and support is assumed to be zero and therefore excluded from all calculations.

[12] In the investment-state, GP time spent on portal subscription and support is non-zero and included in all calculations.

We further measured the effect increasing practice size on the outcomes for general practices derived from varying each of the above design parameters.

From this process we identified various interrelationships between the parameters. The effect of each interrelationship on the outcome variables were further influenced by scale. We attempt to shed light on these interactions in the discussion section.

Summary

Table 10 reports the change in FTE for GP, nurse and admin staff in the baseline ePortal model compared to the status quo, as well as the estimated net monetary gains.

Table 10 Baseline summary results

Δ GP FTE	Δ Nurse FTE	Δ Admin Staff FTE	Net Gains ($)
0.138	-0.080	-0.833	9,863

The estimated results imply that for a 5000 patient practice with 40% subscribed to the portal, GP FTE increased by approximately 0.138, whereas nurse and admin staff FTE decreased by approximately 0.080 and 0.833 respectively. The estimated net gains were $9,863.

Patient uptake

Increasing the percentage of patient uptake reduced nurse FTE, admin staff FTE but increased GP FTE. Overall the net monetary gains for a practice increased with uptake.

Figures 1-4 document the estimated changes in outcomes for practices of different scale when uptake increases.

Figure 1 Change in GP FTE conditional on patient uptake and practice size

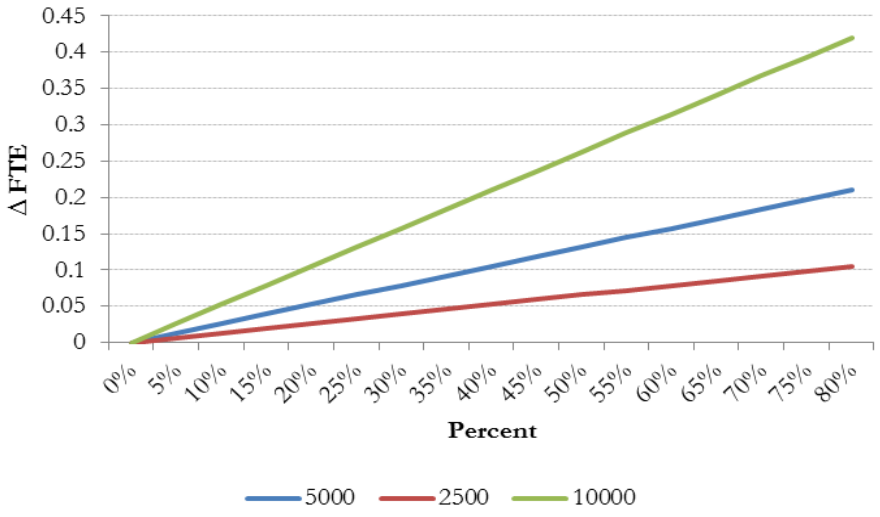


Figure 2 Change in nurse FTE conditional on patient uptake and practice size

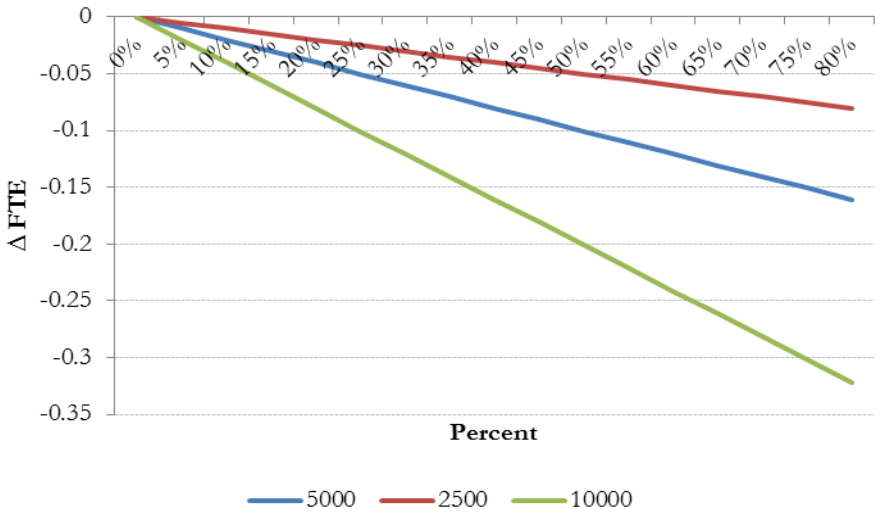


Figure 3 Change in admin staff FTE conditional on patient uptake and practice size

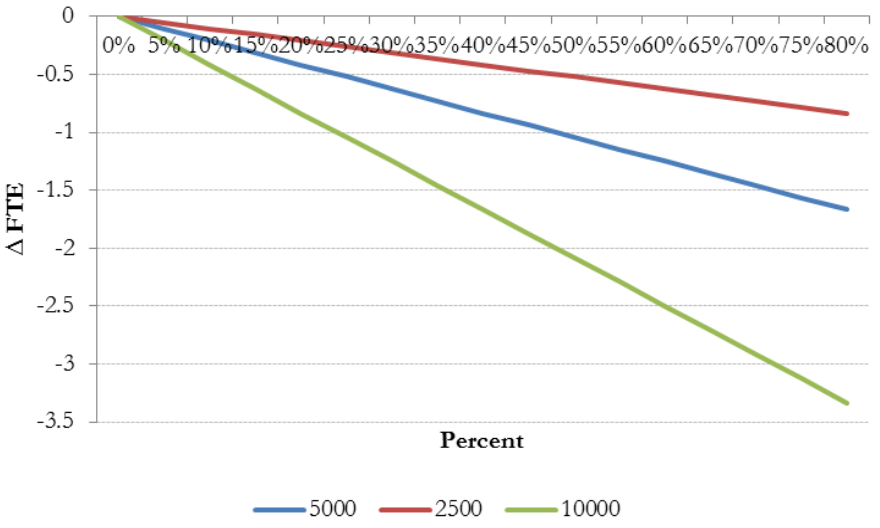


Figure 4 Change in net monetary gains conditional on patient uptake and practice size

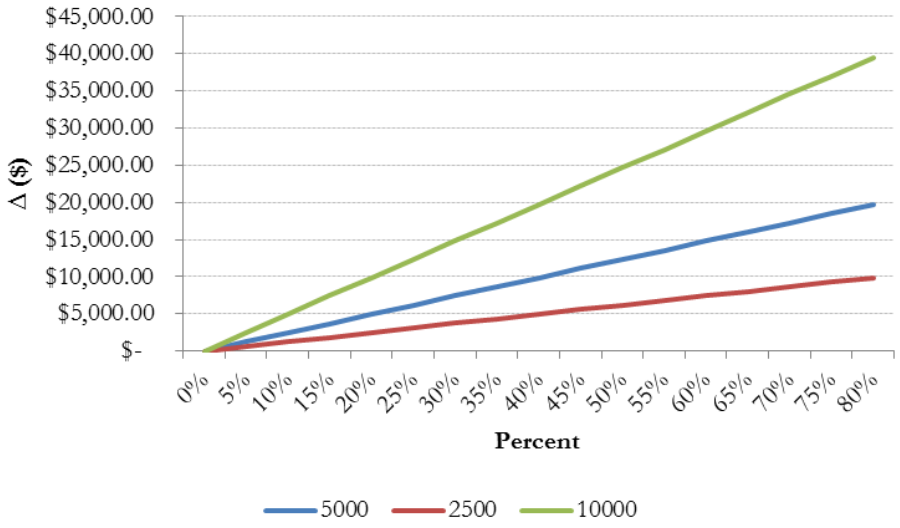


Table 11 summaries the above figures and reports the potential outcomes for general practices.

Table 11 Summary of changes conditional on uptake

Practice Size	Patient Uptake	Δ GP FTE	Δ Nurse FTE	Δ Admin Staff FTE	Net Gains ($)
2500	20%	0.034	-0.020	-0.208	2,466
	40%	0.069	-0.040	-0.417	4,931
	80%	0.138	-0.080	-0.833	9,863
5000	20%	0.069	-0.040	-0.417	4,931
	40%	0.138	-0.080	-0.833	9,863
	80%	0.275	-0.161	-1.666	19,725
10000	20%	0.138	-0.080	-0.833	9,863
	40%	0.275	-0.161	-1.666	19,725
	80%	0.550	-0.321	-3.332	39,459

All else being equal, increasing the practice size has a 1:1 scale effect on the outcomes for general practices. Further, practice size changes the rate which outcome parameters evolve conditional on patient uptake.

Rate of substitution

Increasing the substitution between in-person consults and online clinical queries has a positive effect on general practice outcomes. That is the rate of increase in GP FTE decreases when the rate of substitution increases. Conversely, the rate of increase in the net monetary gains increases when the rate of substitution increases.

Only change in GP FTE and net monetary gains were reported because the substitution effect for nurse and admin staff was minimal and was not considered relevant in the

interviews. Figures 5-6 present the substitution effect on the change in GP FTE and net monetary gains.

Figure 5 Change in GP FTE conditional on the rate of substitution between in-person consults and online clinical queries

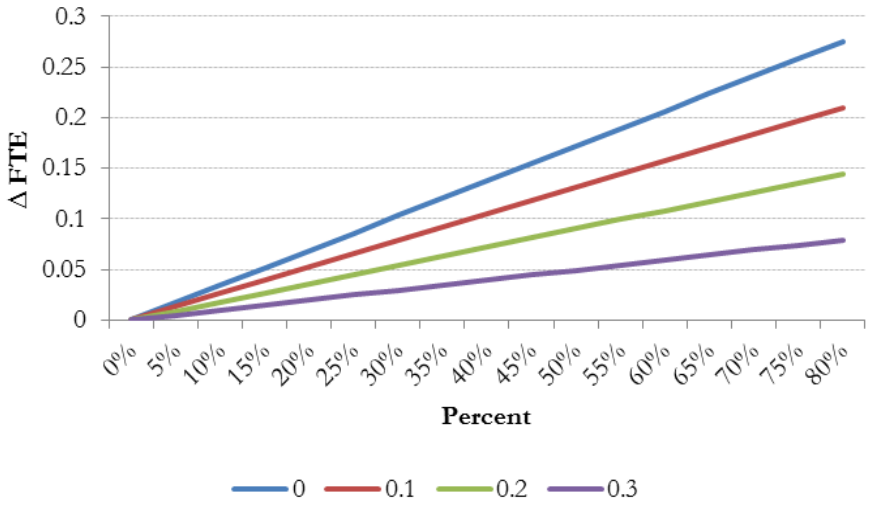


Figure 6 Change in net gains conditional on the rate of substitution between in-person consults and online clinical queries

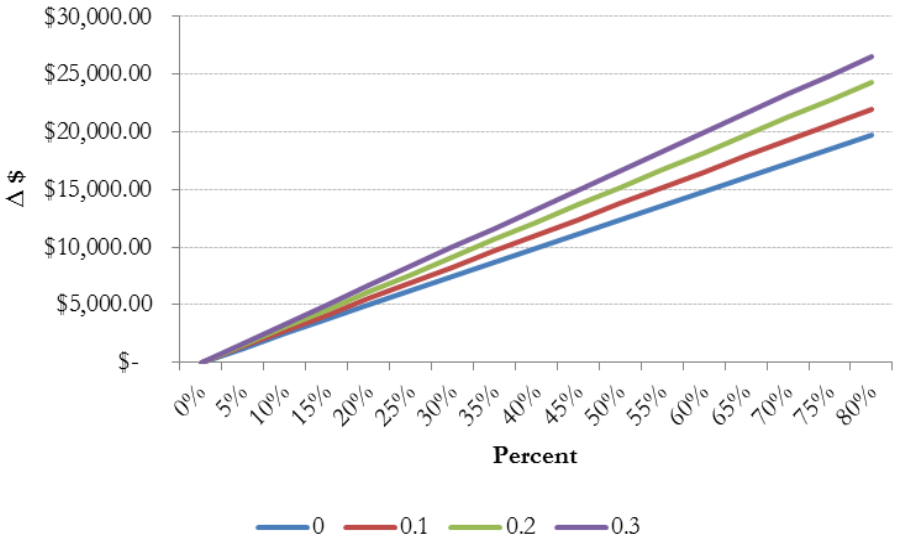


Table 12 summaries the estimated results for different practice sizes.

Table 12 Summary of outcome parameters conditional on the rate of substitution

Practice Size	Substitution (%)	GP FTE	Net Gains ($)
2500	0.00	0.069	4,933
	0.10	0.052	5,502
	0.20	0.036	6,071
	0.30	0.020	6,639
5000	0.00	0.138	9,862
	0.10	0.105	11,001
	0.20	0.072	12,139
	0.30	0.040	13,277
10000	0.00	0.275	19,729
	0.10	0.210	22,007
	0.20	0.144	24,284
	0.30	0.079	26,563

The rate of substitution has a noticeably larger effect on GP FTE than net gains. For example for a 5000 patient practice with 40 percent uptake the range in required GP FTE between 0-0.3 substitution was 71.3 percent, whereas the range for net gains was 34.6 percent.

Further practice size has an absolute effect on the outcome parameters when the rate of substitution changed. For example, increasing the rate of substitution by 10 percent for a 2500 patient practice with 40 percent uptake causes the accumulated additional required GP FTE to fall by 0.016. In comparison for a 10000 patient practice the same increase in rate of substitution causes the additional required GP FTE to drop by 0.065.

Importantly the increase in net gains for higher rates of substitution indicates the value of the released GP FTE must be greater than the forgone fee revenue.

Email-level consults

All else equal, increasing the number of email consults per patient increases GP FTE and decreases the net monetary gains. Again we omitted the changes in nurse and admin FTE because they were minimal and not consider relevant.

Figures 7-8 illustrate the effect of increasing the number of emails per patient on GP FTE and net monetary gains

Figure 7 Change in GP FTE conditional on the number of clinical queries per patient

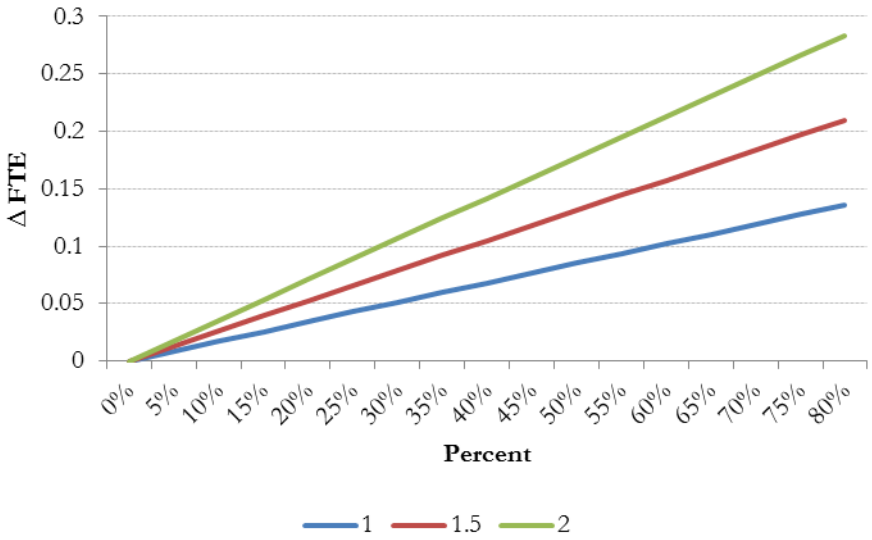
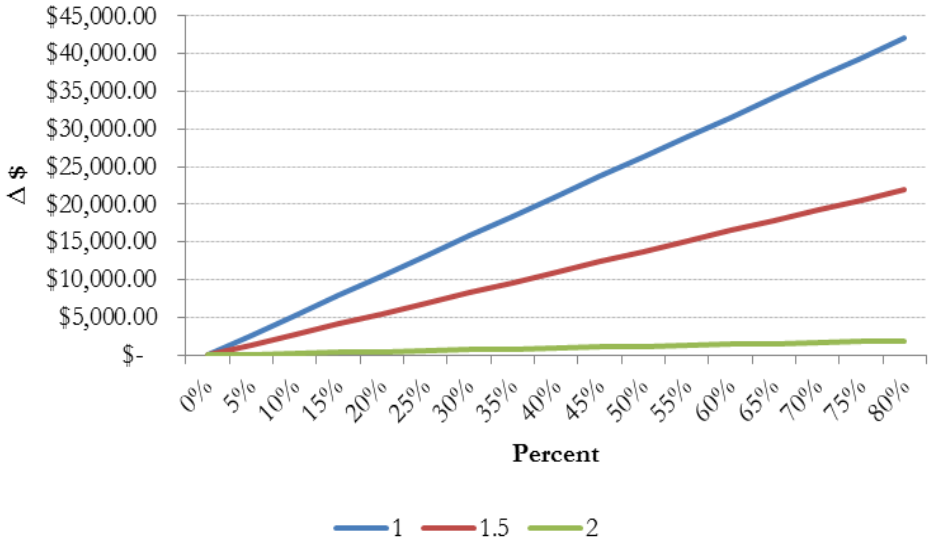


Figure 8 Change in net gains conditional on the number of clinical queries per patient



The results derived assumed a 10 percent rate of substitution. Table 13 summaries the estimated results for different practice sizes.

Table 13 Summary of outcome parameters conditional on the number of email consults per patient

Practice Size	Email consults per patient	GP FTE	Net Gains ($)
2500	1	0.034	10,530
	1.5	0.052	5,502
	2	0.071	474
5000	1	0.068	21,057
	1.5	0.105	11,001
	2	0.142	944
10000	1	0.136	42,119
	1.5	0.210	22,007
	2	0.284	1,894

Increasing the number of clinical queries per patient had a marginally larger effect on GP FTE compared to practices net monetary gains. For example for a 5000 patient practice with 40 percent uptake the range in required GP FTE between 1-2 clinical queries per patient was 100.09 percent whereas the range for net gains was 95.5 percent.[13]

Practice size has a negative absolute effect on the observed outcomes. Increasing the average number of email consults per patient from 1-2 causes a 2500 patient practice with 40 percent uptake increases required GP FTE by 0.037 and decreases net gains by $10,561.61. However, for a 10000 patient practice with 40 percent uptake required GP FTE increases by 0.158 and net gains decreases by $40,224.73.

The effect of the number of clinical queries per patient on the outcome variables is likely to be closely interrelated with the rate of substitution. That is, if patients engage in more clinical queries through the portal as a substitute for in-person consults then the higher value of GP time will further outweigh the loss in fee revenue. At the same time, more clinical queries increase the required GP FTE at a practice for any level of substitution. Put together, a higher volumes of clinical queries should result in a larger range of potential outcomes for practices when the rate of substitution varies/

Figures 9-11 explore this idea by systematically increasing the number of clinical queries per patient while allowing the rate of substitution to vary and observing the effect this has on practices net gains.

[13] All else equal the change in net gains is smaller due to small decreases in required FTE for nurses and admin staff (not reported) caused by a higher number of avoided consults.

Figure 9 Change in net gains conditional on the rate of substitution (1 clinical query per patient)

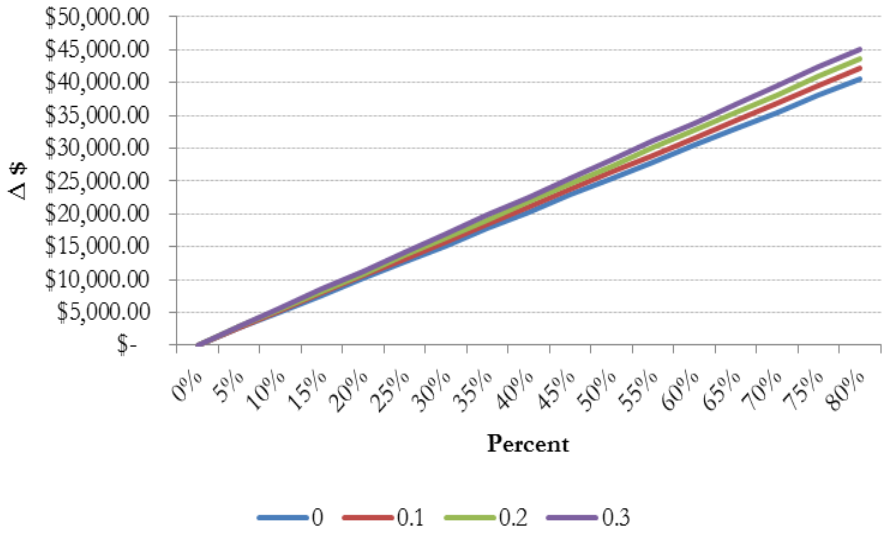


Figure 10 Change in net gains conditional on the rate of substitution (1.5 clinical queries per patient)

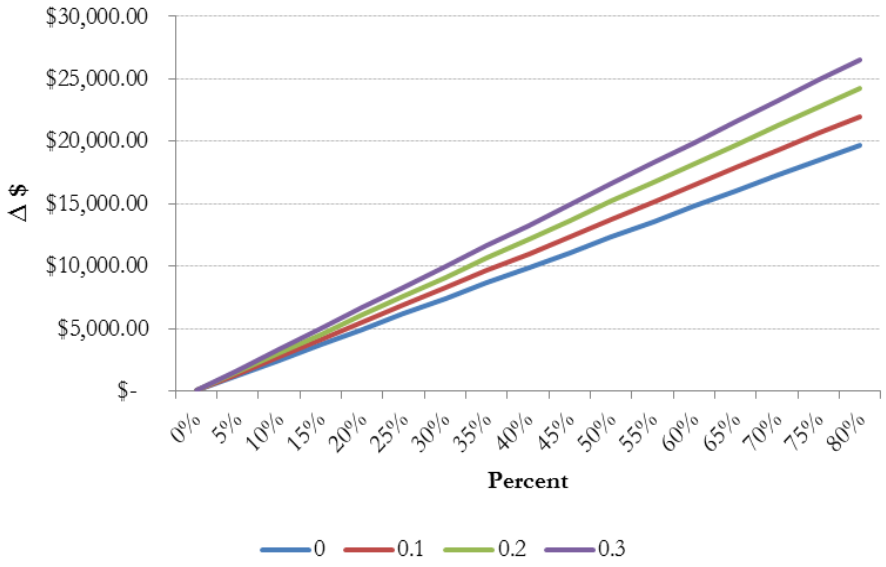
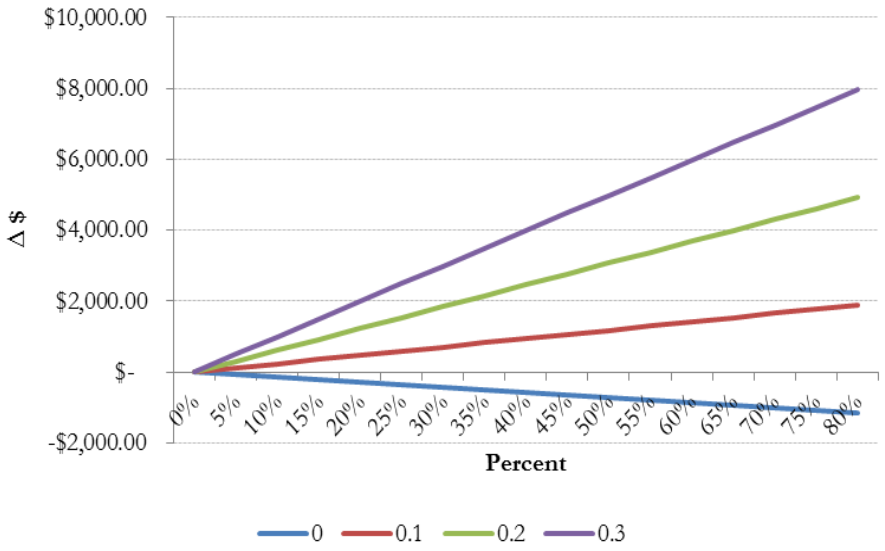


Figure 11 Change in net gains conditional on the rate of substitution (2 clinical queries per patient)



For higher volumes of clinical queries practices finances are relatively more sensitive to the rate of substitution. This is particularly apparent when practices average 2 clinical queries per patient.

Table 14 documents the effect the interrelationship between the number of clinical queries per patient and the rate of substitution has on GP FTE and net monetary gains.

Table 14 Interrelationship between the number of clinical queries per patient and the rate of substitution

Clinical queries per patient	Rate of substitution	GP FTE	Net Gains ($)
1	0.00	0.090	20,298
	0.10	0.068	21,057
	0.20	0.046	21,816
	0.30	0.0244	22,575
1.5	0.00	0.138	9,862
	0.10	0.105	11,001
	0.20	0.072	12,139
	0.30	0.040	13,277
2	0.00	0.185	-573
	0.10	0.142	944.70
	0.20	0.098	2,462.59
	0.30	0.055	3,980.48

It's apparent the sensitivity of net gains to substitution increases for higher volumes of clinical queries; although the mechanisms for this are not initially clear

All else equal an increase in the number of clinical queries has two direct effects: a) GP FTE increases; and b) the number of avoided consults increases. Increasing the number of avoided consults puts downward pressure on GP, nurse and admin staff FTE. Increasing the rate of substitution accentuates this downward pressure. Further, higher volumes of clinical queries allows for more consults to be avoided at any given level of substitution.

It's important to note that the sensitivity of GP FTE to substitution remains relatively constant as the number of clinical queries increases. Intuitively if the substitution rate remains constant then for any volume of clinical queries the proportion of avoided consults will remain the same. This implies that the responsiveness of GP FTE to changes in the rate of substitution will be the same for any volume of clinical queries – i.e. the substation effect on GP FTE is independent of the number of clinical queries per patient.

At the same time, increasing the volume of clinical queries per patients doesn't directly affect nurse and admin FTE; rather the required FTE decreases via a greater number of avoided consults. It follows that, with no offsetting negative affect from higher volumes of clinical queries, the reduction in nurse and admin staff FTE drives the increase in sensitivity of net gains.

3.3.2 Investment-state

The investment-state modelling is useful to inform practices of the potential investment costs associated with portal implementation. We compare outcomes for a 5000 patient practice with 40% uptake in the steady-state model against the investment-state model.

The results calculated in the investment-state model are likely to be a "worst-case" scenario for practices. That is, it seems unlikely practices will subscribe more than 40 percent of their patients in a year and for some practices this is will be an over-estimation.

Table 15 reports the change in FTE for GP, nurse and admin staff as well as the net monetary gains in the baseline steady-state model compared to the investment-state model.

Table 15 Steady-state versus investment-state

Model State	Δ GP FTE	Δ Nurse FTE	Δ Admin Staff FTE	Net Gains ($)
Investment-state	0.143	-0.097	-0.876	2,652
Steady-state	0.105	-0.097	-0.876	11,001
Difference	0.038	0	0	-8,349

In the investment-state GP workload increased by 0.038 FTE and net gains decreased by $8,349. Interestingly the net gains from portal implementation are still positive in the investment-state and the increase in GP FTE is modest.

3.3.3 Cost-recovery models

Cost-recovery models are particularly relevant to ensure the long-run viability of patient portals. With this in mind we considered two cost-recovery models:

- Subscription
- Pay-as-you go

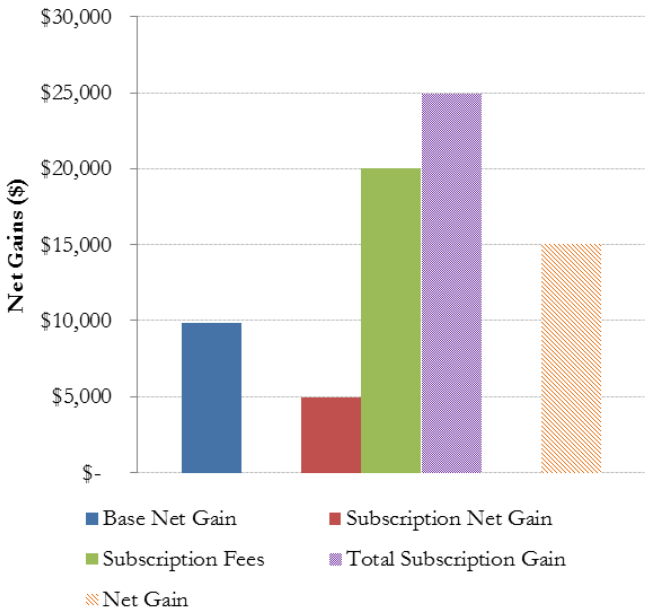
Given the cost-recovery models are interested in how practices can effectively recover their costs from implementing the patient portal, we only reported the change in net gains.

Subscription model

The subscription model introduces a $20 fee for each patient subscribed to the portal which the practice collectes as additional revenue. In response to being charged a fee for subscribing we assumed patient uptake halved (i.e. when patient uptake is 40 percent in the baseline model, uptake is only 20 percent in the subscription model).

Figure 12 shows the net monetary outcome comparing the baseline model with 40 percent uptake against the subscription model.

Figure 12 Comparison of financial outcomes between the baseline and subscription model



The figure illustrates how net gains are reduced from charging a subscription fee – net gains fall from $9,863 to $4,931. However this is easily compensated by the subscription fee revenue - $20,000.Conseqeuntly the total monetary gain from the subscription model is estimated to be $24,931 and the net gain over and above the base line model is$15,069

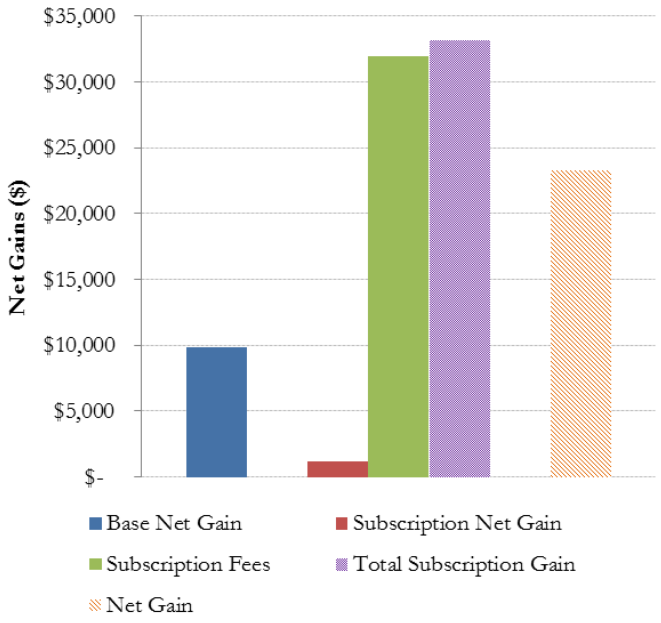
We have not reported how these outcomes change when design parameters such as practice size, rate of substitution or email consults per patient vary. Given the myriad of interrelationships between these parameters it seems fruitless to speculate potential different outcomes for practices when they are likely to vary on a case-by-case basis. Instead, this figure should be interpreted as an illustration of how introducing a patient portal could reduce potential gains considerably (before fee revenue is taken into account) rather than an endorsement for better financial results.

However we did extend the subscription model to allow practices to offer patients a discount on their repeat scripts to incentivise uptake. That is patients who subscribed to the portal received a 50% discount on their scripts. In response to this "reward" for subscribing we

assumed the adverse effect of charging a subscription fee only reduced patient uptake by 20% compared to the baseline case.

Figure 13 shows the net monetary outcome comparing the baseline model with 40 percent uptake against the new subscription model

Figure 13 Comparison of financial outcomes between the baseline and updated subscription model



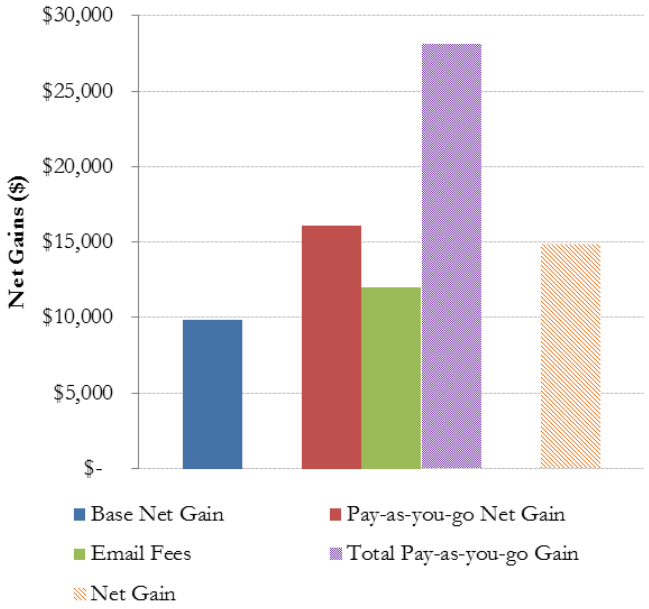
The new subscription net gain decreases suggesting the value of the lost scripts fee revenue is greater than the additional monetary benefits from having a higher patient uptake. However, this is easily compensated by the increased subscription fee revenue. The end result is a net gain of $23,302 - $8,233 greater than the net benefits from the previous subscription model.

Pay-as-you go model

The pay-as-you go model charged patients $5 for each email consult. We assumed this would reduce the number of e-consults per patient and consequently the number of avoided consults by 20 percent.

Figure 14 shows the net monetary outcome comparing the baseline model with 40 percent uptake against the pay-as-you-go model.

Figure 14 Comparison of financial outcomes between the baseline and pay-as-you-go model



As in the subscription model, the base net gain is $9,863. However unlike in the subscription model the pay-as-you-go net gain is larger than the base case - $16,124. The email fees collected are a modest $12,000. The total monetary gain in the pay-as-you-go model is $28,124 and therefore the net gain is $14,846 - $222 less than in the subscription model

Again this figure is intended to illustrate the general effect introducing a pay-as-you-go scheme on a practices financial outcome compared to a subscription fee – that is the pay-as-you-go has less distortion effects on the base net gains, which can evidently be positive all else equal, but forgoes fee revenue. The overall difference in their effect on a general practices' financials will depend crucially on the specific values of the design parameters.

4. Discussion

The purpose of the resource modelling was to identify the likely consequences of ePortal implementation at a practice level. In this section we discuss the reported result with a specific focus on the patterns which emerged from the modelling as opposed to the measured effect of the design parameters. The quantified results are a useful starting point for discussion around the effect of implementing portals but are not a means to an end. By identifying the design parameters which support positive results, practices can make more informed decisions about how to implement patient portals to suit their model of care.

With this in mind we identified several key results which emerged from the modelling:

- Scale is imperative to successful outcomes for practices
- Considerable resource release can be realised through low-level tasks
- Substitution between online clinical queries and in-person consults has a decreasing effect of GP workload and a small but positive effect on net monetary gains
- A high volume of online clinical queries can dampen a practices finances and increase GP workload. However the rate of substitution mitigates this effect to a large extent
- Cost-recovery models will effect practices on a case-by-case basis

Each result is discussed in detail below.

Larger practices achieve larger benefits

A scale effect was observed both as a relative measure and as an absolute measure. That is for any practice size increasing the percentage of patient uptake emphasised the effect of implementing portals on the practice. At the same time for a given level of uptake increasing the practice size steepened the rate of change in required resources. Ultimately, the more patients subscribed to the portal the better the outcomes for practices.

The gains in required nurse and admin staff FTE out-weighed the increase in GP FTE for all levels for uptake. As uptake increased there was considerable disparity in the net monetary gains between large and small practices. This scale effect was persistent when the rate of substitution and/or the number of clinical queries per patient varied.

The results from the resource modelling are coherent with the information presented in the interview; in the sense that larger practices achieve larger benefits. However, there is a small inconsistency regarding when the benefits are realised; in the modelling we monetised the change in required resources for all levels and so benefits were realised immediately. In contrast few practices interviewed described uptake to be sufficiently high for released resources to be realised in a meaningful way.

To reconcile this difference, there appears to be a level of scale required in the resources released before they can be realised. For simplicity we assumed the benefits of the portal were realised linearly when in reality this may be lumpy and with some lag. For example, it could be argued that a 0.05 decrease in required FTE does not easily extend to a useful gain in resources whereas a 0.2 decrease in FTE is relatively easier to realise meaningfully. Reaching this level of reduction requires a high level of uptake for small-medium practices.

Consequently, practices ,ay not immediately observe the benefits from the portal demonstrated in the resource modelling.

Low-level tasks achieve high benefits

While the modelling identified modest changes in GP FTE and nurse FTE requirements, the decrease in admin staff FTE was considerable. Even for a relatively small practice the potential gain was upward of 1 FTE.

We assumed relatively small changes in the time admin staff spent on each task following portal implementation but the cumulative effect was substantial. For example, a three minute decrease in the time required to make bookings (five minutes to two minutes) resulted in an annual decrease of 31,156 minutes of admin staff time for a 5000 patient practice with 40 percent uptake. There are clear advantages to streamlining low-level clinical activities for practices.

Substitution helps manage GP workload

GP workload was the only outcome adversely affected from portal implementation in the modelling. This result by itself does nothing to reassure concerned practices that implementing patient portals will be beneficial to their practice. However, the rate of substitution between online clinical queries and in-person consults appears to a crucial tool for practices to "even-out" the potential for increased GP workload. This result augments the interviews suggesting that GP workload is reallocated rather than reduced.

Importantly, we identified the monetary value of released GP FTE from substitution was approximately equal to the loss in revenue from activity fees. Accordingly, concerns that practices may struggle financially through lost fee revenue are not supported as long as practices can meaningful utilised the released GP resources. Further it suggests practices can tailor how actively they encourage their patients to engage in online clinical queries rather than in-person consults to suit the practices model of care without worrying about the financial repercussions.

Although the rate of substitution had a positive effect on the net monetary gain in our model, it is possible this effect could be negative for a practices with higher patient co-payments. However, the range in positive net monetary gains was relatively small, even following large increases in the rate of substitution. Therefore, if the effect is negative, it seems unlikely this should be a significant concern for practices – particularly if some sort of charging regime is used for electronic services.[14]

The one instance where this could be an issue is when a practice has a high rate of substitution and a large volume of online clinical queries. This scenario is discussed below.

[14] Co-payments would need to be sufficiently larger than those applied in our modelling for this assertion not to hold.

The interrelationship between the number of clinical queries per patient and the rate of substitution

Expectedly a high volume of online clinical queries increased GP workload and put downward pressure on practices finances. However the downward pressure can be eased by increasing the rate of substitution – particularly for higher volumes of online clinical queries.

It seems likely a high volume of clinical queries will be associated with a higher rate of substitution – i.e. practices that are keen to substitute between clinical queries and in-person consults are likely to integrate the patient portal into their model of care such that patients are encouraged to engage in online consultations. A higher rate of substitution doesn't completely offset the downward pressure caused by a high volume of clinical queries on practices finances but does enough to ensure the practice is profitable while at the same time reducing GP workloads to more sustainable levels.

Practices should be cautious in cases where substitution has a negative effect on a practices finances; a high rate of substitution will amplify the downward pressure caused by a high volume of online clinical queries. Consequently cost-recovery models will be even more important for the long-term viability of patient portals for practices wishing to pursue a model of care with high volumes of clinical queries and high rates of substitution

No cost-recovery model should be the same

Cost-recovery models will generate similar distorting patterns for a practices finances, but the exact outcome will depend on the myriad of interrelationships between the design parameters.[15] Practices need to carefully consider how their unique case will be affected by the distortions created from cost-recovery models, and therefore we encourage practices to undertake their own modelling before deciding on the appropriate model.

Further there are several factors not captured in the model that will influence the usefulness of a cost-recovery model. Firstly as mentioned above, benefits from the portal are likely to be realised in clumps (i.e. as a certain scale threshold is reached) and the speed at which released resources can be realised will be increasingly important for subscription models. If the speed is relatively slow (i.e. the scale threshold is high) then barriers to uptake could be particularly harmful and practices would be advised to implement a pay-as-you-go model. Conversely if practices can realise benefits relatively quickly a subscription model may be preferred.

Estimating the value/benefits to patients from using the portal was beyond the scope of this work. However, several potential benefits were raised in interviews, including improved accuracy or results, increased patient health literacy and reduced demands upon patient time. Given that the benefits for patients come through actively using the portal, practices need to consider the trade-off between uptake and usage when deciding on a charging scheme. That is, a pay-as-you-go model should encourage greater uptake compared to a subscription model but at the cost of lower relative usage and value for patients.

[15] For example a subscription model will negatively distort the direct financial benefits of the portal but receive a large compensation in subscription fees

Finally, cost-recovery models could be extended in more intricate ways. For example practices may target specific patients who will receive the greatest benefits from using the portal by offering them a discounted subscription fee or reduced user fees. Alternatively practices may be tempted to charge a "premium" fee to patients for the increased speed in the delivery of services. Much depends upon the particular context of the patient population and their expectations of their general practice.