Valuing the Extended Role of Prescribing Pharmacist in General Practice: Results from a Discrete Choice Experiment

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ABSTRACT

Objectives: To quantify patients' preferences for new pharmacist independent prescribing services in general practice for managing common existing long-term conditions compared with usual medical prescribing. Methods: A discrete choice experiment cross-sectional survey was conducted in five general practices in England (October–November 2009). Four service attributes reported on the length of consultation and aspects of patient-professional interaction. A choice between three alternatives—novel pharmacist independent prescribing service ("prescribing pharmacist"), "own (family) doctor" service, and "available (family) doctor" service—was presented. Alternative regression models were compared according to their goodness of fit, and the preferred one was used to inform policy analysis. Results: A total of 451 patients completed questionnaires. Respondents preferred a "pharmacist" or "own doctor" compared with "available doctor," with a larger value given to own doctor. All attributes on patient-professional interaction were important in choosing how to manage diagnosed hypertension, while the "length of consultation" (P = 0.42) did not have any impact. The impact of introducing a pharmacist prescribing service into a general practice setting was estimated from these findings. Patients' preferences suggested that about 16% of consultations with a patient's own doctor can be switched to a prescribing pharmacist instead. Although there is a stronger preference for seeing own doctor, alternative combinations of attribute levels can be used to compensate and reconfigure a more preferred prescribing pharmacist service. Conclusions: The pharmacist service is valued by patients as an alternative to doctor prescribing in primary care and therefore represents an acceptable form of service delivery when informing policy.

Keywords: discrete choice experiment (DCE), NMP services, patient preferences, pharmacist independent prescribing services, primary care

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Introduction

In the United Kingdom, appropriately qualified pharmacists and nurses prescribe independently, within their competence, any medicine for any condition: for pharmacists, this excludes controlled drugs. The introduction of independent prescribing across the whole formulary in 2006 built upon previous forms of nonmedical prescribing (NMP). "Supplementary" prescribing was first introduced in the United Kingdom in 2003 to enable pharmacists and nurses to prescribe in partnership with an independent prescriber (doctor or dentist) and within a patient-specific clinical management plan [1]. A supplementary prescriber is able to prescribe any medicine, including controlled drugs, for any condition within his or her competence. The scope of supplementary prescribing is an issue that is agreed in the patient's clinical management plan and is for the medical judgment of the independent prescriber [2]. Health care professionals able to prescribe as supplementary prescribers undertake a training program in prescribing and learning practice with a medically qualified mentor. NMP service aims to improve patient care, choice and access, safety, use of health professionals' skills, and more flexible team working across the National Health Service (NHS) [3,4]. It can further provide important new opportunities to reconfigure the delivery of health care that has a greater patient focus and a better use of scarce resources. For example, the community pharmacist has been shown to provide valued additional support for medication use, adherence, and review [5].

In a patient-focused health service it follows that to take patients' preferences into consideration we need their views on what aspects of an extended professional role is valuable. We used the discrete choice experiment (DCE) approach as the best valuation tool for assessing patient preferences for the pharmacist independent prescribing (PIP) service in the current study.

The DCE approach is a multiattribute-based survey method for valuing benefits on a latent utility index. The approach assumes individuals derived utility from the attributes of the service rather than the service per se and choose from a set of alternatives the one that gives highest utility. The DCE tool has been used to value

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Table 1 – Attributes and levels.

<table>
<thead>
<tr>
<th>Attribute (short name)</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of consultation (length)</td>
<td>5, 10, 15, 20 (min)</td>
</tr>
<tr>
<td>Professional’s words and explanations about your medicines (words)</td>
<td>Difficult to understand, Easy to understand</td>
</tr>
<tr>
<td>Attention paid by professional to your views about medicines (attention)</td>
<td>Appears not to listen, Appears to listen</td>
</tr>
<tr>
<td>Health review covers (review)</td>
<td>High blood pressure only, High blood pressure and review of overall health</td>
</tr>
</tbody>
</table>

The DCE study reported forms part of a wider evaluation of independent NMP in England [7]. The DCE identifies and quantifies patient preferences for new PIP services in general practice for managing common existing long-term conditions. The study set out to address the following question: what are patients’ preferences for who prescribes their medication? It also aimed to quantify the extent to which choosing who to consult is considered important relative to other patient experience factors, explore preference differences for prescribing services among key patient subgroups, and use the findings to predict the uptake of ‘prescribing pharmacist’ services and assess the impact of quality improvements to the service.

Methods

A DCE survey asks individuals to make hypothetical (yet realistic) choices about their most preferred option from a choice of service options uniquely described by combinations of attribute levels. The approach is based on the premise that all decisions involve choice and all choices involve sacrifice. Choosing forces the respondent to value attributes against each other. Typically, respondents are asked to complete a series of such choices. The underlying assumptions are that the individual can make informed choices by weighing up the differences in attribute levels and will consider all the information provided before selecting the alternative with the highest utility. A random utility model is used to estimate the impact of attributes and contextual variables on choice (preference) [8]. We used guidance on how to design a rigorous DCE to inform the development of this study [9].

The DCE questionnaire

Attributes and their levels

Four key attributes were selected to characterize differences in consulting an NMP service (i.e., PIP) or a medical prescribing service. The attribute levels were combined to describe unique alternatives important for patients yet amenable to change by the service provider. Attribute selection was based on generic characteristics known to be important to patients wanting better access to family doctor services and a quality interpersonal relationship where the professional is committed to the patient’s care [10,11]. These generic attributes were tailored to represent the current context: key differences in medical prescribing and NMP for a long-term condition managed in general practice. Table 1 presents the final list of attributes and levels used. Attribute levels were sufficiently varied to distinguish between alternatives by using data from the national survey of prescribing pharmacists and the pilot study.

The attribute reporting on access to prescribing services was the “length of consultation.” Studies have shown the importance of the length of a primary care consultation in patients’ experience of satisfactory appointments [12], although the type of health problem consulted for may mitigate this effect [11]. Typical doctor appointments last between 5 and 10 minutes (although “double appointments” can be booked [13]). In contrast, a national survey of PIPs’ working practices showed consultations for a long-term condition such as hypertension lasting, on average, 18 minutes (range 5–60 minutes) [7]. The survey was distributed to all 358 pharmacists in England registered as an independent prescriber on May 1, 2008 [7]. Longer PIP consultations, if they also enable high-quality patient-professional interaction, may be an alternative option to support the development of frontline primary care services.

Attributes reporting on patient-professional interaction were “professional’s words and explanations about medication,” “attention paid by the professional to the patient’s views about medicines,” and “the extent of review undertaken.”

Aside from the National Primary Care Research and Development Centre’s own research [14], a substantial body of evidence shows that the quality of patient-professional interaction matters to patients, for example, “whether the doctor seemed to listen” [15] and “doctor’s manner” [16]. In a survey of patient attitudes and satisfaction with pharmacist supplementary prescribers and doctors, value was attached to whether the professional knew the patient well and/or demonstrated an interest in getting to know them as “a whole person” rather than just their illness [17]. In a study of pharmacists’ preferences for extending the community pharmacy role, undertaking regular medication review was a significant influence on choice [18] and further research has shown that patients value pharmacist advice on all aspects of their medication, general health, and lifestyle [5]. Pharmacists’ preferences have also shown that they value providing patient-centered services such as medication therapy management and chronic diseases management [19]. The policymakers too believe that promoting patient-centered care will improve patient adherence to medication [20].

The choice context and the services on offer

We again drew on the PIP survey to ensure that respondents were presented with an appropriate choice context in as realistic and understandable way as possible. It showed that the most frequent setting for prescribing was general medical practice (55% of active pharmacists worked in this setting). Hypertension was the single most common condition pharmacists managed (25% of the PIPs reported this as the condition they prescribed most frequently) [7]. Overall, 77% of the survey respondents reported that they worked from a diagnosis made by a doctor and 40% considered that in their most common treatment area their prescribing replaced medical prescribing.

A “labeled”-choice experiment was selected for choosing between appointments for a prescribing pharmacist, “own (family) doctor,” or “available (family) doctor” service. Such labels expect to have an intrinsic value [21,22], and this has been demonstrated, for example [23].

By focusing on an existing long-term condition managed by either doctor or pharmacist (hypertension), we assumed prior diagnosis at the time of the current appointment and it followed that the subsequent consultation was for managing and reviewing medication, adherence, and providing a routine health checkup. We assumed that patients wanted to attend follow-up appointments with a prescribing pharmacist, “own doctor,” or an “available doctor.” In any such appointment, the prescriber (“own” doc-
Vignette: Imagine you have had high blood pressure (hypertension) for some time and it is now time for your regular review at your general practice surgery. This will involve your blood pressure being measured and may involve some changes to your medication.

<table>
<thead>
<tr>
<th>Example of choice</th>
<th>Prescribing pharmacist</th>
<th>Your own doctor</th>
<th>Available doctor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of consultation</td>
<td>20 min</td>
<td>5 min</td>
<td>10 min</td>
</tr>
<tr>
<td>Professional’s words &amp; explanations about your medicines</td>
<td>easy to understand</td>
<td>difficult to understand</td>
<td>difficult to understand</td>
</tr>
<tr>
<td>Attention paid by professional to your views about medicines</td>
<td>appears to listen</td>
<td>appears not to listen</td>
<td>appears not to listen</td>
</tr>
<tr>
<td>Health review covers</td>
<td>only high blood pressure</td>
<td>both high blood pressure &amp; overall health</td>
<td>only high blood pressure</td>
</tr>
</tbody>
</table>

Which would you choose? Tick one box only

Fig. 1 – Vignette and example of a choice.
whether they pay for NHS prescriptions), health status (chronic health problems, health today), use of prescriptions, expectations (of getting a prescription), and experience of NMP services. An example of a choice is given in Figure 1.

The Survey, Sample Size, and Ethics Approval
The survey was conducted during October and November 2009 in five general practices geographically spread across England providing NMP services with health professionals working within their premises. Three practices listed a total of two NMP personnel within their staff, while two practices employed one PIP. Respondents were current patients waiting to see health professionals in the doctor surgery. Overall, each practice was asked to hand out 150 questionnaires. However, because each practice could not keep close track of the 150, it was not possible to calculate a response rate. Each practice had 38 questionnaires of each version, with a minimum target response of 105 questionnaires (70%); overall, the target was 525. This sample size provided ample opportunity to explore subgroup analysis and respondent heterogeneity, because sample size calculation was based on a minimum 100 responses per subgroup [28]. A priori two subgroups were of particular interest—the impact of previous experience of an NMP service and consistency of respondents. The importance of experience has previously been demonstrated [23]. DCES rely on hypothetical choices, and much debate has grown up around the issue of whether to include all respondents or only those who have answered consistently [6]. Because currently available tests of consistency are not conclusive, best practice is to explore the impact of consistency by considering utility models with/without inconsistent respondents but remain cautious of deleting responses because this may be inappropriate for policy-making purposes (see discussion on the matter reported by Lanscar and Louviere [9]).

NHS Ethics approval was obtained from Dorset Research Ethics Committee in February 2009 (REC Ref No 08/H0201/163).

Utility models, their comparison, and theoretical validity of responses
When analyzing responses to multiple-choice DCE survey, typically the multinomial logit (MNL) model is used, although there is growing application of alternative models when relaxing its assumptions. One example is provided by the mixed logit (MXL) model, a framework already employed when evaluating health care intervention [4]. Our strategy sought the most parsimonious model by starting with a basic MNL model to predict choice ictly, because sample size calculation was based on a minimum 100 responses per subgroup [28]. A priori two subgroups were of particular interest—the impact of previous experience of an NMP service and consistency of respondents. The importance of experience has previously been demonstrated [23].

Policy analysis
Results from the utility models can be used to estimate the probability of uptake for the introduction of a new (prescribing pharmacist) service. This kind of information may be a useful contribution to policy analysis. We use results from the preferred model to estimate the impact of introducing the prescribing pharmacist service into a general practice setting. In doing so, attribute levels are predefined and resultant utility scores converted to probabilities (for details, see Equation 1, Table 4, and [8]). We also used the same utility functions to derive utility scores for given levels of own doctor and new prescribing pharmacist services to assess the impact of quality improvements to the service. In this scenario, we considered that no additional resources were available to improve a current own doctor service but that by considering trade-off information between attributes how a better service could be configured by reducing one aspect of service (attribute level) for an increase in another attribute level and how, overall, this could increase utility. When using DCE findings to inform policy analysis, the overall representativeness of the sample needs to be considered and any limitation discussed.

Results
Patients’ responses and their background characteristics
Questionnaires were completed by 451 patients attending all practices. Response rates were not calculable. Table 2 shows the background characteristics of respondents and the distribution of

<table>
<thead>
<tr>
<th>Table 2 – Characteristics of sample and choices.</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondents (N = 451)</td>
<td>217</td>
<td>51.9</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>166</td>
<td>43.0</td>
</tr>
<tr>
<td>Age (age), median (IQR)</td>
<td>48 (35–62)</td>
<td></td>
</tr>
<tr>
<td>Lives with a chronic disease (chronic)</td>
<td>137</td>
<td>30.7</td>
</tr>
<tr>
<td>Health today</td>
<td>50</td>
<td>11.2</td>
</tr>
<tr>
<td>Very good</td>
<td>137</td>
<td>30.7</td>
</tr>
<tr>
<td>Good</td>
<td>50</td>
<td>11.2</td>
</tr>
<tr>
<td>Neither good nor poor</td>
<td>118</td>
<td>26.5</td>
</tr>
<tr>
<td>Poor</td>
<td>121</td>
<td>27.1</td>
</tr>
<tr>
<td>Very poor</td>
<td>20</td>
<td>4.5</td>
</tr>
<tr>
<td>Usually pays for NHS prescription (payNHS)</td>
<td>289</td>
<td>72.3</td>
</tr>
<tr>
<td>Income status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to £20,000</td>
<td>119</td>
<td>28.2</td>
</tr>
<tr>
<td>£21,000–£40,000</td>
<td>165</td>
<td>39.1</td>
</tr>
<tr>
<td>More than £40,000</td>
<td>138</td>
<td>32.7</td>
</tr>
<tr>
<td>Expecting a prescription today</td>
<td>250</td>
<td>56.1</td>
</tr>
<tr>
<td>Expecting to see pharmacist today</td>
<td>50</td>
<td>19.9</td>
</tr>
<tr>
<td>Has experience consulting nonmedical prescriber (experienced)</td>
<td>166</td>
<td>43.0</td>
</tr>
<tr>
<td>Passed consistency test* (consistent)</td>
<td>356</td>
<td>1.9</td>
</tr>
<tr>
<td>Observations (N = 1779)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescribing pharmacist</td>
<td>761</td>
<td>42.8</td>
</tr>
<tr>
<td>Your own family doctor</td>
<td>964</td>
<td>55.3</td>
</tr>
<tr>
<td>Available family doctor</td>
<td>34</td>
<td>1.9</td>
</tr>
<tr>
<td>IQR, interquartile range, NHS, National Health Service. * Consistent responses were identified by building in a test of “consistency” into the questionnaire. A pseudo choice that contained one superior option in a set of choices was added, i.e., dominated on all the attribute levels—a “pass” was given for the dominant option being selected.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Utility models

Table 3 presents the regression results for all models run. The first series of results relates to the basic model, MNL1, and is shown in the third column of the table. Overall, this basic model, the most largely applied, retained decent model fit (pseudo R² of 0.406) [22]. The impact of attributes on choice shows. There is a general preference for managing preexisting hypertension by using a prescribing pharmacist (α1 = 2.05; P < 0.01) or own family doctor (α = 2.41; P < 0.01)—these health professionals were more preferred to the fixed alternative “available doctor.” This means that respondents preferred to move from a service provided by an available doctor to an alternative offering to see a prescribing pharmacist or own doctor; however, this move was not equally preferred. The larger value given to own doctor suggests that this alternative was the more preferred.

Furthermore, all service attributes considered in the experiment, with the exception of the length of consultation (β1 = −0.005; P = 0.42), were important in choosing how to manage diagnosed hypertension and had signs as expected. The attribute “attention paid by professional to the patient’s views about medicines” was judged the most important (with greatest absolute value of 0.889; P < 0.01), and respondents preferred professionals to appear to listen. Respondents were more likely to prefer a service offering professional’s words and explanations about medicines to appear to listen. Respondents were more likely to prefer a service offering professional’s words and explanations about medicines to appear to listen. Respondents were more likely to prefer a service offering professional’s words and explanations about medicines to appear to listen.

### Utility models

All respondents: MNL1, MNL2, and MXL

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### Utility models

All respondents: MNL1, MNL2, and MXL

<table>
<thead>
<tr>
<th>Utility models</th>
<th>All with interactions</th>
<th>All respondents</th>
<th>All MXL*</th>
<th>Subgroups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MNL1</td>
<td>MNL2</td>
<td>MXL</td>
<td>Using NMP</td>
</tr>
<tr>
<td>Pharmacist</td>
<td>Coefficient (α1)</td>
<td>2.05†</td>
<td>1.33†</td>
<td>2.05†</td>
</tr>
<tr>
<td>Own doctor</td>
<td>Coefficient (α2)</td>
<td>2.41†</td>
<td>1.73†</td>
<td>2.42†</td>
</tr>
<tr>
<td>Length of consultation</td>
<td>Coefficient (β1)</td>
<td>−0.005</td>
<td>−0.004</td>
<td>−0.005</td>
</tr>
<tr>
<td>Professional’s words</td>
<td>Coefficient (β2)</td>
<td>0.686†</td>
<td>0.695†</td>
<td>0.693†</td>
</tr>
<tr>
<td>Attention paid to patient’s views</td>
<td>Coefficient (β3)</td>
<td>0.889†</td>
<td>0.906†</td>
<td>0.906†</td>
</tr>
<tr>
<td>Extent of review</td>
<td>Coefficient (β4)</td>
<td>0.173†</td>
<td>0.173†</td>
<td>0.262</td>
</tr>
<tr>
<td>Female (β5)</td>
<td></td>
<td></td>
<td></td>
<td>0.898†</td>
</tr>
<tr>
<td>Female (β9)</td>
<td></td>
<td>0.466</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (β6)</td>
<td></td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (β10)</td>
<td></td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic (β7)</td>
<td></td>
<td>0.930†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic (β11)</td>
<td></td>
<td>0.931†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PayNHS (β8)</td>
<td></td>
<td>0.222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PayNHS (β12)</td>
<td></td>
<td>0.222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of responses</td>
<td>1767</td>
<td>1767</td>
<td>1767</td>
<td>653</td>
</tr>
<tr>
<td>Number of respondents</td>
<td>451</td>
<td>451</td>
<td>451</td>
<td>166</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>−1940.437</td>
<td>−1940.437</td>
<td>−1954.43</td>
<td>−716.583</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>−1153.507</td>
<td>−1131.297</td>
<td>−1159.76</td>
<td>−432.939</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.406</td>
<td>0.410</td>
<td>0.401</td>
<td>0.387</td>
</tr>
<tr>
<td>Log likelihood ratio test</td>
<td>44.42</td>
<td>12.506</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The preferred model MNL1 used for policy analysis is reported in italics bold.

MNL, multinomial logit; MXL, mixed logit; NHS, National Health Service; NMP, nonmedical prescribing.

* Estimated with normal distributions assigned to variables β1 to β4 by using 100 Halton draws and convergence was achieved in 1000 iterations.
† Statistically significant at the 1% level.
consult. Female respondents more strongly prefer to choose a prescribing pharmacist service ($\beta_5 = 0.898; P < 0.01$) and those who live with a chronic health condition hold stronger (and equal) preferences for seeing a prescribing pharmacist ($\beta_7 = 0.930; P < 0.01$) and own family doctor ($\beta_{11} = 0.931; P < 0.01$) compared with the average respondent.

The MNL model results are shown in column 6 of the table. In this case, the model does not appear to fit as well, the pseudo $R^2$ value decreased to 0.401, and although overall there was a statistically significant improvement in the log likelihood ratio test compared with model MNL1 ($q^2 = 12.506, 4$ degrees of freedom, and $P < 0.01$), there was no added value in the information obtained. The same general picture is true as it is for MNL1: a general preference for managing preexisting hypertension by using a prescribing pharmacist ($a_1 = 2.05; P < 0.01$) or own doctor ($a_2 = 2.42; P < 0.01$) and the mean of the sample population random parameter estimates taking on similar importance. That is to say that the length of consultation was found not to be important ($\beta_1 = -0.005; P = 0.42$) but the remaining attributes were. Their mean estimates were statistically significant: “attention paid by professional to the patient’s views about medicines” was again judged the most important (with greatest absolute value of 0.906; $P < 0.01$) followed by professionals appearing to listen ($\beta_2 = 0.693; P < 0.01$) and “health care review” ($\beta_4 = 0.171; P < 0.01$). None of the estimates for the spread around the mean values, however, was statistically significant, suggesting that no further heterogeneity was identified.

### Subgroups: Respondents experienced in using NMP and consistent respondents

When considering the impact of experience of NMP on preferences (MNL3), the model appears to have an acceptable model fit ($R^2 = 0.387$) even though two attributes “length of consultation” ($\beta_1 = -0.004; P = 0.83$) and “extent of review” ($\beta_4 = 0.173; P = 0.32$) are not valued (see Table 3).

The subgroup of respondents who were judged to have passed the test of consistency (MNL4) also had a good model fit ($R^2 = 0.441$; see Table 3). Consistent respondents preferred, to similar extents, using a prescribing pharmacist service ($a_1 = 2.33; P < 0.01$) or own family doctor ($a_2 = 2.35; P < 0.01$) compared with the fixed alternative, “available doctor,” given the similar absolute values on these coefficients. As with MNL1, who was seen was the main influence on choice with the remaining significant attributes contributing to preference in a similar (relative) order of importance.

### Policy analysis

Output from the basic MNL1 was used for policy analysis. The regression results can be used in a number of ways, including 1 predicting the impact of introducing a new service on the take up of services (or market share) and 2 assessing the impact of quality improvements to the service.

#### Predicting the impact of introducing a new service on the take up of services

This is demonstrated in Table 4 where we assume two hypothetical options currently available in a general practice for the ongoing management of hypertension and then explore the impact of introducing a new prescribing pharmacist service.

The existing services are described as 1 “basic” (or available doctor), where patients can see the available doctor for a 10-minute consultation during which they do not find the doctor appearing to listen to their views about their medicines, or the doctor using easy to understand words and explanations about medication and performing a limited health review and 2 own doctor, where patients can see their doctor for a 10-minute consultation during which they also find the doctor not appearing to listen to their views about their medicines but the doctor uses easy to understand words and explanations about medication and performs a comprehensive health review. The new prescribing pharmacist service is similar to the own doctor option except that patients see a prescribing pharmacist for a 10-minute consultation.

We use the MNL1 regression results to calculate the indirect utility for each option and from that estimate the probability of uptake (see Equation 1, as footnoted to Table 4). Table 4 shows that before the introduction of the prescribing pharmacist service, the own doctor service makes up the predominant share of total consultations, 96.3% compared with 3.6% for the basic option. After the introduction of the new prescribing pharmacist service, the utility model suggests a significant change in who is consulted. About 17% of consultations are switched from family doctor services (either own doctor or available doctor) to prescribing pharmacist services, the large majority (16%) from own doctor. This can be seen as evidence of the acceptability of a prescribing pharmacist service to patients as a means of accessing their medicines and thus as a way of alleviating pressure on scarce doctor time.

### Assessing the impact of quality improvements to the service

We further use the MNL1 regression results to estimate utility scores obtained from given combinations of attribute levels and overall preference for health professional consulted. From this we can learn about the relative ranking of alternative service options by overall utility and trade-offs between attributes that may inform how services can be reconfigured to yield greater patient utility. Table 5 shows the estimated utility scores of a current level of service (based on own doctor prescribing) and compares it with a possible new prescribing pharmacist service. Although there is a general stronger preference for seeing own doctor ($a_1 = 2.41$), this is not the only factor contributing to utility. Thus, alternative combinations of attribute levels can be used to compensate for a given own doctor service. This is shown in the table by a prescribing pharmacist service that pays attention to the patients’ views about medicines when the own doctor service does not, all else equal. This combination of attribute levels is more preferred (the

<table>
<thead>
<tr>
<th>Table 4 – Probability of take up (based on MNL1).</th>
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</thead>
<tbody>
<tr>
<td>Probability* of choice</td>
</tr>
<tr>
<td>Before new prescribing service</td>
</tr>
<tr>
<td>After new prescribing service introduced</td>
</tr>
</tbody>
</table>

MNL, multinomial logit.

* Probabilities calculated by using the following formula: $P_c(\text{option } j) = \exp (V_{cj})/\Sigma \exp V_{cj}$. (Equation 1), where individual $n$ will choose option 1 within a choice set $C$ of ($j = 1, ..., J$) options. Note results based on the attribute-level assumptions given as follows: Option 1: $a_1 = 0, a_2 = 0, b_1 = 10$ min, $b_2 = 2.41$; Option 2: $a_1 = 0, a_2 = 0$, own doctor, $b_1 = 10$ min, $b_2 = 0.01$; Option 3: $a_1 = -0.004, a_2 = 0$, prescribing pharmacist, $b_1 = 10$ min, $b_2 = 0.01$.
utility model predicts a utility of 3.793 compared with 3.264 for the own doctor service described, a gain of 0.529 in overall utility).

**Table 5 – Utility scores for alternative service configurations (based on MNL1).**

<table>
<thead>
<tr>
<th>Factor</th>
<th>New service</th>
<th>Current service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative-specific constant</td>
<td>PIP</td>
<td>Own doctor</td>
</tr>
<tr>
<td>Length of consultation</td>
<td>10 min</td>
<td>10 min</td>
</tr>
<tr>
<td>Professional’s words and explanations about medicines</td>
<td>Easy to understand</td>
<td>Easy to understand</td>
</tr>
<tr>
<td>Attention paid by professional to your views about medicines</td>
<td>Appears to listen</td>
<td>Appears not to listen</td>
</tr>
<tr>
<td>Health review covers</td>
<td>Comprehensive</td>
<td>Comprehensive</td>
</tr>
<tr>
<td>Total estimated utility</td>
<td>3.793</td>
<td>3.264</td>
</tr>
<tr>
<td>Gain in utility</td>
<td>0.529</td>
<td></td>
</tr>
</tbody>
</table>

MNL, multinomial logit; PIP, prescribing independent pharmacist.

**Discussion**

The wider study set out to evaluate NMP in England to inform planning for current and future prescribers [7]. Part of this evaluation included the DCE study reported, a study that investigated and provided new empirical evidence of the strength of patient preferences for using prescribing pharmacists in a primary care setting. In health economics and health policy, it is important to have such information on preferences and to use them in conjunction with efficient allocation of health care resources. By using the estimated parameters from a well-fitting regression model, we demonstrated not only patients’ acceptability of using prescribing pharmacists for a certain condition but also explored how patients trade between whom they prefer to consult and other important qualitative aspects of the service.

At the commencement of the study, there was limited information of current working practices for the new prescribing pharmacist role(s) or how these might be developed as frontline services. Earlier evidence of supplementary prescribing pharmacist showed then prescribing practices to be predominantly based in primary care and for cardiovascular conditions [17]. Informed further by the seminal national survey of pharmacists working practices [7], the decision was taken to elicit patient preferences within a context of offering choice of family doctor (either own doctor or available doctor) or prescribing pharmacist consultations. The study assessed the relative importance of service attributes for appointments to manage a preexisting condition, exemplified by the cardiovascular condition hypertension. This choice context is likely to remain relevant in the future development of frontline services of this kind.

The study suggested that our sample found prescribing pharmacist services plausible alternatives for family doctor services. Depending on the model used to explain choices, all respondents demonstrated the greatest preference for being seen by their own doctor when compared with the available doctor but also demonstrated a strong preference for being seen by the prescribing pharmacist. This meant that there was evidence to support a move from a service provided by an available doctor to an alternative offering to see a prescribing pharmacist or own doctor, all else being equal. Furthermore, the attribute “length of consultation” was not on this occasion shown to be a statistically significant predictor of choice. One explanation is that follow-up consultations of long-term conditions such as hypertension may simply not require longer consultations because the patient is sufficiently knowledgeable about his or her condition and management; rather, it is the fine detail and quality of service that matters. Therefore, what appeared to subsequently matter to the level of patients’ utility, and in order of relative importance, were attributes reporting on patient-professional interaction: “attention paid by the professional to the patient’s views about medicines,” followed by “professional’s words and explanations about medication,” and “the extent of review undertaken.”

It was also observed that when key contextual variables were explored as further determinants of choice, statistically significant differences in tastes were limited to respondents’ gender and health status. In our sample, it was female respondents who held stronger preferences for choosing a prescribing pharmacist service while those who live with a long-term health condition held equally stronger preferences for a prescribing pharmacist service and own doctor service when compared with the available doctor service. As a result, one policy recommendation may be to provide prescribing pharmacist services at locations and times at greatest convenience to women and individuals with existing long-term conditions. Findings from an RCT evaluating a community-pharmacy–based medicines management service for chronic patients with coronary heart disease showed females more satisfied with the new pharmacy service [29].

While others have argued the importance of exploring the extent to which individuals may have different preferences and that some of this may be unrelated to observable personal characteristics [27], this study did not uncover any further preference heterogeneity of this kind, as evidenced by the lack of statistical significance in the estimates for the SD values associated with attributes in the MXL model that was estimated.

An interesting finding was the difference found between relative preferences obtained by the complete sample and a more limited sample judged to have answered the DCE consistently. Here the main finding was that consistent respondents appeared to be more equally balanced in their preference for a prescribing pharmacist and family doctor than the whole sample. As previously discussed, there is much debate in the literature about what to do with such preferences. In the current study, the main impact of our subgroup findings served to strengthen the relative importance of prescribing pharmacists.

When the results were used to explore the take up of new prescribing pharmacist services under different states of the world, our model showed that of the 17% of new prescribing pharmacist consultations, most (16%) could expect to arise from a switch from own family doctor services.

We further explored how the DCE could be used to exploit “trade-off” information by considering whether patients might prefer to see a prescribing pharmacist if they were “compensated”
by particular changes in the level of other service attributes. In the example given, we showed how an improvement in the attribute “attention paid by professional to patients’ views about medication” yielded higher utility than the own family doctor service, all else being equal.

Clearly, there are a number of strengths and weaknesses of an empirical study such as this one. A particular strength was using an evidence-based approach in planning the intervention, basing the research on key findings from the health care literature and previous DCE applications to pharmacy research as well as the national survey in the first phase of the wide study. The choice set for this study included an opt-out or status quo alternative with attribute levels defined during piloting work. This provided a further strength when limiting overestimation of responses [30]. In the process of creating the experiment, contemporary issues about measuring design efficiency and choosing the most appropriate design available in terms of its statistical properties were considered. A further strength of the DCE method is that alternative DCE modeling can be considered and a strategy for choosing the preferred model developed [22]. In this case, a reasonably extensive strategy was adopted although there is always scope for considering alternatives (e.g., different assumption in MAXL models or latent class models; see [19] for latent class model with application to pharmacy). The impact of consistency of responses and patient experience of NMP on regression modeling was also considered. The implication of alternative models on policy decision making might also be a matter of discussion.

A possible limitation of the study was the representativeness of the respondents and therefore generalizability of findings. Although the five sites involved in the study for data collection were spread across England and delivered comparable NMP services [7], the overall representativeness of the sample remains unknown and no other evaluation of NMP services in the United Kingdom are available to compare findings. Poor patient responses from three specific general practice sites (i.e., fewer than 50 questionnaires per practice) could not allow testing for variability in patient preferences across sites. Any possible issue in the representativeness of the sample could have an impact on policy analysis and the use of findings to support any policy change.

The DCE survey involved a separate sample of patients from the one replying to a wider patients’ experience questionnaire that took place within the wider study [7], but this two-phase survey strategy did not reduce the number of patients who were available to be given a DCE questionnaire. In both surveys we aimed at distributing a questionnaire to comparable samples from each participating site (200 for the patients’ experience questionnaire and 150 for the DCE questionnaire). Unfortunately, data from the two surveys could not be linked and patients’ views and experiences on their direct consultation with the independent prescribers could not be incorporated within the DCE modeling. A further limitation to the study is that response rates were not calculable because questionnaires handed out could not be tracked.

The experimental design used for this application was created by adding a fixed opt-out option to a binary orthogonal choice set derived from a catalog of orthogonal arrays with application of foldover approach [21]. Alternative approaches are now available to researchers to create multiple-choice designs that are statistically efficient [31]. Recent developments include using prior assumptions about parameters to improve statistical efficiency [32] and construct multiple-choice designs with customized reference alternatives for each respondent (http://www.choice-metrics.com).

Other aspects, such as possible concerns about the appropriateness of the health care received, might be important to patients when choosing between different health care packages, although for our study the choice of these specific DCE attributes was supported by evidence from the literature, discussion with experts, and pilot work with patients. Unfortunately, no costing data on the delivery of the alternative services were considered. Future work should integrate costing and DCE output within a cost-effectiveness framework to investigate how preferences (and their heterogeneity) might influence cost-effective decisions.

In conclusion our study demonstrates that patients have valid preferences for how primary care prescribing services in general practice for long-term conditions are delivered. On this occasion, the pharmacist prescribing service is valued by patients as an alternative to doctor prescribing and therefore represents an acceptable form of service delivery when informing policy and practice. In turn, it is important that policymakers and practices take note of these preferences.

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REFERENCES


