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1 **Title:** Patient and primary care physician perceptions of penicillin allergy testing and subsequent use
2 of penicillin containing antibiotics: A qualitative study

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38 Conflicts of interest

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46

47 **Abstract**

48 **Background**

49 Removal of an inaccurate penicillin allergy record following testing allows patients to access first-line
50 treatment for infections, and reduce use of broad spectrum antibiotics which contribute to antibiotic
51 resistance. However, it is seldom undertaken.

52

53 **Objectives**

54 To identify clinicians' working in primary care and patients' views on barriers and enablers for
55 penicillin allergy testing and subsequent antibiotic use.

56 **Methods**

57 Fifty interviews with patients and clinicians; including 31 patients with a record of penicillin allergy,
58 16 with experience of testing, and 19 clinicians. Interviews were analysed thematically.

59

60 **Results**

61 Patients were often unaware of the benefits of penicillin allergy testing and only patients who had
62 experienced negative consequences of having a penicillin allergy label were motivated to get tested.
63 Clinicians were reluctant to change patient records based on their clinical judgment alone but had
64 limited experience of referring patients with suspected penicillin allergy and were often uncertain
65 about referral criteria and what the testing involved. Clinicians felt allergy testing could be beneficial
66 and patients who had attended testing reported benefits of the test. Clinicians expressed
67 uncertainty related to whose responsibility it was to make sure that patient understood allergy test
68 results.

69 **Conclusions**

70 Clinicians would benefit from information about penicillin allergy testing in order to be able to use
71 these services appropriately, and to discuss referral with patients. Patients might be more

72 motivated to seek testing if they were more informed regarding its benefits. Good communication
73 between primary and secondary care would facilitate the updating of medical records, and promote
74 better patient education.

75 **Highlights**

76 What is already known about this topic?

- 77 • Up to 15% of primary care patients carry an unsubstantiated label of penicillin allergy.
78 Penicillin allergy testing offers an opportunity to confirm or exclude allergy but despite
79 recommendations, clinicians rarely use allergy services.

80 What does this article add to our knowledge?

- 81 • This article fills an important gap by highlighting barriers and facilitators to using allergy
82 services and subsequent consumption of penicillin from the perspective of both patients and
83 primary care physicians.

84 How does this study impact current management guidelines

- 85 • Both patients and clinicians need to be supported to use penicillin allergy services, and be
86 provided with the skills and information to prescribe and consume penicillins appropriately
87 following a negative test result.

88 **Key words:**

89 penicillin allergy; antibiotic stewardship; prescribing; antibiotic resistance; qualitative

90

91 **Abbreviations:**

92 National Institute for Health and Care Excellence (NICE)

93 Methicillin-resistant *Staphylococcus aureus* (MRSA)

94

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97 (NIHR CRN).

98 **Introduction**

99 It is estimated that between 10% of patients registered with a UK general practitioner and up to 15%
100 of primary care patients in the US carry an unsubstantiated label of penicillin allergy. Fewer than
101 10% of these patients are found to be allergic when formally tested (1-3). Therefore, a significant
102 proportion of the population may, unnecessarily, be denied access to first-line antibiotic therapy.

103 The consequences of incorrect penicillin allergy records are significant. They include longer hospital
104 stays(4), increased surgical site infections(5), and increased infections with Methicillin-resistant
105 *Staphylococcus aureus* and *Clostridium difficile* through the use of non-penicillin antibiotics (5-8).

106 Patients are also more likely to be prescribed broad spectrum antibiotics such as quinolones,
107 clindamycin, tetracycline, and sulphonamides macrolides (6, 7), which are often more expensive and
108 are associated with increased treatment failure (9). This research has recently informed the UK
109 National Institute for Health and Care Excellence (NICE) advice to clinicians to “double check patients
110 with penicillin allergy to avoid increased MRSA risk” (10). The Choosing Wisely initiative of the
111 American Board of Internal Medicine Foundation recommends “don't overuse non-beta-lactam
112 antibiotics in patients with a history of penicillin allergy, without an appropriate allergy evaluation”
113 (11).

114 Patients are frequently given a label of penicillin allergy due to common side effects of the drug such
115 as nausea, or rash caused by concomitant viral illness. Often, there is incomplete or inconsistent
116 documentation of allergy in medical records; or patients received the allergy diagnosis in childhood
117 and have no recollection of the index event (2, 12, 13).

118 Penicillin allergy testing offers an opportunity to confirm or exclude penicillin allergy; patients who
119 test negative can be 'de-labelled' and advised that their risk of allergy is the same as for the general
120 population. Testing with a combination of skin testing and oral challenge, offers 99% negative
121 predictive value for penicillin allergy (14). Despite recommendations from key organisations such as
122 the American Academy of Allergy, Asthma & Immunology and UK NICE to test patients with a
123 penicillin allergy record (1, 14, 15), clinicians rarely use these services (16, 17), so it is vital to identify
124 the barriers and enablers to uptake of testing among both physicians and patients. A recent rapid
125 review assessing patient and clinician views on testing and subsequent antibiotic use found limited
126 relevant literature, and no qualitative studies exploring these issues (18). We aimed to address this
127 important gap by identifying clinician and patient views and experiences of referring to or attending
128 for penicillin allergy testing, and the use of penicillins following negative allergy testing.

129 **Methods**

130 Participants and procedure

131 Design

132 Qualitative study using semi-structured interviews, UK primary care.

133

134 Recruitment

135 *Patients*

136 Patients were identified using two methods. Patients with experience of penicillin allergy testing
137 were identified from a general adult hospital allergy clinic in the North of England. An audit of clinic
138 records identified patients who had attended for testing between April 2015 and April 2017. In
139 addition, patients who did not undergo testing were identified from general practices in the
140 geographical area which the allergy clinic served. Each general practice identified 50-100 patients
141 with a record of penicillin allergy. All potential participants were sent a recruitment pack and asked
142 to contact the research team if they were interested in participating in an interview.

143

144 *Primary care clinicians*

145 Clinicians were identified using three methods. Firstly, clinicians working in practices with patients
146 who had undergone penicillin allergy testing in the hospital allergy clinic were identified and invited;
147 secondly clinicians working in general practices in the geographical areas served by the hospital were
148 invited; thirdly clinicians who contacted the local microbiology services with queries during the study
149 period were invited. All potential participants were sent a recruitment pack and asked to contact the
150 research team if they were interested in participating.

151

152 Interviews

153 Two semi-structured interview guides were developed based on the primary research questions and
154 informed by the existing literature on penicillin allergy (18). Interview guides were added to as
155 necessary, when initial interviewees discussed additional relevant topics (Appendix 1). Patients were
156 asked about their personal experience or hypothetical views on, penicillin allergy testing and
157 subsequent use of penicillin. Clinicians were asked about their views of penicillin allergy testing and
158 prescription of penicillins to patients who had a negative test result. After obtaining consent,
159 interviews were conducted over the telephone by an experienced qualitative researcher (PhD
160 qualified with substantial previous experience of conducting qualitative research, audio recorded
161 and transcribed verbatim. Interviews continued until data indicated saturation in each participant
162 group.

163 Analysis

164 Data collection and analysis took place concurrently. Data from all interviews were analysed.
165 Transcripts were read and reread by MW both during and after data collection. To enhance the
166 credibility of our analysis researcher triangulation was performed; this meant that one third of
167 transcripts were read and analysed by the wider multidisciplinary team to ensure that data was
168 accurately represented. An inductive thematic analysis approach was used to analyse data (19). One

169 author (MW) independently coded initial transcripts which were then discussed with the wider team
170 who met to review and agree on preliminary codes. Following coding of further transcript, MW
171 developed a draft coding framework which was discussed and agreed by the team. The remaining
172 interviews were then analysed using this framework with changes made if needed. To enhance the
173 trustworthiness of data, analysis was conducted and discussed by a multidisciplinary team consisting
174 of psychologists, a sociologist, a primary care clinician and colleagues from hospital-based
175 immunology with expertise in penicillin allergy and microbiology services.

176

177 **Results**

178 **Participants**

179 A total of 50 participants completed an interview. Of these 31 were patients and 19 were primary
180 care clinicians. Table 1 provides a summary of participant characteristics. Interviews were conducted
181 between December 2017 and August 2018 and lasted 20-60 minutes (average 46 minutes).

182 Insert Table 1

183 Three themes captured the variation in patient views and experiences of attending for penicillin
184 allergy testing; three themes captured the clinician experience of utilizing penicillin allergy services.

185 **PATIENT VIEWS**

186 **Personal relevance and benefits of the test**

187 Patients both with and without experience of penicillin allergy testing reflected on the extent to
188 which penicillin allergy created a problem for them. The majority of participants who were
189 motivated to get tested had already experienced negative consequences of having a penicillin allergy
190 label, such as not being able to have a planned operation, being denied first-line treatment, and
191 having limited antibiotic choice because of other allergies or having the impression that other

192 antibiotics were not working for them. Importantly, they had not been aware of these consequences
193 of penicillin allergy labelling before they experienced problems.

194

195 *I said well look, I'd like [a penicillin allergy] test. I've been asking for years for a test [...]*
196 *because I've had infections where it has been bad— I said my body's just used to*
197 *erythromycin. My body's just used to it [...].t's like taking sweets. Doesn't do anything at all*
198 *for me (P1, Female, 69, negative allergy test)*

199 In contrast, participants whose penicillin allergy status did not affect their day-to-day lives did not
200 see an allergy test as personally relevant. This was often because they had not needed to take
201 antibiotics and therefore had not experienced any negative impact of a penicillin allergy label. They
202 also were not informed about benefits of having access to penicillin.

203

204 *I suppose the only benefit would be it would be an alternative option to prescribe, I don't*
205 *know whether that would be a benefit. As I say, I've not had a really negative impact, I've*
206 *never had a condition where an antibiotic hasn't been prescribed to me that hasn't seemed*
207 *to do the trick (P22, Female, 51, no allergy test)*

208 Finally, a small number of patients without experience of testing but who had sought additional
209 information and were aware that penicillin is a first-line treatment for many infections, felt that
210 having access to a wider range of antibiotics could be beneficial to them in the future.

211

212 *If the test showed that I was not allergic, I would be pleased; it would be a relief to know I*
213 *wasn't (P17, Female, 68, no allergy test)*

214

215 **Importance of safety and perceived risks of test**

216 Patients often considered risks involved in undergoing a penicillin allergy test. The first common
217 concern was related to the possibility of having an allergic reaction. This was particularly true when
218 patients had been told by their primary care clinician for many years to avoid penicillin:

219 *The doctors were telling me I was allergic to them, then you worry that if you're going to do*
220 *[a test] we'll get a bad reaction (P7, Female, 65, negative allergy test)*

221 Severity of the index reaction played a role in how patients perceived the risk of a further reaction;
222 patients with previous severe reactions were more apprehensive about having the test. Patients
223 with perceived severe co-morbidity worried that if they were to have a reaction this could worsen
224 their overall state of health.

225 The second concern of patients was around the degree of invasiveness of the test. Skin testing was
226 generally perceived to be less frightening than an oral challenge test.

227 *Because it's on the skin, it's not going in your mouth is it? You're swallowing a tablet, or two*
228 *or three tablets, that's going in your system and you don't know what the reaction is going to*
229 *be. I think that's the fear bit, really (P18, Female, 68, no allergy test)*

230 Patients were concerned about how they would be monitored during a test. Assurance of access to
231 trained medical staff at the time of the test seemed to counterbalance patient worries about
232 reactions. Taking penicillin at home following allergy testing in the clinic to check for delayed
233 reactions was particularly worrying for some.

234 Participants who had previously undergone penicillin allergy testing described the importance of
235 feeling safe while undertaking the test. They commented that feeling 'properly monitored' was
236 important but did not want the procedure to be overly medicalised (for example not having to lay in
237 a bed). Participants felt reassured when testing took place on hospital premises.

238 Finally, participants also described the importance of the provision of information prior to testing,
239 presented in lay terms. This allowed participants to know what to expect and addressed their
240 concerns.

241 *The [allergy] doctor I saw was very, very good. I mean he explained everything. He went*
242 *through everything with me and you know, even made a joke about certain things that I was*
243 *frightened of you know so it was – I was quite at ease in a way (P1, Female, 69, negative*
244 *allergy test).*

245 **Confidence in test result**

246 Patients reported benefits and reassurance from having undertaken allergy assessment but also
247 some uncertainties. Those who had had an allergy test often felt that the test result provided a
248 definitive answer about their allergy status and was perceived as a proof.

249

250 *You always have that bit of doubt in your mind of am I or aren't I [allergic]? My husband*
251 *thought it was [psychological], because I was reading what can happen, but even when I*
252 *didn't read what could happen, it still happened, so [the test result] put my mind at complete*
253 *rest that it's not just in my mind, it is actually an allergy that I've got (P4, Female, 47, positive*
254 *allergy test)*

255 Participants reported having confidence in the test when they felt they had undergone a thorough
256 testing procedure. Other participants felt confident in the result after they had taken penicillin
257 without a reaction following the test.

258 *I think if I hadn't had all the thorough testing, I would have been quite nervous to take*
259 *penicillin. Because obviously with what had happened before, when I was younger. But now,*

260 *I'm fine. It doesn't bother me, I can take it and it won't scare me (P3, Female, 19, negative*
261 *allergy test)*

262 Of note, some participants reported that their clinician had doubts about a negative test result and
263 continued to prescribe alternative antibiotics; other clinicians reversed changes to medical records
264 to reapply the allergy label if participants experienced any side effects from penicillin. Re-labelling
265 might have been appropriate in some cases; however, it was not possible to assess based on
266 patients' reports.

267 A minority of participants felt anxious about taking penicillin after a negative test. This was often
268 related to the fact that the allergy label had been in place for a long time; occasionally they
269 (incorrectly) believed that they had only received small doses of penicillin during the test and were
270 worried about having a full dose of penicillin for the first time without supervision.

271 *Cause I've lived with that fear, if anybody gives me penicillin I'm gonna die sort of thing, for*
272 *years you know, from being a baby so of course you can't just terminate a fear like that. It's*
273 *still there in the back of your mind all the time (P1, Female, 69, negative allergy test)*

274 Similarly some patients with no experience of testing doubted whether they would ever believe a
275 result which indicated they were not allergic to penicillin, as they believed they had had very severe
276 reactions in the past.

277 **CLINICIAN VIEWS**

278 **Doubts about removing penicillin allergy labels**

279 Clinicians often reflected on whether allergies recorded in medical records were likely to be accurate
280 and often doubted whether allergy labels were correct. However for the majority their clinical

281 judgement alone was not enough to change the medical records and they were worried about being
282 responsible for causing someone to have an allergic reaction.

283 *In general practice quite often once something is coded, yes of course you can change the*
284 *codes but quite often when something is coded it's kind of set in stone (Clinician 11)*

285

286 On occasions, this was due to the clinician's perceived lack of knowledge, for example being unsure
287 whether allergy is hereditary and therefore avoiding penicillin in the children of penicillin allergic
288 patients.

289

290 Some clinicians perceived patients taking penicillin without problems as convincing evidence that a
291 patient was not allergic and felt confident in changing medical records in this situation.

292

293 *Yes, if it's been demonstrated that they're actually okay with the antibiotic after that original*
294 *documentation then I have removed it. For example, if it said allergy to amoxicillin and*
295 *they've subsequently had amoxicillin and been fine with it then I'd remove the allergy*
296 *warning (Clinician 13)*

297 However even after repeated penicillin prescriptions some clinicians were still reluctant to amend
298 the records and for the majority, only penicillin allergy testing was perceived as definite proof of
299 tolerance.

300 *If I was 100% sure I had specialist advice that the patients did not have an allergy to penicillin*
301 *I would remove it from the records (Clinician 4)*

302 **Knowledge of the allergy service and referral process**

303 While clinicians saw value in the allergy service they had very limited experience of it and thus poor
304 understanding of what the service could offer. Even clinicians with experience of referral had limited

305 information on the actual test procedure and accuracy of the results. While some were familiar with
306 skin testing, few were aware of the oral challenge test component. Clinicians described the
307 importance of guidelines in learning about the allergy service as well as deciding which patients
308 should be referred. Many felt that since they lacked information about tests, including benefits and
309 risks, they were unable to advise or encourage patients to be tested.

310 *Maybe some advice on what we can tell the patient about what it would mean for them, as*
311 *in if they weren't penicillin-allergic, what actual benefit we'd be able to provide to them if we*
312 *could give them penicillin [...] because they might say, 'Actually, I've never had penicillin, I'm*
313 *not bothered, just don't give me it, I don't want to go and have any testing.'* (Clinician 2)

314 Clinicians had a range of experiences in referring patients for penicillin allergy testing, but none
315 routinely referred. Clinicians with experience of referring patients mostly referred those reporting
316 numerous allergies or who had developed an antibiotic resistant infection. They also referred
317 patients who had suffered a severe reaction. Clinicians were particularly concerned about the
318 appropriate referral criteria and whether they would overburden the allergy service; in many cases
319 this resulted in never referring patients.

320 Clinicians with experience of referring had positive views on the service and the referral process and
321 thought it helped them improve their management of patients. However some could not recall
322 seeing patients' test results, indicating a possible lack of follow up.

323 **Process of updating medical records**

324 The majority of clinicians reported that it is easy to change a patient's allergy status on their
325 electronic medical record if required provided a reason is given. Others highlighted that allergy alerts
326 might still be active if the system did not differentiate between intolerance and allergy; this might
327 prevent penicillin prescriptions despite negative testing.

328 Clinicians described their views on who should be responsible for the process of updating the
329 records and how and whether the results should be communicated to patients. Some felt this was
330 the responsibility of the allergy clinic; others believed it was their role to ensure the patient
331 understood the results since they were responsible for ongoing care. Some felt it was important to
332 discuss negative test results to address patients' potential concerns about taking penicillin.

333 *You would have to discuss [the test results] with the patient, because some patients might*
334 *say, 'I still don't want it.' [...] I think patients have their own opinion, so if information came*
335 *back to me that it was safe to prescribe, I would have to speak to the patient, because they*
336 *might just say, 'Oh, I don't care about that result, I don't want it anyway.' (Clinician 8)*

337 **Discussion**

338 This study is the first to provide an in-depth understanding of patients' and primary care clinicians'
339 views of the consequences of a penicillin allergy record and penicillin allergy testing. It highlights key
340 barriers and facilitators to effectively using penicillin allergy testing services and prescribing/using
341 penicillins appropriately following a negative test result.

342 While most patients talked freely about their perception of risk many were unaware of the negative
343 consequences of a penicillin allergy label; those who were had gained this understanding though
344 direct experience. The majority of patients who had undergone testing felt confident to take
345 penicillin after a negative test result; however some patients remained anxious about safety.

346 Clinicians were aware that penicillin allergy records were often incorrect but felt reluctant to change
347 them based on their clinical judgement. They had positive views towards penicillin allergy services
348 but reported numerous barriers to their use. They were uncertain about whose responsibility it was
349 to make sure that patient understood the allergy test results.

350 Only two questionnaire studies have previously explored patients' views on, and satisfaction with,
351 penicillin allergy testing (17, 20). These studies demonstrated that patients had positive views
352 towards getting tested for penicillin allergy and those who had undergone testing felt it provided
353 them with useful medical information (17, 20). Our study highlights that patients weigh the possible
354 benefits of testing against the perceived risks. Not knowing the potential negative consequences of
355 a penicillin allergy label meant that patients had reduced motivation to attend for testing. The
356 results highlight that patients appeared to judge the risk of the test based on a number of factors;
357 perception of likelihood and severity of a reaction; degree of invasiveness of the test, and the degree
358 to which they felt they would be monitored.

359 In line with previous research (18, 21) we found that clinicians had limited experience of referring
360 patients for penicillin allergy testing and were often unaware of the existence of allergy services.
361 Even clinicians with experience of referral were sometimes unaware of the specific nature of the
362 testing. Clinicians approved of the penicillin allergy service; however, they would benefit from more
363 information about the harms of a penicillin allergy label and the process of testing to help them
364 confidently refer and to be able to discuss referral with their patients. Patients' concerns about
365 potential benefits and risks of testing need be addressed by both clinicians and allergists in order to
366 increase their motivation to attend for testing. Appropriate evaluation of patients with a penicillin
367 allergy label is rapidly becoming a focus point for public health and antibiotic stewardship initiatives
368 (10, 12, 22).

369 We identified the potential barriers and facilitators to penicillin prescription and use following
370 negative testing. This is an area not well defined in the literature; studies have highlighted patient
371 anxiety around having a reaction (23-26), lack of confidence in the safety of penicillin administration
372 (23-26), or uncertainty about which class of antibiotics could be safely received (27, 28). Patients
373 were reassured by having undergone a "thorough" testing process and having a need for a penicillin

374 following a negative test motivated consumption of penicillin; a barrier to consumption was the
375 presence of an allergy label for many years.

376 Clinicians expressed uncertainty about who is responsible for ensuring patients understand the
377 results and for updating the medical record. This highlights the need for a clear and consistent
378 approach to de-labelling with support from colleagues in secondary care. Documentation of side
379 effects during future courses of penicillin needs to be clear and precise in order to prevent re-
380 labelling of the patient (13).

381 Strengths and limitations

382 This is the first qualitative interview study to provide in-depth understanding of patient and clinician
383 views and experiences of penicillin allergy testing and of subsequent penicillin use. It highlights key
384 barriers and facilitators to clinicians referring patients, and to patients then attending for testing. As
385 previous studies used mainly survey designs and often focused on clinicians' views, this study fills an
386 important gap by providing a patient-centred perspective. This is a qualitative study with a
387 purposeful sample which recruited from one region in England; the results should be interpreted
388 cautiously in terms of their transferability to other settings. The next step could include conducting a
389 survey with a representative sample of patients, designed based on the results from this study.

390 Conclusions

391 Both patients and clinicians need to be supported to use penicillin allergy services, and be provided
392 with the skills and information to prescribe and use of penicillins appropriately following a negative
393 test result.

394

395

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476

477 Table 1 Summary of patient and PCP characteristics

	Patients	Clinicians
Mean age (years)	56	42
Age range	19-72	34-60
Gender (%)	25 women (80%)	16 women (84%)
Experience of penicillin allergy testing/referring patients for penicillin allergy testing	16 (51%); (4 reported testing positive; 11 reported testing negative and 1 reported an	9 (47%)

	inconclusive result)*	
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478 *Patient reports of the test outcome have not been independently verified, rather these numbers

479 reflect patient understanding of the test result.

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